Cisco ONS 15310-MA SDH Reference Manual

Product and Documentation Release 9.1 and Release 9.2
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Cisco ONS 15310-MA SDH Reference Manual, Release 9.1 and 9.2

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Preface

Note The terms “Unidirectional Path Switched Ring” and "UPSR" may appear in Cisco literature. These terms do not refer to using Cisco ONS 15xxx products in a unidirectional path switched ring configuration. Rather, these terms, as well as “Path Protected Mesh Network” and “PPMN,” refer generally to Cisco's path protection feature, which may be used in any topological network configuration. Cisco does not recommend using its path protection feature in any particular topological network configuration.

This section explains the objectives, intended audience, and organization of this publication and describes the conventions that convey instructions and other information.

This section provides the following information:

Revision History

Date	Notes
December 2009	Updated Figure1-7, ACS Cable T015654 in Chapter 1, “Cisco ONS 15310-MA SDH Shelf Assembly Hardware”.
February 2010	Added section 1.5: Rear Cover to Chapter “Cisco ONs 15310-MA SDH Shelf Assembly Hardware”
April 2010	Added a note in section “SNMP Overview” in the chapter “SNMP”.
July 2010	• Updated the section “SFP Specifications” in the appendix “Specifications”. • Updated the section “CE-100T-8 and ML-100T-8 Cards” in the appendix “Specifications”.

Date	Notes
November 2010	• Added the section “Open-Ended VCAT” in the chapter “Circuits and Tunnels”. • Updated the table “Switch Times” in the chapter “Circuits and Tunnels”. • Changed the CTX2500 card name to 15310E-CTX-K9 through out the document.
December 2010	• Updated the section “CE-MR-6 Card” in the chapter “Card Reference”. • Updated the table "ONS 15310-MA SDH Security Levels—Node View" in the chapter "Security".
January 2011	Updated the sections “CE-100T-8 Card” and “CE-MR-6 Card” in the chapter “Card Reference”.
July 2011	Added a note in the “PC and UNIX Workstation Requirements” section of Chapter, “Cisco Transport Controller Operation”.
March 2012	Updated the section “15310E-CTX-K9 Card” in the appendix “Specifications”.
August 2012	The full length book-PDF was generated.

Document Objectives

The *Cisco ONS 15310-MA SDH Reference Manual* provides hardware and software reference information for Cisco ONS 15310 nodes and networks. Use this manual in conjunction with the appropriate publications listed in the Related Documentation section.

Audience

To use this publication, you should be familiar with Cisco or equivalent optical transmission hardware and cabling, telecommunications hardware and cabling, electronic circuitry and wiring practices, and preferably have experience as a telecommunications technician.

Related Documentation

Use the *Cisco ONS 15310-MA SDH Reference Manual* in conjunction with the following referenced publications:

- *Cisco ONS 15310-MA SDH Procedure Guide*
  Provides installation, turn up, test, and maintenance procedures.
- *Cisco ONS 15310-MA SDH Troubleshooting Guide*
  Provides alarm descriptions and troubleshooting procedures, general troubleshooting procedures, error messages, performance monitoring parameters, and SNMP information.
- *Cisco ONS SONET TL1 Command Guide*
  Provides a full TL1 command and autonomous message set including parameters, AIDs, conditions and modifiers for the Cisco ONS 15454, ONS 15600, and Cisco ONS 15310-MA SDH systems.

- *Cisco ONS SONET TL1 Reference Guide*
  Provides general information, procedures, and errors for TL1 in the Cisco ONS 15454, ONS 15600, and Cisco ONS 15310-MA SDH systems.
- *Cisco ONS 15310-CL and Cisco ONS 15310-MA SDH Ethernet Card Software Feature and Configuration Guide*
  Provides software feature and operation information for Ethernet cards in the Cisco ONS 15310-MA SDH.
- *Release Notes for the Cisco ONS 15310-MA SDH Release 9.1 and 9.2*
  Provides new features and functionality information.

For an update on End-of-Life and End-of-Sale notices, refer to http://www.cisco.com/en/US/products/hw/optical/ps2001/prod_eol_notices_list.html.

Document Conventions

This publication uses the following conventions:

Convention	Application
boldface	Commands and keywords in body text.
italic	Command input that is supplied by the user.
[ ]	Keywords or arguments that appear within square brackets are optional.
{ x | x | x }	A choice of keywords (represented by x) appears in braces separated by vertical bars. The user must select one.
Ctrl	The control key. For example, where Ctrl + D is written, hold down the Control key while pressing the D key.
`screen font`	Examples of information displayed on the screen.
`boldface screen font`	Examples of information that the user must enter.
< >	Command parameters that must be replaced by module-specific codes.

Note Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the document.

Caution Means *reader be careful*. In this situation, the user might do something that could result in equipment damage or loss of data.

Warning **IMPORTANT SAFETY INSTRUCTIONS**

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071

SAVE THESE INSTRUCTIONS

Waarschuwing **BELANGRIJKE VEILIGHEIDSINSTRUCTIES**

Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van de standaard praktijken om ongelukken te voorkomen. Gebruik het nummer van de verklaring onderaan de waarschuwing als u een vertaling van de waarschuwing die bij het apparaat wordt geleverd, wilt raadplegen.

BEWAAR DEZE INSTRUCTIES

Varoitus **TÄRKEITÄ TURVALLISUUSOHJEITA**

Tämä varoitusmerkki merkitsee vaaraa. Tilanne voi aiheuttaa ruumiillisia vammoja. Ennen kuin käsittelet laitteistoa, huomioi sähköpiirien käsittelemiseen liittyvät riskit ja tutustu onnettomuuksien yleisiin ehkäisytapoihin. Turvallisuusvaroitusten käännökset löytyvät laitteen mukana toimitettujen käännettyjen turvallisuusvaroitusten joukosta varoitusten lopussa näkyvien lausuntonumeroiden avulla.

SÄILYTÄ NÄMÄ OHJEET

Attention **IMPORTANTES INFORMATIONS DE SÉCURITÉ**

Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant entraîner des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers liés aux circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions des avertissements figurant dans les consignes de sécurité traduites qui accompagnent cet appareil, référez-vous au numéro de l'instruction situé à la fin de chaque avertissement.

CONSERVEZ CES INFORMATIONS

Warnung **WICHTIGE SICHERHEITSHINWEISE**

Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu Verletzungen führen kann. Machen Sie sich vor der Arbeit mit Geräten mit den Gefahren elektrischer Schaltungen und den üblichen Verfahren zur Vorbeugung vor Unfällen vertraut. Suchen Sie mit der am Ende jeder Warnung angegebenen Anweisungsnummer nach der jeweiligen Übersetzung in den übersetzten Sicherheitshinweisen, die zusammen mit diesem Gerät ausgeliefert wurden.

BEWAHREN SIE DIESE HINWEISE GUT AUF.

Avvertenza **IMPORTANTI ISTRUZIONI SULLA SICUREZZA**

Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di intervenire su qualsiasi apparecchiatura, occorre essere al corrente dei pericoli relativi ai circuiti elettrici e conoscere le procedure standard per la prevenzione di incidenti. Utilizzare il numero di istruzione presente alla fine di ciascuna avvertenza per individuare le traduzioni delle avvertenze riportate in questo documento.

CONSERVARE QUESTE ISTRUZIONI

Advarsel **VIKTIGE SIKKERHETSINSTRUKSJONER**

Dette advarselssymbolet betyr fare. Du er i en situasjon som kan føre til skade på person. Før du begynner å arbeide med noe av utstyret, må du være oppmerksom på farene forbundet med elektriske kretser, og kjenne til standardprosedyrer for å forhindre ulykker. Bruk nummeret i slutten av hver advarsel for å finne oversettelsen i de oversatte sikkerhetsadvarslene som fulgte med denne enheten.

TA VARE PÅ DISSE INSTRUKSJONENE

Aviso **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

Este símbolo de aviso significa perigo. Você está em uma situação que poderá ser causadora de lesões corporais. Antes de iniciar a utilização de qualquer equipamento, tenha conhecimento dos perigos envolvidos no manuseio de circuitos elétricos e familiarize-se com as práticas habituais de prevenção de acidentes. Utilize o número da instrução fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham este dispositivo.

GUARDE ESTAS INSTRUÇÕES

¡Advertencia! **INSTRUCCIONES IMPORTANTES DE SEGURIDAD**

Este símbolo de aviso indica peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considere los riesgos de la corriente eléctrica y familiarícese con los procedimientos estándar de prevención de accidentes. Al final de cada advertencia encontrará el número que le ayudará a encontrar el texto traducido en el apartado de traducciones que acompaña a este dispositivo.

GUARDE ESTAS INSTRUCCIONES

Varning! **VIKTIGA SÄKERHETSANVISNINGAR**

Denna varningssignal signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanliga förfaranden för att förebygga olyckor. Använd det nummer som finns i slutet av varje varning för att hitta dess översättning i de översatta säkerhetsvarningar som medföljer denna anordning.

SPARA DESSA ANVISNINGAR

FONTOS BIZTONSÁGI ELOÍRÁSOK

Ez a figyelmezeto jel veszélyre utal. Sérülésveszélyt rejto helyzetben van. Mielott bármely berendezésen munkát végezte, legyen figyelemmel az elektromos áramkörök okozta kockázatokra, és ismerkedjen meg a szokásos balesetvédelmi eljárásokkal. A kiadványban szereplo figyelmeztetések fordítása a készülékhez mellékelt biztonsági figyelmeztetések között található; a fordítás az egyes figyelmeztetések végén látható szám alapján keresheto meg.

ORIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

Предупреждение **ВАЖНЫЕ ИНСТРУКЦИИ ПО СОБЛЮДЕНИЮ ТЕХНИКИ БЕЗОПАСНОСТИ**

Этот символ предупреждения обозначает опасность. То есть имеет место ситуация, в которой следует опасаться телесных повреждений. Перед эксплуатацией оборудования выясните, каким опасностям может подвергаться пользователь при использовании электрических цепей, и ознакомьтесь с правилами техники безопасности для предотвращения возможных несчастных случаев. Воспользуйтесь номером заявления, приведенным в конце каждого предупреждения, чтобы найти его переведенный вариант в переводе предупреждений по безопасности, прилагаемом к данному устройству.

СОХРАНИТЕ ЭТИ ИНСТРУКЦИИ

警告 重要的安全性说明

此警告符号代表危险。您正处于可能受到严重伤害的工作环境中。在您使用设备开始工作之前，必须充分意识到触电的危险，并熟练掌握防止事故发生的标准工作程序。请根据每项警告结尾提供的声明号码来找到此设备的安全性警告说明的翻译文本。

请保存这些安全性说明

警告 安全上の重要な注意事項

「危険」の意味です。人身事故を予防するための注意事項が記述されています。装置の取り扱い作業を行うときは、電気回路の危険性に注意し、一般的な事故防止策に留意してください。警告の各国語版は、各注意事項の番号を基に、装置に付属の「Translated Safety Warnings」を参照してください。

これらの注意事項を保管しておいてください。

주의 중요 안전 지침

이 경고 기호는 위험을 나타냅니다. 작업자가 신체 부상을 일으킬 수 있는 위험한 환경에 있습니다. 장비에 작업을 수행하기 전에 전기 회로와 관련된 위험을 숙지하고 표준 작업 관례를 숙지하여 사고를 방지하십시오. 각 경고의 마지막 부분에 있는 경고문 번호를 참조하여 이 장치와 함께 제공되는 번역된 안전 경고문에서 해당 번역문을 찾으십시오.

이 지시 사항을 보관하십시오.

Aviso **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

Este símbolo de aviso significa perigo. Você se encontra em uma situação em que há risco de lesões corporais. Antes de trabalhar com qualquer equipamento, esteja ciente dos riscos que envolvem os circuitos elétricos e familiarize-se com as práticas padrão de prevenção de acidentes. Use o número da declaração fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham o dispositivo.

GUARDE ESTAS INSTRUÇÕES

Advarsel **VIGTIGE SIKKERHEDSANVISNINGER**

Dette advarselssymbol betyder fare. Du befinder dig i en situation med risiko for legemesbeskadigelse. Før du begynder arbejde på udstyr, skal du være opmærksom på de involverede risici, der er ved elektriske kredsløb, og du skal sætte dig ind i standardprocedurer til undgåelse af ulykker. Brug erklæringsnummeret efter hver advarsel for at finde oversættelsen i de oversatte advarsler, der fulgte med denne enhed.

GEM DISSE ANVISNINGER

تحذير **إرشادات الأمان الهامة**

يوضح رمز التحذير هذا وجود خطر. وهذا يعني أنك متواجد في مكان قد ينتج عنه التعرض لإصابات. قبل بدء العمل، احذر مخاطر التعرض للصدمات الكهربائية وكن على علم بالإجراءات القياسية للحيلولة دون وقوع أي حوادث. استخدم رقم البيان الموجود في أخر كل تحذير لتحديد مكان ترجمته داخل تحذيرات الأمان المترجمة التي تأتي مع الجهاز.
قم بحفظ هذه الإرشادات

Upozorenje **VAŽNE SIGURNOSNE NAPOMENE**

Ovaj simbol upozorenja predstavlja opasnost. Nalazite se u situaciji koja može prouzročiti tjelesne ozljede. Prije rada s bilo kojim uređajem, morate razumjeti opasnosti vezane uz električne sklopove, te biti upoznati sa standardnim načinima izbjegavanja nesreća. U prevedenim sigurnosnim upozorenjima, priloženima uz uređaj, možete prema broju koji se nalazi uz pojedino upozorenje pronaći i njegov prijevod.

SAČUVAJTE OVE UPUTE

Upozornění **DŮLEŽITÉ BEZPEČNOSTNÍ POKYNY**

Tento upozorňující symbol označuje nebezpečí. Jste v situaci, která by mohla způsobit nebezpečí úrazu. Před prací na jakémkoliv vybavení si uvědomte nebezpečí související s elektrickými obvody a seznamte se se standardními opatřeními pro předcházení úrazům. Podle čísla na konci každého upozornění vyhledejte jeho překlad v přeložených bezpečnostních upozorněních, která jsou přiložena k zařízení.

USCHOVEJTE TYTO POKYNY

Προειδοποίηση

ΣΗΜΑΝΤΙΚΕΣ ΟΔΗΓΙΕΣ ΑΣΦΑΛΕΙΑΣ

Αυτό το προειδοποιητικό σύμβολο σημαίνει κίνδυνο. Βρίσκεστε σε κατάσταση που μπορεί να προκαλέσει τραυματισμό. Πριν εργαστείτε σε οποιοδήποτε εξοπλισμό, να έχετε υπόψη σας τους κινδύνους που σχετίζονται με τα ηλεκτρικά κυκλώματα και να έχετε εξοικειωθεί με τις συνήθεις πρακτικές για την αποφυγή ατυχημάτων. Χρησιμοποιήστε τον αριθμό δήλωσης που παρέχεται στο τέλος κάθε προειδοποίησης, για να εντοπίσετε τη μετάφρασή της στις μεταφρασμένες προειδοποιήσεις ασφαλείας που συνοδεύουν τη συσκευή.

ΦΥΛΑΞΤΕ ΑΥΤΕΣ ΤΙΣ ΟΔΗΓΙΕΣ

אזהרה

הוראות בטיחות חשובות

סימן אזהרה זה מסמל סכנה. אתה נמצא במצב העלול לגרום לפציעה. לפני שתעבוד עם ציוד כלשהו, עליך להיות מודע לסכנות הכרוכות במעגלים חשמליים ולהכיר את הנהלים המקובלים למניעת תאונות. השתמש במספר ההוראה המסופק בסופה של כל אזהרה כד לאתר את התרגום באזהרות הבטיחות המתורגמות שמצורפות להתקן.

שמור הוראות אלה

Opomena

ВАЖНИ БЕЗБЕДНОСНИ НАПАТСТВИЈА

Симболот за предупредување значи опасност. Се наоѓате во ситуација што може да предизвика телесни повреди. Пред да работите со опремата, бидете свесни за ризикот што постои кај електричните кола и треба да ги познавате стандардните постапки за спречување на несреќни случаи. Искористете го бројот на изјавата што се наоѓа на крајот на секое предупредување за да го најдете неговиот период во преведените безбедносни предупредувања што се испорачани со уредот.

ЧУВАЈТЕ ГИ ОВИЕ НАПАТСТВИЈА

Ostrzeżenie

WAŻNE INSTRUKCJE DOTYCZĄCE BEZPIECZEŃSTWA

Ten symbol ostrzeżenia oznacza niebezpieczeństwo. Zachodzi sytuacja, która może powodować obrażenia ciała. Przed przystąpieniem do prac przy urządzeniach należy zapoznać się z zagrożeniami związanymi z układami elektrycznymi oraz ze standardowymi środkami zapobiegania wypadkom. Na końcu każdego ostrzeżenia podano numer, na podstawie którego można odszukać tłumaczenie tego ostrzeżenia w dołączonym do urządzenia dokumencie z tłumaczeniami ostrzeżeń.

NINIEJSZE INSTRUKCJE NALEŻY ZACHOWAĆ

Upozornenie

DÔLEŽITÉ BEZPEČNOSTNÉ POKYNY

Tento varovný symbol označuje nebezpečenstvo. Nachádzate sa v situácii s nebezpečenstvom úrazu. Pred prácou na akomkoľvek vybavení si uvedomte nebezpečenstvo súvisiace s elektrickými obvodmi a oboznámte sa so štandardnými opatreniami na predchádzanie úrazom. Podľa čísla na konci každého upozornenia vyhľadajte jeho preklad v preložených bezpečnostných upozorneniach, ktoré sú priložené k zariadeniu.

USCHOVAJTE SI TENTO NÁVOD

Obtaining Optical Networking Information

This section contains information that is specific to optical networking products. For information that pertains to all of Cisco, refer to the Obtaining Documentation and Submitting a Service Request section.

Where to Find Safety and Warning Information

For safety and warning information, refer to the *Cisco Optical Transport Products Safety and Compliance Information* document that accompanied the product. This publication describes the international agency compliance and safety information for the Cisco ONS 15310 system. It also includes translations of the safety warnings that appear in the ONS 15310 system documentation.

Cisco Optical Networking Product Documentation CD-ROM

Optical networking-related documentation, including Cisco ONS 15xxx product documentation, is available in a CD-ROM package that ships with your product. The Optical Networking Product Documentation CD-ROM is updated periodically and may be more current than printed documentation.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html

Subscribe to the *What's New in Cisco Product Documentation* as a Really Simple Syndication (RSS) feed and set content to be delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS version 2.0.

CHAPTER 1

Cisco ONS 15310-MA SDH Shelf Assembly Hardware

This chapter provides a description of Cisco ONS 15310-MA SDH shelf hardware. Instructions for installing equipment are provided in the *Cisco ONS 15310-MA SDH Procedure Guide*.

Chapter topics include:

1.1 Installation Overview

You can mount the ONS 15310-MA SDH in a 19-inch (482.6 mm) or 600x600 mm ETSI rack.

The ONS 15310-MA SDH is powered using –48 VDC power. DC power connections are accessed from the rear of the shelf assembly. ONS 15310-MA SDH Ethernet and optical ports are accessible at the front of the shelf assembly, and electrical connections (E1, E3/DS3) are accessible at the rear of the shelf assembly through electrical interface assemblies (EIAs).

When installed in an equipment rack, the ONS 15310-MA SDH assembly is typically connected to a fuse and alarm panel that provides centralized alarm connection points and distributed power for the ONS 15310-MA SDH. Fuse and alarm panels are third-party equipment and are not described in this documentation. If you are unsure about the requirements or specifications for a fuse and alarm panel, consult the documentation for that product.

Note In this chapter, the terms “ONS 15310-MA SDH” and “shelf assembly” are used interchangeably. In the installation context, these terms have the same meaning. Otherwise, shelf assembly refers to the physical steel enclosure that holds cards and connects power, and ONS 15310-MA SDH refers to the entire system, both hardware and software.

Note The ONS 15310-MA SDH is suitable for installation in network telecommunication facilities where National Electric Code (NEC) applies.

Install the ONS 15310-MA SDH in compliance with your local and national electrical codes:

- United States: National Fire Protection Association (NFPA) 70; United States National Electrical Code
- Canada: Canadian Electrical Code, Part I, CSA C22.1
- Other countries: If local and national electrical codes, are not available, refer to IEC 364, Part 1 through Part 7

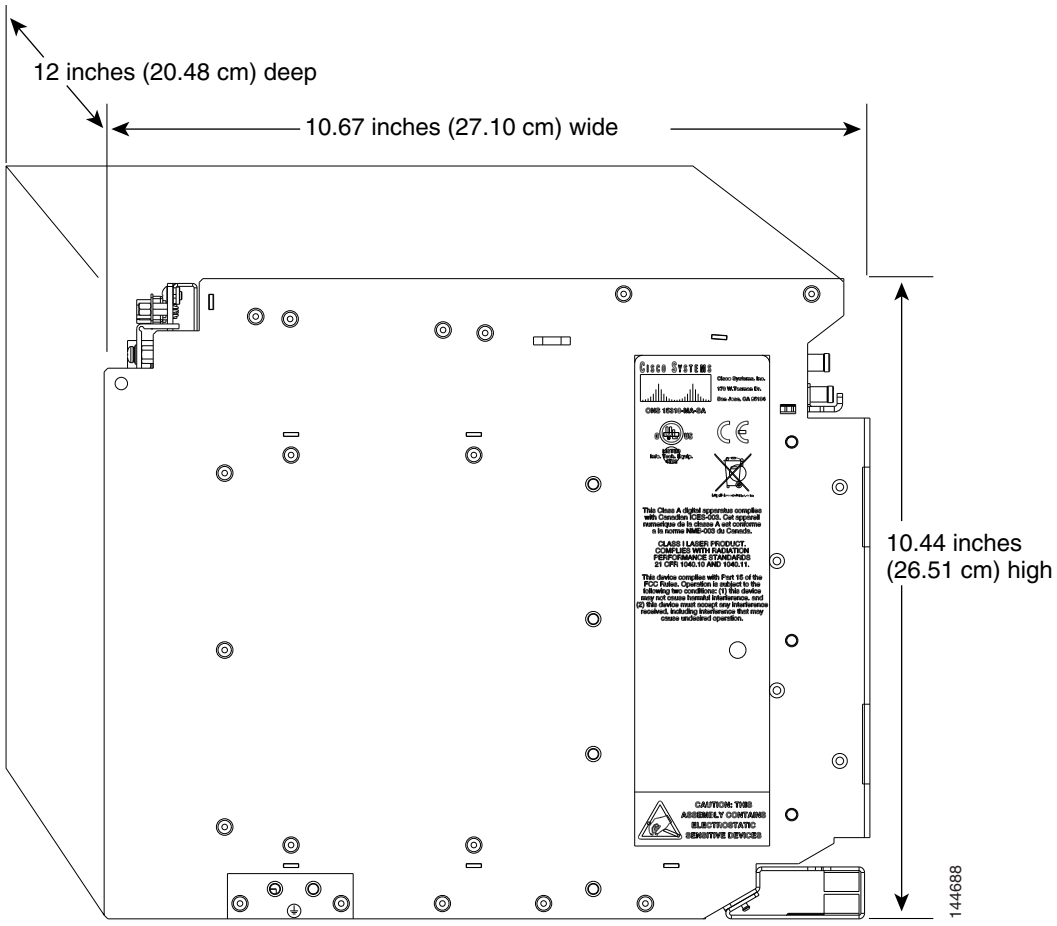
Detailed compliance and safety information is provided in the *Cisco Optical Transport Products Safety and Compliance Information* document that ships with the Cisco ONS 15310-MA SDH.

1.2 Rack Installation

The ONS 15310-MA SDH is easily mounted in a 19-inch (482.6 mm) or 600x600 mm equipment rack. The shelf assembly can be mounted so that it projects five inches from the front of the rack. It mounts in both EIA-standard and Telcordia-standard racks. A single shelf assembly is 10.67 inches (27.1 mm) wide and occupies 6 RUs (10.5 in. [267.6 mm]) in a rack when installed with a standard cable management bracket. If an extended cable management bracket is installed below the shelf assembly, an additional RU is occupied, for a total of 7 RUs (12.25 in. [311.1 mm]).

The ONS 15310-MA SDH measures 10.44 inches (26.51 cm) high, 10.67 inches (27.10 cm) wide, and 12 inches (20.48 cm) deep. Figure 1-1 shows the dimensions of the ONS 15310-MA SDH shelf assembly.

Figure 1-1 ONS 15310-MA SDH Shelf Assembly Dimensions



1.2.1 Mounting Brackets

Caution Use only the fastening hardware provided with the ONS 15310-MA SDH to prevent loosening, deterioration, and electromechanical corrosion of the hardware and joined material.

Caution When mounting the ONS 15310-MA SDH in a frame with a nonconductive coating (such as paint, lacquer, or enamel) use either the thread-forming screws provided with the ONS 15310-MA SDH shipping kit or remove the coating from the threads to ensure electrical continuity.

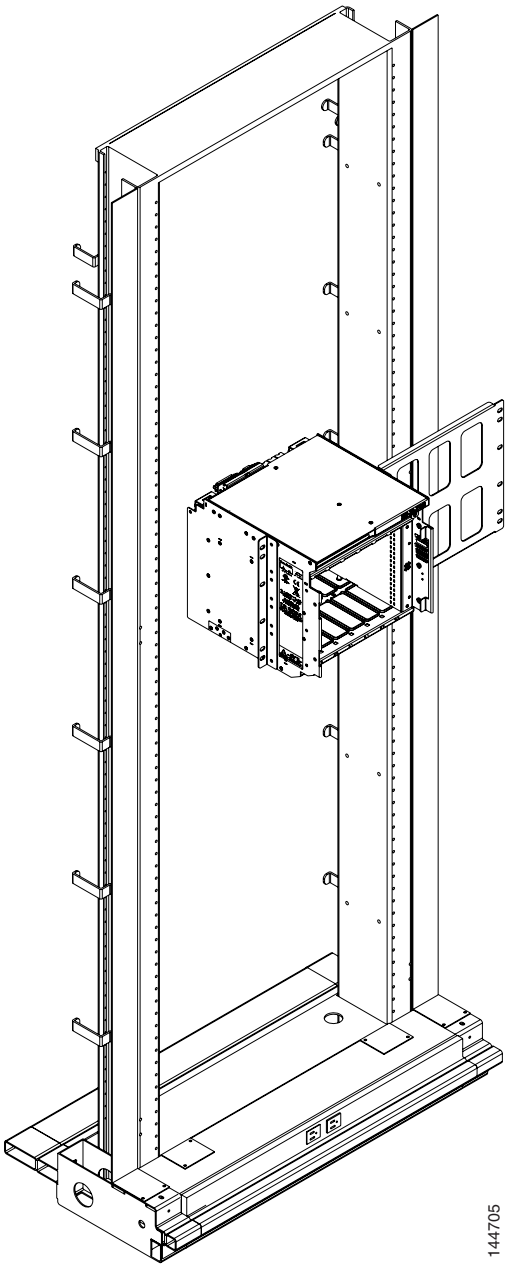
The shelf assembly ships without mounting brackets. You need to purchase brackets suitable either for use with 19-inch (482.6mm) or 600x600mm racks.

1.2.2 Mounting a Single Node

Mounting the ONS 15310-MA SDH in a rack requires a minimum of 10.5 inches of vertical rack space. To ensure that the mounting is secure, use four #12-24 mounting screws for each side of the shelf assembly. If the larger cable router is used, 12.5 inches of rack space is required.

Figure 1-2 shows a single ONS 15310-MA SDH being mounted in a rack, using a universal bracket.

Figure 1-2 Mounting a Single ONS 15310-MA SDH in a Rack



1.2.3 Mounting Multiple Nodes

Most standard 2200 mm racks can hold numerous (up to 6 or 7) ONS 15310-MA SDH nodes and a fuse and alarm panel.

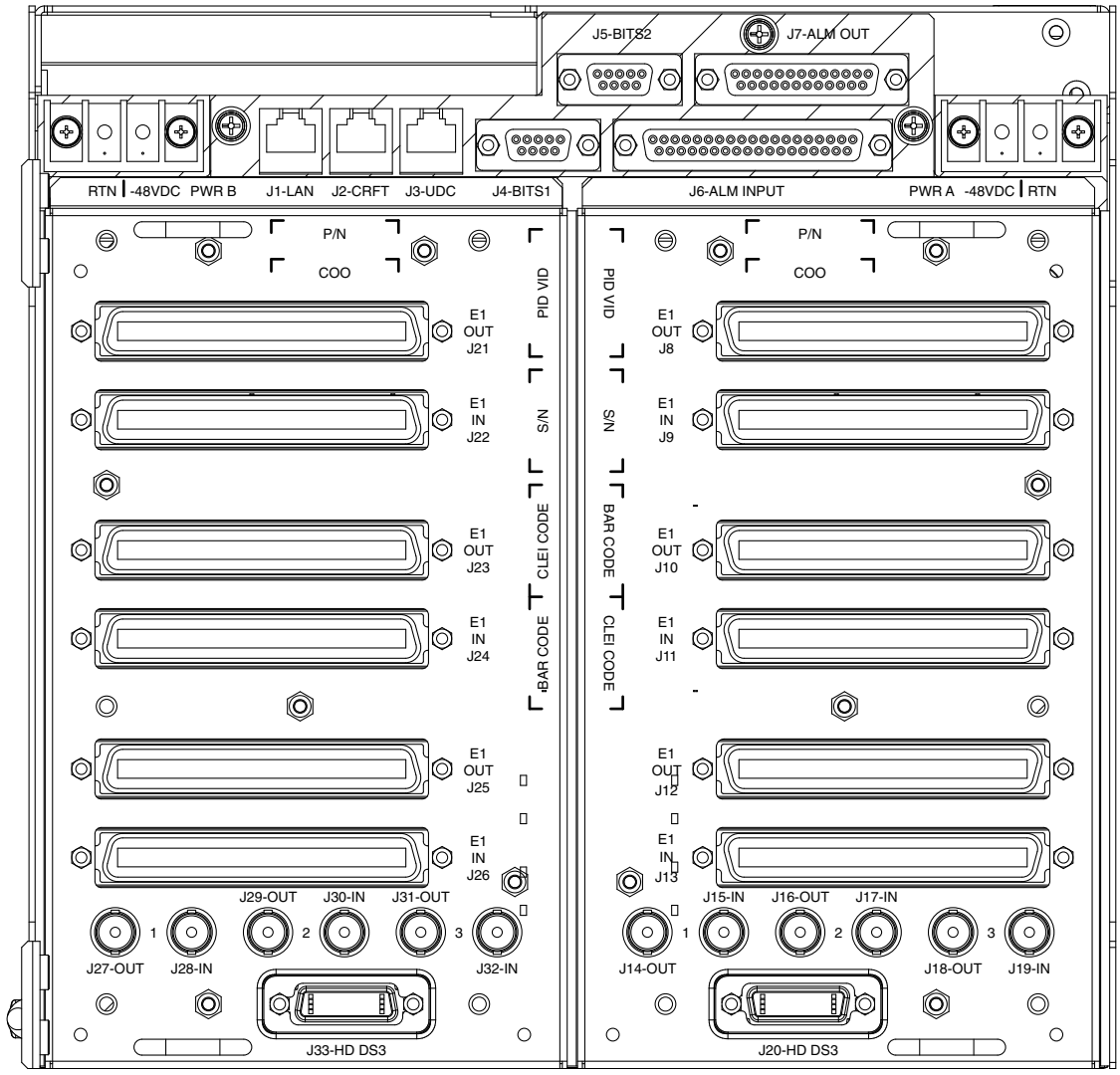
1.3 Electrical Interface Assemblies

High-density EIAs are attached to the ONS 15310-MA SDH shelf assembly backplane to provide up to 126 transmit and receive E1 connections through six Champ connectors per side (A and B) or six transmit and receive E3/DS3 connections through six BNC connectors per side. The EIAs are designed to support E1, E3/DS3 signals. The appropriate cable assembly is required depending on the type of signal.

You can install EIAs on one or both sides of the ONS 15310-MA SDH. As you face the rear of the shelf assembly, the right side is the A side (15310-EIA-HD-A) and the left side is the B side (15310-EIA-HD-B).

Figure 1-3 shows the J connectors on the A- and B-side high-density EIAs installed on the ONS 15310-MA SDH.

Figure 1-3 High-Density EIA Connectors



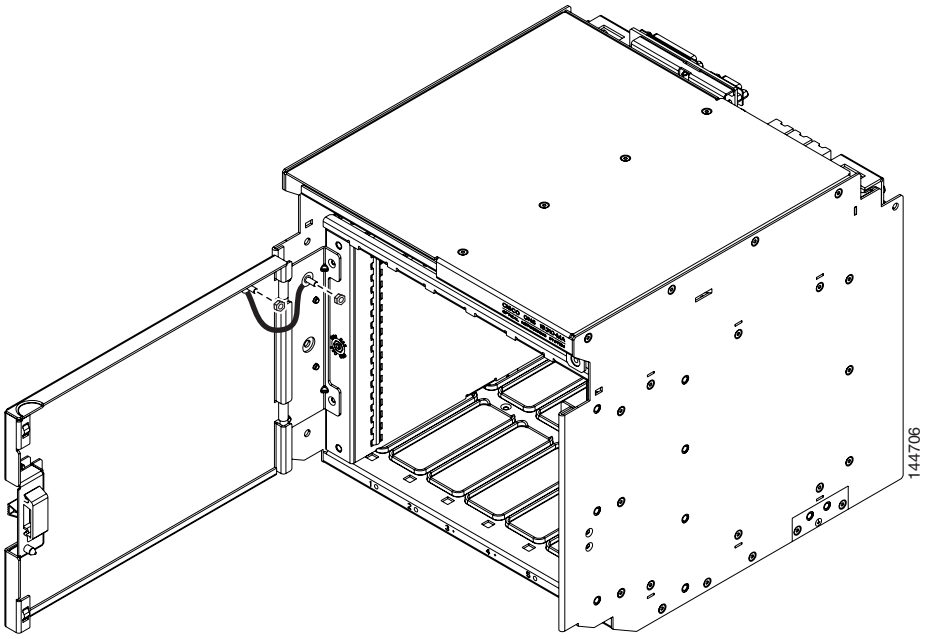
To install the EIA on the rear of the shelf assembly, you must first remove the standard sheet metal covers. The EIAs use the same screw holes as the standard sheet metal covers, but they use three holes for panhead screws and two holes for jack screws.

When installed with the standard door and cabling on the backplane, the ONS 15310-MA SDH shelf measures approximately 13.7 inches (34.8 cm) deep when fully populated with backplane cables.

1.4 Front Door

The ONS 15310-MA SDH is orderable with a front door. You must install the ground strap on the door after you install the door (Figure 1-4).

Figure 1-4 ONS 15310-MA SDH Door Ground Strap



1.5 Rear Cover

The ONS 15310-MA SDH is orderable with an optional, clear-plastic, rear cover. The rear cover protects the connectors installed on the back plane of the chassis.

Rear cover specifications are:

- Environmental
  - Operating temperature: –40 to +65 degrees Celsius (–40 to +149 degrees Fahrenheit)
  - Operating humidity: 5 to 95%, noncondensing
- Dimensions
  - 10.59 in. x 10.44 in. x 0.5 in. (26.9 cm x 26.52 cm x 1.27 cm)
  - Weight: Approximately 0.67 lb (300 g)

1.6 Power and Ground Description

This section describes how to connect the ONS 15310-MA SDH shelf assembly to the power supply. For detailed procedures, refer to the "Install the Cisco ONS 15310-MA SDH" chapter in the *Cisco ONS 15310-MA SDH Procedure Guide*. Terminate the chassis ground (located on both sides of the rear of the shelf assembly or at the bottom of the shelf assembly) to either the office ground or rack ground before you install the power. Use the grounding lug to attach the #6 AWG ground cable to the #10-32 mount ground lug on the shelf assembly according to local site practice.

Ground one cable to ground the shelf assembly. Terminate the other end of the rack ground cable to ground according to local site practice.

Note For detailed instructions on how to ground the chassis, refer to the Cisco ONS Electrostatic Discharge (ESD) and Grounding Guide.

Note Additional ground cables may be added depending on the local site practice.

Figure 1-5 shows the grounding holes on the bottom of the ONS 15310-MA SDH.

Figure 1-5 Ground Holes on the Bottom of the ONS 15310-MA SDH Shelf Assembly

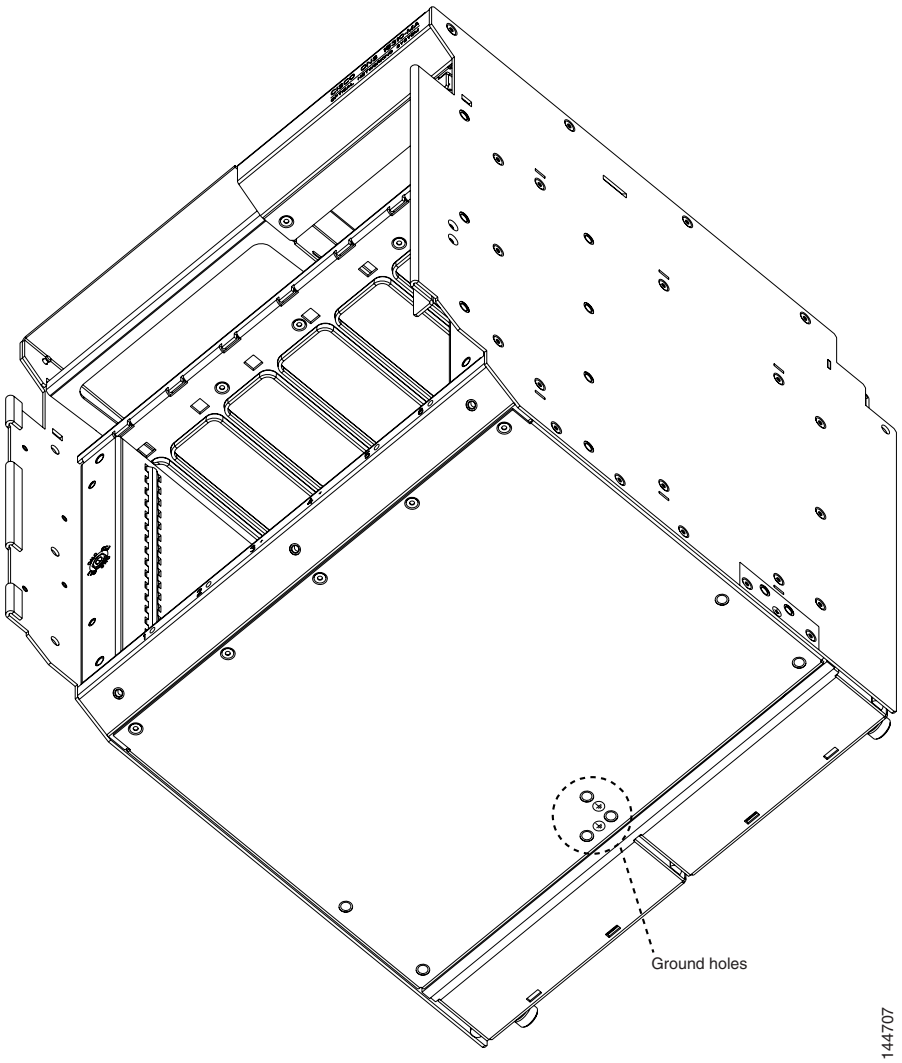
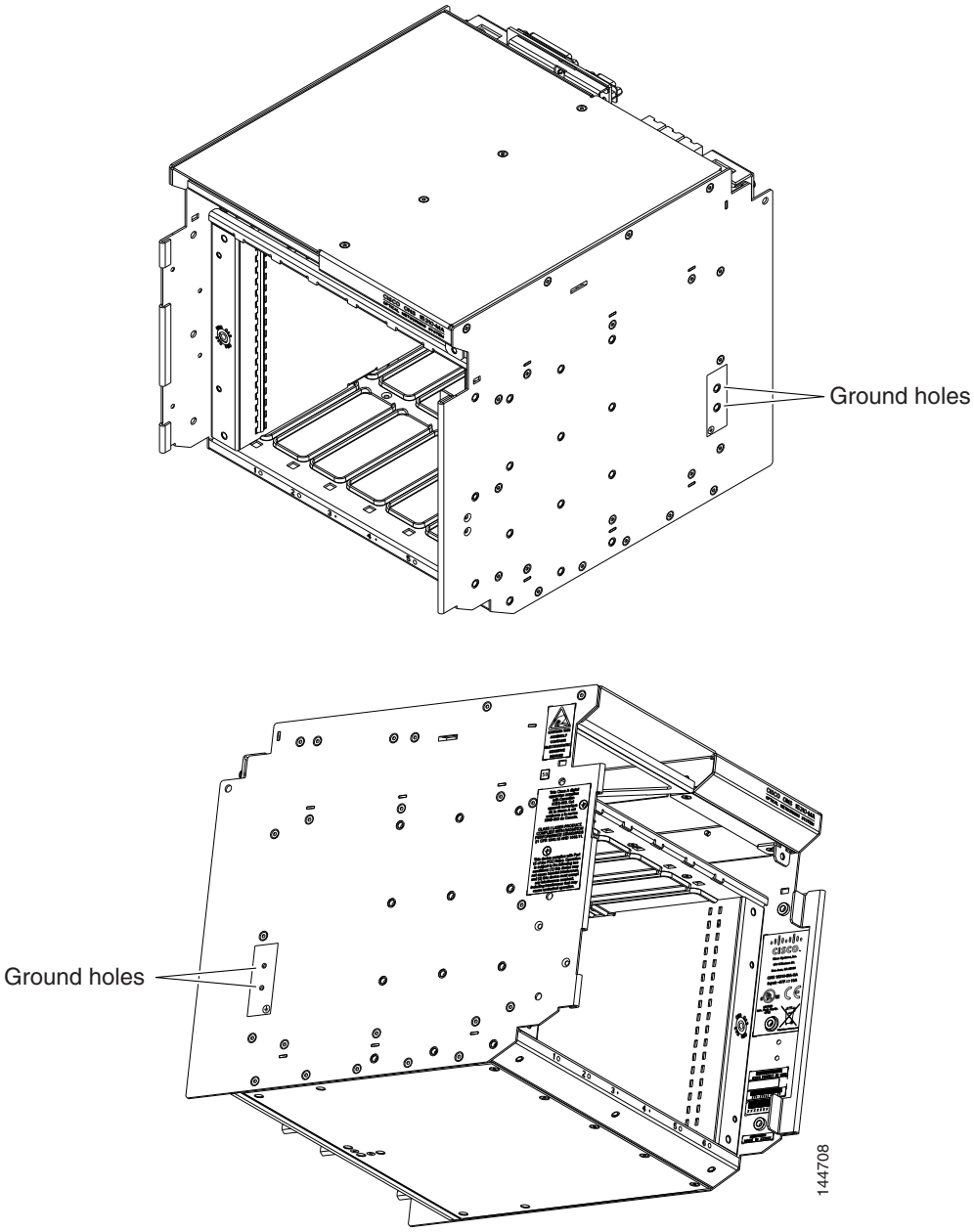


Figure 1-6 show the grounding holes on the sides of the ONS 15310-MA SDH.

Figure 1-6 Ground Holes on the Left and Right Sides of the ONS 15310-MA SDH Shelf Assembly



Caution Always use the supplied ESD wristband when working with a powered ONS 15310-MA SDH. For detailed instructions on how to wear the ESD wristband, refer to the Cisco ONS Electrostatic Discharge (ESD) and Grounding Guide.

Note Use an external disconnect for service purposes and install it according to local site practice.

The ONS 15310-MA SDH DC power provides redundant –48 VDC power terminals on the rear of the chassis. The terminals are labeled A and B and are located at each end of the shelf assembly.

To install redundant power feeds, use four power cables and one ground cable. For a single power feed, only two power cables and one ground cable are required. A 1-inch (minimum) wide copper braid is required to ground the ONS 15310-MA SDH outside plant (OSP) cabinet and is recommended for indoor installations. For example, central office.Use #12 AWG power cables and a #6 AWG ground cable and, to ensure circuit overcurrent protection, use a conductor with low impedance. The conductor must have the capability to safely conduct any fault current that might be imposed. Do not use aluminum conductors.

Note The DC power Battery Return (BR) or positive terminal, must be grounded at the source end (power feed or DC mains power end). The DC power BR input terminal of the ONS 15xxx is not connected to the equipment frame (chassis).

Caution If the system loses power or the 15310E-CTX-K9 card is reset, you must reset the ONS 15310-MA SDH clock unless the node has been previously provisioned to use Simple Network Time Protocol (SNTP). SNTP updates the clock over the LAN.

1.7 Shelf Temperature

The ONS 15310-MA SDH chassis temperature is displayed in the **Shelf view > Provisioning > General > Voltage/Temperature** pane in CTC. The temperature of the shelf (in degrees Celsius) is displayed in the Temperature area of the Voltage/Temperature pane.

Note For ONS 15310-MA SDH chassis, voltage monitoring is not performed.

1.8 Cable Description and Installation

This section describes fiber-optic, E3 (coaxial), E1 (64-pin Champ), UDC, and twisted-pair cables.

1.8.1 Cabling Types

The following types of cables are used with the ONS 15310-MA SDH:

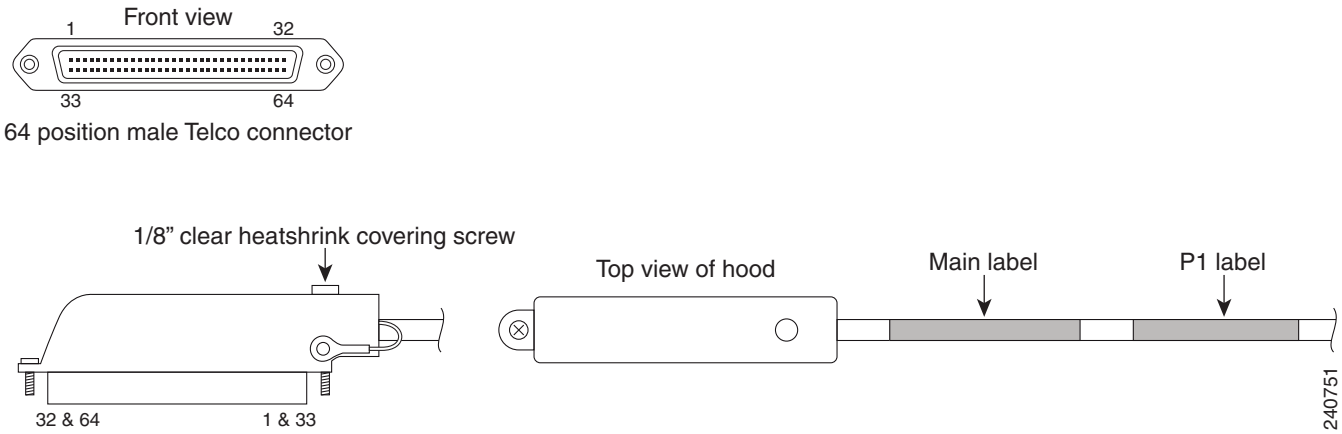
- Optical cables: The STM1/4/16 signals operate over fiber spans through SFP optics, including intermediate-reach (IR) and long-reach (LR) SFPs. Specification references can be found for the interface in ITU G.957 and Telcordia GR-253. See the "1.8.2 Fiber Cable Installation" section on page 1-13 for more information. Make sure the fiber cables do not bend excessively; maintaining a proper bend radius prevents damage to the optical cable.
- E1 cables: E1 cables (shielded, twisted-pair) connect to the electrical ports at the rear of the shelf assembly using Champ cable connectors. E1 cables carry E1 traffic to and from the ONS 15310-MA SDH. The ONS 15310-MA SDH supports up to three transmit and three receive Champ-64 connectors on each side of the shelf assembly, for a maximum of 63 E1 signals per side of the shelf, 28+28+7

  A compatible E1 cable is available from Lorom Industrial Co., LTD.

Lorom Industrial Co., LTD.
15th Floor, Room 2, Number 78, Sec 2
AN-HO Road
Taipei, Taiwan
Phone: 886-2-2706-6037
Fax: 886-2-2704-6396
POC: Monica.Huang@lorom.com

The ACS part number and description are: T015654-Length. Cable assembly with the cable exit at 1 & 33. This cable solution offers two screw points on the cable head for attachment, see Figure 1-7 on page 1-11, and is equivalent in characteristics to the defacto 1161A rated cable.

Figure 1-7 ACS Cable T015654



Refer to Table 2-1 for compatible E1 cables available from Lorom Industrial Co., LTD.

Lorom Industrial Co., LTD.
15th Floor, Room 2, Number 78, Sec 2
AN-HO Road
Taipei, Taiwan
Phone: 886-2-2706-6037
Fax: 886-2-2704-6396

Figure 1-8 32-PAIR/24-GAUGE T1 SHIELDED CABLE ASSEMBLY

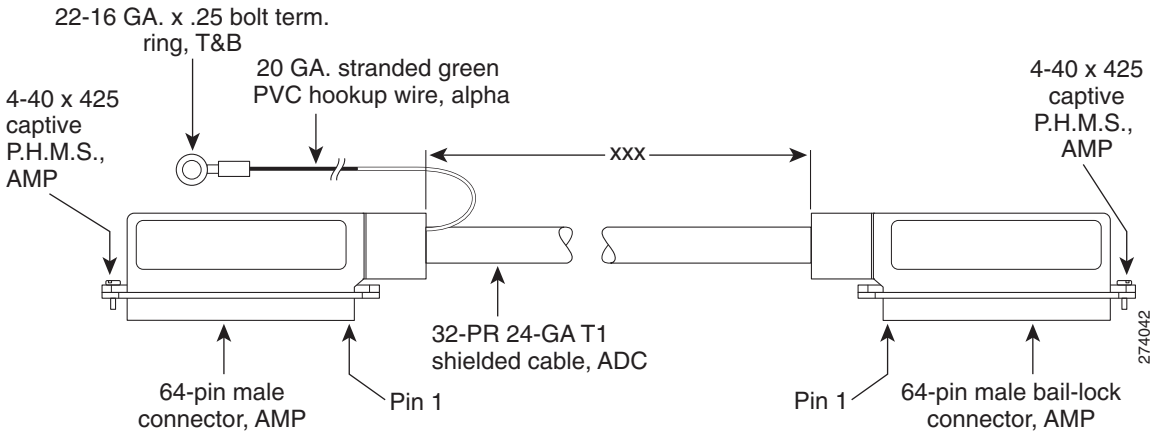


Figure 1-9 25-PR 24-GA CORR-SHIELD OUTDOOR CABLE ASSEMBLY

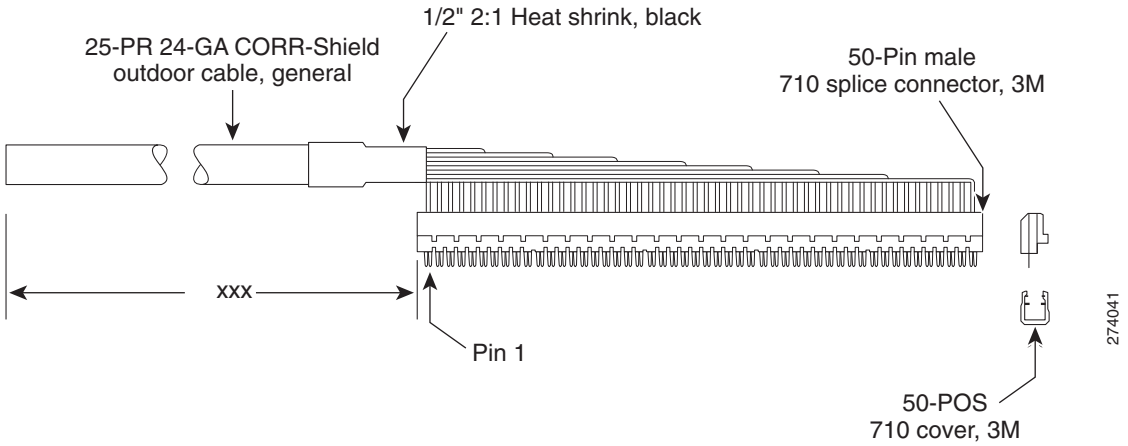


Table 1-1 E1 cables for wire-wrap connection

ACS Part Numbers	Length	Description
PCAM90SPA0PC001	25 feet	Connector-Wire Wrap, DSX
PCAM90SPA1OC001	50 feet	Connector-Wire Wrap, DSX
PCAM90SPA3MC001	100 feet	Connector-Wire Wrap, DSX
PCAM90SPA7IC001	200 feet	Connector-Wire Wrap, DSX

- Coaxial cables: Coaxial cables connect to the electrical ports using BNC cable connectors. Coaxial cables carry E3/DS3 traffic to and from the ONS 15310-MA SDH. The ONS 15310-MA SDH supports up to three transmit and three receive coaxial connectors on each shelf assembly.

Warning **The E1/E3 ports on the ONS 15310-MA SDH are intra-building ports and are suitable only for connecting to shielded cabling grounded at both ends.** Statement 1084

Note In ONS 15310-MA SDH OSP installations, E1/E3 ports are connected to the OSP. The OSP cabinet is equipped with primary and secondary protections. In addition, isolation transformers are also provided.

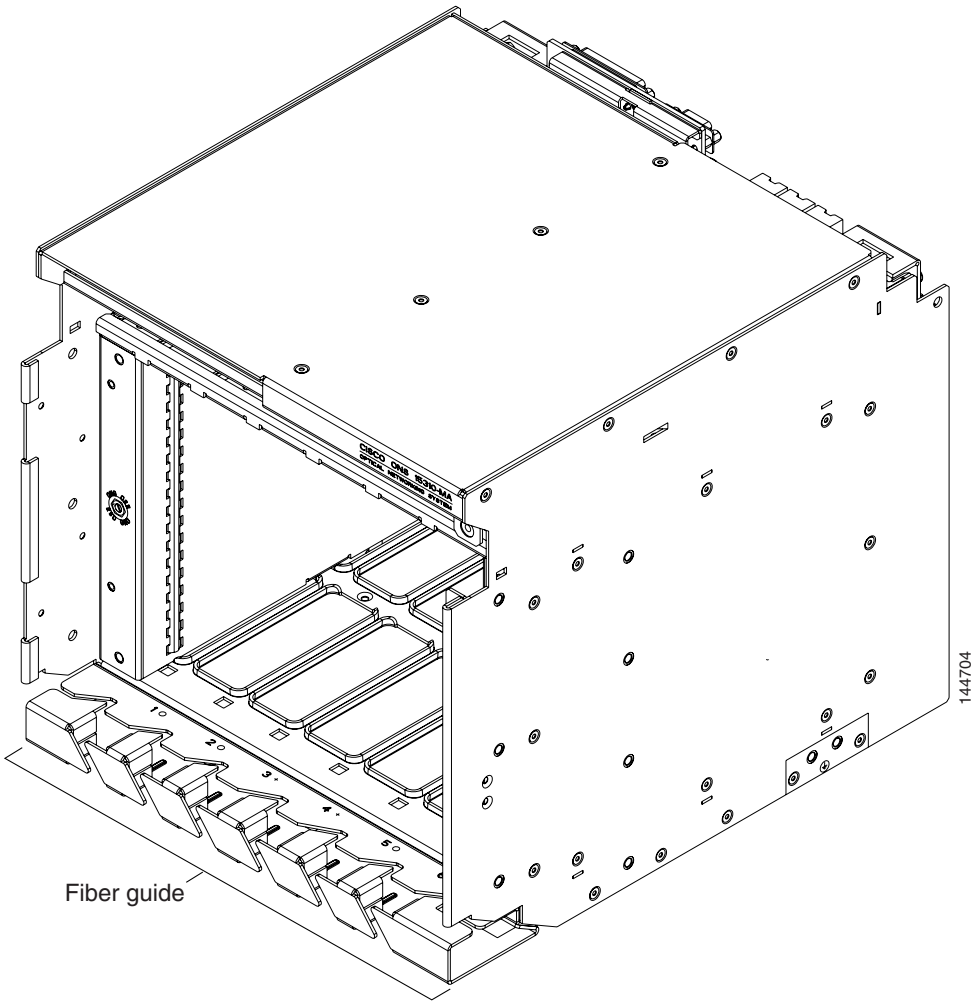
- RJ-45 cables: RJ-45 cables connect to the LAN, CRAFT, and UDC ports. An unshielded twisted-pair (STP) #22 or #24 AWG wire is required for the CRAFT and UDC ports. Unshielded twisted-pair is sufficient for the alarm and LAN(rear). 10/100-Mbps RJ-45 Ethernet STP (Shielded Twisted Pair) cables are used to connect the CE-100T-8 and ML-100T-8 cards.
- Alarm and timing (BITS) cables: The Alarm In port requires a shielded cable terminated with a DB-37 connector; Alarm Out requires a shielded cable terminated with a DB-25 connector; and the building integrated timing supply (BITS) ports require DB-9 connectors or a DB9BIT=BB9 to wire wrap adapter.

1.8.2 Fiber Cable Installation

To install fiber-optic cables on the ONS 15310-MA SDH, a fiber cable with an LC connector must be connected to an SFP. SFPs are installed in the SFP port on the ONS 15310-MA SDH. Each LC connector contains the transmit (Tx) and receive (Rx) signal for that port. Cisco recommends that you label the transmit and receive ports and the working and protection fibers at each end of the fiber span to avoid confusion with cables that are similar in appearance.

You can route fiber cables through the optional fiber guide, installed at the bottom of the shelf assembly (Figure 1-10).

Figure 1-10 Shelf Assembly with Fiber Guide Installed



Caution You must provide some type of strain relief for the cables, using either a tie-bar or other site-specific solution.

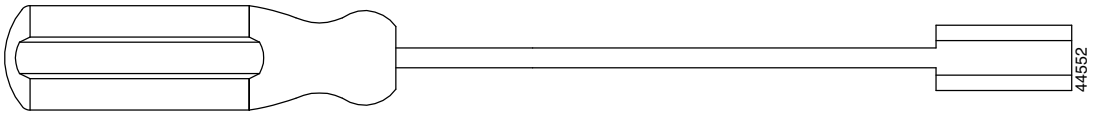
Note Clean all fiber connectors thoroughly. Dust particles can degrade performance. Put caps on any fiber connectors that you do not use.

1.8.3 Coaxial Cable Installation

For E3/DS3 traffic, the ONS 15310-MA SDH uses coaxial cables and connectors. Cisco recommends connecting a 735A coaxial cable to a patch panel. Use a compatible male BNC connector to connect the cable to the E3/DS3 ports. The E3/DS3 cables should be terminated with BNC connectors on the ONS 15310-MA SDH side and BNC connectors on the client side.

Due to the minimal space between BNC connectors and E1 connectors, you might require a special tool for inserting and removing BNC EIAs (Figure 1-11).

Figure 1-11 BNC Insertion and Removal Tool



This tool can be obtained with P/N 227-T1000 from:

Amphenol USA (www.amphenol.com)
One Kennedy Drive
Danbury, CT 06810
Phone: 203 743-9272 Fax: 203 796-2032

This tool can be obtained with P/N RT-1L from:

Trompeter Electronics Inc. (www.trompeter.com)
31186 La Baya Drive
Westlake Village, CA 91362-4047
Phone: 800 982-2629 Fax: 818 706-1040

1.8.4 E1 Cable Installation

The ONS 15310-MA SDH uses 64-pin Champ connector cabling for E1 connections.

Table 1-2 lists the Champ connector pin assignments and the corresponding EIA connector mapping for connectors J8 and J9 on the EIA installed on the A side, and connectors J21 and J22 on the EIA installed on the B side.

Table 1-2 Champ Connector Pin Assignments—Side-A EIA, Connectors J8 and J9; Side-B EIA, Connectors J21 and J22

Signal	Pin	Signal	Pin
Ring Port 1	1	Tip Port 1	33
Ring Port 2	2	Tip Port 2	34
Ring Port 3	3	Tip Port 3	35
Ring Port 4	4	Tip Port 4	36
Ring Port 5	5	Tip Port 5	37
Ring Port 6	6	Tip Port 6	38
Ring Port 7	7	Tip Port 7	39
Ring Port 8	8	Tip Port 8	40
Ring Port 9	9	Tip Port 9	41
Ring Port 10	10	Tip Port 10	42
Ring Port 11	11	Tip Port 11	43
Ring Port 12	12	Tip Port 12	44
Ring Port 13	13	Tip Port 13	45
Ring Port 14	14	Tip Port 14	46
Ring Port 15	15	Tip Port 15	47

Table 1-2 Champ Connector Pin Assignments—Side-A EIA, Connectors J8 and J9; Side-B EIA, Connectors J21 and J22 (continued)

Signal	Pin	Signal	Pin
Ring Port 16	16	Tip Port 16	48
Ring Port 17	17	Tip Port 17	49
Ring Port 18	18	Tip Port 18	50
Ring Port 19	19	Tip Port 19	51
Ring Port 20	20	Tip Port 20	52
Ring Port 21	21	Tip Port 21	53
Ring Port 22	22	Tip Port 22	54
Ring Port 23	23	Tip Port 23	55
Ring Port 24	24	Tip Port 24	56
Ring Port 25	25	Tip Port 25	57
Ring Port 26	26	Tip Port 26	58
Ring Port 27	27	Tip Port 27	59
Ring Port 28	28	Tip Port 28	60
Unused	29	Unused	61
Unused	30	Unused	62
Unused	31	Unused	63
Unused	32	Unused	64

Table 1-3 lists the Champ connector pin assignments and the corresponding EIA connector mapping for connectors J10 and J11 on the EIA installed on the A side, and connectors J23 and J24 on the EIA installed on the B side.

Table 1-3 Champ Connector Pin Assignments—Side-A EIA, Connectors J10 and J11; Side-B EIA, Connectors J23 and J24

Signal	Pin	Signal	Pin
Ring Port 29	1	Tip Port 29	33
Ring Port 30	2	Tip Port 30	34
Ring Port 31	3	Tip Port 31	35
Ring Port 32	4	Tip Port 32	36
Ring Port 33	5	Tip Port 33	37
Ring Port 34	6	Tip Port 34	38
Ring Port 35	7	Tip Port 35	39
Ring Port 36	8	Tip Port 36	40
Ring Port 37	9	Tip Port 37	41
Ring Port 38	10	Tip Port 38	42
Ring Port 39	11	Tip Port 39	43
Ring Port 40	12	Tip Port 40	44

Table 1-3 Champ Connector Pin Assignments—Side-A EIA, Connectors J10 and J11; Side-B EIA, Connectors J23 and J24 (continued)

Signal	Pin	Signal	Pin
Ring Port 41	13	Tip Port 41	45
Ring Port 42	14	Tip Port 42	46
Ring Port 43	15	Tip Port 43	47
Ring Port 44	16	Tip Port 44	48
Ring Port 45	17	Tip Port 45	49
Ring Port 46	18	Tip Port 46	50
Ring Port 47	19	Tip Port 47	51
Ring Port 48	20	Tip Port 48	52
Ring Port 49	21	Tip Port 49	53
Ring Port 50	22	Tip Port 50	54
Ring Port 51	23	Tip Port 51	55
Ring Port 52	24	Tip Port 52	56
Ring Port 53	25	Tip Port 53	57
Ring Port 54	26	Tip Port 54	58
Ring Port 55	27	Tip Port 55	59
Ring Port 56	28	Tip Port 56	60
Unused	29	Unused	61
Unused	30	Unused	62
Unused	31	Unused	63
Unused	32	Unused	64

Table 1-4 lists the Champ connector pin assignments and the corresponding EIA mapping for connectors J12 and J13 on the A-side EIA, and connectors J25 and J26 on the B-side EIA.

Table 1-4 Champ Connector Pin Assignments—Side-A EIA, Connectors J12 and J13; Side-B EIA, Connectors J25 and J26

Signal	Pin	Signal	Pin
Not used	1	Not used	33
Not used	2	Not used	34
Ring Port 57	3	Tip Port 57	35
Ring Port 58	4	Tip Port 58	36
Ring Port 59	5	Tip Port 59	37
Ring Port 60	6	Tip Port 60	38
Ring Port 61	7	Tip Port 61	39
Ring Port 62	8	Tip Port 62	40
Ring Port 63	9	Tip Port 63	41

Table 1-4 Champ Connector Pin Assignments—Side-A EIA, Connectors J12 and J13; Side-B EIA, Connectors J25 and J26 (continued)

Signal	Pin	Signal	Pin
Unused	10	Unused	42
Unused	11	Unused	43
Unused	12	Unused	44
Unused	13	Unused	45
Unused	14	Unused	46
Unused	15	Unused	47
Unused	16	Unused	48
Unused	17	Unused	49
Unused	18	Unused	50
Unused	19	Unused	51
Unused	20	Unused	52
Unused	21	Unused	53
Unused	22	Unused	54
Unused	23	Unused	55
Unused	24	Unused	56
Unused	25	Unused	57
Unused	26	Unused	58
Unused	27	Unused	59
Unused	28	Unused	60
Unused	29	Unused	61
Unused	30	Unused	62
Unused	31	Unused	63
Unused	32	Unused	64

1.8.5 Alarm Cable Installation

The alarm cables attach to the rear of the ONS 15310-MA SDH at the ALARM In and ALARM Out ports. The other ends of the cables plug into the alarm-collection equipment. Terminate the ends of these cables according to local site practice. The pins on the ALARM In and ALARM Out ports correspond to the 32 external alarm inputs and the 8 external alarm outputs (controls) that you can define using Cisco Transport Controller (CTC).

Table 1-5 shows the default input alarm pinouts and the corresponding alarm numbers assigned to each port. Refer to this table when connecting alarm cables to the ONS 15310-MA SDH.

Table 1-5 Default Alarm Pin Assignments—Inputs

DB-37 Pin Number	Function	DB-37 Pin Number	Function
1	Alarm 1	20	Alarm 18
2	Alarm 2	21	Alarm 19
3	Alarm 3	22	Alarm 20
4	Alarm 4	23	Alarm 21
5	Alarm 5	24	Alarm 22
6	Alarm 6	25	Alarm 23
7	Alarm 7	26	Alarm 24
8	Alarm 8	27	Common 17–24
9	Common 1–8	28	Alarm 25
10	Alarm 9	29	Alarm 26
11	Alarm 10	30	Alarm 27
12	Alarm 11	31	Alarm 28
13	Alarm 12	32	Alarm 29
14	Alarm 13	33	Alarm 30
15	Alarm 14	34	Alarm 31
16	Alarm 15	35	Alarm 32
17	Alarm 16	36	Common 25–32
18	Common 9–16	37	N/C
19	Alarm 17	—	—

Table 1-6 shows the default output alarm pinouts and the corresponding alarm numbers assigned to each port. Refer to this table when connecting alarm cables to the ONS 15310-MA SDH.

Table 1-6 Default Alarm Pin Assignments—Outputs

DB-25 Pin Number	Function	DB-25 Pin Number	Function
1	Out 1+	14	Out 2+
2	Out 1–	15	Out 2–
3	—	16	Out 3+
4	—	17	Out 3–
5	—	18	Out 4+
6	—	19	Out 4–
7	—	20	Out 5+
8	—	21	Out 5–
9	—	22	Out 6+
10	—	23	Out 6–
11	—	24	Out 7+

Table 1-6 Default Alarm Pin Assignments—Outputs (continued)

DB-25 Pin Number	Function	DB-25 Pin Number	Function
12	Out 8+	25	Out 7–
13	Out 8–	—	—

For information about provisioning alarms for external devices, refer to Chapter, "Manage alarms", Section, "Provision External Alarms and Controls" in the *Cisco ONS 15310-MA SDH Procedure Guide*.

1.8.6 BITS Cable Installation

The BITS clock cable (terminated with a DB-9 connector or with a DB9BIT=BB9 to wire wrap adapter) attaches to the BITS port on the ONS 15310-MA SDH. The other end of the cable plugs into the BITS clock, terminate this end of the cable according to local site practice. In case the DB9BIT=BB9 to wire wrap adapter is used on the ONS 15310-MA, the cable shield must be wire-wrapped to the GND pin of the wire wrap adapter.

The 15310-MA SDH has one BITS input and one BITS output. The BITS inputs and outputs have corresponding pins on the DB-9 BITS ports. When connecting BITS cable to the ONS 15310-MA SDH, see Table 1-7 for the BITS cable pin assignments.

Table 1-7 BITS Cable Pin Assignments

DB-9 Pin Number	Function
1	BITS Output+
2	BITS Output–
3	—
4	—
5	—
6	BITS Input+
7	BITS Input–
8	—
9	—

Note Refer to Telcordia SR-NWT-002224 for rules about how to provision timing references.

1.8.7 UDC Cable Installation

The 64K, EIA/TIA-232 user data channel (UDC) interface provides F1 and F2 byte input and output. When connecting the UDC cable to the ONS 15310-MA SDH, see Table 1-8 for the UDC cable pin assignments. Unshielded twisted-pair #22 or #24 AWG wire is required for the UDC ports.

Table 1-8 UDC Cable Pin Assignments

RJ-45 Pin Number	RS-232/64K Mode
1	TX +
2	TX –
3	RX +
4	—
5	—
6	RX –
7	—
8	—

1.9 Cable Routing and Management

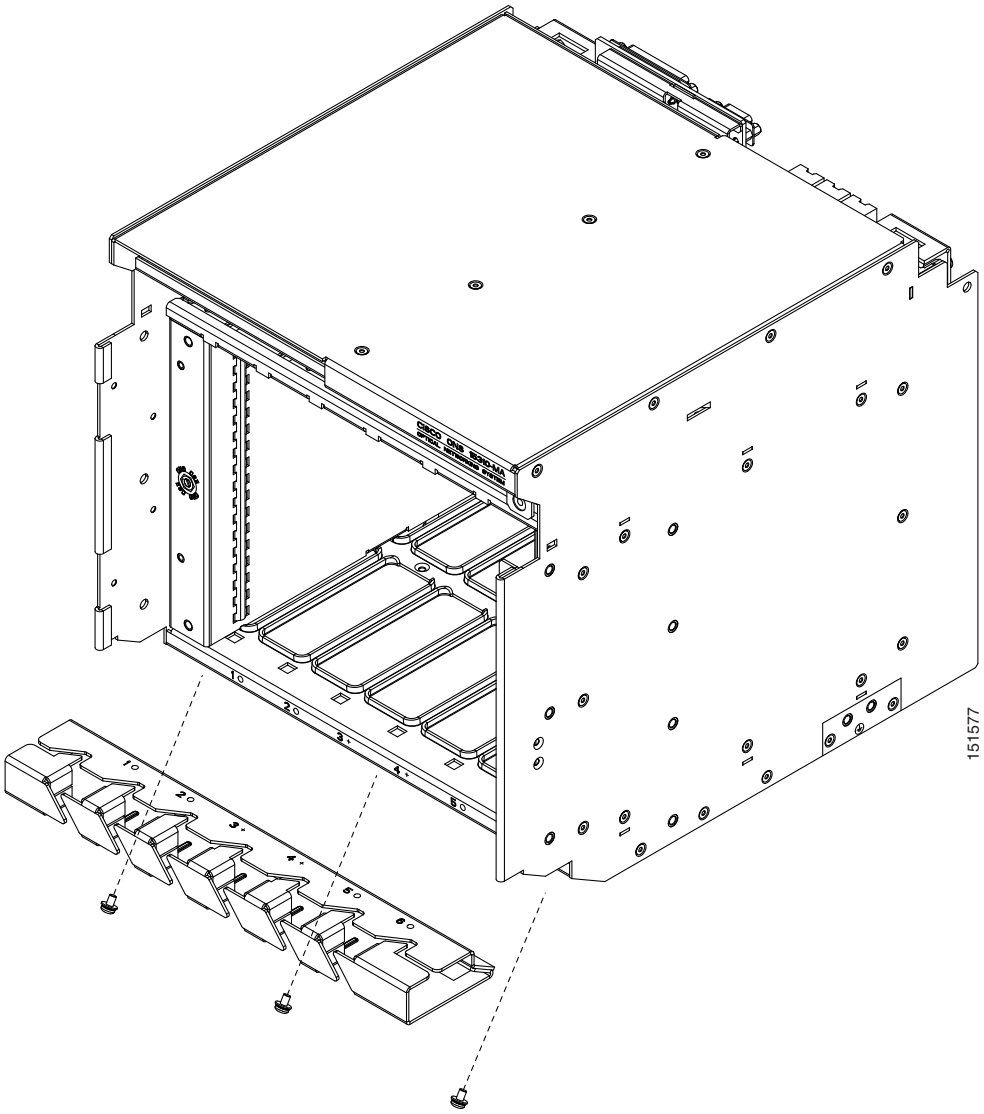
Two types of cable management brackets are available for the ONS 15310-MA SDH shelf assembly: the standard bracket, which ships with the ONS 15310-MA SDH ship kit, and the extended bracket, which ships as a separate orderable part. You can install either bracket under the shelf assembly.

1.9.1 Standard Cable Management Bracket

The standard cable management bracket has one area in the rear that can be used for routing cables. Fiber-optic cable can be routed through the rear trough of the bracket. Ethernet cables can be passed through the front of the bracket to be bundled and secured using tie-wraps or other site-specific materials.

Figure 1-12 shows the installation of the standard cable management bracket.

Figure 1-12 Installing the Standard Cable Management Bracket

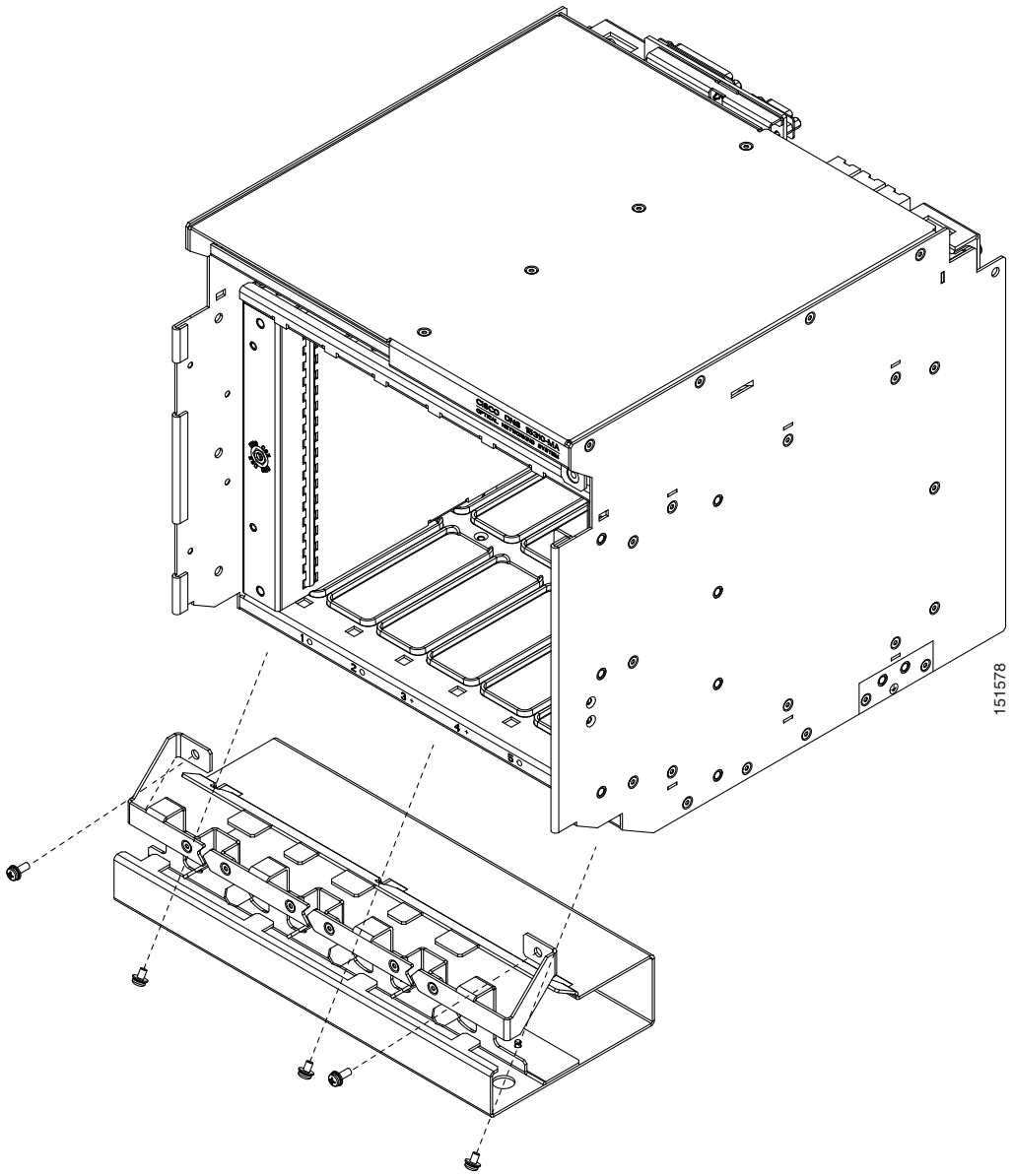


1.9.2 Extended Cable Management Bracket

The extended cable management bracket has two areas that can be used for routing cables, one in the front and one in the rear. Fiber-optic cables can be routed through the smaller front trough, and Ethernet cables can be routed through the larger rear trough.

Figure 1-13 shows the installation of the extended cable management bracket.

Figure 1-13 Installing the Extended Cable Management Bracket



1.10 Fan-Tray Assembly

The fan-tray assembly is located at the top of the ONS 15310-MA SDH shelf assembly, under the air filter, rear exhaust, and air inlet. The fan tray is a removable drawer that holds four fans, the fan-control circuitry, and the fuse-control circuitry for the ONS 15310-MA SDH. After you install the fan tray, you should only need to access it if a fan failure occurs.

The new fan-tray assembly (FTA2) has a fuse-control circuitry that is capable of blowing a low-current fuse (1/4-A to 1/2-A). This is useful when you are using power distribution equipment that has a low current fuse connected in parallel with the main fuse to help detect any failures in the main fuse. The fuse-control circuitry independently draws a short current (approximately 900 mA) for about 0.7 seconds

every 15 minutes (at 24 degrees Celsius or 120 degrees Fahrenheit), alternating between power supply inputs A and B. This allows the ONS 15310-MA SDH to blow the low current fuse when there is a failure or loss of the main fuse and report an alarm (FAN alarm).

The front of the fan-tray assembly has CRIT, MAJ, and MIN alarm LEDs that illuminate if a Critical, Major, or Minor alarm is present anywhere on the ONS 15310-MA SDH assembly.

1.10.1 Fan Speed and Power Requirements

Fan speed is controlled by temperature sensors on the 15310E-CTX-K9 card. The sensors measure the input air temperature at the fan-tray assembly. Fan speed options are low, medium, and high.

1.10.2 Fan Failure

If one or more fans fail on the fan-tray assembly, replace the entire assembly. You cannot replace individual fans. The red Fan Fail LED on the front of the fan tray illuminates when one or more fans fail. For fan-tray replacement instructions, refer to the *Cisco ONS 15310-MA SDH Troubleshooting Guide*. The red Fan Fail LED is unlit after you install a working fan tray.

Note The red Fan Fail LED on the front of the fan tray illuminates when only one power source is connected to the chassis, or any fuse blows.

1.10.3 Air Filter

The ONS 15310-MA SDH contains a reusable air filter (15310-MA SDH-FTF) that is installed above the fan-tray assembly. The reusable filter is made of a gray, open-cell, polyurethane foam that is specially coated to provide fire and fungi resistance. Spare filters should be kept in stock.

Caution Do not operate an ONS 15310-MA SDH without the mandatory fan-tray air filter.

1.10.4 Orderwire

Orderwire allows a crafts person to plug a phone set into an ONS 15310-MA SDH and communicate with crafts people working at other ONS 15310-MA SDH nodes or other facility equipment. The orderwire is a pulse code modulation (PCM) encoded voice channel that uses E1 or E2 bytes in the MSOH and in the regenerator section overhead.

The FTA allows simultaneous either local (RSOH signal) or express (MSOH signal) orderwire channels on an SDH ring or particular optics facility. Express orderwire also allows communication through regeneration sites when the regenerator is not a Cisco device.

You can provision orderwire functions with CTC similar to the current provisioning model for DCC channels. In CTC, you provision the orderwire communications network during ring turn-up so that all network elements (NEs) on the ring can communicate with one another. Orderwire terminations (that is, the optics facilities that receive and process the orderwire channels) are provisionable. Both express and local orderwire can be configured as on or off on a particular SDH facility. The ONS 15310-MA SDH supports up to four orderwire channel terminations per shelf. This allows linear, single ring, dual ring,

and small hub-and-spoke configurations. Keep in mind that orderwire is not protected in ring topologies such as multiplex section-shared protection ring (MS-SPRing) and subnetwork connection protection (SNCP).

Note The Cisco ONS 15310-MA SDH Orderwire functionality is compatible with Cisco ONS 15454 Orderwire functionality.

Caution Do not configure orderwire loops. Orderwire loops cause feedback that disables the orderwire channel.

The ONS 15310-MA SDH implementation of both local and express orderwire is broadcast in nature. The line acts as a party line. Anyone who picks up the orderwire channel can communicate with all other participants on the connected orderwire subnetwork. The local orderwire party line is separate from the express orderwire party line. Up to four STM-N facilities for each local and express orderwire are provisionable as orderwire paths.

The FTA supports selective dual tone multifrequency (DTMF) dialing for telephony connectivity, which causes specific or all ONS 15310-MA SDH FTAs on the orderwire subnetwork to "ring." The ringer/buzzer resides on the FTA. There is also a "ring" LED that mimics the FTA ringer. It flashes when a call is received on the orderwire subnetwork. A party line call is initiated by pressing ***0000** on the DTMF pad.

The orderwire ports are standard RJ-11 receptacles. The pins on the orderwire ports correspond to the tip and ring orderwire assignments.

Table 1-9 describes the orderwire pin assignments.

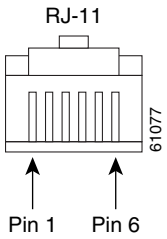
Table 1-9 Orderwire Pin Assignments

RJ-11 Pin Number	Description
1	Four-wire receive ring
2	Four-wire transmit tip
3	Two-wire ring
4	Two-wire tip
5	Four-wire transmit ring
6	Four-wire receive tip

When provisioning the orderwire subnetwork, make sure that an orderwire loop does not exist. Loops cause oscillation and an unusable orderwire channel.

Figure 1-14 shows the standard RJ-11 connectors used for orderwire ports. Use a shielded RJ-11 cable.

Figure 1-14 RJ-11 Cable Connector



1.11 Cards and Slots

Caution Always use the supplied ESD wristband when working with a powered ONS 15310-MA SDH. For detailed instructions on how to wear the ESD wristband, refer to the Cisco ONS Electrostatic Discharge (ESD) and Grounding Guide.

The ONS 15310-MA SDH has six card slots. Slots 3 and 4 are dedicated to the common-control (15310E-CTX-K9) cards. Slots 1, 2, 5, and 6 can accommodate the following traffic cards:

- Ethernet: CE-100T-8 card, ML-100T-8, CE-MR-6 card
- Electrical: E1_21_E3_DS3_3 card, E1_63_E3_DS3_3 card

These cards have plugs at the rear of the card. When the ejectors are fully closed, the card plugs into the assembly backplane.

When no card is installed in a card slot, a filler card should be installed. Use a 15310E-CTX-K9 filler card in empty 15310E-CTX-K9 slots (Slots 3 and 4), and an expansion filler card in empty traffic card slots (Slots 1, 2, 5, and 6).

Figure 1-15 shows card installation for the ONS 15310-MA SDH.

Figure 1-15 Installing a Card in an ONS 15310-MA SDH

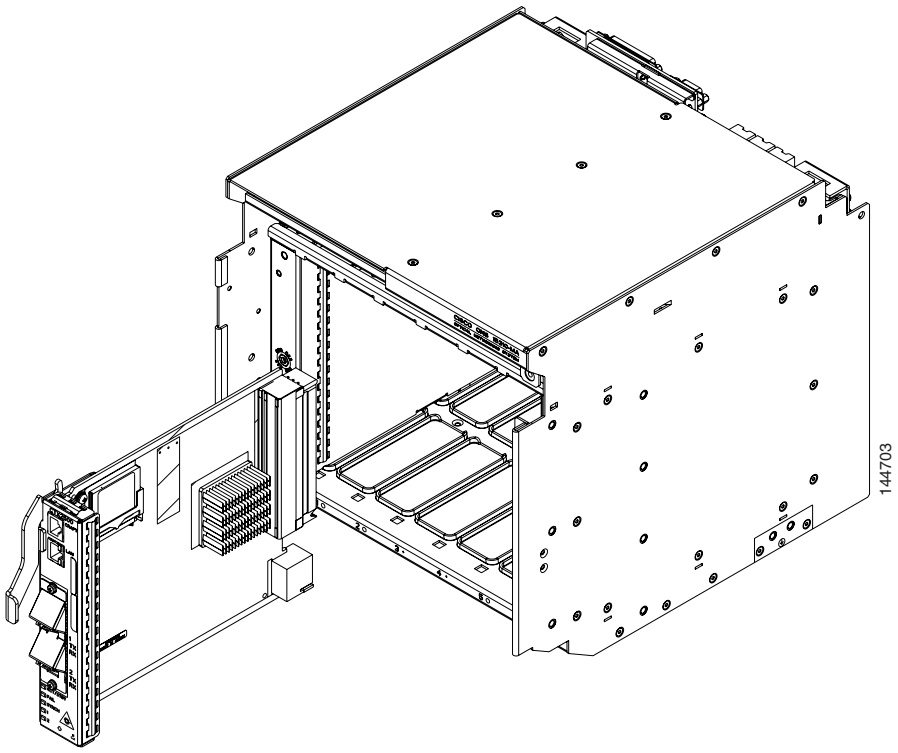


Table 1-10 lists the number of ports, line rates, connector options, and connector locations for ONS 15310-MA SDH electrical, Ethernet, and optical interfaces.

Table 1-10 Port Line Rates, Connector Types, and Locations

Interface	Ports	Line Rate per Port	Connector Type	Connector Location
E1	21/63	2.048 Mbps	Champ	Rear of the 15310-MA SDH shelf assembly
DS-3	3	44.736 Mbps	BNC	Rear of the 15310-MA SDH shelf assembly
E3	3	34 Mbps	BNC	Rear of the 15310-MA SDH shelf assembly
STM1/STM4/STM16	2	155.52 Mbps (VC4) 622.08 Mbps (VC4-4c)	LC	15310E-CTX-K9 card faceplate
Ethernet (CE-100T-8 card)[1]	8	10/100 Mbps	RJ-45	CE-100T-8 card faceplate

Table 1-10 Port Line Rates, Connector Types, and Locations (continued)

Interface	Ports	Line Rate per Port	Connector Type	Connector Location
Ethernet (ML-100T-8 card)[2]	8	10/1000 Mbps	RJ-45	ML-100T-8 card faceplate
Ethernet (CE-MR-6 card)	6	10/100/1000 Mbps	LC (SFP), Copper (SFP)-RJ45	Faceplate

1. The CE-100T-8 card with PID 15310-CE-100T-8 is not compatible with the ONS 15310-MA SDH. The 15310-P-CE-100T-8 is compatible with the ONS 15310-MA SDH shelf assemblies.
2. The ML-100T-8 card with PID 15310-ML-100T-8 is not compatible with the ONS 15310-MA SDH. The 15310-P-ML-100T-8 is compatible with the ONS 15310-MA SDH shelf assemblies.

CHAPTER 2

Card Reference

This chapter describes the Cisco ONS 15310-MA SDH cards. It includes descriptions and block diagrams for each card. For specifications, see Appendix A, "Specifications."For card installation and turn-up procedures, refer to the *Cisco ONS 15310-MA SDH Procedure Guide*.

Chapter topics include:

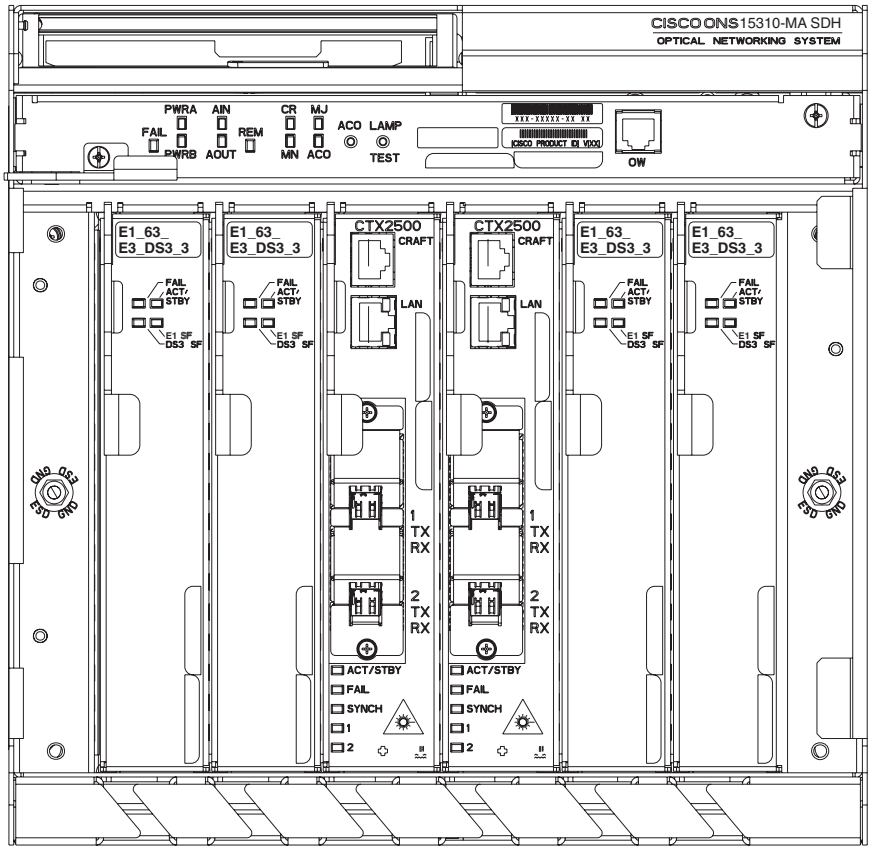
Note The I-Temp symbol is located on the faceplate of an I-Temp compliant card. A card without this symbol is C-Temp compliant.

2.1 Card Summary and Compatibility

The Cisco ONS 15310-MA SDH uses a common-control card (the 15310E-CTX-K9) and a combination of Ethernet cards (CE-100T-8, CE-MR-6, and ML-100T-8) and electrical cards (E1_21_E3_DS3_3 and E1_63_E3_DS3_3). The 15310E-CTX-K9 card provides optical connections for the ONS 15310-MA SDH.

This section provides a card summary. Figure 2-1 shows the ONS 15310-MA SDH fully populated with cards.

Figure 2-1 ONS 15310-MA SDH with Cards Installed



2.1.1 Card Summary

The ONS 15310-MA SDH cards are summarized in Table 2-1.

Table 2-1 ONS 15310-MA SDH Cards and Descriptions

Card	Compatible Platform(s)	Description	For Additional Information...
15310E-CTX-K9	MA	The 15310E-CTX-K9 card serves as the common control and central switching element for the ONS 15310-MA SDH.	See the "2.2 15310E-CTX-K9 Card" section on page 2-4.
CE-100T-8	MA	The CE-100T-8 card provides eight RJ-45 10/100-Mbps Ethernet ports.	See the "2.3 CE-100T-8 Card" section on page 2-6.
CE-MR-6	MA	The CE-MR-6 card provides six 10/100/1000-Mbps Gigabit Ethernet ports.	See the "2.4 CE-MR-6 Card" section on page 2-9.
ML-100T-8	MA	The ML-100T-8 Ethernet card provides eight ports of 10/100 Ethernet-encapsulated traffic into SDH VC4/STM-1 payloads.	See the "2.5 ML-100T-8 Card" section on page 2-12.

Table 2-1 ONS 15310-MA SDH Cards and Descriptions (continued)

Card	Compatible Platform(s)	Description	For Additional Information...
E1_21_E3_DS3_3 and E1_63_E3_DS3_3	MA SDH	The E1_21_E3_DS3_3 and E1_63_E3_DS3_3 cards provide 21 and 63 ITU-Compliant G.703 E1 ports, respectively, as well as three E3/DS3 ports.	See the "2.6 E1_21_E3_DS3_3 and E1_63_E3_DS3_3 Cards" section on page 2-16.
Filler Card (Traffic Slot)	MA	The FILLER card is used to fill unused traffic card slots in the ONS 15310-MA SDH shelves. The Cisco Transport Controller (CTC) graphical user interface (GUI) detects the filler card.	See the "2.7 Filler Cards" section on page 2-18.
Filler Card (15310E-CTX-K9 Slot)	MA	The CTX FILLER card is used to fill unused 15310E-CTX-K9 card slots in the ONS 15310-MA SDH shelf. CTC detects the filler card.	See the "2.7 Filler Cards" section on page 2-18.
SFP Modules	MA	Small Form-factor Pluggables (SFPs) are integrated fiber-optic transceivers that provide high-speed serial links from a port or slot to the network.	See the "2.8 SFP Modules" section on page 2-19

2.1.2 Card Compatibility

Table 2-2 lists CTC software release compatibility for each ONS 15310-MA SDH card. In the table, "Yes" means that the card is compatible with the listed software release.

Table 2-2 ONS 15310-MA SDH Software Release Compatibility Per Card

Card	R9.1 and R9.2
15310E-CTX-K9	Yes
CE-100T-8 Card[1]	Yes
CE-MR-6 Card	Yes
ML-100T-8 Card[2]	Yes
E1_21_E3_DS3_3	Yes
E1_63_E3_DS3_3	Yes
FILLER Card	Yes
CTX FILLER Card	Yes

1. The CE-100T-8 card with product ID (PID) 15310-CE-100T-8 is not compatible with the ONS 15310-MA SDH. 15310-P-CE-100T-8 is compatible with the ONS 15310-MA SDH shelf assembly.
2. The ML-100T-8 card with PID 15310-ML-100T-8 is not compatible with the ONS 15310-MA SDH shelf assembly. 15310-P-ML-100T-8 is compatible with the ONS 15310-MA SDH shelf assembly.

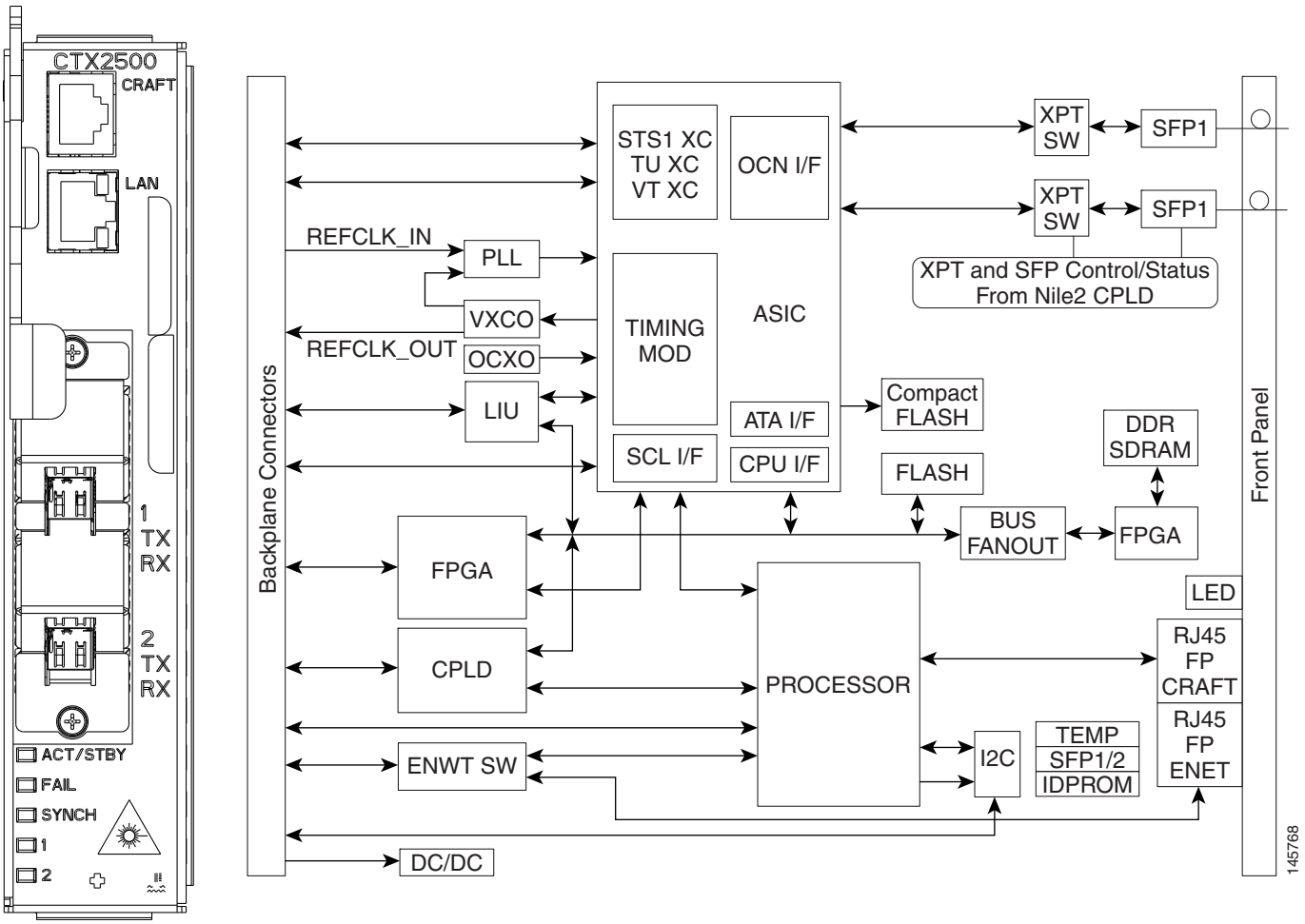
2.2 15310E-CTX-K9 Card

The 15310E-CTX-K9 card, for use with the ONS 15310-MA SDH, is a fully nonblocking cross-connect card that operates in either a simplex or duplex (redundant) configuration. It performs system initialization, provisioning, alarm reporting, maintenance, diagnostics, IP address detection/resolution, SDH DCC termination, system fault detection, and cross-connect maintenance and management for the ONS 15310-MA SDH. The card also provides the circuitry for the STM1/STM4/STM16 interfaces, and ensures that the system maintains timing with SETS stability.

Caution If the system loses power or the 15310E-CTX-K9 card is reset, you must reset the ONS 15310-MA SDH clock unless the node has been previously provisioned to use Simple Network Time Protocol (SNTP) to update the clock over the LAN.

Figure 2-2 shows the 15310E-CTX-K9 card faceplate and block diagram.

Figure 2-2 15310E-CTX-K9 Faceplate and Block Diagram



2.2.1 System Cross-Connect

The 15310E-CTX-K9 card provides:

- 2016 VC12 ports. That is, 1008 VC-12 Cross-connections (1008X1008)
- 96 VC3 ports. That is, 48 VC-3 Cross-Connections (48X48)
- 128 VC4 ports. That is, 64 VC-4 Cross -Connections (64X64)

2.2.2 15310E-CTX-K9 Card Side Switches

The 15310E-CTX-K9 supports errorless side switches (less than a 50-ms impact to any traffic) when the switch is initiated through software, through either a soft-reset or a software upgrade where there is no FPGA or firmware upgrade. A side switch means switching from a 15310E-CTX-K9 on one side of the shelf to the redundant 15310E-CTX-K9 on the other side of the shelf.

2.2.3 15310E-CTX-K9 Optical Interfaces

There are two PPM (SFP) slots on the 15310E-CTX-K9 faceplate to provide optical interfaces. (PPM is the graphical user interface term for SFP.) Each slot can contain a one-port PPM. Cisco-qualified PPMs can be single-rate (STM1, STM4, or STM16) or multirate (STM1/STM4). Single-rate PPMs are autoprovisioned when they are installed, but multirate PPMs must be provisioned. This behavior can be controlled by NE defaults.

Note To provision, edit, or delete PPM ports, refer to the "Change Port Settings" chapter in the *Cisco ONS 15310-MA SDH Procedure Guide*. For more information about PPM/SFP hardware, see the "2.8 SFP Modules" section on page 2-19.

Note CTX-2500 only supports STM1-E Electrical SFP.

2.2.4 15310E-CTX-K9 Card-Level Indicators

The 15310E-CTX-K9 card has four card-level LEDs, described in Table 2-3.

Table 2-3 15310E-CTX-K9 Card-Level Indicators

Card-Level LEDs	Description
FAIL LED (Red)	The red FAIL LED indicates that the card processor is not ready or that a catastrophic software failure occurred on the card. As part of the boot sequence, the FAIL LED turns on and flashes until the software deems the card operational.

Table 2-3 15310E-CTX-K9 Card-Level Indicators (continued)

Card-Level LEDs	Description
ACT/STBY LED (Green/Amber)	The ACT/STBY LED is green if the card is the active 15310E-CTX-K9 card. It is amber if the card is the standby card.
SYNC LED (Green/Amber)	The SYNC LED is green if the 15310E-CTX-K9 card detects both a primary and secondary clock reference. It is amber if the card detects only a single clock reference.

2.2.5 15310E-CTX-K9 Port-Level Indicators

Two bicolor LEDs show the status per port (Ports 1 and 2). The port LED is green if the port is available to carry traffic and is provisioned as in-service. The port LED is red if there is a signal failure or loss of signal on the port.

2.3 CE-100T-8 Card

This section describes the features and functions of the Layer 1 Ethernet card, the CE-100T-8.

Note The CE-100T-8 card with PID 15310-CE-100T-8 is not compatible with the ONS 15310-MA SDH. The 15310-P-CE-100T-8 is compatible with the ONS 15310-MA SDH shelf assembly. If you install a 15310-CE-100T-8 in an ONS 15310-MA SDH shelf assembly, you will receive a mismatched equipment alarm (mismatchofEquipment). You can view the PID under the node view Inventory tab in CTC.

Caution Do not install CE-100T-8 and ML-100T-8 cards in OSP.

The CE-100T-8 card maps 8-port 10/100-Mbps Ethernet-encapsulated traffic into SDH payloads, making use of low-order (VC12) virtual concatenation (VCAT), high-order (VC3, VC4) VCAT, generic framing procedure (GFP), and Point-to-Point Protocol/high-level data link control (PPP/HDLC) framing protocols. It also supports the link capacity adjustment scheme (LCAS), which allows hitless dynamic adjustment of SDH link bandwidth. The CE-100T-8 card provides eight RJ-45 10/100-Mbps Ethernet ports on the faceplate of the card. An inactive RJ-11 console port is also on the faceplate.

The circuit types supported are:

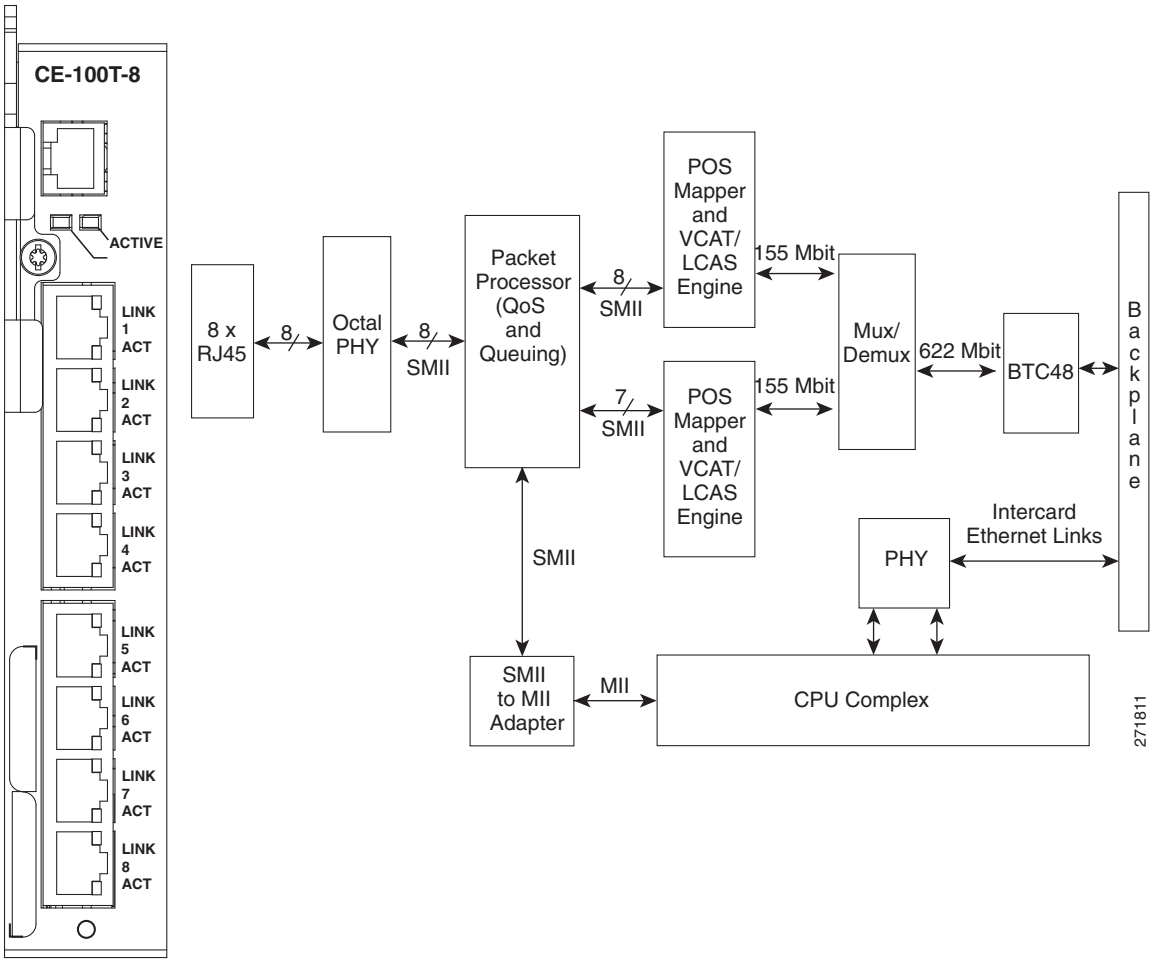
- VC3 and VC4 CCAT
- VC3-Nv VCAT (N = 1–3)
- VC3-Nv LCAS (N = 1–3)
- VC3-2v software LCAS (SW-LCAS) (compatible with ML-Series cards only)
- VC12-Nv VCAT (N = 1-63)
- VC12-Nv LCAS(N = 1-63)

Note The SW-LCAS is not supported on CE-100T-8 cards for interoperation with the CE-MR-6 and ML-MR-10 cards.

Each 10/100 Ethernet port can be mapped to an SDH channel in increments of VC12 or VC3 granularity. There are eight backend packet-over-SDH (POS) ports (VCAT groups [VCGs]) available on the ML-100T-8 card. Additionally, the CE-100T-8 card supports packet processing, classification, quality of service (QoS)-based queuing, and traffic scheduling.

Figure 2-3 shows the CE-100T-8 card faceplate and block diagram.

Figure 2-3 CE-100T-8 Faceplate and Block Diagram



The following paragraphs describe the general functions of the CE-100T-8 card and relate it to the block diagram in Figure 2-3.

In the ingress direction (Ethernet-to-SDH), an octal PHY, which performs all of the physical layer interface functions for 10/100-Mbps Ethernet, sends the frame to the packet processor for queuing in the respective packet buffer memory. The packet processor performs packet processing, packet switching, and classification. The Ethernet frames are then passed over SMII channels to the POS mappers, where Ethernet traffic is terminated and is encapsulated using the PPP/HDLC or GFP framing protocols. The encapsulation method is selected on a per-port basis. The encapsulated Ethernet frames are then mapped into a configurable number of VCAT low-order and high-order payloads, such as VC12 synchronous payload envelope (SPE), VC3 SPE, or a contiguous concatenated (CCAT) payload such as VC4 SPE. Up to 63 VC12 SPEs or three VC3 SPEs can be virtually concatenated.

The SPE from each POS mapper (up to VC4) carrying encapsulated Ethernet frames are passed onto the multiplexer/demultiplexer (mux/demux) next, where the VC4 frames from both POS mappers are multiplexed to form an VC4-4 frame for transport over the SDH network by means of the Bridging Transmission Convergence (BTC-48) application-specific integrated circuit (ASIC).

Note Although the VC4 frames are multiplexed into an VC4-4 frame, the frame carries at most an VC4-2c payload, leaving half of the VC4-4 bandwidth free.

In the egress direction (SDH-to-Ethernet), the mux/demux extracts the first and second VC4 SPEs from the VC4-4 frame it receives from the BTC-48 before sending them to the POS mappers. The VC4 SDH SPE carrying GFP or PPP/HDLC encapsulated Ethernet frames are then extracted and buffered in the external memory of the POS mappers. This memory is used for providing alignment and differential delay compensation for the received low/high order virtual concatenated payloads. When alignment and delay compensation are complete, the Ethernet frames are decapsulated with one of the framing protocols (GFP or PPP/HDLC). Decapsulated Ethernet frames are then passed onto the packet processor for QoS queuing and traffic scheduling. The network processor switches the frame to one of the corresponding PHY channels and then onto the Ethernet port for transmission to the external clients.

With regard to QoS, the VLAN class-of-service (CoS) threshold (value 0 to 7, default 7) and the IP type-of-service (ToS) threshold (value 0 to 255, default 255) on incoming Ethernet packets are both available for priority queuing. These thresholds are provisionable through CTC, TL1, and Cisco Transport Manager (CTM). CoS takes precedence over ToS unless the CoS threshold is set to the default of 7. This threshold value does not prioritize any packets based on CoS, so ToS is used. The value configured is a threshold and any value greater than that value is set as a priority. For example, if a CoS of 5 is set as the threshold, only CoS values of 6 and 7 would be set to priority.

2.3.1 CE-100T-8 Card-Level Indicators

The CE-100T-8 card faceplate has two card-level LED indicators, described in Table 2-4.

Table 2-4 CE-100T-8 Card-Level Indicators

Card-Level LEDs	Description
SF LED (Red)	The red FAIL LED indicates that the card processor is not ready or that a catastrophic software failure occurred on the CE-100T-8 card. As part of the boot sequence, the FAIL LED blinks until the software deems the card operational, then it turns off.
ACT LED (Green)	The ACT LED provides the operational status of the CE-100T-8. When the ACT LED is green, it indicates that the CE-100T-8 card is active and the software is operational; otherwise, it is off.

2.3.2 CE-100T-8 Port-Level Indicators

The CE-100T-8 card has two LEDs embedded into each of the eight Ethernet-port RJ-45 connectors. The LEDs are described in Table 2-5.

Table 2-5 CE-100T-8 Port-Level Indicators

Port-Level Indicators	Description
ACT LED (Amber)	A steady amber LED indicates a link is detected, but there is an issue inhibiting traffic. A blinking amber LED means traffic is flowing.
LINK LED (Green)	A steady green LED indicates that a link is detected, but there is no traffic. A blinking green LED flashes at a rate proportional to the level of traffic being received and transmitted over the port.
Both ACT and LINK LED OFF	Unlit green and amber LEDs indicate no traffic.

2.4 CE-MR-6 Card

This section describes the features and functions of the CE-MR-6 Ethernet card. This card is compatible with the Cisco ONS 15310-MA SDH.

The CE-MR-6 card provides six IEEE 802.3-compliant 10/100/1000-Mbps Gigabit Ethernet ports at the ingress. At the egress, the CE-MR-6 card provides an integrated Ethernet over SDH mapper with six virtual ports to transfer Ethernet packets over an SDH network.

The CE-MR-6 card uses pluggable Small Form-Factor Pluggable Interface Converters (SFPs) to transport Ethernet traffic over an SDH network. SFP modules are offered as separate orderable products for flexibility. For details, see the "2.8 SFP Modules" section on page 2-19.

The Ethernet frames are encapsulated using the ITU-T generic framing procedure (GFP) [with or without cyclic redundancy check (CRC)] or LAN extension (LEX), the point-to-point protocol (PPP) with high-level data link control (HDLC).

The Ethernet ports automatically configure to operate at either half or full duplex and can determine whether to enable or disable flow control. The Ethernet ports can also be oversubscribed using flow control.

The CE-MR-6 card supports the link capacity adjustment scheme (LCAS), which allows hitless dynamic adjustment of SDH link bandwidth. The CE-MR-6 card's LCAS is hardware-based, but the CE-MR-6 also supports software LCAS (SW-LCAS). This makes it compatible with ML-Series cards, which support only SW-LCAS, along with the CE-100T-8 cards. The CE-MR-6 card also supports the non link capacity adjustment scheme (no-LCAS). The CE-MR-6 card supports both flexible and fixed VCAT groups (VCG).

Note The SW-LCAS is not supported on CE-MR-6 cards for interoperation with the CE-100T-8 and ML-MR-10 cards.

Note The CE-MR-6 card does not support interoperation between the LCAS and non-LCAS circuits.

The Ethernet frames can be mapped into:

- E1X1 G.707-based high-order virtual concatenated (HO VCAT) payloads
  - VC4-nv, where n is 1 to 7
  - VC3-nv, where n is 1 to 21

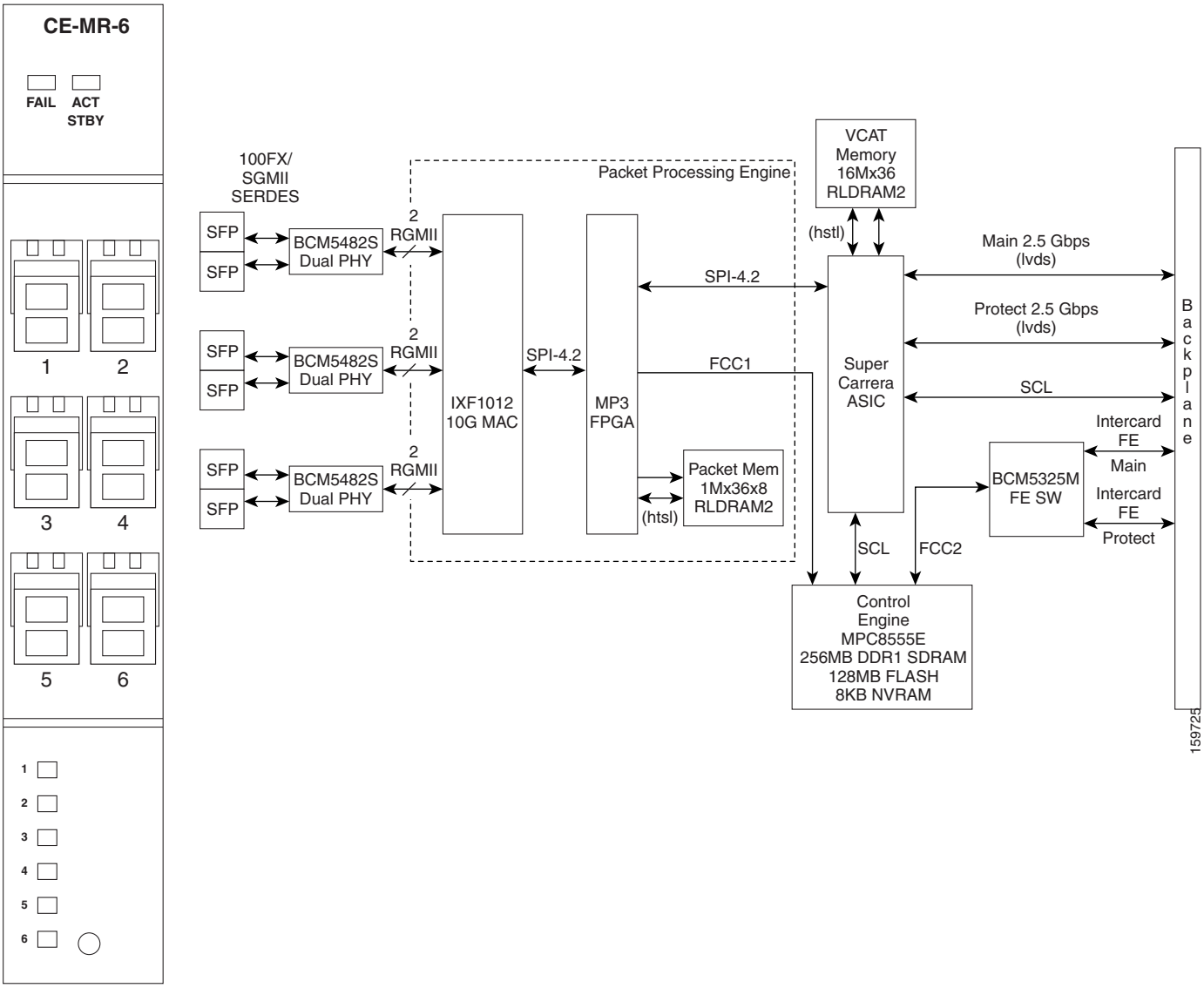
- E1X1 G.707-based low-order virtual concatenated (LO VCAT) payloads
  - VC12-nv, where n is 1 to 63
- Contiguously concatenated (CCAT) SDH payloads
  - Standard CCAT sizes (VC3, VC4, VC4-4c, VC4-8c, and VC4-16c)
  - Non-standard CCAT sizes (VC4-2c and VC4-3c)

To configure a CE-MR-6 card circuit, refer to the "Create Circuits and VC low-order path Tunnels" chapter in the *Cisco ONS 15310-MASDH Procedure Guide.*

The CE-MR-6 card provides multiple management options through Cisco Transport Controller (CTC), Cisco Transport Manager (CTM), Transaction Language 1 (TL1), and Simple Network Management Protocol (SNMP).

Figure 2-4 shows the CE-MR-6 card faceplate and block diagram.

Figure 2-4 CE-MR-6 Faceplate and Block Diagram



2.4.1 CE-MR-6 Card-Level Indicators

The CE-MR-6 card faceplate has two card-level LED indicators, described in Table 2-6.

Table 2-6 CE-MR-6 Card-Level Indicators

Card-Level LEDs	Description
FAIL LED (Red)	The red FAIL LED indicates that the card processor is not ready or that a catastrophic software failure occurred on the CE-MR-6 card. As part of the boot sequence, the FAIL LED blinks until the software deems the card operational, then it turns off.
ACT/STBY LED (Green)	The ACT/STBY LED provides the operational status of the CE-MR-6. When the ACT/STBY LED is green, it indicates that the CE-MR-6 card is active and the software is operational; otherwise, it is off.

2.4.2 CE-MR-6 Port-Level Indicators

The CE-MR-6 card has an LED for each of the six ports, described in Table 2-7.

Table 2-7 CE-MR-6 Port-Level Indicators

Port-Level Indicators	Description
Off	No link exists to the Ethernet port.
Steady amber	A link exists to the Ethernet port, but traffic flow is inhibited. For example, a lack of circuit setup, an error on the line, or a disabled port might inhibit traffic flow.
Solid green	A link exists to the Ethernet port, but no traffic is carried on the port.
Flashing green	A link exists to the Ethernet port, and traffic is carried on the port. The LED flash rate reflects the traffic rate for that port.

2.5 ML-100T-8 Card

This section describes the features and functions of the Layer 2 10/100 Ethernet card, the ML-100T-8. The card is compatible with the ONS 15310-MA SDH.

Note The ML-100T-8 card with PID 15310-ML-100T-8 is not compatible with the ONS 15310-MA SDH. 15310-P-ML-100T-8 is compatible with the ONS 15310-MA SDH shelf assembly. If you install a 15310-ML-100T-8 in an ONS 15310-MA SDH shelf assembly, you will receive a mismatched equipment alarm (mismatchofEquipment). You can view the PID under the node view Inventory tab in CTC.

2.5.1 ML-100T-8 Card Description

Caution Do not install CE-100T-8 and ML-100T-8 cards in OSP.

The ML-100T-8 card maps eight ports of 10/100 Ethernet encapsulated traffic into SDH VC4 payloads. The card is compatible with high-order VC3 VCAT and the GFP and PPP/HDLC framing protocols. It also supports LCAS, which allows hitless dynamic adjustment of SDH link bandwidth. Each 10/100 Ethernet port can be mapped to an SDH channel in increments of VC3 granularity.

The ML-100T-8 card provides a switched operating mode, with eight subscriber interfaces and two virtual POS (VCG) interfaces mapped through the cross-connect for transport with other services between network elements (NEs).

The circuit types supported are:

- VC3
- VC3-Nv VCAT (N=1–2)
- VC3-Nv LCAS (N=1–2)
- VC3-2v SW-LCAS

Additionally, the ML-100T-8 card supports packet processing, classification, QoS-based queuing, traffic scheduling, and packet multiplexing services for Layer 2/3.

2.5.2 ML-Series Cisco IOS CLI Console Port

The ML-Series card has an RJ-11 serial console port on the card faceplate labeled Console. It enables communication from the serial port of a PC or workstation running terminal emulation software to the Cisco IOS command line interface (CLI) on a specific ML-Series card.

Due to space limitations on the ML-Series card faceplate, the console port is an RJ-11 modular jack instead of the more common RJ-45 modular jack. Cisco supplies an RJ-11 to RJ-45 console cable adapter with each ML-Series card. After connecting the adapter, the console port functions like the standard Cisco RJ-45 console port. Figure 2-5 shows the RJ-11-to-RJ-45 console cable adapter.

Figure 2-5 Console Cable Adapter

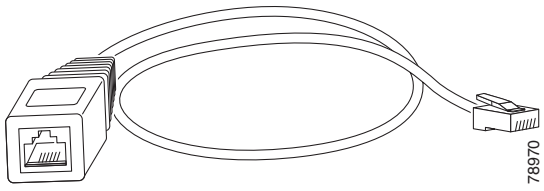
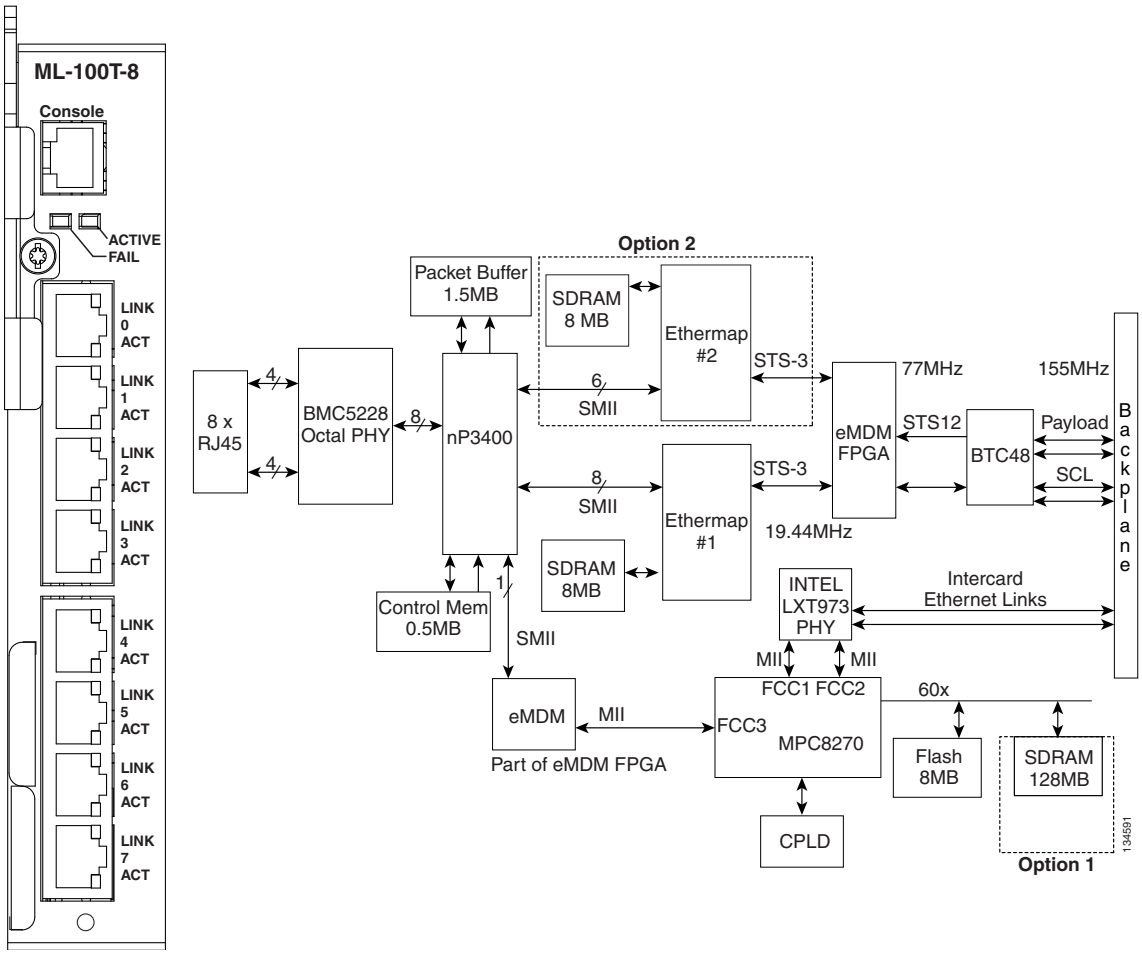


Figure 2-6 shows the ML-100T-8 card faceplate and block diagram.

Figure 2-6 ML-100T-8 Card Faceplate and Block Diagram



The following paragraphs describe the general functions of the ML-100T-8 card and relate to the block diagram in Figure 2-6.

In the ingress direction (Ethernet-to-SDH), Ethernet frames first enter from a physical Ethernet port to one of the corresponding channels of the octal PHY, which performs all of the physical layer interface functions for 10/100 Ethernet. The PHY sends the Ethernet frame to the packet processor by means of the SMII interfaces for queuing in the respective packet buffer memory. The packet processor performs packet processing, packet switching, and classification. The Ethernet frames are then passed on to the POS mappers through the SMII interfaces. The POS mappers terminate the 10/100-Mbps Ethernet traffic. The Ethernet frames are extracted and buffered in POS mapper external memory. Ethernet frames are encapsulated using one of the framing protocols (PPP/HDLC or GFP), selected on a per-port basis. The encapsulated Ethernet frames are mapped into a configurable number of VC3 or VCAT low-order payloads (VC3-1v or VC3-2v). The SPE from each POS mapper (up to VC4) carrying encapsulated Ethernet frames are next passed onto the mux/demux, where the VC4 frames from both POS mappers are multiplexed to form an VC4-4c frame for transport over the SDH network by means of the BTC-48 ASIC.

Note Although the VC4 frames are multiplexed into an VC4-4c frame, the frame carries at most an VC4-2c payload, leaving half of the VC4-4c bandwidth free.

In the egress direction (SDH-to-Ethernet), the mux/demux extracts the first and second VC4 SPEs from the VC4-4 frame it receives from the BTC-48 before sending it to the POS mapper. The VC4 SDH SPEs carrying GFP or PPP/HDLC encapsulated Ethernet frames are then extracted and buffered in the POS mapper external memory. This memory is used for providing alignment and differential delay compensation for the received high-order VCAT payloads. After alignment and delay compensation have been done, the Ethernet frames are decapsulated with one of the framing protocols (GFP or PPP/HDLC). Decapsulated Ethernet frames are then passed onto the network processor for QoS queuing, traffic scheduling, packet switching, and multiplexing. The network processor switches the frame to one of the corresponding PHY channels and then onto the Ethernet port for transmission to the external clients.

2.5.3 ML-100T-8 Card-Level Indicators

The ML-100T-8 card faceplate has two card-level LED indicators, described in Table 2-8.

Table 2-8 ML-100T-8 Card-Level Indicators

Card-Level LEDs	Description
SF LED (Red)	The red FAIL LED indicates that the card processor is not ready or that a catastrophic software failure occurred on the ML-100T-8 card. As part of the boot sequence, the FAIL LED blinks until the software deems the card operational, then it turns off.
ACT LED (Green)	The ACT LED provides the operational status of the ML-100T-8. When the ACT LED is green, it indicates that the ML-100T-8 card is active and the software is operational; otherwise, it is off.

2.5.4 ML-100T-8 Port-Level Indicators

The ML-100T-8 card has two LEDs embedded into each of the eight Ethernet port RJ-45 connectors. The LEDs are described in Table 2-9.

Table 2-9 ML-100T-8 Port-Level Indicators

Port-Level Indicators	Description
ACT LED (Amber)	A steady amber LED indicates a link is detected, but there is an issue inhibiting traffic. A blinking amber LED means traffic is flowing.
LINK LED (Green)	A steady green LED indicates that a link is detected, but there is no traffic. A blinking green LED flashes at a rate proportional to the level of traffic being received and transmitted over the port.
Both ACT and LINK LED OFF	Unlit LEDs indicate no traffic.

2.6 E1_21_E3_DS3_3 and E1_63_E3_DS3_3 Cards

Note For hardware specifications, see the "A.2.5 E1_21_E3_DS3_3 and E1_63_E3_DS3_3 Cards" section on page A-7.

The ONS 15310-MA SDH E1_21_E3_DS3_3 and E1_63_E3_DS3_3 cards provide 21 and 63 ITU-Compliant G.703 E1 ports, respectively, as well as three E3/DS3 ports. Each E1 port operates at 2.048 Mbps. Each E3/DS3 port operates at 34.368 Mbps/44.736 Mbps over a single 75-ohm 728 A or equivalent coaxial span. These cards can operate as a working or protect card in 1:1 protection schemes.

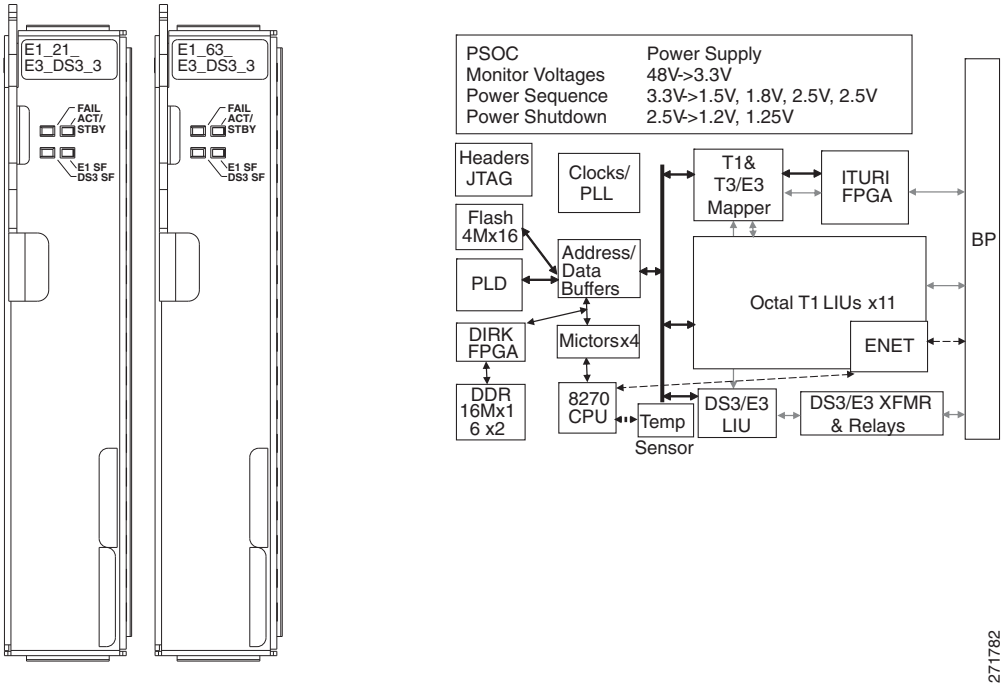
In addition, the E1_21_E3_DS3_3 card provides retiming, so that any outgoing E1 signal can be retimed to eliminate accumulated jitter and wander at the point of egress from a synchronous network. Any incoming E1 signal from the transport element can also be used as a timing source.

The E1_21_E3_DS3_3 and E1_63_E3_DS3_3 cards can be installed in Slots 1, 2, 5, and 6. Card installed in Slots 1 and 2 correspond with the electrical interface assembly (EIA) installed on Side A at the rear of the shelf assembly, and cards in Slots 5 and 6 correspond with the EIA installed on Side B.

See the "3.2.1 1:1 Electrical Card Protection" section on page 3-2 for information about electrical card protection and supported shelf configurations.

Figure 2-7 shows the E1_21_E3_DS3_3 and E1_63_E3_DS3_3 card faceplates and block diagram.

Figure 2-7 E1_21_E3_DS3_3 and E1_63_E3_DS3_3 Card Faceplates and Block Diagram



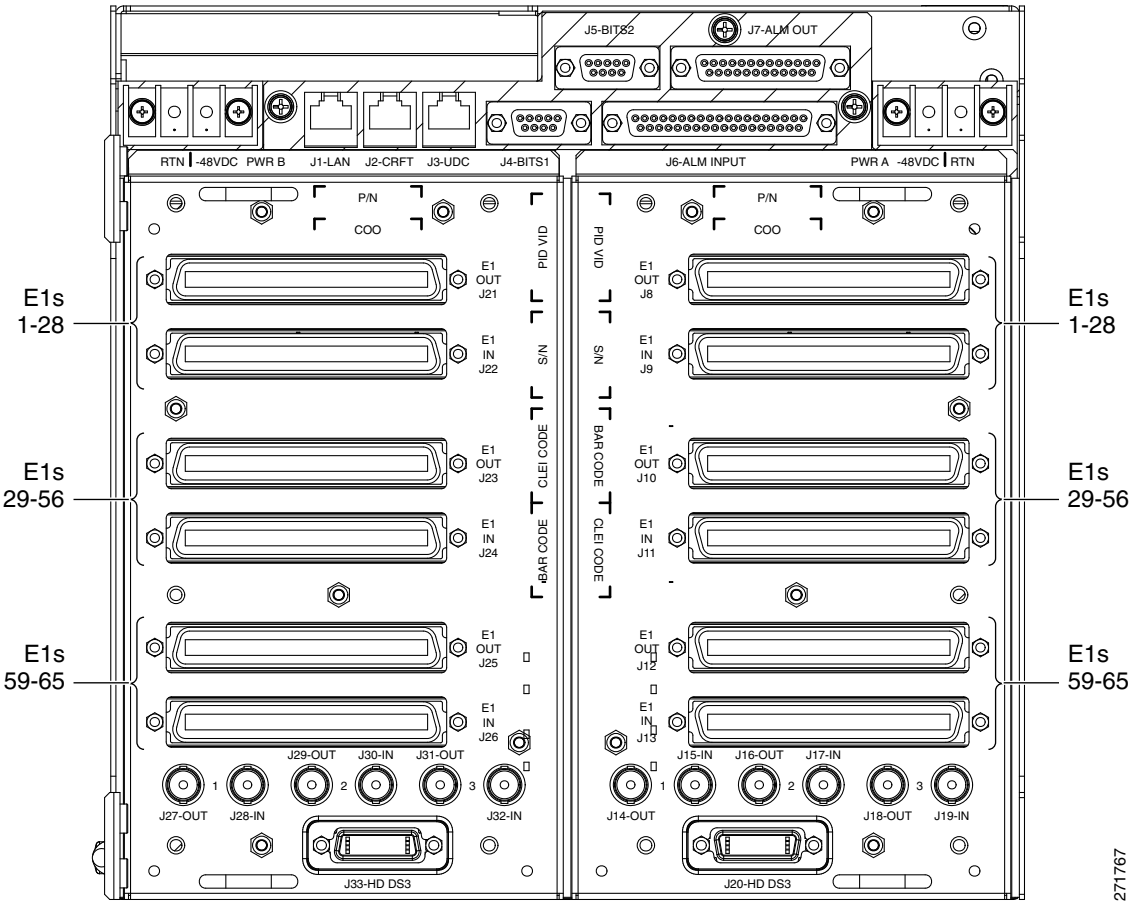
In E1_63_E3_DS3_3 cards, the 63 E1 ports have backplane interface connectors as shown in Figure 2-8. Wideband Electrical Ports (WBE) E1s 1 to 28 are connected to the AMP Champ-1 connector Ports 1 to 28, WBE E1 Ports 29 to 56 to the Amp Champ-2 connector Ports 29 to 56, and WBE E1 Ports 59 to 65 to the AMP Champ-3 connector Ports 59 to 65, respectively. In AMP Champ-3, you can only use the

seven E1 ports from 59 to 65. You cannot use connectors 57 and 58, because the line timing configuration on the ASIC might disturb the data path in these two ports. WBE Port 63 is accessed by AMP Champ-3 connector Port 65. This restriction is not applicable to the E1_21_E3_DS3_3 card.

Refer to the 32xE1-LFH-RJ45 Panel and 32xE1-LFH-1.0/2.3 Panel sections of *Cisco ONS 15305 Installation and Operations Guide, Release 2.0* for information about patch panels.

Note When you use a third-party patch panel, you need to use an unconnectored cable.

Figure 2-8 BIC Configuration on WBE Cards



2.6.1 E1_21_E3_DS3_3 and E1_63_E3_DS3_3 Card-Level Indicators

The E1_21_E3_DS3_3 and E1_63_E3_DS3_3 cards have three card-level LED indicators (Table 2-10).

Table 2-10 E1_21_E3_DS3_3 and E1_63_E3_DS3_3 Card-Level Indicators

Card-Level Indicators	Description
Red FAIL LED	Indicates that the card processor is not ready. This LED is on during reset. The FAIL LED flashes during the boot process. Replace the card if the red FAIL LED persists in flashing.
ACT/STBY LED Green (Active) Amber (Standby)	When the ACT/STBY LED is green, the card is operational and ready to carry traffic. When the ACT/STBY LED is amber, the card is operational and in standby (protect) mode.
Amber E1 and DS3 SF LEDs	Indicates a signal failure or condition such as LOS or LOF on one or more card ports.

2.7 Filler Cards

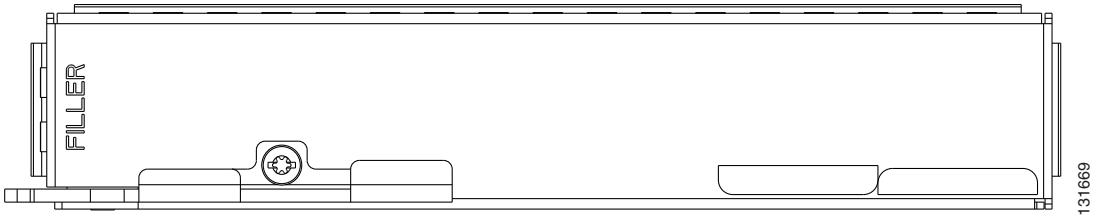
If a card slot is left empty, a filler card must be installed in the slot. The filler card serves three functions: it prevents exposure to hazardous voltages and currents inside the chassis, it eliminates electromagnetic interference (EMI) that might disrupt other equipment, and it directs the flow of cooling air through the chassis.

Caution Do not operate the ONS 15310-MA SDH system unless a card is plugged into each card slot.

The blank card is a printed circuit board (PCB) with a blank faceplate and two rear connectors that plug into receptacles at the back of the slot. CTC detects when a filler card is plugged in and displays it in node view.

Figure 2-9 shows the filler card faceplate. This card is used in ONS 15310-MA SDH traffic card slots.

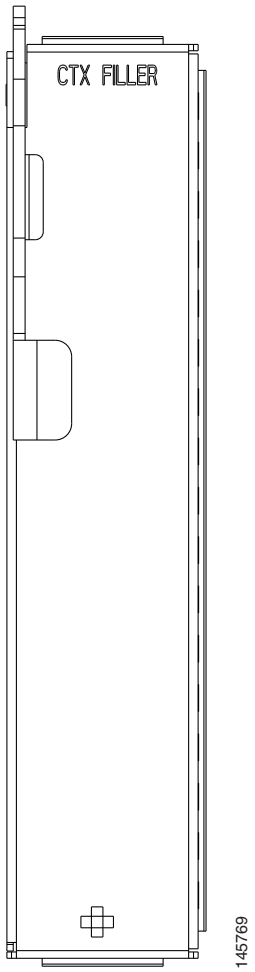
Figure 2-9 Filler Card



Caution Do not attempt to install the FILLER card in a 15310E-CTX-K9 card slot (Slots 3 and 4) on the 15310-MA SDH shelf assembly. Only a CTX FILLER card should be installed in the 15310E-CTX-K9 slot.

Figure 2-10 shows the 15310E-CTX-K9 filler card faceplate for the ONS 15310-MA SDH.

Figure 2-10 15310E-CTX-K9 Filler Card



Caution Do not attempt to install the CTX FILLER card in a traffic card slot (Slots 1, 2, 5, and 6 in the ONS 15310-MA SDH). Only 15310-EXP-FILLER cards should be installed in the traffic card slots.

2.8 SFP Modules

This section describes the small-form factor pluggables (SFPs) that can be used with the CE-MR-6 and 15310E-CTX-K9 cards to provide optical interfaces. The SFP slots for the ONS 15310-MA SDH are located at the bottom of the 15310E-CTX-K9 card. The CE-100T-8, ML-100T-8, and electrical cards do not use SFPs.

2.8.1 Compatibility by Card

Table 2-11 lists the SFPs compatible with the 15310E-CTX-K9 and CE-MR-6 cards. For more information about SFPs, see the "A.3 SFP Specifications" section on page A-9.

Caution Only use SFPs certified for use in Cisco Optical Networking Systems (ONSs). The qualified Cisco SFP top assembly numbers (TANs) are provided in Table 2-11.

Table 2-11 SFP Card Compatibility

Card	Compatible SFP (Cisco Product ID)	Cisco Top Assembly Number (TAN)
15310E-CTX-K9	ONS-SI-2G-I1 ONS-SI-2G-L1 ONS-SI-2G-S1 ONS-SI-2G-L2 ONS-SI-622-L2 ONS-SE-2G-S1 ONS-SE-2G-1470 through ONS-SE-2G-1610 ONS-SE-155-1470 ONS-SE-155-1490 ONS-SE-155-1510 ONS-SE-155-1530 ONS-SE-155-1550 ONS-SE-155-1570	10-1993-02 10-2102-02 10-1992-02 10-1990-02 10-1936-02 10-2017-01 10-2461-01 through 10-2468-01 10-1996-02 10-1998-02 10-1999-02 10-2000-02 10-2001-02 10-2002-02
	ONS-SE-155-1590 ONS-SE-155-1610 ONS-SE-622-1470 ONS-SE-622-1490 ONS-SE-622-1510 ONS-SE-622-1530 ONS-SE-622-1550 ONS-SE-622-1570 ONS-SE-622-1590 ONS-SE-622-1610 ONS-SI-622-I1 ONS-SI-622-L1	10-2003-02 10-1997-02 10-2004-02 10-2005-02 10-2006-02 10-2007-02 10-2008-02 10-2009-02 10-2010-02 10-2011-02 10-1956-02 10-1958-02
	ONS-SC-2G-30.3 ONS-SC-2G-31.1 ONS-SC-2G-31.9 ONS-SC-2G-32.6 ONS-SC-2G-34.2 ONS-SC-2G-35.0 ONS-SC-2G-35.8 ONS-SC-2G-36.6 ONS-SC-2G-38.1 ONS-SC-2G-38.9	10-2155-02 10-2156-02 10-2157-02 10-2158-02 10-2159-02 10-2160-02 10-2161-02 10-2162-02 10-2163-02 10-2164-02

Table 2-11 SFP Card Compatibility (continued)

Card	Compatible SFP (Cisco Product ID)	Cisco Top Assembly Number (TAN)
15310E-CTX-K9	ONS-SC-2G-39.7 ONS-SC-2G-40.5 ONS-SC-2G-42.1 ONS-SC-2G-42.9 ONS-SC-2G-43.7 ONS-SC-2G-44.5 ONS-SC-2G-46.1 ONS-SC-2G-46.9 ONS-SC-2G-47.7 ONS-SC-2G-48.5 ONS-SE-Z1=	10-2165-02 10-2185-02 10-2166-02 10-2167-02 10-2168-02 10-2169-02 10-2170-02 10-2171-02 10-2172-02 10-2173-02 10-1971-02
	ONS-SC-2G-50.1 ONS-SC-2G-50.9 ONS-SC-2G-51.7 ONS-SC-2G-52.5 ONS-SC-2G-54.1 ONS-SC-2G-54.9 ONS-SC-2G-55.7 ONS-SC-2G-56.5 ONS-SC-2G-58.1 ONS-SC-2G-58.9 ONS-SC-2G-59.7 ONS-SC-2G-60.6	10-2186-02 10-2174-02 10-2175-02 10-2176-02 10-2177-02 10-2178-02 10-2179-02 10-2180-02 10-2181-02 10-2182-02 10-2183-02 10-2184-02
	ONS-SI-155-I1 ONS-SI-155-SR-MM ONS-SI-155-L1 ONS-SI-155-L2 ONS-SC-155-EL	10-1938-02 10-2279-01 10-1957-02 10-1937-02 10-2363-01
CE-MR-6	ONS-SI-GE-SX ONS-SI-GE-LX ONS-SI-GE-ZX ONS-SI-100-FX ONS-SI-100-LX10 ONS-SE-ZE-EL ONS-SE-100-BX10U ONS-SE-100-BX10D	10-2295-01 10-2300-01 10-2296-01 10-2350-01 10-2294-01 10-2351-01 10-2352-01 10-2353-01

2.8.2 SFP Description

SFPs are integrated fiber-optic transceivers that provide high-speed serial links from a port or slot to the network. Various latching mechanisms can be utilized on the SFPs. There is no correlation between the type of latch to the model type (such as SX or LX/LH) or technology type (such as Gigabit Ethernet). See the label on the SFP for the technology type and model. One type of latch available is a mylar tab, shown in Figure 2-11. A second type of latch is an actuator/button (Figure 2-12), and a third type is a bail clasp (Figure 2-13).

SFP dimensions are:

- Height 0.03 in. (8.5 mm)
- Width 0.53 in. (13.4 mm)
- Depth 2.22 in. (56.5 mm)

SFP temperature ranges are:

- COM—Commercial operating temperature range –5 to 70 degrees C (23 to 158 degrees F)
- EXT—Extended operating temperature range –5 to 85 degrees C (23 to 185 degrees F)
- IND—Industrial operating temperature range –40 to 85 degrees C (–40 to 85 degrees F)

Figure 2-11 Mylar Tab SFP

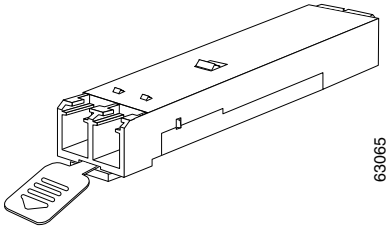


Figure 2-12 Actuator/Button SFP

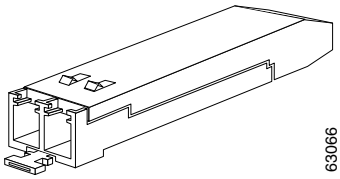
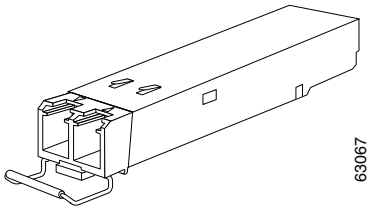


Figure 2-13 Bail Clasp SFP



2.8.3 PPM Provisioning

SFPs are known as pluggable port modules (PPMs) in CTC. PPMs provide STM1, STM4, and STM16 line rates for the ONS 15310-MA SDH. See the "2.2.3 15310E-CTX-K9 Optical Interfaces" section on page 2-5 for more information. To provision PPMs, including provisioning or changing the optical line rate, refer to the *Cisco ONS 15310-MA SDH Procedure Guide*.

CHAPTER 3

Card Protection

Note The terms "Unidirectional Path Switched Ring" and "UPSR" may appear in Cisco literature. These terms do not refer to using Cisco ONS 15xxx products in a unidirectional path switched ring configuration. Rather, these terms, as well as "Path Protected Mesh Network" and "PPMN," refer generally to Cisco's path protection feature, which may be used in any topological network configuration. Cisco does not recommend using its path protection feature in any particular topological network configuration.

This chapter describes the card and port protection configurations for the Cisco ONS 15310-MA SDH. To provision protection, refer to the "Turn Up a Node" chapter in the *Cisco ONS 15310-MA SDH Procedure Guide*. Chapter topics include:

3.1 Overview

The Cisco ONS 15310-MA SDH has a pair of common control cards (15310E-CTX-K9), each with two optical ports, and up to four electrical cards (E1_21_E3_DS3_3 or E1_63_E3_DS3_3). 1:1 protection groups are supported for like pairs of electrical cards, and 1+1 protection groups can be set up between two optical ports on the same 15310E-CTX-K9 card or between the optical ports on two separate 15310E-CTX-K9 cards.

When two 15310E-CTX-K9 cards are installed, the 15310E-CTX-K9 card is 1:1 protected. The 15310-MA SDH can function in a single 15310E-CTX-K9 configuration mode.

3.2 ONS 15310-MA SDH Card and Port Protection

This section describes the card and port protection methods for the ONS 15310-MA SDH.

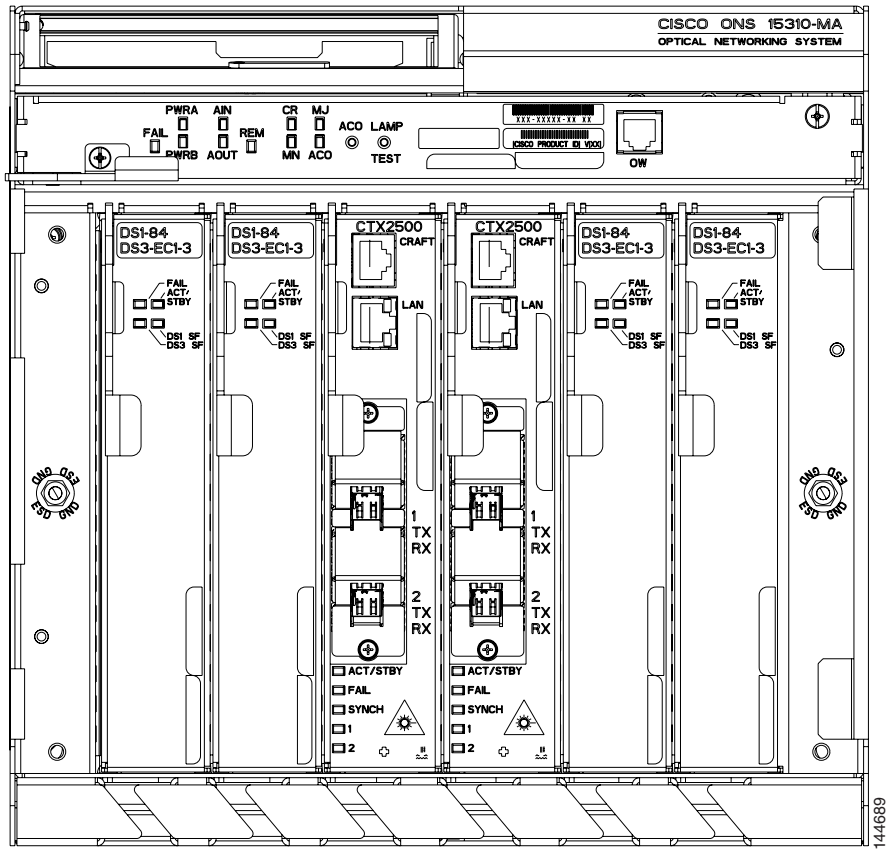
3.2.1 1:1 Electrical Card Protection

The ONS 15310-MA SDH chassis accommodates two types of electrical cards, the E1_21_E3_DS3_3 and E1_63_E3_DS3_3, and one type of common-control card, the 15310E-CTX-K9. Figure 3-1 illustrates one possible chassis configuration, with two 15310E-CTX-K9 cards and two pairs of E1_63_E3_DS3_3 cards.

The following examples show a few of the several possible ONS 15310-MA SDH chassis configurations:

- No electrical cards at all. This is the case if you choose to install Ethernet cards, such as the CE-100T-8 or ML-100T-8, instead of electrical cards. The Ethernet cards cannot be used to form a protection group.
- Unprotected electrical cards. This is the case if, instead of a pair of electrical cards in Slots 1 and 2 or 5 and 6, you install only a single electrical card in Slots 1, 2, 5, or 6. A filler card or Ethernet card must be installed in a slot where an input/output (I/O) card is missing.
- A single 15310E-CTX-K9 card. In this case, a filler card must be installed in a slot where a 15310E-CTX-K9 card is missing.
- A mix of electrical cards. An E1_21_E3_DS3_3 card can protect an adjacent E1_21_E3_DS3_3 card, an E1_63_E3_DS3_3 card can protect an adjacent E1_63_E3_DS3_3 card, and an E1_63_E3_DS3_3 card can protect an adjacent E1_21_E3_DS3_3 card. However, an E1_21_E3_DS3_3 card cannot protect an adjacent E1_63_E3_DS3_3 card.

Figure 3-1 ONS 15310-MA SDH Chassis Card Layout



The configuration of the backplane connectors creates two sets of paired (adjacent) expansion slots for electrical cards. Slots 1 and 2 are a pair and Slots 5 and 6 are a pair. When two electrical cards are plugged into either of the card-slot pairs, the ONS 15310-MA SDH automatically creates a 1:1 protection group for the two cards, if possible.If a protection group cannot be created (see the rules for protection group creation later in this section), one of the cards will be marked as UNKNOWN with the state as MISMATCH in CTC, because the ONS 15310-MA SDH cannot support two unprotected electrical cards in the 1–2 or 5–6 card slot pairs. The 1:1 automatic protection group is created when the second electrical card in a pair is either plugged in or is preprovisioned.

Unprotected is the default state for the first electrical card plugged into (or preprovisioned) in either the Slot 1-to-2 or Slot 5-to-6 card slot pairs. When the second card is plugged in or preprovisioned, the protection group is created, if possible.

When protection groups are created, the following rules must be noted:

1. The protection group will be automatically created if possible. If the node cannot create the protection group automatically, then the second card to be plugged in or preprovisioned will be shown as UNKNOWN with the state as MISMATCH in CTC.
2. If possible, the ONS 15310-MA SDH designates the cards in Slots 1 and 5 as working. If Slot 1 or 5 cannot be working (due to violation of one of the other rules), then Slot 2 or 6 will be the working slot.
3. Cards can protect like cards. In addition, an E1_63_E3_DS3_3 card can protect an E1_21_E3_DS3_3 card. However, an E1_21_E3_DS3_3 card cannot protect an E1_63_E3_DS3_3 card.
4. If the first card to be provisioned has existing circuits or is in use as a timing source when the second card is provisioned, then the first card must become the working card and cannot become the protect card.
5. The timing source will not switch to a protect card, when a soft reset is executed on the card that is used as a timing source.
6. Automatic protection groups default to nonrevertive. The protection group can be edited to turn on reversion and set a revert time. The protection group can also be edited to change the protection group name.

The following scenario does not result in the creation of a protection group because rules are violated:

1. Plug an E1_63_E3_DS3_3 card into Slot 1 and provision a circuit on it.
2. Plug an E1_21_E3_DS3_3 card into Slot 2.

The E1_63_E3_DS3_3 card needs to be the working card, because it has a circuit on it (see Rule 4). However, the E1_21_E3_DS3_3 card cannot protect the E1_63_E3_DS3_3 card (see Rule 3), so no protection group is formed.

The following scenario also does not result in the creation of a protection group because rules are violated:

1. Plug an E1_21_E3_DS3_3 card into Slot 1 and enable the retiming option on it.
2. Plug an E1_63_E3_DS3_3 card into Slot 2.

Because the E1_63_E3_DS3_3 card does not support retiming, it cannot become a protection card for the E1_21_E3_DS3_3 card, so no protection group is formed.

The following scenario results in the creation of a protection group because no rules are violated:

1. Plug an E1_21_E3_DS3_3card into Slot 1 and provision a circuit on it.
2. Plug an E1_63_E3_DS3_3 card into Slot 2.

A protection group is automatically formed, with the E1_21_E3_DS3_3 card operating as the working card, and the E1_63_E3_DS3_3 card operating as the protection card.

Automatic protection groups cannot be created or deleted by users. A protection group is automatically deleted when the protect card is deleted.

3.2.2 LMSP Optical Port Protection

With two 15310E-CTX-K9 cards installed, four optical ports are available (two on each card). A Linear Multiplex Section Protection group can be created between any two pairs of optical ports with matched port rates.

A protection group can be created using two ports on the same 15310E-CTX-K9 card or between ports on adjacent 15310E-CTX-K9 cards. You can also create a 1+1 protection group on each card for a total of two protection groups. In this case, working and protection ports are provisioned on Slot 3 and working and protection ports are provisioned on Slot 4 (the same card can have both working and protect ports on it).

3.2.3 15310E-CTX-K9 Card Equipment Protection

The ONS 15310MA supports a single and dual 15310E-CTX-K9 card configurations. In the dual configuration, with a 15310E-CTX-K9 card inserted in Slot 3 and Slot 4, the 15310E-CTX-K9 card is also protected. One of the cards becomes the active card and the other becomes the standby card. Soft resets executed in the dual 15310E-CTX-K9 card configuration as well as in the single 15310E-CTX-K9 card configuration are errorless. Software upgrades in the single and dual configurations are also errorless.

In the dual configuration, there is a switchover from the active 15310E-CTX-K9 card to standby 15310E-CTX-K9 card during the soft reset of the active 15310E-CTX-K9 card. After the soft reset or software upgrade, the old standby 15310E-CTX-K9 card becomes the new active 15310E-CTX-K9 card. The old active 15310E-CTX-K9 card becomes the standby 15310E-CTX-K9 card.

The 15310E-CTX-K9 card is equipment protected in a dual 15310E-CTX-K9 card configuration. Any reset occurring on the active 15310E-CTX-K9 card that is triggered due to failure causes a switchover of the 15310E-CTX-K9 card, causing the old standby card to become the active card.

Note The ONS 15310-MA SDH and the 15310E-CTX-K9 card do not support SNCP switching for VC3 circuits containing BIP errors. The SF/SD alarm is not raised for VC3 circuits.

If there are any path protection or 1+1 protected ports configured across the two 15310E-CTX-K9 cards, a protection switch will cause the port on the active 15310E-CTX-K9 card to become the active port for 1+1 or the path protection selector.

Note

- Any unprotected port on the 15310E-CTX-K9 card being reset may undergo a traffic loss when the 15310E-CTX-K9 is reinitialized.
- If protection exists between two optical ports on the same 15310E-CTX-K9 card and if that 15310E-CTX-K9 card is reset, the traffic might be affected when the 15310E-CTX-K9 card is reinitialized.

The two items above do not apply for a user-initiated soft reset or software upgrade. These resets are errorless

3.3 Automatic Protection Switching

Unidirectional switching allows traffic on the transmit and receive optical fibers to switch independently.

With nonrevertive 1+1 protection, automatic protection switching (APS) switches a signal after a failure from the working port to the protect port and the signal stays switched to the protect port until it is manually switched back. Revertive switching automatically switches the signal back to the working port when the working port comes back online. 1+1 protection is unidirectional and nonrevertive by default; revertive switching is easily provisioned using CTC.

3.4 External Switching Commands

The external switching commands on the ONS 15310-MA SDH are Manual, Force, and Lock Out. A Manual switch will switch traffic if the path has an error rate less than the signal degrade (SD). A Force switch will switch traffic even if the path has SD or signal fail (SF) conditions. A Force switch has a higher priority than a Manual switch. In 1+1 mode, however, if there is an SF condition on the protect line, the SF condition has a higher priority than Force, and Force cannot override the SF condition to make a switch to the protect line. Lockouts can only be applied to a protect port (in 1+1 configurations) and prevent traffic from switching to the protect port under any circumstance. Lockouts have the highest priority. In a 1+1 configuration you can also apply a lock-on to the working port. A working port with a lock-on applied cannot switch traffic to the protect port in the protection group (pair).

CHAPTER 4

Cisco Transport Controller Operation

This chapter describes Cisco Transport Controller (CTC), the Cisco ONS 15310-MA SDH software interface. For CTC set up and login information, refer to the *Cisco ONS 15310-MA SDH Procedure Guide*.

Chapter topics include:

4.1 CTC Software Delivery Methods

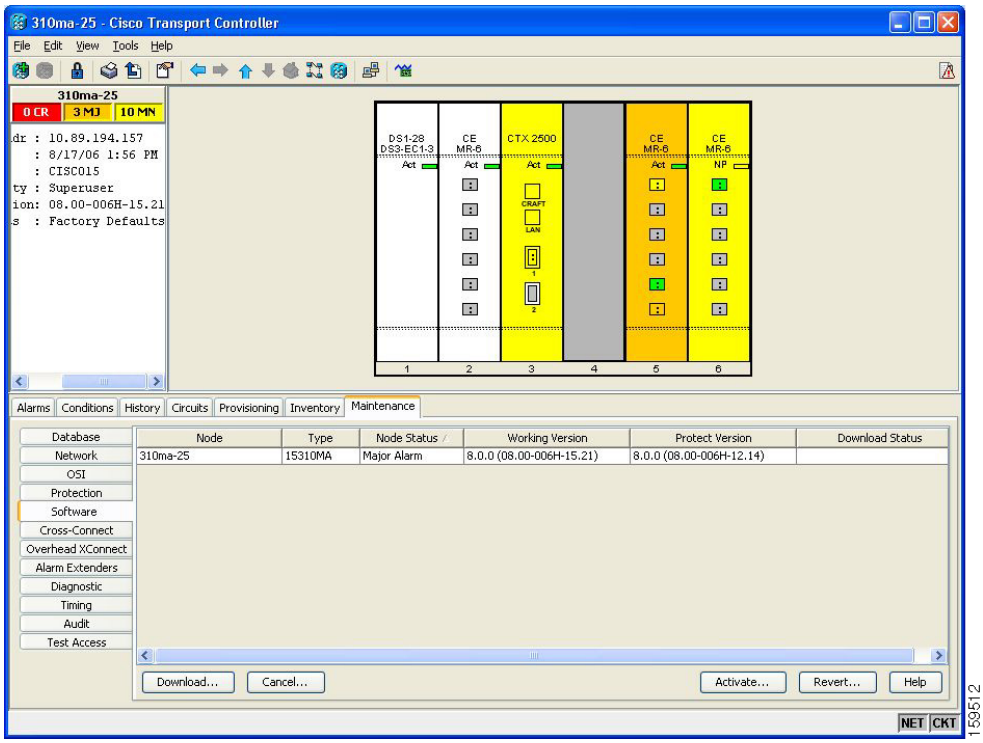
ONS 15310-MA SDH provisioning and administration is performed using CTC software. CTC is a Java application that is stored on the 15310E-CTX-K9 card in the ONS 15310-MA SDH. CTC is downloaded to your workstation the first time you log into a ONS 15310-MA SDH with a new software release.

4.1.1 CTC Software Installed on the 15310E-CTX-K9 Card

CTC software is preloaded on the 15310E-CTX-K9 cards; therefore, you do not need to install software.

You can view the software versions that are installed on an ONS 15310-MA SDH by selecting the Maintenance > Software tabs in node view (Figure 4-1). Select the Maintenance > Software tabs in network view to display the software versions installed on all the network nodes.

Figure 4-1 CTC Software Versions in an ONS 15310-MA SDH (Node View)



4.1.2 CTC Software Installed on the PC or UNIX Workstation

CTC software Java Archive (JAR) files are installed on your computer using one of the following methods:

- The JAR files are downloaded from the 15310E-CTX-K9 card and installed on your computer automatically the first time you connect to an ONS 15310-MA SDH. Downloading the CTC software files at login ensures that your computer has the same CTC software version as the ONS 15310-MA SDH you are accessing. The CTC JAR files are stored in the temporary directory designated by your computer operating system.

  You can use the Delete CTC Cache button to remove files. If the files are deleted, they are downloaded the next time you connect to an ONS node. Downloading the CTC JAR files may take 1-2 minutes, or 45-50 minutes, depending on the bandwidth of the connection between your workstation and the ONS 15310-MA SDH. JAR files downloaded from a modem or a data communication channel (DCC) network link will require more time than JAR files downloaded over a LAN connection.

- You can install the JAR files on your computer using the CTC setup wizard provided on the CTC software CD. If you install the JAR files with the setup wizard you do not need to wait for the files to download the first time you log into the node. In addition, you can manage ONS 15310-MA SDH nodes that are added to networks with ONS nodes running older software releases. After you install the JAR files, you can log into an ONS 15454 running an earlier software release and manage the ONS 15310-MA SDH nodes. However, if you use the Delete CTC Cache function, you must reinstall the JAR files from the software CD.

During network topology discovery, CTC polls each node in the network to determine which one contains the most recent version of the CTC software. If CTC discovers a node in the network that has a more recent version of CTC than the version you are currently running, CTC generates a message stating that a later version of CTC has been found in the network and offers to install the CTC software upgrade JAR files. If you have network discovery disabled, CTC will not seek more recent versions of the software. Unreachable nodes are not included in the upgrade discovery.

Note Upgrading the CTC software will overwrite your existing software. You must restart CTC after the upgrade is complete.

4.2 CTC Installation Overview

To connect to an ONS 15310-MA SDH using CTC, enter the ONS 15310-MA SDH IP address in the URL field of Navigator or Microsoft Internet Explorer. After connecting to an ONS 15310-MA SDH, the following events occur automatically:

1. The CTC launcher applet downloads from the 15310E-CTX-K9 card to your computer.
2. The launcher determines whether your computer has a CTC release matching the release on the 15310E-CTX-K9 card.
3. If the computer does not have CTC installed, or if the installed release is older than the 15310E-CTX-K9 card version, the launcher downloads the CTC program files from the card.
4. The launcher starts CTC. The CTC session is separate from the web browser session, so the web browser is no longer needed.
5. You should always log into nodes having the latest software release unless you run the CTC setup wizard and install the ONS 15310-MA SDH JAR client software files on your computer. If the JAR files are installed on your computer, you can log into ONS 15454s running Release 4.1 or later o manage ONS 15310-MA SDH nodes that are connected by DCCs to the ONS 15454s.

Each ONS 15310-MA SDH can handle up to five concurrent CTC sessions. CTC performance can vary, depending on the volume of activity in each session, network bandwidth, and 15310E-CTX-K9 card load.

4.3 PC, UNIX and Mac Workstation Requirements

To use CTC, your computer must have a web browser with the correct Java Runtime Environment (JRE) installed for the software release in use. The correct JRE and Java plug-in for each CTC software release are included on the Cisco ONS 15310-MA SDH software CDs. Table 4-1 lists the requirements for PCs and UNIX workstations.

Table 4-1 CTC Computer Requirements

Area	Requirements	Notes
Processor (PC only)	Pentium 4 processor or equivalent	A faster CPU is recommended if your workstation runs multiple applications or if CTC manages a network with a large number of nodes and circuits.
RAM	512 MB RAM or more (1 GB RAM or more for Release 9.2)	A minimum of 1 GB is recommended if your workstation runs multiple applications or if CTC manages a network with a large number of nodes and circuits.
Hard drive	20 GB hard drive with 100MB of free space required (250 MB of free space required for Release 9.2)	CTC application files are downloaded from the TCC2/TCC2P to your computer. These files occupy around 100MB (250MB to be safer) or more space depending on the number of versions in the network.
Operating System	• PC: Windows 2000, Windows XP, Windows Vista SP1, Windows Server 2003 (Windows 7, Windows Server 2008 for Release 9.2) • Workstation: Solaris version 9 or 10 • Apple Mac OS X, CTC Needs to be installed using the CacheInstaller available on CCO or the Release CD (for Release 9.2).	Use the latest patch/Service Pack released by the OS vendor. Check with the vendor for the latest patch/Service Pack.
Java Runtime Environment	JRE 5.0 (JRE 1.6 for Release 9.2)	JRE 5.0 (JRE 1.6 for Release 9.2) is installed by the CTC Installation Wizard included on the Cisco ONS 15454 software CD. JRE 5.0 (JRE 1.6 for Release 9.2) provides enhancements to CTC performance, especially for large networks with numerous circuits. Cisco recommends that you use JRE 5.0 for networks with Software R9.1 (JRE 1.6 for Release 9.2) nodes. If CTC must be launched directly from nodes running software R7.0 or R7.2, Cisco recommends JRE 1.4.2 or JRE 5.0. If CTC must be launched directly from nodes running software R5.0 or R6.0, Cisco recommends JRE 1.4.2.If CTC must be launched directly from nodes running software earlier than R5.0, Cisco recommends JRE 1.3.1_02.

Table 4-1 CTC Computer Requirements (continued)

Area	Requirements	Notes
Web browser	• PC:Internet Explorer 6.x, 7x (8.x for Release 9.2) • UNIX Workstation: Mozilla 1.7, Netscape 4.76, Netscape 7.x • MacOS-X PC: Safari (for Release 9.2)	For the PC, use JRE 5.0 (JRE 1.6 for Release 9.2) with any supported web browser. The supported browser can be downloaded from the Web.
Cable	User-supplied CAT-5 straight-through cable with RJ-45 connectors on each end to connect the computer to the ONS 15310-MA SDH directly or though a LAN	—

Note To avoid network performance issues, Cisco recommends managing a maximum of 50 nodes concurrently with CTC. The 50 nodes can be on a single DCC or split across multiple DCCs. Cisco does not recommend running multiple CTC sessions when managing two or more large networks. To manage more than 50 nodes, Cisco recommends using Cisco Transport Manager (CTM). If you do use CTC to manage more than 50 nodes, you can improve performance by adjusting the heap size; see the "General Troubleshooting" chapter of the *Cisco ONS 15310-MA SDH Troubleshooting Guide*. You can also create login node groups; see the "Connect the PC and Log Into the GUI" chapter of the *Cisco ONS 15310-MA SDH Procedure Guide*.

4.4 ONS 15310-MA SDH Connection

Table 4-2 lists the connection options and requirements for connecting a PC to the ONS 15310-MA SDH node.

Table 4-2 ONS 15310-MA SDH Connection Methods

Method	Description	Requirements
Local craft	Refers to onsite network connections between the CTC computer and the ONS 15310-MA SDH using one of the following: • The RJ-45 (LAN) port on the ONS 15310-MA SDH 15310E-CTX-K9 card faceplate • A hub or switch to which the ONS 15310-MA SDH is connected	If you do not use Dynamic Host Configuration Protocol (DHCP), you must change the computer IP address, subnet mask, and default router, or use automatic host detection.
Corporate LAN	Refers to a connection to the ONS 15310-MA SDH through a corporate or network operations center (NOC) LAN.	• The ONS 15310-MA SDH must be provisioned for LAN connectivity, including IP address, subnet mask, default gateway. • The ONS 15310-MA SDH must be physically connected to the corporate LAN. • The CTC computer must be connected to the corporate LAN that has connectivity to the ONS 15310-MA SDH.
TL1	Refers to a connection to the ONS 15310-MA SDH using TL1 rather than CTC. TL1 sessions can be started from CTC, or you can use a TL1 terminal. The physical connection can be a craft connection, corporate LAN, or a TL1 terminal. Refer to the *Cisco ONS SDH TL1 Reference Guide*.	—
Remote	Refers to a connection made to the ONS 15310-MA SDH using a modem.	• A modem must be connected to the ONS 15310-MA SDH. • The modem must be provisioned for the ONS 15310-MA SDH. To run CTC, the modem must be provisioned for Ethernet access.

4.5 CTC Login

After you have installed CTC, you can log in to a node using your browser. To log in, you must type the node IP address in the URL window. The CTC Login window appears.

The CTC Login window provides the following options to accelerate the login process.

- The Disable Network Discovery option omits the discovery of nodes with data communications channel (DCC) connectivity. To access all nodes with DCC connectivity, make sure that Disable Network Discovery is not checked. If you have network discovery disabled, CTC will not poll the

network for more recent versions of the software. (For more information about the automatic download of the latest CTC JAR files, see the "4.1.2 CTC Software Installed on the PC or UNIX Workstation" section on page 4-2.)

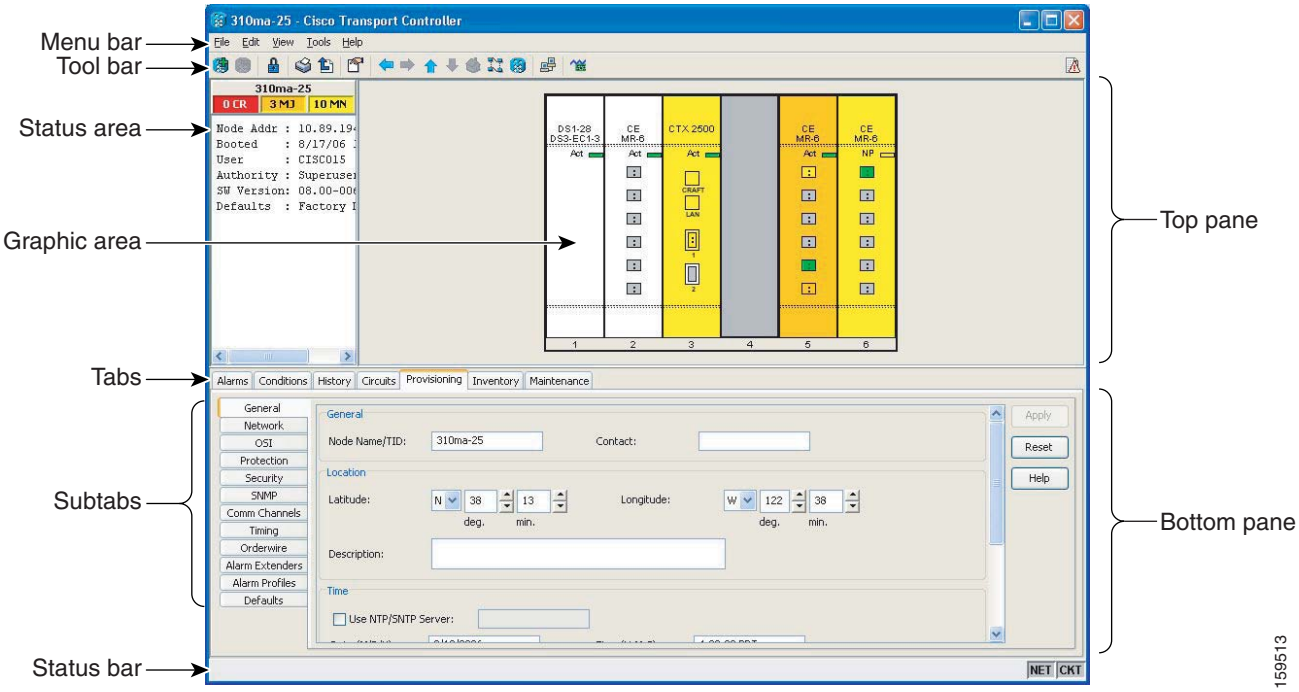
- The Disable Circuit Management option omits the discovery of circuits. To view circuits immediately after logging in, make sure that Disable Circuit Management is not checked. However, if disabled, after you have logged in you can click the Circuits tab and CTC will give you the option to enable circuit management.

These options are useful if you want to log in to a node to perform a single task, such as placing a card in or out of service, and do not want to wait while CTC discovers DCC connections and circuits.

4.6 CTC Window

The CTC window (Figure 4-2) appears after you log into an ONS 15310-MA SDH. The CTC window includes a menu bar, toolbar, and a top and bottom pane. The top pane provides status information about the selected objects and a graphic of the current view. The bottom pane provides tabs and subtabs to view ONS 15310-MA SDH information and perform provisioning and maintenance. The CTC window provides three views: network, node, and card.

Figure 4-2 ONS 15310-MA SDH Node View (Default Login View)



4.6.1 Node View

Node view is the first view that appears after you log into an ONS 15310-MA SDH. The login node is the first node shown, and it is the "home view" for the session. Node view allows you to view and manage one node. The status area shows the node name; IP address; session boot date and time; number of Critical (CR), Major (MJ), and Minor (MN) alarms; the name of the current logged-in user; the security level of the user; the software version; and the network element default setup.

4.6.1.1 CTC Card Colors

The graphic area of the CTC window depicts the shelf assembly. The colors of the cards in the graphic reflect the real-time status of the physical card and slot (Table 4-3).

Table 4-3 Node View Card and Slot Colors

Card and Slot Color	Status
Gray	Slot is not provisioned; no card is installed.
Violet	Slot is provisioned; no card is installed.
White	Slot is provisioned; a functioning card is installed.
Yellow	Slot is provisioned; a Minor alarm condition exists.
Orange	Slot is provisioned; a Major alarm condition exists.
Red	Slot is provisioned; a Critical alarm exists.

The port color in both card and node view indicates the port service state. Table 4-4 lists the port colors and their service states. For more information about port service states, see Appendix B, "Administrative and Service States."

Table 4-4 Node View Card Port Colors and Service States

Port Color	Service State	Description
Cyan (blue)	locked-enabled,loopback	(Out-of-Service and Management, Loopback) Port is in a loopback state. On the card in node view, a line between ports indicates that the port is in terminal or facility loopback (see Figure 4-3 on page 4-9 and Figure 4-4 on page 4-10). Traffic is carried and alarm reporting is suppressed. Raised fault conditions, whether or not their alarms are reported, can be retrieved on the CTC Conditions tab or by using the TL1 RTRV-COND command.
Cyan (blue)	locked-enabled,maintenance	(Out-of-Service and Management, Maintenance) Port is out-of-service for maintenance. Traffic is carried and loopbacks are allowed. Alarm reporting is suppressed. Raised fault conditions, whether or not their alarms are reported, can be retrieved on the CTC Conditions tab or by using the TL1 RTRV-COND command. Use locked-enabled,maintenance for testing or to suppress alarms temporarily. Change the state to unlocked-enabled, locked-enabled,disabled, or locked-disabled,Automatic In Service when testing is complete.
Gray	locked-enabled,disabled	(Out-of-Service and Management, Disabled) The port is out-of-service and unable to carry traffic. Loopbacks are not allowed in this service state.
Green	unlocked-enabled	(In-Service and Normal) The port is fully operational and performing as provisioned. The port transmits a signal and displays alarms; loopbacks are not allowed.
Violet	locked-disabled,Automatic In Service	(Out-of-Service and Autonomous, Automatic In-Service) The port is out-of-service, but traffic is carried. Alarm reporting is suppressed. The node monitors the ports for an error-free signal. After an error-free signal is detected, the port stays in locked-disabled,Automatic In Service state for the duration of the soak period. After the soak period ends, the port service state changes to unlocked-enabled. Raised fault conditions, whether or not their alarms are reported, can be retrieved on the CTC Conditions tab or by using the TL1 RTRV-COND command. The Automatic In Service port will automatically transition to unlocked-enabled when a signal is received for the length of time provisioned in the soak field.

Figure 4-3 Terminal Loopback Indicator

Figure 4-4 Facility Loopback Indicator

Table 4-5 lists the card statuses.

Table 4-5 Node View Card Statuses

Card Status	Description
Stby	Card is in standby.
Act	Card is active.
NP	Card is not present.
Mis	Card is mismatched.
Ldg	Card is resetting.

4.6.1.2 Node View Card Shortcuts

If you move your mouse over cards in the graphic, popups display additional information about the card including the card type; card status (active or standby); the type of alarm, such as Critical, Major, and Minor (if any); and the alarm profile used by the card. Right-click a card to reveal a shortcut menu, which you can use to open, reset, or delete the card. Right-click a card slot to preprovision it before installing the card.

4.6.1.3 Node View Tabs

Table 4-6 lists the tabs and subtabs available in the node view.

Table 4-6 Node View Tabs and Subtabs

Tab	Description	Subtabs
Alarms	Lists current alarms (CR, MJ, MN) for the node and updates them in real time.	—
Conditions	Displays a list of standing conditions on the node.	—
History	Provides a history of node alarms including date, type, and severity of each alarm. The Session subtab displays alarms and events for the current session. The Node subtab displays alarms and events retrieved from a fixed-size log on the node.	Session, Node
Circuits	Creates, deletes, edits, and maps circuits.	Circuits, Rolls
Provisioning	Provisions the ONS 15310-MA SDH node.	General, Network, OSI, Protection, Security, SNMP, Comm Channels, Timing, Alarm Extenders, Alarm Profiles, Defaults

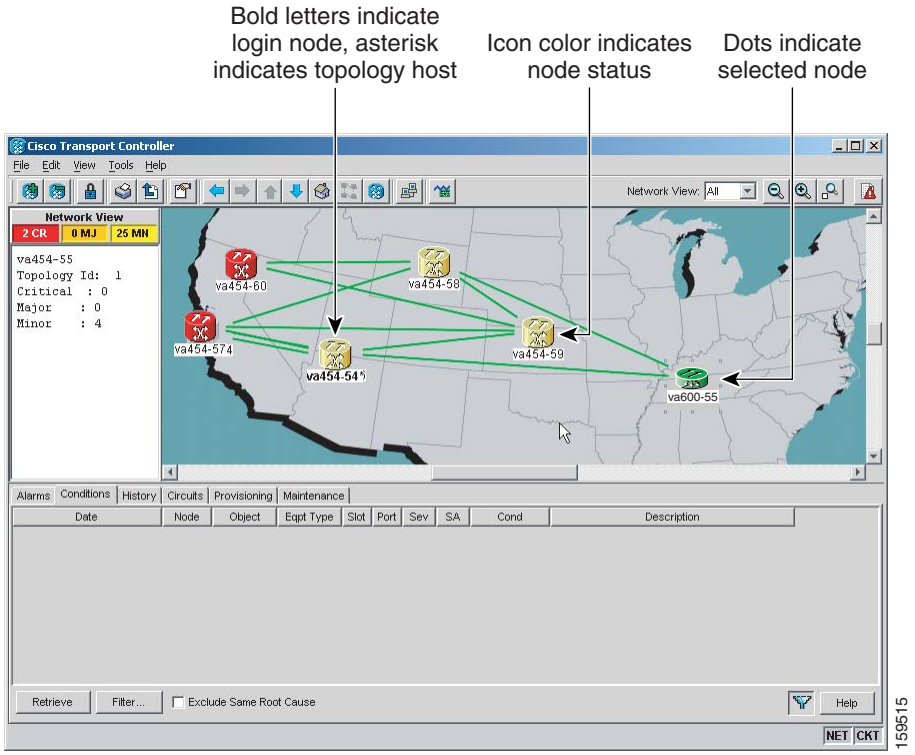
Table 4-6 Node View Tabs and Subtabs (continued)

Tab	Description	Subtabs
Inventory	Provides inventory information (part number, serial number, Common Language Equipment Identification [CLEI] codes) for cards installed in the node. Allows you to delete and reset cards, and to change card service state. For more information on card service states, see Appendix B, "Administrative and Service States."	—
Maintenance	Performs maintenance tasks for the node.	Database, OSI, Protection, Software, Cross-Connect, Overhead XConnect, Alarm Extenders, Diagnostic, Timing, Audit, Test Access

4.6.2 Network View

Network view allows you to view and manage ONS 15310-MA SDH nodes that have DCC connections to the node that you logged into and any login node groups you have selected (Figure 4-5).

Figure 4-5 Network in CTC Network View



Nodes with DCC connections to the login node will not appear if you selected Disable Network Discovery on the Login dialog box.

The graphic area displays a background image with colored ONS 15310-MA SDH icons. A Superuser can set up the logical network view feature, which enables each user to see the same network view. Selecting a node or span in the graphic area displays information about the node and span in the status area. The icon colors indicate the node status (Table 4-7).

4.6.2.1 CTC Node Colors

The color of a node in network view indicates the node alarm status. Table 4-7 lists the node colors shown in network view.

Table 4-7 Node Colors Indicating Status in Network View

Color	Alarm Status
Green	No alarms
Yellow	Minor alarms
Orange	Major alarms
Red	Critical alarms
Gray with Unknown#	Node initializing for the first time (CTC displays Unknown# because CTC has not yet discovered the name of the node)

4.6.2.2 Network View Tabs

Table 4-8 lists the tabs and subtabs available in the network view.

Table 4-8 Network View Tabs and Subtabs

Tab	Description	Subtabs
Alarms	Lists current alarms (CR, MJ, MN) for the network and updates them in real time.	—
Conditions	Displays a list of standing conditions on the network.	—
History	Provides a history of network alarms including date, type, and severity of each alarm.	—
Circuits	Creates, deletes, edits, filters, and searches for network circuits.	Circuits, Rolls
Provisioning	Provisions security, alarm profiles, MS-SPRing, overhead circuits, server trails, and loads/manages VLAN databases	Security, Alarm Profiles, MS-SPRing, Overhead Circuits, Provisionable Patchcords (PPC), Server Trails, VLAN DB Profile
Maintenance	Displays the working and protect software versions, and allows software to be downloaded, retrieves Open Shortest Path First (OSPF) node information, and displays the list of automatic power control (APC) domains for a network	Software, Diagnostic, APC

4.6.2.3 DCC Links

The lines between nodes in the network view indicate DCC connections between the nodes. Active DCC connections appear as green/solid or green/dashed. Solid means circuits can be routed through the link, and dashed means circuits cannot be routed through the link. A gray link is in a fail state.

4.6.2.4 Link Consolidation

CTC provides the ability to consolidate the DCC, general communications channel (GCC), optical transport section (OTS), provisionable patchcord (PPC), and server trail links shown in the network view into a more streamlined view. Link consolidation allows you to condense multiple inter-nodal links into a single link. The link consolidation sorts links by class, meaning that, for example, all DCC links are consolidated together. You can access individual links within consolidated links using the right-click shortcut menu.

In OSP installations, the ONS 15310-MA SDH cannot be monitored through a standard Ethernet/LAN connection. So an alternate connection is established through the optical link of the aggregated client traffic (SDH) and a supporting Network Element (NE). The support node (installed indoors) and the ONS 15310-MA SDH OSP node are set up with a direct IP access to a far-end ONS 15310-MA SDH OSP node over a Data Communications Channel (DCC) network.

Each link has an associated icon (Table 4-9).

Table 4-9 Link Icons

Icon	Description
	DCC icon
	GCC icon
	OTS icon
	PPC icon
	Server Trail icon

Note Link consolidation is only available on non-detailed maps. Non-detailed maps display nodes in icon form instead of detailed form, meaning the nodes appear as rectangles with ports on the sides. Refer to the *Cisco ONS 15310-MA SDH Procedure Guide* for more information about consolidated links.

4.6.3 Card View

Card view provides information about individual ONS 15310-MA SDH cards. Use this view to perform card-specific maintenance and provisioning (Figure 4-6). A graphic showing the ports on the card appears in the graphic area. The status area provides the node name, slot, number of alarms, card type, equipment type, and either the card status (active or standby), card service state if the card is present, or port service state (Table 4-4 on page 4-9). The information that appears and the actions you can perform depend on the card.

Figure 4-6 CTC Card View of an E1_21_E3_DS3_3 Card

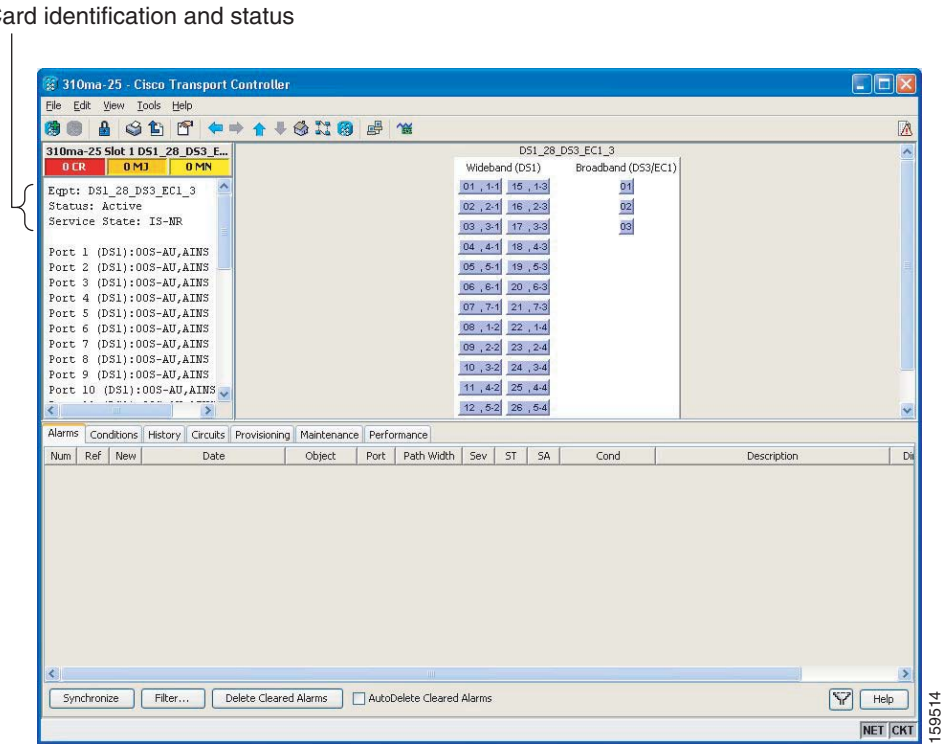


Table 4-10 shows the tabs and subtabs available in card view. The subtabs, fields, and information shown under each tab depend on the card type selected.

Table 4-10 Card View Tabs and Subtabs

Tab	Description	Subtabs
Alarms	Lists current alarms (CR, MJ, MN) for the card and updates them in real-time.	—
Conditions	Displays a list of standing conditions on the card.	—
History	Provides a history of card alarms including date, object, port, and severity of each alarm.	Session (displays alarms and events for the current session), Card (displays alarms and events retrieved from a fixed-size log on the card)

Table 4-10 Card View Tabs and Subtabs (continued)

Tab	Description	Subtabs
Circuits	Creates, deletes, edits, and search circuits, and completes rolls.	Circuits, Rolls
Provisioning	Provisions a card.	15310-MA SDH electrical cards: Wideband Ports, Broadband Ports, E1 (subtabs include Line, Line Thresholds, Elect Path Thresholds, and SDH Thresholds); DS3 (subtabs include Line, Line Thresholds, Elect Path Thresholds, and SDH Thresholds); E3 (subtabs include Line, SDH Thresholds, and SDH VC high-order path) 15310E-CTX-K9 card: Optical (subtabs include Line, SDH Thresholds, SDH VC high-order path, and Optics Thresholds); Pluggable Port Modules; External Alarms; External Controls, and Alarm Profiles. Ethernet cards (subtabs depend on the card type): Ether Ports, POS Ports, Ether VLAN, Ether Card, Card, Ether Thresholds, Alarm Profiles
Maintenance	Performs maintenance tasks for the card.	15310-MA SDH electrical cards: E1 (subtabs include Loopback, Protection, Path Trace Automatic In Service Soak); DS3 (subtabs include Loopback, Protection, Path Trace Automatic In Service Soak); E3(subtabs include Loopback, Protection, Path Trace Automatic In Service Soak) 15310E-CTX-K9 card: Optical (subtabs include Loopback, ALS, Protection, Path Trace Automatic In Service Soak); External Alarms; External Controls; and Virtual Wires Ethernet cards: Path Trace, Loopback, VC (virtual container) Allocation, Bandwidth, Automatic In Service Soak
Performance	Performs performance monitoring for the card.	15310E-CTX-K9 card: E1, DS3, E3, Optical Ethernet cards (subtabs depend on the card type): Ether Ports, POS Ports

4.6.4 Print and Export CTC Data

You can use the File > Print or File > Export options to print or export CTC provisioning information for record keeping or troubleshooting. The functions can be performed in card, node, or network views. The File > Print function sends the data to a local or network printer. File > Export exports the data to a file where it can be imported into other computer applications, such as spreadsheets and database management programs.

Whether you choose to print or export data, you can choose from the following options:

- Entire frame—Prints or exports the entire CTC window including the graphical view of the card, node, or network. This option is available for all windows.
- Tabbed view—Prints or exports the lower half of the CTC window containing tabs and data. The printout includes the selected tab (on top) and the data shown in the tab window. For example, if you print the History window tabbed view, you print only history items appearing in the window. This option is available for all windows.
- Table Contents—Prints CTC data in table format without graphical representations of shelves, cards, or tabs. This option does not apply to all windows; refer to the print task in the *Cisco ONS 15310-MA SDH Procedure Guide* for specifics.
- The Table Contents option prints all the data contained in a table with the same column headings. For example, if you print the History window Table Contents view, you print all data included in the table whether or not items appear in the window.

4.7 Using the CTC Launcher Application to Manage Multiple ONS Nodes

The CTC Launcher application is an executable file, StartCTC.exe, that is provided on Software Release 9.1 and 9.2 CDs for Cisco ONS products. You can use CTC Launcher to log into multiple ONS nodes that are running CTC Software Release 3.3 or higher, without using a web browser.

CTC Launcher provides two connection options. The first option is used to connect to ONS network elements (NEs) that have an IP connection to the CTC computer. The second option is used to connect to ONS NEs that reside behind third party, OSI-based gateway network elements (GNEs). For this option, CTC Launcher creates a TL1 tunnel to transport the TCP traffic through the OSI-based GNE.

The TL1 tunnel transports the TCP traffic to and from ONS end network elements (ENEs) through the OSI-based GNE. TL1 tunnels are similar to the existing static IP-over-CLNS tunnels, GRE and Cisco IP, that can be created at ONS NEs using CTC. (Refer to the Cisco ONS product documentation for information about static IP-over-CLNS tunnels.) However, unlike the static IP-over-CLNS tunnels, TL1 tunnels require no provisioning at the ONS ENE, the third-party GNE, or DCN routers. All provisioning occurs at the CTC computer when the CTC Launcher is started.

Figure 4-7 shows examples of two static IP-over-CLNS tunnels. A static Cisco IP tunnel is created from ENE 1 through other vendor GNE 1 to a DCN router, and a static GRE tunnel is created from ONS ENE 2 to the other vender, GNE 2. For both static tunnels, provisioning is required on the ONS ENEs. In addition, a Cisco IP tunnel must be provisioned on the DCN router and a GRE tunnel provisioned on GNE 2.

Figure 4-7 Static IP-Over-CLNS Tunnels

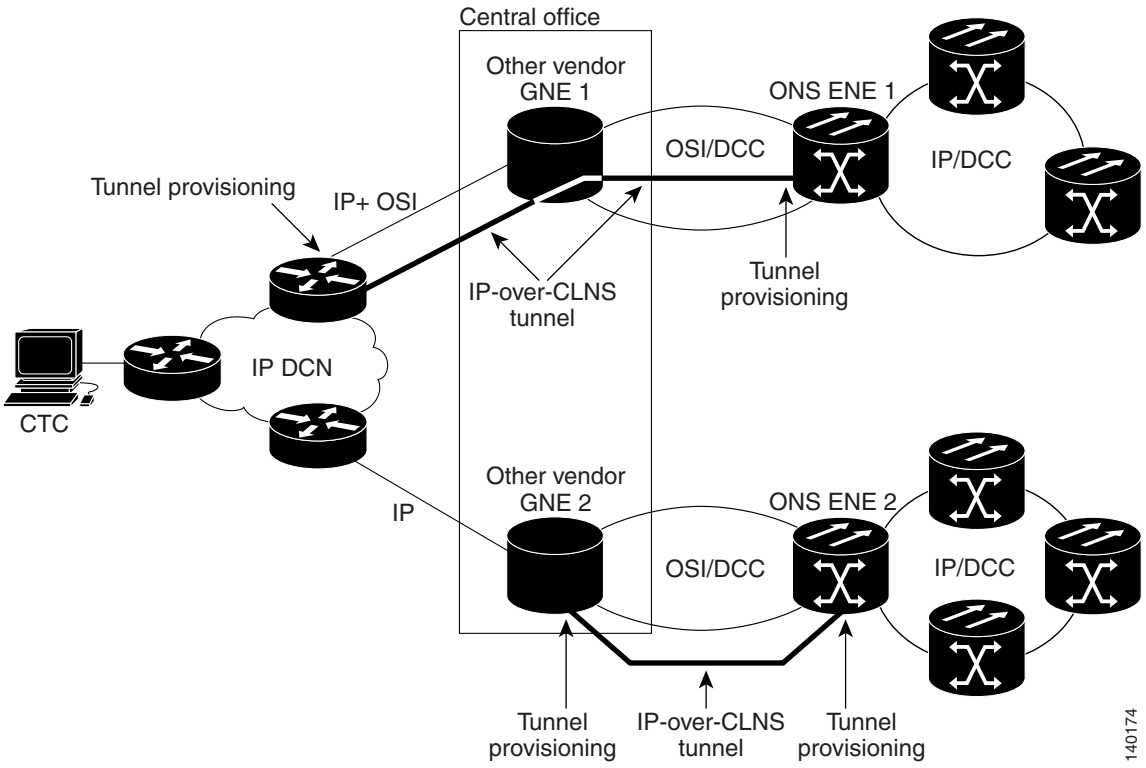
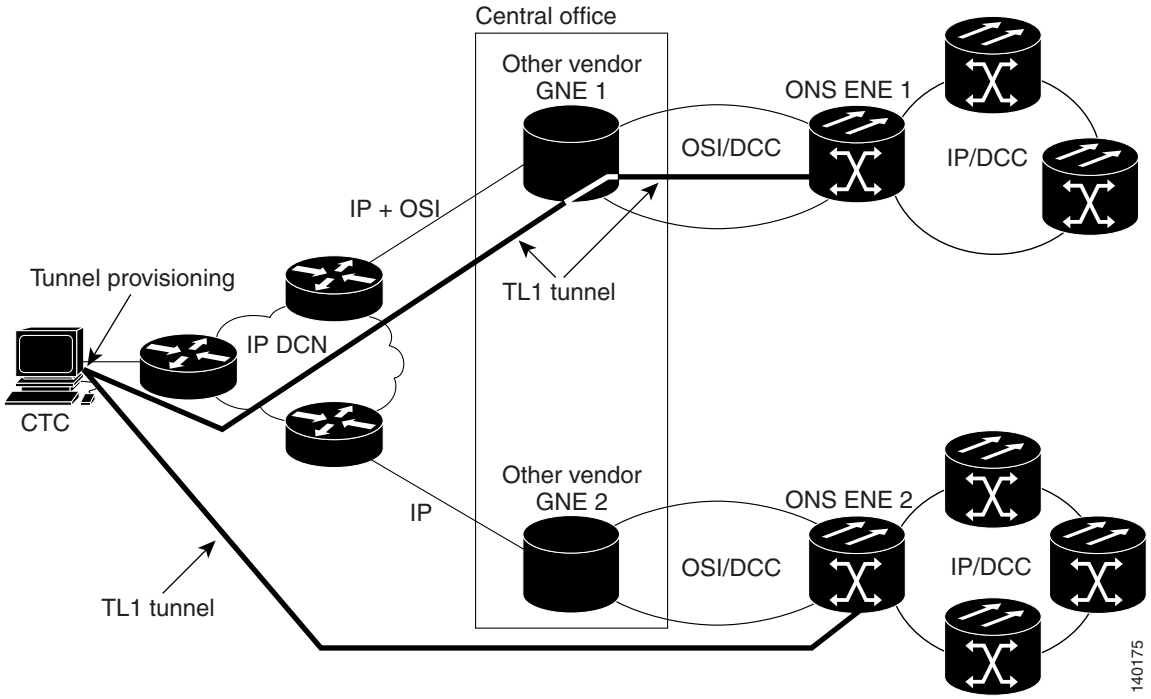


Figure 4-8 shows the same network using TL1 tunnels. Tunnel provisioning occurs at the CTC computer when the tunnel is created with the CTC Launcher. No provisioning is needed at ONS NEs, GNEs or routers.

Figure 4-8 TL1 Tunnels



TL1 tunnels provide several advantages over static IP-over-CLNS tunnels. Because tunnel provisioning is needed only at the CTC computer, they are faster to set up. Because they use TL1 for TCP transport, they are more secure. TL1 tunnels also provide better flow control. On the other hand, IP over CLNS tunnels require less overhead and usually provide a slight performance edge over TL1 Tunnels (depending on network conditions). TL1 tunnels do not support all IP applications such as SNMP and RADIUS Authentication. Table 4-11 shows a comparison between the two types of tunnels.

Table 4-11 TL1 and Static IP-Over-CLNS Tunnels Comparison

Category	Static IP-Over-CLNS	TL1 Tunnel	Comments
Setup	Complex	Simple	Requires provisioning at ONS NE, GNE, and DCN routers. For TL1 tunnels, provisioning is needed at CTC computer.
Performance	Best	Average to good	Static tunnels generally provide better performance than TL1 tunnels, depending on TL1 encoding used. LV+Binary provides the best performance. Other encoding will produce slightly slower TL1 tunnel performance.
Support all IP applications	Yes	No	TL1 tunnels do not support SNMP or RADIUS Server IP applications.
ITU Standard	Yes	No	Only the static IP-over-CLNS tunnels meet ITU standards. TL1 tunnels are new.
Tunnel traffic control	Good	Very good	Both tunnel types provide good traffic control
Security setup	Complex	No setup needed	Static IP-over-CLNS tunnels require careful planning. Because TL1 tunnels are carried by TL1, no security provisioning is needed.

Table 4-11 TL1 and Static IP-Over-CLNS Tunnels Comparison (continued)

Category	Static IP-Over-CLNS	TL1 Tunnel	Comments
Potential to breach DCN from DCC using IP.	Possible	Not possible	A potential exists to breach a DCN from a DCC using IP. This potential does not exist for TL1 tunnels.
IP route management	Expensive	Automatic	For static IP-over-CLNS tunnels, route changes require manual provisioning at network routers, GNEs, and ENEs. For TL1 tunnels, route changes are automatic.
Flow control	Weak	Strong	TL1 tunnels provide the best flow control.
Bandwidth sharing among multiple applications	Weak	Best	—
Tunnel lifecycle	Fixed	CTC session	TL1 tunnels are terminated when the CTC session ends. Static IP-over-CLNS tunnels exist until they are deleted in CTC.

TL1 tunnel specifications and general capabilities include:

- Each tunnel generally supports between six to eight ENEs, depending on the number of tunnels at the ENE.
- Each CTC session can support up to 32 tunnels.
- The TL1 tunnel database is stored locally in the CTC Preferences file.
- Automatic tunnel reconnection when the tunnel goes down.
- Each ONS NE can support at least 16 concurrent tunnels.

4.8 Common Control Card Reset

You can reset the common control card for the ONS 15310-MA SDH (the 15310E-CTX-K9 card) by using the hard-reset or soft-reset commands in CTC. A soft reset reboots the 15310E-CTX-K9 card and reloads the operating system and the application software. A hard reset temporarily removes power from the 15310E-CTX-K9 card and clears all buffer memory. Before you hard-reset a card, put the card in standby mode by completing a soft-reset.

From the node view, select a card and right-click to open a menu with the hard-reset and soft-reset commands. Soft resets do not impact traffic, but hard resets are service affecting. A card must be in the Out-of-Service and Management, Maintenance (locked-enabled,maintenance) service state before you can perform a hard reset.

4.9 Traffic Card Reset

You can reset the CE-100T-8, ML-100T-8, E1_21_E3_DS3_3, and E1_63_E3_DS3_3 cards by using the hard-reset or soft-reset commands in CTC. A soft reset reboots the card and reloads the operating system and the application software. A hard reset temporarily removes power from the card and clears all buffer memory.

From the node view, select a card and right-click to open a menu with the hard-reset and soft-reset commands. A card must be in the Out-of-Service and Management, Maintenance (locked-enabled,maintenance) service state before you can perform a hard reset.

4.10 Database Backup

You can store a back-up version of the database on the workstation running CTC. This operation should be part of a regular ONS 15310-MA SDH maintenance program performed at approximately weekly intervals and should also be completed when preparing an ONS 15310-MA SDH for a pending natural disaster, such as a flood.

A database backup may be restored in two ways, partial or complete. A partial database restore operation restores only the provisioning data. A complete database restore operation restores both system and provisioning data. For more information on restore database, refer to the *Cisco ONS 15310-MA SDH Procedure Guide*.

Note The following parameters are not backed up and restored: node name, IP address, mask and gateway, and Internet Inter-ORB Protocol (IIOP) port. If you change the node name and then restore a backed up database with a different node name, the circuits will map to the new node name. Cisco recommends keeping a record of the old and new node names.

4.11 Software Revert

When you click the Activate button after a software upgrade, the 15310E-CTX-K9 copies the current working database and saves it in a reserved location in the 15310E-CTX-K9 flash memory. If you later need to revert to the original working software load from the protect software load, the saved database installs automatically. You do not need to restore the database manually or recreate circuits.

The revert feature is useful if a maintenance window closes while you are upgrading CTC software. You can revert to the standby software load without losing traffic. When the next maintenance window opens, complete the upgrade and activate the new software load.

Circuits that were created and provisioning that was performed after a software load is activated (upgraded to a higher release) do not reinstate with a revert. The database configuration at the time of activation is reinstated after a revert. This does not apply to maintenance reverts (for example 8.0.1 to 8.0.0), because maintenance releases use the same database.

CHAPTER 5

Security

This chapter provides information about Cisco ONS 15310-MA SDH user security. To provision security, refer to the *Cisco ONS 15310-MA SDH Procedure Guide*.

Chapter topics include:

5.1 Users IDs and Security Levels

A CISCO15 user ID is provided with the ONS 15310-MA SDH for use with initial login. Use this ID to set up other ONS 15310-MA SDH user IDs. (For instructions, see the "Turn Up a Node" chapter in the *Cisco ONS 15310-MA SDH Procedure Guide*.)

Note Cisco Transport Controller (CTC) does not display the CISCO15 user ID when you log in.

An ONS 15310-MA SDH node can support up to 500 user IDs. Each CTC or Transaction Language 1 (TL1) user ID can be assigned one of the following security levels:

- Retrieve—Users can retrieve and view CTC information but cannot set or modify parameters.
- Maintenance—Users can access only the ONS 15310-MA SDH maintenance options.
- Provisioning—Users can access provisioning and maintenance options.
- Superuser—Users can perform all of the functions of the other security levels as well as set names, passwords, and security levels for other users.

By default, multiple concurrent user ID sessions are permitted on the node; that is, multiple users can log into a node using the same user ID. However, you can provision the node to allow only a single login per user ID and prevent concurrent logins for all users.

See Table 5-3 on page 5-6 for idle user timeout information for each security level.

5.2 User Privileges and Policies

This section lists user privileges for each CTC action and describes the security policies available to Superusers.

5.2.1 User Privileges by CTC Action

Table 5-1 shows the actions that each user privilege level can perform in node view.

Table 5-1 ONS 15310-MA SDH Security Levels—Node View

CTC Tab	Subtab	[Subtab]: Actions	Retrieve	Maintenance	Provisioning	Superuser
Alarms	—	Synchronize/Filter/Delete Cleared Alarms	X	X	X	X
Conditions	—	Retrieve/Filter	X	X	X	X
History	Session	Filter	X	X	X	X
	Shelf	Retrieve/Filter	X	X	X	X
Circuits	Circuits	Create/Edit/Delete	—	—	X	X
		Filter/Search	X	X	X	X
	Rolls	Complete/Force Valid Signal/Finish	—	—	X	X
Provisioning	General	Edit	—	—	Partial[1]	X
	Network	General: Edit	—	—	—	X
		Static Routing: Create/Edit/ Delete	—	—	X	X
		OSPF: Create/Edit/Delete	—	—	X	X
		RIP: Create/Edit/Delete	—	—	X	X
		Proxy: Create/Edit/Delete	—	—	—	X
		Firewall: Create/Edit/Delete	—	—	—	X
	OSI	Main Setup: Edit	—	—	—	X
		TARP: Config: Edit	—	—	X	X
		TARP: Static TDC: Add/Edit/Delete	—	—	X	X
		TARP: MAT: Add/Edit/Delete	—	—	X	X
		Routers: Setup: Edit	—	—	—	X
		Routers: Subnets: Edit/Enable/Disable	—	—	X	X
		Tunnels: Create/Edit/Delete	—	—	X	X
	Protection	Create/Delete/Edit	—	—	X	X

Table 5-1 ONS 15310-MA SDH Security Levels—Node View (continued)

CTC Tab	Subtab	[Subtab]: Actions	Retrieve	Maintenance	Provisioning	Superuser
Provisioning (continued)	Security	Users: Create/Delete/Clear Security Intrusion Alarm	—	—	—	X
		Users: Change	Same user	Same user	Same user	All users
		Active Logins: View/Logout/ Retrieve Last Activity Time	—	—	—	X
		Policy: Edit/View (Prevent superuser disable - NE Default)	—	—	—	X
		Data Comm: Edit/View	—	—	—	X
		Access: Edit/View	—	—	—	X
		RADIUS Server: Create/Edit/Delete/Move Up/ Move Down/View	—	—	—	X
		Legal Disclaimer: Edit	—	—	—	X
	SNMP	Create/Edit/Delete	—	—	X[2]	X
		Browse trap destinations	X	X	X	X
	Comm Channels	RS-DCC: Create/Edit/Delete	—	—	X	X
		MS-DCC: Create/Edit/Delete	—	—	X	X
		PPC: Create/Edit/Delete	—	—	X	X
	Timing	General/BITS Facilities: Edit	—	—	X	X
	Orderwire	Enable Buzzer	—	—	X	X
	Alarm Extenders	External Alarms: Edit	—	—	X	X
		External Controls: Edit	—	—	X	X
	Alarm Profiles	Alarm Behavior: Edit	—	—	X	X
		Alarm Profile Editor: Store/Delete[3]	—	—	X	X
		Alarm Profile Editor: New/Load/Compare/Available/ Usage	X	X	X	X
	Defaults	Edit/Import	—	—	—	X
		Reset/Export	X	X	X	X
Inventory	—	Delete	—	—	X	X
		Hard Reset/Soft Reset	—	X	X	X
Maintenance	Database	Backup	—	X	X	X
		Restore	—	—	—	X
	Network	Routing Table: Retrieve	X	X	X	X
		RIP Routing Table: Retrieve	X	X	X	X

Table 5-1 ONS 15310-MA SDH Security Levels—Node View (continued)

CTC Tab	Subtab	[Subtab]: Actions	Retrieve	Maintenance	Provisioning	Superuser
Maintenance (continued)	OSI	IS-IS RIB: Refresh	X	X	X	X
		ES-IS RIB: Refresh	X	X	X	X
		TDC: TID to NSAP/Flush Dynamic Entries	—	X	X	X
		TDC: Refresh	X	X	X	X
	Protection	Switch/Lock out/ Lock-on/Clear/ Unlock	—	X	X	X
	Software	Download	—	X	X	X
		Activate/Revert	—	—	—	X
	Cross-Connect	Resource Usage: Delete	—	—	X	X
		Resource Usage: Refresh	X	X	X	X
	Overhead XConnect	View	X	X	X	X
	Alarm Extenders	External Alarms: View	X	X	X	X
		External Controls: View	X	X	X	X
		Virtual Wires: View/Retrieve	X	X	X	X
		Overhead Termination: View	X	X	X	X
	Diagnostic	Retrieve Tech Support Log Node Diagnostic Logs (Release 9.2)	—	—	X[2]	X
		Lamp Test	—	X	X	X
	Timing	Source: Edit	—	X	X	X
		Report: View/Refresh	X	X	X	X
	Audit	Retrieve	—	—	—	X
		Archive	—	—	X	X
	Test Access	View	X	X	X	X

1. Provisioner user cannot change node name, contact, location, or Virtual Tributary alarm indication signal (AIS-V) insertion on VC3 signal degrade (SD) parameters.
2. Provisioner user cannot perform this task in secure mode.
3. The action buttons in the subtab are active for all users, but the actions can be completely performed only by the users with the required security levels.

Table 5-2 shows the actions that each user privilege level can perform in network view.

Table 5-2 ONS 15310-MA SDH Security Levels—Network View

CTC Tab	Subtab	[Subtab]: Actions	Retrieve	Maintenance	Provisioning	Superuser
Alarms	—	Synchronize/Filter/Delete cleared alarms	X	X	X	X
Conditions	—	Retrieve/Filter	X	X	X	X
History	—	Filter	X	X	X	X

Table 5-2 ONS 15310-MA SDH Security Levels—Network View (continued)

CTC Tab	Subtab	[Subtab]: Actions	Retrieve	Maintenance	Provisioning	Superuser
Circuits	Circuits	Create/Edit/Delete	—	—	X	X
		Filter/Search	X	X	X	X
	Rolls	Complete/ Force Valid Signal/ Finish	—	—	X	X
Provisioning	Security	Users: Create/Delete/Clear Security Intrusion Alarm	—	—	—	X
		Users: Change	Same User	Same User	Same User	All Users
		Active logins: Logout/Retrieve Last Activity Time	—	—	—	X
		Policy: Change	—	—	—	X
	Alarm Profiles	Store/Delete[1]	—	—	X	X
		New/Load/Compare/Available/ Usage	X	X	X	X
	MS-SPRing	Create/Delete/Edit/Upgrade	—	—	X	X
	Overhead Circuits	Create/Delete/Edit/Merge	—	—	X	X
		Search	X	X	X	X
	Provisionable Patchcords (PPC)	Create/Edit/Delete	—	—	X	X
	Server Trails	Create/Edit/Delete	—	—	X	X
	VLAN DB Profile	Load/Store/Merge/Circuits	X	X	X	X
		Add/Remove Rows	—	—	X	X
Maintenance	Software	Download/Cancel	—	X	X	X
	Diagnostic	OSPF Node Information: Retrieve/Clear	X	X	X	X
	APC	Run APC/Disable APC	—	—	—	X
		Refresh	X	X	X	X

1. The action buttons in the subtab are active for all users, but the actions can be completely performed only by the users assigned with the required security levels.

5.2.2 Security Policies

Users with the Superuser security privilege can provision security policies on the ONS 15310-MA SDH. These security policies include idle user timeouts, password changes, password aging, and user lockout parameters. In addition, a Superuser can access the ONS 15310-MA SDH through the LAN port on the front of the node. If enabled in the NE defaults, superusers can be configured to override the inactive user timeout interval.

5.2.2.1 Superuser Privileges for Provisioning Users

Superusers can grant permission to Provisioning users to perform a set of tasks. The tasks include retrieving an audit log, restoring a database, clearing performance monitoring (PM) parameters, and activating and reverting software loads. These privileges, except the PM clearing privilege, can only be granted using CTC network element (NE) defaults. See Appendix C, "Network Element Defaults" for more information. To grant the PM clearing privilege using CTC, click the Provisioning > Security > Access tabs. For more information about setting up Superuser privileges, refer to the "Change Node Settings" chapter in the *Cisco ONS 15310-MA SDH Procedure Guide*.

5.2.2.2 Idle User Timeout

Each ONS 15310-MA SDH CTC or TL1 user can be idle during his or her login session for a specified amount of time before the CTC window is locked. A lockout prevents unauthorized users from making changes. Higher-level users have shorter default idle periods and lower-level users have longer or unlimited default idle periods, as shown in Table 5-3. The user idle period can be modified by a Superuser; refer to the "Change Node Settings" chapter in the *Cisco ONS 15310-MA SDH Procedure Guide* for instructions.

Table 5-3 Default User Idle Times

Security Level	Idle Time
Superuser	15 minutes
Provisioning	30 minutes
Maintenance	60 minutes
Retrieve	Unlimited

5.2.2.3 User Password, Login, and Access Policies

Superusers can view real-time lists of users who are logged in via CTC or TL1 for each node. Superusers can also provision the following password, login, and node access policies:

- Password length, expiration and reuse—Superusers can configure the password length using NE defaults. The password length, by default, is set to a minimum of six and a maximum of 20 characters. You can configure the default values in CTC node view using the Provisioning > NE Defaults > Node > security > password Complexity tabs. The minimum length can be set to eight, ten, or twelve characters, and the maximum length to 80 characters. The password must be a combination of alphanumeric (a-z, A-Z, 0-9) and special (+, #,%) characters, where at least two characters are nonalphabetic and at least one character is a special character. Superusers can specify when users must change their passwords and how frequently passwords can be reused.
- Login attempts and locking out users—Superusers can specify the maximum number of times that a user can unsuccessfully attempt to log in before being locked out of CTC. Superusers can also provision the length of time before the lockout is removed.
- Disabling users—Superusers can provision the length of time before inactive user IDs are disabled.
- Node access and user sessions—Superusers can limit the number of CTC sessions one user can have, and they can prohibit access to the ONS 15310-MA SDH using the LAN connection.

- Secure shell—Superusers can select secure shell (SSH) instead of Telnet at the CTC Provisioning > Security > Access tab. SSH is a terminal-remote host Internet protocol that uses encrypted links. It provides authentication and secure communication over channels that are not secure. Port 22 is the default port and cannot be changed.

5.3 Audit Trail

The ONS 15310-MA SDH maintain a GR-839-CORE-compliant audit trail log that resides on the 15310E-CTX-K9 cards. Audit trails are useful for maintaining security, recovering lost transactions, and tracing user activities. The audit trail log shows who has accessed the node and what operations were performed during a given period of time. The log includes authorized Cisco support logins and logouts using the operating system command line interface (CLI), CTC, and TL1; the log also includes FTP actions, circuit creation/deletion, and user/system generated actions.

Event monitoring is also recorded in the audit log. An event is defined as a change in status of an element within the network. External events, internal events, attribute changes, and software upload/download activities are recorded in the audit trail.

To view the audit trail log, refer to the *Cisco ONS 15310-MA SDH Procedure Guide*. Users can access the audit trail logs from any management interface (CTC, Cisco Transport Manager [CTM], or TL1).

The audit trail is stored in persistent memory and is not corrupted by processor switches or upgrades.

Note The ONS 15310-MA SDH do not support a real-time clock with battery backup. Therefore, when you reset 15310E-CTX-K9 card, the audit log is reset to 1970 until you set the date and time again.

5.3.1 Audit Trail Log Entries

Audit trail records capture various types of activities. Individual audit entries contain some or all of the following information:

- User—Name of the user performing the action
- Host—Host from where the activity is logged
- Device ID—IP address of the device involved in the activity
- Application—Name of the application involved in the activity
- Task—Name of the task involved in the activity (view a dialog box, apply configuration, and so on)
- Connection Mode—The service used to connect to the node (for example, Telnet, console, or Simple Network Management Protocol [SNMP])
- Category—Type of change: Hardware, Software, or Configuration
- Status—Status of the user action: Read, Initial, Successful, Timeout, or Failed
- Time—Time of change
- Message Type—Denotes whether the event succeeded or failed
- Message Details—A description of the change

5.3.2 Audit Trail Capacities

The ONS 15310-MA SDH is able to store 640 log entries.When this limit is reached, the oldest entries are overwritten with new events. When the log server is 80 percent full, an AUD-LOG-LOW condition is raised and logged.

When the log server reaches the maximum capacity of 640 entries and begins overwriting records that were not archived, an AUD-LOG-LOSS condition is raised and logged. This event indicates that audit trail records have been lost. Until you off-load the file, this event will not occur a second time regardless of the amount of entries that are overwritten by incoming data. To export the audit trail log, refer to the *Cisco ONS 15310-MA SDH Procedure Guide*.

5.4 RADIUS Security

Users with Superuser security privileges can configure nodes to use Remote Authentication Dial In User Service (RADIUS) authentication. Cisco Systems uses a strategy known as authentication, authorization, and accounting (AAA) for enabling, verifying, and tracking the actions of remote users.

RADIUS server supports IPv6 addresses and can process authentication requests from a GNE or an ENE that uses IPv6 addresses.

5.4.1 RADIUS Authentication

RADIUS is a system of distributed security that secures remote access to networks and network services against unauthorized access. RADIUS contains three components:

- A protocol with a frame format that utilizes User Datagram Protocol (UDP)/IP
- A server
- A client

The server runs on a central computer, typically at a customer site, while the clients reside in the dial-up access servers and can be distributed throughout the network.

ONS 15310-MA SDH nodes operate as clients of the RADIUS server. The client is responsible for passing user information to designated RADIUS servers, and then acting on the response that is returned. RADIUS servers are responsible for receiving user connection requests, authenticating the user, and returning all configuration information necessary for the client to deliver service to the user. The RADIUS servers can act as proxy clients to other kinds of authentication servers. Transactions between the RADIUS client and server are authenticated through the use of a shared secret, which is never sent over the network. In addition, any user passwords are sent encrypted between the client and RADIUS server. This prevents someone monitoring an unsecured network from determine a user's password. Refer to the *Cisco ONS 15310-MA SDH Procedure Guide* to implement RADIUS authentication.

5.4.2 Shared Secrets

A shared secret is a text string that serves as a password between:

- A RADIUS client and a RADIUS server
- A RADIUS client and a RADIUS proxy
- A RADIUS proxy and a RADIUS server

For a configuration that uses a RADIUS client, a RADIUS proxy, and a RADIUS server, the shared secret that is used between the RADIUS client and the RADIUS proxy can be different from the shared secret used between the RADIUS proxy and the RADIUS server.

Shared secrets are used to:

- Verify that RADIUS messages, with the exception of the Access-Request message, are sent by a RADIUS-enabled device that is configured with the same shared secret.
- Verify that the RADIUS message has not been modified in transit (message integrity).
- Encrypt some RADIUS attributes, such as User-Password and Tunnel-Password.

When creating and using a shared secret:

- Use the same case-sensitive shared secret on both RADIUS devices.
- Use a different shared secret for each RADIUS server-RADIUS client pair.
- Generate a random sequence at least 22 characters long to ensure a random shared secret.
- Use any standard alphanumeric and special characters.
- Use a shared secret of up to 128 characters in length. To protect your server and your RADIUS clients from brute force attacks, use long shared secrets (more than 22 characters).
- Make the shared secret a random sequence from each of the following three categories: letters (upper or lower case), numbers, and punctuation.
- Change the shared secret often to protect your server and your RADIUS clients from dictionary attacks. An example of a strong shared secret is 8d#>9fq4bV)H7%a3-zE13sW$hIa32M#m<PqAa72(.

CHAPTER 6

Timing

This chapter provides information about Cisco ONS 15310-MA SDH timing. To provision timing, refer to the *Cisco ONS 15310-MA SDH Procedure Guide*.

Chapter topics include:

6.1 Timing Parameters

Node Timing parameters must be set for each ONS 15310-MA SDH. Each ONS 15310-MA SDH independently accepts its timing reference from one of three sources:

- The building integrated timing supply (BITS) port on the ONS 15310-MA SDH.
- An STM-N/E1 port on the ONS 15310-MA SDH. The port is connected to a node that receives timing through a BITS source.
- The internal G.813/SMC clock on the CTX card.

You can set ONS 15310-MA SDH timing to one of three modes: external, line, or mixed. If timing is coming from the BITS port, set ONS 15310-MA SDH timing to external. If the timing comes from an STM-N and E1 port, set the timing to line. Typical ONS 15310-MA SDH networks have the following timing configurations:

- One node is set to external. The external node derives its timing from a BITS source wired to the CTX port. The BITS source derives its timing from a primary reference source (PRS) such as a Stratum 1 clock or global positioning satellite (GPS) signal.
- The other nodes are set to line. The line nodes derive timing from the externally timed node through the E1 port and STMN trunk (span) port.

You can set three timing references for each ONS 15310-MA SDH. The first two references are typically one BITS-level sources, or two line-level sources optically connected to a node with a BITS source. The third reference is usually assigned to the internal clock provided on every ONS 15310-MA SDH CTX card. However, if you assign all three references to other timing sources, the internal clock is always available as a backup timing reference. The internal clock is a SETS (G.813) in ONS 15310-MA SDH. If a node becomes isolated, timing is maintained at the SETS level.

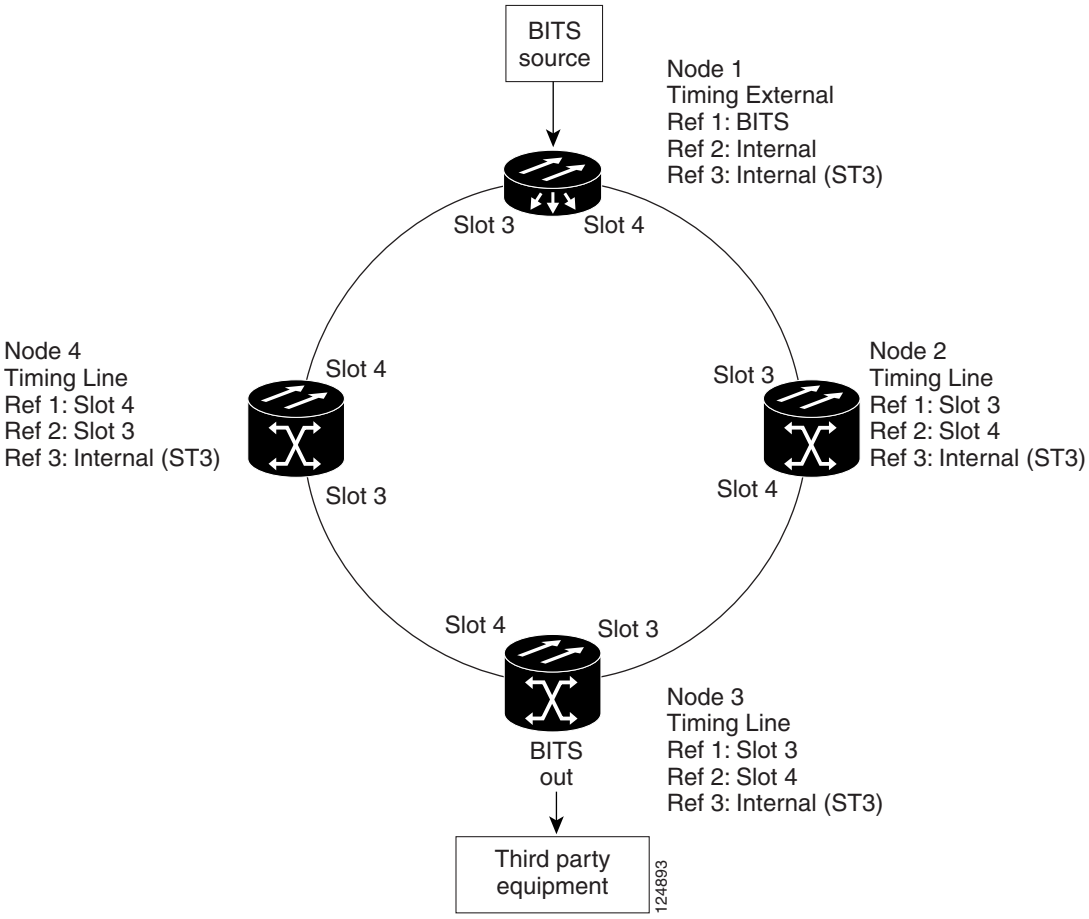
The CTC Maintenance > Timing > Report tabs show current timing information for an ONS 15310-MA SDH, including the timing mode, clock state and status, switch type, and reference data.

Caution Mixed timing allows you to select both external and line timing sources. However, Cisco does not recommend its use because it can create timing loops. Use mixed timing mode with caution.

6.2 Network Timing

Figure 6-1 shows an example of an ONS 15310-MA SDH network timing setup. Node 1 is set to external timing. One reference is set to BITS, the two references are set to internal. The BITS output pins on the CTX cards of Node 3 provide timing to outside equipment, such as a digital access line multiplexer.

Figure 6-1 ONS 15310-MA SDH Timing Example



6.3 Synchronization Status Messaging

Synchronization status messaging (SSM) is an SDH protocol that communicates information about the quality of the timing source. SSM messages are carried on the S1 byte of the SDH line layer. They enable SDH devices to automatically select the highest quality timing reference and to avoid timing loops.

If you enable SSM for the ONS 15310-MA SDH, consult your timing reference documentation to determine which message set to use. Table 6-1 and Table 6-2 show the Generation 1 and Generation 2 message sets.

Table 6-1 SSM Message Set

Message	Quality	Description
G811	1	Primary reference clock
STU	2	Sync traceability unknown
G812T	3	Transit node clock traceable
G812L	4	Local node clock traceable
SETS	5	Synchronous equipment
DUS	6	Do not use for timing synchronization

Table 6-2 SSM Generation 2 Message Set

Message	Quality	Description
PRC	1	Primary reference source—Stratum 1
STU	2	Synchronization traceability unknown
ST2	3	Stratum 2
TNC	4	Transit node clock
G.813E	5	Stratum 3E
G.813	6	PRC
SMC	7	SDH minimum clock
ST4	8	Stratum 4
DUS	9	Do not use for timing synchronization
RES		Reserved; quality level set by user

CHAPTER 7

Circuits and Tunnels

Note The terms “Unidirectional Path Switched Ring” and “UPSR” may appear in Cisco literature. These terms do not refer to using Cisco ONS 15xxx products in a unidirectional path switched ring configuration. Rather, these terms, as well as “Path Protected Mesh Network” and “PPMN,” refer generally to Cisco's path protection feature, which may be used in any topological network configuration. Cisco does not recommend using its path protection feature in any particular topological network configuration.

This chapter explains Cisco ONS 15310-MA SDH synchronous transport signal (VC high-order path) and Virtual Tributary (VC low-order path) circuits and VC low-order path and data communications channel (DCC) tunnels. To provision circuits and tunnels, refer to the *Cisco ONS 15310-MA SDH Procedure Guide*.

Chapter topics include:

7.1 Overview

You can create circuits across and within ONS 15310-MA SDH nodes and assign different attributes to circuits. For example, you can:

- Create one-way, two-way (bidirectional), or broadcast circuits.
- Assign user-defined names to circuits.

- Assign different circuit sizes.
- Automatically or manually route circuits.
- Automatically create multiple circuits with autoranging. VC low-order path tunnels do not use autoranging.
- Provide full protection to the circuit path.
- Provide only protected sources and destinations for circuits.
- Define a secondary circuit source or destination that allows you to interoperate an ONS 15310-MA SDH Linear Multiplex Section Protection configuration with third-party equipment Linear Multiplex Section Protection configurations.
- Set Linear Multiplex Section Protection circuits as revertive or nonrevertive.

For the ONS 15310-MA SDH CE-100T-8, CE-MR-6 (ONS 15310-MA SDH only), or ML-100T-8 cards, you can provision circuits either before or after the cards are installed if the slots are provisioned. For the 15310-MA SDH 15310E-CTX-K9 card, you must preprovision the small form-factor pluggables (SFPs) (called pluggable port modules [PPMs] in CTC) before you can create an optical circuit. However, circuits do not carry traffic until the cards and SFPs are installed and the ports are In-Service and Normal (unlocked-enabled); Out-of-Service and Autonomous, Automatic In-Service (OO-AU,Automatic In Service); or Out-of-Service and Management, Maintenance (locked-enabled,maintenance).

7.2 Circuit Properties

You can view information about circuits in the ONS 15310-MA SDH Circuits window, which appears in network, node, and card view. The Circuits window shows the following information:

- Name—The name of the circuit. The circuit name can be manually assigned or automatically generated.
- Type—The circuit types are: VC high-order path (VC high-order path circuit), VC low-order path (VC low-order path circuit), LOP Tunnel (VC low-order path tunnel), LAP (VC low-order path aggregation point), HOP-V (VC virtual concatenated [VCAT] circuit), or VC low-order path-V (VC low-order path VCAT circuit).
- Size—The circuit size. VC low-order path circuits are VC12 and VC3. ONS 15310-MA SDH VC high-order path circuits are VC4, VC4-2c, VC4-3c, or VC4-4c, VC4-8c, and VC4-16c. VCAT circuits are VC-12-*n*v or VC3-*n*v, where *n* is the number of members.
- Protection—The type of circuit protection.
- Direction—The circuit direction, either two-way or one-way.
- Status—The circuit status. See the "7.2.1 Circuit Status" section on page 7-3.
- Source—The circuit source in the format: *node/slot/port "port name"/VC*. (Port name appears in quotes.) Node and slot always appear; *port "port name"/VC* might appear, depending on the source card, circuit type, and whether a name is assigned to the port. If the port uses a pluggable port module (PPM), the port format is *PPM-port number*, for example, p2-1. If the port is a E1, DS3, or E3 port, port type is indicated, for example, pE1. If the circuit size is a concatenated size (3c, 6c, 9c, 12c), VCs used in the circuit are indicated by an ellipsis, for example, S7..9, (VCs 7, 8, and 9) or S10..12 (VCs 10, 11, and 12).
- Destination—The circuit destination in the same format as the circuit source.
- # of Spans—The number of internode links that constitute the circuit. Right-clicking the column displays a shortcut menu from which you can choose to show or hide circuit span detail.

- State—The circuit state. See the "7.2.2 Circuit States" section on page 7-4.

The Filter button allows you to filter the circuits in network, node, or card view based on circuit name, size, type, direction, and other attributes. In addition, you can export the Circuit window data in HTML, comma-separated values (CSV), or tab-separated values (TSV) format using the Export command from the File menu.

7.2.1 Circuit Status

The circuit statuses that appear in the Circuit window Status column are generated by Cisco Transport Controller (CTC) based on conditions along the circuit path. Table 7-1 shows the statuses that can appear in the Status column.

Table 7-1 ONS 15310-MA SDH Circuit Status

Status	Definition/Activity
CREATING	CTC is creating a circuit.
DISCOVERED	CTC created a circuit. All components are in place and a complete path exists from circuit source to destination.
DELETING	CTC is deleting a circuit.
PARTIAL	A CTC-created circuit is missing a cross-connect or network span or a complete path from source to destination(s) does not exist. In CTC, circuits are represented using cross-connects and network spans. If a network span is missing from a circuit, the circuit status is PARTIAL. However, a PARTIAL status does not necessarily mean a circuit traffic failure has occurred, because traffic might flow on a protect path. Network spans are in one of two states: up or down. On CTC circuit and network maps, up spans appear as green lines, and down spans appear as gray lines. If a failure occurs on a network span during a CTC session, the span remains on the network map but its color changes to gray to indicate that the span is down. If you restart your CTC session while the failure is active, the new CTC session cannot discover the span and its span line does not appear on the network map. Subsequently, circuits routed on a network span that goes down appear as DISCOVERED during the current CTC session, but appear as PARTIAL to users who log in after the span failure.
DISCOVERED_TL1	A TL1-created circuit or a TL1-like CTC-created circuit is complete. A complete path from source to destinations exists.
PARTIAL_TL1	A TL1-created circuit or a TL1-like CTC-created circuit is missing a cross-connect or circuit span (network link), and a complete path from source to destinations does not exist.
CONVERSION_PENDING	An existing circuit in a topology upgrade is set to this status. The circuit returns to the DISCOVERED status when the topology upgrade is complete. For more information about in-service topology upgrades, see Chapter 9, "SDH Topologies and Upgrades."

Table 7-1 ONS 15310-MA SDH Circuit Status (continued)

Status	Definition/Activity
PENDING_MERGE	Any new circuits created to represent an alternate path in a topology upgrade are set to this status to indicate that the circuit is temporary. These circuits can be deleted if a topology upgrade fails. For more information about in-service topology upgrades, see Chapter 9, "SDH Topologies and Upgrades."
DROP_PENDING	A circuit is set to this status when a new circuit drop is being added.

7.2.2 Circuit States

The circuit service state is an aggregate of the cross-connect states within the circuit.

- If all cross-connects in a circuit are in the unlocked-enabled service state, the circuit service state is In-Service (unlocked).
- If all cross-connects in a circuit are in an Out-of-Service (locked) service state, such as locked-enabled,maintenance; Out-of-Service and Autonomous, Automatic In-Service (locked-disabled,Automatic In Service); or Out-of-Service and Management, Disabled (locked-enabled,disabled), the circuit service state is locked.
- PARTIAL is appended to the locked circuit service state when circuit cross-connect states are mixed and not all states are unlocked-enabled. The locked-PARTIAL state can occur during automatic or manual transitions between states. locked-PARTIAL can appear during a manual transition caused by an abnormal event such as a CTC crash or communication error, or if one of the cross-connects could not be changed. Refer to the *Cisco ONS 15310-MA SDH Troubleshooting Guide* for troubleshooting procedures.

You can assign a state to circuit cross-connects at two points:

- During circuit creation, you can set the state on the Create Circuit wizard.
- After circuit creation, you can change a circuit state in the Edit Circuit window or from the Tools > Circuits > Set Circuit State menu.

Note After you have created an initial circuit in a CTC session, the subsequent circuit states default to the circuit state of the initial circuit, regardless of which nodes in the network the circuits traverse or the node.ckt.state default setting.

During circuit creation, you can apply a service state to the drop ports in a circuit. You cannot transition a drop port from the unlocked-enabled service state to the locked-enabled,disabled service state; you must first put the port in the locked-enabled,maintenance state before changing it to the locked-enabled,disabled state. For more information about port service state transitions, see Appendix B, "Administrative and Service States."

Circuits do not use the soak timer, but ports do. The soak period is the amount of time that the port remains in the locked-disabled,Automatic In Service service state after a signal is continuously received. When the cross-connects in a circuit are in the locked-disabled,Automatic In Service service state, the ONS 15310-MA SDH monitor the cross-connects for an error-free signal. It changes the state of the circuit from locked to unlocked or to locked-PARTIAL as each cross-connect assigned to the circuit path

is completed. This allows you to provision a circuit using TL1, verify its path continuity, and prepare the port to go into service when it receives an error-free signal for the time specified in the port soak timer. Two common examples of state changes you see when provisioning circuits using CTC are:

- When assigning the Automatic In Service administrative state to cross-connects in VC-12 circuits and VC low-order path tunnels, the source and destination ports on the VC-12 circuits remain in the locked-disabled,Automatic In Service service state until an alarm-free signal is received for the duration of the soak timer. When the soak timer expires and an alarm-free signal is found, the VC-12 source port and destination port service states change to unlocked-enabled and the circuit service state becomes unlocked.
- When assigning the Automatic In Service administrative state to cross-connects in VC high-order path circuits, the circuit source and destination ports transition to the locked-disabled,Automatic In Service service state. When an alarm-free signal is received, the source and destination ports remain locked-disabled,Automatic In Service for the duration of the soak timer. After the port soak timer expires, VC high-order path source and destination ports change to unlocked-enabled and the circuit service state to unlocked.

To find the remaining port soak time, choose the Maintenance > Automatic In Service Soak tabs in card view and click the Retrieve button. If the port is in the locked-disabled,Automatic In Service service state and has a good signal, the Time Until unlocked column shows the soak count down status. If the port is locked-disabled,Automatic In Service and has a bad signal, the Time Until unlocked column indicates that the signal is bad. You must click the Retrieve button to obtain the latest time value.

Note Although the ML-100T-8 card does not use the Telcordia GR-1093-CORE state model, you can also set a soak timer for ML-100T-8 card ports. The soak period is the amount of time that the ML-100T-8 port remains in the Down state after an error-free signal is continuously received before changing to the Up state. To find the remaining port soak time, choose the Maintenance > Ether/POS Port Soak tabs in ML-100T-8 card view and click the Retrieve button.

For more information about port and cross-connect service states, see Appendix B, "Administrative and Service States."

7.2.3 Circuit Protection Types

The Protection column on the Circuit window shows the card (line) and SDH topology (path) protection used for the entire circuit path. Table 7-2 shows the protection type indicators that you see in this column.

Table 7-2 Circuit Protection Types

Protection Type	Description
LMSP	The circuit is protected by a LMSP protection group.
N/A	A circuit with connections on the same node is not protected.
Protected	The circuit is protected by diverse SDH topologies, for example, a Linear Multiplex Section Protection and 1+1.
Unknown	A circuit has a source and destination on different nodes and communication is down between the nodes. This protection type appears if not all circuit components are known.
Unprot (black)	A circuit with a source and destination on different nodes is not protected.

Table 7-2 Circuit Protection Types

Protection Type	Description
Unprot (red)	A circuit created as a fully protected circuit is no longer protected due to a system change, such as removal of a 1+1 protection group.
SNCP	

7.2.4 Circuit Information in the Edit Circuits Window

You can edit a selected circuit using the Edit button on the Circuits window. The tabs that appear depend on the circuit chosen:

- General—Displays general circuit information and allows you to edit the circuit name.
- Monitors—Displays possible monitor sources and allows you to create a monitor circuit.
- Subnetwork Connection Protection—Allows you to change linear multiplex section protection selectors. For more information, see the "7.6 Subnetwork Connection Protection Circuits" section on page 7-9.
- Subnetwork Connection Protection Switch Counts—Allows you to change linear multiplex section protection switch protection paths. For more information, see the "7.6 Subnetwork Connection Protection Circuits" section on page 7-9.
- State—Allows you to edit cross-connect service states.
- Merge—Allows you to merge aligned circuits. For more information, see the "7.10 Merged Circuits" section on page 7-22.

Using the Export command from the File menu, you can export data from the Linear Multiplex Section Protection Selectors, Linear Multiplex Section Protection Switch Counts, State, and Merge tabs in HTML, comma-separated values (CSV), or tab-separated values (TSV) format.

The Show Detailed Map checkbox in the Edit Circuit window updates the graphical view of the circuit to show more detailed routing information, such as:

- Circuit direction (unidirectional/bidirectional)
- The nodes, VCs, and VTs through which the circuit passes including slots and port numbers
- The circuit source and destination points
- Open Shortest Path First (OSPF) area IDs
- Link protection (linear multiplex section protection, unprotected, 1+1) and bandwidth (STMN)

Alarms and states can also be viewed on the circuit map, including:

- Alarm states of nodes on the circuit route
- Number of alarms on each node, organized by severity
- Port service states on the circuit route
- Alarm state/color of most severe alarm on port
- Loopbacks
- Path trace states
- Path selectors states

By default, the working path on the detailed circuit map is indicated by a green bidirectional arrow, and the protect path is indicated by a purple bidirectional arrow. Source and destination ports are shown as circles with an S and D. Port states are indicated by colors, shown in Table 7-3.

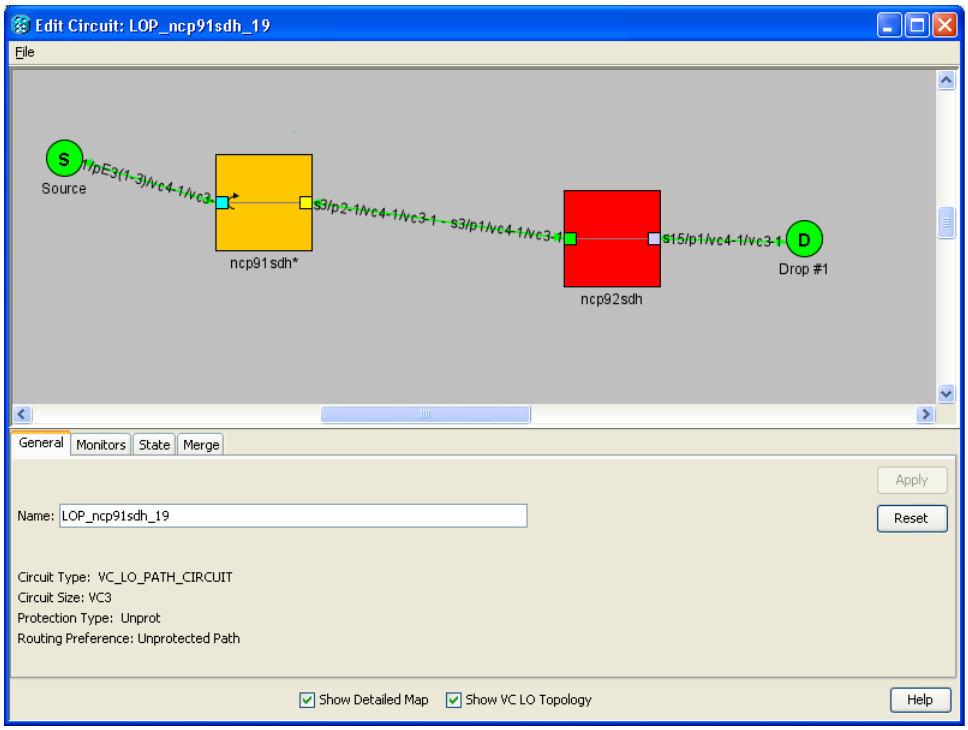
Table 7-3 Port State Color Indicators

Port Color	State
Green	unlocked-enabled
Gray	locked-enabled,disabled
Purple	locked-disabled,Automatic In Service
Light blue	locked-enabled,maintenance

Notations within or next to the squares or selector pentagons on each node indicate switches and other conditions. For example:

- F = Force switch
- M = Manual switch
- L = Lockout switch
- Arrow = Facility (outward) or terminal (inward) loopback (Figure 7-1)

Figure 7-1 Terminal Loopback in the Edit Circuits Window



Move the mouse cursor over nodes, ports, and spans to see tooltips with information including the number of alarms on a node (organized by severity), a port's service state, and the protection topology.

Right-click a node, port, or span on the detailed circuit map to initiate certain circuit actions:

- Right-click a unidirectional circuit destination node to add a drop to the circuit.
- Right-click a port containing a path-trace-capable card to initiate the path trace.
- Right-click a linear multiplex section protection span to change the state of the path selectors in the linear multiplex section protection circuit.

7.3 VC-12 Bandwidth

The 15310E-CTX-K9 in the ONS 15310-MA SDH performs port-to-port time-division multiplexing (TDM). The VC low-order path matrix for the 15310E-CTX-K9 has 96 logical VC high-order path ports. All VC-12 multiplexing is achieved through these logical VC high-order path ports. Although the 15310E-CTX-K9 can support up to 2016 VC-12 cross-connects and 1344 bidirectional VC low-order path circuits, the maximum number of VC12s that can be provisioned for Software Release 9.1 and 9.2 is 2016 VC 12 low-order path cross-connects and 1008 bidirectional VC12 low-order path circuits.

To view VC low-order path matrix resource usage, use the Maintenance > Cross-connect > Resource Usage subtabs.

7.4 VC Low-order Path Tunnels and Aggregation Points

To maximize VC-12 cross-connect resources, you can tunnel VC-12 circuits through ONS 15310-MA SDH nodes. VC-12 tunnels do not use VC low-order path matrix capacity at pass-through nodes, thereby freeing the cross-connect resources for other VC-12 circuits.

VC low-order path aggregation points (VAPs) allow you to provision circuits from multiple VC-12 sources to a single VC high-order path destination. Like circuits, a LAP has a source and a destination. The source is the VC high-order path grooming end, the node where the VC-12 circuits are aggregated into a single VC high-order path. The LAP VC high-order path must be an STMn port. VC low-order path matrix resources are not used on the LAP source node, which is the key advantage of VAPs. The LAP destination is the node where the VC-12 circuits originate. Circuits can originate on any ONS 15310-MA SDH card or port.

7.5 DCC Tunnels

Each SDH frame provides four DCCs for network element (NE) Operations, Administration, Maintenance, and Provisioning (OAM&P): one on the SDH Section layer (DCC1) and three on the SDH Line layer (DCC2, DCC3, DCC4). The ONS 15310-MA SDH use the Section DCC (RS-DCC) or Line DCC (MS-DCC) for management and provisioning. When multiple DCC channels exist between two neighboring nodes, the ONS 15310-MA SDH balances traffic over the existing DCC channels using a load-balancing algorithm. This algorithm chooses a DCC for packet transport by considering packet size and DCC utilization. You can tunnel third-party SDH equipment across ONS 15310-MA SDH networks using one of two tunneling methods, a traditional DCC tunnel or an IP-encapsulated tunnel.

7.5.1 Traditional DCC Tunnels

In traditional DCC tunnels, you can use the three available channels of the MS-DCC and/or the single channel of the RS-DCC, when not used for ONS 15310-MA SDH DCC terminations, to tunnel third-party SDH equipment across ONS networks. A DCC tunnel endpoint is defined by slot, port, and DCC channel. You can connect any of the four available channels to any other available channel. To create a DCC tunnel, you connect the tunnel endpoints from one ONS 15310-MA SDH optical port to another.

Table 7-4 shows the DCC tunnels that you can create.

Table 7-4 DCC Tunnels

DCC	SDH Layer	SDH Bytes	STM1, STM4
DCC1	Section	D1 to D3	Yes
DCC2	Line	D4 to D6	Yes
DCC3	Line	D7 to D9	Yes
DCC4	Line	D10 to D12	Yes

When you create DCC tunnels, keep the following guidelines in mind:

- An optical port used for a DCC termination cannot be used as a DCC tunnel endpoint, and an optical port that is used as a DCC tunnel endpoint cannot be used as a DCC termination.
- All DCC tunnel connections are bidirectional.

7.5.2 IP-Encapsulated Tunnels

An IP-encapsulated tunnel puts an RS-DCC in an IP packet at a source node and dynamically routes the packet to a destination node. To compare traditional DCC tunnels with IP-encapsulated tunnels, a traditional DCC tunnel is configured as one dedicated path across a network and does not provide a failure recovery mechanism if the path is down. An IP-encapsulated tunnel is a virtual path, which adds protection when traffic travels between different networks.

IP-encapsulated tunneling has the potential to flood the DCC network with traffic, which causes CTC performance to degrade. The data originating from an IP tunnel can be throttled to a user-specified rate, which is a percentage of the total RS-DCC bandwidth.

Each ONS 15310-MA SDH supports one IP-encapsulated tunnel. You can convert a traditional DCC tunnel to an IP-encapsulated tunnel or an IP-encapsulated tunnel to a traditional DCC tunnel. Only tunnels in the Discovered status can be converted.

Caution Converting from one tunnel type to the other is service-affecting.

7.6 Subnetwork Connection Protection Circuits

From the Subnetwork Connection Protection Selectors subtab in the Edit Circuits window, you can perform the following:

- View the Subnetwork Connection Protection(SNCP) circuit's working and protection paths.

- Edit the reversion time.
- Set the hold-off timer (HOT) for linear multiplex section protection selector switching.
- Edit the Signal Fail (SF)/Signal Degrade (SD) bit error rate (BER) thresholds.
- Change path payload defect indication (PDI-P) settings.

Note On the Subnetwork Connection Protection Selectors tab, the SF Ber Level and SD Ber Level columns display "N/A" for those nodes that do not support VC low-order path signal BER monitoring.

In the Subnetwork Connection Protection Switch Counts subtab, you can:

- Perform maintenance switches on the circuit selector.
- View switch counts for the selectors.

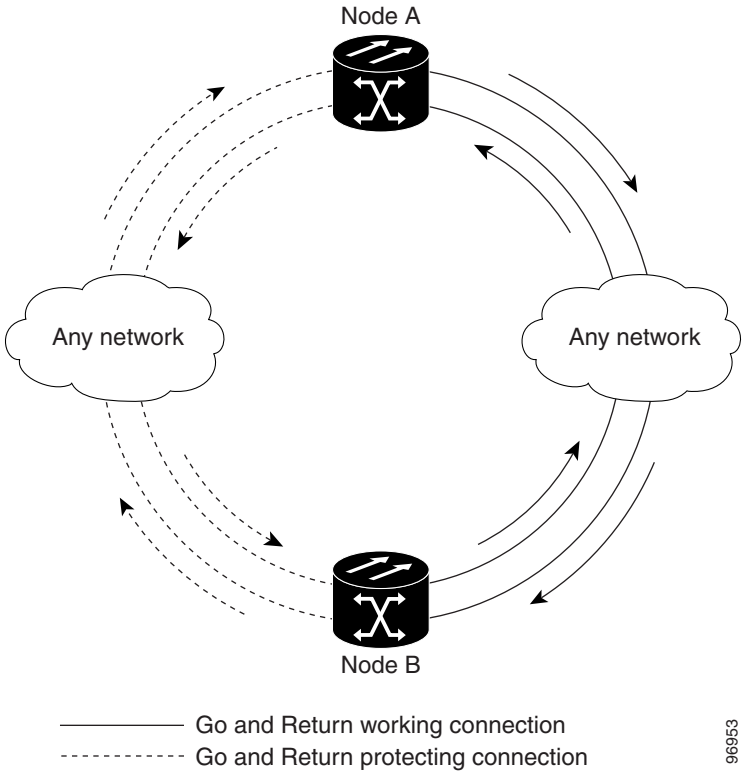
7.6.1 Open-Ended Subnetwork Connection Protection Circuits

If ONS 15310-MA SDH nodes are connected to a third-party network, you can create an open-ended Subnetwork Connection Protection circuit to route a circuit through the network. To do this, you create four circuits. One circuit is created on the source network. This circuit has one source and two destinations, with each destination provisioned to the interface that is connected to the third-party network. The second and third circuits are created on the third-party network so that the circuit travels across the network on two diverse paths to the far-end node. At the destination node, the fourth circuit is created with two sources, one at each node interface connected to the third-party network. A selector at the destination node chooses between the two signals that arrive at the node, similar to a regular Subnetwork Connection Protection circuit.

7.6.2 Go-and-Return Subnetwork Connection Protection Routing

The go-and-return Subnetwork Connection Protection routing option allows you to route the Subnetwork Connection Protection working path on one fiber pair and the protect path on a separate fiber pair (Figure 7-2). The working path will always be the shortest path. If a fault occurs, neither the working or protection fibers are affected. This feature only applies to bidirectional Subnetwork Connection Protection circuits. The go-and-return option appears on the Circuit Attributes page of the Circuit Creation wizard.

Figure 7-2 Subnetwork Connection Protection Go-and-Return Routing



7.7 Virtual Concatenated Circuits

Virtual concatenated (VCAT) circuits, also called VCAT groups (VCGs), transport traffic using noncontiguous TDM time slots, avoiding the bandwidth fragmentation problem that exists with contiguous concatenated (CCAT) circuits. The ONS 15310-MA SDH cards that support VCAT circuits are the CE-100T-8, CE-MR-6, and ML-100T-8 cards.

In a VCAT circuit, circuit bandwidth is divided into smaller circuits called VCAT members. The individual members act as independent TDM circuits. All VCAT members should be the same size and must originate/terminate at the same end points.

To enable end-to-end connectivity in a VCAT circuit that traverses through a third-party network, you must create a server trail between the ports. For more details, refer to the "Create Circuits and VC low-order path Tunnels" chapter in the *Cisco ONS 15310-MA SDH Procedure Guide*.

7.7.1 VCAT Circuit States

The state of a VCAT circuit is an aggregate of its member circuits. You can view whether a VCAT member is In Group or Out of Group in the VCAT State column in the Edit Circuits window.

- If all member circuits are unlocked, the VCAT circuit is unlocked.
- If all In Group member circuits are locked, the VCAT circuit state is locked.
- If no member circuits exist or if all are Out of Group, the state of a VCAT circuit is locked.

- A VCAT circuit is locked-PARTIAL when In Group member states are mixed and not all member states are unlocked.

7.7.2 VCAT Member Routing

The automatic and manual routing selection applies to the entire VCAT circuit, that is, all members are manually or automatically routed. Bidirectional VCAT circuits are symmetric, which means that the same number of members travel in each direction. With automatic routing, you can specify the constraints for individual members; with manual routing, you can select different spans for different members.

Two types of automatic and manual routing are available for VCAT members on CE-100T-8, CE-MR-6, and ML-100T-8 cards: common fiber routing and split fiber routing. In common fiber routing, all VCAT members travel on the same fibers, which eliminates delay between members. Three protection options are available for common fiber routing: Fully Protected, PCA, and Unprotected. Split fiber routing allows the individual members to be routed on different fibers or each member to have different routing constraints. This mode offers the greatest bandwidth efficiency and also the possibility of differential delay, which is handled by the buffers on the terminating cards or ports. Three protection options are available for split fiber routing: Fully Protected, Unprotected, and DRI. In both common fiber and split fiber routing, each member can use a different protection scheme; however, for common fiber routing, CTC checks the combination to make sure that a valid route exists. If it does not, the user must modify the protection type.

In both common fiber and split fiber routing, intermediate nodes treat the VCAT members as normal circuits that are independently routed and protected by the SDH network. At the terminating nodes, these member circuits are multiplexed into a contiguous stream of data. Figure 7-3 shows an example of common fiber routing.

Figure 7-3 VCAT Common Fiber Routing

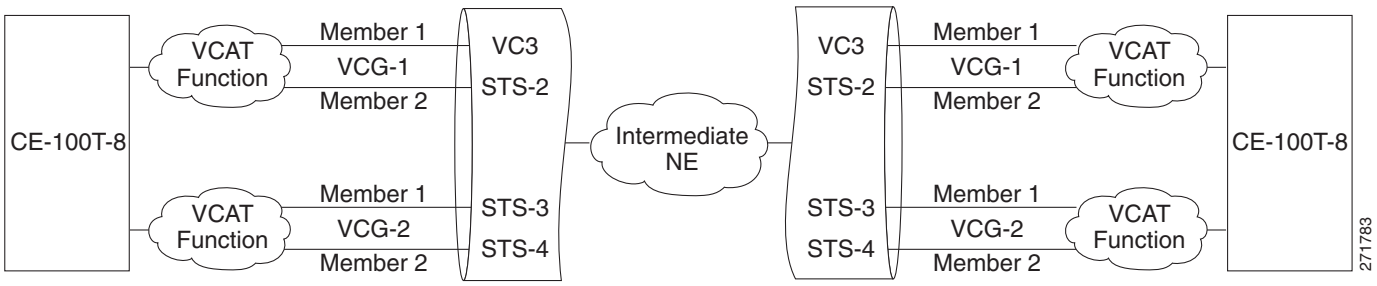


Figure 7-4 shows an example of split fiber routing.

Figure 7-4 VCAT Split Fiber Routing

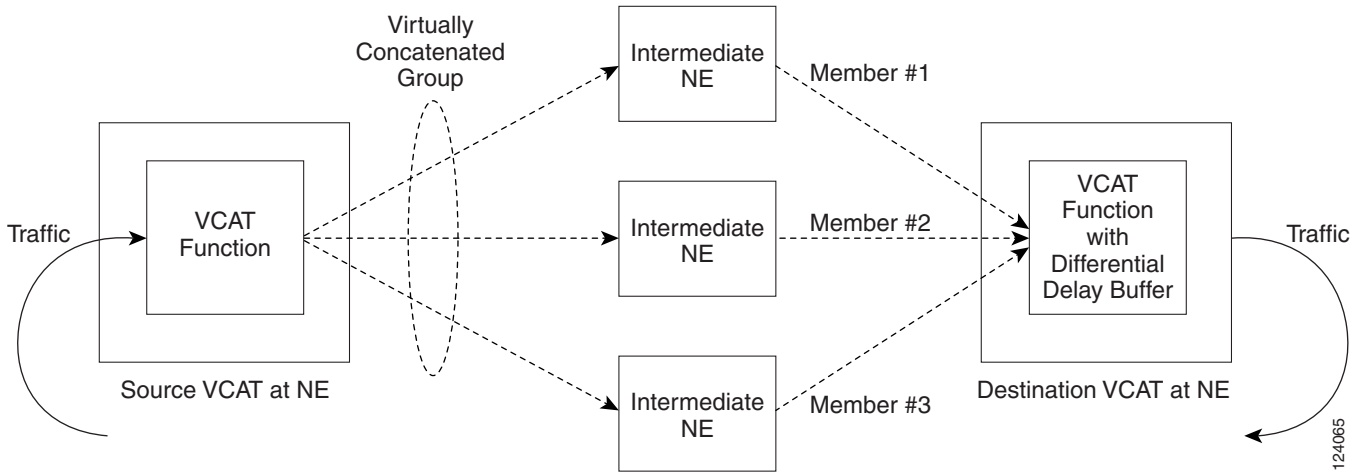


Table 7-5 Switch Times

Type of circuit	For CE100T-8 card	For CE-MR-6 card
CCAT	60 ms	60 ms
HO VCAT	60 ms	90 ms
HO LCAS[1]	90 ms	148 ms
LO VCAT	202 ms	202 ms
LO LCAS	202 m	256 ms
SWLCAS	—	500 ms

1. The calculated number for HO LCAS includes all the inherent delays of the protocol. Also the CE-100-T numbers are for a group size of only three members.

Note The switch time values shown in Table 7-5 does not include differential delay. The maximum differential delay for CE100T-8 is 48ms. This differential delay is added to the switch time to get the maximum time.

7.7.3 Link Capacity Adjustment

The CE-100T-8, CE-MR-6, and ML-100T-8 cards support the Link Capacity Adjustment Scheme (LCAS), which is a signaling protocol that allows dynamic bandwidth adjustment of VCAT circuits. When a member fails, LCAS temporarily removes the failed member from the VCAT circuit for the duration of the failure, leaving the remaining members to carry the traffic. When the failure clears, the member circuit is automatically added back into the VCAT circuit. You can select LCAS during VCAT circuit creation.

Note Although LCAS operations are errorless, an SDH error can affect one or more VCAT members. If this occurs, the VCAT Group Degraded (VCG-DEG) alarm is raised. For information about clearing this alarm, refer to the "Alarm Troubleshooting" chapter in the *Cisco ONS 15310-MA SDH Troubleshooting Guide*.

SW-LCAS is a limited form of LCAS that allows the VCAT circuit to adapt to member failures and keep traffic flowing at a reduced bandwidth. SW-LCAS is necessary when interoperating with the ONS 15454 ML-Series cards. SW-LCAS uses legacy SDH failure indicators like path alarm indication signal (AIS-P) and path remote defect indication (RDI-P) to detect member failure. You can select SW-LCAS during VCAT circuit creation.

In addition, you can create non-LCAS VCAT circuits, which do not use LCAS or SW-LCAS. While LCAS and SW-LCAS member cross-connects can be in different service states, all In Group non-LCAS members must have cross-connects in the same service state. A non-LCAS circuit can mix Out of Group and In Group members if the In Group members are in the same service state. Non-LCAS members do not support the locked-enabled,outOfGroup service state; to put a non-LCAS member in the Out of Group VCAT state, use locked-enabled,disabled.

Note Protection switching for LCAS and non-LCAS VCAT circuits might exceed 60 ms. Traffic loss for VC low-order path VCAT circuits is approximately two times more than traffic loss for a VC high-order path VCAT circuit. You can minimize traffic loss by reducing path differential delay.

7.7.4 VCAT Circuit Size

Table 7-6 lists supported VCAT circuit rates and the number of members for each card.

Table 7-6 ONS 15310-MA SDH Card VCAT Circuit Rates and Members

Card	Circuit Rate	Number of Members
CE-100T-8 [1]	VC12	1–63
	VC3	1-3
ML-100T-8 [1]	VC3	1–2
CE-MR-6	VC12	1-63
	VC3	1-21
	VC4	1-7

1. A VCAT circuit with an ONS 15310-MA SDH CE-100T-8 or ML-100T-8 card as a source or destination and an ONS 15454 ML-Series card as a source or destination can have only two members.

Use the Members tab in the Edit Circuit window to add or delete members from a VCAT circuit. The capability to add or delete members depends on whether the VCAT circuit is LCAS, SW-LCAS, or non-LCAS:

- For VCAT LCAS circuits, you can add or delete members without affecting service. Before deleting a member, Cisco recommends that you put the member in the locked-enabled,outOfGroup service state.

- For SW-LCAS circuits used when interoperating with ONS 15454 ML-Series cards, you cannot add or delete members.
- For non-LCAS VCAT circuits that use CE-100T-8 or CE-MR-6 cards, adding and deleting members to/from the circuit is possible, but service-affecting. For ML-100T-8 cards, you cannot add or delete members from non-LCAS VCAT circuits without affecting the entire VCAT circuit.

Table 7-7 summarizes the VCAT capabilities for the CE-100T-8 and ML-100T-8 cards.

Table 7-7 ONS 15310-MA SDH VCAT Card Capabilities

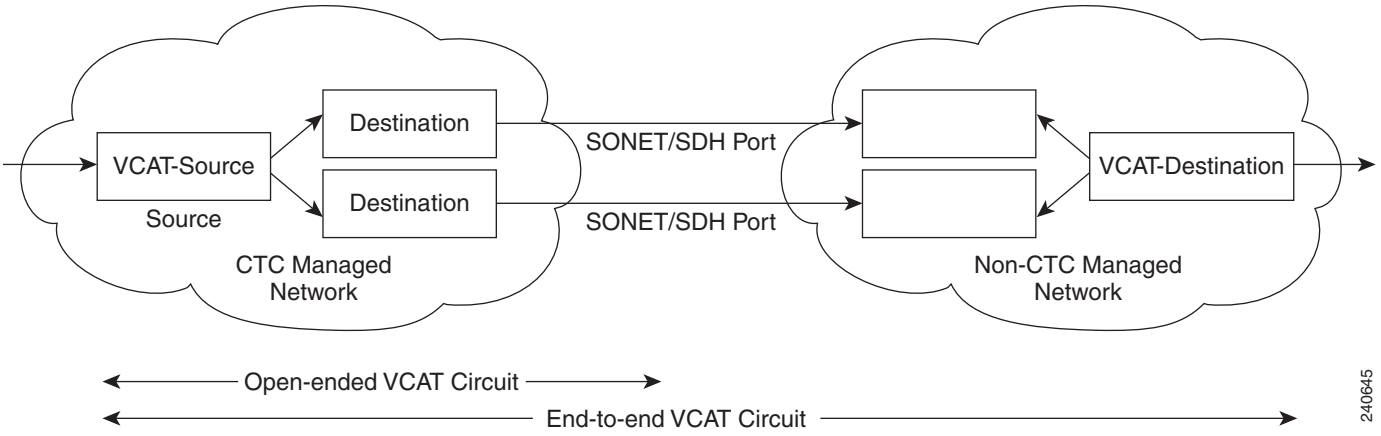
Card	Mode	Add a Member	Delete a Member	Support locked-enabled,outOfGroup
CE-100T-8	LCAS	Yes	Yes	Yes
	SW-LCAS	No	No	No
	Non-LCAS	Yes[1]	Yes[1]	No
ML-100T-8	LCAS	Yes	Yes	Yes
	SW-LCAS	No	No	No
	Non-LCAS	No	No	No
CE-MR-6	LCAS	Yes	Yes	Yes
	SW-LCAS	Yes	Yes	No
	Non-LCAS	Yes	Yes	No

1. For CE-100T-8 cards, you can add or delete members after creating a VCAT circuit with no protection. During the time it takes to add or delete members (from seconds to minutes), the entire VCAT circuit will be unable to carry traffic.

7.7.5 Open-Ended VCAT

For applications where the complete end-to-end VCAT circuit is not in a CTC managed network, CTC will only see either the source or the destination of the Virtual Concatenated Group (VCG) and some of the intermediate nodes. Figure 7-5 shows an end-to-end VCAT circuit. The termination points of the end-to-end VCAT circuit, with VCAT functionality, are referred to as the VCAT-Source and VCAT-Destination. The termination points of the CTC managed circuit, which is the Open-Ended VCAT circuit, is referred to as simply the Source and Destination.

Figure 7-5 Open-Ended VCAT



Open-ended VCAT circuits can originate or terminate on any pair of OC-N ports and you can route open-ended VCAT circuits using any of the cards and ports supported by VCAT. The CTC circuit creation wizard provides an additional check box in the VCAT attributes pane to enable Open-VCAT circuit creation. Enabling the check box differentiates open-ended VCAT from regular VCAT Circuits.

The routing preferences for an open-ended VCAT circuit must be specified in the initial stages of circuit provisioning. For example, if the circuit is independent fiber routing, then multiple OC-N ports can be involved. Alternatively, the source of an open-VCAT circuit should always be a card capable of participating in a VCG. This allows CTC to determine which routing preferences are permissible.

7.7.5.1 Open-Ended VCAT Protection

Table 7-8 summarizes the protection options for open-ended VCAT circuits. Note that members can have different routing preferences.

Table 7-8 Protection options for Open-Ended VCAT Circuits

Routing Preferences	Routing Mode	Protection Options
Common fiber	Manual/Auto	• Fully protected (Line only) • Unprotected • PCA

Table 7-8 Protection options for Open-Ended VCAT Circuits

Routing Preferences	Routing Mode	Protection Options
Split fiber	Manual/Auto	• Fully protected (Line only) • Unprotected • PCA • DRI **Note** Path protection is not supported.
Split fiber with secondary destinations	Manual/Auto	• Fully protected **Note** Line protection is not supported. • DRI

7.8 Section and Path Trace

SDH J0 section and J1 and J2 path trace are repeated, fixed-length strings composed of 16 or 64 consecutive bytes. You can use the strings to monitor interruptions or changes to circuit traffic. For the ONS 15310-MA SDH node, J0 section trace is supported for optical and E3 ports on the 15310E-CTX-K9, E1_21_E3_DS3_3, or E1_63_E3_DS3_3 cards. Table 7-9 shows the ONS 15310-MA SDH cards and/or ports that support J1 and/or J2 path trace.

Table 7-9 ONS 15310-MA SDH Cards/Ports Capable of J1/J2 Path Trace

Trace Function	J1 or J2	Cards/Ports
Transmit and receive	J1	CE-MR-6
		ML-100T-8
	J1 and J2	CE-100T-8
	J2	ONS 15310-MA SDH STMN, and E1 ports
Receive	J1	ONS 15310-MA SDH STMN, E1, and DS3 ports

If the string received at a circuit drop port does not match the string that the port expects to receive, an alarm is raised. Two path trace modes are available:

- Automatic—The receiving port assumes that the first string it receives is the baseline string.
- Manual—The receiving port uses a string that you manually enter as the baseline string.

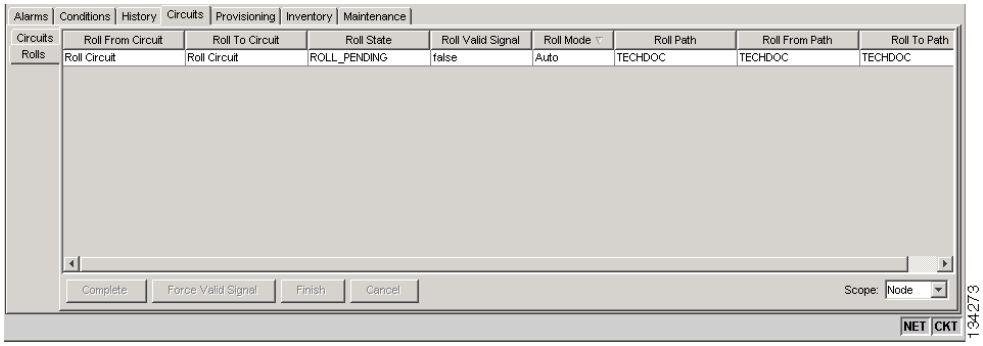
7.9 Bridge and Roll

The CTC Bridge and Roll wizard reroutes live traffic without interrupting service. The bridge process takes traffic from a designated "roll from" facility and establishes a cross-connect to the designated "roll to" facility. When the bridged signal at the receiving end point is verified, the roll process creates a new cross-connect to receive the new signal. When the roll completes, the original cross-connects are released. You can use the bridge and roll feature for maintenance functions such as card or facility replacement, or for load balancing. You can perform a bridge and roll on the following ONS platforms: ONS 15600, ONS 15600 SDH, ONS 15454, ONS 15454 SDH, and ONS 15310-MA SDH.

7.9.1 Rolls Window

The Rolls window lists information about a rolled circuit before the roll process is complete. You can access the Rolls window by clicking the Circuits > Rolls tabs in either network or node view. Figure 7-6 shows the Rolls window.

Figure 7-6 Rolls Window



The Rolls window information includes:

- Roll From Circuit—The circuit with connections that will no longer be used when the roll process is complete.
- Roll To Circuit—The circuit that will carry the traffic when the roll process is complete. The Roll To Circuit is the same as the Roll From Circuit if a single circuit is involved in a roll.
- Roll State—The roll status; see the "7.9.2 Roll Status" section on page 7-19 for information.
- Roll Valid Signal—If the Roll Valid Signal status is true, a valid signal was found on the new port. If the Roll Valid Signal status is false, a valid signal was not found. It is not possible to get a true Roll Valid Signal status for a one-way destination roll.
- Roll Mode—The mode indicates whether the roll is automatic or manual.

  CTC implements a roll mode at the circuit level. TL1 implements a roll mode at the cross-connect level. If a single roll is performed, CTC and TL1 behave the same. If a dual roll is performed, the roll mode specified in CTC might be different than the roll mode retrieved in TL1. For example, if you select Automatic, CTC coordinates the two rolls to minimize possible traffic hits by using the Manual mode behind the scenes. When both rolls have a good signal, CTC signals the nodes to complete the roll.

  - Automatic—When a valid signal is received on the new path, CTC completes the roll on the node automatically. One-way source rolls are always automatic.

  - Manual—You must complete a manual roll after a valid signal is received. One-way destination rolls are always manual.
- Roll Path—The fixed point of the roll object.
- Roll From Path— The old path that is being rerouted.
- Roll To Path—The new path where the Roll From Path is rerouted.
- Complete—Completes a manual roll after a valid signal is received. You can complete a manual roll if it is in a ROLL_PENDING status and you have not yet completed the roll or have not cancelled its sibling roll.
- Force Valid Signal—Forces a roll onto the Roll To Circuit destination without a valid signal. If you choose Force Valid Signal, traffic on the circuit that is involved in the roll will be dropped when the roll is completed.
- Finish—Completes the circuit processing of both manual and automatic rolls and changes the circuit status from ROLL_PENDING to DISCOVERED. After a roll, the Finish button also removes any cross-connects that are no longer used from the Roll From Circuit field.
- Cancel—Cancels the roll process. When the roll mode is Manual, cancel roll is only allowed before you click the Complete button. When the roll mode is Auto, cancel roll is only allowed before a good signal is detected by the node or before you click the Force Valid Signal button.

7.9.2 Roll Status

Table 7-10 lists the roll statuses. You can only reroute circuits that have a DISCOVERED status. (See Table 7-1 on page 7-3 for a list of circuit statuses.) You cannot reroute circuits that are in the ROLL_PENDING status.

Table 7-10 Roll Statuses

State	Description
ROLL_PENDING	The roll is awaiting completion or cancellation.
ROLL_COMPLETED	The roll is complete. Click the **Finish** button.
ROLL_CANCELLED	The roll has been canceled.
TL1_ROLL	A TL1 roll was initiated. **Note** If a roll is created using TL1, a CTC user cannot complete or cancel the roll. Also, if a roll is created using CTC, a TL1 user cannot complete or cancel the roll. You must use the same interface to complete or change a roll.
INCOMPLETE	This state appears when the underlying circuit becomes incomplete. To correct this state, you must fix the underlying circuit problem before the roll state will change. For example, a circuit traveling on Nodes A, B, and C can become INCOMPLETE if Node B is rebooted. The cross connect information is lost on Node B during a reboot. The Roll State on Nodes A and C will change to INCOMPLETE.

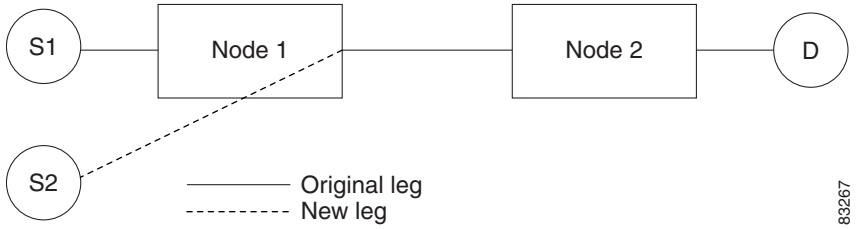
7.9.3 Single and Dual Rolls

Circuits have an additional layer of roll types: single and dual. A single roll on a circuit is a roll on one of its cross-connects. Use a single roll to:

- Change either the source or destination of a selected circuit (Figure 7-7 and Figure 7-8, respectively).
- Roll a segment of the circuit onto another chosen circuit (Figure 7-9 on page 7-20). This roll also results in a new destination or a new source.

In Figure 7-7, you can select any available VC high-order path on Node 1 for a new source.

Figure 7-7 Single Source Roll



In Figure 7-8, you can select any available VC high-order path on Node 2 for a new destination.

Figure 7-8 Single Destination Roll

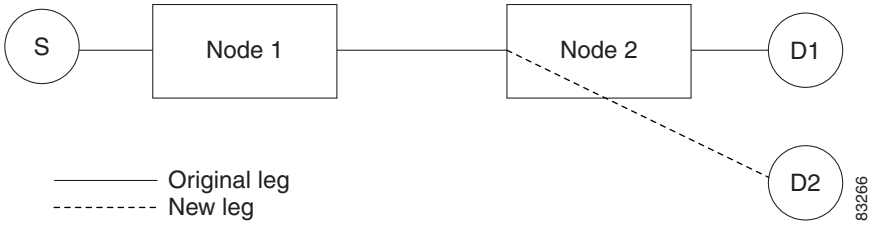


Figure 7-9 shows one circuit rolling onto another circuit at the destination. The new circuit has cross-connects on Node 1, Node 3, and Node 4. CTC deletes the cross-connect on Node 2 after the roll.

Figure 7-9 Single Roll from One Circuit to Another Circuit (Destination Changes)

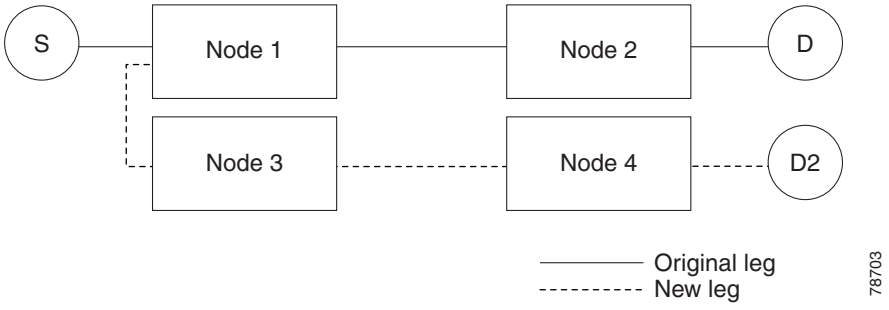
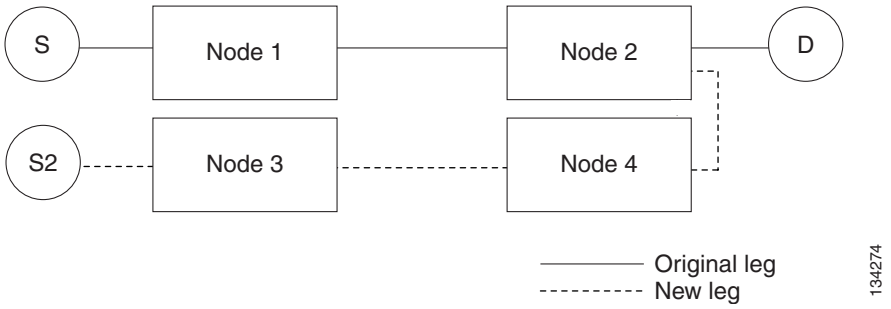


Figure 7-10 shows one circuit rolling onto another circuit at the source.

Figure 7-10 Single Roll from One Circuit to Another Circuit (Source Changes)



Note Create a Roll To Circuit before rolling a circuit with the source on Node 3 and the destination on Node 4.

A dual roll involves two cross-connects. It allows you to reroute intermediate segments of a circuit, but keep the original source and destination. If the new segments require new cross-connects, use the Bridge and Roll wizard or create a new circuit and then perform a roll.

Caution Only single rolls can be performed using TL1. Dual rolls require the network-level view that only CTC or CTM provide.

Dual rolls have several constraints:

- You must complete or cancel both cross-connects rolled in a dual roll. You cannot complete one roll and cancel the other roll.
- When a Roll To circuit is involved in the dual roll, the first roll must roll onto the source of the Roll To circuit and the second roll must roll onto the destination of the Roll To circuit.

Figure 7-11 illustrates a dual roll on the same circuit.

Figure 7-11 Dual Roll to Reroute a Link

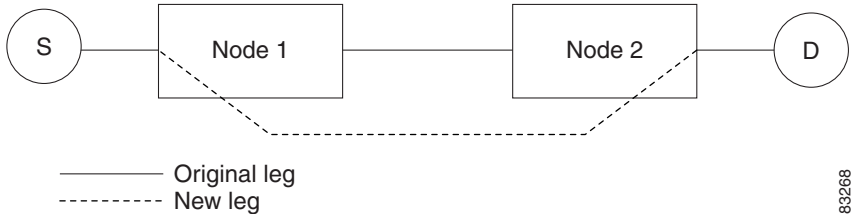
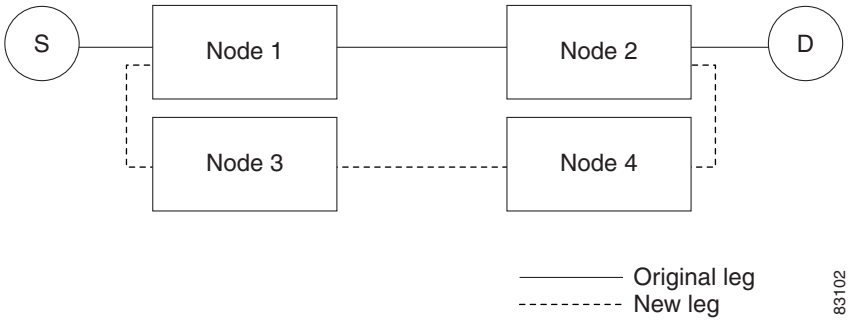


Figure 7-12 illustrates a dual roll involving two circuits.

Figure 7-12 Dual Roll to Reroute to a Different Node



Note If a new segment is created on Nodes 3 and 4 using the Bridge and Roll wizard, the created circuit has the same name as the original circuit with the suffix _ROLL**. The circuit source is on Node 3 and the circuit destination is on Node 4.

7.9.4 Two-Circuit Bridge and Roll

When using the bridge and roll feature to reroute traffic using two circuits, the following constraints apply:

- DCC must be enabled on the circuits involved in a roll before roll creation.
- A maximum of two rolls can exist between any two circuits.
- If two rolls are involved between two circuits, both rolls must be on the original circuit. The second circuit should not carry live traffic. The two rolls loop from the second circuit back to the original circuit. The roll mode of the two rolls must be identical (either automatic or manual).
- If a single roll exists on a circuit, you must roll the connection onto the source or the destination of the second circuit and not an intermediate node in the circuit.

7.9.5 Protected Circuits

CTC allows you to roll the working or protect path regardless of which path is active. You can upgrade an unprotected circuit to a fully protected circuit or downgrade a fully protected circuit to an unprotected circuit with the exception of a Linear Multiplex Section Protection circuit. When using bridge and roll on Linear Multiplex Section Protection circuits, you can roll the source or destination or both path selectors in a dual roll. However, you cannot roll a single path selector.

7.10 Merged Circuits

A circuit merge combines a single selected circuit with one or more circuits. You can merge VC low-order path tunnels, LAP circuits, orderwire and user data channel (UDC) overhead circuits, CTC-created traffic circuits, and TL1-created traffic circuits. To merge circuits, you choose a master circuit on the CTC Circuits tab. Then, you choose the circuits that you want to merge with the master circuit on the Merge tab in the Edit Circuits window. The Merge tab shows only the circuits that are available for merging with the master circuit:

- Circuit cross-connects must create a single, contiguous path.
- Circuits types must be a compatible. For example, you can combine a VC high-order path circuit with a LAP circuit to create a longer LAP circuit, but you cannot combine a VC low-order path circuit with a VC high-order path circuit.
- Circuit directions must be compatible. You can merge a one-way and a two-way circuit, but not two one-way circuits in opposing directions.
- Circuit sizes must be identical.
- Circuit endpoints must send or receive the same framing format.
- The merged circuits must become a DISCOVERED circuit.

If all connections from the master circuit and all connections from the merged circuits align to form one complete circuit, the merge is successful. If all connections from the master circuit and some, but not all, connections from the other circuits align to form a single complete circuit, CTC notifies you and gives you the chance to cancel the merge process. If you choose to continue, the aligned connections merge successfully into the master circuit, and the unaligned connections remain in the original circuits. All connections in the completed master circuit use the original master circuit name.

All connections from the master circuit and at least one connection from the other selected circuits must be used in the resulting circuit for the merge to succeed. If a merge fails, the master circuit and all other circuits remain unchanged. When the circuit merge completes successfully, the resulting circuit retains the name of the master circuit.

7.11 Reconfigured Circuits

You can reconfigure multiple circuits, which is typically necessary when a large number of circuits are in the PARTIAL status. When reconfiguring multiple circuits, the selected circuits can be any combination of DISCOVERED, PARTIAL, DISCOVERED_TL1, or PARTIAL_TL1 circuits. You can reconfigure tunnels, LAP circuits, CTC-created circuits, and TL1-created circuits. The Reconfigure command maintains the names of the original cross-connects.

Use the CTC Tools > Circuits > Reconfigure Circuits command to reconfigure selected circuits. During reconfiguration, CTC reassembles all connections of the selected circuits into circuits based on path size, direction, and alignment. Some circuits might merge and others might split into multiple circuits. If the resulting circuit is a valid circuit, it appears as a DISCOVERED circuit. Otherwise, the circuit appears as a PARTIAL or PARTIAL_TL1 circuit.

Note PARTIAL tunnel circuits do not split into multiple circuits during reconfiguration.

7.12 Server Trails

A server trail is a non-DCC (logical or virtual) link across a third-party network that connects two CTC network domains. A server trail allows A-Z circuit provisioning when no DCC is available. You can create server trails between two distant optical or STM-1E ports. The end ports on a server trail can be different types (for example, an STM-4 port can be linked to an STM-1 port). Server trails are not allowed on DCC-enabled ports.

The server trail link is bidirectional and can be VC3, VC11, VC12, VC4, VC4-2c, VC4-3c, VC4-4c, VC4-6c, VC4-8c, VC4-12c, VC4-16c, VC4-32c, and VC4-64c; you cannot change an existing server trail to another size. It must be deleted and recreated. A circuit provisioned over a server trail must match the type and size of the server trail it uses. For example, an VC4-3c server trail can carry only VC4-3c circuits and not three VC4 circuits.

Note There is no OSPF or any other management information exchange between NEs over a server trail.

7.12.1 Server Trail Protection Types

The server trail protection type determines the protection type for any circuits that traverse it. A server trail link can be one of the following protection types:

- Preemptible—PCA circuits will use server trails with the Preemptible attribute.
- Unprotected—In Unprotected Server Trail, CTC assumes that the circuits going out from that specific port will not be protected by provider network and will look for a secondary path from source to destination if you are creating a protected circuit.
- Fully Protected—In Fully Protected Server Trail, CTC assumes that the circuits going out from that specific port will be protected by provider network and will not look for a secondary path from source to destination.

Note Only SNCP protection is available on server trails. MS-SPRing procection is not available on server trail.

7.12.2 VCAT Circuit Routing over Server Trails

An VC4-3c server trail can be used to route VC4-3c circuits and an VC4 server trail can be used to route VC4 circuits. Similarly, a VC3 server trail can be used to route VC3 circuits.

For example, to route a VC4-3c-2v circuit over a server trail, you must enable split fiber routing and create two VC4-3c server trails and route each member manually or automatically over each server trail. To route a VC4-12c-2v circuit over a server trail, you must enable split fiber routing and create two VC4 server trails and route each member manually or automatically over each server trail.

Note Server trails can only be created between any two optical ports or STM-1E ports.

VCAT circuities can be created over server trails in the following ways:

- Manual routing
- Automatic routing
  - Diverse routing: This method enables VCAT circuit routing over diverse server trail links.

Note When creating circuits or VCATs, you can choose a server trail link during manual circuit routing. CTC may also route circuits over server trail links during automatic routing. VCAT common-fiber automatic routing is not supported.

For a detailed procedure on how to route a VCAT circuit over a server trail, refer “Chapter 6, Create Circuits and VT Tunnels, Section NTP-A264, Create an Automatically Routed VCAT Circuit and Section NTP-A265, Create a Manually Routed VCAT Circuit” in the *Cisco ONS 15454 Procedure Guide*.

7.12.2.1 Shared Resource Link Group

The Shared Resource Link Group (SRLG) attribute can be assigned to a server trail link using a commonly shared resource such as port, fiber or span. For example, if two server trail links are routed over the same fiber, an SRLG attribute can be assigned to these links. SRLG is used by Cisco Transport Manager (CTM) to specify link diversity. If you create multiple server trails from one port, you can assign the same SRLG value to all the links to indicate that they originate from the same port.

CHAPTER 8

Management Network Connectivity

This chapter provides an overview of Cisco ONS 15310-MA SDH data communications network (DCN) connectivity. Cisco Optical Networking System (ONS) network communication is based on IP, including communication between Cisco Transport Controller (CTC) computers and ONS 15310-MA SDH nodes, and communication among networked ONS 15310-MA SDH nodes. The chapter provides scenarios showing ONS 15310-MA SDH nodes in common IP network configurations as well as information about provisionable patchcords, the IP routing table, external firewalls, and open gateway network element (GNE) networks.

Although ONS 15310-MA SDH DCN communication is based on IP, ONS 15310-MA SDH nodes can be networked to equipment that is based on the Open System Interconnection (OSI) protocol suites. This chapter describes the OSI implementation and provides scenarios that show how the ONS 15310-MA SDH can be networked within a mixed IP and OSI environment.

Chapter topics include:

Note This chapter does not provide a comprehensive explanation of IP networking concepts and procedures, nor does it provide IP addressing examples to meet all networked scenarios. For networking setup instructions, refer to the "Turn Up a Node" chapter of the *Cisco ONS 15310-MA SDH Procedure Guide*.

Note To connect ONS 15310-MA SDH nodes to an IP network, you must work with a LAN administrator or other individual at your site who has IP networking training and experience.

8.1 IP Networking Overview

ONS 15310-MA SDH nodes can be connected in many different ways within an IP environment:

- They can be connected to LANs through direct connections or a router.
- IP subnetting can create ONS 15310-MA SDH login node groups, which allow you to provision non-data communications channel (DCC) connected nodes in a network.
- Different IP functions and protocols can be used to achieve specific network goals. For example, Proxy Address Resolution Protocol (ARP) enables one LAN-connected ONS 15310-MA SDH to serve as a gateway for ONS 15310-MA SDH nodes that are not connected to the LAN.
- You can create static routes to enable connections among multiple Cisco Transport Controller (CTC) sessions with ONS 15310-MA SDH nodes that reside on the same subnet with multiple CTC sessions.
- If ONS 15310-MA SDH nodes are connected to Open Shortest Path First (OSPF) networks, ONS 15310-MA SDH network information is automatically communicated across multiple LANs and WANs.
- The ONS 15310-MA SDH proxy server controls the visibility and accessibility between CTC computers and ONS 15310-MA SDH element nodes.

8.2 IP Addressing Scenarios

ONS 15310-MA SDH IP addressing generally has seven common scenarios or configurations. Use the scenarios as building blocks for more complex network configurations. Table 8-1 provides a general list of items to check when setting up ONS 15310-MA SDH nodes in IP networks.

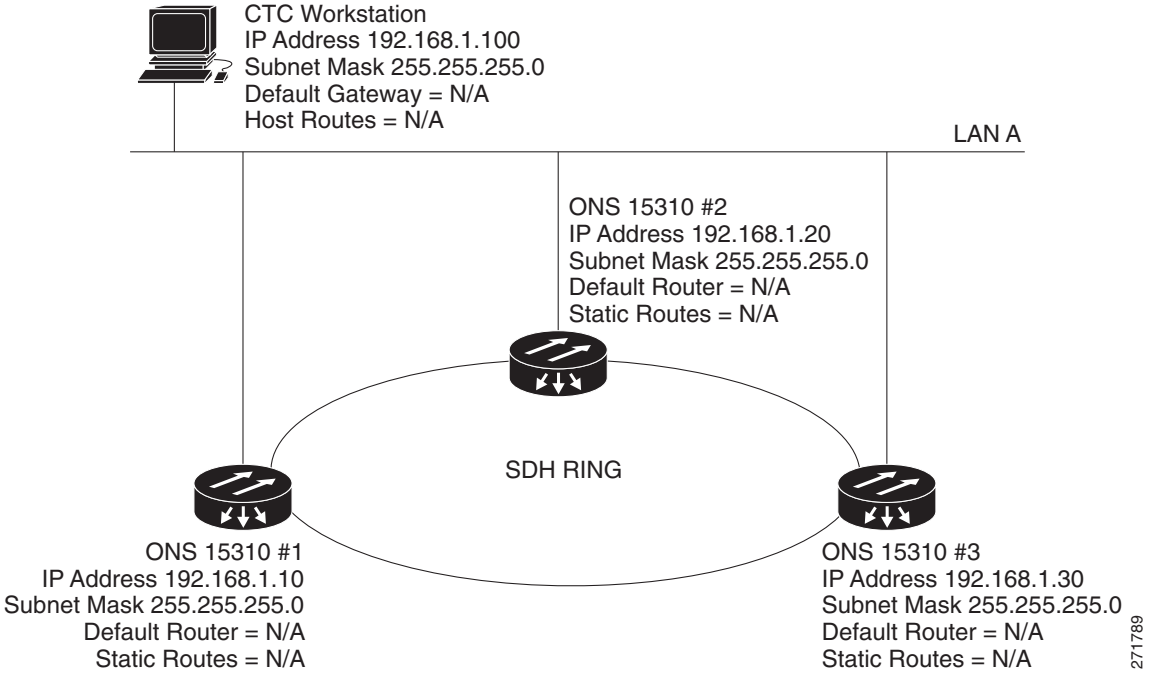
Table 8-1 General P Troubleshooting Checklist

Item	What to Check
Link integrity	Verify that link integrity exists between: • CTC computer and network hub/switch • ONS 15310-MA SDH nodes (RJ-45 ports labeled LAN) and network hub/switch • Router ports and hub/switch ports
Node hub/switch ports	Verify connectivity. If connectivity problems occur, set the hub or switch port that is connected to the ONS 15310-MA SDH to 10 Mbps half-duplex.
Ping	Ping the node to test connections between computers and ONS 15310-MA SDH nodes.
IP addresses/subnet masks	Verify that ONS 15310-MA SDH IP addresses and subnet masks are set up correctly.
Optical connectivity	Verify that ONS 15310-MA SDH optical trunk ports are in service and that a DCC is enabled on each trunk port.

8.2.1 Scenario 1: CTC and ONS 15310-MA SDH Nodes on the Same Subnet

Scenario 1 shows a basic ONS 15310-MA SDH LAN configuration (Figure 8-1). The ONS 15310-MA SDH nodes and CTC computer reside on the same subnet. All nodes connect to LAN A and have DCC connections.

Figure 8-1 Scenario 1: CTC and ONS 15310-MA SDH Nodes on the Same Subnet

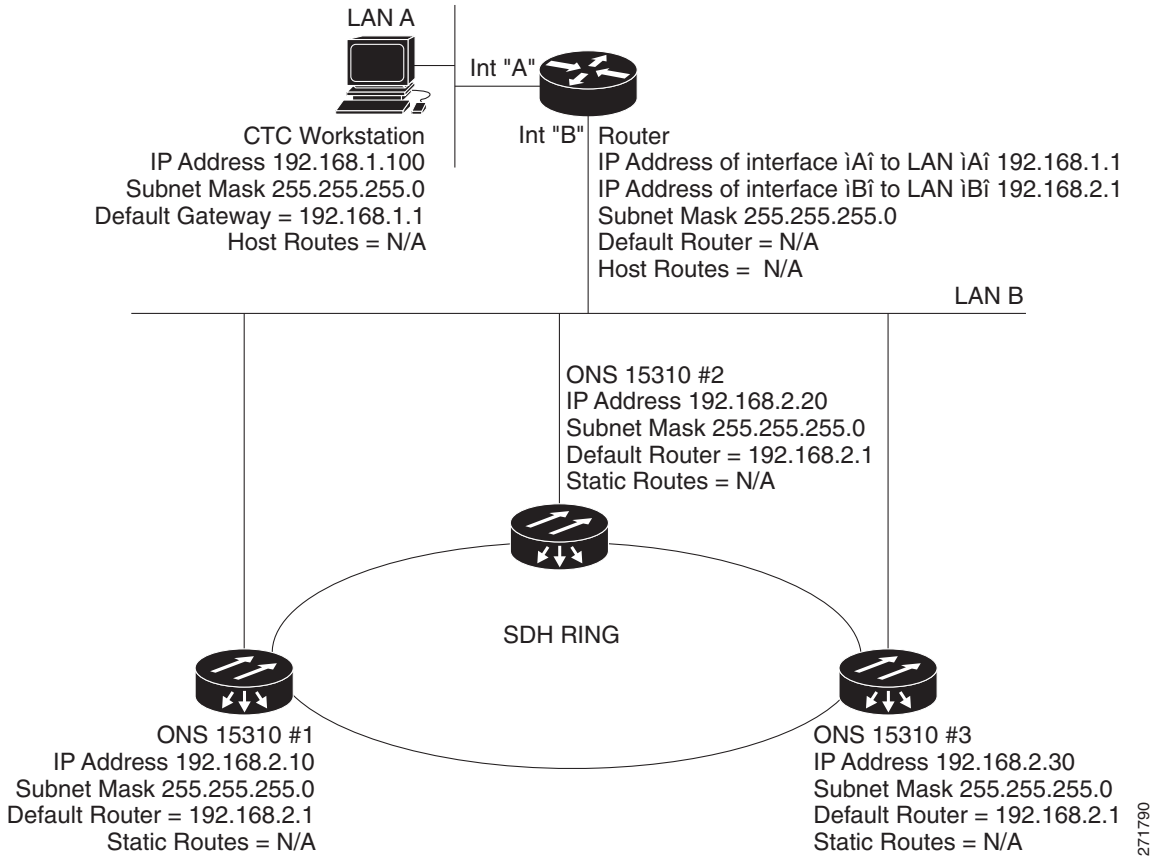


8.2.2 Scenario 2: CTC and ONS 15310-MA SDH Nodes Connected to a Router

In Scenario 2 the CTC computer resides on a subnet (192.168.1.0) and attaches to LAN A (Figure 8-2). The ONS 15310-MA SDH nodes reside on a different subnet (192.168.2.0) and attach to LAN B. A router connects LAN A to LAN B. The IP address of router interface A is set to LAN A (192.168.1.1), and the IP address of router interface B is set to LAN B (192.168.2.1).

On the CTC computer, the default gateway is set to router interface A. If the LAN uses Dynamic Host Configuration Protocol (DHCP), the default gateway and IP address are assigned automatically. In Figure 8-2, a DHCP server is not available.

Figure 8-2 Scenario 2: CTC and ONS 15310-MA SDH Nodes Connected to Router



8.2.3 Scenario 3: Using Proxy ARP to Enable an ONS 15310-MA SDH Gateway

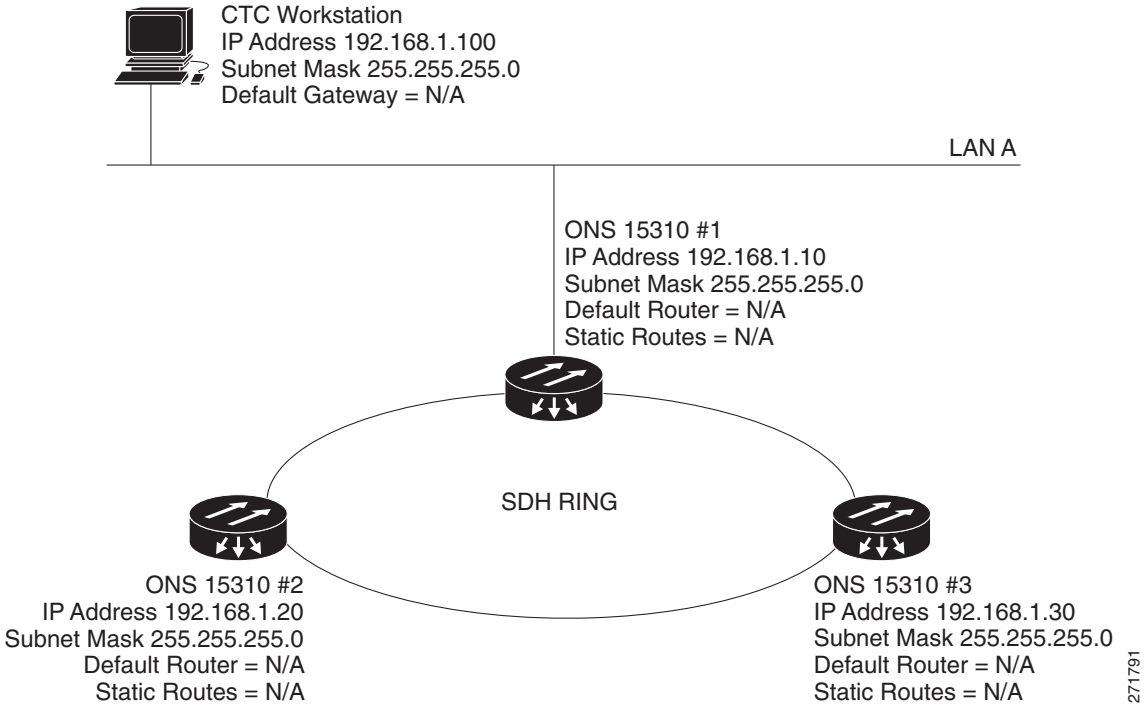
ARP matches higher-level IP addresses to the physical addresses of the destination host. It uses a lookup table (called ARP cache) to perform the translation. When the address is not found in the ARP cache, a broadcast is sent out on the network with a special format called the ARP request. If one of the machines on the network recognizes its own IP address in the request, it sends an ARP reply back to the requesting host. The reply contains the physical hardware address of the receiving host. The requesting host stores this address in its ARP cache so that all subsequent datagrams (packets) to this destination IP address can be translated to a physical address.

Proxy ARP enables one LAN-connected ONS 15310-MA SDH to respond to the ARP request for ONS 15310-MA SDH nodes not connected to the LAN. (Proxy ARP requires no user configuration.) For the proxy ARP node to require no user confirmation, the DCC-connected nodes must reside on the same subnet. When a LAN device sends an ARP request to an ONS 15310-MA SDH that is not connected to the LAN, the gateway ONS 15310-MA SDH returns its MAC address to the LAN device. The LAN device then sends the datagram for the remote ONS 15310-MA SDH to the MAC address of the proxy node. The proxy ONS 15310-MA SDH uses its routing table to forward the datagram to the non-LAN ONS 15310-MA SDH.

Scenario 3 is similar to Scenario 1, but only one ONS 15310-MA SDH node (#1) connects to the LAN (Figure 8-3). Two ONS 15310-MA SDH nodes (#2 and #3) connect to Node 1 through the SDH DCC. Because all three nodes are on the same subnet, Proxy ARP enables Node 1 to serve as a gateway for Nodes 2 and 3.

Note This scenario assumes all CTC connections are to Node 1. If you connect a laptop to either Node 2 or Node 3, network partitioning occurs, and neither the laptop or the CTC computer is able to see all nodes. If you want laptops to connect directly to end network elements, you need to create static routes (see Scenario 5) or enable the ONS 15310-MA SDH proxy server (see Scenario 7).

Figure 8-3 Scenario 3: Using Proxy ARP

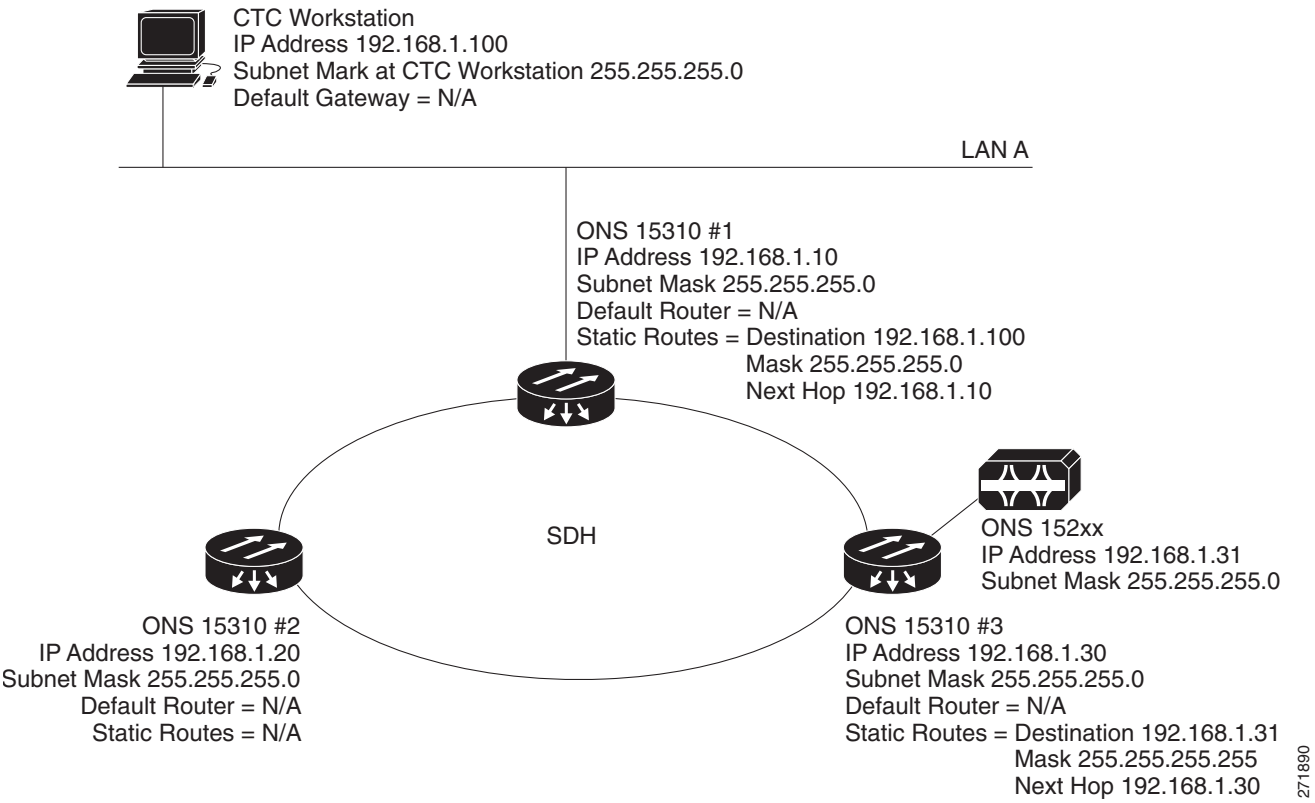


You can also use proxy ARP to communicate with hosts attached to the craft Ethernet ports of DCC-connected nodes (Figure 8-4). The node with an attached host must have a static route to the host. Static routes are propagated to all DCC peers using OSPF. The existing proxy ARP node is the gateway for additional hosts. Each node examines its routing table for routes to hosts that are not connected to the DCC network but are within the subnet. The existing proxy server replies to ARP requests for these additional hosts with the node MAC address. The existence of the host route in the routing table ensures that the IP packets addressed to the additional hosts are routed properly. Other than establishing a static route between a node and an additional host, no provisioning is necessary. The following restrictions apply:

- Only one node acts as the proxy ARP server for any given additional host.
- A node cannot be the proxy ARP server for a host connected to its Ethernet port.

In Figure 8-4, Node 1 announces to Node 2 and 3 that it can reach the CTC host. Similarly, Node 3 announces that it can reach the ONS 152xx. The ONS 152xx is shown as an example; any network element can be set up as an additional host.

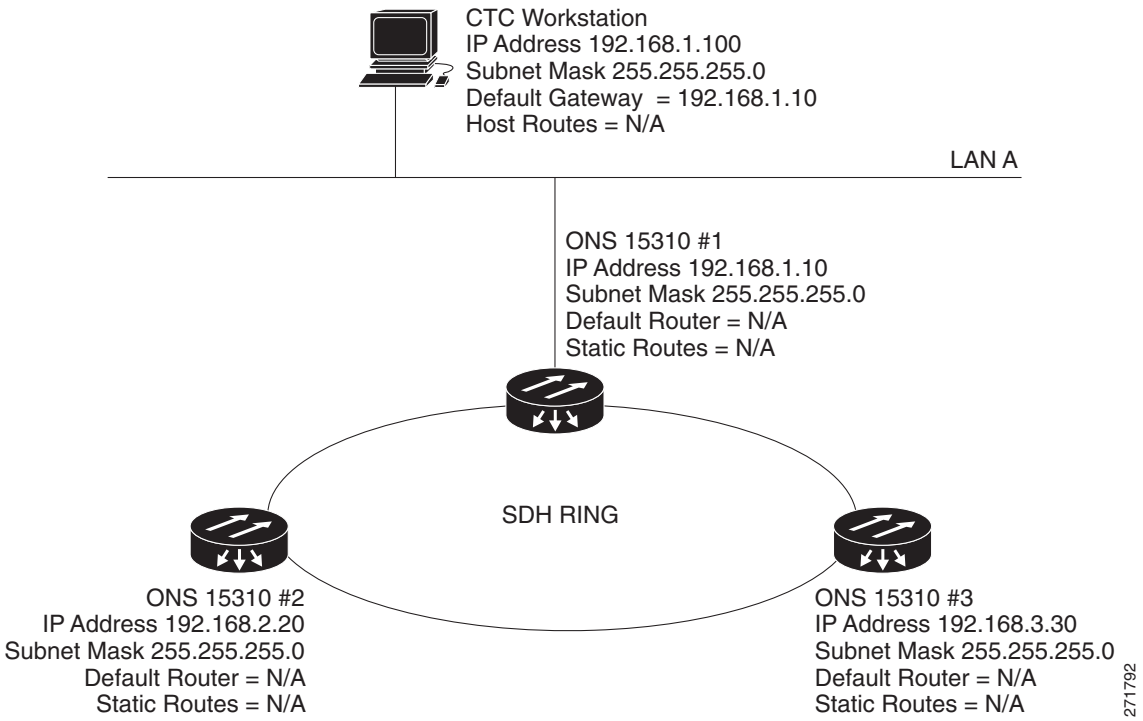
Figure 8-4 Scenario 3: Using Proxy ARP with Static Routing



8.2.4 Scenario 4: Default Gateway on CTC Computer

Scenario 4 is similar to Scenario 3, but ONS 15310-MA SDH Node 2 and Node 3 reside on different subnets, 192.168.2.0 and 192.168.3.0, respectively (Figure 8-5). Node 1 and the CTC computer are on subnet 192.168.1.0. Proxy ARP is not used because the network includes different subnets. For the CTC computer to communicate with Nodes 2 and 3, Node 1 is entered as the default gateway on the CTC computer.

Figure 8-5 Scenario 4: Default Gateway on a CTC Computer



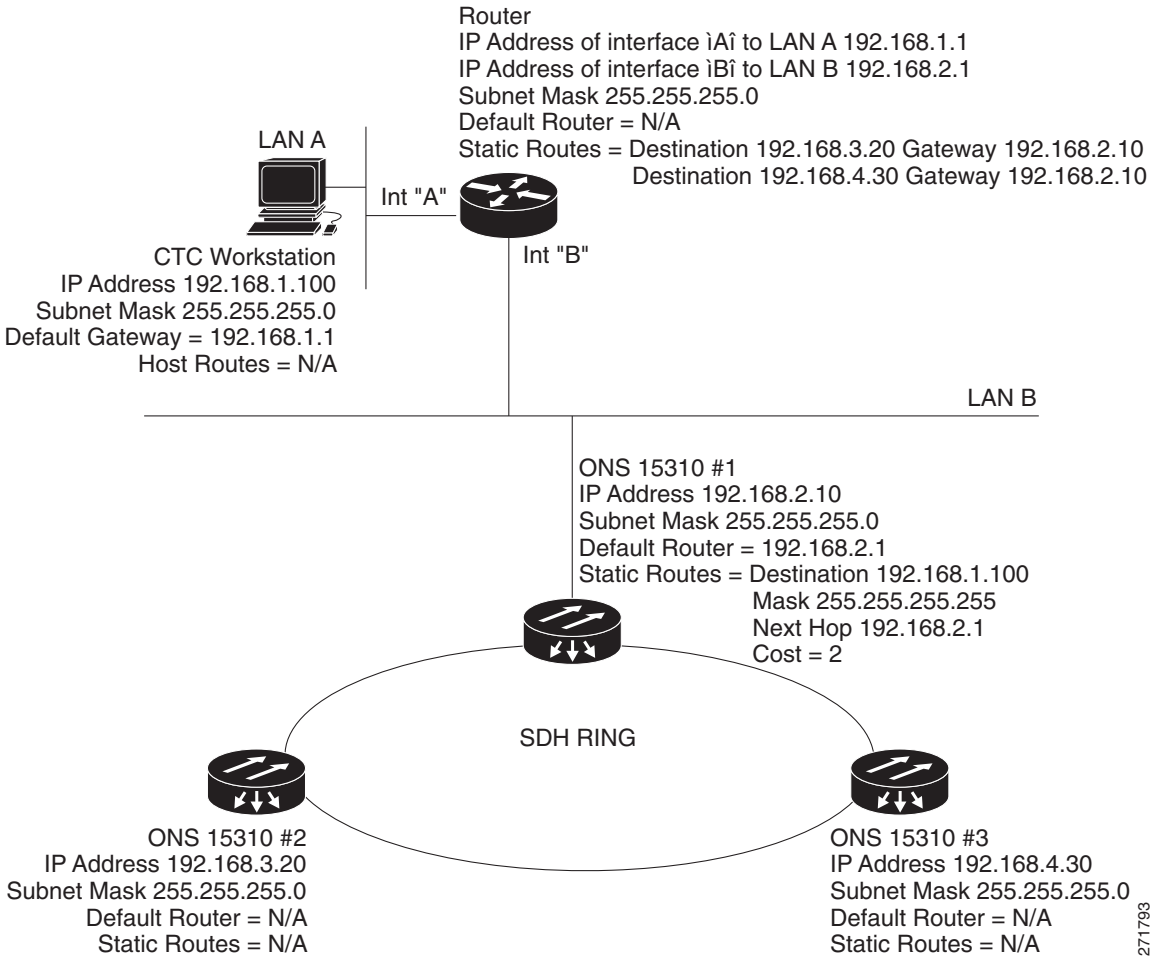
8.2.5 Scenario 5: Using Static Routes to Connect to LANs

Static routes are used for two purposes:

- To connect ONS 15310-MA SDH nodes to CTC sessions on one subnet that are connected by a router to ONS 15310-MA SDH nodes residing on another subnet. (These static routes are not needed if OSPF is enabled. Scenario 6 shows an OSPF example.)
- To enable multiple CTC sessions among ONS 15310-MA SDH nodes residing on the same subnet.

In Figure 8-6, one CTC residing on subnet 192.168.1.0 connects to a router through interface A. (The router is not set up with OSPF.) ONS 15310-MA SDH nodes residing on different subnets are connected through Node 1 to the router through interface B. Because Nodes 2 and 3 are on different subnets, proxy ARP does not enable Node 1 as a gateway. To connect to CTC computers on LAN A, a static route is created on Node 1.

Figure 8-6 Scenario 5: Static Route with One CTC Computer Used as a Destination

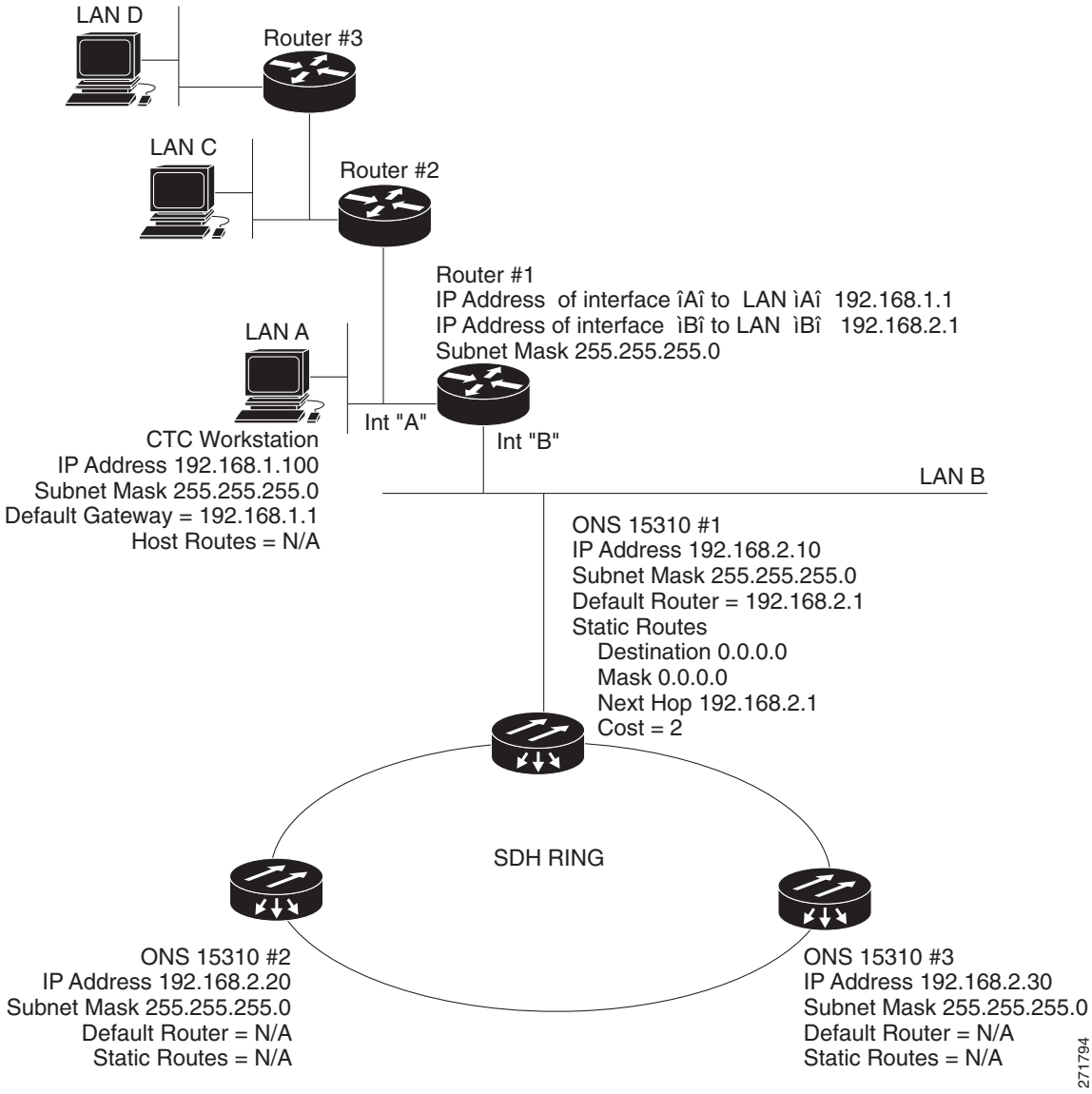


The destination and subnet mask entries control access to the ONS 15310-MA SDH nodes:

- If a single CTC computer is connected to a router, enter the complete CTC “host route” IP address as the destination with a subnet mask of 255.255.255.255.
- If CTC computers on a subnet are connected to a router, enter the destination subnet (in this example, 192.168.1.0) and a subnet mask of 255.255.255.0.
- If all CTC computers are connected to a router, enter a destination of 0.0.0.0 and a subnet mask of 0.0.0.0. Figure 8-7 shows an example.

The IP address of router interface B is entered as the next hop, and the cost (number of hops from source to destination) is 2.

Figure 8-7 Scenario 5: Static Route with Multiple LAN Destinations



8.2.6 Scenario 6: Using OSPF

Open Shortest Path First (OSPF) is a link-state Internet routing protocol. Link-state protocols use a "hello protocol" to monitor their links with adjacent routers and to test the status of their links to their neighbors. Link-state protocols advertise their directly connected networks and their active links. Each link state router captures the link state "advertisements" and puts them together to create a topology of the entire network or area. From this database, the router calculates a routing table by constructing a shortest path tree. Routes are recalculated when topology changes occur.

The ONS 15310-MA SDH uses OSPF protocol in internal ONS 15310-MA SDH networks for node discovery, circuit routing, and node management. You can enable OSPF on the ONS 15310-MA SDH so that the ONS 15310-MA SDH topology is sent to OSPF routers on a LAN. Advertising the ONS 15310-MA SDH network topology to LAN routers eliminates the need to enter static routes for ONS 15310-MA SDH subnetworks manually.

OSPF divides networks into smaller regions, called areas. An area is a collection of networked end systems, routers, and transmission facilities organized by traffic patterns. Each OSPF area has a unique ID number, known as the area ID. Every OSPF network has one backbone area called “area 0.” All other OSPF areas must connect to area 0.

When you enable an ONS 15310-MA SDH OSPF topology for advertising to an OSPF network, you must assign an OSPF area ID in decimal format to the network. Coordinate the area ID number assignment with your LAN administrator. All DCC-connected ONS 15310-MA SDH nodes should be assigned the same OSPF area ID.

Figure 8-8 shows a network enabled for OSPF.

Figure 8-8 Scenario 6: OSPF Enabled

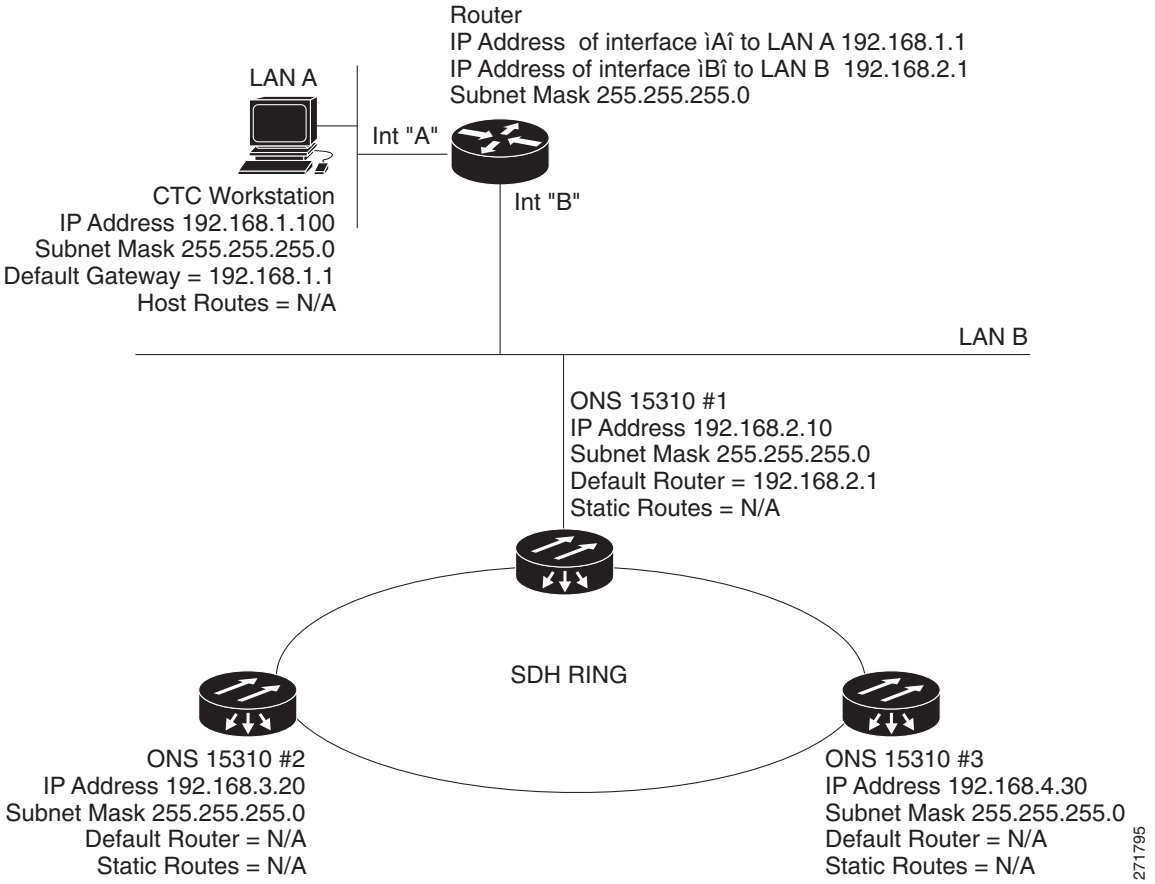
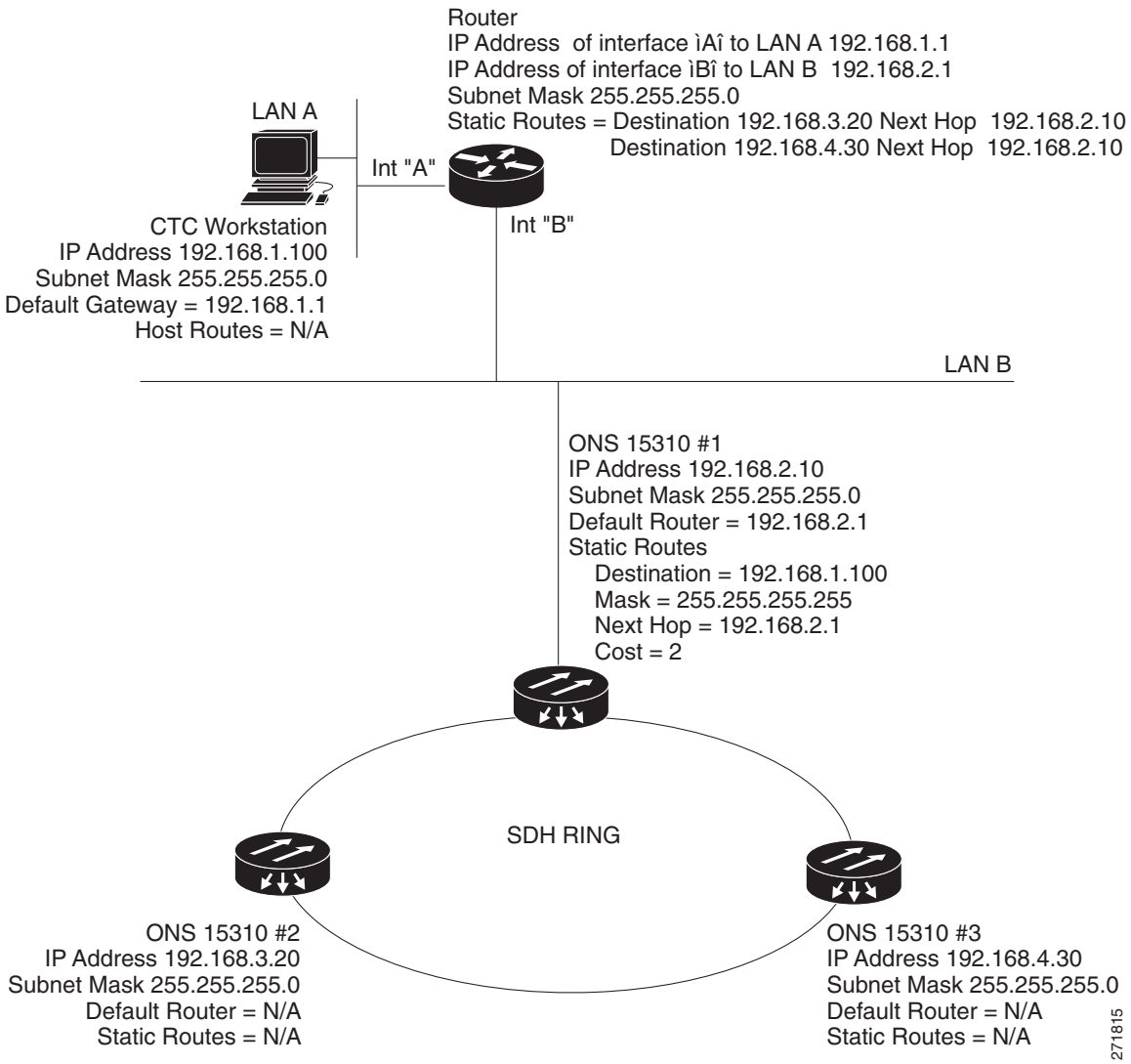


Figure 8-9 shows the same network without OSPF. Static routes must be manually added to the router for CTC computers on LAN A to communicate with Nodes 2 and 3 because these nodes reside on different subnets.

Figure 8-9 Scenario 6: OSPF Not Enabled



8.2.7 Scenario 7: Provisioning the ONS 15310-MA SDH Proxy Server

The ONS 15310-MA SDH proxy server is a set of functions that allows you to network ONS 15310-MA SDH nodes in environments where visibility and accessibility between nodes and CTC computers must be restricted. For example, you can set up a network so that field technicians and network operating center (NOC) personnel can both access the same nodes while preventing the field technicians from accessing the NOC LAN. To do this, one ONS 15310-MA SDH node is provisioned as a gateway network element (GNE) and the other nodes are provisioned as end network elements (ENEs). The GNE tunnels connections between CTC computers and ENEs, which provides management capability while preventing access for non-ONS 15310-MA SDH management purposes.

The ONS 15310-MA SDH proxy server performs the following tasks:

- Isolates DCC IP traffic from Ethernet (CRAFT port) traffic and accepts packets based on filtering rules. The filtering rules depend on whether the packet arrives at the DCC or CRAFT port Ethernet interface. Table 8-3 on page 8-15 and Table 8-4 on page 8-16 provide the filtering rules.
- Processes SNTP (Simple Network Timing Protocol) and NTP (Network Timing Protocol) requests. Element ONS 15310-MA SDH NEs can derive time-of-day from an SNTP/NTP LAN server through the GNE.
- Process SNMPv1 traps. The GNE receives SNMPv1 traps from the ENE and forwards them to all provisioned SNMPv1 trap destinations.

The ONS 15310-MA SDH proxy server is provisioned using the Enable proxy server on port check box on the Provisioning > Network > General tab. If checked, the ONS 15310-MA SDH serves as a proxy for connections between CTC clients and ONS 15310-MA SDH nodes that are DCC-connected to the proxy ONS 15310-MA SDH. The CTC client establishes connections to DCC-connected nodes through the proxy node. The CTC client can connect to nodes that it cannot directly reach from the host on which it runs. If the Enable proxy server on port check box is not checked, the node does not proxy for any CTC clients, although any established proxy connections continue until the CTC client exits. In addition, you can set the proxy server as an ENE or a GNE:

- External Network Element (ENE)—If set as an ENE, the ONS 15310-MA SDH neither installs nor advertises default or static routes. CTC computers can communicate with the node using the craft port, but they cannot communicate directly with any other DCC-connected node.

  In addition, firewall is enabled, which means that the node prevents IP traffic from being routed between the DCC and the LAN port. The ONS 15310-MA SDH can communicate with machines connected to the LAN port or connected through the DCC. However, the DCC-connected machines cannot communicate with the LAN-connected machines, and the LAN-connected machines cannot communicate with the DCC-connected machines. A CTC client using the LAN to connect to the firewall-enabled node can use the proxy capability to manage the DCC-connected nodes that would otherwise be unreachable. A CTC client connected to a DCC-connected node can only manage other DCC-connected nodes and the firewall itself.
- Gateway Network Element (GNE)—If set as a GNE, the CTC computer is visible to other DCC-connected nodes and firewall is enabled.
- Proxy-only—If Proxy-only is selected, CTC cannot communicate with any other DCC-connected ONS 15310-MA SDH nodes and firewall is not enabled.

Note If you launch CTC against a node through a NAT (Network Address Translation) or PAT (Port Address Translation) router and that node does not have proxy enabled, your CTC session starts and initially appears to be fine. However CTC never receives alarm updates and disconnects and reconnects every two minutes. If the proxy is accidentally disabled, it is still possible to enable the proxy during a reconnect cycle and recover your ability to manage the node, even through a NAT/PAT firewall.

Note ENEs that belong to different private subnetworks do not need to have unique IP addresses. Two ENEs that are connected to different GNEs can have the same IP address. However, ENEs that connect to the same GNE must always have unique IP addresses.

Figure 8-10 shows an ONS 15310-MA SDH proxy server implementation. A GNE is connected to a central office LAN and to ENEs. The central office LAN is connected to a NOC LAN, which has CTC computers. The NOC CTC computer and craft technicians must both be able to access the ENEs. However, the craft technicians must be prevented from accessing or seeing the NOC or central office LANs.

In the example, the GNE is assigned an IP address within the central office LAN and is physically connected to the LAN through its LAN port. ENEs are assigned IP addresses that are outside the central office LAN and given private network IP addresses. If the ENEs are collocated, the LAN ports could be connected to a hub. However, the hub should have no other network connections.

Figure 8-10 ONS 15310-MA SDH Proxy Server with GNE and ENEs on the Same Subnet

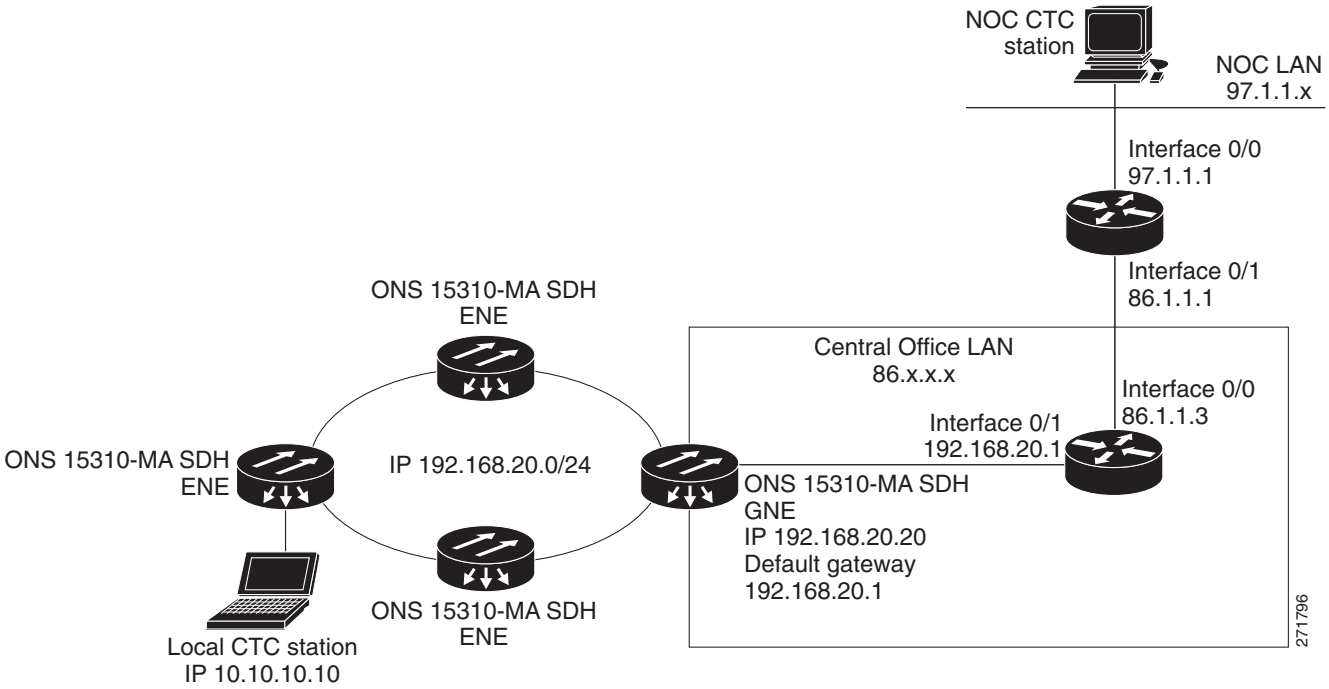


Table 8-2 shows recommended settings for ONS 15310-MA SDH GNEs and ENEs in the configuration shown in Figure 8-10.

Table 8-2 ONS 15310-MA SDH GNE and ENE Settings

Setting	ONS 15310-MA SDH GNE	ONS 15310-MA SDH ENE
OSPF	Off	Off
SNTP Server (if used)	SNTP server IP address	Set to node GNE IP address
SNMP (if used)	SNMPv1 trap destinations	Set SNMPv1 trap destinations to node GNE

Figure 8-11 shows the same proxy server implementation with ONS 15310-MA SDH ENEs on different subnets. In this example, GNEs and ENEs are provisioned with the settings shown in Table 8-2.

Figure 8-11 Scenario 7: Proxy Server with GNE and ENEs on Different Subnets

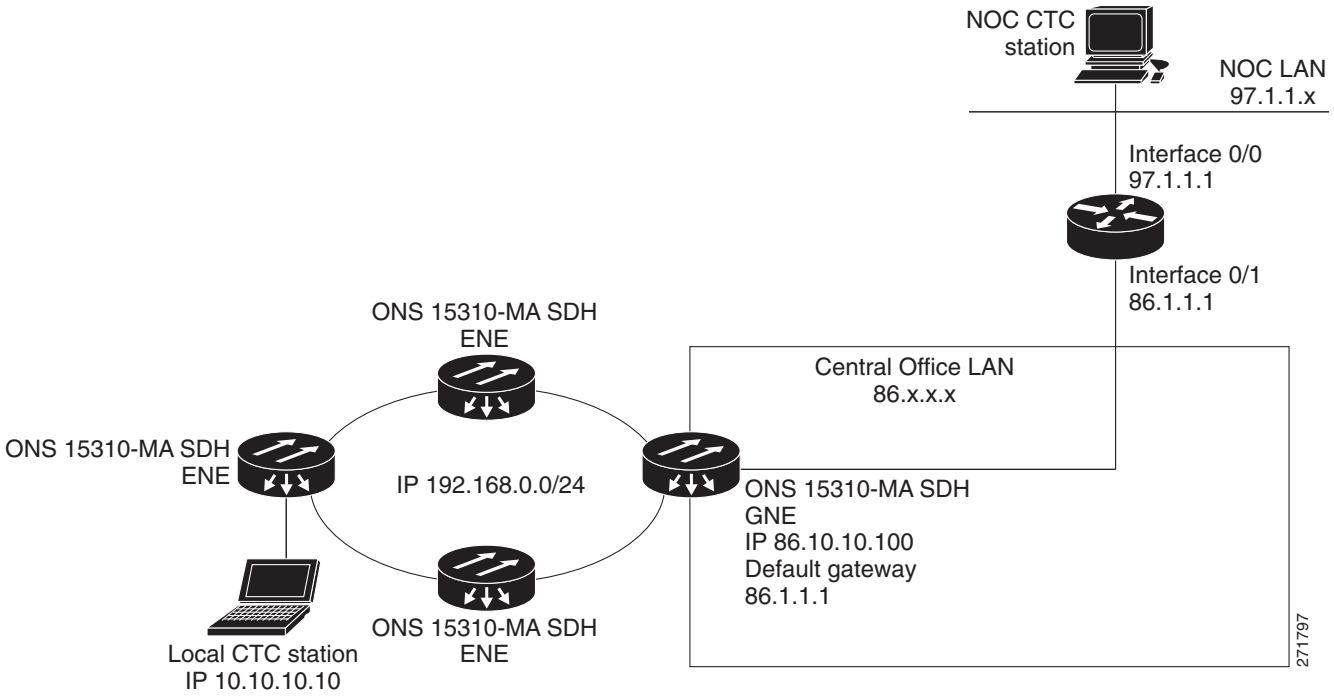


Figure 8-12 shows the implementation with ONS 15310-MA SDH ENEs in multiple rings. In this example, GNEs and ENEs are provisioned with the settings shown in Table 8-2.

Figure 8-12 Scenario 7: Proxy Server with ENEs on Multiple Rings

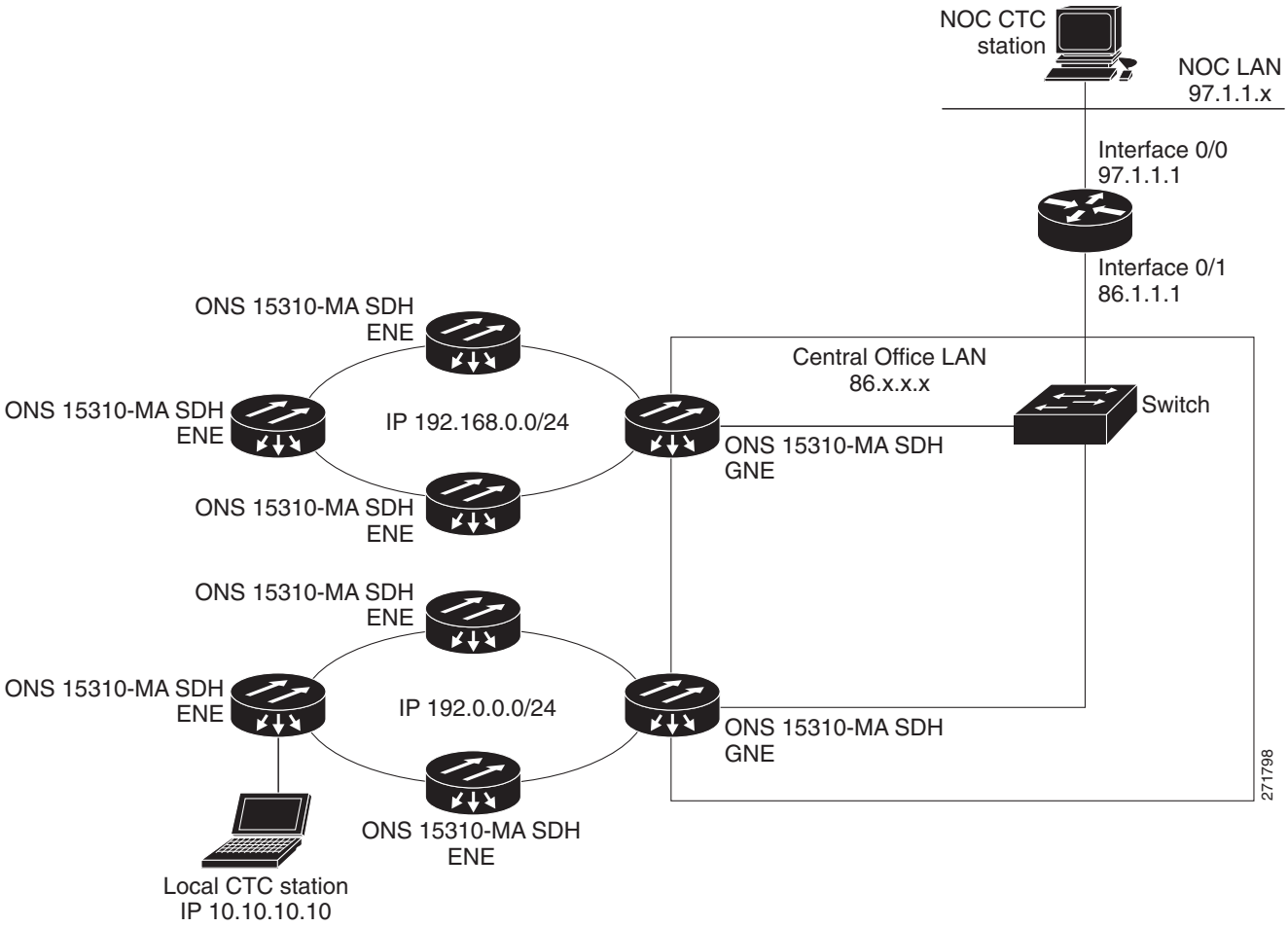


Table 8-3 shows the rules the ONS 15310-MA SDH follows to filter packets when Enable Firewall is enabled.

Table 8-3 Proxy Server Firewall Filtering Rules

Packets arriving at:	Are accepted if the IP destination address is:
15310E-CTX-K9 Ethernet interface	• The ONS 15310-MA SDH shelf itself • The ONS 15310-MA SDH's subnet broadcast address • Within the 224.0.0.0/8 network (reserved network used for standard multicast messages) • Subnet mask = 255.255.255.255
DCC interface	• The ONS 15310-MA SDH itself • Any destination that is connected through another DCC interface • Within the 224.0.0.0/8 network

Table 8-4 shows additional rules that apply if the packet addressed to the ONS 15310-MA SDH is discarded. Rejected packets are silently discarded.

Table 8-4 Proxy Server Firewall Filtering Rules When the Packet is Addressed to the ONS 15310-MA SDH

Packets Arrive At	Accepts	Rejects
15310E-CTX-K9 LAN port	• All User Datagram Protocol (UDP) packets except those in the Rejected column	• UDP packets addressed to the SNMP trap relay port (391)
DCC interface	• All UDP packets • All TCP packets except those packets addressed to the Telnet and SOCKS proxy server ports • OSPF packets • Internet Control Message Protocol (ICMP) packets	• TCP packets addressed to the Telnet port • TCP packets addressed to the proxy server port • All packets other than UDP, TCP, OSPF, ICMP

If you implement the proxy server, keep the following rules in mind:

1. All DCC-connected ONS 15310-MA SDH nodes on the same Ethernet segment must have the same Craft Access Only setting. Mixed values produce unpredictable results, and might leave some nodes unreachable through the shared Ethernet segment.
2. All DCC-connected ONS 15310-MA SDH nodes on the same Ethernet segment must have the same Enable Firewall setting. Mixed values produce unpredictable results. Some nodes might become unreachable.
3. If you check Enable Firewall, always check Enable Proxy. If Enable Proxy is unchecked, CTC is not able to see nodes on the DCC side of the ONS 15310-MA SDH.
4. If Craft Access Only is checked, check Enable Proxy. If Enable Proxy is not checked, CTC is not able to see nodes on the DCC side of the ONS 15310-MA SDH.

If nodes become unreachable in cases 1, 2, and 3, you can correct the setting with one of the following actions:

- Disconnect the craft computer from the unreachable ONS 15310-MA SDH. Connect to the ONS 15310-MA SDH through another ONS 15310-MA SDH in the network that has a DCC connection to the unreachable node.
- Disconnect the Ethernet cable from the unreachable ONS 15310-MA SDH. Connect a CTC computer directly to the ONS 15310-MA SDH.

8.3 Routing Table

ONS 15310-MA SDH routing information appears on the Maintenance > Routing Table tabs. The routing table provides the following information:

- Destination—Displays the IP address of the destination network or host.
- Mask—Displays the subnet mask used to reach the destination host or network.
- Gateway—Displays the IP address of the gateway used to reach the destination network or host.
- Usage—Shows the number of times the listed route has been used.
- Interface—Shows the ONS 15310-MA SDH interface used to access the destination.

- cpm0—The ONS 15310-MA SDH Ethernet interface (RJ45 LAN jack)
- pdcc0—An RS-DCC interface, that is, an STMN trunk port identified as the RS-DCC termination
- lo0—A loopback interface

Table 8-5 shows sample routing entries for an ONS 15310-MA SDH.

Table 8-5 Sample Routing Table Entries

Entry	Destination	Mask	Gateway	Interface
1	0.0.0.0	0.0.0.0	172.20.214.1	cpm0
2	172.20.214.0	255.255.255.0	172.20.214.92	cpm0
3	172.20.214.92	255.255.255.255	127.0.0.1	lo0
4	172.20.214.93	255.255.255.255	0.0.0.0	pdcc0
5	172.20.214.94	255.255.255.255	172.20.214.93	pdcc0

Entry 1 shows the following:

- Destination (0.0.0.0) is the default route entry. All undefined destination network or host entries on this routing table is mapped to the default route entry.
- Mask (0.0.0.0) is always 0 for the default route.
- Gateway (172.20.214.1) is the default gateway address. All outbound traffic that cannot be found in this routing table or is not on the node's local subnet is sent to this gateway.
- Interface (cpm0) indicates that the ONS 15310-MA SDH Ethernet interface is used to reach the gateway.

Entry 2 shows the following:

- Destination (172.20.214.0) is the destination network IP address.
- Mask (255.255.255.0) is a 24-bit mask, meaning all addresses within the 172.20.214.0 subnet can be a destination.
- Gateway (172.20.214.92) is the gateway address. All outbound traffic belonging to this network is sent to this gateway.
- Interface (cpm0) indicates that the ONS 15310-MA SDH Ethernet interface is used to reach the gateway.

Entry 3 shows the following:

- Destination (172.20.214.92) is the destination host IP address.
- Mask (255.255.255.255) is a 32-bit mask, meaning only the 172.20.214.92 address is a destination.
- Gateway (127.0.0.1) is a loopback address. The host directs network traffic to itself using this address.
- Interface (lo0) indicates that the local loopback interface is used to reach the gateway.

Entry 4 shows the following:

- Destination (172.20.214.93) is the destination host IP address.
- Mask (255.255.255.255) is a 32-bit mask, meaning only the 172.20.214.93 address is a destination.
- Gateway (0.0.0.0) means the destination host is directly attached to the node.

- Interface (pdcc0) indicates that an SDH RS-DCC interface is used to reach the destination host.

Entry 5 shows a DCC-connected node that is accessible through a node that is not directly connected:

- Destination (172.20.214.94) is the destination host IP address.
- Mask (255.255.255.255) is a 32-bit mask, meaning only the 172.20.214.94 address is a destination.
- Gateway (172.20.214.93) indicates that the destination host is accessed through a node with IP address 172.20.214.93.
- Interface (pdcc0) indicates that an SDH RS-DCC interface is used to reach the gateway.

8.4 External Firewalls

Table 8-6 shows the ports that are used by the 15310E-CTX-K9 cards.

Table 8-6 Ports Used by the 15310E-CTX-K9

Port	Function	Action[1]
0	Never used	D
20	FTP	D
21	FTP control	D
22	SSH (Secure Shell)	D
23	Telnet	D
80	HTTP	D
111	SUNRPC (Sun Remote Procedure Call)	NA
161	SNMP traps destinations	D
162	SNMP traps destinations	D
513	rlogin	NA
683	CORBA IIOP	OK
1080	Proxy server (socks)	D
2001-2017	I/O card Telnet	D
2018	DCC processor on active 15310-MA SDH-CTX	D
2361	TL1	D
3082	Raw TL1	D
3083	TL1	D
5001	Multiplex-section shared protection ring (MS-SPRing) server port	D
5002	MS-SPRing client port	D
7200	SNMP alarm input port	D
9100	EQM port	D
9401	TCC boot port	D
9999	Flash manager	D

Table 8-6 Ports Used by the 15310E-CTX-K9 (continued)

Port	Function	Action[1]
10240-12287	Proxy client	D
57790	Default TCC listener port	OK

1. D = deny, NA = not applicable, OK = do not deny

The following access control list (ACL) examples show a firewall configuration when the proxy server gateway setting is not enabled. In the example, the CTC workstation address is 192.168.10.10 and the ONS 15310-MA SDH address is 10.10.10.100. The firewall is attached to the GNE, so the inbound path is CTC to the GNE and the outbound path is from the GNE to CTC. The CTC CORBA Standard constant is 683 and the TCC CORBA Default is TCC Fixed (57790).

```
access-list 100 remark *** Inbound ACL, CTC -> NE ***
access-list 100 remark
access-list 100 permit tcp host 192.168.10.10 host 10.10.10.100 eq www
access-list 100 remark *** allows initial contact with the 15310-MA SDH using http (port
80) ***
access-list 100 remark
access-list 100 permit tcp host 192.168.10.10 host 10.10.10.100 eq 57790
access-list 100 remark *** allows CTC communication with the 15310-MA SDH GNE (port 57790)
***
access-list 100 remark

access-list 101 remark
access-list 101 permit tcp host 10.10.10.100 host 192.168.10.10 eq 683
access-list 101 remark *** allows alarms etc., from the 15310-MA SDH (random port) to the
CTC workstation (port 683) ***
access-list 100 remark
access-list 101 permit tcp host 10.10.10.100 host 192.168.10.10 established
access-list 101 remark *** allows ACKs from the 15310-MA SDH GNE to CTC ***
```

The following ACL examples show a firewall configuration when the proxy server gateway setting is enabled. As with the first example, the CTC workstation address is 192.168.10.10 and the ONS 15310-MA SDH address is 10.10.10.100. The firewall is attached to the GNE, so the inbound path is CTC to the GNE and the outbound path is from the GNE to CTC. The CTC CORBA Standard constant is 683 and the TCC CORBA Default is TCC Fixed (57790).

```
access-list 100 remark *** Inbound ACL, CTC -> NE ***
access-list 100 remark
access-list 100 permit tcp host 192.168.10.10 host 10.10.10.100 eq www
access-list 100 remark *** allows initial contact with the 15310-MA SDH using http (port
80) ***
access-list 100 remark
access-list 100 permit tcp host 192.168.10.10 host 10.10.10.100 eq 1080
access-list 100 remark *** allows CTC communication with the 15310-MA SDH GNE proxy server
(port 1080) ***
access-list 100 remark
access-list 100 permit tcp host 192.168.10.10 host 10.10.10.100 established
access-list 100 remark *** allows ACKs from CTC to the 15310-MA SDH GNE ***
access-list 101 remark *** Outbound ACL, NE -> CTC ***
access-list 101 remark
access-list 101 permit tcp host 10.10.10.100 eq 1080 host 192.168.10.10
access-list 101 remark *** allows alarms and other communications from the 15310-MA SDH
(proxy server) to the CTC workstation
(port 683) ***
access-list 100 remark
access-list 101 permit tcp host 10.10.10.100 host 192.168.10.10 established
access-list 101 remark *** allows ACKs from the 15310-MA SDH GNE to CTC ***
```

8.5 Open GNE

The ONS 15310-MA SDH can communicate with non-ONS nodes that do not support point-to-point protocol (PPP) vendor extensions or OSPF type 10 opaque link-state advertisements (LSA), both of which are necessary for automatic node and link discovery. An open GNE configuration allows the DCC-based network to function as an IP network for non-ONS nodes.

To configure an open GNE network, you can provision RS-DCC and MS-DCC terminations to include a far-end, non-ONS node using either the default IP address of 0.0.0.0 or a specified IP address. You provision a far-end, non-ONS node by checking the "Far End is Foreign" check box during RS-DCC and MS-DCC creation. The default 0.0.0.0 IP address allows the far-end, non-ONS node to provide the IP address; if you set an IP address other than 0.0.0.0, a link is established only if the far-end node identifies itself with that IP address, providing an extra level of security.

By default, the proxy server only allows connections to discovered ONS peers and the firewall blocks all IP traffic between the DCC network and LAN. You can, however, provision proxy tunnels to allow up to 12 additional destinations for SOCKS version 5 connections to non-ONS nodes. You can also provision firewall tunnels to allow up to 12 additional destinations for direct IP connectivity between the DCC network and LAN. Proxy and firewall tunnels include both a source and destination subnet. The connection must originate within the source subnet and terminate within the destination subnet before either the SOCKS connection or IP packet flow is allowed.

To set up proxy and firewall subnets in CTC, use the Provisioning > Network > Proxy and Firewalls subtabs. The availability of proxy and/or firewall tunnels depends on the network access settings of the node:

- If the node is configured with the proxy server enabled in GNE or ENE mode, you must set up a proxy tunnel and/or a firewall tunnel.
- If the node is configured with the proxy server enabled in proxy-only mode, you can set up proxy tunnels. Firewall tunnels are not allowed.
- If the node is configured with the proxy server disabled, neither proxy tunnels or firewall tunnels are allowed.

Figure 8-13 shows an example of a foreign node connected to the DCC network. Proxy and firewall tunnels are useful in this example because the GNE would otherwise block IP access between the PC and the foreign node.

Figure 8-13 Proxy and Firewall Tunnels for Foreign Terminations

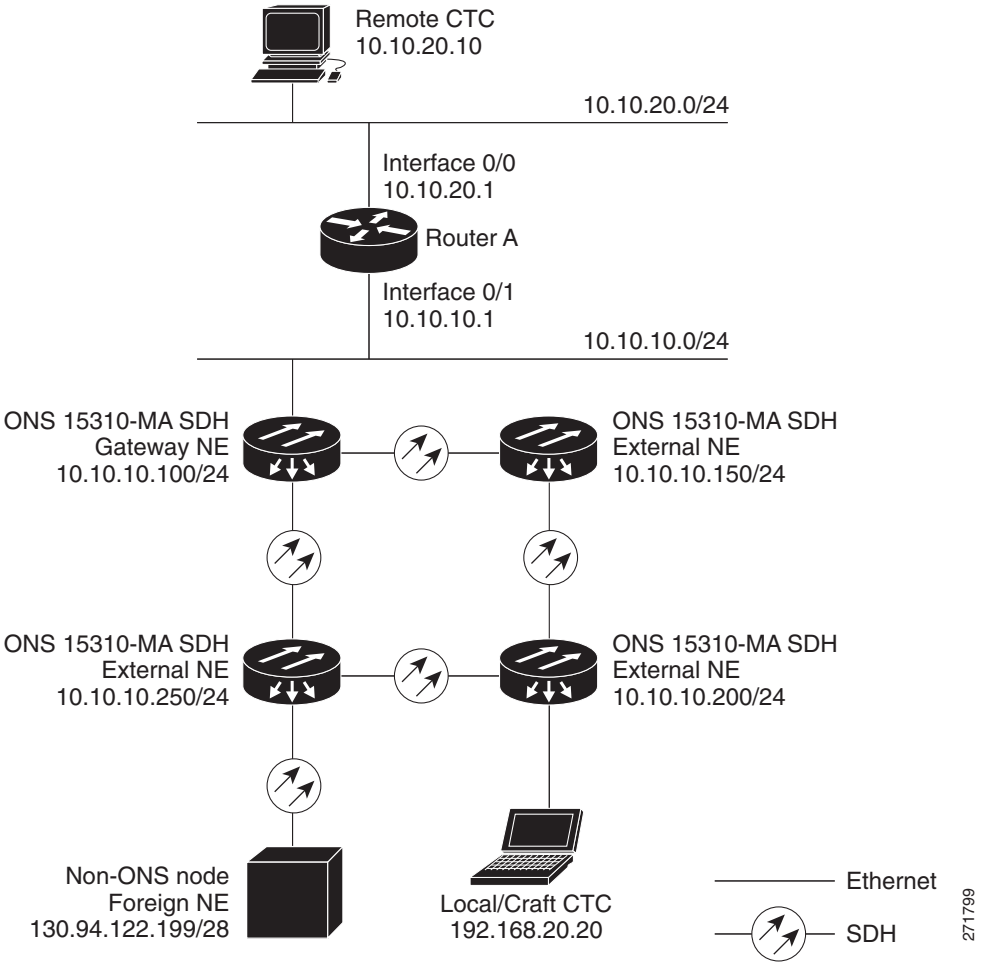
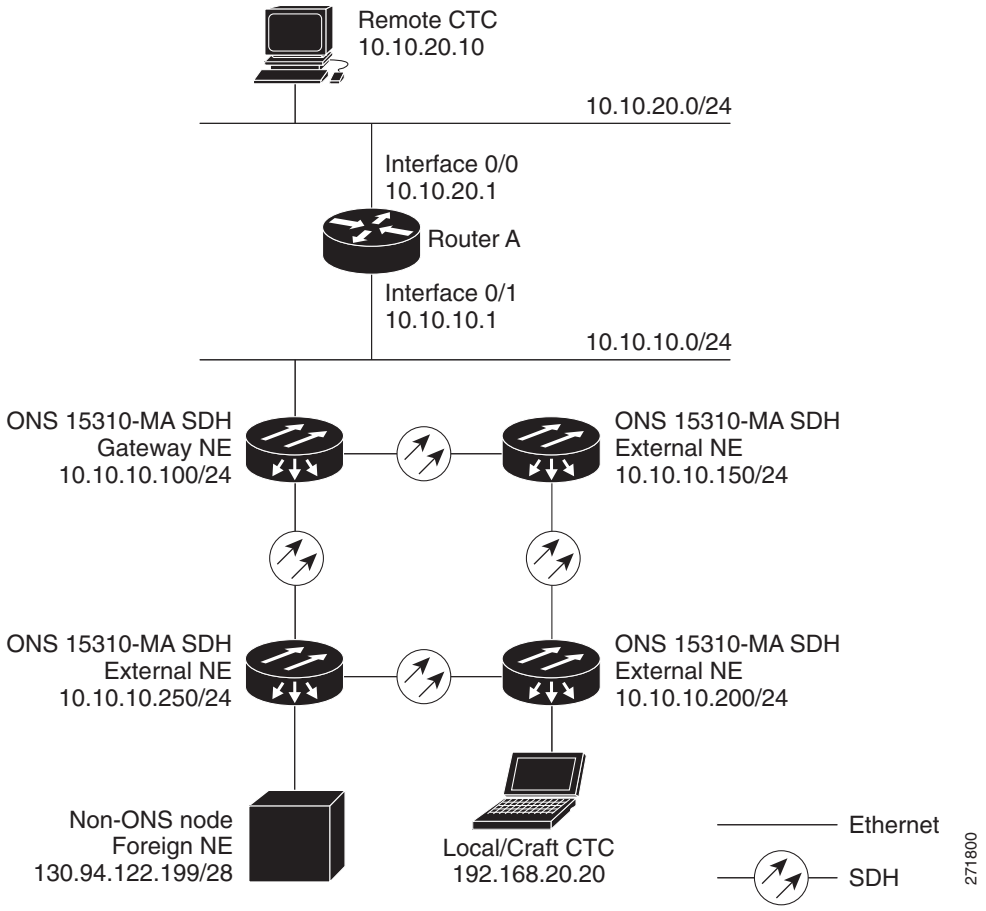


Figure 8-14 shows a remote node connected to an ENE Ethernet port. Proxy and firewall tunnels are useful in this example because the GNE would otherwise block IP access between the PC and foreign node. This configuration also requires a firewall tunnel on the ENE.

Figure 8-14 Foreign Node Connection to an ENE Ethernet Port



8.6 TCP/IP and OSI Networking

ONS 15310-MA SDH DCN communication is based on the TCP/IP protocol suite. However, ONS 15310-MA SDH nodes can also be networked with equipment that uses the OSI protocol suite. While TCP/IP and OSI protocols are not directly compatible, they do have the same objectives and occupy similar layers of the OSI reference model. Table 8-7 shows the protocols that are involved when TCP/IP-based NEs are networked with OSI-based NEs.

Table 8-7 TCP/IP and OSI Protocols

OSI Model	IP Protocols	OSI Protocols		IP-OSI Tunnels
Layer 7 Application	• TL1 • FTP • HTTP • Telnet • IIOP	• TARP[1]	• TL1 (over OSI) • FTAM[2] • ACSE[3]	
Layer 6 Presentation			• Administrative State[4]	
Layer 5 Session			• Session	
Layer 4 Transport	• TCP • UDP		• TP (Transport) Class 4	• IP-over-CLNS[5] tunnels
Layer 3 Network	• IP • OSPF	• CLNP[6] • ES-IS[7] • IS-IS[8]		
Layer 2 Data link	• PPP	• PPP • LAP-D[9]		
Layer 1 Physical	DCC, LAN, fiber, electrical	DCC, LAN, fiber, electrical		

1. TARP = TID Address Resolution Protocol
2. FTAM = File Transfer and Access Management
3. ACSE = association-control service element
4. Administrative State = Presentation layer
5. CLNS = Connectionless Network Layer Service
6. CLNP = Connectionless Network Layer Protocol
7. ES-IS = End System-to-Intermediate System
8. IS-IS = Intermediate System-to-Intermediate System
9. LAP-D = Link Access Protocol on the D Channel

8.6.1 Point-to-Point Protocol

Point-to-Point protocol (PPP) is a data link (Layer 2) encapsulation protocol that transports datagrams over point-to-point links. Although PPP was developed to transport IP traffic, it can carry other protocols including the OSI Connectionless Network Protocol (CLNP). PPP components used in the transport of OSI include:

- High-level data link control (HDLC)—Performs the datagram encapsulation for transport across point-to-point links.
- Link control protocol (LCP)—Establishes, configures, and tests point-to-point connections.

CTC automatically enables IP over PPP whenever you create an RS-DCC or MS-DCC. The RS-DCC or MS-DCC can be provisioned to support OSI over PPP.

8.6.2 Link Access Protocol on the D Channel

LAP-D is a data link protocol used in the OSI protocol stack. LAP-D is assigned when you provision an ONS 15310-MA SDH RS-DCC as OSI-only. Provisionable LAP-D parameters include:

- Transfer Service—One of the following transfer services must be assigned:
  - Acknowledged Information Transfer Service (AITS)—(Default) Does not exchange data until a logical connection between two LAP-D users is established. This service provides reliable data transfer, flow control, and error control mechanisms.
  - Unacknowledged Information Transfer Service (UITS)—Transfers frames containing user data with no acknowledgement. The service does not guarantee that the data presented by one user will be delivered to another user, nor does it inform the user if the delivery attempt fails. It does not provide any flow control or error control mechanisms.
- Mode—LAP-D is set to either Network or User mode. This parameter sets the LAP-D frame command/response (C/R) value, which indicates whether the frame is a command or a response.
- Maximum transmission unit (MTU)—The LAP-D N201 parameter sets the maximum number of octets in a LAP-D information frame. The range is 512 to 1500 octets.

Note The MTU must be the same size for all NEs on the network.

- Transmission Timers—The following LAP-D timers can be provisioned:
  - The T200 timer sets the timeout period for initiating retries or declaring failures.
  - The T203 timer provisions the maximum time between frame exchanges, that is, the trigger for transmission of the LAP-D “keep-alive” Receive Ready (RR) frames.

Fixed values are assigned to the following LAP-D parameters:

- Terminal Endpoint Identifier (TEI)—A fixed value of 0 is assigned.
- Service Access Point Identifier (SAPI)—A fixed value of 62 is assigned.
- N200 supervisory frame retransmissions—A fixed value of 3 is assigned.

8.6.3 OSI Connectionless Network Service

OSI connectionless network service is implemented by using the Connectionless Network Protocol (CLNP) and Connectionless Network Service (CLNS). CLNP and CLNS are described in the ISO 8473 standard. CLNS provides network layer services to the transport layer through CLNP. CLNS does not perform connection setup or termination because paths are determined independently for each packet that is transmitted through a network. CLNS relies on transport layer protocols to perform error detection and correction.

CLNP is an OSI network layer protocol that carries upper-layer data and error indications over connectionless links. CLNP provides the interface between the CLNS and upper layers. CLNP performs many of the same services for the transport layer as IP. The CLNP datagram is very similar to the IP datagram. It provides mechanisms for fragmentation (data unit identification, fragment/total length, and offset). Like IP, a checksum computed on the CLNP header verifies that the information used to process the CLNP datagram is transmitted correctly, and a lifetime control mechanism (Time to Live) limits the amount of time a datagram is allowed to remain in the system.

CLNP uses network service access points (NSAPs) to identify network devices. The CLNP source and destination addresses are NSAPs. In addition, CLNP uses a network element title (NET) to identify a network-entity in an end system (ES) or intermediate system (IS). NETs are allocated from the same name space as NSAP addresses. Whether an address is an NSAP address or a NET depends on the network selector value in the NSAP.

The ONS 15310-MA SDH support the ISO Data Country Code (ISO-DCC) NSAP address format as specified in ISO 8348. The NSAP address is divided into an initial domain part (IDP) and a domain-specific part (DSP). NSAP fields are shown in Table 8-8. NSAP field values are in hexadecimal format. All NSAPs are editable and shorter NSAPs can be used; however, NSAPs for all NEs residing within the same OSI network area usually have the same NSAP format.

Table 8-8 NSAP Fields

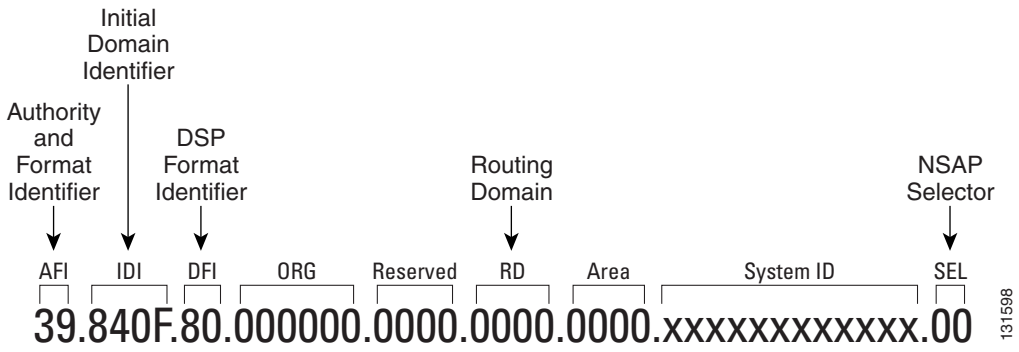
Field	Definition	Description
IDP		
AFI	Authority and format identifier	Specifies the NSAP address format. The initial value is 39 for the ISO-DCC address format.
IDI	Initial domain identifier	Specifies the country code. The initial value is 840F, the United States country code padded with an F.
DSP		
DFI	DSP format identifier	Specifies the DSP format. The initial value is 80, indicating the DSP format follows American National Standards Institute (ANSI) standards.
ORG	Organization	Organization identifier. The initial value is 000000.
Reserved	Reserved	Reserved NSAP field. The Reserved field is normally all zeros (0000).
RD	Routing domain	Defines the routing domain. The initial value is 0000.
AREA	Area	Identifies the OSI routing area to which the node belongs. The initial value is 0000.

Table 8-8 NSAP Fields (continued)

Field	Definition	Description
System	System identifier	The ONS 15310-MA SDH system identifier is set to its IEEE 802.3 MAC address.
SEL	Selector	The selector field directs the protocol data units (PDUs) to the correct destination using the CLNP network layer service. Selector values supported by the ONS 15310-MA SDH include: • 00—Network Entity Title (NET). Used to exchange PDUs in the ES-IS and IS-IS routing exchange protocols. (See the "8.6.4.1 End System-to-Intermediate System Protocol" section on page 8-28, and the "8.6.4.2 Intermediate System-to-Intermediate System Protocol" section on page 8-28.) • 1D—Selector for Transport Class 4 (and for FTAM and TL1 applications • AF—Selector for the TARP protocol • 2F—Selector for the GRE IP-over-CLNS tunnel (ITU/RFC standard) • CC—Selector for the Cisco IP-over-CLNS tunnels (Cisco specific) • E0—Selector for the OSI ping application (Cisco specific) NSELs are only advertised when the node is configured as an ES. They are not advertised when a node is configured as an IS. Tunnel NSELs are not advertised until a tunnel is created.

Figure 8-15 shows the default ISO-DCC NSAP address delivered with the ONS 15310-MA SDH. The System ID is automatically populated with the node's MAC address.

Figure 8-15 ISO-DCC NSAP Address



The ONS 15310-MA SDH main NSAP address is shown on the node view Provisioning > OSI > Main Setup subtab. This address is also the Router 1 primary manual area address, which is viewed and edited on the Provisioning > OSI > Routers subtab. See the "8.6.6 OSI Virtual Routers" section on page 8-32 for information about the OSI router and manual area addresses in CTC.

8.6.4 OSI Routing

OSI architecture includes ESs and ISs. The OSI routing scheme includes:

- A set of routing protocols that allow ESs and ISs to collect and distribute the information necessary to determine routes. Protocols include the ES-IS and IS-IS protocols. ES-IS routing establishes connectivity among ESs and ISs attached to the same (single) subnetwork.
- A routing information base (RIB) containing this information, from which routes between ESs can be computed. The RIB consists of a table of entries that identify a destination (for example, an NSAP), the subnetwork over which packets should be forwarded to reach that destination, and a routing metric. The routing metric communicates characteristics of the route (such as delay properties or expected error rate) that are used to evaluate the suitability of a route compared to another route with different properties, for transporting a particular packet or class of packets.
- A routing algorithm, Shortest Path First (SPF), that uses information contained in the RIB to derive routes between ESs.

In OSI networking, discovery is based on announcements. An ES uses the ES-IS protocol end system hello (ESH) message to announce its presence to ISs and ESs connected to the same network. Any ES or IS that is listening for ESHs gets a copy. ISs store the NSAP address and the corresponding subnetwork address pair in routing tables. ESs might store the address, or they might wait to be informed by ISs when they need such information.

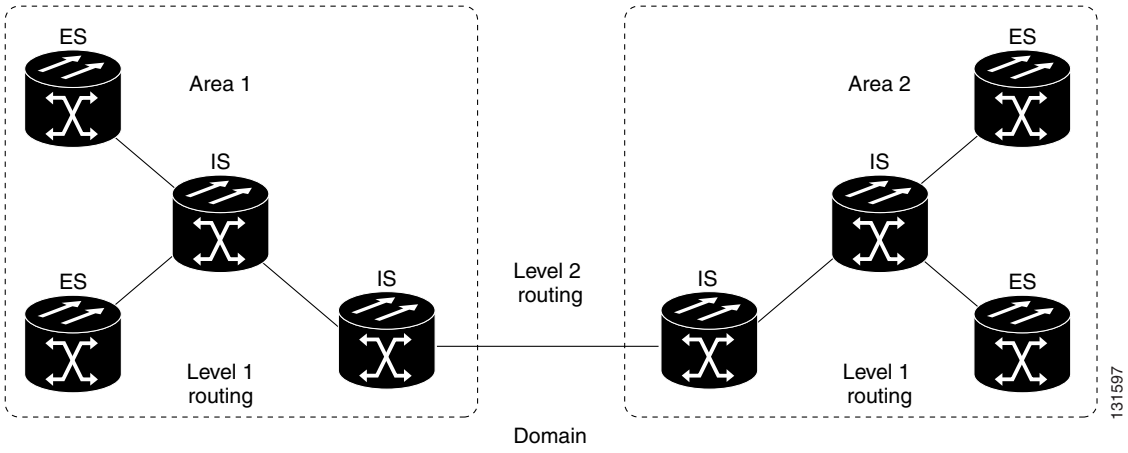
An IS composes intermediate system hello (ISH) messages to announce its configuration information to ISs and ESs that are connected to the same broadcast subnetwork. Like the ESHs, the ISH contains the addressing information for the IS (the NET and the subnetwork point-of-attachment address [SNPA]) and a holding time. ISHs might also communicate a suggested ES configuration time recommending a configuration timer to ESs.

The exchange of ISHs is called neighbor greeting or initialization. Each router learns about the other routers with which they share direct connectivity. After the initialization, each router constructs a link-state packet (LSP). The LSP contains a list of the names of the IS's neighbors and the cost to reach each of the neighbors. Routers then distribute the LSPs to all of the other routers. When all LSPs are propagated to all routers, each router has a complete map of the network topology (in the form of LSPs). Routers use the LSPs and the SPF algorithm to compute routes to every destination in the network.

OSI networks are divided into areas and domains. An area is a group of contiguous networks and attached hosts that is designated as an area by a network administrator. A domain is a collection of connected areas. Routing domains provides full connectivity to all ESs within the domains. Routing within the same area is known as Level 1 routing. Routing between two areas is known as Level 2 routing. LSPs that are exchanged within a Level 1 area are called L1 LSPs. LSPs that are exchanged across Level 2 areas are called L2 LSPs. Figure 8-16 shows an example of Level 1 and Level 2 routing.

Note The ONS 15310-MA SDH do not support Level 1/Level 2 routing. Level 1/Level 2 routing is supported by the ONS 15454, ONS 15454 SDH, and the ONS 15600.

Figure 8-16 Level 1 and Level 2 OSI Routing



When you provision an ONS 15310-MA SDH for a network with NEs that use both the TCP/IP and OSI protocol stacks, you will provision it as one of the following:

- End System—The ONS 15310-MA SDH performs OSI ES functions and relies upon an IS for communication with nodes that reside within its OSI area.
- Intermediate System Level 1—The ONS 15310-MA SDH performs OSI IS functions. It communicates with IS and ES nodes that reside within its OSI area. It depends upon an IS L1/L2 node to communicate with IS and ES nodes that reside outside its OSI area.

8.6.4.1 End System-to-Intermediate System Protocol

ES-IS is an OSI protocol that defines how ESs (hosts) and ISs (routers) learn about each other. ES-IS configuration information is transmitted at regular intervals through the ES and IS hello messages. The hello messages contain the subnetwork and network layer addresses of the systems that generate them.

The ES-IS configuration protocol communicates both OSI network layer addresses and OSI subnetwork addresses. OSI network layer addresses identify either the NSAP, which is the interface between OSI Layer 3 and Layer 4, or the NET, which is the network layer entity in an OSI IS. OSI SNPAs are the points at which an ES or IS is physically attached to a subnetwork. The SNPA address uniquely identifies each system attached to the subnetwork. In an Ethernet network, for example, the SNPA is the 48-bit MAC address. Part of the configuration information transmitted by ES-IS is the NSAP-to-SNPA or NET-to-SNPA mapping.

8.6.4.2 Intermediate System-to-Intermediate System Protocol

IS-IS is an OSI link-state hierarchical routing protocol that floods the network with link-state information to build a complete, consistent picture of a network topology. IS-IS distinguishes between Level 1 and Level 2 ISs. Level 1 ISs communicate with other Level 1 ISs in the same area. Level 2 ISs route between Level 1 areas and form an intradomain routing backbone. Level 1 ISs need to know only how to get to the nearest Level 2 IS. The backbone routing protocol can change without impacting the intra-area routing protocol.

OSI routing begins when the ESs discover the nearest IS by listening to ISH packets. When an ES wants to send a packet to another ES, it sends the packet to one of the ISs on its directly attached network. The router then looks up the destination address and forwards the packet along the best route. If the destination ES is on the same subnetwork, the local IS knows this from listening to ESHs and forwards

the packet appropriately. The IS also might provide a redirect (RD) message back to the source to tell it that a more direct route is available. If the destination address is an ES on another subnetwork in the same area, the IS knows the correct route and forwards the packet appropriately. If the destination address is an ES in another area, the Level 1 IS sends the packet to the nearest Level 2 IS. Forwarding through Level 2 ISs continues until the packet reaches a Level 2 IS in the destination area. Within the destination area, the ISs forward the packet along the best path until the destination ES is reached.

Link-state update messages help ISs learn about the network topology. Each IS generates an update specifying the ESs and ISs to which it is connected, as well as the associated metrics. The update is then sent to all neighboring ISs, which forward (flood) it to their neighbors, and so on. (Sequence numbers terminate the flood and distinguish old updates from new ones.) Using these updates, each IS can build a complete topology of the network. When the topology changes, new updates are sent.

IS-IS uses a single required default metric with a maximum path value of 1024. The metric is arbitrary and typically is assigned by a network administrator. Any single link can have a maximum value of 64, and path links are calculated by summing link values. Maximum metric values were set at these levels to provide the granularity to support various link types while at the same time ensuring that the shortest-path algorithm used for route computation is reasonably efficient. Three optional IS-IS metrics (costs)—delay, expense, and error—are not supported by the ONS 15310-MA SDH. IS-IS maintains a mapping of the metrics to the quality of service (QoS) option in the CLNP packet header. IS-IS uses the mappings to compute routes through the internetwork.

8.6.5 TARP

TARP is used when TL1 target identifiers (TIDs) must be translated to NSAP addresses. The TID-to-NSAP translation occurs by mapping TIDs to the NETs, then deriving NSAPs from the NETs by using the NSAP selector values (see Table 8-8 on page 8-25).

TARP uses a selective PDU propagation methodology in conjunction with a distributed database (that resides within the NEs) of TID-to-NET mappings. TARP allows NEs to translate between TID and NET by automatically exchanging mapping information with other NEs. The TARP PDU is carried by the standard CLNP Data PDU. TARP PDU fields are shown in Table 8-9.

Table 8-9 TARP PDU Fields

Field	Abbreviation	Size (bytes)	Description
TARP Lifetime	tar-lif	2	The TARP time-to-live in hops.
TARP Sequence Number	tar-seq	2	The TARP sequence number used for loop detection.
Protocol Address Type	tar-pro	1	Used to identify the type of protocol address that the TID must be mapped to. The value FE is used to identify the CLNP address type.
TARP Type Code	tar-tcd	1	The TARP Type Code identifies the TARP type of PDU. Five TARP types, shown in Table 8-10, are defined.
TID Target Length	tar-tln	1	The number of octets that are in the tar-ttg field.
TID Originator Length	tar-oln	1	The number of octets that are in the tar-tor field.
Protocol Address Length	tar-pln	1	The number of octets that are in the tar-por field.

Table 8-9 TARP PDU Fields (continued)

Field	Abbreviation	Size (bytes)	Description
TID of Target	tar-ttg	*n* = 0, 1, 2...	TID value for the target NE.
TID of Originator	tar-tor	*n* = 0, 1, 2...	TID value of the TARP PDU originator.
Protocol Address of Originator	tar-por	*n* = 0, 1, 2...	Protocol address (for the protocol type identified in the tar-pro field) of the TARP PDU originator. When the tar-pro field is set to FE (hex), tar-por will contain a CLNP address (that is, the NET).

Table 8-10 shows the TARP PDU types that govern TARP interaction and routing.

Table 8-10 TARP PDU Types

Type	Description	Procedure
1	Sent when a device has a TID for which it has no matching NSAP.	After an NE originates a TARP Type 1 PDU, the PDU is sent to all adjacencies within the NE's routing area.
2	Sent when a device has a TID for which it has no matching NSAP and no response was received from the Type 1 PDU.	After an NE originates a TARP Type 2 PDU, the PDU is sent to all Level 1 and Level 2 neighbors.
3	Sent as a response to Type 1, Type 2, or Type 5 PDUs.	After a TARP Request (Type 1 or 2) PDU is received, a TARP Type 3 PDU is sent to the request originator. Type 3 PDUs do not use the TARP propagation procedures.
4	Sent as a notification when a change occurs locally, for example, a TID or NSAP change. It might also be sent when an NE initializes.	A Type 4 PDU is a notification of a TID or Protocol Address change at the NE that originates the notification. The PDU is sent to all adjacencies inside and outside the NE's routing area.
5	Sent when a device needs a TID that corresponds to a specific NSAP.	When a Type 5 PDU is sent, the CLNP destination address is known, so the PDU is sent to only that address. Type 5 PDUs do not use the TARP propagation procedures.

8.6.5.1 TARP Processing

A TARP data cache (TDC) is created at each NE to facilitate TARP processing. In CTC, the TDC is displayed and managed on the node view Maintenance > OSI > TDC subtab. The TDC subtab contains the following TARP PDU fields:

- TID—TID of the originating NE (tar-tor).
- NSAP—NSAP of the originating NE.
- Type— Indicates whether the TARP PDU was created through the TARP propagation process (dynamic) or manually created (static).

Provisionable timers, shown in Table 8-11, control TARP processing.

Table 8-11 TARP Timers

Timer	Description	Default (seconds)	Range (seconds)
E1	Waiting for response to TARP Type 1 Request PDU	15	0–3600
T2	Waiting for response to TARP Type 2 Request PDU	25	0–3600
DS3/E3	Waiting for response to address resolution request	40	0–3600
T4	Timer starts when T2 expires (used during error recovery)	20	0–3600

Table 8-12 shows the main TARP processes and the general sequence of events that occurs in each process.

Table 8-12 TARP Processing Flow

Process	General TARP Flow
Find a NET that matches a TID	1. TARP checks its TDC for a match. If a match is found, TARP returns the result to the requesting application. 2. If no match is found, a TARP Type 1 PDU is generated and Timer E1 is started. 3. If Timer E1 expires before a match if found, a Type 2 PDU is generated and Timer T2 is started. 4. If Timer T2 expires before a match is found, Timer T4 is started. 5. If Timer T4 expires before a match is found, a Type 2 PDU is generated and Timer T2 is started.
Find a TID that matches a NET	A Type 5 PDU is generated. Timer DS3/E3 is used. However, if the timer expires, no error recovery procedure occurs, and a status message is provided to indicate that the TID cannot be found.
Send a notification of TID or protocol address change	TARP generates a Type 4 PDU in which the tar-ttg field contains the NE's TID value that existed prior to the change of TID or protocol address. Confirmation that other NEs successfully received the address change is not sent.

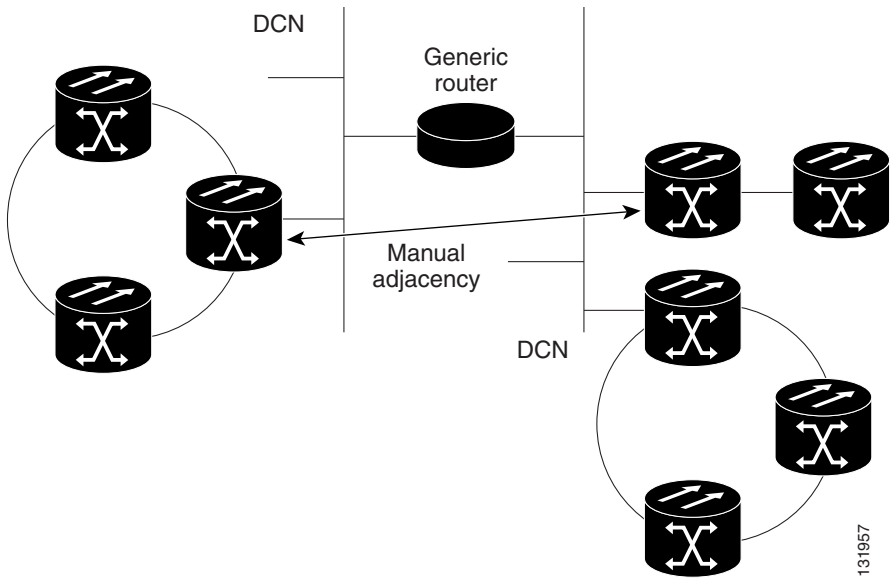
8.6.5.2 TARP Loop Detection Buffer

The TARP loop detection buffer (LDB) can be enabled to prevent duplicate TARP PDUs from entering the TDC. When a TARP Type 1, 2, or 4 PDU arrives, TARP checks its LDB for the NET address of the PDU originator match. If no match is found, TARP processes the PDU and assigns a tar-por, tar-seq (sequence) entry for the PDU to the LDB. If the tar-seq is zero, a timer associated with the LDB entry is started using the provisionable LDB entry timer on the node view OSI > TARP > Config tab. If a match exists, the tar-seq is compared to the LDB entry. If the tar-seq is not zero and is less than or equal to the LDB entry, the PDU is discarded. If the tar-seq is greater than the LDB entry, the PDU is processed and the tar-seq field in the LDB entry is updated with the new value. The Cisco ONS 15310-MA SDH LDB holds approximately 500 entries. The LDB is flushed periodically based on the time set in the LDB Flush timer on the node view OSI > TARP > Config tabs.

8.6.5.3 Manual TARP Adjacencies

TARP adjacencies can be manually provisioned in networks where ONS 15310-MA SDH nodes must communicate across routers or non-SDH NEs that lack TARP capability. In CTC, manual TARP adjacencies are provisioned on the node view Provisioning > OSI > TARP > MAT (Manual Area Table) subtab. The manual adjacency causes a TARP request to hop through the general router or non-SDH NE, as shown in Figure 8-17.

Figure 8-17 Manual TARP Adjacencies



8.6.5.4 Manual TID to NSAP Provisioning

TIDs can be manually linked to NSAPs and added to the TDC. Static TDC entries are similar to static routes. For a specific TID, you force a specific NSAP. Resolution requests for that TID always return that NSAP. No TARP network propagation or instantaneous replies are involved. Static entries allow you to forward TL1 commands to NEs that do not support TARP. However, static TDC entries are not dynamically updated, so outdated entries are not removed after the TID or the NSAP changes on the target node.

8.6.6 OSI Virtual Routers

The ONS 15310-MA SDH support one OSI virtual router. The router is provisioned on the Provisioning > OSI > Routers tabs. The router has an editable manual area address and a unique NSAP System ID that is set to the node MAC address. The router can be enabled and connected to different OSI routing areas. The Router 1 manual area address and System ID create the NSAP address assigned to the node's TID. Router 1 supports OSI TARP and tunneling functions. These include:

- TARP data cache
- IP-over-CLNS tunnels
- LAN subnet

In addition to the primary manual area address, you can also create two additional manual area addresses. These manual area addresses can be used to:

- Split up an area—Nodes within a given area can accumulate to a point that they are difficult to manage, cause excessive traffic, or threaten to exceed the usable address space for an area. Additional manual area addresses can be assigned so that you can smoothly partition a network into separate areas without disrupting service.
- Merge areas—Use transitional area addresses to merge as many as three separate areas into a single area that shares a common area address.
- Change to a different address—You might need to change an area address for a particular group of nodes. Use multiple manual area addresses to allow incoming traffic intended for an old area address to continue being routed to associated nodes.

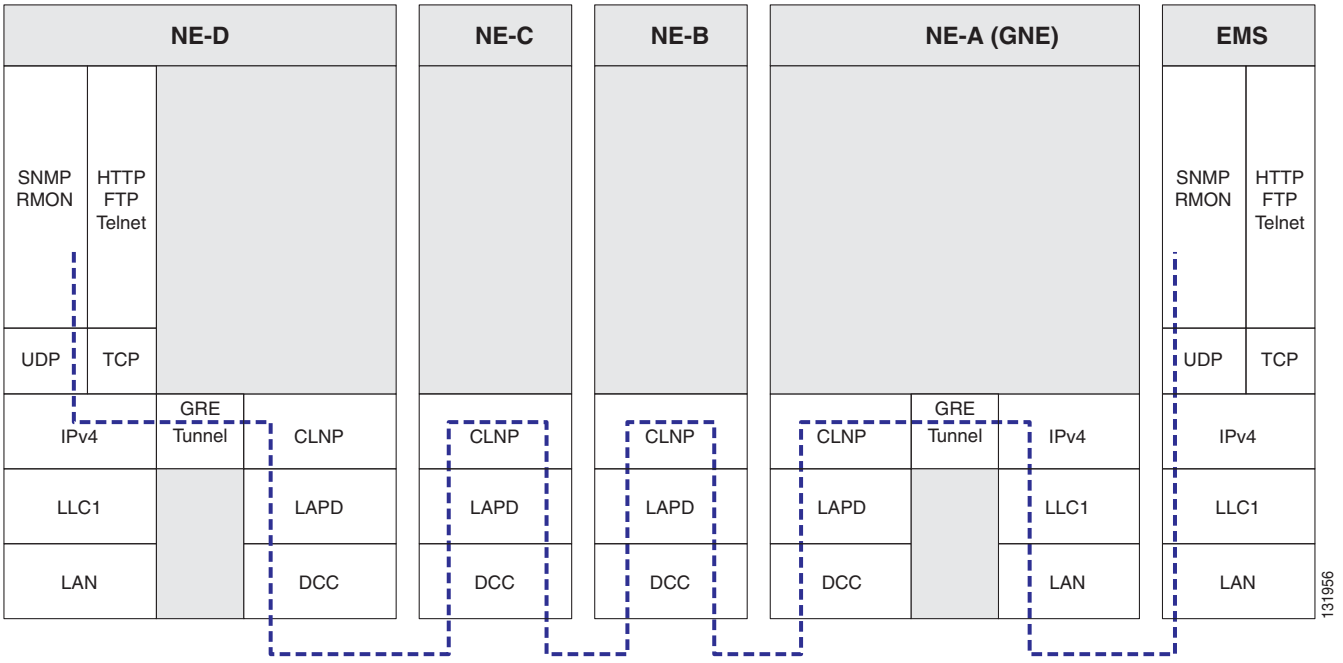
8.6.7 IP-over-CLNS Tunnels

IP-over-CLNS tunnels are used to encapsulate IP for transport across OSI NEs. The ONS 15310-MA SDH supports two tunnel types:

- GRE—Generic Routing Encapsulation is a tunneling protocol that encapsulates one network layer for transport across another. GRE tunnels add both a CLNS header and a GRE header to the tunnel frames. GRE tunnels are supported by Cisco routers and some other vendor NEs.
- Cisco IP—The Cisco IP tunnel directly encapsulates the IP packet with no intermediate header. Cisco IP is supported by most Cisco routers.

Figure 8-18 shows the protocol flow when an IP-over-CLNS tunnel is created through four NEs (A, B, C, and D). The tunnel ends are configured on NEs A and D, which support both IP and OSI. NEs B and C only support OSI, so they only route the OSI packets.

Figure 8-18 IP-over-CLNS Tunnel Flow



8.6.7.1 Provisioning IP-over-CLNS Tunnels

IP-over-CLNS tunnels must be carefully planned to prevent nodes from losing visibility or connectivity. Before you begin a tunnel, verify that the tunnel type, either Cisco IP or GRE, is supported by the equipment at the other end. Always verify IP and NSAP addresses. Provisioning of IP-over-CLNS tunnels in CTC is performed on the node view Provisioning > OSI > IP over CLNS Tunnels tab. For procedures, see the "Turn Up a Node" chapter in the *Cisco ONS 15310-MA SDH Procedure Guide*.

Provisioning IP-over-CLNS tunnels on Cisco routers requires the following prerequisite tasks, as well as other OSI provisioning:

- (Required) Enable IS-IS
- (Optional) Enable routing for an area on an interface
- (Optional) Assign multiple area addresses
- (Optional) Configure IS-IS interface parameters
- (Optional) Configure miscellaneous IS-IS parameters

The Cisco IOS commands used to create IP-over-CLNS tunnels (CTunnels) are shown in Table 8-13.

Table 8-13 IP Over CLNS Tunnel Cisco IOS Commands

Step	Step	Purpose
1	Router (config) # **interface ctunnel** *interface-number*	Creates a virtual interface to transport IP over a CLNS tunnel and enters interface configuration mode. The interface number must be unique for each CTunnel interface.
2	Router (config-if # **ctunnel destination** *remote-nsap-address*	Configures the destination parameter for the CTunnel. Specifies the destination NSAP1 address of the CTunnel, where the IP packets are extracted.
3	Router (config-if) # **ip address** *ip-address mask*	Sets the primary or secondary IP address for an interface.

If you are provisioning an IP-over-CLNS tunnel on a Cisco router, always follow procedures provided in the Cisco IOS documentation for the router you are provisioning. For information about ISO CLNS provisioning including IP-over-CLNS tunnels, refer to the "Configuring ISO CLNS" chapter in the *Cisco IOS Apollo Domain, Banyon VINES, DECnet, ISO CLNS, and XNS Configuration Guide*.

8.6.7.2 IP Over CLNS Tunnel Scenario 1: ONS Node to Other Vendor GNE

Figure 8-19 shows an IP-over-CLNS tunnel created from an ONS node to another vendor GNE. The other vendor NE has an IP connection to an IP DCN to which a CTC computer is attached. An OSI-only (LAP-D) RS-DCC and a GRE tunnel are created between the ONS NE 1 to the other vender GNE.

IP-over-CLNS tunnel provisioning on the ONS NE 1:

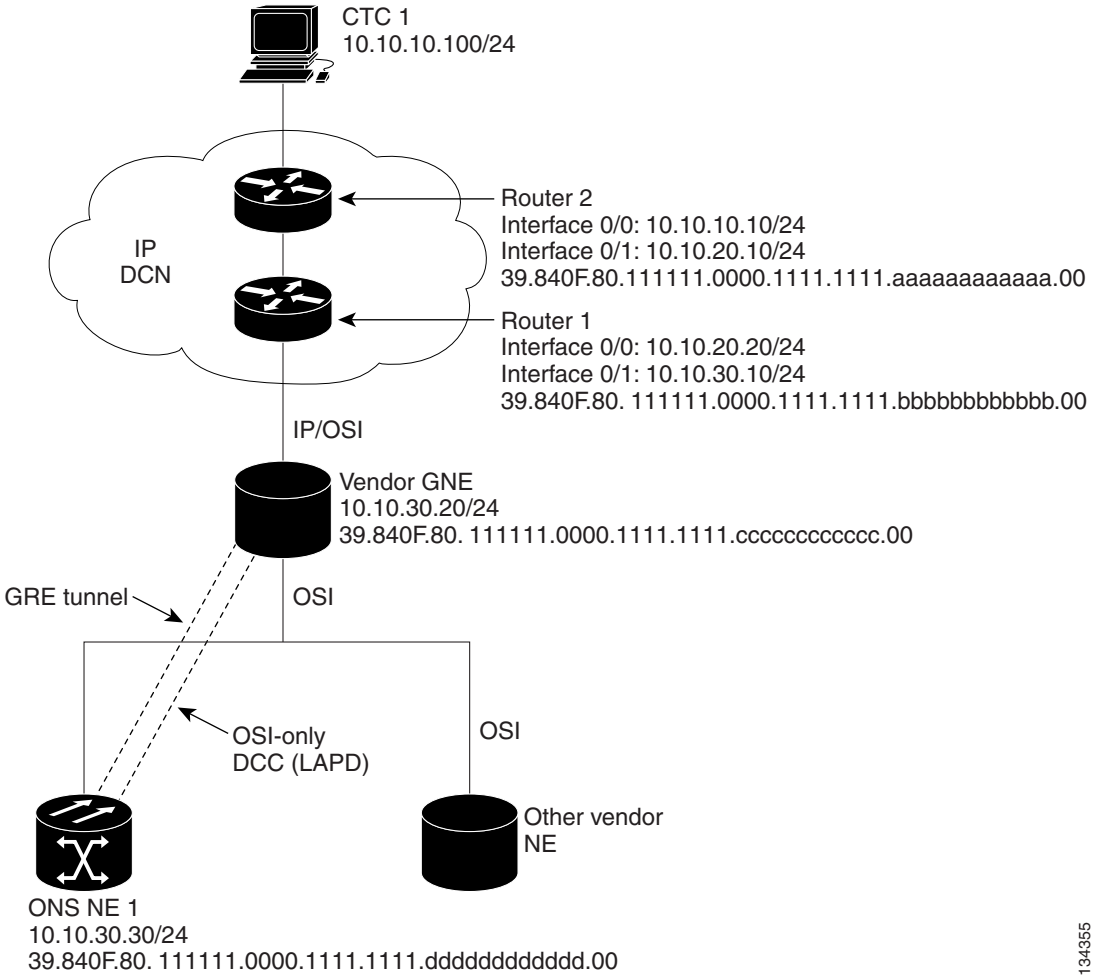
- Destination: 10.10.10.100 (CTC 1)
- Mask: 255.255.255.255 for host route (CTC 1 only), or 255.255.255.0 for subnet route (all CTC computers residing on the 10.10.10.0 subnet)
- NSAP: 39.840F.80.1111.0000.1111.1111.ccccccccccc.00 (other vendor GNE)
- Metric: 110

- Tunnel Type: GRE

IP-over-CLNS tunnel provisioning on the other vender GNE:

- Destination: 10.20.30.30 (ONS NE 1)
- Mask: 255.255.255.255 for host route (ONS NE 1 only), or 255.255.255.0 for subnet route (all ONS nodes residing on the 10.30.30.0 subnet)
- NSAP: 39.840F.80.1111.0000.1111.1111.ddddddddddd.00 (ONS NE 1)
- Metric: 110
- Tunnel Type: GRE

Figure 8-19 IP Over CLNS Tunnel Scenario 1: ONS NE to Other Vender GNE



8.6.7.3 IP-Over-CLNS Tunnel Scenario 2: ONS Node to Router

Figure 8-20 shows an IP-over-CLNS tunnel from an ONS node to a router. The other vendor NE has an OSI connection to a router on an IP DCN, to which a CTC computer is attached. An OSI-only (LAP-D) RS-DCC is created between the ONS NE 1 and the other vender GNE. The OSI-over-IP tunnel can be either the Cisco IP tunnel or a GRE tunnel, depending on the tunnel types supported by the router.

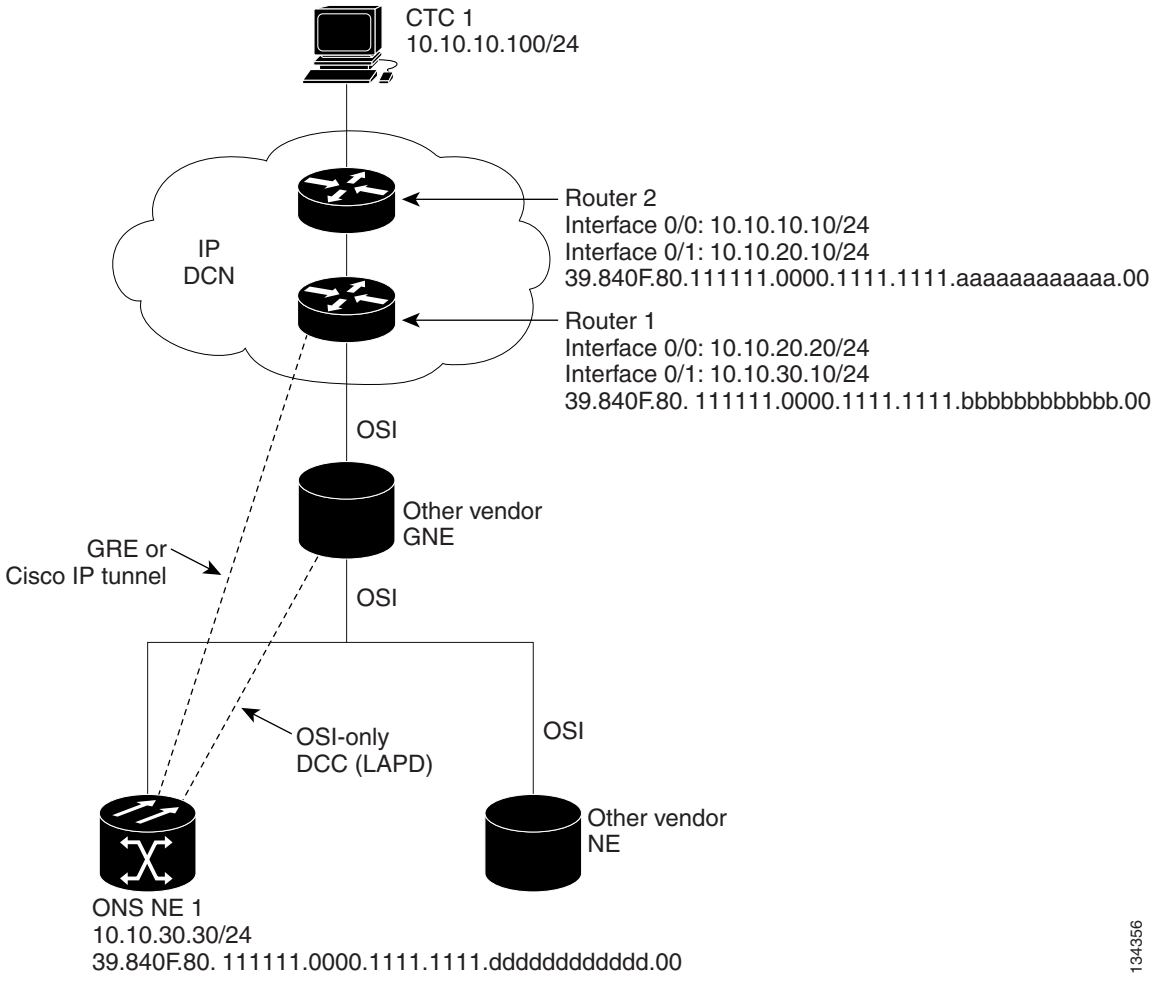
IP-over-CLNS tunnel provisioning on ONS NE 1:

- Destination: 10.10.30.10 (Router 1, Interface 0/1)
- Mask: 255.255.255.255 for host route (Router 1 only), or 255.255.255.0 for subnet route (all routers on the same subnet)
- NSAP: 39.840F.80.1111.0000.1111.1111.bbbbbbbbbbbb.00 (Router 1)
- Metric: 110
- Tunnel Type: Cisco IP

CTunnel (IP over CLNS) provisioning on Router 1:

```
ip routing
clns routing
interface ctunnel 102
    ip address 10.10.30.30 255.255.255.0
    ctunnel destination 39.840F.80.1111.0000.1111.1111.dddddddddddd.00
interface Ethernet0/1
    clns router isis
router isis
    net 39.840F.80.1111.0000.1111.1111.bbbbbbbbbbbb.00
```

Figure 8-20 IP-Over-CLNS Tunnel Scenario 2: ONS Node to Router



8.6.7.4 IP-Over-CLNS Tunnel Scenario 3: ONS Node to Router Across an OSI DCN

Figure 8-21 shows an IP-over-CLNS tunnel from an ONS node to a router across an OSI DCN. The other vendor NE has an OSI connection to an IP DCN to which a CTC computer is attached. An OSI-only (LAP-D) RS-DCC is created between the ONS NE 1 and the other vender GNE. The OSI-over-IP tunnel can be either the Cisco IP tunnel or a GRE tunnel, depending on the tunnel types supported by the router.

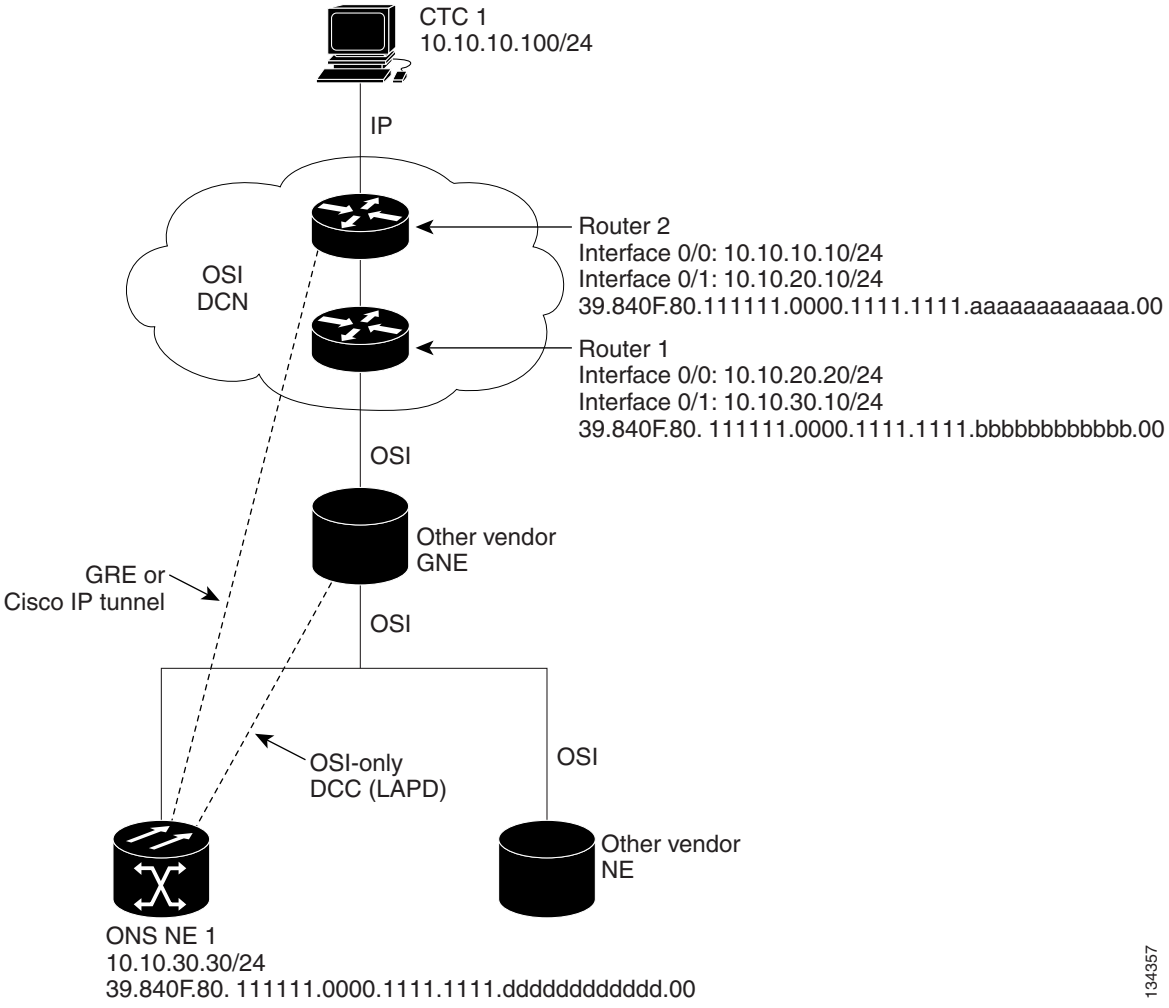
IP-over-CLNS tunnel provisioning on ONS NE 1:

- Destination: Router 2 IP address
- Mask: 255.255.255.255 for host route (CTC 1 only), or 255.255.255.0 for subnet route (all CTC computers on the same subnet)
- NSAP: Other vender GNE NSAP address
- Metric: 110
- Tunnel Type: Cisco IP

IP-over-OSI tunnel provisioning on Router 2 (sample Cisco IOS provisioning):

```
ip routing
clns routing
interface ctunnel 102
    ip address 10.10.30.30 255.255.255.0
    ctunnel destination 39.840F.80.1111.0000.1111.1111.dddddddddddd.00
interface Ethernet0/1
    clns router isis
router isis
    net 39.840F.80.1111.0000.1111.1111.aaaaaaaaaaaa.00
```

Figure 8-21 IP-Over-CLNS Tunnel Scenario 3: ONS Node to Router Across an OSI DCN



8.6.8 Provisioning OSI in CTC

Table 8-14 shows the OSI actions that can be performed in CTC using the node view Provisioning tab. Refer to the *Cisco ONS 15310-MA SDH Procedure Guide* for OSI procedures and tasks.

Table 8-14 OSI Actions from the CTC Node View Provisioning Tab

Tab	Actions
OSI > Main Setup	• View and edit Primary Area Address. • Change OSI routing mode. • Change LSP buffers.
OSI > TARP > Config	Configure the TARP parameters: • PDU L1/L2 propagation and origination. • TARP data cache and loop detection buffer. • LAN storm suppression. • Type 4 PDU on startup. • TARP timers: LDB, E1, T2, DS3/E3, T4.
OSI > TARP > Static TDC	Add and delete static TARP data cache entries.
OSI > TARP > MAT	Add and delete static manual area table entries.
OSI > Routers > Setup	• Enable and disable routers. • Add, delete, and edit manual area addresses.
OSI > Routers > Subnets	Edit RS-DCC, MS-DCC, and LAN subnets that are provisioned for OSI.
OSI > Tunnels	Add, delete, and edit Cisco and IP-over-CLNS tunnels.
Comm Channels > RS-DCC	• Add OSI configuration to an RS-DCC. • Choose the data link layer protocol, PPP or LAP-D.
Comm Channels > MS-DCC	• Add OSI configuration to an RS-DCC.

Table 8-15 shows the OSI actions that can be performed in CTC using the node view Maintenance tab.

Table 8-15 OSI Actions from the CTC Maintenance Tab

Tab	Actions
OSI > ISIS RIB	View the IS-IS routing table.
OSI > ESIS RIB	View ESs that are attached to ISs.
OSI > TDC	• View the TARP data cache and identify static and dynamic entries. • Perform TID to NSAP resolutions. • Flush the TDC.

8.7 IPv6 Network Compatibility

IPv6 simplifies IP configuration and administration and has a larger address space than IPv4 to support the future growth of the Internet and Internet related technologies. It uses 128-bit addresses as against the 32-bit used in IPv4 addresses. Also, IPv6 gives more flexibility in designing newer addressing architectures.

Cisco ONS 15310-MA SDH can function in an IPv6 network when an Internet router that supports Network Address Translation-Protocol Translation (NAT-PT) is positioned between the GNE, such as an ONS 15310-MA SDH, and the client workstation. NAT-PT is a migration tool that helps users transition from IPv4 networks to IPv6 networks. NAT-PT is defined in RFC-2766. IPv4 and IPv6 nodes communicate with each other using NAT-PT by allowing both IPv6 and IPv4 stacks to interface between the IPv6 DCN and the IPv4 DCC networks.

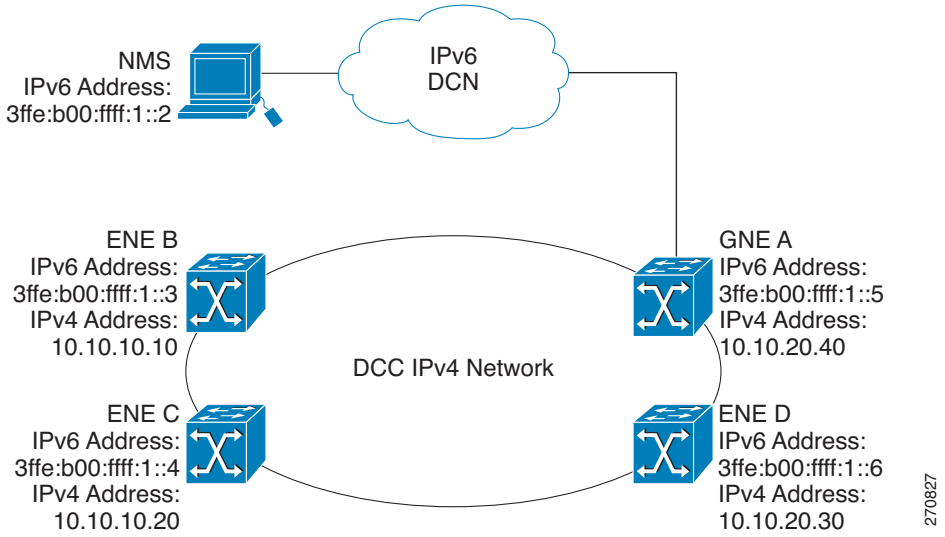
8.8 IPv6 Native Support

Cisco ONS 15310-MA SDH Software R9.0 and later supports native IPv6. ONS 15310-MA SDH can be managed over IPv6 DCN networks by enabling the IPv6 feature. After you enable IPv6 in addition to IPv4, you can use CTC, TL1, and SNMP over an IPv6 DCN to manage ONS 15310-MA SDH. Each NE can be assigned an IPv6 address in addition to the IPv4 address. You can access the NE by entering the IPv4 address, an IPv6 address or the DNS name of the device. The IPv6 address is assigned only on the LAN interface of the NE. DCC/GCC interfaces use the IPv4 address.

By default, when IPv6 is enabled, the node processes both IPv4 and IPv6 packets on the LAN interface. If you want to process only IPv6 packets, you need to disable IPv4 on the node. Before you disable IPv4, ensure that IPv6 is enabled and the node is not in multishelf mode.

Figure 8-22 shows how an IPv6 DCN interacts with and IPv4 DCC.

Figure 8-22 IPv6-IPv4 Interaction



You can manage MSTP multishelf nodes over IPv6 DCN. RADIUS, FTP, SNTP, and other network applications support IPv6 DCN. To enable IPv6 addresses, you need to make the necessary configuration changes from the CTC or TL1 management interface. After you enable IPv6, you can start a CTC or TL1 session using the provisioned IPv6 address. The ports used for all IPv6 connections to the node are the same as the ports used for IPv4.

An NE can either be in IPv6 mode or IPv4 mode. In IPv4 mode, the LAN interface does not have an IPv6 address assigned to it. An NE, whether it is IPv4 or IPv6, has an IPv4 address and subnet mask. TCC2/TCC2P cards do not reboot automatically when you provision an IPv6 address, but a change in IPv4 address initiates a TCC2/TCC2P card reset. Table 8-16 describes the differences between an IPv4 node and an IPv6 node.

Table 8-16 Differences Between an IPv6 Node and an IPv4 Node

IPv6 Node	IPv4 Node
Has both IPv6 address and IPv4 address assigned to its craft Ethernet interface.	Does not have an IPv6 address assigned to its craft Ethernet interface.
The default router has an IPv6 address for IPv6 connectivity, and an IPv4 address for IPv4 connectivity.	The default router has an IPv4 address.
Cannot enable OSPF on LAN. Cannot change IPv4 NE to IPv6 NE if OSPF is enabled on the LAN.	Can enable OSPF on the LAN.
Cannot enable RIP on the LAN. Cannot change IPv4 NE to IPv6 NE if RIP is enabled on the LAN.	Can enable static routes/RIP on the LAN.
Not supported on static routes, proxy tunnels, and firewall tunnels.	Supported on static routes, proxy tunnels, and firewall tunnels.
Routing decisions are based on the default IPv6 router provisioned.	

8.8.1 IPv6 Enabled Mode

The default IP address configured on the node is IPv4. You can use either CTC or the TL1 management interface to enable IPv6. For more information about enabling IPv6 from the CTC interface, see the *Cisco ONS 15310-MA SDH Procedure Guide*. For more information about enabling IPv6 using TL1 commands, see the *Cisco ONS 15454 SDH, Cisco ONS 15600 SDH, and Cisco ONS 15310 MA SDH TL1 Command Guide*.

8.8.2 IPv6 Disabled Mode

You can disable IPv6 either from the CTC or from the TL1 management interface. For more information about disabling IPv6 from the CTC interface, see the *Cisco ONS 15310-MA SDH Procedure Guide*. For more information about disabling IPv6 using TL1 commands, see the *Cisco ONS 15454 SDH, Cisco ONS 15600 SDH, and Cisco ONS 15310 MA SDH TL1 Command Guide*.

8.8.3 IPv6 in Non-secure Mode

In non-secure mode, IPv6 is supported on the front and the rear Ethernet interfaces. You can start a CTC or TL1 session using the IPv6 address provisioned on the on the front and rear ports of the NE.

8.8.4 IPv6 in Secure Mode

In secure mode, IPv6 is only supported on the rear Ethernet interface. The front port only supports IPv4 even if it is disabled on the rear Ethernet interface. For more information about provisioning IPv6 addresses in secure mode, see the *Cisco ONS 15310-MA SDH Procedure Guide*.

8.8.5 IPv6 Limitations

IPv6 has the following configuration restrictions:

- You can provision an NE as IPv6 enabled only if the node is a SOCKS-enabled or firewall-enabled GNE/ENE.
- IPSec is not supported.
- OSPF/RIP cannot be enabled on the LAN interface if NE is provisioned as an IPv6 node.
- Static route/firewall/proxy tunnel provisioning is applicable only to IPv4 addresses even if the IPv6 is enabled.
- In secure mode, IPv6 is supported only on the rear Ethernet interface. IPv6 is not supported on the front port.
- ONS platforms use NAT-PT internally for providing IPv6 native support. NAT-PT uses the IPv4 address range 128.x.x.x for packet translation. Do not use the 128.x.x.x address range when you enable IPv6 feature.

8.9 FTP Support for ENE Database Backup

The Cisco ONS 15310-MA SDH provides FTP database backup and restore download to ENEs when proxy/firewall is enabled. This feature allows you to provision a list of legal FTP hosts in CTC, that can be used with TL1 commands to perform database backup/restore or software download. The FTP hosts can be provisioned to elapse after a specified time interval with the enable FTP relay function.

Once FTP host are provisioned, and FTP Relay is enabled, TL1 users can then use the COPY-RFILE command to perform database backup/restore or software download to and from this list of legal FTP hosts that are provisioned to ENEs. Also, TL1 supports TID to IP address translation for the GNE TID that is specified in the FTP URL of COPY-RFILE and COPY-IOSCFG commands.

Using the FTP Host provisioning feature in CTC and TL1 you can configure up to 12 valid FTP hosts.

ENEs are allowed access through the firewall according to the time configured in the FTP Relay Timer in CTC or TL1. The time interval is 1 to 60 minutes, and once the timer elapses, all FTP access to the FTP host is blocked again. A time of 0 disallows ENE access to FTP commands through the firewall.

When the firewall is not enabled (Proxy only), all FTP operations to the ENE will be allowed – software download, database backup/restore and IOS config file backup/restore. All FTP operations to the ENEs will be blocked when firewall is enabled.

CHAPTER 9

SDH Topologies and Upgrades

Note The terms "Unidirectional Path Switched Ring" and "UPSR" may appear in Cisco literature. These terms do not refer to using Cisco ONS 15xxx products in a unidirectional path switched ring configuration. Rather, these terms, as well as "Path Protected Mesh Network" and "PPMN," refer generally to Cisco's path protection feature, which may be used in any topological network configuration. Cisco does not recommend using its path protection feature in any particular topological network configuration.

This chapter explains Cisco ONS 15310-MA SDH topologies and upgrades. To provision topologies, refer to the *Cisco ONS 15310-MA SDH Procedure Guide*.

Chapter topics include:

9.1 Subnetwork Connection Protection Configurations

Subnetwork Connection Protection (SNCP) configurations provide duplicate fiber paths around the ring. Working traffic flows in one direction and protection traffic flows in the opposite direction. If a problem occurs with the working traffic path, the receiving node switches to the path coming from the opposite direction.

CTC automates ring configuration. Subnetwork Connection Protection traffic is defined within the ONS 15310-MA SDH on a circuit-by-circuit basis. If a path-protected circuit is not defined within a 1+1 line protection scheme and Subnetwork Connection Protection is available and specified, CTC uses Subnetwork Connection Protection as the default.

A Subnetwork Connection Protection circuit requires two data communications channel (DCC)-provisioned optical spans per node. Subnetwork Connection Protection circuits can be created across these spans until their bandwidth is consumed.

Note If a Subnetwork Connection Protection circuit is created manually by TL1, DCCs are not needed. Therefore, Subnetwork Connection Protection circuits are limited by the cross-connection bandwidth or the span bandwidth, but not by the number of DCCs.

Because each traffic path is transported around the entire ring, Subnetwork Connection Protection configurations are best suited for networks where traffic concentrates at one or two locations and is not widely distributed. Subnetwork Connection Protection capacity is equal to its bit rate. Services can originate and terminate on the same Subnetwork Connection Protection configuration, or they can be passed to an adjacent access or interoffice ring for transport to the service-terminating location.

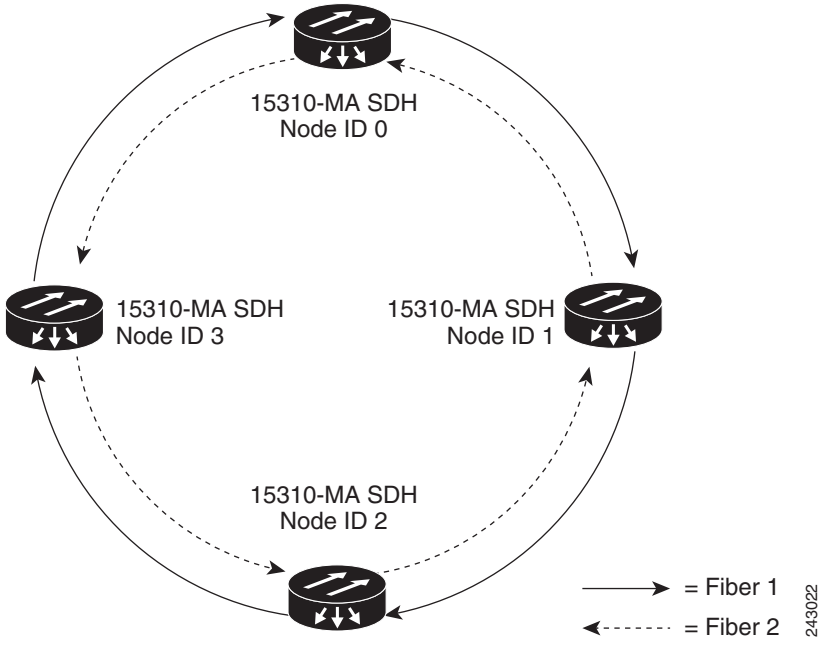
9.1.1 Subnetwork Connection Protection Bandwidth

The span bandwidth consumed by a Subnetwork Connection Protection circuit is two times the circuit bandwidth, because the circuit is duplicated. The cross-connection bandwidth consumed by a Subnetwork Connection Protection circuit is three times the circuit bandwidth at the source and destination nodes only. For the ONS 15310-MA SDH, the spans can be STM1, STM4, or STM16.

9.1.2 Subnetwork Connection Protection Application Example

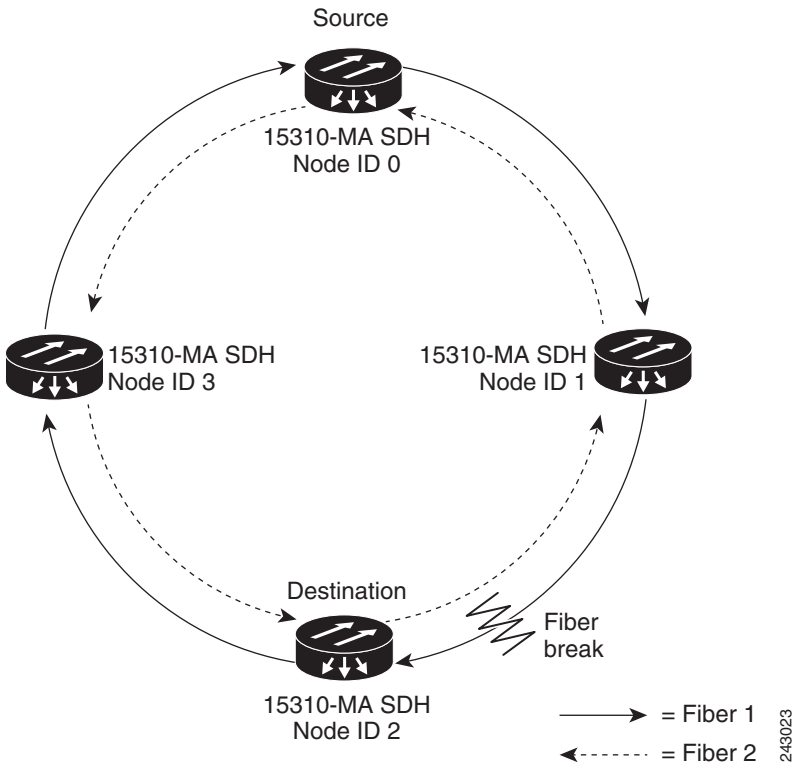
Figure 9-1 shows a basic Subnetwork Connection Protection configuration. If Node ID 0 sends a signal to Node ID 2, the working signal travels on the working traffic path through Node ID 1. The same signal is also sent on the protect traffic path through Node ID 3.

Figure 9-1 Basic Four-Node SNCP Ring



If a fiber break occurs (Figure 9-2), Node ID 2 switches its active receiver to the protect signal coming through Node ID 3.

Figure 9-2 Subnetwork Connection Protection with a Fiber Break



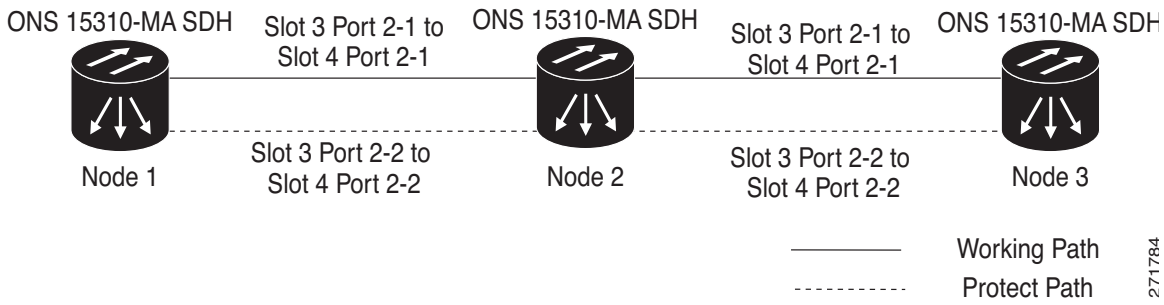
9.2 Terminal Point-to-Point and Linear ADM Configurations

You can configure Cisco ONS 15310-MAs in a terminal point-to-point network (two nodes) or as a line of add/drop multiplexers (ADMs) (3 or more nodes) by configuring the STMN ports as the working path and a second set as the protect path. Unlike rings, terminal and linear ADMs require that the STMN port at each node be in 1+1 protection to ensure that a break to the working line is automatically routed to the protect line.

Note In a linear ADM configuration, two STMN ports in 1+1 protection are connected to two STMN ports in 1+1 protection on a second node. On the second node, two more STMN ports are connected to a third node. The third node can be connected to a fourth node, and so on, depending on the number of nodes in the linear ADM. The 15310-MA SDH has four optical ports, so it can operate either as a terminal or intermediate node in a linear ADM network.

Figure 9-3 shows three ONS 15310-MAs in a linear ADM configuration. In this example, working traffic flows from Node 1/Slot 3/Port 2-1 to Node 2/Slot 4/Port 2-1, and from Node 2/Slot 3/Port 2-1 to the Node 3/Slot 4/Port 2-1. You create the protect path by placing Slot 3/Port 2-1 in 1+1 protection with Slot 4/Port 2-2 at Nodes 1 through 3.

Figure 9-3 ONS 15310-MA SDH Linear ADM Configuration



9.3 Interoperability

The ONS 15310-MA SDH supports up to four SDH SDCCs and two Subnetwork Connection Protection configurations per node. You can install ONS 15310-MA SDH nodes into a network comprised entirely of ONS 15310-MA nodes or into a network that has a mix of ONS 15310-MA SDH, and ONS 15454 nodes. The ONS 15310-MA SDH nodes interoperate with the ONS 15454 nodes in linear or Subnetwork Connection Protection configurations. Because connection procedures for these types of nodes are the same (for example, adding or dropping nodes from a Subnetwork Connection Protection or linear configuration, or creating DCCs), follow the instructions in the "Add and Remove Nodes" chapter of the *Cisco ONS 15310-MA SDH Procedure Guide* whenever you make connections between ONS 15310-MA SDH, and ONS 15454 nodes.

9.3.1 Subtending Rings

Subtending rings reduce the number of nodes and cards required and reduce external shelf-to-shelf cabling. Figure 9-4 shows an ONS 15454 SDH with two subtending rings using ONS 15310-MA SDH nodes.

Figure 9-4 ONS 15454 SDH with Two ONS 15310-MA SDH Nodes Subtending Linear Multiplex Section Protection Configurations

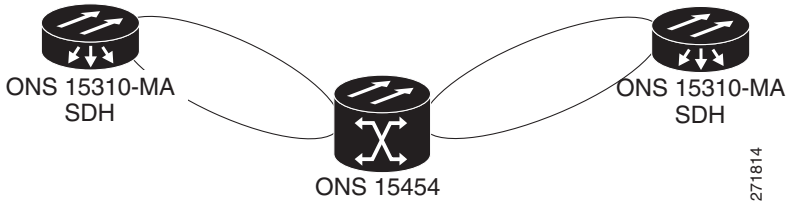


Figure 9-5 shows an ONS 15310-MA SDH with two subtending rings Linear Multiplex Section Protection configurations.

Figure 9-5 ONS 15310-MA SDH with Two Subtending Linear Multiplex Section Protection Configurations

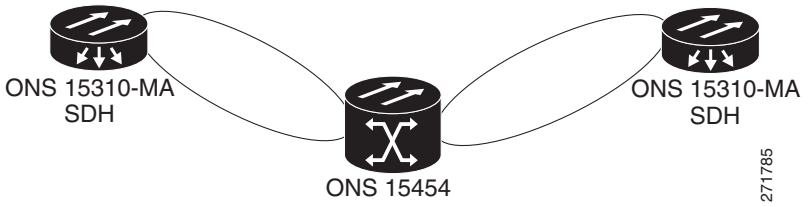
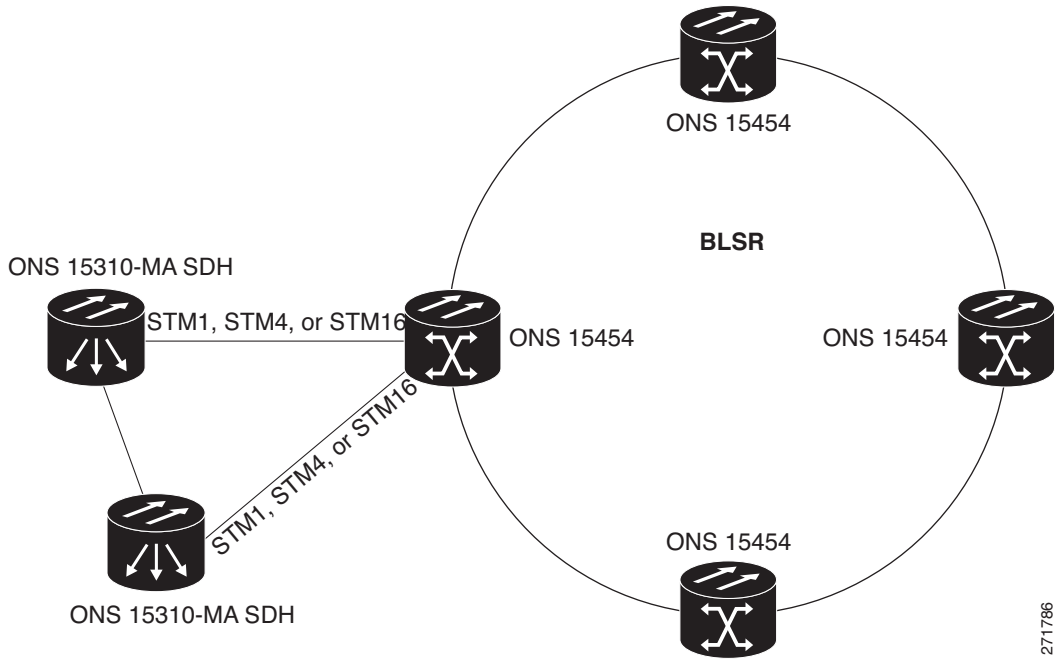


Figure 9-6 shows a ring of ONS 15310-MA SDH nodes subtended from a ring of ONS 15454 nodes.

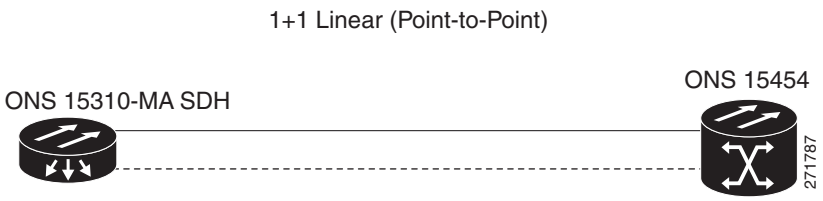
Figure 9-6 ONS 15310-MA SDH Ring Subtended from an ONS 15454 Ring



9.3.2 Linear Connections

Figure 9-7 shows a basic linear or Linear Multiplex Section Protection connection between ONS 15454 nodes.

Figure 9-7 Linear or Linear Multiplex Section Protection Connection Between ONS 15454 and ONS 15310-MA SDH Nodes



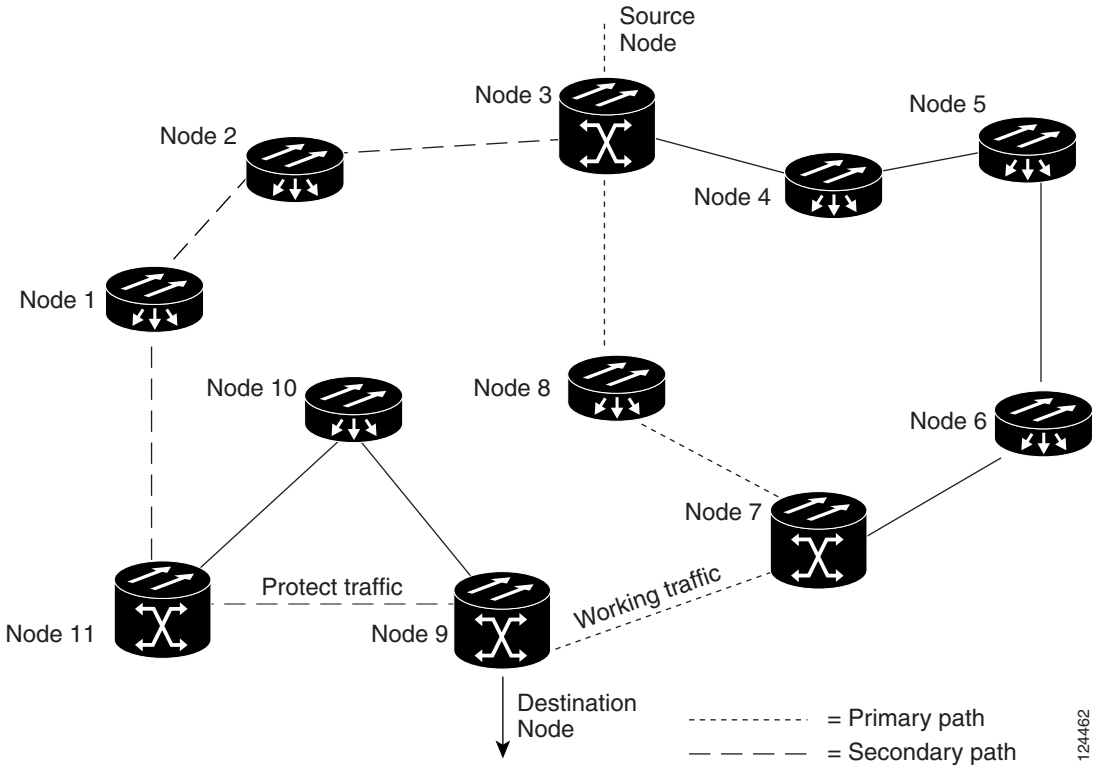
9.4 Path-Protected Mesh Networks

In addition to single Linear Multiplex Section Protection (LMSP) configurations, terminal point-to-point or linear ADMs, you can extend ONS 15310-MA SDH traffic protection by creating path-protected mesh networks (PPMNs). PPMNs include multiple ONS 15310-MA SDH topologies and extend the protection provided by a single LMSP configuration to the meshed architecture of several interconnecting rings. In a PPMN, circuits travel diverse paths through a network of single or multiple meshed rings. When you create circuits, CTC can automatically route circuits across the PPMN or you can manually route them. You can also choose levels of circuit protection. For example, if you choose full protection, CTC creates an alternate route for the circuit in addition to the main route. The second route follows a unique path through the network between the source and destination and sets up a second set of cross-connections.

For example, in Figure 9-8, a circuit is created from the ONS 15454 shown at Node 3 to the ONS 15454 shown at Node 9. CTC determines that the shortest route between the two nodes passes through Node 8 and Node 7, shown by the dotted line, and automatically creates cross-connections at Nodes 3, 8, 7, and 9 to provide the primary circuit path.

If full protection is selected, CTC creates a second unique route between Nodes 3 and 9 which, in this example, passes through Nodes 2, 1, and 11. Cross-connections are automatically created at Nodes 3, 2, 1, 11, and 9, shown by the dashed line. If a failure occurs on the primary path, traffic switches to the second circuit path. In this example, Node 9 switches from the traffic coming in from Node 7 to the traffic coming in from Node 11 and service resumes. The switch occurs within 50 ms.

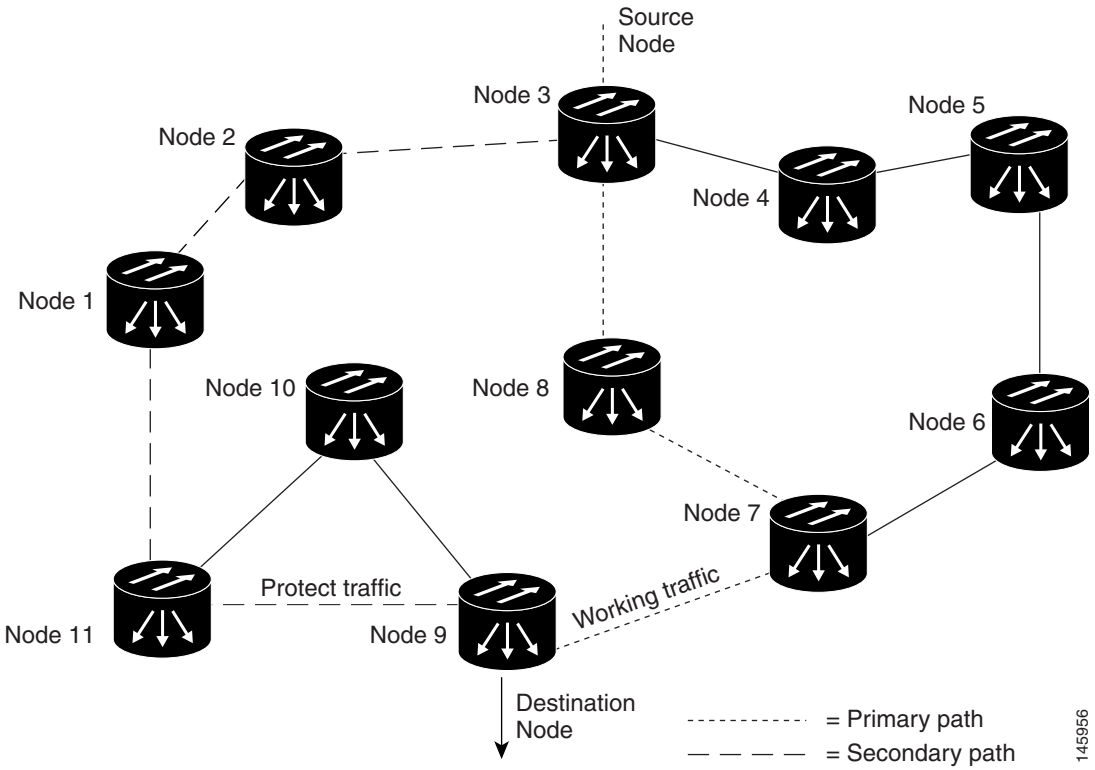
Figure 9-8 Path-Protected Mesh Network for ONS 15310-MA SDH Nodes



For example, in Figure 9-9, a circuit is created from Node 3 to Node 9. CTC determines that the shortest route between the two nodes passes through Node 8 and Node 7, shown by the dotted line, and automatically creates cross-connections at Nodes 3, 8, 7, and 9 to provide the primary circuit path.

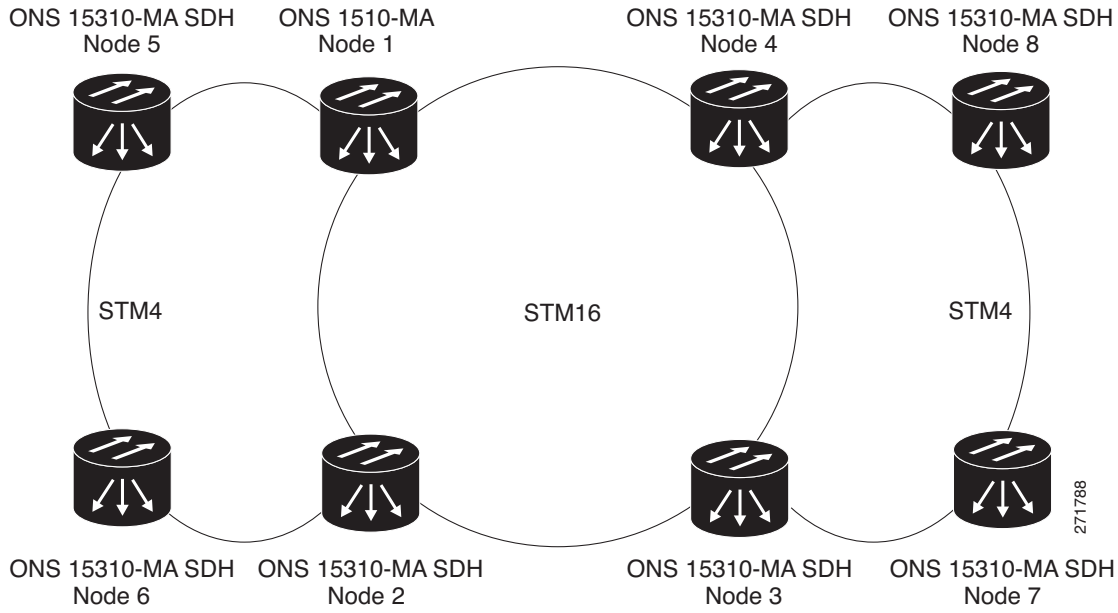
If full protection is selected, CTC creates a second unique route between Nodes 3 and 9 which, in this example, passes through Nodes 2, 1, and 11. Cross-connections are automatically created at Nodes 3, 2, 1, 11, and 9, shown by the dashed line. If a failure occurs on the primary path, traffic switches to the second circuit path. In this example, Node 9 switches from the traffic coming in from Node 7 to the traffic coming in from Node 11 and service resumes. The switch occurs within 50 ms.

Figure 9-9 Path-Protected Mesh Network for ONS 15310-MA SDH Nodes



PPMN also allows spans with different SDH speeds to be mixed together in "virtual rings." Figure 9-10 shows an ONS 15310-MA SDH with Nodes 1, 2, 3, and 4 in a standard STM16 ring. Nodes 5, 6, 7, and 8 link to the backbone ring through the STM4 fiber. The virtual ring formed by Nodes 5, 6, 7, and 8 use both the STM16 and STM4 cards.

Figure 9-10 Virtual Ring for ONS 15310-MA SDH



9.5 Four Node Configurations

You can link multiple ONS 15310-MA SDH nodes using their STMN ports (also known as creating a fiber-optic bus) to accommodate more access traffic than a single ONS 15310-MA SDH can support. You can link nodes with STMN fiber spans as you would link any other two network nodes. The nodes can be grouped in one facility to aggregate more local traffic.

9.6 STMN Speed Upgrades

A span is the optical fiber connection between two ONS 15310-MA SDH nodes. In a span (optical speed) upgrade, the transmission rate of a span is upgraded from an STM1 to STM4 signal (ONS 15310-MA SDH), from an STM4 to STM16 signal (ONS 15310-MA SDH only), or from an STM1 to STM16 signal (ONS 15310-MA SDH only), but all other span configuration attributes remain unchanged. With multiple nodes, a span upgrade is a coordinated series of upgrades on all nodes in the ring or protection group. The ONS 15310-MA SDH nodes support the span upgrade wizard if you are upgrading two ONS 15310-MAs with 1+1 protection from STM1 to STM4, STM4 to STM16, or STM1 to STM16.

To perform a span upgrade, the higher-rate pluggable port module (PPM) must replace the lower-rate PPM in the same slot. If you are using a multi-rate PPM, you do not need to physically replace the PPM. All spans in the network must be upgraded. The 1+1 protection configuration of the original lower-rate PPM is retained for the higher-rate PPM.

When performing span upgrades, Cisco recommends that you upgrade all spans in a network consecutively and in the same maintenance window. Until all spans are upgraded, mismatched PPM types will be present.

If you are upgrading two ONS 15310-MA SDH nodes with 1+1 protection from STM1 to STM4, STM4 to STM16, or STM1 to STM16, Cisco recommends using the Span Upgrade Wizard to perform span upgrades. Although you can also use the manual span upgrade procedures, the manual procedures are

mainly provided as error recovery for the wizard. The Span Upgrade Wizard and the manual span upgrade procedures require at least two technicians (one at each end of the span) who can communicate with each other during the upgrade. Upgrading a span is non-service affecting and will cause no more than three switches, each of which is less than 50 ms in duration. To initiate the span upgrade, right-click the span and choose Span Upgrade.

Note Span upgrades do not upgrade SDH topologies (for example, a 1+1 group to a Linear Multiplex Section Protection configuration). Refer to the "Convert Network Configurations" chapter of the *Cisco ONS 15310-MA SDH Procedure Guide* for topology upgrade procedures.

9.6.1 Span Upgrade Wizard

The Span Upgrade Wizard automates all steps in the manual 1+1 span upgrade procedure, if you are upgrading two ONS 15310-MA SDH nodes. The wizard can upgrade both lines of a 1+1 group. The Span Upgrade Wizard requires that spans have DCCs enabled.

The Span Upgrade Wizard provides no way to back out of an upgrade. In the case of an error, you must exit the wizard and initiate the manual procedure to either continue with the upgrade or back out of it. To continue with the manual procedure, examine the standing conditions and alarms to identify the stage in which the wizard failure occurred.

9.6.2 Manual Span Upgrades

Manual span upgrades are mainly provided as error recovery for the Span Upgrade Wizard, but they can be used to perform span upgrades. You can perform a manual span upgrade on a 1+1 protection group, if you are upgrading two ONS 15310-MA SDH nodes.

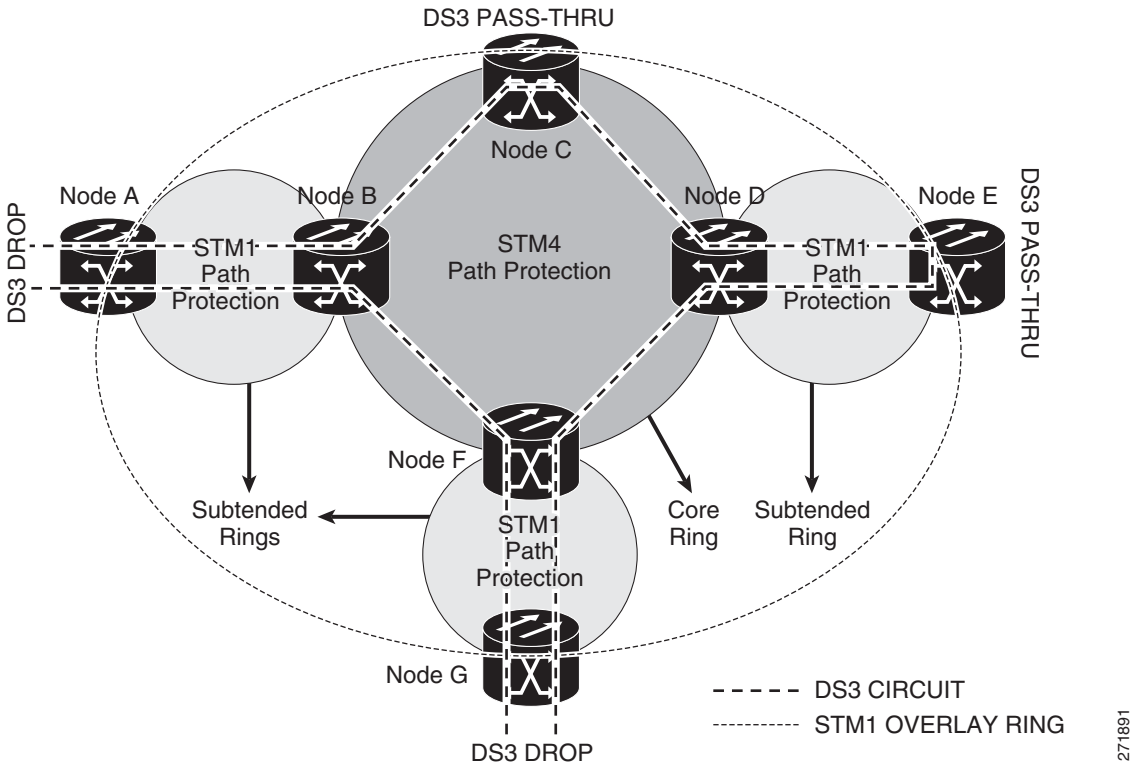
Downgrading can be performed to back out of a span upgrade. The procedure for downgrading is the same as upgrading except that you provision a lower-rate PPM (STM1 or STM4 for the 15310-MA SDH) and install a lower-rate PPM (if you are not using a multi-rate PPM). You cannot downgrade if circuits exist on the VCs that will be removed (the higher VCs).

9.7 Overlay Ring Circuits

An overlay ring configuration consists of a core ring and subtended rings (Figure 9-11). An Overlay Ring Circuit routes traffic around multiple rings in an overlay ring configuration, passing through one or more nodes more than once. This results in multiple cross-connections on the nodes connecting the core ring to the subtended rings. For example, a customer having a core ring with cross-connects provisioned using TL1 can create cross-connects on subtended rings, due to a business need, without having to hamper the existing cross-connects on the core ring. This circuit can be either protected or unprotected.

A typical path protected overlay ring configuration is shown in Figure 9-11, where the circuit traverses the nodes B, D, and F twice resulting in two cross-connections on these nodes for the same circuit. In Figure 9-11, the circuits on the STM4 path are unprotected. The DS3/E3 drop traffic is protected on the drop nodes by provisioning a primary and secondary destination, making it a path protected circuit.

Figure 9-11 Overlay Ring Circuit



Overlay ring supports circuit sizes; VC-3, VC4, VC4-2c, VC4-3c, VC4-4c, VC4-8c, VC4-12c, VC4-16c, and VC4-64c. Both unidirectional and bidirectional circuits are supported. Overlay ring circuits are contiguous concatenated (CCAT) and not virtual concatenated (VCAT) circuits.

Manual routing is mandatory while provisioning the overlay ring circuit. Overlay ring circuits created using Transaction Language 1 (TL1) are discovered by CTC and the status “DISCOVERED” is displayed.

If the overlay ring circuit is deleted, the cross-connects on the core ring and subtended rings get deleted. Cross-connects on a subtended ring can be deleted through TL1 but would reflect as a partial overlay ring circuit in CTC, i.e. core ring will continue having cross-connects.

CHAPTER 10

Alarm Monitoring and Management

This chapter describes Cisco Transport Controller (CTC) alarm management. To troubleshoot specific alarms, refer to the *Cisco ONS 15310-MA SDH Troubleshooting Guide*. Chapter topics include:

10.1 Overview

Cisco Transport Controller (CTC) detects and reports SDH alarms generated by the Cisco ONS 15310-MA SDH and the larger SDH network. You can use CTC to monitor and manage alarms at the card, node, or network level. You can set alarm severities in customized alarm profiles or suppress CTC alarm reporting. For a detailed description of the standard Telcordia categories employed by Optical Networking System (ONS) nodes, refer the *Cisco ONS 15310-MA SDH Procedure Guide.*

Note ONS 15310-MA SDH alarms can also be monitored and managed through Transaction Language One (TL1) or a network management system (NMS).

10.2 Viewing Alarms

You can use the Alarms tab to view card, node, or network-level alarms. This means that if a network problem causes two alarms, such as loss of frame (LOF) and loss of signal (LOS), CTC only shows the LOS alarm in this window because it supersedes LOF. (The LOF alarm can still be retrieved in the Conditions window.)

The Path Width column in the Alarms and Conditions tabs expands upon alarmed object information contained in the access identifier (AID) string (such as “VC-4-1-3”) by giving the number of synchronous transport signals (VCs) contained in the alarmed path. For example, the Path Width will tell you whether a Critical alarm applies to an VC3 or an VC4-16c. The column reports the width as a 1, 3, 6, 12, 48, etc. as appropriate, understood to be “VC-*N*.”

Table 10-1 lists the Alarms tab column headings and the information recorded in each column.

Table 10-1 Alarms Column Descriptions

Column	Information Recorded
New	Indicates a new alarm. To change this status, click either the Synchronize button or the Delete Cleared Alarms button.
Date	Date and time of the alarm.
Node	Shows the name of the node where the condition or alarm occurred. (Visible in network view.)
Object	TL1 AID for the alarmed object. For an VCMON-LP or VTmon, this is the monitored VC high-order path or VC low-order path object, which is explained in Table 10-3 on page 10-3.
Eqpt Type	Card type in this slot (appears only in network and node view).
Shelf	For DWDM configurations, the shelf where the alarmed object is located. Visible in network view.
Slot	Slot where the alarm occurred (appears only in network and node view).
Port	Port where the alarm is raised. For VCTRM-LP and VTTerm, the port refers to the upstream card it is partnered with.
Path Width	Indicates how many VCs are contained in the alarmed path. This information compliments the alarm object notation, which is explained in Table 10-3 on page 10-3.
Sev	Severity level: CR (Critical), MJ (Major), MN (Minor), NA (Not-Alarmed), NR (Not-Reported).
ST	Status: R (raised), C (clear).
SA	When checked, indicates a service-affecting alarm.
Cond	The error message/alarm name. These names are alphabetically defined in the "Alarm Troubleshooting" chapter of the *Cisco ONS 15310-MA SDH Troubleshooting Guide.*
Description	Description of the alarm.
Num	Num (number) is the quantity of alarm messages received and is increments automatically as alarms occur to display the current total of received error messages. (The column is hidden by default; to view it, right-click a column and choose **Show Column > Num**.)
Ref	Ref (reference) is a unique identification number assigned to each alarm to reference a specific alarm message that is displayed. (The column is hidden by default; to view it, right-click a column and choose **Show Column > Ref**.)

Table 10-2 lists the color codes for alarm and condition severities. In addition to the severities listed in the table, CTC alarm profiles list inherited (I) and unset (U) severities.

Table 10-2 Color Codes for Alarm and Condition Severities

Color	Description
Red	Raised Critical (CR) alarm
Orange	Raised Major (MJ) alarm
Yellow	Raised Minor (MN) alarm

Table 10-2 Color Codes for Alarm and Condition Severities (continued)

Color	Description
Magenta	Raised Not-Alarmed (NA) condition
Blue	Raised Not-Reported (NR) condition
White	Cleared (C) alarm or condition

In network view, CTC identifies VC high-order path and VC low-order path alarm objects using a TL1-type AID, as shown in Table 10-3.

Table 10-3 VC high-order path and Alarm Object Identification

VC high-order path and VC low-order path Alarm Numbering	
MON Object (Optical)	**Syntax and Examples**
STM1/STM4 VC high-order path	Syntax: VC-<Slot>-<Ppm>-<Port>-<VC> Ranges: VC-{2}-{1-2}-{1}-{1-*n*}[1] Example: VC-2-1-1-6
STM1/STM4 VC low-order path	Syntax: VT1-<Slot>-<Ppm>-<Port>-<VC>-<VT Group>-<VT> Ranges: VT1-{2}-{1-2}-{1}-{1-*n*[1]}-{1-7}-{1-4} Example: VT1-2-1-1-6-1-1
TERM Object (Electrical)	**Syntax and Examples**
E1 VC high-order path	Syntax: VC-<Slot>-<VC> Ranges: VC-{2}-{1-*n*}[1] Example: VC-2-6
E1 VC low-order path	Syntax: VT1-<Slot>-<VC>-VT Group>-<VT> Ranges: VT1-{2}-{1-*n*}[1]-{1-7}-{1-3} Example: VT1-2-6-1-1
DS3/E3 VC high-order path	Syntax: VC-<Slot>-<Port>-<VC> Ranges: VC-{2}-{1-3}-{1-*n*}[1] Example: VC-2-1-6
DS3/E3 VC low-order path	VC low-order path not supported

1. The maximum number of VC high-order paths depends on the rate and size of the VC.

10.2.1 Viewing Alarms With Each Node's Time Zone

By default, alarms and conditions are displayed with the time stamp of the CTC workstation where you are viewing them. But you can set the node to report alarms (and conditions) using the time zone where the node is located by clicking Edit > Preferences, and clicking the Display Events Using Each Node's Timezone check box.

10.2.2 Controlling Alarm Display

You can control the display of the alarms shown in the Alarms window. Table 10-4 shows the actions you can perform in the Alarms window.

Table 10-4 Alarm Display

Button/Check box/Tool	Action
Filter button	Allows you to change the display in the Alarms window to show only alarms that meet a certain severity level, occur in a specified time frame, and/or reflect specific conditions. For example, you can set the filter so that only Critical alarms are displayed in the window. If you enable the Filter feature by clicking the Filter tool in one CTC view, such as node view, it is enabled in the others as well (card view and network view).
Synchronize button	Updates the alarm display. Although CTC displays alarms in real time, the Synchronize button allows you to verify the alarm display. This is particularly useful during provisioning or troubleshooting.
Delete Cleared Alarms button	Deletes, from the view, alarms that have been cleared.
AutoDelete Cleared Alarms check box	If checked, CTC automatically deletes cleared alarms.
Filter tool	Enables or disables alarm filtering in the card, node, or network view. When enabled or disabled, this state applies to other views for that node and for all other nodes in the network. For example, if the Filter tool is enabled in the node (default login) view Alarms window, the network view Alarms window and card view Alarms window also show the tool enabled. All other nodes in the network also show the tool enabled.

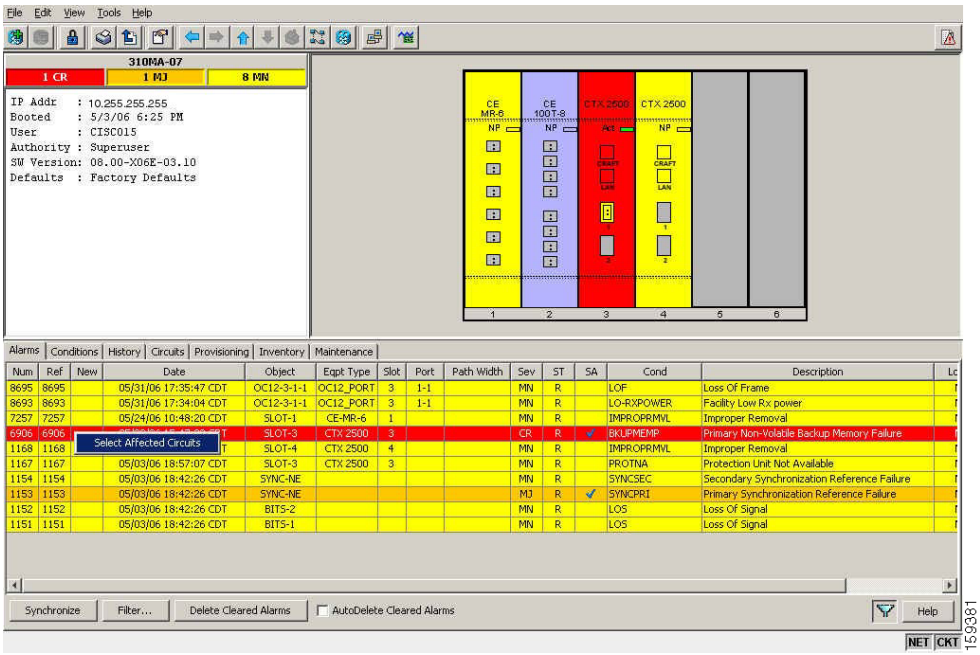
10.2.3 Filtering Alarms

The alarm display can be filtered to prevent display of alarms with certain severities or alarms that occurred between certain dates and times. You can set the filtering parameters by clicking the Filter button at the bottom-left of the Alarms window. You can turn the filter on or off by clicking the Filter tool at the bottom-right of the window. CTC retains your filter activation setting. For example, if you turn the filter on and then log out, CTC keeps the filter active the next time you log in.

10.2.4 Viewing Alarm-Affected Circuits

To view which ONS 15310-MA SDH circuits are affected by a specific alarm, right-click an alarm in the Alarm window. A shortcut menu appears, as shown in Figure 10-1. (This figure illustrates the ONS 15310-MA SDH Select Affected Circuits shortcut menu.) When you select the Select Affected Circuits option, the Circuits window opens to show the circuits that are affected by the alarm.

Figure 10-1 ONS 15310-MA SDH Select Affected Circuits Option



10.2.5 Conditions Tab

The Conditions window displays retrieved fault conditions. A condition is a fault or status detected by ONS 15310-MA SDH hardware or software. When a condition occurs and continues for a minimum period, CTC raises a standing condition, which is a flag showing that this particular condition currently exists on the ONS 15310-MA SDH.

The Conditions window, in contrast with the Alarms window, shows all conditions that occur, including those that are superseded. For instance, if a network problem causes two alarms, such as LOF and LOS, CTC shows both the LOF and LOS conditions in this window (even though LOS supersedes LOF). Having all conditions visible can be helpful when troubleshooting the ONS 15310-MA SDH. If you want to retrieve conditions that obey a root-cause hierarchy (that is, LOS supersedes and replaces LOF), you can exclude the same root causes by checking “Exclude Same Root Cause” check box in the window.

Fault conditions include reported alarms and Not-Reported or Not-Alarmed conditions. Refer to the trouble notifications information in the *Cisco ONS 15310-MA SDH Troubleshooting Guide* for more information about alarm and condition classifications.

10.2.6 Controlling the Conditions Display

You can control the display of the conditions on the Conditions window. Table 10-5 shows the actions you can perform in the window.

Table 10-5 Conditions Display

Button	Action
Retrieve	Retrieves the current set of all existing fault conditions (maintained by the alarm manager) from the ONS 15310-MA SDH.
Filter	Allows you to change the Conditions window display to only show the conditions that meet a certain severity level or occur in a specified time. For example, you can set the filter so that only Critical conditions display on the window. There is a Filter tool on the lower-right of the window that allows you to enable or disable the filter feature.

10.2.6.1 Retrieving and Displaying Conditions

The current set of all existing conditions maintained by the alarm manager can be seen when you click the Retrieve button. The set of conditions retrieved is relative to the view. For example, if you click the button while displaying the node view, node-specific conditions appear. If you click the button while displaying the network view, all conditions for the network (including ONS 15310-MA SDH nodes and other connected nodes) appear, and the card view shows only card-specific conditions.

You can also set a node to display conditions using the time zone where the node is located, rather than the time zone of the PC where they are being viewed. Refer to the *Cisco ONS 15310-MA SDH Procedure Guide* for instructions.

10.2.6.2 Conditions Column Descriptions

Table 10-6 lists the Conditions window column headings and the information recorded in each column.

Table 10-6 Conditions Column Description

Column	Information Recorded
Date	Date and time of the condition.
Node	Shows the name of the node where the condition or alarm occurred. (Visible in network view.)
Object	TL1 AID for the condition object. For an VCMON-LP or VTmon, this is the monitored VC high-order path or VC low-order path object, which is explained in Table 10-3 on page 10-3.
Eqpt Type	Card type in this slot (appears only in network and node view).
Shelf	For DWDM configurations, the shelf where the alarmed object is located. Visible in network view.
Slot	Slot where the condition occurred (appears only in network and node view).
Port	Port where the condition occurred. For VCTRM-LP and VTTerm, the port refers to the upstream card it is partnered with.
Path Width	Width of the signal path

Table 10-6 Conditions Column Description (continued)

Column	Information Recorded
Sev[1]	Severity level: CR (Critical), MJ (Major), MN (Minor), NA (Not-Alarmed), NR (Not-Reported).
SA[1]	Indicates a service-affecting alarm (when checked).
Cond	The error message/alarm name; these names are alphabetically defined in the *Cisco and ONS 15310-MA SDH Troubleshooting Guide.*
Description	Description of the condition.

1. All alarms, their severities, and service-affecting statuses are also displayed in the Condition tab unless you choose to filter the alarm from the display using the Filter button.

10.2.6.3 Filtering Conditions

The condition display can be filtered to prevent the appearance of conditions (including alarms) with certain severities or that occurred between certain dates. You can set the filtering parameters by clicking the Filter button at the bottom-left of the Conditions window. You can turn the filter on or off by clicking the Filter tool at the bottom-right of the window. CTC retains your filter activation setting. For example, if you turn the filter on and then log out, CTC keeps the filter active the next time you log in.

10.2.7 Viewing History

The History window displays historic alarm or condition data for the node or for your login session. You can chose to display only alarm history, only events, or both by checking check boxes in the History > Shelf window. You can view network-level alarm and condition history, such as for circuits, for all the nodes visible in network view. At the node level, you can see all port (facility), card, VC high-order path, and system-level history entries for that node. For example, protection-switching events or performance-monitoring threshold crossings appear here. If you double-click a card, you can view all port, card, and VC high-order path alarm or condition history that directly affects the port.

Note In the Preference dialog General tab, the Maximum History Entries value only applies to the Session window.

Different views of CTC display different kinds of history:

- The History > Session window is shown in network view, node view, and card view. It shows alarms and conditions that occurred during the current user CTC session.
- The History > Shelf window is only shown in node view. It shows the alarms and conditions that occurred on the node since CTC software was operated on the node.
- The History > Card window is only shown in card view. It shows the alarms and conditions that occurred on the card since CTC software was installed on the node.

Tip Double-click an alarm in the History window to display the corresponding view. For example, double-clicking a card alarm takes you to card view. In network view, double-clicking a node alarm takes you to node view.

If you check the History window Alarms check box, you display the node history of alarms. If you check the Events check box, you display the node history of Not Alarmed and transient events (conditions). If you check both check boxes, you retrieve node history for both.

10.2.7.1 History Column Descriptions

Table 10-7 lists the History window column headings and the information recorded in each column.

Table 10-7 History Column Description

Column	Information Recorded
Num	An incrementing count of alarm or condition messages. (The column is hidden by default; to view it, right-click a column and choose **Show Column > Num**.)
Ref	The reference number assigned to the alarm or condition. (The column is hidden by default; to view it, right-click a column and choose **Show Column > Ref**.)
Date	Date and time of the condition.
Node	Shows the name of the node where the condition or alarm occurred. (Visible in network view.)
Object	TL1 AID for the condition object. For an VCMON-LP or VTmon, this is the monitored VC high-order path or VC low-order path object, which is explained in Table 10-3 on page 10-3.
Eqpt Type	Card type in this slot (only displays in network view and node view).
Shelf	For DWDM configurations, the shelf where the alarmed object is located. Visible in network view.
Slot	Slot where the condition occurred (only displays in network view and node view).
Port	Port where the condition occurred. For VCTRM-LP and VTTerm, the port refers to the upstream card it is partnered with.
Path Width	Width of the signal path.
Sev	Severity level: Critical (CR), Major (MJ), Minor (MN), Not-Alarmed (NA), Not-Reported (NR).
ST	Status: raised (R), cleared (C), or transient (T).
SA	A service-affecting alarm (when checked).
Description	Description of the condition.
Cond	Condition name.

10.2.7.2 Retrieving and Displaying Alarm and Condition History

You can retrieve and view the history of alarms and conditions, as well as transients (passing notifications of processes as they occur) in the CTC history window. The information in this window is specific to the view where it is shown (that is, network history in the network view, node history in the node view, and card history in the card view).

The node and card history views are each divided into two tabs. In node view, when you click the Retrieve button, you can see the history of alarms, conditions, and transients that have occurred on the node in the History > Shelf window, and the history of alarms, conditions, and transients that have occurred on the node during your login session in the History > Session window. In the card-view history window, after you retrieve the card history, you can see the history of alarms, conditions, and transients

on the card in the History > Card window, or a history of alarms, conditions, and transients that have occurred during your login session in the History > Session window. You can also filter the severities and occurrence period in these history windows.

10.2.8 Alarm History and Log Buffer Capacities

The ONS 15310-MA SDH alarm history log, stored in the 15310E-CTX-K9 RSA memory, contains four categories of alarms. These include:

- CR severity alarms
- MJ severity alarms
- MN severity alarms
- the combined group of cleared, Not Alarmed severity, and Not Reported severity alarms

Each category can store between 4 and 640 alarm chunks, or entries. In each category, when the upper limit is reached, the oldest entry in the category is deleted. The capacity is not user-provisionable.

CTC also has a log buffer, separate from the alarm history log, that pertains to the total number of entries displayed in the Alarms, Conditions, and History windows. The total capacity is provisionable up to 5,000 entries. When the upper limit is reached, the oldest entries are deleted.

10.3 Alarm Severities

A condition may be Alarmed at a severity of Critical (CR), Major (MJ), or Minor (MN) with a severity of Not Alarmed (NA) or Not Reported (NR). These severities are reported in the CTC software Alarms, Conditions, and History windows at all levels: network, node, and card.

ONS equipment provides a standard profile named “Default” that lists all alarms and conditions with severity settings, but users can create their own profiles with different settings for some or all conditions and apply these wherever needed. (See the “10.4 Alarm Profiles” section on page 10-9 for more information.) For example, in a custom alarm profile, the default severity of a carrier loss (CARLOSS) alarm on an Ethernet port can be changed from Major to Critical.

Critical and Major severities are only used for service-affecting alarms. If a condition is set as Critical or Major by profile, it will raise as a Minor alarm in the following situations:

- In a protection group, if the alarm is on a standby entity (side not carrying traffic)
- If the alarmed entity has no traffic provisioned on it, so no service is lost

Because the alarm might be raised at two different levels, the alarm profile pane shows Critical as “CR / MN” and Major as “MJ / MN.”

10.4 Alarm Profiles

The alarm profiles feature allows you to change default alarm severities by creating unique alarm profiles for individual ONS 15310-MA SDH ports, cards, or nodes. A created alarm profile can be applied to any node on the network. Alarm profiles can be saved to a file and imported elsewhere in the network, but the profile must be stored locally on a node before it can be applied to the node, cards, or ports.

CTC can store up to ten active alarm profiles at any time to apply to the node. Custom profiles can take eight of these active profile positions. Two other profiles, Default profile and Inherited profile, are reserved by the NE, and cannot be edited. The reserved Inherited profile allows port alarm severities to be governed by the card-level severities, or card alarm severities to be determined by the node-level severities.

If one or more alarm profiles is stored as files from elsewhere in the network onto the local PC or server hard drive where CTC resides, you can use as many profiles as you can physically store by deleting and replacing them locally in CTC so that only eight are active at any given time.

10.4.1 Creating and Modifying Alarm Profiles

Alarm profiles are created in the network view using the Provisioning > Alarm Profiles tabs. After loading the default profile or another profile on the node, you can use the Clone feature to create custom profiles. After the new profile is created, the Alarm Profiles window shows the original profile—frequently Default—and the new profile.

Tip To see the full list of profiles including those available for loading or cloning, click the Available button. You must load a profile before you can clone it.

In the Inherited profile, alarms inherit, or copy severity from the next-highest level. For example, a card with an Inherited alarm profile copies the severities used by the node housing the card. If you choose the Inherited profile from the network view, the severities at the lower levels (node and card) are copied from this selection.

You do not have to apply a single severity profile to the node, card, and port level alarms. Different profiles can be applied at different levels. For example, you could use the inherited or default profile on a node and on all cards and ports, but apply a custom profile that downgrades an alarm on one particular card. Or you might choose to downgrade an STMN unequipped path alarm (UNEQ-P) from Critical (CR) to Not Alarmed (NA) on an optical card because this alarm is raised and then clears every time you create a circuit. UNEQ-P alarms for the card with the custom profile would not display on the Alarms tab (but they would still be recorded on the Conditions and History tabs).

When you modify severities in an alarm profile:

- All Critical (CR) or Major (MJ) default or user-defined severity settings are demoted.
- Default severities are used for all alarms and conditions until you create a new profile and apply it.

10.4.2 Alarm Profile Buttons

The Alarm Profiles window displays six buttons at the bottom. Table 10-8 lists and describes each of the alarm profile buttons and their functions.

Table 10-8 Alarm Profile Buttons

Button	Description
New	Adds a new alarm profile.
Load	Loads a profile from a node or a file.
Store	Saves profiles on a node (or nodes) or in a file.
Delete	Deletes profiles from a node.

Table 10-8 Alarm Profile Buttons (continued)

Button	Description
Compare	Displays differences between alarm profiles (for example, individual alarms that are not configured equivalently between profiles).
Available	Displays all profiles available on each node.
Usage	Displays all entities (nodes and alarm subjects) present in the network and which profiles contain the alarm. Can be printed.

10.4.3 Alarm Profile Editing

Table 10-9 lists and describes the five profile-editing options available when you right-click an alarm item in the profile column.

Table 10-9 Alarm Profile Editing Options

Button	Description
Store	Saves a profile in a node or in a file.
Rename	Changes a profile name.
Clone	Creates a profile that contains the same alarm severity settings as the profile being cloned.
Reset	Restores a profile to its previous state or to the original state (if it has not yet been applied).
Remove	Removes a profile from the table editor.

10.4.4 Alarm Severity Options

To change or assign alarm severity, left-click the alarm severity you want to change in the alarm profile column. Seven severity levels appear for the alarm:

- Not-reported (NR)
- Not-alarmed (NA)
- Minor (MN)
- Major (MJ)
- Critical (CR)
- Use Default
- Inherited (I)

Inherited and Use Default severity levels only appear in alarm profiles. They do not appear when you view alarms, history, or conditions.

10.4.5 Row Display Options

In the network view, the Alarm Profiles window displays two check boxes at the bottom of the window:

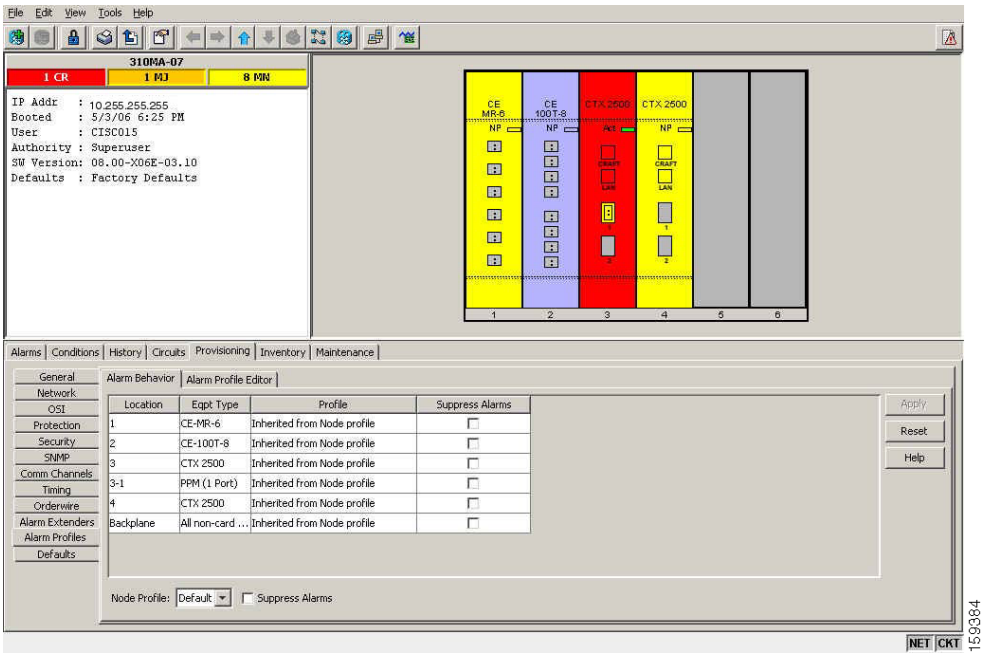
- Hide reference values—Highlights alarms with non-default severities by clearing alarm cells with default severities. This check-box is normally greyed out. It becomes active only when more than one profile is listed in the Alarm Profile Editor window. (The check box text changes to “Hide Values matching profile Default” in this case.
- Hide identical rows—Hides rows of alarms that contain the same severity for each profile.

10.4.6 Applying Alarm Profiles

In CTC node view, the Alarm Behavior window displays alarm profiles for the node. In card view, the Alarm Behavior window displays the alarm profiles for the selected card. Alarm profiles form a hierarchy. A node alarm profile applies to all cards in the node except cards that have their own profiles. A card alarm profile applies to all ports on the card except ports that have their own profiles.

At the node level, you can apply profile changes on a card-by-card basis or set a profile for the entire node. At the card view, you can apply profile changes on a port-by-port basis or set alarm profiles for all ports on that card. Figure 10-2 shows an ONS 15310-MA SDH 15310E-CTX-K9 card alarm profile.

Figure 10-2 Alarm Profile for a 15310-MA SDH 15310E-CTX-K9 Card



10.5 Alarm Suppression

The following sections explain alarm suppression features for the ONS 15310-MA SDH.

10.5.1 Alarms Suppressed for Maintenance

When you place a port in locked, maintenance administrative state, this raises the alarm suppressed for maintenance (AS-MT) condition in the Conditions and History windows[1] and causes subsequently raised alarms for that port to be suppressed.

While the facility is in the locked, maintenance state, any alarms or conditions that are raised and suppressed on it (for example, a transmit failure [TRMT] alarm) are reported in the Conditions window and show their normal severity in the Sev column. The suppressed alarms are not shown in the Alarms and History windows. (These windows only show AS-MT). When you place the port back into Automatic In Service administrative state, the AS-MT condition is resolved in all three windows. Suppressed alarms remain raised in the Conditions window until they are cleared.

10.5.2 Alarms Suppressed by User Command

In the Provisioning > Alarm Profiles > Alarm Behavior tabs, the ONS 15310-MA SDH have an alarm suppression option that clears raised alarm messages for the node, chassis, one or more slots (cards), or one or more ports. Using this option raises the alarms suppressed by user command, or AS-CMD condition. The AS-CMD condition, like the AS-MT condition, appears in the Conditions, and History[1] windows. Suppressed conditions (including alarms) appear only in the Conditions window—showing their normal severity in the Sev column. When the Suppress Alarms check box is unchecked, the AS-CMD condition is cleared from all three windows.

A suppression command applied at a higher level does not supersede a command applied at a lower level. For example, applying a node-level alarm suppression command makes all raised alarms for the node appear to be cleared, but it does not cancel out card-level or port-level suppression. Each of these conditions can exist independently and must be cleared independently.

Caution Use alarm suppression with caution. If multiple CTC or TL1 sessions are open, suppressing the alarms in one session suppresses the alarms in all other open sessions.

10.6 External Alarms and Controls

External alarm physical connections are made with the ONS 15310-MA SDH ALARM port. However, the alarms are provisioned using the 15310E-CTX-K9 card view for external sensors such as an open door and flood sensors, temperature sensors, and other environmental conditions. External control outputs on the 15310E-CTX-K9 cards allow you to drive external visual or audible devices such as bells and lights. They can control other devices such as generators, heaters, and fans.

Provision external alarms in the 15310E-CTX-K9 card view Provisioning > External Alarms tab and provision controls in the 15310E-CTX-K9 card view Provisioning > External Controls tab. Up to 32 alarm contact inputs and 8 alarm contact outputs are available with the 15310E-CTX-K9 cards.

10.6.1 External Alarm Input

You can provision each alarm input separately. Provisionable characteristics of external alarm inputs include:

1. AS-MT can be seen in the Alarms window as well if you have set the Filter dialog box to show NA severity events.

- Alarm type
- Alarm severity (CR, MJ, MN, NA, and NR)
- Alarm-trigger setting (open or closed); open means that the normal condition is to have current flowing through the contact, and the alarm is generated when the current stops flowing; closed means that normally no current flows through the contact, and the alarm is generated when current does flow.
- Virtual wire associated with the alarm
- CTC alarm log description (up to 63 characters)

Note If you provision an external alarm to raise when a contact is open, and you have not attached the alarm cable, the alarm will remain raised until the alarm cable is connected.

Note When you provision an external alarm, the alarm object is ENV-IN-nn. The variable nn refers to the external alarm's number, regardless of the name you assign.

10.6.2 External Control Output

You can provision each alarm output separately. Provisionable characteristics of alarm outputs include:

- Control type
- Trigger type (alarm or virtual wire)
- Description for CTC display
- Closure setting (manually or by trigger). If you provision the output closure to be triggered, the following characteristics can be used as triggers:
  - Local NE alarm severity—A chosen alarm severity (for example, Major) and any higher-severity alarm (in this case, Critical) causes output closure
  - Remote NE alarm severity—Similar to local NE alarm severity trigger setting, but applies to remote alarms
  - Virtual wire entities—You can provision an alarm that is input to a virtual wire to trigger an external control output

For information about provisioning alarms for external devices, refer to the Chapter, "Manage alarms", Section, "Provision External Alarms and Controls" in the *Cisco ONS 15310-MA SDH Procedure Guide*.

CHAPTER 11

Performance Monitoring

Note The terms “Unidirectional Path Switched Ring” and “UPSR” may appear in Cisco literature. These terms do not refer to using Cisco ONS 15xxx products in a unidirectional path switched ring configuration. Rather, these terms, as well as “Path Protected Mesh Network” and “PPMN,” refer generally to Cisco's path protection feature, which may be used in any topological network configuration. Cisco does not recommend using its path protection feature in any particular topological network configuration.

Performance monitoring (PM) parameters are used by service providers to gather, store, threshold, and report performance data for early detection of problems. In this chapter, PM parameters and concepts are defined for electrical cards, Ethernet cards, and optical cards in the Cisco ONS 15310-MA SDH.

For information about enabling and viewing PM parameters, refer to the *Cisco ONS 15310-MA SDH Procedure Guide*.

Chapter topics include:

Note When circuits transition from the out-of-service state to the in-service state, the performance monitoring counts during the out-of-service circuit state are not part of the accumulation cycle.

11.1 Threshold Performance Monitoring

Thresholds are used to set error levels for each PM parameter. You can program PM parameter threshold ranges from the Provisioning > Line Thresholds tab in card view. For procedures for provisioning card thresholds, such as line, path, and SDH thresholds, refer to the *Cisco ONS 15310-MA SDH Procedure Guide*.

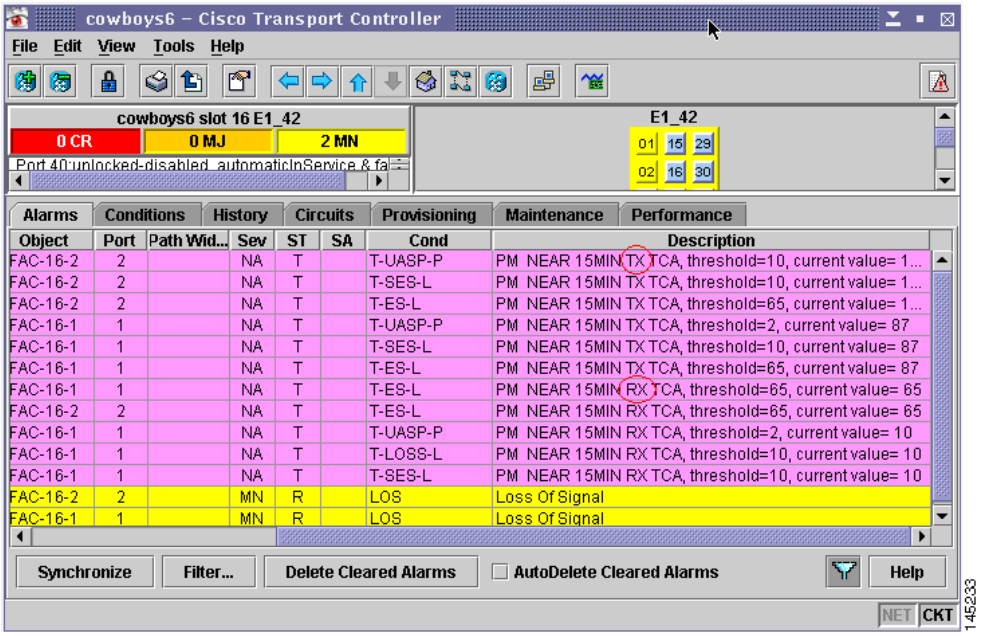
During the accumulation cycle, if the current value of a PM parameter reaches or exceeds its corresponding threshold value, a threshold crossing alert (TCA) is generated by the node and is sent to CTC. TCAs provide early detection of performance degradation. When a threshold is crossed, the node continues to count the errors during a given accumulation period. If 0 is entered as the threshold value, the PM parameter is disabled.

Change the threshold if the default value does not satisfy your error monitoring needs. For example, customers with a critical E1 installed for 911 calls must guarantee the best quality of service on the line; therefore, they lower all thresholds so that the slightest error raises a TCA.

When TCAs occur, CTC displays them in the Alarms tab. For example, in Figure 11-1, T-UASP-P is shown under the Cond column. The "T-" indicates a threshold crossing alert.

For the E1 and E3/DS3 electrical ports on the 15310-MA SDH E1_21_E3_DS3_3 and E1_63_E3_DS3_3 cards, RX or TX is appended to the TCA description (see the red circles in Figure 11-1). RX indicates that the TCA is associated with the receive direction, and TX indicates the TCA is associated with the transmit direction.

Figure 11-1 TCAs Displayed in CTC



For electrical ports, only the receive direction is detected and appended to TCA descriptions. The E1 and E3/DS3 ports for which RX is appended to TCA descriptions are shown in Table 11-1.

Table 11-1 Electrical Ports that Report RX Direction for TCAs

Port	Line		Path	
	Near End	Far End	Near End	Far End
E1	YES	YES	YES	YES
DS-3	YES	—	YES	YES
E3	YES	YES	YES	YES

11.2 Intermediate-Path Performance Monitoring

Intermediate-path performance monitoring (IPPM) allows transparent monitoring of a constituent channel of an incoming transmission signal by a node that does not terminate that channel. You can program IPPM from the Provisioning > Optical > SDH VC high-order path tab in card view. Many large ONS 15310-MA SDH networks only use line terminating equipment (LTE), not path terminating equipment (PTE).

ONS 15310-MA SDH allows monitoring of near-end PM parameter data on individual VC high-order path payloads by enabling IPPM. After enabling IPPM provisioning on the line card, service providers can monitor large amounts of synchronous transport signal (VC high-order path) traffic through intermediate nodes, thus making troubleshooting and maintenance activities more efficient.

IPPM occurs only on VC high-order path paths that have IPPM enabled, and TCAs are raised only for PM parameters on the selected IPPM paths. The monitored IPPM parameters are VC high-order path CV-P, VC ES-P, VC SES-P, VC UAS-P.

Note Far-end IPPM is not supported. However, SDH path PM parameters can be monitored by logging into the far-end node directly.

The ONS 15310-MA SDH perform IPPM by examining the overhead in the monitored path and by reading all of the near-end path PM parameters in the incoming direction of transmission. The IPPM process allows the path signal to pass bidirectionally through the node completely unaltered.

For detailed information about specific PM parameters, locate the card name in the following sections and review the appropriate definition.

11.3 Pointer Justification Count Performance Monitoring

Pointers are used to compensate for frequency and phase variations. Pointer justification counts indicate timing errors on SDH networks. When a network is out of sync, jitter and wander occurs on the transported signal. Excessive wander can cause terminating equipment to slip. It also causes slips at the synchronous digital hierarchy (SDH) and plesiochronous digital hierarchy (PDH) boundaries.

Slips cause different effects in service. Voice service has intermittent audible clicks. Compressed voice technology has short transmission errors or dropped calls. Fax machines lose scanned lines or experience dropped calls. Digital video transmission has distorted pictures or frozen frames. Encryption service loses the encryption key, causing data to be transmitted again.

Pointers provide a way to align the phase variations in VC high-order path and VC low-order path payloads. The VC high-order path payload pointer is located in the H1 and H2 bytes of the line overhead. Clocking differences are measured by the offset in bytes from the pointer to the first byte of the VC high-order path synchronous payload envelope (SPE), called the J1 byte. Clocking differences that exceed the normal range of 0 to 782 can cause data loss.

You can enable positive pointer justification count (PPJC) and negative pointer justification count (NPJC) PM parameters for LTE cards. PPJC is a count of path-detected (PPJC-Pdet) or path-generated (PPJC-Pgen) positive pointer justifications. NPJC is a count of path-detected (NPJC-Pdet) or path-generated (NPJC-Pgen) negative pointer justifications, depending on the specific PM parameter.

A consistent pointer justification count indicates clock synchronization problems between nodes. A difference between the counts means that the node transmitting the original pointer justification has timing variations with the node detecting and transmitting this count. Positive pointer adjustments occur when the frame rate of the SPE is too slow in relation to the rate of the VC3.

For pointer justification count definitions, depending on the cards in use, see the "11.7.1 STM1 Port Performance Monitoring Parameters" section on page 11-25 and the "11.7.2 STM4 Port Performance Monitoring Parameters" section on page 11-27.

In CTC, the count fields for PPJC and NPJC PM parameters appear white and blank unless they are enabled on the Provisioning > Optical > Line tab PJVC4MON# drop-down list.

11.4 Performance Monitoring Parameter Definitions

Table 11-2 gives a definition for each type of PM parameter found in the ONS 15310-MA SDH.

Table 11-2 Performance Monitoring Parameters

Parameter	Definition
AISS-P	AIS Seconds Path (AISS-P) is a count of one-second intervals containing one or more alarm indication signal (AIS) defects.
BBE	Path Background Block Error (BBE) is an errored block not occurring as part of a severely errored second (SES).
BBE-PM	Path Monitoring Background Block Errors (BBE-PM) indicates the number of background block errors recorded in the optical transfer network (OTN) path during the PM time interval.
BBER	Path Background Block Error Ratio (BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.
BBER-PM	Path Monitoring Background Block Errors Ratio (BBER-PM) indicates the background block errors ratio recorded in the OTN path during the PM time interval.
BBER-SM	Section Monitoring Background Block Errors Ratio (BBER-SM) indicates the background block errors ratio recorded in the OTN section during the PM time interval.
BBE-SM	Section Monitoring Background Block Errors (BBE-SM) indicates the number of background block errors recorded in the optical transport network (OTN) section during the PM time interval.
BIE	The number of bit errors (BIE) corrected in the dense wavelength division multiplexing (DWDM) trunk line during the PM time interval.
BIEC	The number of Bit Errors Corrected (BIEC) in the DWDM trunk line during the PM time interval.
CGV	Code Group Violations (CGV) is a count of received code groups that do not contain a start or end delimiter.
CVCP-P	Code Violation Path (CVCP-P) is a count of CP-bit parity errors occurring in the accumulation period.
CVCP-PFE	Code Violation (CVCP-PFE) is a parameter that is counted when the three far-end block error (FEBE) bits in a M-frame are not all collectively set to 1.
MS-EB	Indicates the number of coding violations occurring on the line. This parameter is a count of BPVs and EXZs occurring over the accumulation period.

Table 11-2 Performance Monitoring Parameters (continued)

Parameter	Definition
CVP-P	Code Violation Path (CVP-P) is a code violation parameter for M23 applications. CVP-P is a count of P-bit parity errors occurring in the accumulation period.
DCG	Date Code Groups (DCG) is a count of received data code groups that do not contain ordered sets.
EB	Path Errored Block (EB) indicates that one or more bits are in error within a block.
ES	Path Errored Second (ES) is a one-second period with one or more errored blocks or at least one defect.
ESCP-P	Errored Second Path (ESCP-P) is a count of seconds containing one or more CP-bit parity errors, one or more severely errored framing (SEF) defects, or one or more AIS defects. ESCP-P is defined for the C-bit parity application.
ESCP-PFE	Far-End Errored Second CP-bit Path (ESCP-PFE) is a count of one-second intervals containing one or more M-frames with the three FEBE bits not all collectively set to 1 or one or more far-end SEF/AIS defects.
MS-ES	Errored Seconds Line (ES-L) is a count of the seconds containing one or more anomalies (BPV + EXZ) and/or defects (loss of signal) on the line.
ES-P	Path Errored Second (ES-P) is a one-second period with at least one defect.
ES-PM	Path Monitoring Errored Seconds (ES-PM) indicates the errored seconds recorded in the OTN path during the PM time interval.
ESP-P	Errored Second Path (ESP-P) is a count of seconds containing one or more P-bit parity errors, one or more SEF defects, or one or more AIS defects.
ESR	Path Errored Second Ratio (ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
ESR-P	Path Errored Second Ratio (ESR-P) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
ESR-PM	Path Monitoring Errored Seconds Ratio (ESR-PM) indicates the errored seconds ratio recorded in the OTN path during the PM time interval.
ESR-SM	Section Monitoring Errored Seconds Ratio (ESR-SM) indicates the errored seconds ratio recorded in the OTN section during the PM time interval.
ES-SM	Section Monitoring Errored Seconds (ES-SM) indicates the errored seconds recorded in the OTN section during the PM time interval.
FC-PM	Path Monitoring Failure Counts (FC-PM) indicates the failure counts recorded in the OTN path during the PM time interval.
FC-SM	Section Monitoring Failure Counts (FC-SM) indicates the failure counts recorded in the OTN section during the PM time interval.
HP-BBE	High-Order Path Background Block Error (HP-BBE) is an errored block not occurring as part of an SES.
HP-BBER	High-Order Path Background Block Error Ratio (HP-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.

Table 11-2 Performance Monitoring Parameters (continued)

Parameter	Definition
HP-EB	High-Order Path Errored Block (HP-EB) indicates that one or more bits are in error within a block.
HP-ES	High-Order Path Errored Second (HP-ES) is a one-second period with one or more errored blocks or at least one defect.
HP-ESR	High-Order Path Errored Second Ratio (HP-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
HP-NPJC-Pdet	High-Order, Negative Pointer Justification Count, Path Detected (HP-NPJC-Pdet) is a count of the negative pointer justifications detected on a particular path on an incoming SDH signal.
HP-NPJC-Pdet	High-Order Path Negative Pointer Justification Count, Path Detected (HP-NPJC-Pdet) is a count of the negative pointer justifications detected on a particular path on an incoming SDH signal.
HP-NPJC-Pgen	High-Order, Negative Pointer Justification Count, Path Generated (HP-NPJC-Pgen) is a count of the negative pointer justifications generated for a particular path.
HP-PJCDiff	High-Order Path Pointer Justification Count Difference (HP-PJCDiff) is the absolute value of the difference between the total number of detected pointer justification counts and the total number of generated pointer justification counts. That is, HP-PJCDiff is equal to (HP-PPJC-PGen – HP-NPJC-PGen) – (HP-PPJC-PDet – HP-NPJC-PDet).
HP-PJCS-Pdet	High-Order Path Pointer Justification Count Seconds (HP-PJCS-PDet) is a count of the one-second intervals containing one or more HP-PPJC-PDet or HP-NPJC-PDet.
HP-PJCS-Pgen	High-Order Path Pointer Justification Count Seconds (HP-PJCS-PGen) is a count of the one-second intervals containing one or more HP-PPJC-PGen or HP-NPJC-PGen.
HP-PPJC-Pdet	High-Order, Positive Pointer Justification Count, Path Detected (HP-PPJC-Pdet) is a count of the positive pointer justifications detected on a particular path on an incoming SDH signal.
HP-PPJC-Pgen	High-Order, Positive Pointer Justification Count, Path Generated (HP-PPJC-Pgen) is a count of the positive pointer justifications generated for a particular path.
HP-SES	High-Order Path Severely Errored Seconds (HP-SES) is a one-second period containing 30 percent or more errored blocks or at least one defect. SES is a subset of ES.
HP-SESR	High-Order Path Severely Errored Second Ratio (HP-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
HP-UAS	High-Order Path Unavailable Seconds (HP-UAS) is a count of the seconds when the VC path was unavailable. A high-order path becomes unavailable when ten consecutive seconds occur that qualify as HP-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as HP-SESs.

Table 11-2 Performance Monitoring Parameters (continued)

Parameter	Definition
IOS	Idle Ordered Sets (IOS) is a count of received packets containing idle ordered sets.
IPC	A count of received packets that contain errored data code groups that have start and end delimiters.
LBC-MIN	LBC-MIN is the minimum percentage of Laser Bias Current.
LBC-AVG	Laser Bias Current—Average (LBC-AVG) is the average percentage of laser bias current.
LBC-MAX	Laser Bias Current—Maximum (LBC-MAX) is the maximum percentage of laser bias current.
LBC-MIN	Laser Bias Current—Minimum (LBC-MIN) is the minimum percentage of laser bias current.
LOSS-L	Line Loss of Signal Seconds (LOSS-L) is a count of one-second intervals containing one or more LOS defects.
LP-BBE	Low-Order Path Background Block Error (LP-BBE) is an errored block not occurring as part of an SES.
LP-BBER	Low-Order Path Background Block Error Ratio (LP-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.
LP-EB	Low-Order Path Errored Block (LP-EB) indicates that one or more bits are in error within a block.
LP-ES	Low-Order Path Errored Second (LP-ES) is a one-second period with one or more errored blocks or at least one defect.
LP-ESR	Low-Order Path Errored Second Ratio (LP-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
LP-SES	Low-Order Path Severely Errored Seconds (LP-SES) is a one-second period containing greater than or equal to 30 percent errored blocks or at least one defect. SES is a subset of ES.
LP-SESR	Low-Order Path Severely Errored Second Ratio (LP-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
LP-UAS	Low-Order Path Unavailable Seconds (LP-UAS) is a count of the seconds when the VC path was unavailable. A low-order path becomes unavailable when ten consecutive seconds occur that qualify as LP-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as LP-SESs.
MS-BBE	Multiplex Section Background Block Error (MS-BBE) is an errored block not occurring as part of an SES.
MS-BBER	Multiplex Section Background Block Error Ratio (MS-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.
MS-EB	Multiplex Section Errored Block (MS-EB) indicates that one or more bits are in error within a block.

Table 11-2 Performance Monitoring Parameters (continued)

Parameter	Definition
MS-ES	Multiplex Section Errored Second (MS-ES) is a one-second period with one or more errored blocks or at least one defect.
MS-ESR	Multiplex Section Errored Second Ratio (MS-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
MS-NPJC-Pgen	Multiplex Section Negative Pointer Justification Count, Path Generated (MS-NPJC-Pgen) is a count of the negative pointer justifications generated for a particular path.
MS-PPJC-Pgen	Multiplex Section Positive Pointer Justification Count, Path Generated (MS-PPJC-Pgen) is a count of the positive pointer justifications generated for a particular path.
MS-PSC (1+1 protection)	In a 1+1 protection scheme for a working card, Multiplex Section Protection Switching Count (MS-PSC) is a count of the number of times service switches from a working card to a protection card plus the number of times service switches back to the working card. For a protection card, MS-PSC is a count of the number of times service switches to a working card from a protection card plus the number of times service switches back to the protection card.
MS-PSC[1] (MS-SPRing)	For a protect line in a two-fiber multiplex section-shared protection ring (MS-SPRing), Multiplex Section Protection Switching Count (MS-PSC) refers to the number of times a protection switch has occurred either to a particular span's line protection or away from a particular span's line protection. Therefore, if a protection switch occurs on a two-fiber MS-SPRing, the MS-PSC of the protection span to which the traffic is switched will increment, and when the switched traffic returns to its original working span from the protect span, the MS-PSC of the protect span will increment again.
MS-PSC-R[1]	In a four-fiber MS-SPRing, Multiplex Section Protection Switching Count-Ring (MS-PSC-R) is a count of the number of times service switches from a working line to a protection line plus the number of times it switches back to a working line. A count is only incremented if ring switching is used.
MS-PSC-S	In a four-fiber MS-SPRing, Multiplex Section Protection Switching Count-Span (MS-PSC-S) is a count of the number of times service switches from a working line to a protection line plus the number of times it switches back to the working line. A count is only incremented if span switching is used.

Table 11-2 Performance Monitoring Parameters (continued)

Parameter	Definition
MS-PSC-W	For a working line in a two-fiber MS-SPRing, Multiplex Section Protection Switching Count-Working (MS-PSC-W) is a count of the number of times traffic switches away from the working capacity in the failed line and back to the working capacity after the failure is cleared. MS-PSC-W increments on the failed working line and MS-PSC increments on the active protect line. For a working line in a four-fiber MS-SPRing, MS-PSC-W is a count of the number of times service switches from a working line to a protection line plus the number of times it switches back to the working line. MS-PSC-W increments on the failed line and MS-PSC-R or MS-PSC-S increments on the active protect line.
MS-PSD	Multiplex Section Protection Switching Duration (MS-PSD) applies to the length of time, in seconds, that service is carried on the protection line. For a working line, MS-PSD is a count of the number of seconds that service was carried on the protection line. For the protection line, MS-PSD is a count of the seconds that the line was used to carry service. The MS-PSD PM is only applicable if revertive line-level protection switching is used. MS-PSD increments on the active protect line and MS-PSD-W increments on the failed working line.
MS-PSD-R	In a four-fiber MS-SPRing, Multiplex Section Protection Switching Duration-Ring (MS-PSD-R) is a count of the seconds that the protection line was used to carry service. A count is only incremented if ring switching is used.
MS-PSD-S	In a four-fiber MS-SPRing, Multiplex Section Protection Switching Duration-Span (MS-PSD-S) is a count of the seconds that the protection line was used to carry service. A count is only incremented if span switching is used.
MS-PSD-W	For a working line in a two-fiber MS-SPRing, Multiplex Section Protection Switching Duration-Working (MS-PSD-W) is a count of the number of seconds that service was carried on the protection line. MS-PSD-W increments on the failed working line and PSD increments on the active protect line.
MS-SES	Multiplex Section Severely Errored Second (MS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES. For more information, refer to ITU-T G.829 Section 5.1.3.
MS-SESR	Multiplex Section Severely Errored Second ratio (MS-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
MS-UAS	Multiplex Section Unavailable Seconds (MS-UAS) is a count of the seconds when the section was unavailable. A section becomes unavailable when ten consecutive seconds occur that qualify as MS-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as MS-SESs. When the condition is entered, MS-SESs decrement and then count toward MS-UAS.

Table 11-2 Performance Monitoring Parameters (continued)

Parameter	Definition
NIOS	Non-Idle Ordered Sets (NIOS) is a count of received packets containing non-idle ordered sets.
OPR	Optical Power Received (OPR) is the measure of average optical power received as a percentage of the nominal OPT.
OPR-AVG	Average Receive Optical Power (dBm).
OPR-MAX	Maximum Receive Optical Power (dBm).
OPR-MIN	Minimum Receive Optical Power (dBm).
OPT	Optical Power Transmitted (OPT) is the measure of average optical power transmitted as a percentage of the nominal OPT.
OPT-AVG	Average Transmit Optical Power (dBm).
OPT-MAX	Maximum Transmit Optical Power (dBm).
OPT-MIN	Minimum Transmit Optical Power (dBm).
RS-BBE	Regenerator Section Background Block Error (RS-BBE) is an errored block not occurring as part of an SES.
RS-BBER	Regenerator Section Background Block Error Ratio (RS-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.
RS-EB	Regenerator Section Errored Block (RS-EB) indicates that one or more bits are in error within a block.
RS-ES	Regenerator Section Errored Second (RS-ES) is a one-second period with one or more errored blocks or at least one defect.
RS-ESR	Regenerator Section Errored Second Ratio (RS-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
RS-SES	Regenerator Section Severely Errored Second (RS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES.
RS-SESR	Regenerator Section Severely Errored Second Ratio (RS-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
RS-UAS	Regenerator Section Unavailable Second (RS-UAS) is a count of the seconds when the regenerator section was unavailable. A section becomes unavailable when ten consecutive seconds occur that qualify as RS-UASs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as RS-UASs.
Rx AISS-P	Receive Path Alarm Indication Signal Seconds (AISS-P) means that an alarm indication signal occurred on the receive end of the path. This parameter is a count of seconds containing one or more AIS defects.
Rx BBE-P	Receive Path Background Block Error (BBE-P) is an errored block not occurring as part of an SES.
Rx EB-P	Receive Path Errored Block (EB-P) indicates that one or more bits are in error within a block.

Table 11-2 Performance Monitoring Parameters (continued)

Parameter	Definition
Rx ES-P	Receive Path Errored Second (ES-P) is a one-second period with one or more errored blocks or at least one defect.
Rx ESR-P	Receive Path Errored Second Ratio (ESR-P) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
Rx SES-P	Receive Path Severely Errored Seconds (SES-P) is a one-second period containing 30 percent or more errored blocks or at least one defect; SES is a subset of ES.
Rx SESR-P	Receive Path Severely Errored Second Ratio (SESR-P) is the ratio of SES to total seconds in available time during a fixed measurement interval.
Rx UAS-P	Receive Path Unavailable Seconds (UAS-P) is a count of one-second intervals when the E-1 path is unavailable on the signal receive end. The E-1 path is unavailable when ten consecutive SESs occur. The ten SESs are included in unavailable time. After the E-1 path becomes unavailable, it becomes available when ten consecutive seconds occur with no SESs. The ten seconds with no SESs are excluded from unavailable time.
Rx BBER-P	Receive Path Background Block Error Ratio (BBER-P) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.
SASCP-P	SEF/AIS Second (SASCP-P) is a count of one-second intervals containing one or more near-end SEF/AIS defects.
SASP-P	SEF/AIS Seconds Path (SASP-P) is a count of one-second intervals containing one or more SEFs or one or more AIS defects on the path.
SES	Severely Errored Seconds (SES) is a one-second period containing 30 percent or more errored blocks or at least one defect. SES is a subset of ES.
SESCP-P	Severely Errored Seconds CP-bit Path (SESCP-P) is a count of seconds containing more than 44 CP-bit parity errors, one or more SEF defects, or one or more AIS defects.
SESCP-PFE	Severely Errored Seconds CP-bit Path Far End (SESCP-PFE) is a count of one-second intervals containing one or more 44 M-frames with the three FEBE bits not all collectively set to 1, or with one or more far-end SEF/AIS defects.
MS-SES	A count of the seconds containing more than a particular quantity of anomalies (BPV + EXZ $\geq$ 44) and/or defects on the line.
SES-P	Severely Errored Seconds Path (SES-P) is a one-second period containing at least one defect. SES-P is a subset of ES-P.
SES-PFE	Far-End Path Severely Errored Seconds (SES-PFE) is a one-second period containing at least one defect. SES-PFE is a subset of ES-PFE.
SES-PM	Path Monitoring Severely Errored Seconds (SES-PM) indicates the severely errored seconds recorded in the OTN path during the PM time interval.
SESP-P	Severely Errored Seconds Path (SESP-P) is a count of seconds containing more than 44 P-bit parity violations, one or more SEF defects, or one or more AIS defects.

Table 11-2 Performance Monitoring Parameters (continued)

Parameter	Definition
SESR-P	Path Severely Errored Second Ratio (SESR-P) is the ratio of SES to total seconds in available time during a fixed measurement interval.
SESR-PM	Path Monitoring Severely Errored Seconds Ratio (SESR-PM) indicates the severely errored seconds ratio recorded in the OTN path during the PM time interval.
SES-SM	Section Monitoring Severely Errored Seconds (SES-SM) indicates the severely errored seconds recorded in the OTN section during the PM time interval.
Tx AISS-P	Transmit Path Alarm Indication Signal (AISS-P) means that an alarm indication signal occurred on the transmit end of the path. This parameter is a count of seconds containing one or more AIS defects.
Tx BBE-P	Transmit Path Background Block Error (BBE-P) is an errored block not occurring as part of an SES.
Tx ES-P	Transmit Path Errored Second (ES-P) is a one-second period with one or more errored blocks or at least one defect.
Tx ESR-P	Transmit Path Errored Second Ratio (ESR-P) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
Tx SES-P	Transmit Path Severely Errored Seconds (SES-P) is a one-second period containing 30 percent or more errored blocks or at least one defect; SES is a subset of ES.
Tx SESR-P	Transmit Path Severely Errored Second Ratio (SESR-P) is the ratio of SES to total seconds in available time during a fixed measurement interval.
Tx UAS-P	Transmit Path Unavailable Seconds (UAS-P) is a count of one-second intervals when the E-1 path is unavailable on the transmit end of the signal. The E-1 path is unavailable when ten consecutive SESs occur. The ten SESs are included in unavailable time. After the E-1 path becomes unavailable, it becomes available when ten consecutive seconds occur with no SESs. The ten seconds with no SESs are excluded from unavailable time.
Tx BBER-P	Transmit Path Background Block Error Ratio (BBER-P) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.
Tx EB-P	Transmit Path Errored Block (EB-P) indicates that one or more bits are in error within a block.
UAS	Path Unavailable Seconds (UAS) is a count of the seconds when the VC path was unavailable. A high-order path becomes unavailable when ten consecutive seconds occur that qualify as HP-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as HP-SESs.
UASCP-P	Unavailable Seconds CP-bit Path (UASCP-P) is a count of one-second intervals when the DS3 path is unavailable. A DS3 path becomes unavailable when ten consecutive SESCP-Ps occur. The ten SESCP-Ps are included in unavailable time. After the DS3 path becomes unavailable, it becomes available when ten consecutive seconds with no SESCP-Ps occur. The ten seconds with no SESCP-Ps are excluded from unavailable time.

Table 11-2 Performance Monitoring Parameters (continued)

Parameter	Definition
UASCP-PFE	Unavailable Seconds CP-bit Far End Path (UASCP-PFE) is a count of one-second intervals when the DS3 path becomes unavailable. A DS3 path becomes unavailable when ten consecutive far-end CP-bit SESs occur. The ten CP-bit SESs are included in unavailable time. After the DS3 path becomes unavailable, it becomes available when ten consecutive seconds occur with no CP-bit SESs. The ten seconds with no CP-bit SESs are excluded from unavailable time.
UAS-P	Path Unavailable Seconds (UAS-P) is a count of the seconds when the path was unavailable. A path becomes unavailable when ten consecutive seconds occur that qualify as P-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as P-SESs.
UAS-PFE	Far-End Path Unavailable Seconds (UAS-PFE) is a count of the seconds when the path was unavailable. A path becomes unavailable when ten consecutive seconds occur that qualify as P-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as P-SESs.
UAS-PM	Path Monitoring Unavailable Seconds (UAS-PM) indicates the unavailable seconds recorded in the OTN path during the PM time interval.
UASP-P	Unavailable Second Path (UASP-P) is a count of one-second intervals when the DS3 path is unavailable. A DS3/E3 path becomes unavailable when ten consecutive SESP-Ps occur. The ten SESP-Ps are included in unavailable time. After the DS3 path becomes unavailable, it becomes available when ten consecutive seconds with no SESP-Ps occur. The ten seconds with no SESP-Ps are excluded from unavailable time.
UAS-SM	Section Monitoring Unavailable Seconds (UAS-SM) indicates the unavailable seconds recorded in the OTN section during the PM time interval.
UNC-WORDS	The number of uncorrectable words detected in the DWDM trunk line during the PM time interval.
VPC	A count of received packets that contain non-errored data code groups that have start and end delimiters.

1. 4-fiber MS-SPRing is not supported on the STM-4 and STM4 SH 1310-4 cards; therefore, the MS-PSC-S and MS-PSC-R PM parameters do not increment.

Note PPJC-PGEN-P, NPJC-PGEN-P, and PJCS-PGEN-P are not supported in Cisco ONS 15310-MA SDH R9.1 and 9.2.

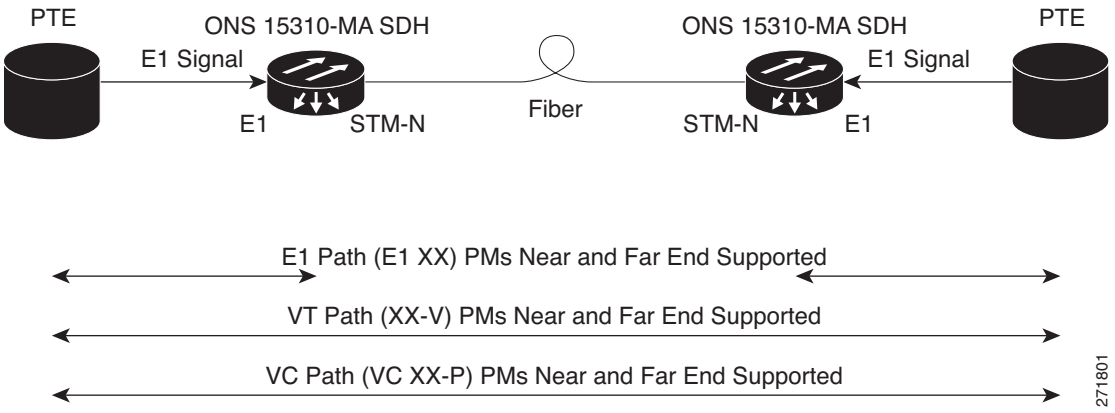
11.5 Performance Monitoring for Electrical Ports

The following sections define PM parameters for the E1 and DS3 electrical ports.

11.5.1 E1 Port Performance Monitoring Parameters

Figure 11-2 shows the signal types that support near-end and far-end PM parameters.

Figure 11-2 Monitored Signal Types for the E1 Ports

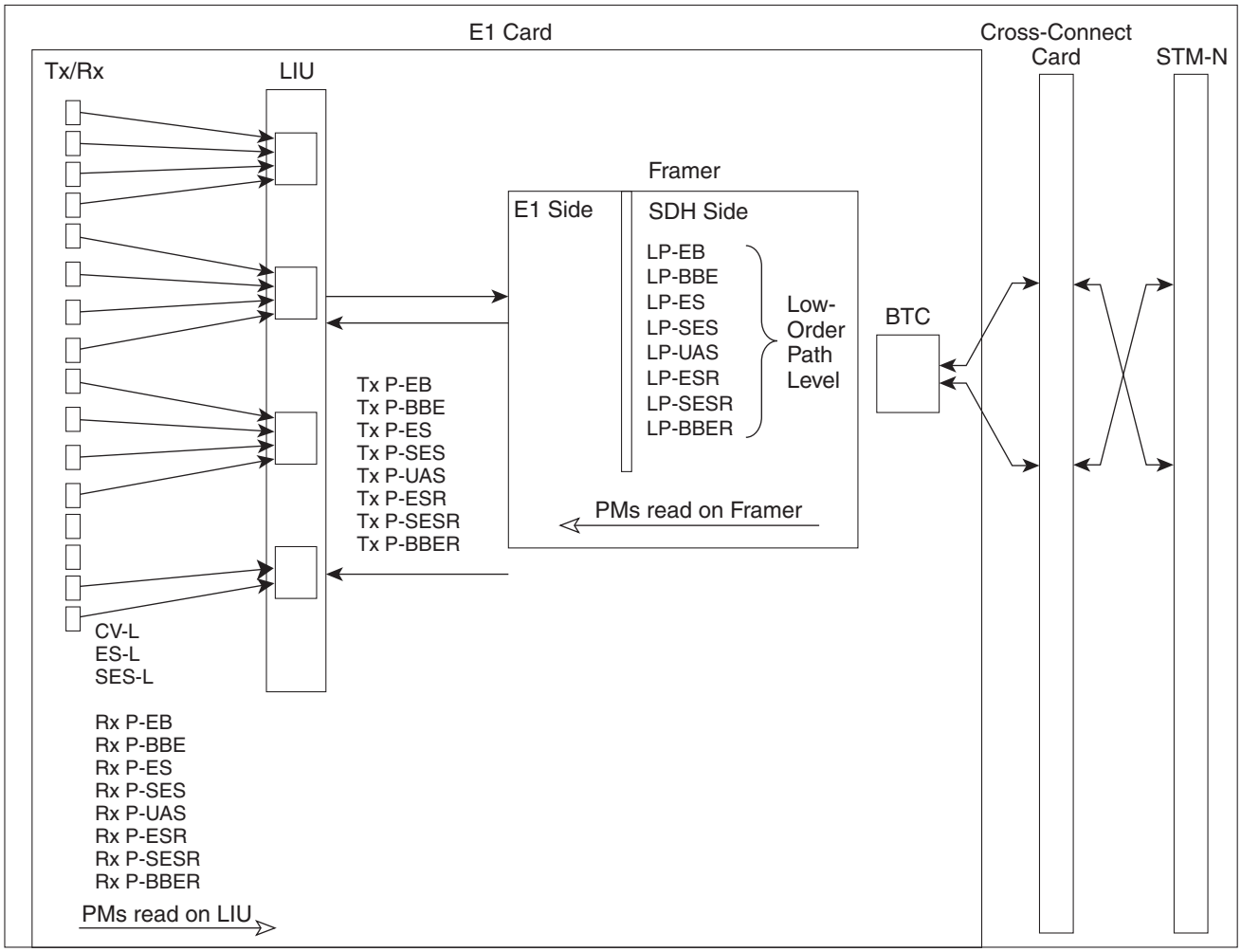


Note The XX in Figure 11-2 represents all PM parameters listed in Figure 11-3 with the given prefix and/or suffix.

Figure 11-3 shows where overhead bytes detected on the application-specific integrated circuits (ASICs) produce PM parameters for the E1 ports.

Figure 11-3 PM Parameter Read Points on the E1 Ports

ONS 15310-MA SDH



The PM parameters for the E1 ports are listed in Table 11-3.

Table 11-3 PM Parameters for E1 Ports

Line (NE)[1]	Tx/Rx Path (NE)[2,3]	VC12 LP (NE/FE)	Tx/Rx Path (FE)[2,3]
CV-L	AISS-P	LP-EB	AISS-PFE
ES-L	BBE-P	LP-ES	BBE-PFE
SES-L	BBER-P	LP-SES	BBER-PFE
LOSS-L	EB-P	LP-UAS	EB-PFE
	ES-P	LP-BBE	ES-PFE
	ESR-P	LP-ESR	ESR-PFE
	SES-P	LP-SESR	SES-PFE
	SESR-P	LP-BBER	SESR-PFE
	UAS-P		UAS-PFE

1. SDH path PMs do not increment unless IPPM is enabled. See the 11.2 Intermediate-Path Performance Monitoring section.

2. Transmit and receive CEPT and CRC4 framing path PM parameters for the near-end and far-end E1-N-14 and E1-42 cards.
3. Under the Provisioning > Threshold tab, the E1-N-14 card and the E1-42 card have user-defined thresholds for the E-1 Rx path PM parameters. In the Threshold tab, they are displayed as EB, BBE, ES, SES, and UAS without the Rx prefix.

Note Under the Provisioning > E1 > SDH Threshold tab, the E1_21_E3_DS3_3, and E1_63_E3_DS3_3 cards have user-defined thresholds for the E1 receive (Rx) path PM parameters. In the SDH Threshold tab they appear as CV, ES, FC, SES, and UAS without the Rx prefix.

Note Under the Performance tab, the displayed E1 Tx path PM parameter values are based on calculations performed by the card and therefore have no user-defined thresholds. The tab is labeled Elect[rical] Path Threshold.

11.5.2 E3 Port Performance Monitoring Parameters

Figure 11-4 shows the signal types that support near-end and far-end PM parameters for the E3 Ports.

Figure 11-4 Monitored Signal Types for the E3 Ports

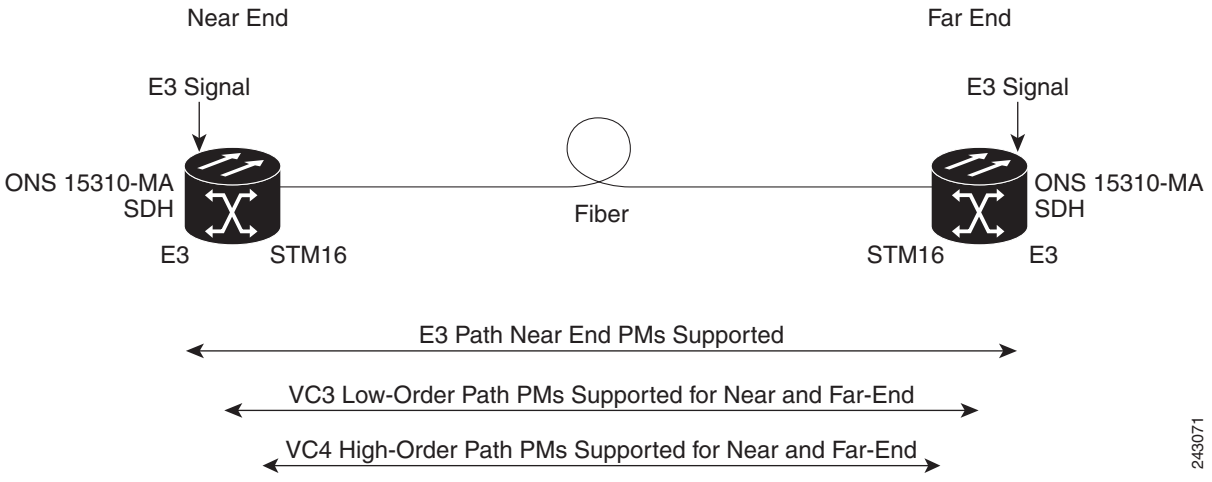
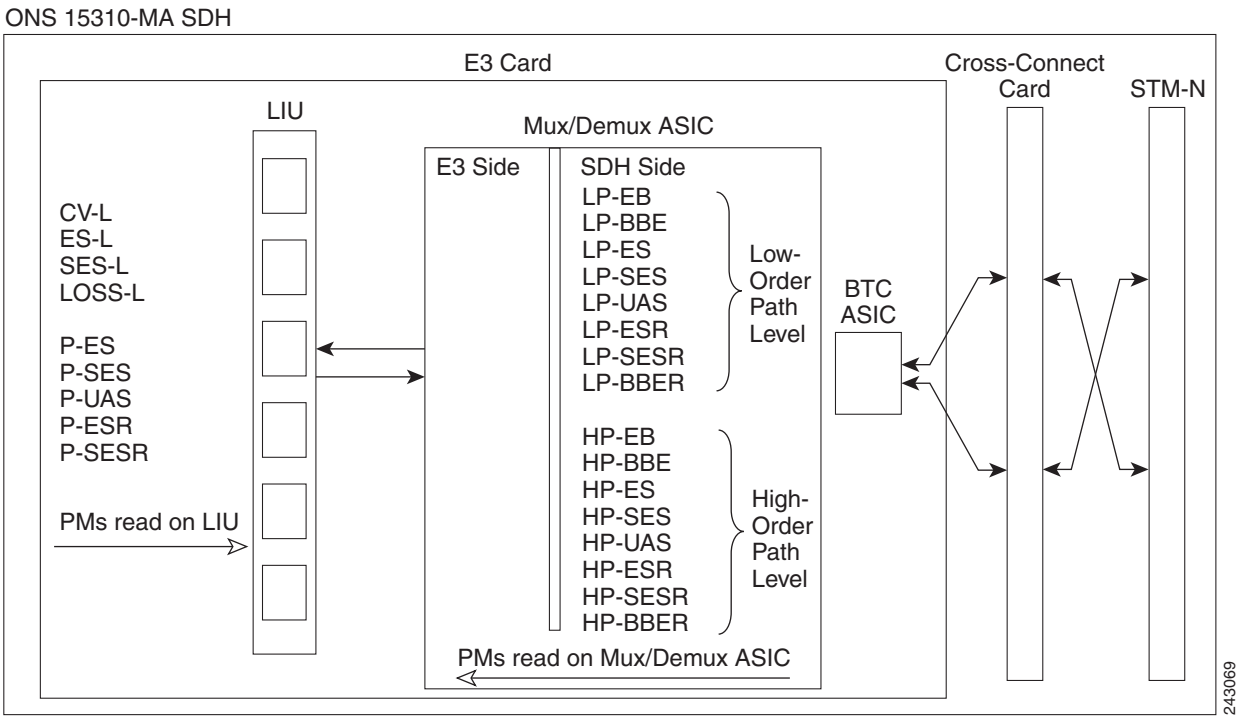


Figure 11-5 shows where overhead bytes detected on the ASICs produce performance monitoring parameters for the E3 ports.

Figure 11-5 PM Read Points on the E3 Ports



The PM parameters for the E3 ports are listed in Table 11-4. The parameters are defined in Table 11-2 on page 11-4.

Table 11-4 PM Parameters for the E3 Ports

Line (NE)	Path (NE)	VC3 Low-End Path (NE/FE)	VC4 HP Path (NE/FE)
CV-L	ES-P	LP-BBE	HP-BBE
ES-L	ESR-P	LP-BBER	HP-BBER
SES-L	SES-P	LP-EB	HP-EB
LOSS-L	SESR-P	LP-ES	HP-ES
	UAS-P	LP-ESR	HP-ESR
		LP-SES	HP-SES
		LP-SESR	HP-SESR
		LP-UAS	HP-UAS

11.5.3 DS3 Port Performance Monitoring Parameters

Figure 11-6 shows the signal types that support near-end and far-end PM parameters for the DS3 Port. Figure 11-7 shows where overhead bytes detected on the ASICs produce performance monitoring parameters for the DS3/E3 Port.

Figure 11-6 Monitored Signal Types for the DS3 Port

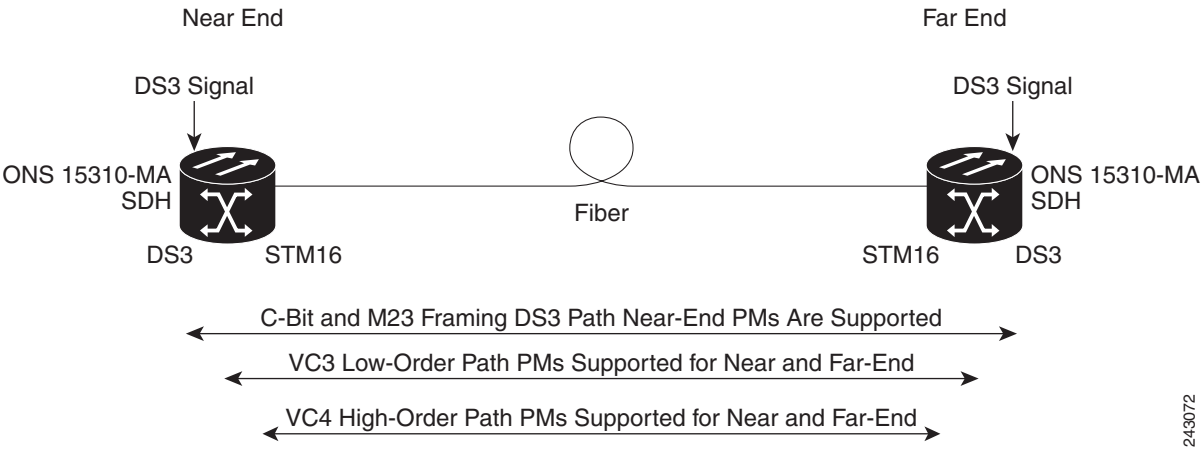
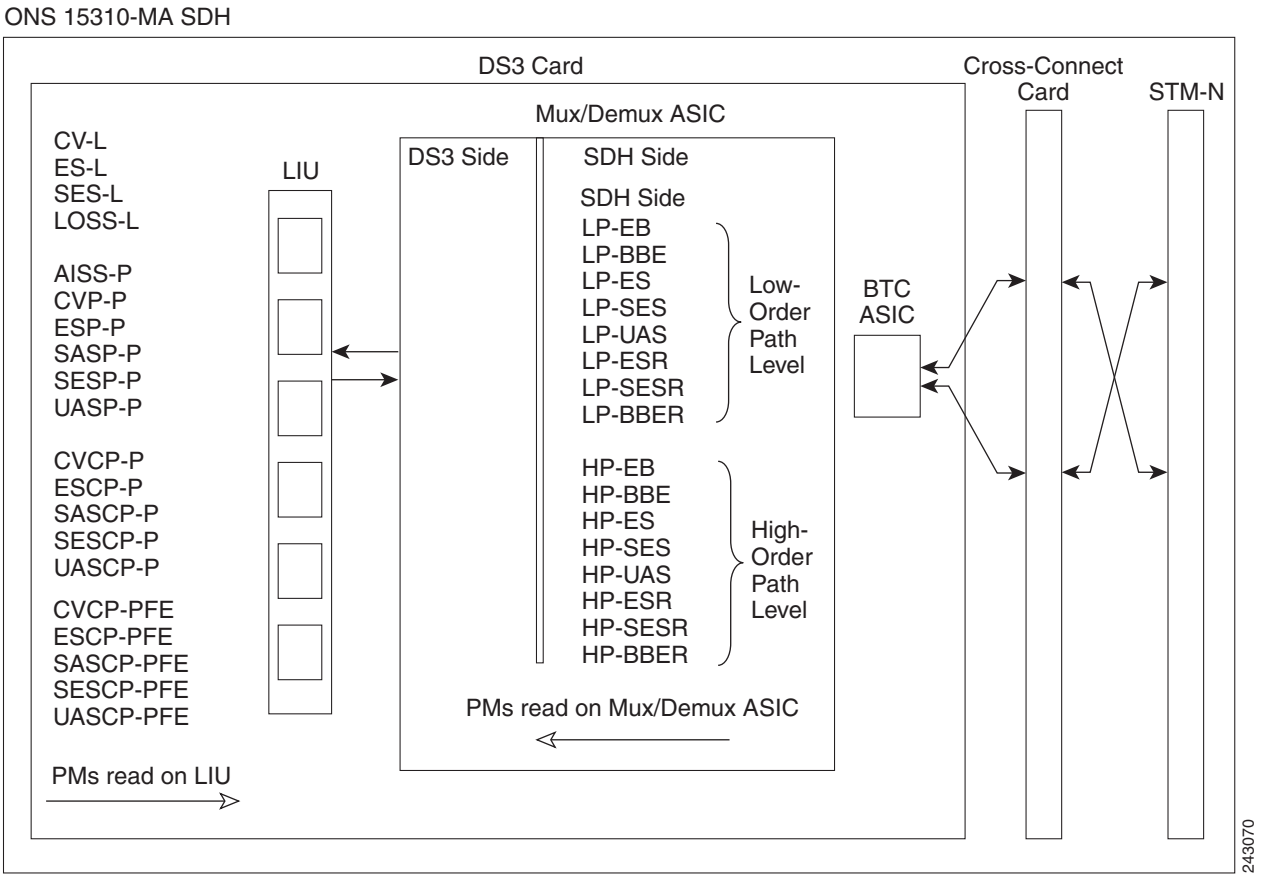


Figure 11-7 PM Read Points on the DS3 Port



The PM parameters for the DS3 port are listed in Table 11-5. The parameters are defined in Table 11-2 on page 11-4.

Table 11-5 DS3 Port PMs

Line (NE)	Path (NE)[1, 2]	Path (FE)[1, 2]	VC3 Low-End Path (NE/FE)	VC4 HP Path (NE/FE)
MS-EB	AISS-P	CVCP-PFE	LP-BBE	HP-BBE
MS-ES	CVP-P	ESCP-PFE	LP-BBER	HP-BBER
MS-SES	ESP-P	SASCP-PFE	LP-EB	HP-EB
LOSS-L	SASP-P[3]	SESCP-PFE	LP-ES	HP-ES
	SESP-P	UASCP-PFE	LP-ESR	HP-ESR
	UASP-P		LP-SES	HP-SES
	CVCP-P		LP-SESR	HP-SESR
	ESCP-P		LP-UAS	HP-UAS
	SASP-P			
	SESCP-P			
	UASCP-P			

1. C-Bit and M23 framing path PM parameters
2. The C-bit PMs (PMs that contain the text “CP-P”) are applicable only if line format is C-bit.
3. DS3 ports support SAS-P only on the Rx path.

11.6 Performance Monitoring for Ethernet Cards

The following sections define PM parameters and definitions for the CE-100T-8, CE-MR-6, and ML-100T-8 Ethernet cards.

11.6.1 CE-100T-8, CE-MR-6, ML-100T-8 Card Ethernet Performance Monitoring Parameters

CTC provides Ethernet performance information, including line-level parameters, port bandwidth consumption, and historical Ethernet statistics. The CE-100T-8, CE-MR-6, and ML-100T-8 card Ethernet performance information is divided into Ether Ports and POS Ports tabbed windows within the card view Performance tab window.

11.6.1.1 CE-100T-8, CE-MR-6, and ML-100T-8 Card Ether Ports Statistics Window

The Ether Ports statistics window lists Ethernet parameters at the line level. The Ether Ports Statistics window provides buttons to change the statistical values shown. The Baseline button resets the displayed statistics values to zero. The Refresh button manually refreshes statistics. Auto-Refresh sets a time interval at which automatic refresh occurs. The window also has a Clear button. The Clear button sets the values on the card to zero, but does not reset the CE-100T-8, and ML-100T-8 cards.

During each automatic cycle, whether auto-refreshed or manually refreshed (using the Refresh button), statistics are added cumulatively and are not immediately adjusted to equal total received packets until testing ends. To see the final PM count totals, allow a few moments for the PM window statistics to finish testing and update fully. PM counts are also listed in the CE-100T-8 and ML-100T-8 card Performance > History window.

Table 11-6 defines the CE-100T-8, CE-MR-6, and ML-100T-8 card Ether Ports statistics parameters.

Table 11-6 CE-100T-8, CE-MR-6, and ML-100T-8 Ether Ports Statistics Parameters

Parameter	Definition
Time Last Cleared	A time stamp indicating the last time statistics were reset.
Link Status	Indicates whether the Ethernet link is receiving a valid Ethernet signal (carrier) from the attached Ethernet device; up means link integrity is present, and down means link integrity is not present.
iflnOctets	The total number of octets received on the interface, including framing octets.
rxTotalPkts	The total number of receive packets.
iflnUcastPkts	The total number of unicast packets delivered to an appropriate protocol.
ifInMulticastPkts	Number of multicast frames received error free.
ifInBroadcastPkts	The number of packets, delivered by this sublayer to a higher (sub)layer, that were addressed to a broadcast address at this sublayer.
ifInDiscards	The number of inbound packets that were chosen to be discarded even though no errors had been detected to prevent them from being deliverable to a higher-layer protocol.
iflnErrors	Number of inbound packets discarded because they contain errors.
ifOutOctets	The total number of transmitted octets, including framing packets.
txTotalPkts	The total number of transmit packets.
ifOutUcastPkts	The total number of unicast packets requested to transmit to a single address.
ifOutMulticastPkts	Number of multicast frames transmitted error free.
ifOutBroadcastPkts	The total number of packets that higher-level protocols requested be transmitted, and that were addressed to a broadcast address at this sublayer, including those that were discarded or not sent.
dot3statsAlignmentErrors	The number of frames with an alignment error, that is, frames with a length that is not an integral number of octets and where the frame cannot pass the frame check sequence (FCS) test.
dot3StatsFCSErrors	The number of frames with frame check errors, that is, where there is an integral number of octets, but an incorrect FCS.
dot3StatsSingleCollisionFrames	The number of successfully transmitted frames that had exactly one collision.
dot3StatsFrameTooLong	The count of frames received on a particular interface that exceed the maximum permitted frame size.
etherStatsUndersizePkts	The number of packets received with a length less than 64 octets.
etherStatsFragments	The total number of packets that are not an integral number of octets or have a bad FCS, and that are less than 64 octets long.
etherStatsPkts64Octets	The total number of packets received (including error packets) that were 64 octets in length.
etherStatsPkts65to127Octets	The total number of packets received (including error packets) that were 65 to 172 octets in length.

Table 11-6 CE-100T-8, CE-MR-6, and ML-100T-8 Ether Ports Statistics Parameters (continued)

Parameter	Definition
etherStatsPkts128to255Octets	The total number of packets received (including error packets) that were 128 to 255 octets in length.
etherStatsPkts256to511Octets	The total number of packets received (including error packets) that were 256 to 511 octets in length.
etherStatsPkts512to1023Octets	The total number of packets received (including error packets) that were 512 to 1023 octets in length.
etherStatsPkts1024to1518Octets	The total number of packets received (including error packets) that were 1024 to 1518 octets in length.
etherStatsBroadcastPkts	The total number of good packets received that were directed to the broadcast address. This does not include multicast packets.
etherStatsMulticastPkts	The total number of good packets received that were directed to a multicast address. This number does not include packets directed to the broadcast.
etherStatsOversizePkts	The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets) and were otherwise well formed.
etherStatsJabbers	The total number of packets longer than 1518 octets that were not an integral number of octets or had a bad FCS.
etherStatsOctets	The total number of octets of data (including those in bad packets) received on the network (excluding framing bits but including FCS octets).
etherStatsCollisions	The best estimate of the total number of collisions on this segment.
etherStatsCRCAlignErrors	The total number of packets with a length between 64 and 1518 octets, inclusive, that had a bad FCS or were not an integral number of octets in length.
etherStatsDropEvents	The total number of events in which packets were dropped by the probe due to lack of resources. This number is not necessarily the number of packets dropped; it is just the number of times this condition has been detected.
rxPauseFrames	Number of received pause frames. **Note** rxPauseFrames is not supported on CE-100T-8
txPauseFrames	Number of transmitted pause frames. **Note** txPauseFrames is not supported on CE-100T-8
ifOutDiscards	Number of outbound packets that were chosen to be discarded even though no errors had been detected to prevent their transmission. A possible reason for discarding such packets could be to create buffer space.

11.6.1.2 CE-100T-8, CE-MR-6, and ML-100T-8 Card Ether Ports Utilization Window

The Ether Ports Utilization window shows the percentage of Tx and Rx line bandwidth used by the Ethernet ports during consecutive time segments. The Ether Ports Utilization window provides an Interval drop-down list that enables you to set time intervals of 1 minute, 15 minutes, 1 hour, and 1 day. Line utilization for Ethernet ports is calculated with the following formulas:

Rx = (inOctets + inPkts * 20) * 8 / 100% interval * maxBaseRate

Tx = (outOctets + outPkts * 20) * 8 / 100% interval * maxBaseRate

The interval is defined in seconds. The maxBaseRate is defined by raw bits per second in one direction for the Ethernet port (that is, 1 Gbps). The maxBaseRate for CE-100T-8, CE-MR-6, and ML-100T-8 Ethernet cards is shown in Table 11-7.

Table 11-7 maxBaseRate for VC high-order path Circuits

VC high-order path	maxBaseRate
VC3	51840000
VC4	155000000
VC4-2c	311000000
VC4-4c	622000000

Note Line utilization numbers express the average of ingress and egress traffic as a percentage of capacity.

11.6.1.3 CE-100T-8, CE-MR-6, and ML-100T-8 Card Ether Ports History Window

The Ether Ports History window lists past Ethernet statistics for the previous time intervals. Depending on the selected time interval, the Ether Ports History window displays the statistics for each port for the number of previous time intervals as shown in Table 11-8. The parameters are defined in Table 11-6 on page 11-20.

Table 11-8 Ethernet History Statistics per Time Interval

Time Interval	Number of Intervals Displayed
1 minute	60 previous time intervals
15 minutes	32 previous time intervals
1 hour	24 previous time intervals
1 day (24 hours)	7 previous time intervals

11.6.1.4 CE-100T-8, CE-MR-6, and ML-100T-8 Card POS Ports Statistics Parameters

In the CE-100T-8, CE-MR-6, and ML-100T-8 POS Ports window, the parameters that appear depend on the framing mode employed by the cards. The two framing modes for the packet-over-SDH (POS) port on the CE-100T-8, CE-MR-6, and ML-100T-8 cards are high-level data link control (HDLC) and frame-mapped generic framing procedure (GFP-F). For more information on provisioning a framing mode, refer to *Cisco ONS 15310-MA SDH Procedure Guide.*

The POS Ports statistics window lists POS parameters at the line level.

Table 11-9 defines the CE-100T-8, CE-MR-6, and ML-100T-8 card POS ports parameters for HDLC mode.

Table 11-9 CE-100T-8, CE-MR-6, and ML-100T-8 POS Ports Parameters for HDLC Mode

Parameter	Definition
Time Last Cleared	A time stamp indicating the last time statistics were reset.
Link Status	Indicates whether the Ethernet link is receiving a valid Ethernet signal (carrier) from the attached Ethernet device; up means present, and down means not present.
iflnOctets	The total number of octets received on the interface, including framing octets.
txTotalPkts	The total number of transmit packets.
ifInDiscards	The number of inbound packets that were chosen to be discarded even though no errors had been detected to prevent their being deliverable to a higher-layer protocol.
iflnErrors	Number of inbound packets discarded because they contain errors.
ifOutOctets	The total number of transmitted octets, including framing packets.
rxTotalPkts	The total number of receive packets.
ifOutOversizePkts	Number of packets larger than 1518 bytes sent out into SDH. Packets larger than 1600 bytes do not get transmitted.
mediaIndStatsRxFramesBadCRC	A count of the received Fibre Channel frames with errored CRCs.
hdlcRxAborts	Number of received packets aborted before input.
ifInPayloadCRCErrors	The number of receive data frames with payload CRC errors.
ifOutPayloadCRCErrors	The number of transmit data frames with payload CRC errors.
ifOutDiscards	Number of outbound packets that were chosen to be discarded even though no errors had been detected to prevent their transmission. A possible reason for discarding such packets could be to create buffer space. **Note** ifOutDiscards is not supported on ML cards.

Table 11-10 defines the CE-100T-8, CE-MR-6, and ML-100T-8 card POS ports parameter for GFP-F mode.

Table 11-10 CE-100T-8, CE-MR-6, and ML-100T-8 POS Ports Parameters for GFP-F Mode

Parameter	Definition
Time Last Cleared	A time stamp indicating the last time statistics were reset.
Link Status	Indicates whether the Ethernet link is receiving a valid Ethernet signal (carrier) from the attached Ethernet device; up means present, and down means not present.
iflnOctets	The total number of octets received on the interface, including framing octets.

Table 11-10 CE-100T-8, CE-MR-6, and ML-100T-8 POS Ports Parameters for GFP-F Mode (continued)

Parameter	Definition
txTotalPkts	The total number of transmit packets.
ifInDiscards	The number of inbound packets that were chosen to be discarded even though no errors had been detected to prevent their being deliverable to a higher-layer protocol.
iflnErrors	Number of inbound packets discarded because they contain errors.
ifOutOctets	The total number of transmitted octets, including framing packets.
rxTotalPkts	The total number of receive packets.
ifOutOversizePkts	Number of packets larger than 1518 bytes sent out into SDH. Packets larger than 1600 bytes do not get transmitted.
gfpStatsRxSBitErrors	Receive frames with single bit errors (cHEC, tHEC, eHEC).
gfpStatsRxMBitErrors	Receive frames with multibit errors (cHEC, tHEC, eHEC).
gfpStatsRxTypeInvalid	Receive frames with invalid type (PTI, EXI, UPI).
gfpStatsRxCRCErrors	Receive data frames with payload CRC errors.
gfpStatsRxCIDInvalid	Receive frames with invalid CID.
gfpStatsCSFRaised	Number of Rx client management frames with client signal fail indication.
ifInPayloadCRCErrors	The number of receive data frames with payload CRC errors.
ifOutPayloadCRCErrors	The number of transmit data frames with payload CRC errors.
gfpStatsRxFrame	Number of received GFP frames.
gfpStatsTxOctets	Number of GFP bytes transmitted.
ifOutDiscards	Number of outbound packets that were chosen to be discarded even though no errors had been detected to prevent their transmission. A possible reason for discarding such packets could be to create buffer space. **Note** ifOutDiscards is not supported on ML cards.

11.6.1.5 CE-100T-8, CE-MR-6, and ML-100T-8 Card POS Ports Utilization Window

The POS Ports Utilization window shows the percentage of Tx and Rx line bandwidth used by the POS ports during consecutive time segments. The POS Ports Utilization window provides an Interval drop-down list that enables you to set time intervals of 1 minute, 15 minutes, 1 hour, and 1 day. Line utilization for POS ports is calculated with the following formulas:

Rx = (inOctets * 8) / (interval * maxBaseRate)

Tx = (outOctets * 8) / (interval * maxBaseRate)

The interval is defined in seconds. The maxBaseRate is defined by raw bits per second in one direction for the Ethernet port (that is, 1 Gbps).

Refer to Table 11-7 on page 11-22 for maxBaseRate values for VC high-order path circuits.

Note Line utilization numbers express the average of ingress and egress traffic as a percentage of capacity.

11.6.1.6 CE-100T-8, CE-MR-6, and ML-100T-8 Card POS Ports History Window

The Ethernet POS Ports History window lists past Ethernet POS Ports statistics for the previous time intervals. Depending on the selected time interval, the History window displays the statistics for each port for the number of previous time intervals as shown in Table 11-8 on page 11-22. The listed parameters are defined in Table 11-6 on page 11-20.

11.7 Performance Monitoring for Optical Ports

The following sections list the PM parameters for the STM1, STM4 and STM16 ports. The listed parameters are defined in Table 11-2 on page 11-4.

11.7.1 STM1 Port Performance Monitoring Parameters

Figure 11-8 shows the signal types that support near-end and far-end PM parameters.

Figure 11-8 Monitored Signal Types for the STM1 Port

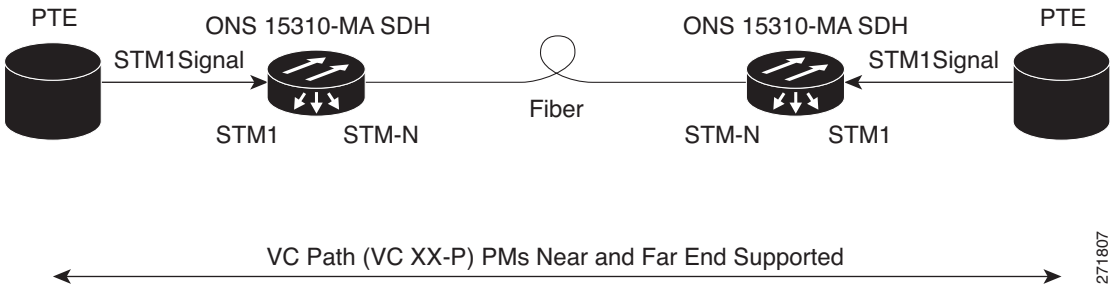
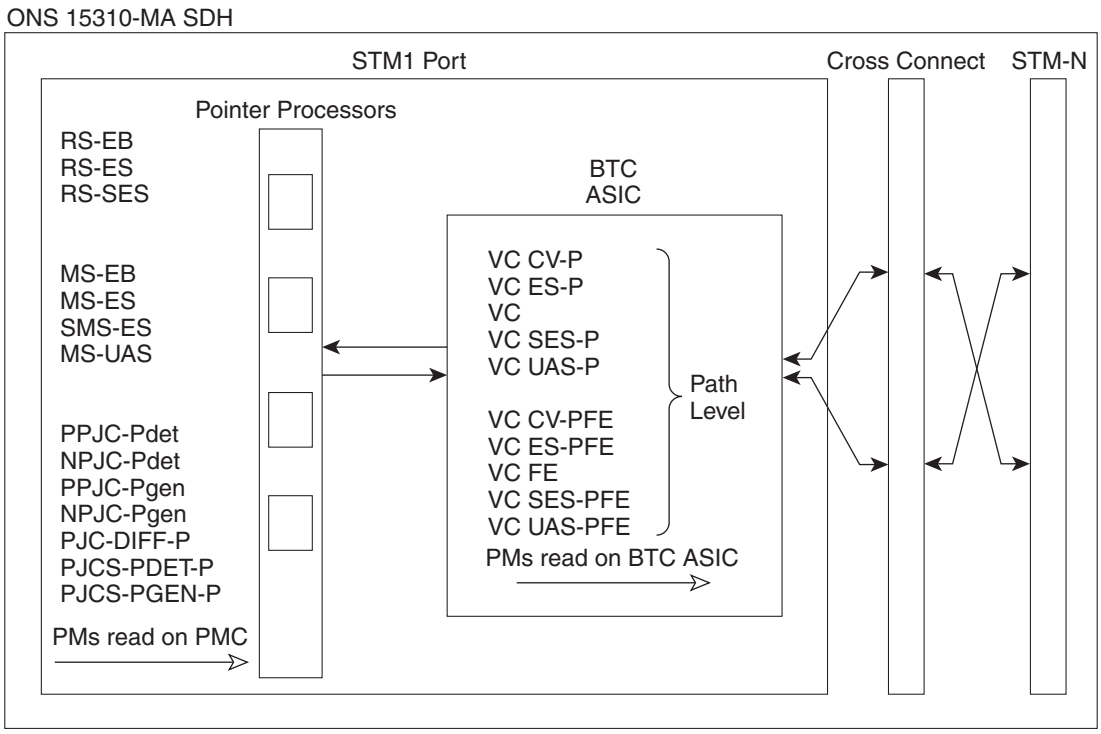


Figure 11-9 shows where overhead bytes detected on the ASICs produce PM parameters for the STM1 port.

Figure 11-9 PM Parameter Read Points on the STM1 Port



The PM parameters for the STM1 ports are listed in Table 11-11. The listed parameters are defined in Table 11-2 on page 11-4.

Note The parameters listed below are applicable for STM1 optical and Electrical SFPs.

Table 11-11 STM1 Port PM Parameters

RS (NE)	MS (NE/FE)	MS (NE/FE) 1+1 LMSP (NE)[1, 2]	PJC (NE)[3]	VC4 and VC4-Xc HP Path (NE/FE4[4])[5]
RS-BBE	MS-BBE	MS-PSC (1+1)	HP-PPJC-Pdet	HP-BBE
RS-EB	MS-EB	MS-PSD	HP-NPJC-Pdet	HP-BBER
RS-ES	MS-ES		HP-PPJC-Pgen	HP-EB
RS-SES	MS-SES		HP-NPJC-Pgen	HP-ES
RS-UAS	MS-UAS		HP-PJCS-Pdet	HP-ESR
			HP-PJCS-Pgen	HP-SES
			HP-PJCDiff	HP-SESR
				HP-UAS

1. For information about troubleshooting subnetwork connection protection (SNCP) switch counts, refer to the "Alarm Troubleshooting" chapter in the *Cisco ONS 15310-MA SDH Troubleshooting Guide*. For information about creating circuits that perform a switch, refer to Chapter 7, "Circuits and Tunnels".
2. MS-SPRing is not supported on the STM-1 card and STM-1E card; therefore, the MS-PSD-W, MS-PSD-S, and MS-PSD-R PM parameters do not increment.
3. In CTC, the count fields for the HP-PPJC and HP-NPJC PM parameters appear white and blank unless they are enabled on the Provisioning > Line tab. See the 11.3 Pointer Justification Count Performance Monitoring section.

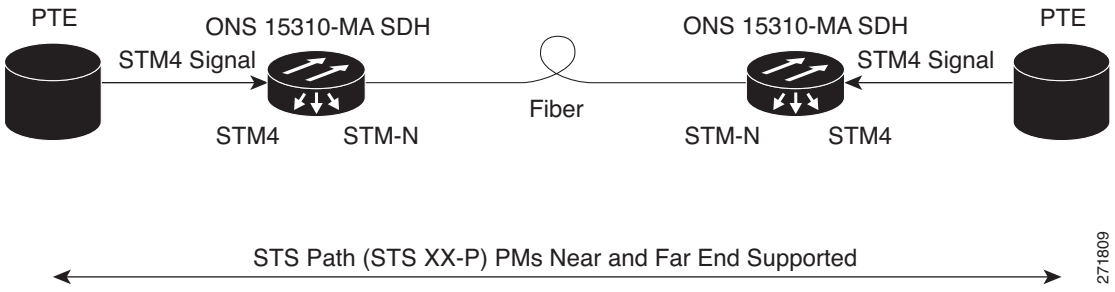
4. Far-end high-order VC4 and VC4-Xc path PM parameters applies only to the STM1-4 card. Also, MRC-12 and OC192/STM64-XFP based cards support far-end path PM parameters. All other optical cards do not support far-end path PM parameters.
5. SDH path PM parameters do not increment unless IPPM is enabled. See the 11.2 Intermediate-Path Performance Monitoring section.

Note For information about troubleshooting Linear Multiplex Section Protection switch counts, refer to the *Cisco ONS 15310-MA SDH Troubleshooting Guide*. For information about creating circuits that perform a switch, refer to the *Cisco ONS 15310-MA SDH Procedure Guide*.

11.7.2 STM4 Port Performance Monitoring Parameters

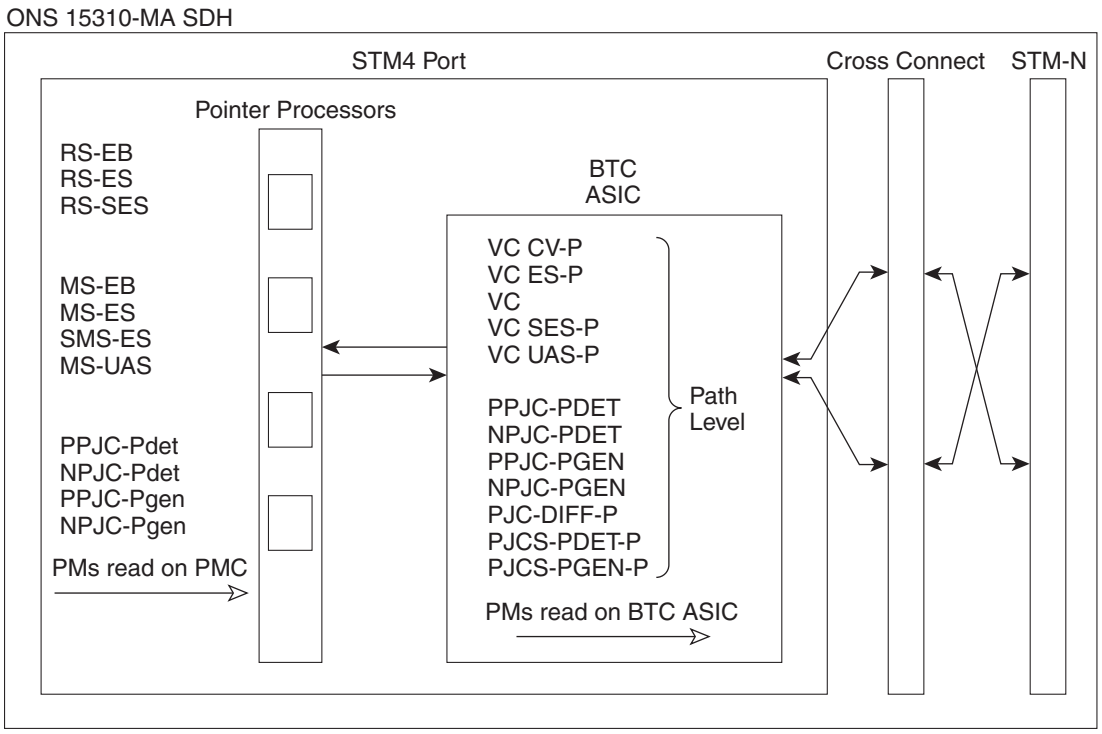
Figure 11-10 shows the signal types that support near-end and far-end PM parameters. Figure 11-11 shows where overhead bytes detected on the ASICs produce PM parameters for the STM4 ports.

Figure 11-10 Monitored Signal Types for the STM4 Ports



Note The XX in Figure 11-10 represents all PM parameters listed in Figure 11-11 with the given prefix and/or suffix.

Figure 11-11 PM Parameter Read Points on the STM4 Ports



Note For PM locations relating to protection switch counts, see the Telcordia GR-1230-CORE document.

The PM parameters for the STM4 ports are listed in Table 11-12. The listed parameters are defined in Table 11-2 on page 11-4.

Table 11-12 STM4 Port PM Parameters

RS (NE)	MS (NE/FE)	MS (NE/FE) 1+1 LMSP (NE)[1, 2]	PJC (NE)[3]	VC4 and VC4-Xc HP Path (NE/FE4[4])[5]
RS-BBE	MS-BBE	MS-PSC (1+1)	HP-PPJC-Pdet	HP-BBE
RS-EB	MS-EB	MS-PSD	HP-NPJC-Pdet	HP-BBER
RS-ES	MS-ES		HP-PPJC-Pgen	HP-EB
RS-SES	MS-SES		HP-NPJC-Pgen	HP-ES
	MS-UAS		HP-PJCS-Pdet	HP-ESR
			HP-PJCS-Pgen	HP-SES
			HP-PJCDiff	HP-SESR
				HP-UAS

1. For information about troubleshooting subnetwork connection protection (SNCP) switch counts, refer to the "Alarm Troubleshooting" chapter in the *Cisco ONS 15310-MA SDH Troubleshooting Guide*. For information about creating circuits that perform a switch, refer to Chapter 7, "Circuits and Tunnels".
2. MS-SPRing is not supported on the STM-1 card and STM-1E card; therefore, the MS-PSD-W, MS-PSD-S, and MS-PSD-R PM parameters do not increment.
3. In CTC, the count fields for the HP-PPJC and HP-NPJC PM parameters appear white and blank unless they are enabled on the Provisioning > Line tab. See the 11.3 Pointer Justification Count Performance Monitoring section.

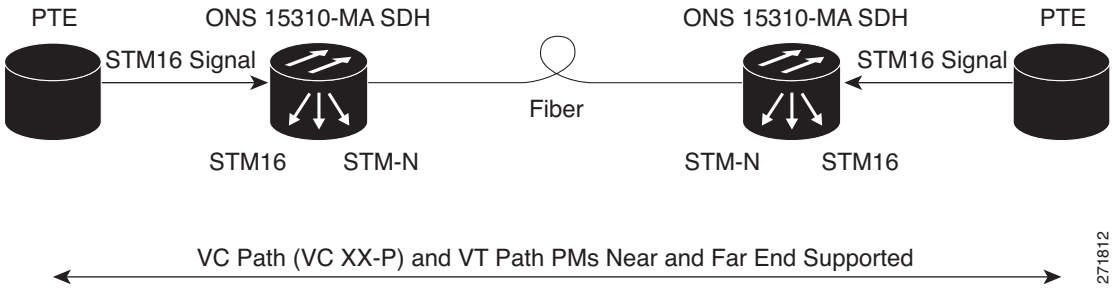
4. Far-end high-order VC4 and VC4-Xc path PM parameters applies only to the STM1-4 card. Also, MRC-12 and OC192/STM64-XFP based cards support far-end path PM parameters. All other optical cards do not support far-end path PM parameters.
5. SDH path PM parameters do not increment unless IPPM is enabled. See the 11.2 Intermediate-Path Performance Monitoring section.

Note For information about troubleshooting Linear Multiplex Section Protection switch counts, refer to the *Cisco ONS 15310-MA SDH Troubleshooting Guide*. For information about creating circuits that perform a switch, refer to the *Cisco ONS 15310-MA SDH Procedure Guide*.

11.7.3 STM16 Port Performance Monitoring Parameters for ONS 15310-MA SDH

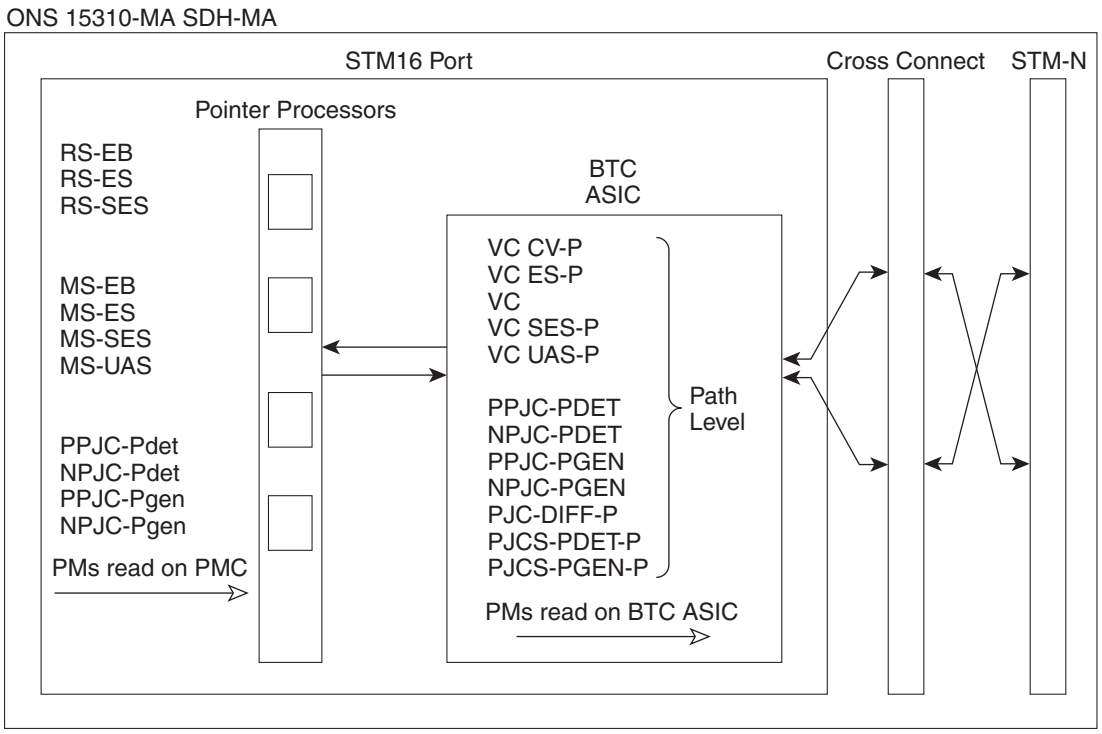
Figure 11-12 shows the signal types that support near-end and far-end PM parameters. Figure 11-13 shows where overhead bytes detected on the ASICs produce PM parameters for the STM16 ports.

Figure 11-12 Monitored Signal Types for the STM16 Ports



Note PM parameters on the protect VC high-order path are not supported for MS-SPRing. The XX in Figure 11-12 represents all PM parameters listed in Figure 11-13 with the given prefix and/or suffix.

Figure 11-13 PM Parameter Read Points on the STM16 Ports



Note For PM locations relating to protection switch counts, see the Telcordia GR-1230-CORE document.

The PM parameters for the STM16 ports are listed in Table 11-13. The listed parameters are defined in Table 11-2 on page 11-4.

Table 11-13 STM16 Port PM Parameters

RS (NE)	MS (NE/FE)	MS (NE/FE) 1+1 LMSP (NE)[1, 2]	PJC (NE)[3]	VC4 and VC4-Xc HP Path (NE/FE4[4])[5]
RS-BBE RS-EB RS-ES RS-SES	MS-BBE MS-EB MS-ES MS-SES MS-UAS	MS-PSC (1+1) MS-PSD	HP-PPJC-Pdet HP-NPJC-Pdet HP-PPJC-Pgen HP-NPJC-Pgen HP-PJCS-Pdet HP-PJCS-Pgen HP-PJCDiff	HP-BBE HP-BBER HP-EB HP-ES HP-ESR HP-SES HP-SESR HP-UAS

1. For information about troubleshooting subnetwork connection protection (SNCP) switch counts, refer to the "Alarm Troubleshooting" chapter in the *Cisco ONS 15310-MA SDH Troubleshooting Guide*. For information about creating circuits that perform a switch, refer to Chapter 7, "Circuits and Tunnels".
2. MS-SPRing is not supported on the STM-1 card and STM-1E card; therefore, the MS-PSD-W, MS-PSD-S, and MS-PSD-R PM parameters do not increment.
3. In CTC, the count fields for the HP-PPJC and HP-NPJC PM parameters appear white and blank unless they are enabled on the Provisioning > Line tab. See the 11.3 Pointer Justification Count Performance Monitoring section.

4. Far-end high-order VC4 and VC4-Xc path PM parameters applies only to the STM1-4 card. Also, MRC-12 and OC192/STM64-XFP based cards support far-end path PM parameters. All other optical cards do not support far-end path PM parameters.
5. SDH path PM parameters do not increment unless IPPM is enabled. See the 11.2 Intermediate-Path Performance Monitoring section.

Note For information about troubleshooting Linear Multiplex Section Protection switch counts, refer to the *Cisco ONS 15310-MA SDH Troubleshooting Guide*. For information about creating circuits that perform a switch, refer to the *Cisco ONS 15310-MA SDH Procedure Guide*.

CHAPTER 12

SNMP

This chapter explains Simple Network Management Protocol (SNMP) as implemented by the Cisco ONS 15310-MA SDH.

For SNMP set up information, refer to the *Cisco ONS 15310-MA SDH Procedure Guide*.

Chapter topics include:

12.1 SNMP Overview

SNMP is an application-layer communication protocol that allows network devices to exchange management information. SNMP enables network administrators to manage network performance, find and solve network problems, and plan network growth. Up to ten SNMP trap destinations and five concurrent Cisco Transport Controller (CTC) user sessions are allowed per node.

The ONS 15310-MA SDH use SNMP to provide asynchronous event notification to a network management system (NMS). ONS SNMP implementation uses standard Internet Engineering Task Force (IETF) management information bases (MIBs) to convey node-level inventory, fault, and performance management information for E1, DS3, SDH, and Ethernet read-only management. SNMP allows limited management of the ONS 15310-MA SDH by a generic SNMP manager—for example, HP OpenView Network Node Manager (NNM) or Open Systems Interconnection (OSI) NetExpert.

The ONS 15310-MA SDH supports SNMP Version 1 (SNMPv1), SNMP Version 2c (SNMPv2c), and SNMP Version 3 (SNMPv3). As compared to SNMPv1, SNMPv2c includes additional protocol operations. SNMPv3 provides authentication, encryption, and message integrity and is more secure. This chapter describes the SNMP versions and explains how to configure SNMP on the ONS 15310-MA SDH.

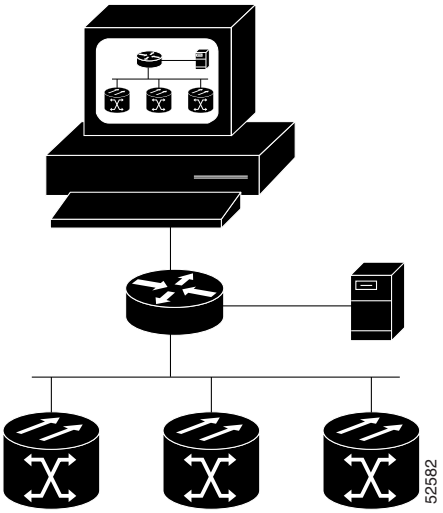
Note It is recommended that the SNMP Manager timeout value be set to 60 seconds. Under certain conditions, if this value is lower than the recommended time, the TCC card can reset. However, the response time depends on various parameters such as object being queried, complexity, and number of hops in the node, etc.

Note In Release 9.1 and 9.2, you can retrieve automatic in service state and soak time through the SNMP and Transaction Language One (TL1) interfaces.

Note The CERENT-MSDWDM-MIB.mib and CERENT-FC-MIB.mib in the CiscoV2 directory support 64-bit performance monitoring counters. However, the SNMPv1 MIB in the CiscoV1 directory does not contain 64-bit performance monitoring counters, but supports the lower and higher word values of the corresponding 64-bit counter. The other MIB files in the CiscoV1 and CiscoV2 directories are identical in content and differ only in format.

Figure 12-1 illustrates a basic network managed by SNMP.

Figure 12-1 Basic Network Managed by SNMP

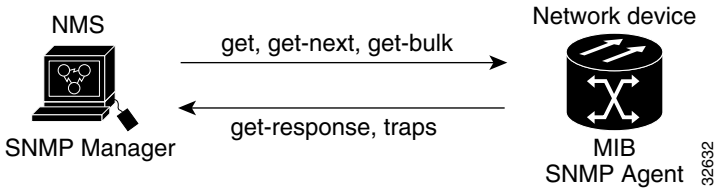


12.2 SNMP Basic Components

An SNMP-managed network consists of three primary components: managed devices, agents, and management systems. A managed device is a network node that contains an SNMP agent and resides on an SNMP-managed network. Managed devices collect and store management information and use SNMP to make this information available to management systems that use SNMP. Managed devices include routers, access servers, switches, bridges, hubs, computer hosts, and network elements such as the ONS 15310-MA SDH.

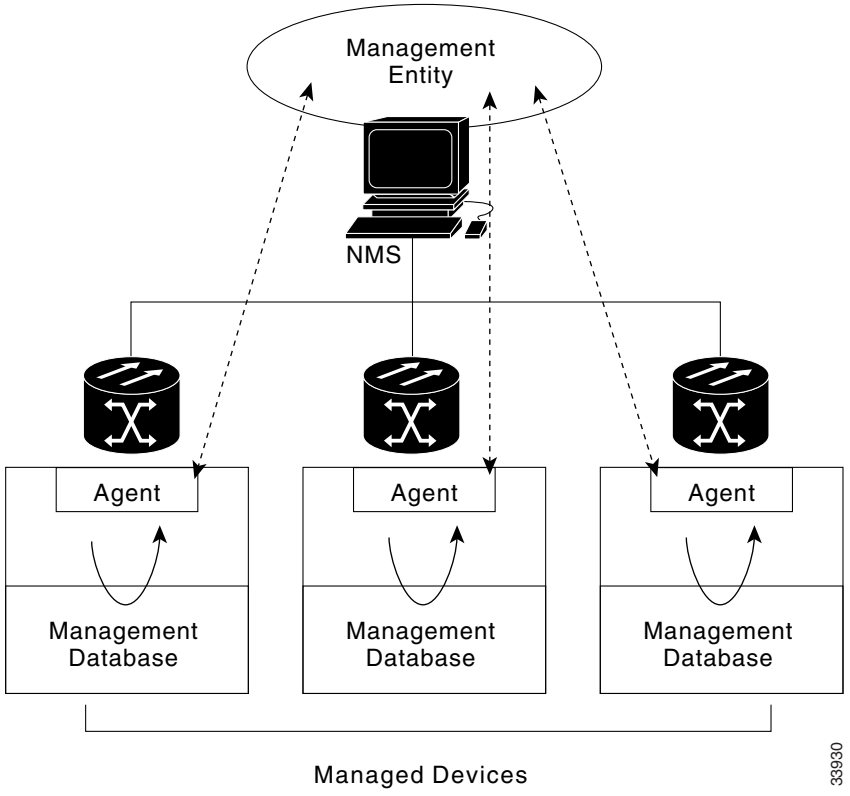
An agent is a software module that resides in a managed device. An agent has local knowledge of management information and translates that information into a form compatible with SNMP. The SNMP agent gathers data from the MIB, which is the repository for device parameter and network data. The agent can also send traps, which are notifications of certain events (such as changes), to the manager. Figure 12-2 illustrates these SNMP operations.

Figure 12-2 SNMP Agent Gathering Data from a MIB and Sending Traps to the Manager



A management system such as HP OpenView executes applications that monitor and control managed devices. Management systems provide the bulk of the processing and memory resources required for network management. One or more management systems must exist on any managed network. Figure 12-3 illustrates the relationship between the three key SNMP components.

Figure 12-3 Example of the Primary SNMP Components



12.3 SNMP Version Support

The ONS 15310-MA SDH support SNMP v1, SNMPv2c and SNMPv3 traps and get requests. The SNMP MIBs in the ONS 15310-MA SDH systems define alarms, traps, and status. Through SNMP, NMS applications can use a supported MIB to query a management agent. The functional entities include Ethernet switches and SDH multiplexers. Refer to the *Cisco ONS 15310-MA SDH Procedure Guide* for procedures to set up or change SNMP settings.

12.3.1 SNMPv3 Support

Cisco ONS 15310-MA SDH Software R9.0 and later supports SNMPv3 in addition to SNMPv1 and SNMPv2c. SNMPv3 is an interoperable standards-based protocol for network management. SNMPv3 provides secure access to devices by a combination of authentication and encryption packets over the network based on the User Based Security Model (USM) and the View-Based Access Control Model (VACM).

- **User-Based Security Model**—The User-Based Security Model (USM) uses the HMAC algorithm for generating keys for authentication and privacy. SNMPv3 authenticates data based on its origin, and ensures that the data is received intact. SNMPv1 and v2 authenticate data based on the plain text community string, which is less secure when compared to the user-based authentication model.
- **View-Based Access Control Model**—The view-based access control model controls the access to the managed objects. RFC 3415 defines the following five elements that VACM comprises:
  - Groups—A set of users on whose behalf the MIB objects can be accessed. Each user belongs to a group. The group defines the access policy, notifications that users can receive, and the security model and security level for the users.
  - Security level—The access rights of a group depend on the security level of the request.
  - Contexts—Define a named subset of the object instances in the MIB. MIB objects are grouped into collections with different access policies based on the MIB contexts.
  - MIB views—Define a set of managed objects as subtrees and families. A view is a collection or family of subtrees. Each subtree is included or excluded from the view.
  - Access policy—Access is determined by the identity of the user, security level, security model, context, and the type of access (read/write). The access policy defines what SNMP objects can be accessed for reading, writing, and creating.

  Access to information can be restricted based on these elements. Each view is created with different access control details. An operation is permitted or denied based on the access control details.

You can configure SNMPv3 on a node to allow SNMP get and set access to management information and configure a node to send SNMPv3 traps to trap destinations in a secure way. SNMPv3 can be configured in secure mode, non-secure mode, or disabled mode.

SNMP, when configured in secure mode, only allows SNMPv3 messages that have the authPriv security level. SNMP messages without authentication or privacy enabled are not allowed. When SNMP is configured in non-secure mode, it allows SNMPv1, SNMPv2, and SNMPv3 message types.

12.4 SNMP Message Types

The ONS 15310-MA SDH SNMP agents communicate with an SNMP management application using SNMP messages. Table 12-1 describes these messages.

Table 12-1 SNMP Message Types

Operation	Description
get-request	Retrieves a value from a specific variable.
get-next-request	Retrieves the value following the named variable; this operation is often used to retrieve variables from within a table. With this operation, an SNMP manager does not need to know the exact variable name. The SNMP manager searches sequentially to find the needed variable from within the MIB.
get-response	Replies to a get-request, get-next-request, get-bulk-request, or set-request sent by an NMS.
get-bulk-request	Fills the get-response with up to the max-repetition number of get-next interactions, similar to a get-next-request.
set-request	Provides remote network monitoring (RMON) MIB.
trap	Indicates that an event has occurred. An unsolicited message is sent by an SNMP agent to an SNMP manager.

12.5 SNMP Management Information Bases

A managed object, sometimes called a MIB object, is one of many specific characteristics of a managed device. The MIB consists of hierarchically organized object instances (variables) that are accessed by network-management protocols such as SNMP.

12.5.1 IETF-Standard MIBs for the ONS 15310-MA SDH

Table 12-2 lists the IETF standard MIBs implemented in the ONS 15310-MA SDH SNMP agent. You must first compile the MIBs inTable 12-2. Compile the MIBS in Table 12-3 next.

Caution If you do not compile MIBs the correct order, one or more might not compile correctly.

Table 12-2 IETF Standard MIBs Implemented in the ONS 15310-MA SDH SNMP Agent

RFC[1] Number	Module Name	Title/Comments
—	IANAifType-MIB.mib	Internet Assigned Numbers Authority (IANA) ifType
1213 1907	RFC1213-MIB-rfc1213.mib, SNMPV2-MIB-rfc1907.mib	Management Information Base for Network Management of TCP/IP-based internets:MIB-II Management Information Base for Version 2 of the Simple Network Management Protocol (SNMPv2)
1253	RFC1253-MIB-rfc1253.mib	OSPF Version 2 Management Information Base
1493	BRIDGE-MIB-rfc1493.mib	Definitions of Managed Objects for Bridges (This defines MIB objects for managing MAC bridges based on the IEEE 802.1D-1990 standard between Local Area Network (LAN) segments.)
2819	RMON-MIB-rfc2819.mib	Remote Network Monitoring MIB

Table 12-2 IETF Standard MIBs Implemented in the ONS 15310-MA SDH SNMP Agent

RFC[1] Number	Module Name	Title/Comments
2737	ENTITY-MIB-rfc2737.mib	Entity MIB (Version 2)
2233	IF-MIB-rfc2233.mib	Interfaces Group MIB using SMIv2
2358	EtherLike-MIB-rfc2358.mib	Definitions of Managed Objects for the Ethernet-like Interface Types
2493	PerfHist-TC-MIB-rfc2493.mib	Textual Conventions for MIB Modules Using Performance History Based on 15 Minute Intervals
2495	E1-MIB-rfc2495.mib	Definitions of Managed Objects for the E1, E1, DS2 and E2 Interface Types
2496	DS3-MIB-rfc2496.mib	Definitions of Managed Object for the DS3/E3 Interface Type
2558	SDH-MIB-rfc2558.mib	Definitions of Managed Objects for the SDH Interface Type
2674	P-BRIDGE-MIB-rfc2674.mib Q-BRIDGE-MIB-rfc2674.mib	Definitions of Managed Objects for Bridges with Traffic Classes, Multicast Filtering and Virtual LAN Extensions
—	CISCO-DOT3-OAM-MIB	A Cisco proprietary MIB defined for IEEE 802.3ah ethernet OAM.
3413	SNMP-NOTIFICATION-MIB	Defines the MIB objects that provide mechanisms to remotely configure the parameters used by an SNMP entity for generating notifications.
3413	SNMP-TARGET-MIB	Defines the MIB objects that provide mechanisms to remotely configure the parameters that are used by an SNMP entity for generating SNMP messages.
3413	SNMP-PROXY-MIB	Defines MIB objects that provide mechanisms to remotely configure the parameters used by a proxy forwarding application.
3414	SNMP-USER-BASED-SM-MIB	The management information definitions for the SNMP User-Based Security Model.
3415	SNMP-VIEW-BASED-ACM-MIB	The management information definitions for the View-Based Access Control Model for SNMP.

1. RFC = Request for Comment

12.5.2 Proprietary ONS 15310-MA SDH MIBs

Each ONS 15310-MA SDH is shipped with a software CD containing applicable proprietary MIBs. Table 12-3 lists the proprietary MIBs for the ONS 15310-MA SDH.

Table 12-3 ONS 15310-MA SDH Proprietary MIBs

MIB Number	Module Name
1	CERENT-GLOBAL-REGISTRY.mib
2	CERENT-TC.mib
3	CERENT-454.mib (for ONS 15454 only)
4	CERENT-GENERIC.mib (for ONS 15327 only)
5	CISCO-SMI.mib
6	CISCO-VOA-MIB.mib
7	CERENT-MSDWDM-MIB.mib
8	CERENT-OPTICAL-MONITOR-MIB.mib
9	CERENT-HC-RMON-MIB.mib
10	CERENT-ENVMON-MIB.mib
11	CERENT-GENERIC-PM-MIB.mib
12	BRIDGE-MIB.my
13	CERENT-454-MIB.mib
14	CERENT-ENVMON-MIB.mib
15	CERENT-FC-MIB.mib
16	CERENT-GENERIC-MIB.mib
17	CERENT-GENERIC-PM-MIB.mib
18	CERENT-GLOBAL-REGISTRY.mib
19	CERENT-HC-RMON-MIB.mib
20	CERENT-IF-EXT-MIB.mib
21	CERENT-MSDWDM-MIB.mib
22	CERENT-OPTICAL-MONITOR-MIB.mib
23	CERENT-TC.mib
24	CISCO-IGMP-SNOOPING-MIB.mib
25	CISCO-OPTICAL-MONITOR-MIB.mib
26	CISCO-OPTICAL-PATCH-MIB.mib
27	CISCO-SMI.mib
28	CISCO-VOA-MIB.mib
29	CISCO-VTP-MIB.mib
30	INET-ADDRESS-MIB.mib
31	OLD-CISCO-TCP-MIB.my
32	OLD-CISCO-TS-MIB.my
33	RFC1155-SMI.my
34	RFC1213-MIB.my
35	RFC1315-MIB.my

Table 12-3 ONS 15310-MA SDH Proprietary MIBs (continued)

MIB Number	Module Name
36	BGP4-MIB.my
37	CERENT-454-MIB.mib
38	CERENT-ENVMON-MIB.mib
39	CERENT-FC-MIB.mib
40	CERENT-GENERIC-MIB.mib
41	CERENT-GENERIC-PM-MIB.mib
42	CERENT-GLOBAL-REGISTRY.mib
43	CERENT-HC-RMON-MIB.mib
44	CERENT-IF-EXT-MIB.mib
45	CERENT-MSDWDM-MIB.mib
46	CERENT-OPTICAL-MONITOR-MIB.mib
47	CERENT-TC.mib
48	CISCO-CDP-MIB.my
49	CISCO-CLASS-BASED-QOS-MIB.my
50	CISCO-CONFIG-COPY-MIB.my
51	CISCO-CONFIG-MAN-MIB.my
52	CISCO-ENTITY-ASSET-MIB.my
53	CISCO-ENTITY-EXT-MIB.my
54	CISCO-ENTITY-VENDORTYPE-OID-MI
55	CISCO-FRAME-RELAY-MIB.my
56	CISCO-FTP-CLIENT-MIB.my
57	CISCO-HSRP-EXT-MIB.my
58	CISCO-HSRP-MIB.my
59	CISCO-IGMP-SNOOPING-MIB.mib
60	CISCO-IMAGE-MIB.my
61	CISCO-IP-STAT-MIB.my
62	CISCO-IPMROUTE-MIB.my
63	CISCO-MEMORY-POOL-MIB.my
64	CISCO-OPTICAL-MONITOR-MIB.mib
65	CISCO-OPTICAL-PATCH-MIB.mib
66	CISCO-PING-MIB.my
67	CISCO-PORT-QOS-MIB.my
68	CISCO-PROCESS-MIB.my
69	CISCO-PRODUCTS-MIB.my
70	CISCO-RTTMON-MIB.my

Table 12-3 ONS 15310-MA SDH Proprietary MIBs (continued)

MIB Number	Module Name
71	CISCO-SMI.mib
72	CISCO-SMI.my
73	CISCO-SYSLOG-MIB.my
74	CISCO-TC.my
75	CISCO-TCP-MIB.my
76	CISCO-VLAN-IFTABLE-RELATIONSHI
77	CISCO-VOA-MIB.mib
78	CISCO-VTP-MIB.mib
79	CISCO-VTP-MIB.my
80	ENTITY-MIB.my
81	ETHERLIKE-MIB.my
82	HC-PerfHist-TC-MIB.my
83	HC-RMON-MIB.my
84	HCNUM-TC.my
85	IANA-RTPROTO-MIB.my
86	IANAifType-MIB.my
87	IEEE-802DOT17-RPR-MIB.my
88	IEEE8023-LAG-MIB.my
89	IF-MIB.my
90	IGMP-MIB.my
91	INET-ADDRESS-MIB.my
92	IPMROUTE-STD-MIB.my
93	OSPF-MIB.my
94	PIM-MIB.my
95	RMON-MIB.my
96	RMON2-MIB.my
97	SNMP-FRAMEWORK-MIB.my
98	SNMP-NOTIFICATION-MIB.my
99	SNMP-TARGET-MIB.my
100	SNMPv2-MIB.my
101	SNMPv2-SMI.my
102	SNMPv2-TC.my
103	TCP-MIB.my
104	TOKEN-RING-RMON-MIB.my
105	UDP-MIB.my

Table 12-3 ONS 15310-MA SDH Proprietary MIBs (continued)

MIB Number	Module Name
106	BRIDGE-MIB-rfc1493.mib
107	DS1-MIB-rfc2495.mib
108	DS3-MIB-rfc2496.mib
109	ENTITY-MIB-rfc2737.mib
110	EtherLike-MIB-rfc2665.mib
111	HC-RMON-rfc3273.mib
112	HCNUM-TC.mib
113	IANAifType-MIB.mib
114	IF-MIB-rfc2233.mib
115	INET-ADDRESS-MIB.mib
116	P-BRIDGE-MIB-rfc2674.mib
117	PerfHist-TC-MIB-rfc2493.mib
118	Q-BRIDGE-MIB-rfc2674.mib
119	RFC1213-MIB-rfc1213.mib
120	RFC1253-MIB-rfc1253.mib
121	RIPv2-MIB-rfc1724.mib
122	RMON-MIB-rfc2819.mib
123	RMON2-MIB-rfc2021.mib
124	RMONTOK-rfc1513.mib
125	SNMP-FRAMEWORK-MIB-rfc2571.mib
126	SNMP-MPD-MIB.mib
127	SNMP-NOTIFY-MIB-rfc3413.mib
128	SNMP-PROXY-MIB-rfc3413.mib
129	SNMP-TARGET-MIB-rfc3413.mib
130	SNMP-USER-BASED-SM-MIB-rfc3414.mib
131	SNMP-VIEW-BASED-ACM-MIB-rfc3415.mib
132	SNMPv2-MIB-rfc1907.mib
133	SONET-MIB-rfc2558.mib

Note If you cannot compile the ONS 15310-MA SDH MIBs, call the Cisco Technical Assistance Center (Cisco TAC). Contact information for Cisco TAC is listed in the Obtaining Documentation and Submitting a Service Request section in Preface.

12.6 SNMP Trap Content

The ONS 15310-MA SDH use SNMP traps to generate all alarms and events, such as raises and clears. The traps contain the following information:

- Object IDs that uniquely identify each event with information about the generating entity such as the slot or port, synchronous transport signal (VC high-order path), and Virtual Tributary (VC low-order path).
- Severity of the alarm (critical, major, minor, or event) and service effect (service-affecting or non-service-affecting).
- Date and time stamp when the alarm occurred.

12.6.1 Generic and IETF Traps

The ONS 15310-MA SDH support the generic and IETF traps listed in Table 12-4.

Table 12-4 Supported IETF Traps for the ONS 15310-MA SDH

Trap	From RFC No. MIB	Description
coldStart	RFC1907-MIB	Agent up, cold start.
warmStart	RFC1907-MIB	Agent up, warm start.
authenticationFailure	RFC1907-MIB	Community string does not match.
newRoot	RFC1493/ BRIDGE-MIB	Sending agent is the new root of the spanning tree.
topologyChange	RFC1493/ BRIDGE-MIB	A port in a bridge has changed from Learning to Forwarding or Forwarding to Blocking.
entConfigChange	RFC2737/ ENTITY-MIB	The entLastChangeTime value has changed.
dsx1LineStatusChange	RFC2495/ E1-MIB	A dsx1LineStatusChange trap is sent when the value of an instance of dsx1LineStatus changes. The trap can be used by an NMS to trigger polls. When the line status change results from a higher-level line status change (for example, a DS3), no traps for the E1 are sent.
dsx3LineStatusChange	RFC2496/ DS3-MIB	A dsx3LineStatusLastChange trap is sent when the value of an instance of dsx3LineStatus changes. This trap can be used by an NMS to trigger polls. When the line status change results in a lower-level line status change (for example, a E1), no traps for the lower-level are sent.
risingAlarm	RFC2819/ RMON-MIB	The SNMP trap that is generated when an alarm entry crosses the rising threshold and the entry generates an event that is configured for sending SNMP traps.
fallingAlarm	RFC2819/ RMON-MIB	The SNMP trap that is generated when an alarm entry crosses the falling threshold and the entry generates an event that is configured for sending SNMP traps.

12.6.2 Variable Trap Bindings

Each SNMP trap contains variable trap bindings that are used to create MIB tables. ONS 15310-MA SDH traps and bindings are listed in Table 12-5.

Table 12-5 Supported ONS 15310-MA SDH SNMPv2 Trap Variable Bindings

Trap Number	ONS 15454 Name	ONS 15310-MA SDH Name	Description
1	sysUpTime	sysUpTime	The first variable binding in the variable binding list of an SNMPv2-Trap-PDU.
2	snmpTrapOID	snmpTrapOID	The second variable binding in the variable binding list of an SNMPv2-Trap-PDU.
3	cerent454NodeTime	cerentGenericNodeTime	The time that an event occurred
4	cerent454AlarmState	cerentGenericAlarmState	The alarm severity and service-affecting status. Severities are Minor, Major, and Critical. Service- affecting statuses are service-affecting and non-service affecting.
5	cerent454AlarmObjectType	cerentGenericAlarmObjectType	The entity type that raised the alarm. The NMS should use this value to decide which table to poll for further information about the alarm.
6	cerent454AlarmObjectIndex	cerentGenericAlarmObjectIndex	Every alarm is raised by an object entry in a specific table. This variable is the index of the objects in each table; if the alarm is interface-related, this is the index of the interfaces in the interface table.
7	cerent454AlarmSlotNumber	cerentGenericAlarmSlotNumber	The slot of the object that raised the alarm. If a slot is not relevant to the alarm, the slot number is zero.
8	cerent454AlarmPortNumber	cerentGenericAlarmPortNumber	The port of the object that raised the alarm. If a port is not relevant to the alarm, the port number is zero.
9	cerent454AlarmLineNumber	cerentGenericAlarmLineNumber	The object line that raised the alarm. If a line is not relevant to the alarm, the line number is zero.
10	cerent454AlarmObjectName	cerentGenericAlarmObjectName	The TL1-style user-visible name that uniquely identifies an object in the system.

12.7 SNMPv1/v2 Community Names

You can provision community names for all SNMP requests from the SNMP Trap Destination dialog box in CTC. When community names are assigned to traps, the ONS 15310-MA SDH treat the request as valid if the community name matches one provisioned in CTC. If the community name does not match the provisioned list, SNMP drops the request.

12.8 SNMPv1/v2 Proxy Support Over Firewalls

Firewalls, often used for isolating security risks inside networks or from outside, have traditionally prevented SNMP and other NMS monitoring and control applications from accessing NEs beyond a firewall.

An application-level proxy is available at each firewall to transport SNMP protocol data units (PDU) between the NMS and NEs. This proxy, integrated into the firewall NE SNMP agent, exchanges requests and responses between the NMS and NEs and forwards NE autonomous messages to the NMS. The usefulness of the proxy feature is that network operations centers (NOCs) can fetch performance monitoring data such as remote monitoring (RMON) statistics across the entire network with little provisioning at the NOC and no additional provisioning at the NEs.

The firewall proxy interoperates with common NMS such as HP-OpenView. It is intended to be used with many NEs through a single NE gateway in a gateway network element (GNE)-end network element (ENE) topology. Up to 64 SNMP requests (such as get, getnext, or getbulk) are supported at any time behind single or multiple firewalls.

For security reasons, the SNMP proxy feature must be turned on at all receiving and transmitting NEs to be enabled. For instructions to do this, refer to the *Cisco ONS 15310-MA SDH Procedure Guide*. The feature does not interoperate with earlier releases.

12.9 SNMPv3 Proxy Configuration

The GNE can act as a proxy for the ENEs and forward SNMP requests to other SNMP entities (ENEs) irrespective of the types of objects that are accessed. For this, you need to configure two sets of users, one between the GNE and NMS, and the other between the GNE and ENE. In addition to forwarding requests from the NMS to the ENE, the GNE also forwards responses and traps from the ENE to the NMS.

The proxy forwarder application is defined in RFC 3413. Each entry in the Proxy Forwarder Table consists of the following parameters:

- Proxy Type—Defines the type of message that may be forwarded based on the translation parameters defined by this entry. If the Proxy Type is read or write, the proxy entry is used for forwarding SNMP requests and their response between the NMS and the ENE. If the Proxy Type is trap, the entry is used for forwarding SNMP traps from the ENE to the NMS.
- Context Engine ID/Context Name—Specifies the ENE to which the incoming requests should be forwarded or the ENE whose traps should be forwarded to the NMS by the GNE.
- TargetParamsIn—Points to the Target Params Table that specifies the GNE user who proxies on behalf of an ENE user. When the proxy type is read or write, TargetParamsIn specifies the GNE user who receives requests from an NMS, and forwards requests to the ENE. When the proxy type is trap, TargetParamsIn specifies the GNE user who receives notifications from the ENE and forwards them to the NMS. TargetParamsIn and the contextEngineID or the contextName columns are used to determine the row in the Proxy Forwarder Table that could be used for forwarding the received message.
- Single Target Out—Refers to the Target Address Table. After you select a row in the Proxy Forwarder Table for forwarding, this object is used to get the target address and the target parameters that are used for forwarding the request. This object is used for requests with proxy types read or write, which only requires one target.

Multiple Target Out (Tag)—Refers to a group of entries in the Target Address Table. Notifications are forwarded using this tag. The Multiple Target Out tag is only relevant when proxy type is Trap and is used to send notifications to one or more NMSs.

12.10 SNMP Remote Monitoring

The ONS 15310-MA SDH incorporate RMON to allow network operators to monitor Ethernet card performance and events. The RMON thresholds are user-provisionable in CTC. Refer to the *Cisco ONS 15310-MA SDH Procedure Guide* for provisioning procedures.

Note Typical RMON operations, other than threshold provisioning, are invisible to the CTC user.

ONS 15310-MA SDH system RMON is based on the IETF-standard MIB RFC2819 and includes the following five groups from the standard MIB: Ethernet Statistics, History Control, Ethernet History, Alarm, and Event.

RMON is sampled at one of four possible intervals. Each interval, or period, contains specific history values called buckets. Table 12-6 on page 12-15 lists the four sampling periods and corresponding buckets.

Certain statistics measured on the ML card are mapped to standard MIB if one exists else mapped to a non standard MIB variable. The naming convention used by the standard/non-standard MIB is not the same as the statistics variable used by the card. Hence when these statistics are obtained via get-request/get-next-request/SNMP Trap they don't match the name used on the card or as seen by CTC/TL1.

- For ex: STATS_MediaIndStatsRxFramesTooLong stats is mapped to cMediaIndependentInFramesTooLong variable in CERENT MIB. STATS_RxTotalPkts is mapped to mediaIndependentInPkts in HC-RMON-rfc3273.mib

12.10.1 Ethernet Statistics Group

The Ethernet Statistics group contains the basic statistics for each monitored subnetwork in a single table named etherstats. The group also contains 64-bit statistics in the etherStatsHighCapacityTable.

12.10.1.1 Row Creation in etherStatsTable

The SetRequest PDU for creating a row in this table contains all needed values to activate a table row in a single operation as well as assign the status variable to createRequest. The SetRequest PDU OID) entries must have an instance value, or type OID, of 0.

In order to create a row, the SetRequest PDU should contain the following:

- The etherStatsDataSource and its desired value
- The etherStatsOwner and its desired value (up to 32 characters)
- The etherStatsStatus with a value of createRequest (2)

The etherStatsTable creates a row if the SetRequest PDU is valid according to these rules. The SNMP agent decides the value of etherStatsIndex when the row is created and this value changes when an Ethernet interface is added or deleted; it is not sequentially allotted or contiguously numbered. A newly

created row will have an etherStatsStatus value of valid (1). If the etherStatsTable row already exists, or if the SetRequest PDU values are insufficient or do not make sense, the SNMP agent returns an error code.

Note EtherStatsTable entries are not preserved if the SNMP agent is restarted.

12.10.1.2 Get Requests and GetNext Requests

Get requests and getNext requests for the etherStatsMulticastPkts and etherStatsBroadcastPkts columns return a value of zero because the variables are not supported by ONS 15310-MA SDH Ethernet operations.

12.10.1.3 Row Deletion in etherStatsTable

To delete a row in the etherStatsTable, the SetRequest PDU should contain an etherStatsStatus "invalid" value (4). The OID marks the row for deletion. If required, a deleted row can be recreated.

12.10.1.4 64-Bit etherStatsHighCapacity Table

The Ethernet statistics group contains 64-bit statistics in the etherStatsHighCapacityTable, which provides 64-bit RMON support for the HC-RMON-MIB. The etherStatsHighCapacityTable is an extension of the etherStatsTable that adds 16 new columns for performance monitoring data in 64-bit format. There is a one-to-one relationship between the etherStatsTable and etherStatsHighCapacityTable when rows are created or deleted in either table.

12.10.2 History Control Group

The History Control group defines sampling functions for one or more monitor interfaces in the historyControlTable. The values in this table, as specified in RFC 2819, are derived from the historyControlTable and etherHistoryTable.

12.10.2.1 History Control Table

The historyControlTable maximum row size is determined by multiplying the number of ports on a card by the number of sampling periods.

Table 12-6 RMON History Control Periods and History Categories

Sampling Periods (historyControlValue Variable)	Total Values, or Buckets (historyControl Variable)
15 minutes	32
24 hours	7
1 minute	60
60 minutes	24

12.10.2.2 Row Creation in historyControlTable

To activate a historyControlTable row, the SetRequest PDU must contain all needed values and have a status variable value of 2 (createRequest). All OIDs in the SetRequest PDU should be type OID.0 for entry creation.

To create a SetRequest PDU for the historyControlTable, the following values are required:

- The historyControlDataSource and its desired value
- The historyControlBucketsRequested and it desired value
- The historyControlInterval and its desired value
- The historyControlOwner and its desired value
- The historyControlStatus with a value of createRequest (2)

The historyControlBucketsRequested OID value is ignored because the number of buckets allowed for each sampling period, based upon the historyControlInterval value, is already fixed as listed in Table 12-6.

The historyControlInterval value cannot be changed from the four allowed choices. If you use another value, the SNMP agent selects the closest smaller time period from the set buckets. For example, if the set request specifies a 25-minute interval, this falls between the 15-minute (32 bucket) variable and the 60-minute (24 bucket) variable. The SNMP agent automatically selects the lower, closer value, which is 15 minutes, so it allows 32 buckets.

If the SetRequest PDU is valid, a historyControlTable row is created. If the row already exists, or if the SetRequest PDU values do not make sense or are insufficient, the SNMP agent does not create the row and returns an error code.

12.10.2.3 Get Requests and GetNext Requests

These PDUs are not restricted.

12.10.2.4 Row Deletion in historyControl Table

To delete a row from the table, the SetRequest PDU should contain a historyControlStatus value of 4 (invalid). A deleted row can be recreated.

12.10.3 Ethernet History RMON Group

The ONS 15310-MA SDH implement the etherHistoryTable as defined in RFC 2819. The group is created within the bounds of the historyControlTable and does not deviate from the RFC in its design.

12.10.3.1 64-Bit etherHistoryHighCapacityTable

64-bit Ethernet history for the HC-RMON-MIB is implemented in the etherHistoryHighCapacityTable, which is an extension of the etherHistoryTable. The etherHistoryHighCapacityTable adds four columns for 64-bit performance monitoring data. These two tables have a one-to-one relationship. Adding or deleting a row in one table will effect the same change in the other.

12.10.4 Alarm RMON Group

The Alarm group consists of the alarmTable, which periodically compares sampled values with configured thresholds and raises an event if a threshold is crossed. This group requires the implementation of the event group, which follows this section.

12.10.4.1 Alarm Table

The NMS uses the alarmTable to determine and provision network performance alarmable thresholds.

12.10.4.2 Row Creation in alarmTable

To create a row in the alarmTable, all OIDs in the SetRequest PDU should be type OID.0. The table has a maximum number of 256 rows.

To create a SetRequest PDU for the alarmTable, the following values are required:

- The alarmInterval and its desired value
- The alarmVariable and its desired value
- The alarmSampleType and its desired value
- The alarmStartupAlarm and its desired value
- The alarmOwner and its desired value
- The alarmStatus with a value of createRequest (2)

If the SetRequest PDU is valid, an alarmTable row is created. If the row already exists, or if the SetRequest PDU values do not make sense or are insufficient, the SNMP agent does not create the row and returns an error code.

In addition to the required values, the following restrictions must be met in the SetRequest PDU:

- The alarmOwner is a string of length 32 characters.
- The alarmRisingEventIndex always takes value 1.
- The alarmFallingEventIndex always takes value 2.
- The alarmStatus has only two values supported in SETs: createRequest (2) and invalid (4).
- The AlarmVariable is of the type OID.ifIndex, where ifIndex gives the interface this alarm is created on and OID is one of the OIDs supported in Table 12-7.

Table 12-7 OIDs Supported in the AlarmTable

No.	Column Name	OID	Status
1	ifInOctets	{1.3.6.1.2.1.2.2.1.10}	—
2	IfInUcastPkts	{1.3.6.1.2.1.2.2.1.11}	—
3	ifInMulticastPkts	{1.3.6.1.2.1.31.1.1.1.2}	Unsupported in E100/E1000
4	ifInBroadcastPkts	{1.3.6.1.2.1.31.1.1.1.3}	Unsupported in E100/E1000
5	ifInDiscards	{1.3.6.1.2.1.2.2.1.13}	Unsupported in E100/E1000
6	ifInErrors	{1.3.6.1.2.1.2.2.1.14}	—
7	ifOutOctets	{1.3.6.1.2.1.2.2.1.16}	—

Table 12-7 OIDs Supported in the AlarmTable (continued)

No.	Column Name	OID	Status
8	ifOutUcastPkts	{1.3.6.1.2.1.2.2.1.17}	—
9	ifOutMulticastPkts	{1.3.6.1.2.1.31.1.1.1.4}	Unsupported in E100/E1000
10	ifOutBroadcastPkts	{1.3.6.1.2.1.31.1.1.1.5}	Unsupported in E100/E1000
11	ifOutDiscards	{1.3.6.1.2.1.2.2.1.19}	Unsupported in E100/E1000
12	Dot3StatsAlignmentErrors	{1.3.6.1.2.1.10.7.2.1.2}	—
13	Dot3StatsFCSErrors	{1.3.6.1.2.1.10.7.2.1.3}	—
14	Dot3StatsSingleCollisionFrames	{1.3.6.1.2.1.10.7.2.1.4}	—
15	Dot3StatsMultipleCollisionFrames	{1.3.6.1.2.1.10.7.2.1.5}	—
16	Dot3StatsDeferredTransmissions	{1.3.6.1.2.1.10.7.2.1.7}	—
17	Dot3StatsLateCollisions	{1.3.6.1.2.1.10.7.2.1.8}	—
18	Dot3StatsExcessiveCollisions	{13.6.1.2.1.10.7.2.1.9}	—
19	Dot3StatsFrameTooLong	{1.3.6.1.2.1.10.7.2.1.13}	—
20	Dot3StatsCarrierSenseErrors	{1.3.6.1.2.1.10.7.2.1.11}	Unsupported in E100/E1000
21	Dot3StatsSQETestErrors	{1.3.6.1.2.1.10.7.2.1.6}	Unsupported in E100/E1000
22	etherStatsUndersizePkts	{1.3.6.1.2.1.16.1.1.1.9}	—
23	etherStatsFragments	{1.3.6.1.2.1.16.1.1.1.11}	—
24	etherStatsPkts64Octets	{1.3.6.1.2.1.16.1.1.1.14}	—
25	etherStatsPkts65to127Octets	{1.3.6.1.2.1.16.1.1.1.15}	—
26	etherStatsPkts128to255Octets	{1.3.6.1.2.1.16.1.1.1.16}	—
27	etherStatsPkts256to511Octets	{1.3.6.1.2.1.16.1.1.1.17}	—
28	etherStatsPkts512to1023Octets	{1.3.6.1.2.1.16.1.1.1.18}	—
29	etherStatsPkts1024to1518Octets	{1.3.6.1.2.1.16.1.1.1.19}	—
30	EtherStatsBroadcastPkts	{1.3.6.1.2.1.16.1.1.1.6}	—
31	EtherStatsMulticastPkts	{1.3.6.1.2.1.16.1.1.1.7}	—
32	EtherStatsOversizePkts	{1.3.6.1.2.1.16.1.1.1.10}	—
33	EtherStatsJabbers	{1.3.6.1.2.1.16.1.1.1.12}	—
34	EtherStatsOctets	{1.3.6.1.2.1.16.1.1.1.4}	—
35	EtherStatsCollisions	{1.3.6.1.2.1.16.1.1.1.13}	—
36	EtherStatsCollisions	{1.3.6.1.2.1.16.1.1.1.8}	—
37	EtherStatsDropEvents	{1.3.6.1.2.1.16.1.1.1.3}	Unsupported in E100/E1000 and G1000

12.10.4.3 Get Requests and GetNext Requests

These PDUs are not restricted.

12.10.4.4 Row Deletion in alarmTable

To delete a row from the table, the SetRequest PDU should contain an alarmStatus value of 4 (invalid). A deleted row can be recreated.

Note Entries in the alarmTable are preserved if the SNMP agent is restarted.

12.10.5 Event RMON Group

The event group controls event generation and notification. It consists of two tables: the eventTable, which is a read-only list of events to be generated, and the logTable, which is a writable set of data describing a logged event. The ONS 15310-MA SDH implement the logTable as specified in RFC 2819.

12.10.5.1 Event Table

The eventTable is read-only and unprovisionable. The table contains one row for rising alarms and another row for falling ones. This table has the following restrictions:

- The eventType is always log-and-trap (4).
- The eventCommunity value is always a zero-length string, indicating that this event causes the trap to be despatched to all provisioned destinations.
- The eventOwner column value is always “monitor.”
- The eventStatus column value is always valid(1).

12.10.5.2 Log Table

The logTable is implemented exactly as specified in RFC 2819. The logTable is based upon data that is cached locally on a controller card. If there is a controller card protection switch, the existing logTable is cleared and a new one is started on the newly active controller card. The table contains as many rows as provided by the alarm controller.

APPENDIX A

Specifications

Note The terms “Unidirectional Path Switched Ring” and “UPSR” may appear in Cisco literature. These terms do not refer to using Cisco ONS 15xxx products in a unidirectional path switched ring configuration. Rather, these terms, as well as “Path Protected Mesh Network” and “PPMN,” refer generally to Cisco's path protection feature, which may be used in any topological network configuration. Cisco does not recommend using its path protection feature in any particular topological network configuration.

This appendix contains the following:

- Shelf, card, and Small Form-factor Pluggable (SFP) specifications for Cisco ONS 15310-MA SDH.
- Cabinet, power, and environmental specifications for the Purcell FLX25GT (ONS 15310-MA SDH OSP cabinet).
- OSP cabinet configuration details.

A.1 Cisco ONS 15310-MA SDH Shelf Specifications

This section provides ONS 15310-MA SDH topologies; Cisco Transport Controller (CTC) specifications; LAN, TL1, modem, alarm, and electrical interface assembly (EIA) interface specifications; timing, power, and environmental specifications; and shelf dimensions.

Note The UDC Interface, TL1 Craft Interface, and BITS Interface are not used in OSP installations.

A.1.1 Alarm Interface

The ONS 15310-MA SDH alarm interface has the following specifications:

- The alarm interface provides 32 alarm inputs and 8 contacts for alarm outputs.
- Connector J6: Alarm inputs
- Connector J7: Alarm outputs

A.1.2 UDC Interface

The ONS 15310-MA SDH 64-kbps user data channel (UDC) digital interface has the following specifications:

- The 64- kbps digital interface provides a digital input and output.
- Any F1 byte that is accessible on the system is interfaced at the UDC connector.
- The UDC provides a simplex interface. Protection for UDC overhead channel(s) follows interface line protection for traffic.
- The UDC can be enabled or disabled through the management interfaces. The default state is disabled.
- The physical interface is defined in ITU-T G.703 as a 120-ohm, twisted pair connection. The jitter specification is defined in ITU-T G.823.
- The UDC supports a serial port interface adaptation function to overhead bytes F1. This is an EIA/TIA-232 interface capable of 9.6-, 19.2-, 38.4-, and 56-kbps operation. The rate is selectable through the management interface. The default is 56 kbps with no parity and 1 stop bit.
- Connector J3: UDC

A.1.3 Cisco Transport Controller LAN Interface

The ONS 15310-MA SDH CTC LAN interface has the following specifications:

- 10/100BaseT
- 15310E-CTX-K9 access: RJ-45 connector
- Connector J3: LAN port

A.1.4 TL1 Craft Interface

The ONS 15310-MA SDH TL1 craft interface has the following specifications:

- Speed: 9600 baud, no parity, 1 stop bit
- 15310E-CTX-K9: EIA/TIA-232 with RJ-45 type connector
- Connector J2: Craft port

A.1.5 Configurations

The ONS 15310-MA SDH supports the following configurations:

- Two-fiber path protection
- 1+1 protection
- Extended SNCP
- Add/drop multiplexer (ADM)
- Point-to-point (PPP) terminal mode

A.1.6 LEDs

Table A-1 describes the system-level LEDs, located on the on the ONS 15310-MA SDH fan tray, and the possible LED colors and their significance.

Table A-1 LED Description

LED	Color and Meaning
FAIL	Red indicates system failure or during initialization
CR	Red indicates a critical alarm is present on the shelf assembly.
MJ	Red indicates a major alarm is present on the shelf assembly.
MN	Amber indicates a minor alarm is present on the shelf assembly.
REM	Red indicates a remote alarm is present on the shelf assembly.
PWR A PWR B	Green indicates that a DC power source present and within normal operating range. Red indicates that DC power source is not present, or is present and not within normal operating range.

A.1.7 Push Buttons

The ONS 15310-MA SDH has the following push buttons:

- Lamp test: When momentarily pushed, lights all LEDs on the ONS 15310-MA SDH front panel. If an LED has more than one color, all the colors will be cycled when the lamp test button is pushed.

Note Another use for the lamp test button is to reset the CTC password to its default value (otbu+1). To reset the password, press the lamp test button for at least five seconds, release it for a maximum of five seconds, then press it again for at least five seconds. After the button is released, the default password is set.

A.1.8 BITS Interface

The ONS 15310-MA SDH has the following building integrated timing supply (BITS) specifications:

- Supports two BITS inputs and two BITS outputs
- The BITS I/O ports support a 100-ohm termination for external 2.048 Mbps for E1.
- Connector J4: BITS1; Connector J5: BITS2

A.1.9 System Timing

The ONS 15310-MA SDH has the following timing specifications:

- +/– 20 ppm SDH Synchronous Equipment Timing Source (SETS) free-running internal clock
- Maintains SETS holdover (+/– 4.6 ppm for first 24 hours) in the event of reference frequency loss
- Timing reference: External BITS, line optical port, any E1 clock, and internal clock

A.1.10 Power Specifications

The ONS 15310-MA SDH has the following power specifications:

- Input power: –48 VDC nominal
- Maximum power consumption
  - Chassis with no cards installed (fan tray only): 55 W
  - Chassis with cards installed: 347 W
- Power requirements: –44 to –52 VDC
- Power terminals: Three-prong male locking connector

Note The DC power Battery Return (BR) or positive terminal, must be grounded at the source end (power feed or DC mains power end). The DC power BR input terminal of the of the ONS 15xxx is not connected to the equipment frame (chassis).

A.1.11 Environmental Specifications

The ONS 15310-MA SDH has the following environmental specifications:

- Operating temperature: -40 to +65 degree Celsius (-40 to + 149 degrees Fahrenheit)
- Operating humidity: 5 to 85 percent relative humidity.

A.1.12 Fan-Tray Assembly Specifications

- Environmental
  - Operating temperature: -40 to +65 degrees Celsius (-40 to 149 degrees Fahrenheit)
  - Operating humidity: 5 to 85 percent, noncondensing. Operation is guaranteed for 96 hours at 95 percent relative humidity.
- Power
  - 50 W, 4.2 Amps (at 12 V), 170 BTU/hr
- Shelf Acoustics (NEBS acoustic noise compliant)
  - Normal fan speed: 58 dBA
  - High fan speed: 64 dBA

A.1.13 Shelf Dimensions

The ONS 15310-MA SDH has the following shelf dimensions:

- Height: 6 Rack Units (RUs), 10.44 inches (26.51 cm)
- Width:
  - 10.67 inches (27.10 cm)
- Depth:

  - 12 inches (20.5 cm) without cables installed
  - 13.7 inches (34.8 cm) with cables installed
- Weight:
  - 25 lbs. (11.3 kg) maximum (line cards, fan-tray assembly, and two electrical interface assemblies (EIAs) installed)

A.2 Card Specifications

This section provides specifications for the 15310-MA SDH electrical and 15310E-CTX-K9 cards. For compliance information, refer to the *Cisco Optical Transport Products Safety and Compliance Information* document.

A.2.1 15310E-CTX-K9 Card

The 15310E-CTX-K9 card is installed in Slots 3 and 4 of the ONS 15310-MA SDH only. The 15310E-CTX-K9 has the following specifications.

- LAN Port
  - Supports a 10/100-Mbps Ethernet interface for Cisco Transport Controller/Transaction Language One (CTC/TL1) provisioning.
  - For node access in secure mode, SSL (for TL1) and HTTPS (for CTC) security protocols are supported.
- CRAFT Port
  - An EIA/TIA-232 craft interface is provided and is used for TL1 provisioning.
  - The craft interface is set to 9600 baud, no parity, and 1 stop bit by default.
- Nonvolatile memory
  - 128 MB, Compact Flash card
- Optical ports: Line
  - Bit rate: STM1 (155.520 Mbps), STM4, (622.080 Mbps), and STM16 (2488.320 Mbps), depending on the SFP installed

Note Both optical interfaces on the card can be configured as STM1, STM4, or STM16.

  - Code: Scrambled NRZ
  - Fiber: depends on the SFP used
    (see the "A.3 SFP Specifications" section on page A-9)
  - Loopback modes: Terminal and facility
  - Connectors: LC duplex connector for each SFP
  - Compliance: ITU-T G.707, ITU-T G.957
- Optical ports: Transmitter
  - Maximum transmitter output power: Depends on the SFP used
    (see the "A.3 SFP Specifications" section on page A-9)

  - Minimum transmitter output power: Depends on the SFP used (see the "A.3 SFP Specifications" section on page A-9)
  - Center wavelength: See wavelength plan
  - Center wavelength accuracy: 1 nm to 4 nm, depending on the SFP used
  - Transmitter: DFB laser
- Optical ports: Receiver
  - Maximum receiver level: Depends on the SFP used (see the "A.3 SFP Specifications" section on page A-9)
  - Minimum receiver level: Depends on the SFP used (see the "A.3 SFP Specifications" section on page A-9)
  - Receiver: PIN PD
  - Receiver input wavelength range: Depends on the SFP used
- Environmental
  - Operating temperature:

    C-Temp: +23 to +131 degrees Fahrenheit (–5 to +55 degrees Celsius)

    I-Temp: –40 to +149 degrees Fahrenheit (–40 to +65 degrees Celsius)
  - Operating humidity: 5 to 85 percent, noncondensing. Operation is guaranteed for 96 hours at 95 percent relative humidity.
  - Power consumption: 9.28 W, 0.19 A, 31.68 BTU/hr
- Dimensions
  - Height: 6.94 in. (167.28 mm)
  - Width: 1.45 in. (36.83 mm)
  - Depth: 8.35 in. (212.09 mm)
  - Weight not including clam shell: 1.6 lb (0.73 kg)

LAN Port

- Supports a 10/100-Mbps Ethernet interface for Cisco Transport Controller/Transaction Language One (CTC/TL1) provisioning.

CRAFT Port

- An EIA/TIA-232 craft interface is provided and is used for TL1 provisioning.
- The craft interface is set to 9600 baud, no parity, and 1 stop bit by default.

A.2.2 Nonvolatile Memory

The ONS 15310-MA SDH nonvolatile memory has a 128 MB Compact Flash card

A.2.3 CE-100T-8 and ML-100T-8 Cards

The CE-100T-8 and ML-100T-8 cards have the following specifications:

- Environmental
  - Operating temperature

C-Temp: 0 to +55 degrees Celsius (32 to 131 degrees Fahrenheit)

- Operating humidity: 5 to 85 percent, noncondensing. Operation is guaranteed for 96 hours at 95 percent relative humidity.
- Power consumption: 1.10 A, 53 W

- Dimensions
  - Height: 176 mm (6.93 in.)
  - Width: 34.29 mm (1.35 in.)
  - Depth: 238.25 mm (9.38 in.)
  - Weight (not including clam shell): 0.499 kg (1.1 lb)

Caution Do not install CE-100T-8 and ML-100T-8 cards in OSP.

A.2.4 CE-MR-6 Card

The CE-MR-6 card has the following specifications:

- Environmental
  - Operating temperature

    I-Temp: -40 to +65 degrees Celsius (-40 to +149 degrees Fahrenheit)
  - Operating humidity: 5 to 85 percent, noncondensing. Operation is guaranteed for 96 hours at 95 percent relative humidity.
  - Power consumption: 63.00 W, 1.32 A at -48 V, 214.96 BTU/hr
- Dimensions
  - Height: 176.28 mm (6.94 in.)
  - Width: 34.29 mm (1.35 in.)
  - Depth: 236.68 mm (9.318 in.)
  - Weight (not including clam shell): 0.499 kg (1.1 lb)

A.2.5 E1_21_E3_DS3_3 and E1_63_E3_DS3_3 Cards

The E1_21_E3_DS3_3 and E1_63_E3_DS3_3 cards have the following specifications:

For E1:

- Environmental
  - Operating temperature:

    I-Temp: -40 to +65 degrees Celsius
  - Operating humidity: 5 to 85 percent, noncondensing. Operation is guaranteed for 96 hours at 95 percent relative humidity.
  - Power consumption:

    E1_63_E3_DS3_3: 40.00 W, 0.96 A

    E1_21_E3_DS3_3: 27.60 W, 0.70 A

- Input
  - Bit rate: 2.048 Mbps +/- 50 ppm
  - Frame format: E1_MF, E1_CRCMF, E1 unframed
  - Line code: HDB3
  - Termination: AMP Champ
  - Input impedance: 120 ohms
  - Cable loss: Max 655 feet ABAM #22 or #24 AWG
  - AIS: TR-TSY-000191 compliant
- Output
  - Bit rate: 2.048 Mbps +/- 50 ppm
  - Frame format: E1_MF, E1_CRCMF, E1 unframed
  - Line code: HDB3
  - Termination: AMP Champ
  - Input impedance: 120 ohms
  - Cable loss: Max 655 feet ABAM #22 or #24 AWG
  - AIS: TR-TSY-000191 compliant
  - Power level: 12.5 to 17.9 dBm, centered at 772 KHz, –16.4 to –11.1 dBm centered at 1544 KHz
  - Pulse shape: Telcordia GR-499-CORE Figure 9-5
  - Pulse amplitude: 2.4 to 3.6 V peak-to-peak
  - Loopback modes: Terminal and facility
  - Line build out: 0 - 131 ft., 132 - 262 ft., 263 - 393 ft., 394 - 524 ft., 525 - 655 ft.
- Electrical interface: 64-pin Champ connectors on high-density EIA

For DS3:

- Input
  - Bit rate: 44.736 Mbps +/- 20 ppm
  - Frame format: Unframed, M13, C-bit
  - Line code: B3ZS
  - Termination: Unbalanced coaxial cable
  - Input impedance: 75 ohms +/-5 percent
  - Cable loss: Max 450 feet with 734A or 728A
  - AIS: TR-TSY-000191 compliant
- Output
  - Bit rate: 44.736 Mbps +/- 20 ppm
  - Frame format: Unframed, M13, C-bit
  - Line code: B3ZS
  - Termination: Unbalanced coaxial cable
  - Input impedance: 75 ohms +/-5 percent
  - Cable loss: Max 450 feet with 734A or 728A cable

  - AIS: TR-TSY-000191 compliant
  - Power level: -1.8 to +5.7 dBm
  - Pulse shape: ANSI E1.102-1988 Figure 8
  - Pulse amplitude: 0.36 to 0.85 V peak
  - Loopback modes: Terminal and facility
  - Line build out: 0 to 225 feet, 226 to 450 feet
- Electrical interface: BNC Connectors on high-density EIA

A.2.6 Filler Cards

The 15310-EXP-FILLER card has the following specifications:

- Environmental
  - Operating temperature

    I-Temp: –40 to +65 degrees Celsius (–40 to 149 degrees Fahrenheit)
  - Operating humidity: 5 to 85 percent, noncondensing. Operation is guaranteed for 96 hours at 95 percent relative humidity.
- Dimensions
  - Height: 6.93 in. (176 mm)
  - Width:1.35 in. (34.29 mm)
  - Depth: 9.38 in. (238.25 mm)
  - Card weight (not including clam shell): 0.9 lb (0.45 kg)

The 15310-CTX-FILLER card has the following specifications:

- Environmental
  - Operating temperature

    I-Temp: -40 to +65 degrees Celsius (-40 to 149 degrees Fahrenheit)
  - Operating humidity: 5 to 85 percent, noncondensing. Operation is guaranteed for 96 hours at 95 percent relative humidity.
- Dimensions
  - Height: 6.94 in. (167.28 mm)
  - Width: 1.450 in. (36.83 mm)
  - Depth:8.35 in. (212.09 mm)
  - Weight not including clam shell: 0.51 lb (0.23 kg)

A.3 SFP Specifications

Table A-2 lists specifications for available SFPs that can be used with the 15310E-CTX-K9 card. Table A-3 lists specifications for available SFPs that can be used only with the CE-MR-6 card (ONS 15310-MA only).

The 15310-CL-CTX card does not have a faceplate because it is located inside the chassis; therefore, the two SFP slots are located on the ONS 15310-CL faceplate, just to the left of the LAN port. The two SFP slots on the 15310E-CTX-K9 are located on 15310E-CTX-K9 faceplate.

Table A-2 SFP Specifications

SFP Product ID	Interface	Transmitter Output Power Min/Max (dBm)	Receiver Input Power Min/Max (dBm)
ONS-SI-155-L1	OC-3	–5.0 to 0	–34 to –10
ONS-SI-155-L2	OC-3	–5.0 to 0	–34 to –10
ONS-SI-155-I1	OC-3	–15 to –8.0	–28 to –8
ONS-SI-622-L1	OC-12	–3.0 to 2.0	–28 to –8
ONS-SI-622-L2	OC-12	–3.0 to 2.0	–28 to –8
ONS-SI-622-I1	OC-12/OC-3	–15 to –8.0	–28 to –8
ONS-SI-155-SR-MM=	OC-3/STM-1	–20 to –14	–30 to –14
ONS-SE-155-1470= through ONS-SE-155-1610=	OC-3	0 to +5	–34 to –3 (at BER 10^{-10})
ONS-SE-622-1470= through ONS-SE-622-1610=	OC-12	0 to +5	–28 to –3 (at BER 10^{-10})
ONS-SI-2G-I1=	OC-48	–5.0 to 0	–18 to –0
ONS-SI-2G-L1=	OC-48	–3 to +2	–27 to –9
ONS-SI-2G-L2=	OC-48	–3 to +2	–28 to –9
ONS-SI-2G-S1=	OC-48	–10 to -3	–18 to –3
ONS-SC-2G-28.7=[1] through ONS-SC-2G-60.6=	OC-48	0 to +4	–28 to –9
ONS-SE-Z1=	OC-3/STM1 OC-12/STM-4 OC-48/STM-16 Fibre Channel (1 and 2 Gbps) GE	–5 to 0	–18 (OC-48/STM-16) –22 (GE) –23 (OC-12/STM-4) –23 (OC-3/STM-1)
ONS-SI-155-SR-MM=	OC-3, STM-1	–19 to –14	–14 to –5
ONS-SC-155-EL	STM1	—	—

1. ONS-SC-2G-28.7, ONS-SC-2G-33.4, ONS-SC-2G-41.3, ONS-SC-2G-49.3, and ONS-SC-2G-57.3 are supported from Release 8.5 and later.

Table A-3 CE-MR-6 SFP Specifications

SFP Product ID	Interface	Transmitter Output Power Min/Max (dBm)	Receiver Input Power Min/Max (dBm)
ONS-SI-GE-SX	GE	–9.5 to 0	–17 to 0
ONS-SI-GE-LX	GE	–9.5 to –3	–19 to –3
ONS-SI-GE-ZX	GE	0 to 5	–23 to –3

Table A-3 CE-MR-6 SFP Specifications (continued)

SFP Product ID	Interface	Transmitter Output Power Min/Max (dBm)	Receiver Input Power Min/Max (dBm)
ONS-SI-100-FX	FE	—	—
ONS-SI-100-LX10	FE	—	—
ONS-SE-ZE-EL[1]	E, FE, or GE	—	—
ONS-SE-100-BX10U	FE	–14 to –8	–28.2 to –7
ONS-SE-100-BX10D	FE	–14 to –8	–28.2 to –7

1. Due to mechanical constraints related to the dimensions of the pluggable device, two ONS-SE-ZE-EL copper SFPs cannot be inserted in the same SFP double cage receptacle. They can only be inserted into slots 1 or 2, 3 or 4, and 5 or 6. Upto three ONS-SE-ZE-EL copper SFPs can be inserted in one CE-MR-6 card.

Table A-4 provides cabling specifications for the single-mode fiber (SMF) SFPs that can be used with the ONS 15310-MA CTX-2500. The ports of the listed SFPs have LC-type connectors. Table A-5 provides cabling specifications for multimode fiber (MMF) SFPs that can only be used with the ONS 15310-MA CTX-2500 card.

Table A-4 Single-Mode Fiber SFP Port Cabling Specifications

SFP Product ID	Wavelength[1]	Fiber Type	Cable Distance
ONS-SI-155-L1 Long Reach	1310 nm	9 micro SMF	50 km (31.07 miles)
ONS-SI-155-L2 Long Reach	1550 nm	9 micro SMF	100 km (62.15 miles)
ONS-SI-155-I1 Intermediate Reach	1310 nm	9 micro SMF	21 km (13.05 miles)
ONS-SI-622-L1 Long Reach	1310 nm	9 micron SMF	42 km (26.10 miles)
ONS-SI-622-L2 Long Reach	1550 nm	9 micron SMF	85 km (52.82 miles)
ONS-SI-622-I1 Intermediate Reach	1310 nm	9 micron SMF	21 km (13.05 miles)
ONS-SE-155-1470 through ONS-SE-155-1610 (CWDM)	1470 nm through 1610 nm, according to the wavelength indicated in the SFP's product ID	9 micron SMF	120 km (74.56 miles)
ONS-SE-622-1470 through ONS-SE-622-1610 (CWDM)	1470 nm through 1610 nm, according to the wavelength indicated in the SFP's product ID	9 micron SMF	100 km (62.14 miles)
ONS-SI-2G-I1	1310 nm	9 micron SMF	15 km (9.3 miles)
ONS-SI-2G-L1	1310 nm	9 micron SMF	40 km (25.80 miles)
ONS-SI-2G-L2	1550 nm	9 micron SMF	80 km (49.71 miles)

Table A-4 Single-Mode Fiber SFP Port Cabling Specifications (continued)

SFP Product ID	Wavelength[1]	Fiber Type	Cable Distance
ONS-SI-2G-S1	1310 nm	9 micron SMF	2 km (1.2 miles)
ONS-SC-2G-28.7[2] through ONS-SC-2G-60.6 (DWDM) When using ONS-SC-2G-xx.x on CTX-2500 the Cisco ONS 15310-MA operating temperature specification is limited to –5 to +55 degrees Celsius (+23 to +131 degrees Fahrenheit).	1528.77 nm through 1560.60 nm, according to the wavelength indicated in the SFP's product ID	9 micron SMF	N/A[3]

1. Typical loss on a 1310-nm wavelength SMF is 0.6 dB/km.
2. ONS-SC-2G-28.7, ONS-SC-2G-33.4, ONS-SC-2G-41.3, ONS-SC-2G-49.3, and ONS-SC-2G-57.3 are supported from Release 8.5 and later.
3. ONS-SC-2G-xx.x cable distance varies depending on DWDM system installation.

Table A-5 Multimode Fiber SFP Port Cabling Specifications

SFP Product ID	Wavelength	Fiber Type	Cable Distance
ONS-SI-155-SR-MM= Intermediate Reach	1310 nm	62.5/125 micron MMF	2 km (1.2 miles)

A.4 Purcell FLX25GT Cabinet Specifications

The following Purcell FLX25GT outdoor enclosure specifications (accessories) are tested and complaint with OSP cabinet and WW EMC requirements:

- Purcell 25RU FLX25GT Equipment Bay
- 25RU Blank Equipment Bay Door
- Battery Bracket Kit
- GT 14-inch Battery Pedestal
- 25RU GT 16-inch PMTM with Battery pedestal
- 8 Position AC Load Center w/ TVSS (Transient Voltage Suppression Module for AC power)- PN #AC2050M-07 (NEBS and WW complaint)
- AC load center (Europe and WW) - PN MCD-01-950-01 w/ Surge Srrestors DEHNguard T275, DEHNgap TC255
- 25RU GT Solar shield with 14-inch Battery pedestal
- Heat Exchanger 80W/C (1539 W, GR-487 complaint) rear door
- GT Anchor Plate - 1EB + 16-inch PMTM Left
- E1 100-Pair Protector Blocks e/w 710 connectors PN #6659 1 105-00/06A
- ADC CPAUS240A1 E1 Protectors
- ADC E1 Cross-connect block - Per-Term Assy - NT 28-ckt PN #6634 1 971-07
- ADC DS3/E3 protector module mounting panels - P3C-175002

- ADC DS3/E3 protector modules - P3M-PB2001
- ADC 23-inch 84 position DSX-1 panel - DI-G2CU1
- Four feet F/M 32 pair (Champ) Amp extension cables
- Hubbell Gen Plug and cover (60 A)
- Valere Power Plant e/w- 3-20 A Rectifiers, AC Cords, Controller, Temperature Probe and Alarm Cable - Shelf CD8D-ANN-VC
- Cylix E1 secondary protection module - # 050-612-00 (NEBS)
- ADC DI-M3GU1 Front cross connect 84 ckt, Cisco WW & 64 AMP DSX- 1
- PCI Alarm Panel cable for ONS 15310-MA
- Eight-hour Battery backup - NorthStar NSB 170FT
- E1 cables from ONS 15310-MA SDH to E1 secondary protector module - HRC-2835-005
- E1 Cables from E1 secondary protector module to primary protector module - HRC 2835-006
- OSP E1 50-pins/25-pair cables with 3M - 710 connectors - HRC-2840-030 (shielded cables ground-terminated at both ends)
- Steward ferrites PN 28B2000-100 applied to OSP E1cables (2 turns) on the cabinet unshielded section
- Flat copper braids, 1-inch wide, for grounding the following:
  - OSP cabinet
  - Bonding of different cabinet sections
  - ONS 15310-MA chassis

Note The tested braids are consolidated tinned copper braid # 1398, for information, see www.conwire.com.

- 50 feet DS3/E3 BNC/BNC cables
- 3 feet DS3/E3 BNC/BNC (ONS 15310-MA SDH to DS3 secondary protection module)
- 3 feet DS3/E3, BNC/BNC (DS3 secondary protection module to DS3 non-protected, cross-connect, and block)

A.4.1 Power Specifications

The Purcell FLX25GT cabinet and accessories has the following power specifications:

- AC input power: Minimum 15 A
- AC input voltage: 230Vac, 50Hz, 16 A single-phase (Line, Neutral, Ground)

A.4.2 Environmental Specifications

The Purcell FLX25GT cabinet and accessories has the following environmental specifications (AC power Europe + other countries w/same AC power):

- Minimum required rate @ maximum operating temperature for ONS 15310-MA SDH: 0.93 m3/min, 33 CFM

- Minimum required rate @ maximum operating temperature for ONS 15310-MA SDH + cabinet: NA
- Maximum allowable rate for ONS 15310-MA SDH: 1.02 m3/min, 36 CFM
- Maximum allowable rate for ONS 15310-MA SDH + cabinet: NA
- Volumetric flow rate for ONS 15310-MA: 0.93 to 1.02 m3/min
- Volumetric flow rate for ONS 15310-MA SDH + cabinet: NA
- Pressure drop through equipment for minimum required and maximum allowable flow rates for 15310-MA SDH: 0.44 inch
- Pressure drop through equipment for minimum required and maximum allowable flow rates for 15310-MA SDH + cabinet: 1.36 wg
- Heat dissipation for maximum load and minimum load on ONS 15310-MA SDH stand alone full chassis: 234 W
- Heat dissipation for maximum load and minimum load on cabinet AC power with fully populated 15310-MA: 390 W
- Heat dissipation for maximum load and minimum load on ONS 15310-MA SDH stand alone empty chassis+fan tray: 48.15 W
- Heat dissipation for maximum load and minimum load on cabinet AC power with empty 15310-MA:181 W
- Power drop (Power in minus Power out) cabinet ONS 15310-MA SDH: power abs 390 W
- Power drop (Power in minus Power out) ONS 15310-MA SDH stand alone: power abs 234 W
- Intake and exhaust temperature (Delta) on cabinet: 2,9
- Intake and exhaust temperature (Delta) on ONS 15310-MA SDH: 7,9
- EC Class of Equipment for Cooling configuration: Class 1 for ONS 15310-MA SDH + cabinet
- EC Class of Equipment for Cooling configuration: Class 2 for ONS 15310-MA SDH stand alone

A.4.3 ONS 15310-MA SDH OSP Statements

The ONS 15310-MA SDH can be installed in OSP with a sealed/weatherproof and GR-487-CORE, Issue 2 complaint OSP cabinet.

The ONS 15310-MA SDH OSP was tested and qualified for sealed/weather-protected locations environmental requirements of GR-487-CORE, Issue 2.

The ONS 15310E-MA SDH OSP was tested and qualified to the non-weather protected locations environmental requirements of EN300-019 1-4 and 2-4 Class T 4.2H and 4M5.

The ONS 15310E-MA SDH OSP was tested and qualified for the weather-protected locations environmental requirements of EN 300-019-1-3 and EN 300-019-1-3 Class 3.3 and for WW EMC requirements.

NEBS compliance covers FCC and other WW EMC requirements (based on CISPR22 and IEC 61000-4-2 to12 standards).

A.4.4 ONS 15310-MA OSP configuration

The following ONS 15310-MA SDH OSP accessories were tested and is complaint with OSP and WW EMC requirements:

- 15310(E)-MA-SA(=)
- 15310-MA-FTA(=)
- 15310-EIA-HD-A(=)
- 15310-EIA-HD-B(=)
- 15310E-EIA-HDA(=)
- 15310E-EIA-HDB(=)
- 15310(E)-28WBE-3BBE(=)
- 15310(E)-84WBE-3BBE(=)
- 15310-CE-MR-6(=)
- 15310-CTX-2500-K9(=)
- 15310E-CTX-K9(=)

To install ONS 15310-MA SDH in an OSP with a different cabinet and if NEBS compliance is required, the cabinet must be GR-487 compliant. In addition, the ONS 15310-MA SDH installed in the cabinet must be tested to NEBS requirements and following components must be installed:

- DS1 primary and secondary surge protection modules.

To install ONS 15310-MA SDH in an OSP with a different cabinet, which does not require NEBS compliance, and if FCC and or other WW EMC requirements must be covered, the following primary surge protection modules must be installed:

- DS1 ADC ComProtect DS1 protection module (ComProtect® Solid-State)
- DS3 ADC ComProtect DS3 protection module (ADC P3M)

To install ONS 15310-MA SDH in an OSP with a different cabinet and safety compliance with UL 60950-1 is required, the following components must be installed:

- E1/DS1 insulation transformer (rated 1500Vac rms)
- Two Cylix DS1/E1 Secondary Protection Modules PCI 050-628-02.
- Cylix DS3/E3 Secondary Protection Module PCI 050-631-01 and DS3 primary protection modules.

Turn off or on AC power in Purcell FLX25GT OSP cabinet

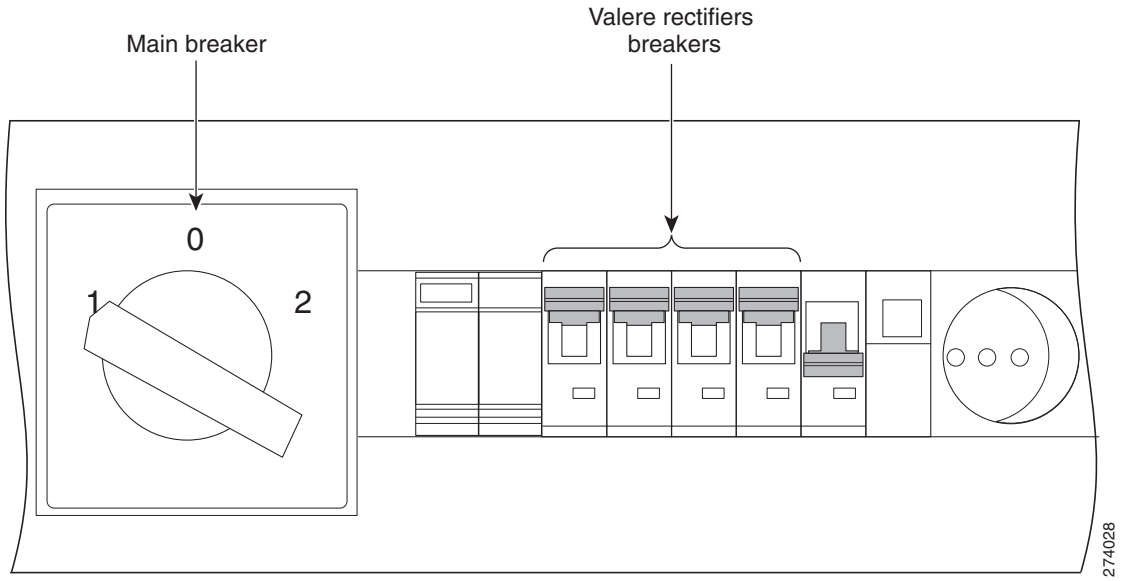
Complete the following steps to turn off or on AC power in Purcell FLX25GT OSP cabinet:

Step 1 Turn off the main breaker in the AC load center.

Step 2 Turn off the two Valere rectifier breakers in the AC load center.

Figure A-1 shows Valere rectifier breakers in the AC load center.

Figure A-1 Valere rectifier breakers in AC load center



Step 3 Unplug the cabinet's AC power cord.

Note The ONS 15310-MA SDH inside the OSP cabinet does not turn off and runs on batteries if the batteries are charged. The batteries in the OSP cabinet run on the DC power from the Valere rectifiers and the battery charge lasts for approximately eight hours.

Step 4 To turn on AC power, plug the AC cord.

Step 5 Turn on the two Valere rectifier breakers in the AC load center.

Step 6 Turn on the main breaker in the AC load center.

Stop. You have completed this procedure.

APPENDIX B

Administrative and Service States

This appendix describes the administrative and service states for Cisco ONS 15310-MA SDH cards, ports, and cross-connects. For circuit state information, see Chapter 7, "Circuits and Tunnels." Software Release 6.0 and later states are based on the generic state model defined in Telcordia GR-1093 Core, Issue 2 and ITU-T X.731.

B.1 Service States

Service states include a Administrative State , a Operational State, and one or more Secondary States (SST). Table B-1 lists the service state PSTs and PSTQs supported by the ONS 15310-MA SDH.

Table B-1 ONS 15310-MA SDH Service State Primary States and Primary State Qualifiers

Primary State, Primary State Qualifier	Definition
unlocked-enabled	(In-Service and Normal) The entity is fully operational and will perform as provisioned.
locked-disabled	(Out-of-Service and Autonomous) The entity is not operational because of an autonomous event.
locked-disabled	(Out-of-Service and Autonomous Management) The entity is not operational because of an autonomous event and has also been manually removed from service.
locked-enabled	(Out-of-Service and Management) The entity has been manually removed from service.

Table B-2 defines the SSTs supported by the ONS 15310-MA SDH.

Table B-2 ONS 15310-MA SDH Secondary States

Secondary State	Definition
Automatic In Service	(Automatic In-Service) The entity is delayed before transitioning to the unlocked-enabled service state. The transition to unlocked-enabled depends on correction of conditions, or on a soak timer. Alarm reporting is suppressed, but traffic is carried. Raised fault conditions, whether or not their alarms are reported, can be retrieved on the CTC Conditions tab or by using the TL1 RTRV-COND command.
disabled	(Disabled) The entity was manually removed from service and does not provide its provisioned functions. All services are disrupted; the entity is unable to carry traffic.
FLT	(Fault) The entity has a raised alarm or condition.
loopback	(Loopback) The entity is in loopback mode.
mismatchofEquipment	(Mismatched Equipment) An improper card is installed. For example, an installed card is not compatible with the card preprovisioning or the slot. This SST applies only to cards.
maintenance	(Maintenance) The entity has been manually removed from service for a maintenance activity but still performs its provisioned functions. Alarm reporting is suppressed, but traffic is carried. Raised fault conditions, whether or not their alarms are reported, can be retrieved on the CTC Conditions tab or by using the TL1 RTRV-COND command.
outOfGroup	(Out of Group) The virtual concatenated (VCAT) member cross-connect is not used to carry VCAT group traffic. This state is used to put a member circuit out of the group and to stop sending traffic. locked-enabled,outOfGroup only applies to the cross-connects on an end node where VCAT resides. The cross-connects on intermediate nodes are in the locked-enabled,maintenance service state.
softwareDownload	(Software Download) The card is involved in a software and database download. This SST applies only to cards.
unassigned	(Unassigned) The card is not provisioned in the database. This SST applies only to cards.
notInstalled	(Unequipped) The card is not physically present (that is, an empty slot). This SST applies only to cards.

B.2 Administrative States

Administrative states are used to manage service states. Administrative states consist of a Administrative State and an SST. Table B-3 lists the administrative states supported by the ONS 15310-MA SDH. See Table B-2 on page B-2 for SST definitions.

Note A change in the administrative state of an entity does not change the service state of supporting or supported entities.

Table B-3 ONS 15310-MA SDH Administrative States

Administrative State (PST,SST)	Definition
unlocked	Puts the entity in-service.
Automatic In Service	Puts the entity in automatic in-service.
locked, disabled	Removes the entity from service and disables it.
locked, maintenance	Removes the entity from service for maintenance.
locked, outOfGroup	(VCAT circuits only) Removes a VCAT member cross-connect from service and from the group of members.

B.3 Service State Transitions

This section describes the transition from one service state to the next for cards, ports, and cross-connects. A service state transition is based on the action performed on the entity.

Note When an entity is put in the locked, maintenance administrative state, the ONS 15310-MA SDH suppresses all standing alarms on that entity. All alarms and events appear on the Conditions tab. You can change this behavior for the LPBKFACILITY and LPBKTERMINAL alarms. To display these alarms on the Alarms tab, set the NODE.general.ReportLoopbackConditionsOnOOS-MTPorts to TRUE on the NE Defaults tab.

B.3.1 Card Service State Transitions

Table B-4 lists card service state transitions.

Table B-4 ONS 15310-MA SDH Card Service State Transitions

Current Service State	Action	Next Service State
unlocked-enabled	Change the administrative state to locked, maintenance.	locked-enabled,maintenance
	Delete the card.	locked-disabled,unassigned
	Pull the card.	locked-disabled,notInstalled
	Reset the card.	locked-disabled,softwareDownload
	Alarm/condition is raised.	locked-disabled,FLT
locked-disabled,Automatic In Service and mismatchofEquipment	Pull the card.	locked-disabled,Automatic In Service & notInstalled
	Delete the card.	locked-disabled,unassigned if the card is valid locked-disabled,mismatchofEquipment & unassigned if the card is invalid

Table B-4 ONS 15310-MA SDH Card Service State Transitions (continued)

Current Service State	Action	Next Service State
locked-disabled,Automatic In Service & softwareDownload	Restart completed.	unlocked-enabled
	Pull the card.	locked-disabled,Automatic In Service & notInstalled
locked-disabled,Automatic In Service & notInstalled	Insert a valid card.	locked-disabled,Automatic In Service & softwareDownload
	Insert an invalid card.	locked-disabled,Automatic In Service & mismatchofEquipment
	Delete the card.	locked-disabled,unassigned & notInstalled
locked-disabled,FLT	Pull the card.	locked-disabled,notInstalled
	Delete the card.	locked-disabled,unassigned
	Change the administrative state to locked, maintenance.	locked-disabled,FLT & maintenance
	Reset the card.	locked-disabled,softwareDownload
	Alarm/condition is cleared.	unlocked-enabled
locked-disabled,mismatchofEquipment	Pull the card.	locked-disabled,notInstalled
	Delete the card.	locked-disabled,unassigned if the card is valid locked-disabled,mismatchofEquipment & unassigned if the card is invalid
	Change the administrative state to locked, maintenance.	locked-disabled,mismatchofEquipment & maintenance
locked-disabled,softwareDownload	Restart completed.	unlocked-enabled
	Pull the card.	locked-disabled,notInstalled
locked-disabled,notInstalled	Insert a valid card.	locked-disabled,softwareDownload
	Insert an invalid card.	locked-disabled,mismatchofEquipment
	Delete the card.	locked-disabled,unassigned & notInstalled
	Change the administrative state to locked, maintenance.	locked-disabled,maintenance & notInstalled

Table B-4 ONS 15310-MA SDH Card Service State Transitions (continued)

Current Service State	Action	Next Service State
locked-disabled,FLT & maintenance	Pull the card.	locked-disabled,maintenance & notInstalled
	Delete the card.	locked-disabled,unassigned
	Change the administrative state to unlocked.	locked-disabled,FLT
	Reset the card.	locked-disabled,maintenance & softwareDownload
	Alarm/condition is cleared.	locked-enabled,maintenance
locked-disabled,mismatchofEquipment & maintenance	Change the administrative state to unlocked.	locked-disabled,mismatchofEquipment
	Pull the card.	locked-disabled,maintenance & notInstalled
	Delete the card.	locked-disabled,unassigned if the card is valid locked-disabled,mismatchofEquipment & unassigned if the card is invalid
locked-disabled,mismatchofEquipment & unassigned	Pull the card.	locked-disabled,unassigned & notInstalled
	Provision the card.	locked-disabled,mismatchofEquipment
locked-disabled,maintenance & softwareDownload	Restart completed.	locked-enabled,maintenance
	Pull the card.	locked-disabled,maintenance & notInstalled
locked-disabled,maintenance & notInstalled	Change the administrative state to unlocked.	locked-disabled,notInstalled
	Insert a valid card.	locked-disabled,maintenance & softwareDownload
	Insert an invalid card.	locked-disabled,mismatchofEquipment & maintenance
	Delete the card.	locked-disabled,unassigned & notInstalled
locked-disabled,unassigned	Pull the card.	locked-disabled,unassigned & notInstalled
	Provision an invalid card.	locked-disabled,mismatchofEquipment
	Provision a valid card.	locked-disabled,softwareDownload

Table B-4 ONS 15310-MA SDH Card Service State Transitions (continued)

Current Service State	Action	Next Service State
locked-disabled,unassigned & notInstalled	Insert a valid card.	locked-disabled,softwareDownload
	Insert an invalid card.	locked-disabled,mismatchofEquipment & unassigned
	Preprovision a card.	locked-disabled,Automatic In Service & notInstalled
locked-enabled,maintenance	Change the administrative state to unlocked.	unlocked-enabled
	Delete the card.	locked-disabled,unassigned
	Pull the card.	locked-disabled,maintenance & notInstalled
	Reset the card.	locked-disabled,maintenance & softwareDownload
	Alarm/condition is raised.	locked-disabled,FLT & maintenance

B.3.2 Port and Cross-Connect Service State Transitions

Table B-5 lists the port and cross-connect service state transitions. Port states do not impact cross-connect states with one exception. A cross-connect in the locked-disabled,Automatic In Service service state cannot transition autonomously into the unlocked-enabled service state until the parent port is in the unlocked-enabled service state.

You cannot transition a port from the unlocked-enabled service state to the locked-enabled,disabled service state. You must first put the port in the locked-enabled,maintenance service state. Once a port is in the locked-enabled,maintenance state, the NODE.general.ForceToOosDsbldStateChange default setting of TRUE allows you to put a port in locked-enabled,disabled even if the following conditions exist:

- The port is a timing source.
- The port is used for line, section, or tunneling DCC.
- The port supports 1+1 protection or bidirectional line switched rings (MS_SPRings).
- Cross-connects are present on the port.
- Overhead connections or overhead terminations are in use (such as express orderwire, local orderwire, or user data channels [UDCs]).

To change this behavior so that you cannot put a port in locked-enabled,disabled if any of these conditions exist, set the NODE.general.ForceToOosDsbldStateChange default setting to FALSE. For the procedure to change node defaults, refer to the "Maintain the Node" chapter in the *Cisco ONS 15310-MA SDH Procedure Guide.*

Note Deleting a port or cross-connect removes the entity from the system. The deleted entity does not transition to another service state.

Table B-5 ONS 15310-MA SDH Port and Cross-Connect Service State Transitions

Current Service State	Action	Next Service State
unlocked-enabled	Put the port or cross-connect in the locked, maintenance administrative state.	locked-enabled,maintenance
	Put the port or cross-connect in the Automatic In Service administrative state.	locked-disabled,Automatic In Service
	Put the VCAT cross-connect in the locked, outOfGroup administrative state.	locked-enabled,maintenance & outOfGroup
	Alarm/condition is raised.	locked-disabled,FLT locked-disabled,FLT & outOfGroup for a VCAT cross-connect
	(Cross-connect only) Put the cross-connect in the locked, disabled administrative state.	locked-enabled,disabled locked-enabled,disabled & outOfGroup for a VCAT cross-connect
locked-disabled,Automatic In Service	Put the port or cross-connect in the unlocked administrative state.	unlocked-enabled
	Put the port or cross-connect in the locked, maintenance administrative state.	locked-enabled,maintenance
	Put the port or cross-connect in the locked, disabled administrative state.	locked-enabled,disabled locked-enabled,disabled & outOfGroup for a VCAT cross-connect
	Put the VCAT cross-connect in the locked, outOfGroup administrative state.	locked-enabled,maintenance and outOfGroup
	Alarm/condition is raised.	locked-disabled,Automatic In Service & FLT locked-disabled,Automatic In Service & FLT & outOfGroup for a VCAT cross-connect

Table B-5 ONS 15310-MA SDH Port and Cross-Connect Service State Transitions (continued)

Current Service State	Action	Next Service State
locked-disabled,Automatic In Service & FLT	Alarm/condition is cleared.	locked-disabled,Automatic In Service
	Put the port or cross-connect in the unlocked administrative state.	locked-disabled,FLT
	Put the port or cross-connect in the locked, disabled administrative state.	locked-enabled,disabled
	Put the port or cross-connect in the locked, maintenance administrative state.	locked-disabled,FLT & maintenance
	Put the VCAT cross-connect in the locked, outOfGroup administrative state.	locked-disabled,FLT & maintenance & outOfGroup
locked-disabled,Automatic In Service & FLT & outOfGroup	Alarm/condition is cleared.	locked-disabled,Automatic In Service or locked-enabled,maintenance • If an In Group member is unlocked-enabled or locked-disabled,Automatic In Service, the member transitions to locked-disabled,Automatic In Service. • If an In Group member is locked-enabled,maintenance, the member transitions to locked-enabled,maintenance.
	Put the VCAT cross-connect in the unlocked administrative state.	locked-disabled,FLT & outOfGroup
	Put the VCAT cross-connect in the locked, disabled administrative state.	locked-enabled,disabled & outOfGroup
	Put the VCAT cross-connect in the locked, maintenance administrative state.	locked-disabled,FLT & maintenance & outOfGroup

Table B-5 ONS 15310-MA SDH Port and Cross-Connect Service State Transitions (continued)

Current Service State	Action	Next Service State
locked-disabled,FLT	Alarm/condition is cleared.	unlocked-enabled
	Put the port or cross-connect in the Automatic In Service administrative state.	locked-disabled,Automatic In Service & FLT
	Put the port or cross-connect in the locked, disabled administrative state.	locked-enabled,disabled locked-enabled,disabled & outOfGroup for a VCAT cross-connect
	Put the port or cross-connect in the locked, maintenance administrative state	locked-disabled,FLT & maintenance
	Put the VCAT cross-connect in the locked, outOfGroup administrative state.	locked-disabled,FLT & maintenance & outOfGroup
locked-disabled,FLT & outOfGroup	Alarm/condition is cleared.	unlocked-enabled or locked-enabled,maintenance • If an In Group member is unlocked-enabled or locked-disabled,Automatic In Service, the member transitions to unlocked-enabled. • If an In Group member is locked-enabled,maintenance, the member transitions to locked-enabled,maintenance
	Put the VCAT cross-connect in the Automatic In Service administrative state.	locked-disabled,Automatic In Service & FLT & outOfGroup
	Put the VCAT cross-connect in the locked, disabled administrative state.	locked-enabled,disabled & outOfGroup
	Put the VCAT cross-connect in the locked, maintenance administrative state.	locked-disabled,FLT & maintenance & outOfGroup
locked-disabled,FLT & loopback & maintenance	Release the loopback.	locked-disabled,FLT & maintenance
	Alarm/condition is cleared.	locked-enabled,loopback & maintenance

Table B-5 ONS 15310-MA SDH Port and Cross-Connect Service State Transitions (continued)

Current Service State	Action	Next Service State
locked-disabled,FLT & loopback & maintenance & outOfGroup	Release the loopback.	locked-disabled,FLT & maintenance & outOfGroup
	Alarm/condition is cleared.	locked, maintenance,maintenance & outOfGroup
locked-disabled,FLT & maintenance	Alarm/condition is cleared.	locked-enabled,maintenance
	Put the port or cross-connect in the unlocked administrative state.	locked-disabled,FLT
	Put the port or cross-connect in the Automatic In Service administrative state.	locked-disabled,Automatic In Service & FLT
	Put the port or cross-connect in the locked, disabled administrative state.	locked-enabled,disabled locked-enabled,disabled & outOfGroup for a VCAT cross-connect
	Put the port or cross-connect in a loopback.	locked-disabled,FLT & loopback & maintenance
	Put the VCAT cross-connect in the locked, outOfGroup administrative state.	locked-disabled,FLT & maintenance & outOfGroup

Table B-5 ONS 15310-MA SDH Port and Cross-Connect Service State Transitions (continued)

Current Service State	Action	Next Service State
locked-disabled,FLT & maintenance & outOfGroup	Alarm/condition is cleared.	locked-enabled,maintenance & outOfGroup
	Put the VCAT cross-connect in the unlocked administrative state. **Note** VCAT In Group members are in the locked-disabled,FLT or unlocked-enabled service state.	locked-disabled,FLT & outOfGroup
	Put the VCAT cross-connect in the Automatic In Service administrative state. **Note** VCAT In Group members are in the locked-disabled,Automatic In Service & FLT or unlocked-enabled service state.	locked-disabled,Automatic In Service & FLT & outOfGroup
	Put the VCAT cross-connect in the locked, disabled administrative state.	locked-enabled,disabled & outOfGroup
	Put the VCAT cross-connect in the locked, maintenance administrative state. **Note** VCAT In Group members are in the locked-enabled,FLT & maintenance service state.	locked-enabled,FLT & maintenance
	Operate a loopback.	locked-enabled,FLT & loopback & maintenance & outOfGroup

Table B-5 ONS 15310-MA SDH Port and Cross-Connect Service State Transitions (continued)

Current Service State	Action	Next Service State
locked-enabled,disabled	Put the port or cross-connect in the unlocked administrative state.	unlocked-enabled
	Put the port or cross-connect in the Automatic In Service administrative state.	locked-disabled,Automatic In Service
	Put the port or cross-connect in the locked, maintenance.	locked-enabled,maintenance
	Put the VCAT cross-connect in the locked, outOfGroup administrative state.	locked-enabled,maintenance & outOfGroup
	Put the VCAT cross-connect in the locked, outOfGroup administrative state.	locked-enabled,maintenance & outOfGroup
locked-enabled,loopback & maintenance	Release the loopback. **Note** While in locked-enabled,loopback & maintenance, both Cisco Transport Controller (CTC) and Transaction Language One (TL1) allow a cross-connect to be deleted, which also removes the loopback. This applies only to the cross-connect, not the ports.	locked-enabled,maintenance
	Alarm/condition is raised.	locked-disabled,FLT & loopback & maintenance locked-disabled,FLT & loopback & maintenance & outOfGroup for a VCAT cross-connect
locked-enabled,loopback & maintenance & outOfGroup	Alarm/condition is raised.	locked-disabled,FLT & loopback & maintenance & outOfGroup

Table B-5 ONS 15310-MA SDH Port and Cross-Connect Service State Transitions (continued)

Current Service State	Action	Next Service State
locked-enabled,maintenance	Put the port or cross-connect in the unlocked administrative state.	unlocked-enabled
	Put the port or cross-connect in the Automatic In Service administrative state.	locked-disabled,Automatic In Service
	Put the port or cross-connect in the locked, disabled administrative state.	locked-enabled,disabled locked-enabled,disabled & outOfGroup for a VCAT cross-connect
	Put the port or cross-connect in a loopback.	locked-enabled,loopback & maintenance
	Put the VCAT cross-connect in the locked, outOfGroup administrative state.	locked-enabled,maintenance & outOfGroup
	Alarm/condition is raised.	locked-disabled,FLT & maintenance locked-disabled,FLT & maintenance & outOfGroup for a VCAT cross-connect
outOfGroup-MA,maintenance & outOfGroup	Alarm/condition is raised.	locked-disabled,FLT & maintenance & outOfGroup

B.3.3 Pluggable Equipment Service State Transitions

The service state transitions for pluggable equipment are the same as for other equipment with the exceptions listed in Table B-6.

Note Pluggable equipment (pluggable interface modules [PIMs] and pluggable port modules [PPMs]) will transition out of the unassigned state when inserted if the software can read the EEPROM and identify information on the pluggable equipment. If the software cannot read the pluggable equipment, the equipment is considered invalid and will not transition out of the unassigned state.

Table B-6 ONS 15310-MA SDH Pluggable Equipment Service State Transitions

Current Service State	Action	Next Service State
unlocked-enabled	Reset the pluggable equipment.	unlocked-enabled
	Provision an unsupported service rate.	locked-disabled,mismatchofEquipment
	Pluggable equipment does not work with the board configuration.	

Table B-6 ONS 15310-MA SDH Pluggable Equipment Service State Transitions (continued)

Current Service State	Action	Next Service State
locked-disabled,Automatic In Service & notInstalled	Insert valid pluggable equipment.	unlocked-enabled
	Insert pluggable equipment with the incorrect rate.	locked-disabled,mismatchofEquipment
	Pluggable equipment does not work with the board configuration.	
locked-disabled,mismatchofEquipment	Delete unsupported service rate or modify provisioning so that the pluggable equipment is no longer a mismatch.	unlocked-enabled
locked-disabled,notInstalled	Insert valid pluggable equipment.	unlocked-enabled
locked-disabled,mismatchofEquipment & maintenance	Delete unsupported service rate or modify provisioning so that the pluggable equipment is no longer a mismatch.	locked-enabled,maintenance
locked-disabled,maintenance & notInstalled	Insert valid pluggable equipment.	locked-enabled,maintenance
locked-disabled,unassigned	Provision valid pluggable equipment.	unlocked-enabled
locked-disabled,unassigned & notInstalled	Insert valid pluggable equipment.	unlocked-enabled
	Insert pluggable equipment with the incorrect rate.	locked-disabled,mismatchofEquipment
	Pluggable equipment does not work with the board configuration.	
locked-enabled,maintenance	Reset the pluggable equipment.	locked-enabled,maintenance
	Provision an unsupported service rate.	locked-disabled,mismatchofEquipment & maintenance
	Pluggable equipment does not work with the board configuration.	

APPENDIX C

Network Element Defaults

Note The terms "Unidirectional Path Switched Ring" and "UPSR" may appear in Cisco literature. These terms do not refer to using Cisco ONS 15xxx products in a unidirectional path switched ring configuration. Rather, these terms, as well as "Path Protected Mesh Network" and "PPMN," refer generally to Cisco's path protection feature, which may be used in any topological network configuration. Cisco does not recommend using its path protection feature in any particular topological network configuration.

This appendix describes the factory-configured (default) network element (NE) settings for the Cisco ONS 15310-MA SDH. It includes descriptions of card default settings, node default settings, and Cisco Transport Controller (CTC) default settings. For procedures for importing, exporting, and editing the settings, refer to the "Maintain the Node" chapter of the *Cisco ONS 15310-MA SDH Procedure Guide*. Cards that are not listed in this appendix are not supported by user-configurable NE defaults settings.

To change card settings individually (that is, without directly changing the NE defaults), refer to the "Change Port Settings" chapter of the *Cisco ONS 15310-MA SDH Procedure Guide*. To change node settings, refer to the "Change Node Settings" chapter of the *Cisco ONS 15310-MA SDH Procedure Guide*.

This appendix includes the following sections:

C.1 Network Element Defaults Description

The NE defaults are preinstalled on each Cisco ONS 15310-MA SDH common control card. Cisco also ships a file named 15310MA-defaults.txt for the ONS 15310-MA SDH on the CTC software CD if you want to import the defaults onto existing common control cards. The NE defaults include card-level, CTC-level, and node-level defaults.

Changes to card provisioning that are made manually using procedures in the "Change Card Settings" chapter of the *Cisco ONS 15310-MA SDH Procedure Guide* override default settings. If you use the CTC Defaults editor (on the node view Provisioning > Defaults tab) or import a new defaults file, any changes to card or port settings only affect cards that are installed or preprovisioned after the defaults have changed.

Changes that are made manually to most node-level default settings override the current settings, whether default or provisioned. If you change node-level default settings, either by using the Defaults editor or by importing a new defaults file, the new defaults reprovision the node immediately for all settings except those relating to protection (1+1 bidirectional switching, 1+1 reversion time, and 1+1 revertive). Settings relating to protection apply to subsequent provisioning.

Note Changing some node-level provisioning through NE defaults can cause CTC disconnection or a reboot of the node in order for the provisioning to take effect. Before you change a default, check in the Side Effects column of the Defaults editor (right-click a column header and select **Show Column > Side Effects**) and be prepared for the occurrence of any side effects listed for that default.

C.2 CTC Default Settings

Table C-1 lists the CTC-level default settings for the Cisco ONS 15310-MA SDH. CTC-level settings affect CTC sessions for the entire network. Cisco provides the following types of user-configurable defaults for CTC:

- Automatic Routing—Set circuit creation with the Route Automatically check box selected by default.
- Create TL1-like—Set whether to create only TL1-like circuits; that is, instruct the node to create only cross-connects, allowing the resulting circuits to be in an upgradable state.
- Network Map—Set the default network map (which country's map is displayed in CTC network view).

Table C-1 CTC Default Settings

Default Name	Default Value	Default Domain
CTC.circuits.CreateLikeTL1	FALSE	TRUE, FALSE
CTC.circuits.RouteAutomatically	TRUE	TRUE, FALSE
CTC.circuits.RouteAutomaticallyDefaultOverridable	TRUE	TRUE, FALSE
CTC.network.Map	United States	-none-, Germany, Japan, Netherlands, South Korea, United Kingdom, United States

Note The CTC.network.LocalDomainCreationAndViewing NE default has been removed. You can provision this setting in the CTC Preferences page.

C.3 Cisco ONS 15310-MA SDH Card Default Settings

The tables in this section list the default settings for Cisco ONS 15310-MA SDH common control, electrical, and data cards. Cisco provides several types of user-configurable defaults for these cards. Types of card defaults can be broadly grouped by function, as outlined in the following subsections. For information about individual card settings, refer to the "Change Port Settings" chapter of the *Cisco ONS 15310-MA SDH Procedure Guide*.

Note When the card level defaults are changed, the new provisioning done after the defaults have changed is affected. Existing provisioning remains unaffected.

The following types of defaults are defined for Cisco ONS 15310-MA SDH cards.

C.3.1 Configuration Defaults

Most card-level and port-level configuration defaults correspond to settings found in the CTC card-level Provisioning tabs.

Note The full set of ALS configuration defaults can be found in the CTC card-level Maintenance > Optical > ALS tabs for supported cards. ALS defaults are supported for PPM (SFP) STMN ports on the 15310E-CTX-K9 card.

Note ML-100T-8 console port access and RADIUS server access defaults can be found in the CTC card-level IOS tab for ML-100T-8 cards.

Configuration defaults that correspond to settings that are reachable from the CTC card-level Provisioning tabs (except as noted) include the following types of options (arranged by CTC subtab):

- Broadband Ports—(E1_21_E3_DS3_3 and E1_63_E3_DS3_3 cards only) Set the BBE port rate as DS3, E3, or unassigned (DS3 is the default).
- E1—(E1_21_E3_DS3_3 and E1_63_E3_DS3_3 cards only) E1 rate port-level line configuration settings.
- DS3—(E1_21_E3_DS3_3 and E1_63_E3_DS3_3 cards only) DS3 rate port-level line configuration settings.
- Pluggable Port Modules—(15310E-CTX-K9 cards only) PPM (SFP) slot and port rate configuration settings.
- Optical—(15310E-CTX-K9 cards only) STMN rate port-level line configuration and SDH VC high-order path settings.
- ALS (card-level Maintenance > Optical > ALS tab)—(15310E-CTX-K9 cards only) PPM (SFP) STMN port ALS configuration defaults.
- IOS (card-level IOS tab)—(ML-100T-8 cards only) Console port and RADIUS server access settings.
- Ether Ports—(CE-100T-8 cards only) Line configuration settings (including IEEE 802.1p CoS and IP ToS).
- POS Ports—(CE-100T-8 cards only) Line configuration settings.

Note Line configuration defaults for the CE-100T-8 apply to both Ethernet port and POS port settings, where the same setting exists for both.

Note PPM (SFP) slots and ports are unassigned by default. You can optionally use the Defaults editor to change these defaults to automatically assign PPM slots to take a single-port PPM, and to automatically assign PPM port STMN rates. However, use discretion in changing the default PPM port rate in cases where single-rate PPMs might be inserted in a card, since preprovisioned PPM port rates that are applied to a single-rate PPM of the wrong rate will result in a mismatch of equipment and software.

Note For further information about the supported features of each individual card, see Chapter 2, "Card Reference."For further information about the supported features of Ethernet cards, consult the *Cisco ONS 15310-CL and Cisco ONS 15310-MA Ethernet Card Software Feature and Configuration Guide*.

C.3.2 Threshold Defaults

Threshold default settings define the default cumulative values (thresholds) beyond which a TCA will be raised, making it possible to monitor the network and detect errors early.

Card threshold default settings are provided as follows:

- PM thresholds—(15310E-CTX-K9, E1_21_E3_DS3_3, and E1_63_E3_DS3_3 cards) Applicable to E1, DS3, E3, and STMN ports. Can be expressed in counts or seconds; includes line, electrical, and SDH thresholds.
- Physical Layer thresholds—(15310E-CTX-K9 cards only) Applicable to STMN ports. Expressed in percentages; includes optics thresholds.

Threshold defaults are defined for near end and/or far end, at 15-minute and one-day intervals. Thresholds are further broken down by type, such as Section, Line, VC high-order path, or VC low-order path for PM thresholds, and TCA (warning) or Alarm (for physical thresholds). PM threshold types define the layer to which the threshold applies. Physical threshold types define the level of response expected when the threshold is crossed.

Note For full descriptions of the thresholds you can set for each card, see Chapter 11, "Performance Monitoring."

Note For additional information regarding PM parameter threshold defaults as defined by Telcordia specifications, refer to Telcordia GR-820-CORE and GR-253-CORE.

C.3.3 Defaults by Card

In the tables that follow, card defaults are defined by the default name, its factory-configured value, and the domain of allowable values that you can assign to it.

Note Some default values, such as certain thresholds, are interdependent. Before changing a value, review the domain for that default and any other related defaults for potential dependencies.

C.3.3.1 15310E-CTX-K9 Card Default Settings

Table C-2 lists the 15310E-CTX-K9 card default settings.

Table C-2 15310E-CTX-K9 Card Default Settings

Default Name	Default Value	Default Domain
CTX-2500.PPM.portAssignment	UNASSIGNED	UNASSIGNED; STM1-PORT; STM4-PORT; STM16-PORT
CTX-2500.PPM.slotAssignment	UNASSIGNED	UNASSIGNED; PPM (1 Port)
CTX-2500.STM1-PORT.config.line.AINSSoakTime	08:00 (hours:mins)	00:00; 00:15; 00:30 .. 48:00
CTX-2500.STM1-PORT.config.line.AdminSSMIn	STU	G811; STU; G812T; G812L; SETS; DUS
CTX-2500.STM1-PORT.config.line.PJVC4Mon#	0 (VC4 #)	0 - 1
CTX-2500.STM1-PORT.config.line.SDBER	1.00E-07	1E-5; 1E-6; 1E-7; 1E-8; 1E-9
CTX-2500.STM1-PORT.config.line.SFBER	1.00E-04	1E-3; 1E-4; 1E-5
CTX-2500.STM1-PORT.config.line.Send<FF>DoNotUse	FALSE	FALSE when SendDoNotUse TRUE; FALSE; TRUE when SendDoNotUse FALSE
CTX-2500.STM1-PORT.config.line.SendAISOnFacilityLoopback	TRUE	TRUE; FALSE
CTX-2500.STM1-PORT.config.line.SendAISOnTerminalLoopback	TRUE	FALSE
CTX-2500.STM1-PORT.config.line.SendDoNotUse	FALSE	FALSE; TRUE
CTX-2500.STM1-PORT.config.line.State	unlocked; automaticInService	unlocked; locked; disabled; locked; maintenance; unlocked; automaticInService
CTX-2500.STM1-PORT.config.line.SyncMsgIn	TRUE	FALSE; TRUE
CTX-2500.STM1-PORT.config.vc4.IPPMEnabled	FALSE	TRUE; FALSE
CTX-2500.STM1-PORT.config.vclo.IPPMEnabled	FALSE	TRUE; FALSE
CTX-2500.STM1-PORT.pmthresholds.ms.farend.15min.BBE	1312 (count)	0 - 137700
CTX-2500.STM1-PORT.pmthresholds.ms.farend.15min.EB	1312 (count)	0 - 137700
CTX-2500.STM1-PORT.pmthresholds.ms.farend.15min.ES	87 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.ms.farend.15min.SES	1 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.ms.farend.15min.UAS	3 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.ms.farend.1day.BBE	13120 (count)	0 - 13219200
CTX-2500.STM1-PORT.pmthresholds.ms.farend.1day.EB	13120 (count)	0 - 13219200
CTX-2500.STM1-PORT.pmthresholds.ms.farend.1day.ES	864 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.ms.farend.1day.SES	4 (seconds)	0 - 86400

Table C-2 15310E-CTX-K9 Card Default Settings (continued)

Default Name	Default Value	Default Domain
CTX-2500.STM1-PORT.pmthresholds.ms.farend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.ms.nearend.15min.BBE	1312 (count)	0 - 137700
CTX-2500.STM1-PORT.pmthresholds.ms.nearend.15min.EB	1312 (count)	0 - 137700
CTX-2500.STM1-PORT.pmthresholds.ms.nearend.15min.ES	87 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.ms.nearend.15min.PSC	1 (count)	0 - 600
CTX-2500.STM1-PORT.pmthresholds.ms.nearend.15min.PSD	300 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.ms.nearend.15min.SES	1 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.ms.nearend.15min.UAS	3 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.ms.nearend.1day.BBE	13120 (count)	0 - 13219200
CTX-2500.STM1-PORT.pmthresholds.ms.nearend.1day.EB	13120 (count)	0 - 13219200
CTX-2500.STM1-PORT.pmthresholds.ms.nearend.1day.ES	864 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.ms.nearend.1day.PSC	5 (count)	0 - 57600
CTX-2500.STM1-PORT.pmthresholds.ms.nearend.1day.PSD	600 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.ms.nearend.1day.SES	4 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.ms.nearend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.path.farend.15min.BBE	25 (count)	0 - 2159100
CTX-2500.STM1-PORT.pmthresholds.path.farend.15min.EB	15 (count)	0 - 13305600
CTX-2500.STM1-PORT.pmthresholds.path.farend.15min.ES	12 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.path.farend.15min.SES	3 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.path.farend.15min.UAS	10 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.path.farend.1day.BBE	250 (count)	0 - 207273600
CTX-2500.STM1-PORT.pmthresholds.path.farend.1day.EB	125 (count)	0 - 691200000
CTX-2500.STM1-PORT.pmthresholds.path.farend.1day.ES	100 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.path.farend.1day.SES	7 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.path.farend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.path.nearend.15min.BBE	25 (count)	0 - 2159100
CTX-2500.STM1-PORT.pmthresholds.path.nearend.15min.EB	15 (count)	0 - 7200000
CTX-2500.STM1-PORT.pmthresholds.path.nearend.15min.ES	12 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.path.nearend.15min.NPJC-PDET	60 (count)	0 - 7200000
CTX-2500.STM1-PORT.pmthresholds.path.nearend.15min.NPJC-PGEN	60 (count)	0 - 7200000
CTX-2500.STM1-PORT.pmthresholds.path.nearend.15min.PJCDIFF	60 (count)	0 - 14400000
CTX-2500.STM1-PORT.pmthresholds.path.nearend.15min.PJCS-PDET	100 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.path.nearend.15min.PJCS-PGEN	100 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.path.nearend.15min.PPJC-PDET	60 (count)	0 - 7200000
CTX-2500.STM1-PORT.pmthresholds.path.nearend.15min.PPJC-PGEN	60 (count)	0 - 7200000
CTX-2500.STM1-PORT.pmthresholds.path.nearend.15min.SES	3 (seconds)	0 - 900

Table C-2 15310E-CTX-K9 Card Default Settings (continued)

Default Name	Default Value	Default Domain
CTX-2500.STM1-PORT.pmthresholds.path.nearend.15min.UAS	10 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.path.nearend.1day.BBE	250 (count)	0 - 207273600
CTX-2500.STM1-PORT.pmthresholds.path.nearend.1day.EB	125 (count)	0 - 691200000
CTX-2500.STM1-PORT.pmthresholds.path.nearend.1day.ES	100 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.path.nearend.1day.NPJC-PDET	5760 (count)	0 - 691200000
CTX-2500.STM1-PORT.pmthresholds.path.nearend.1day.NPJC-PGEN	5760 (count)	0 - 691200000
CTX-2500.STM1-PORT.pmthresholds.path.nearend.1day.PJCDIFF	5760 (count)	0 - 1382400000
CTX-2500.STM1-PORT.pmthresholds.path.nearend.1day.PJCS-PDET	9600 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.path.nearend.1day.PJCS-PGEN	9600 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.path.nearend.1day.PPJC-PDET	5760 (count)	0 - 691200000
CTX-2500.STM1-PORT.pmthresholds.path.nearend.1day.PPJC-PGEN	5760 (count)	0 - 691200000
CTX-2500.STM1-PORT.pmthresholds.path.nearend.1day.SES	7 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.path.nearend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.rs.nearend.15min.BBE	10000 (count)	0 - 138600
CTX-2500.STM1-PORT.pmthresholds.rs.nearend.15min.EB	10000 (count)	0 - 138600
CTX-2500.STM1-PORT.pmthresholds.rs.nearend.15min.ES	500 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.rs.nearend.15min.OFS	500 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.rs.nearend.15min.SES	500 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.rs.nearend.15min.UAS	3 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.rs.nearend.1day.BBE	100000 (count)	0 - 13305600
CTX-2500.STM1-PORT.pmthresholds.rs.nearend.1day.EB	100000 (count)	0 - 13305600
CTX-2500.STM1-PORT.pmthresholds.rs.nearend.1day.ES	5000 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.rs.nearend.1day.OFS	5000 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.rs.nearend.1day.SES	5000 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.rs.nearend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.vclo.farend.15min.BBE	15 (count)	0 - 539100
CTX-2500.STM1-PORT.pmthresholds.vclo.farend.15min.EB	15 (count)	0 - 1800000
CTX-2500.STM1-PORT.pmthresholds.vclo.farend.15min.ES	12 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.vclo.farend.15min.SES	3 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.vclo.farend.15min.UAS	10 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.vclo.farend.1day.BBE	150 (count)	0 - 51753600

Table C-2 15310E-CTX-K9 Card Default Settings (continued)

Default Name	Default Value	Default Domain
CTX-2500.STM1-PORT.pmthresholds.vclo.farend.1day.EB	125 (count)	0 - 172800000
CTX-2500.STM1-PORT.pmthresholds.vclo.farend.1day.ES	100 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.vclo.farend.1day.SES	7 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.vclo.farend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.vclo.nearend.15min.BBE	15 (count)	0 - 539100
CTX-2500.STM1-PORT.pmthresholds.vclo.nearend.15min.EB	15 (count)	0 - 1800000
CTX-2500.STM1-PORT.pmthresholds.vclo.nearend.15min.ES	12 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.vclo.nearend.15min.SES	3 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.vclo.nearend.15min.UAS	10 (seconds)	0 - 900
CTX-2500.STM1-PORT.pmthresholds.vclo.nearend.1day.BBE	150 (count)	0 - 51753600
CTX-2500.STM1-PORT.pmthresholds.vclo.nearend.1day.EB	125 (count)	0 - 172800000
CTX-2500.STM1-PORT.pmthresholds.vclo.nearend.1day.ES	100 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.vclo.nearend.1day.SES	7 (seconds)	0 - 86400
CTX-2500.STM1-PORT.pmthresholds.vclo.nearend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM16-PORT.config.line.AINSSoakTime	08:00 (hours:mins)	00:00; 00:15; 00:30 .. 48:00
CTX-2500.STM16-PORT.config.line.AdminSSMIn	STU	G811; STU; G812T; G812L; SETS; DUS
CTX-2500.STM16-PORT.config.line.AlsMode	Disabled	Disabled; Auto Restart; Manual Restart; Manual Restart for Test
CTX-2500.STM16-PORT.config.line.AlsRecoveryPulseDuration	2.0 (seconds)	2.0; 2.1; 2.2 .. 100.0 when AlsMode Disabled; Auto Restart; Manual Restart; 80.0; 80.1; 80.2 .. 100.0 when AlsMode Manual Restart for Test
CTX-2500.STM16-PORT.config.line.AlsRecoveryPulseInterval	100 (seconds)	60 - 300
CTX-2500.STM16-PORT.config.line.PJVC4Mon#	0 (VC4 #)	0 - 16
CTX-2500.STM16-PORT.config.line.SDBER	1.00E-07	1E-5; 1E-6; 1E-7; 1E-8; 1E-9
CTX-2500.STM16-PORT.config.line.SFBER	1.00E-04	1E-3; 1E-4; 1E-5
CTX-2500.STM16-PORT.config.line.Send<FF>DoNotUse	FALSE	FALSE when SendDoNotUse TRUE; FALSE; TRUE when SendDoNotUse FALSE
CTX-2500.STM16-PORT.config.line.SendAISOnFacilityLoopback	TRUE	TRUE; FALSE
CTX-2500.STM16-PORT.config.line.SendAISOnTerminalLoopback	TRUE	FALSE
CTX-2500.STM16-PORT.config.line.SendDoNotUse	FALSE	FALSE; TRUE

Table C-2 15310E-CTX-K9 Card Default Settings (continued)

Default Name	Default Value	Default Domain
CTX-2500.STM16-PORT.config.line.State	unlocked; automaticInService	unlocked; locked; disabled; locked; maintenance; unlocked; automaticInService
CTX-2500.STM16-PORT.config.line.SyncMsgIn	TRUE	FALSE; TRUE
CTX-2500.STM16-PORT.config.vc4.IPPMEnabled	FALSE	TRUE; FALSE
CTX-2500.STM16-PORT.config.vclo.IPPMEnabled	FALSE	TRUE; FALSE
CTX-2500.STM16-PORT.pmthresholds.ms.farend.15min.BBE	21260 (count)	0 - 2212200
CTX-2500.STM16-PORT.pmthresholds.ms.farend.15min.EB	21260 (count)	0 - 2212200
CTX-2500.STM16-PORT.pmthresholds.ms.farend.15min.ES	87 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.ms.farend.15min.SES	1 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.ms.farend.15min.UAS	3 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.ms.farend.1day.BBE	212600 (count)	0 - 212371200
CTX-2500.STM16-PORT.pmthresholds.ms.farend.1day.EB	212600 (count)	0 - 212371200
CTX-2500.STM16-PORT.pmthresholds.ms.farend.1day.ES	864 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.ms.farend.1day.SES	4 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.ms.farend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.15min.BBE	21260 (count)	0 - 2212200
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.15min.EB	21260 (count)	0 - 2212200
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.15min.ES	87 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.15min.PSC	1 (count)	0 - 600
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.15min.PSC-W	1 (count)	0 - 600
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.15min.PSD	300 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.15min.PSD-W	300 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.15min.SES	1 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.15min.UAS	3 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.1day.BBE	212600 (count)	0 - 212371200
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.1day.EB	212600 (count)	0 - 212371200
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.1day.ES	864 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.1day.PSC	5 (count)	0 - 57600
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.1day.PSC-R	5 (count)	0 - 57600
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.1day.PSC-S	5 (count)	0 - 57600
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.1day.PSC-W	5 (count)	0 - 57600
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.1day.PSD	600 (seconds)	0 - 86400

Table C-2 15310E-CTX-K9 Card Default Settings (continued)

Default Name	Default Value	Default Domain
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.1day.PSD-R	600 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.1day.PSD-S	600 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.1day.PSD-W	600 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.1day.SES	4 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.ms.nearend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.path.farend.15min.BBE	25 (count)	0 - 2159100
CTX-2500.STM16-PORT.pmthresholds.path.farend.15min.EB	15 (count)	0 - 13305600
CTX-2500.STM16-PORT.pmthresholds.path.farend.15min.ES	12 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.path.farend.15min.SES	3 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.path.farend.15min.UAS	10 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.path.farend.1day.BBE	250 (count)	0 - 207273600
CTX-2500.STM16-PORT.pmthresholds.path.farend.1day.EB	125 (count)	0 - 691200000
CTX-2500.STM16-PORT.pmthresholds.path.farend.1day.ES	100 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.path.farend.1day.SES	7 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.path.farend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.path.nearend.15min.BBE	25 (count)	0 - 2159100
CTX-2500.STM16-PORT.pmthresholds.path.nearend.15min.EB	15 (count)	0 - 7200000
CTX-2500.STM16-PORT.pmthresholds.path.nearend.15min.ES	12 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.path.nearend.15min.NPJC-PDET	60 (count)	0 - 7200000
CTX-2500.STM16-PORT.pmthresholds.path.nearend.15min.NPJC-PGEN	60 (count)	0 - 7200000
CTX-2500.STM16-PORT.pmthresholds.path.nearend.15min.PJCDIFF	60 (count)	0 - 14400000
CTX-2500.STM16-PORT.pmthresholds.path.nearend.15min.PJCS-PDET	100 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.path.nearend.15min.PJCS-PGEN	100 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.path.nearend.15min.PPJC-PDET	60 (count)	0 - 7200000
CTX-2500.STM16-PORT.pmthresholds.path.nearend.15min.PPJC-PGEN	60 (count)	0 - 7200000
CTX-2500.STM16-PORT.pmthresholds.path.nearend.15min.SES	3 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.path.nearend.15min.UAS	10 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.path.nearend.1day.BBE	250 (count)	0 - 207273600
CTX-2500.STM16-PORT.pmthresholds.path.nearend.1day.EB	125 (count)	0 - 691200000
CTX-2500.STM16-PORT.pmthresholds.path.nearend.1day.ES	100 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.path.nearend.1day.NPJC-PDET	5760 (count)	0 - 691200000
CTX-2500.STM16-PORT.pmthresholds.path.nearend.1day.NPJC-PGEN	5760 (count)	0 - 691200000
CTX-2500.STM16-PORT.pmthresholds.path.nearend.1day.PJCDIFF	5760 (count)	0 - 1382400000
CTX-2500.STM16-PORT.pmthresholds.path.nearend.1day.PJCS-PDET	9600 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.path.nearend.1day.PJCS-PGEN	9600 (seconds)	0 - 86400

Table C-2 15310E-CTX-K9 Card Default Settings (continued)

Default Name	Default Value	Default Domain
CTX-2500.STM16-PORT.pmthresholds.path.nearend.1day.PPJC-PDET	5760 (count)	0 - 691200000
CTX-2500.STM16-PORT.pmthresholds.path.nearend.1day.PPJC-PGEN	5760 (count)	0 - 691200000
CTX-2500.STM16-PORT.pmthresholds.path.nearend.1day.SES	7 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.path.nearend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.rs.nearend.15min.BBE	10000 (count)	0 - 2151900
CTX-2500.STM16-PORT.pmthresholds.rs.nearend.15min.EB	10000 (count)	0 - 2151900
CTX-2500.STM16-PORT.pmthresholds.rs.nearend.15min.ES	500 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.rs.nearend.15min.OFS	500 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.rs.nearend.15min.SES	500 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.rs.nearend.15min.UAS	3 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.rs.nearend.1day.BBE	100000 (count)	0 - 206582400
CTX-2500.STM16-PORT.pmthresholds.rs.nearend.1day.EB	100000 (count)	0 - 206582400
CTX-2500.STM16-PORT.pmthresholds.rs.nearend.1day.ES	5000 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.rs.nearend.1day.OFS	5000 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.rs.nearend.1day.SES	5000 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.rs.nearend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.vclo.farend.15min.BBE	15 (count)	0 - 539100
CTX-2500.STM16-PORT.pmthresholds.vclo.farend.15min.EB	15 (count)	0 - 1800000
CTX-2500.STM16-PORT.pmthresholds.vclo.farend.15min.ES	12 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.vclo.farend.15min.SES	3 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.vclo.farend.15min.UAS	10 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.vclo.farend.1day.BBE	150 (count)	0 - 51753600
CTX-2500.STM16-PORT.pmthresholds.vclo.farend.1day.EB	125 (count)	0 - 172800000
CTX-2500.STM16-PORT.pmthresholds.vclo.farend.1day.ES	100 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.vclo.farend.1day.SES	7 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.vclo.farend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.vclo.nearend.15min.BBE	15 (count)	0 - 539100
CTX-2500.STM16-PORT.pmthresholds.vclo.nearend.15min.EB	15 (count)	0 - 1800000
CTX-2500.STM16-PORT.pmthresholds.vclo.nearend.15min.ES	12 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.vclo.nearend.15min.SES	3 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.vclo.nearend.15min.UAS	10 (seconds)	0 - 900
CTX-2500.STM16-PORT.pmthresholds.vclo.nearend.1day.BBE	150 (count)	0 - 51753600

Table C-2 15310E-CTX-K9 Card Default Settings (continued)

Default Name	Default Value	Default Domain
CTX-2500.STM16-PORT.pmthresholds.vclo.nearend.1day.EB	125 (count)	0 - 172800000
CTX-2500.STM16-PORT.pmthresholds.vclo.nearend.1day.ES	100 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.vclo.nearend.1day.SES	7 (seconds)	0 - 86400
CTX-2500.STM16-PORT.pmthresholds.vclo.nearend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM4-PORT.config.line.AINSSoakTime	08:00 (hours:mins)	00:00; 00:15; 00:30 .. 48:00
CTX-2500.STM4-PORT.config.line.AdminSSMIn	STU	G811; STU; G812T; G812L; SETS; DUS
CTX-2500.STM4-PORT.config.line.PJVC4Mon#	0 (VC4 #)	0 - 4
CTX-2500.STM4-PORT.config.line.SDBER	1.00E-07	1E-5; 1E-6; 1E-7; 1E-8; 1E-9
CTX-2500.STM4-PORT.config.line.SFBER	1.00E-04	1E-3; 1E-4; 1E-5
CTX-2500.STM4-PORT.config.line.Send<FF>DoNotUse	FALSE	FALSE when SendDoNotUse TRUE; FALSE; TRUE when SendDoNotUse FALSE
CTX-2500.STM4-PORT.config.line.SendAISOnFacilityLoopback	TRUE	TRUE; FALSE
CTX-2500.STM4-PORT.config.line.SendAISOnTerminalLoopback	TRUE	FALSE
CTX-2500.STM4-PORT.config.line.SendDoNotUse	FALSE	FALSE; TRUE
CTX-2500.STM4-PORT.config.line.State	unlocked; automaticInService	unlocked; locked; disabled; locked; maintenance; unlocked; automaticInService
CTX-2500.STM4-PORT.config.line.SyncMsgIn	TRUE	FALSE; TRUE
CTX-2500.STM4-PORT.config.vc4.IPPMEnabled	FALSE	TRUE; FALSE
CTX-2500.STM4-PORT.config.vclo.IPPMEnabled	FALSE	TRUE; FALSE
CTX-2500.STM4-PORT.pmthresholds.ms.farend.15min.BBE	5315 (count)	0 - 552600
CTX-2500.STM4-PORT.pmthresholds.ms.farend.15min.EB	5315 (count)	0 - 552600
CTX-2500.STM4-PORT.pmthresholds.ms.farend.15min.ES	87 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.ms.farend.15min.SES	1 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.ms.farend.15min.UAS	3 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.ms.farend.1day.BBE	53150 (count)	0 - 53049600
CTX-2500.STM4-PORT.pmthresholds.ms.farend.1day.EB	53150 (count)	0 - 53049600
CTX-2500.STM4-PORT.pmthresholds.ms.farend.1day.ES	864 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.ms.farend.1day.SES	4 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.ms.farend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.15min.BBE	5315 (count)	0 - 552600
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.15min.EB	5315 (count)	0 - 552600
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.15min.ES	87 (seconds)	0 - 900

Table C-2 15310E-CTX-K9 Card Default Settings (continued)

Default Name	Default Value	Default Domain
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.15min.PSC	1 (count)	0 - 600
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.15min.PSC-W	0 (count)	0 - 600
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.15min.PSD	300 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.15min.PSD-W	0 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.15min.SES	1 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.15min.UAS	3 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.1day.BBE	53150 (count)	0 - 53049600
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.1day.EB	53150 (count)	0 - 53049600
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.1day.ES	864 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.1day.PSC	5 (count)	0 - 57600
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.1day.PSC-W	0 (count)	0 - 57600
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.1day.PSD	600 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.1day.PSD-W	0 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.1day.SES	4 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.ms.nearend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.path.farend.15min.BBE	25 (count)	0 - 2159100
CTX-2500.STM4-PORT.pmthresholds.path.farend.15min.EB	15 (count)	0 - 13305600
CTX-2500.STM4-PORT.pmthresholds.path.farend.15min.ES	12 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.path.farend.15min.SES	3 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.path.farend.15min.UAS	10 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.path.farend.1day.BBE	250 (count)	0 - 207273600
CTX-2500.STM4-PORT.pmthresholds.path.farend.1day.EB	125 (count)	0 - 691200000
CTX-2500.STM4-PORT.pmthresholds.path.farend.1day.ES	100 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.path.farend.1day.SES	7 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.path.farend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.path.nearend.15min.BBE	25 (count)	0 - 2159100
CTX-2500.STM4-PORT.pmthresholds.path.nearend.15min.EB	15 (count)	0 - 7200000
CTX-2500.STM4-PORT.pmthresholds.path.nearend.15min.ES	12 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.path.nearend.15min.NPJC-PDET	60 (count)	0 - 7200000
CTX-2500.STM4-PORT.pmthresholds.path.nearend.15min.NPJC-PGEN	60 (count)	0 - 7200000
CTX-2500.STM4-PORT.pmthresholds.path.nearend.15min.PJCDIFF	60 (count)	0 - 14400000
CTX-2500.STM4-PORT.pmthresholds.path.nearend.15min.PJCS-PDET	100 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.path.nearend.15min.PJCS-PGEN	100 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.path.nearend.15min.PPJC-PDET	60 (count)	0 - 7200000
CTX-2500.STM4-PORT.pmthresholds.path.nearend.15min.PPJC-PGEN	60 (count)	0 - 7200000
CTX-2500.STM4-PORT.pmthresholds.path.nearend.15min.SES	3 (seconds)	0 - 900

Table C-2 15310E-CTX-K9 Card Default Settings (continued)

Default Name	Default Value	Default Domain
CTX-2500.STM4-PORT.pmthresholds.path.nearend.15min.UAS	10 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.path.nearend.1day.BBE	250 (count)	0 - 207273600
CTX-2500.STM4-PORT.pmthresholds.path.nearend.1day.EB	125 (count)	0 - 691200000
CTX-2500.STM4-PORT.pmthresholds.path.nearend.1day.ES	100 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.path.nearend.1day.NPJC-PDET	5760 (count)	0 - 691200000
CTX-2500.STM4-PORT.pmthresholds.path.nearend.1day.NPJC-PGEN	5760 (count)	0 - 691200000
CTX-2500.STM4-PORT.pmthresholds.path.nearend.1day.PJCDIFF	5760 (count)	0 - 1382400000
CTX-2500.STM4-PORT.pmthresholds.path.nearend.1day.PJCS-PDET	9600 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.path.nearend.1day.PJCS-PGEN	9600 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.path.nearend.1day.PPJC-PDET	5760 (count)	0 - 691200000
CTX-2500.STM4-PORT.pmthresholds.path.nearend.1day.PPJC-PGEN	5760 (count)	0 - 691200000
CTX-2500.STM4-PORT.pmthresholds.path.nearend.1day.SES	7 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.path.nearend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.rs.nearend.15min.BBE	10000 (count)	0 - 553500
CTX-2500.STM4-PORT.pmthresholds.rs.nearend.15min.EB	10000 (count)	0 - 553500
CTX-2500.STM4-PORT.pmthresholds.rs.nearend.15min.ES	500 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.rs.nearend.15min.OFS	500 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.rs.nearend.15min.SES	500 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.rs.nearend.15min.UAS	3 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.rs.nearend.1day.BBE	100000 (count)	0 - 53136000
CTX-2500.STM4-PORT.pmthresholds.rs.nearend.1day.EB	100000 (count)	0 - 53136000
CTX-2500.STM4-PORT.pmthresholds.rs.nearend.1day.ES	5000 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.rs.nearend.1day.OFS	5000 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.rs.nearend.1day.SES	5000 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.rs.nearend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.vclo.farend.15min.BBE	15 (count)	0 - 539100
CTX-2500.STM4-PORT.pmthresholds.vclo.farend.15min.EB	15 (count)	0 - 1800000
CTX-2500.STM4-PORT.pmthresholds.vclo.farend.15min.ES	12 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.vclo.farend.15min.SES	3 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.vclo.farend.15min.UAS	10 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.vclo.farend.1day.BBE	150 (count)	0 - 51753600

Table C-2 15310E-CTX-K9 Card Default Settings (continued)

Default Name	Default Value	Default Domain
CTX-2500.STM4-PORT.pmthresholds.vclo.farend.1day.EB	125 (count)	0 - 172800000
CTX-2500.STM4-PORT.pmthresholds.vclo.farend.1day.ES	100 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.vclo.farend.1day.SES	7 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.vclo.farend.1day.UAS	10 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.vclo.nearend.15min.BBE	15 (count)	0 - 539100
CTX-2500.STM4-PORT.pmthresholds.vclo.nearend.15min.EB	15 (count)	0 - 1800000
CTX-2500.STM4-PORT.pmthresholds.vclo.nearend.15min.ES	12 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.vclo.nearend.15min.SES	3 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.vclo.nearend.15min.UAS	10 (seconds)	0 - 900
CTX-2500.STM4-PORT.pmthresholds.vclo.nearend.1day.BBE	150 (count)	0 - 51753600
CTX-2500.STM4-PORT.pmthresholds.vclo.nearend.1day.EB	125 (count)	0 - 172800000
CTX-2500.STM4-PORT.pmthresholds.vclo.nearend.1day.ES	100 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.vclo.nearend.1day.SES	7 (seconds)	0 - 86400
CTX-2500.STM4-PORT.pmthresholds.vclo.nearend.1day.UAS	10 (seconds)	0 - 86400

C.3.3.2 E1_21_E3_DS3_3 Card Default Settings

Table C-3 lists the E1_21_E3_DS3_3 card default settings.

Table C-3 E1_21_E3_DS3_3 Card Default Settings

Default Name	Default Value	Default Domain
E1-21-E3-DS3-3.Broadband.portAssignment	E3-PORT	DS3-PORT; E3-PORT
E1-21-E3-DS3-3.DS3-PORT.config.AINSSoakTime	08:00 (hours:mins)	00:00; 00:15; 00:30 .. 48:00
E1-21-E3-DS3-3.DS3-PORT.config.FeInhibitLpbk	TRUE	TRUE; FALSE
E1-21-E3-DS3-3.DS3-PORT.config.LineLength	0 - 225 ft	0 - 225 ft; 226 - 450 ft
E1-21-E3-DS3-3.DS3-PORT.config.LineType	M13	UNFRAMED; M13; C BIT
E1-21-E3-DS3-3.DS3-PORT.config.SDBER	1.00E-05	1E-5; 1E-6; 1E-7; 1E-8; 1E-9
E1-21-E3-DS3-3.DS3-PORT.config.SFBER	1.00E-03	1E-3; 1E-4; 1E-5
E1-21-E3-DS3-3.DS3-PORT.config.SendAISOnFacilityLoopback	TRUE	TRUE; FALSE
E1-21-E3-DS3-3.DS3-PORT.config.SendAISOnTerminalLoopback	TRUE	TRUE; FALSE
E1-21-E3-DS3-3.DS3-PORT.config.State	unlocked; automaticInService	unlocked; locked; disabled; locked; maintenance; unlocked; automaticInService
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.15min.CV	382 (BIP count)	0 - 38700

Table C-3 E1_21_E3_DS3_3 Card Default Settings (continued)

Default Name	Default Value	Default Domain
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.15min.ES	25 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.15min.SAS	2 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.15min.SES	4 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.15min.UAS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.1day.CV	3820 (BIP count)	0 - 3715200
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.1day.ES	250 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.1day.SAS	8 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.1day.SES	40 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.1day.UAS	10 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.nearend.15min.CV	382 (BIP count)	0 - 38700
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.nearend.15min.ES	25 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.nearend.15min.SES	4 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.nearend.15min.UAS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.nearend.1day.CV	3820 (BIP count)	0 - 3715200
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.nearend.1day.ES	250 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.nearend.1day.SES	40 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.nearend.1day.UAS	10 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.line.nearend.15min.CV	387 (BPV count)	0 - 38700
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.line.nearend.15min.ES	25 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.line.nearend.15min.LOSS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.line.nearend.15min.SES	4 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.line.nearend.1day.CV	3865 (BPV count)	0 - 3715200
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.line.nearend.1day.ES	250 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.line.nearend.1day.LOSS	10 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.line.nearend.1day.SES	40 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.15min.AISS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.15min.CV	382 (BIP count)	0 - 38700
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.15min.ES	25 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.15min.SAS	2 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.15min.SES	4 (seconds)	0 - 900

Table C-3 E1_21_E3_DS3_3 Card Default Settings (continued)

Default Name	Default Value	Default Domain
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.15min.UAS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.1day.AISS	10 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.1day.CV	3820 (BIP count)	0 - 3715200
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.1day.ES	250 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.1day.SAS	8 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.1day.SES	40 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.1day.UAS	10 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.15min.CV	15 (G1 count)	0 - 2160000
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.15min.ES	12 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.15min.FC	10 (count)	0 - 72
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.15min.SES	3 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.15min.UAS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.1day.CV	125 (G1 count)	0 - 207360000
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.1day.ES	100 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.1day.FC	40 (count)	0 - 6912
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.1day.SES	7 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.1day.UAS	10 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.15min.CV	15 (B3 count)	0 - 2160000
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.15min.ES	12 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.15min.FC	10 (count)	0 - 72
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.15min.SES	3 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.15min.UAS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.1day.CV	125 (B3 count)	0 - 207360000
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.1day.ES	100 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.1day.FC	40 (count)	0 - 6912
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.1day.SES	7 (seconds)	0 - 86400
E1-21-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.1day.UAS	10 (seconds)	0 - 86400
E1-21-E3-DS3-3.E1-PORT.config.AINSSoakTime	08:00 (hours:mins)	00:00; 00:15; 00:30 .. 48:00
E1-21-E3-DS3-3.E1-PORT.config.LineCoding	HDB3	HDB3
E1-21-E3-DS3-3.E1-PORT.config.LineType	E1_MF	E1_MF; E1_CRCMF; UNFRAMED

Table C-3 E1_21_E3_DS3_3 Card Default Settings (continued)

Default Name	Default Value	Default Domain
E1-21-E3-DS3-3.E1-PORT.config.RetimingEnabled	FALSE	TRUE; FALSE
E1-21-E3-DS3-3.E1-PORT.config.SDBER	1.00E-07	1E-5; 1E-6; 1E-7; 1E-8; 1E-9
E1-21-E3-DS3-3.E1-PORT.config.SFBER	1.00E-04	1E-3; 1E-4; 1E-5
E1-21-E3-DS3-3.E1-PORT.config.SaBit	SA Bit 4	SA Bit 4; SA Bit 5; SA Bit 6; SA Bit 7; SA Bit 8
E1-21-E3-DS3-3.E1-PORT.config.SendAISOnFacilityLoopback	TRUE	TRUE; FALSE
E1-21-E3-DS3-3.E1-PORT.config.SendAISOnTerminalLoopback	TRUE	TRUE; FALSE
E1-21-E3-DS3-3.E1-PORT.config.SendAISVOnDefects	FALSE	FALSE; TRUE
E1-21-E3-DS3-3.E1-PORT.config.SendDoNotUse	FALSE	TRUE; FALSE
E1-21-E3-DS3-3.E1-PORT.config.State	unlocked; automaticInService	unlocked; locked; disabled; locked; maintenance; unlocked; automaticInService
E1-21-E3-DS3-3.E1-PORT.config.SyncMsgIn	FALSE	FALSE; TRUE
E1-21-E3-DS3-3.E1-PORT.config.TreatLOFAsDefect	FALSE	FALSE; TRUE
E1-21-E3-DS3-3.E1-PORT.pmthresholds.line.nearend.15min.CV	9 (BPV count)	0 - 1388700
E1-21-E3-DS3-3.E1-PORT.pmthresholds.line.nearend.15min.ES	65 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.line.nearend.15min.LOSS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.line.nearend.15min.SES	10 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.line.nearend.1day.CV	90 (BPV count)	0 - 133315200
E1-21-E3-DS3-3.E1-PORT.pmthresholds.line.nearend.1day.ES	648 (seconds)	0 - 86400
E1-21-E3-DS3-3.E1-PORT.pmthresholds.line.nearend.1day.LOSS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.line.nearend.1day.SES	100 (seconds)	0 - 86400
E1-21-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.15min.AISS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.15min.BBE	9 (count)	0 - 287100
E1-21-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.15min.EB	9 (count)	0 - 450000
E1-21-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.15min.ES	65 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.15min.SES	10 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.15min.UAS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.1day.AISS	10 (seconds)	0 - 86400
E1-21-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.1day.BBE	90 (count)	0 - 27561600
E1-21-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.1day.EB	90 (count)	0 - 43200000
E1-21-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.1day.ES	648 (seconds)	0 - 86400

Table C-3 E1_21_E3_DS3_3 Card Default Settings (continued)

Default Name	Default Value	Default Domain
E1-21-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.1day.SES	100 (seconds)	0 - 86400
E1-21-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.1day.UAS	10 (seconds)	0 - 86400
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vc4.farend.15min.ES	12 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vc4.farend.15min.FC	10 (count)	0 - 72
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vc4.farend.15min.SES	3 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vc4.farend.15min.UAS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vc4.farend.1day.ES	100 (seconds)	0 - 86400
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vc4.farend.1day.FC	40 (count)	0 - 6912
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vc4.farend.1day.SES	7 (seconds)	0 - 86400
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vc4.farend.1day.UAS	10 (seconds)	0 - 86400
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vc4.nearend.15min.ES	12 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vc4.nearend.15min.FC	10 (count)	0 - 72
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vc4.nearend.15min.SES	3 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vc4.nearend.15min.UAS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vc4.nearend.1day.ES	100 (seconds)	0 - 86400
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vc4.nearend.1day.FC	40 (count)	0 - 6912
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vc4.nearend.1day.SES	7 (seconds)	0 - 86400
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vc4.nearend.1day.UAS	10 (seconds)	0 - 86400
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vclo.farend.15min.ES	65 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vclo.farend.15min.FC	10 (count)	0 - 72
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vclo.farend.15min.SES	10 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vclo.farend.15min.UAS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vclo.farend.1day.ES	648 (seconds)	0 - 86400
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vclo.farend.1day.FC	40 (count)	0 - 6912
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vclo.farend.1day.SES	100 (seconds)	0 - 86400
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vclo.farend.1day.UAS	10 (seconds)	0 - 86400
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vclo.nearend.15min.ES	65 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vclo.nearend.15min.FC	10 (count)	0 - 72
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vclo.nearend.15min.SES	10 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vclo.nearend.15min.UAS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vclo.nearend.1day.ES	648 (seconds)	0 - 86400
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vclo.nearend.1day.FC	40 (count)	0 - 6912

Table C-3 E1_21_E3_DS3_3 Card Default Settings (continued)

Default Name	Default Value	Default Domain
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vclo.nearend.1day.SES	100 (seconds)	0 - 86400
E1-21-E3-DS3-3.E1-PORT.pmthresholds.vclo.nearend.1day.UAS	10 (seconds)	0 - 86400
E1-21-E3-DS3-3.E3-PORT.config.AINSSoakTime	08:00 (hours:mins)	00:00; 00:15; 00:30 .. 48:00
E1-21-E3-DS3-3.E3-PORT.config.SDBER	1.00E-07	1E-5; 1E-6; 1E-7; 1E-8; 1E-9
E1-21-E3-DS3-3.E3-PORT.config.SFBER	1.00E-04	1E-3; 1E-4; 1E-5
E1-21-E3-DS3-3.E3-PORT.config.SendAISOnFacilityLoopback	TRUE	TRUE; FALSE
E1-21-E3-DS3-3.E3-PORT.config.SendAISOnTerminalLoopback	TRUE	TRUE; FALSE
E1-21-E3-DS3-3.E3-PORT.config.State	unlocked; automaticInService	unlocked; locked; disabled; locked; maintenance; unlocked; automaticInService
E1-21-E3-DS3-3.E3-PORT.pmthresholds.line.nearend.15min.CV	387 (BPV count)	0 - 29700
E1-21-E3-DS3-3.E3-PORT.pmthresholds.line.nearend.15min.ES	25 (seconds)	0 - 900
E1-21-E3-DS3-3.E3-PORT.pmthresholds.line.nearend.15min.LOSS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.E3-PORT.pmthresholds.line.nearend.15min.SES	4 (seconds)	0 - 900
E1-21-E3-DS3-3.E3-PORT.pmthresholds.line.nearend.1day.CV	3865 (BPV count)	0 - 2851200
E1-21-E3-DS3-3.E3-PORT.pmthresholds.line.nearend.1day.ES	250 (seconds)	0 - 86400
E1-21-E3-DS3-3.E3-PORT.pmthresholds.line.nearend.1day.LOSS	10 (seconds)	0 - 86400
E1-21-E3-DS3-3.E3-PORT.pmthresholds.line.nearend.1day.SES	40 (seconds)	0 - 86400
E1-21-E3-DS3-3.E3-PORT.pmthresholds.path.nearend.15min.ES	25 (seconds)	0 - 900
E1-21-E3-DS3-3.E3-PORT.pmthresholds.path.nearend.15min.SES	4 (seconds)	0 - 900
E1-21-E3-DS3-3.E3-PORT.pmthresholds.path.nearend.15min.UAS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.E3-PORT.pmthresholds.path.nearend.1day.ES	250 (seconds)	0 - 86400
E1-21-E3-DS3-3.E3-PORT.pmthresholds.path.nearend.1day.SES	40 (seconds)	0 - 86400
E1-21-E3-DS3-3.E3-PORT.pmthresholds.path.nearend.1day.UAS	10 (seconds)	0 - 86400
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.15min.BBE	25 (count)	0 - 2159100
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.15min.EB	15 (count)	0 - 7200000
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.15min.ES	12 (seconds)	0 - 900
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.15min.SES	3 (seconds)	0 - 900
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.15min.UAS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.1day.BBE	250 (count)	0 - 207273600
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.1day.EB	125 (count)	0 - 691200000

Table C-3 E1_21_E3_DS3_3 Card Default Settings (continued)

Default Name	Default Value	Default Domain
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.1day.ES	100 (seconds)	0 - 86400
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.1day.SES	7 (seconds)	0 - 86400
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.1day.UAS	10 (seconds)	0 - 86400
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.15min.BBE	25 (count)	0 - 2159100
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.15min.EB	15 (count)	0 - 7200000
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.15min.ES	12 (seconds)	0 - 900
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.15min.SES	3 (seconds)	0 - 900
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.15min.UAS	10 (seconds)	0 - 900
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.1day.BBE	250 (count)	0 - 207273600
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.1day.EB	125 (count)	0 - 691200000
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.1day.ES	100 (seconds)	0 - 86400
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.1day.SES	7 (seconds)	0 - 86400
E1-21-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.1day.UAS	10 (seconds)	0 - 86400

C.3.3.3 E1_63_E3_DS3_3 Card Default Settings

Table C-4 lists the E1_63_E3_DS3_3 card default settings.

Table C-4 E1_63_E3_DS3_3 Card Default Settings

Default Name	Default Value	Default Domain
E1-63-E3-DS3-3.Broadband.portAssignment	E3-PORT	DS3-PORT; E3-PORT
E1-63-E3-DS3-3.DS3-PORT.config.AINSSoakTime	08:00 (hours:mins)	00:00; 00:15; 00:30 .. 48:00
E1-63-E3-DS3-3.DS3-PORT.config.FeInhibitLpbk	TRUE	TRUE; FALSE
E1-63-E3-DS3-3.DS3-PORT.config.LineLength	0 - 225 ft	0 - 225 ft; 226 - 450 ft
E1-63-E3-DS3-3.DS3-PORT.config.LineType	M13	UNFRAMED; M13; C BIT
E1-63-E3-DS3-3.DS3-PORT.config.SDBER	1.00E-05	1E-5; 1E-6; 1E-7; 1E-8; 1E-9
E1-63-E3-DS3-3.DS3-PORT.config.SFBER	1.00E-03	1E-3; 1E-4; 1E-5
E1-63-E3-DS3-3.DS3-PORT.config.SendAISOnFacilityLoopback	TRUE	TRUE; FALSE
E1-63-E3-DS3-3.DS3-PORT.config.SendAISOnTerminalLoopback	TRUE	TRUE; FALSE
E1-63-E3-DS3-3.DS3-PORT.config.State	unlocked; automaticInService	unlocked; locked; disabled; locked; maintenance; unlocked; automaticInService

Table C-4 E1_63_E3_DS3_3 Card Default Settings (continued)

Default Name	Default Value	Default Domain
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.15min.CV	382 (BIP count)	0 - 38700
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.15min.ES	25 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.15min.SAS	2 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.15min.SES	4 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.15min.UAS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.1day.CV	3820 (BIP count)	0 - 3715200
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.1day.ES	250 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.1day.SAS	8 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.1day.SES	40 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.farend.1day.UAS	10 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.nearend.15min.CV	382 (BIP count)	0 - 38700
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.nearend.15min.ES	25 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.nearend.15min.SES	4 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.nearend.15min.UAS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.nearend.1day.CV	3820 (BIP count)	0 - 3715200
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.nearend.1day.ES	250 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.nearend.1day.SES	40 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.cpbitpath.nearend.1day.UAS	10 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.line.nearend.15min.CV	387 (BPV count)	0 - 38700
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.line.nearend.15min.ES	25 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.line.nearend.15min.LOSS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.line.nearend.15min.SES	4 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.line.nearend.1day.CV	3865 (BPV count)	0 - 3715200
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.line.nearend.1day.ES	250 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.line.nearend.1day.LOSS	10 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.line.nearend.1day.SES	40 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.15min.AISS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.15min.CV	382 (BIP count)	0 - 38700
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.15min.ES	25 (seconds)	0 - 900

Table C-4 E1_63_E3_DS3_3 Card Default Settings (continued)

Default Name	Default Value	Default Domain
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.15min.SAS	2 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.15min.SES	4 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.15min.UAS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.1day.AISS	10 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.1day.CV	3820 (BIP count)	0 - 3715200
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.1day.ES	250 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.1day.SAS	8 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.1day.SES	40 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.pbitpath.nearend.1day.UAS	10 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.15min.CV	15 (G1 count)	0 - 2160000
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.15min.ES	12 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.15min.FC	10 (count)	0 - 72
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.15min.SES	3 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.15min.UAS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.1day.CV	125 (G1 count)	0 - 207360000
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.1day.ES	100 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.1day.FC	40 (count)	0 - 6912
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.1day.SES	7 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.farend.1day.UAS	10 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.15min.CV	15 (B3 count)	0 - 2160000
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.15min.ES	12 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.15min.FC	10 (count)	0 - 72
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.15min.SES	3 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.15min.UAS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.1day.CV	125 (B3 count)	0 - 207360000
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.1day.ES	100 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.1day.FC	40 (count)	0 - 6912
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.1day.SES	7 (seconds)	0 - 86400
E1-63-E3-DS3-3.DS3-PORT.pmthresholds.vc4.nearend.1day.UAS	10 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.config.AINSSoakTime	08:00 (hours:mins)	00:00; 00:15; 00:30 .. 48:00

Table C-4 E1_63_E3_DS3_3 Card Default Settings (continued)

Default Name	Default Value	Default Domain
E1-63-E3-DS3-3.E1-PORT.config.LineCoding	HDB3	HDB3
E1-63-E3-DS3-3.E1-PORT.config.LineType	E1_MF	E1_MF; E1_CRCMF; UNFRAMED
E1-63-E3-DS3-3.E1-PORT.config.RetimingEnabled	FALSE	TRUE; FALSE
E1-63-E3-DS3-3.E1-PORT.config.SDBER	1.00E-07	1E-5; 1E-6; 1E-7; 1E-8; 1E-9
E1-63-E3-DS3-3.E1-PORT.config.SFBER	1.00E-04	1E-3; 1E-4; 1E-5
E1-63-E3-DS3-3.E1-PORT.config.SaBit	SA Bit 4	SA Bit 4; SA Bit 5; SA Bit 6; SA Bit 7; SA Bit 8
E1-63-E3-DS3-3.E1-PORT.config.SendAISOnFacilityLoopback	TRUE	TRUE; FALSE
E1-63-E3-DS3-3.E1-PORT.config.SendAISOnTerminalLoopback	TRUE	TRUE; FALSE
E1-63-E3-DS3-3.E1-PORT.config.SendAISVOnDefects	FALSE	FALSE; TRUE
E1-63-E3-DS3-3.E1-PORT.config.SendDoNotUse	FALSE	TRUE; FALSE
E1-63-E3-DS3-3.E1-PORT.config.State	unlocked; automaticInService	unlocked; locked; disabled; locked; maintenance; unlocked; automaticInService
E1-63-E3-DS3-3.E1-PORT.config.SyncMsgIn	FALSE	FALSE; TRUE
E1-63-E3-DS3-3.E1-PORT.config.TreatLOFAsDefect	FALSE	FALSE; TRUE
E1-63-E3-DS3-3.E1-PORT.pmthresholds.line.nearend.15min.CV	9 (BPV count)	0 - 1388700
E1-63-E3-DS3-3.E1-PORT.pmthresholds.line.nearend.15min.ES	65 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.line.nearend.15min.LOSS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.line.nearend.15min.SES	10 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.line.nearend.1day.CV	90 (BPV count)	0 - 133315200
E1-63-E3-DS3-3.E1-PORT.pmthresholds.line.nearend.1day.ES	648 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.pmthresholds.line.nearend.1day.LOSS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.line.nearend.1day.SES	100 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.15min.AISS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.15min.BBE	9 (count)	0 - 287100
E1-63-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.15min.EB	9 (count)	0 - 450000
E1-63-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.15min.ES	65 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.15min.SES	10 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.15min.UAS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.1day.AISS	10 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.1day.BBE	90 (count)	0 - 27561600

Table C-4 E1_63_E3_DS3_3 Card Default Settings (continued)

Default Name	Default Value	Default Domain
E1-63-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.1day.EB	90 (count)	0 - 43200000
E1-63-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.1day.ES	648 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.1day.SES	100 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.pmthresholds.path.nearend.1day.UAS	10 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vc4.farend.15min.ES	12 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vc4.farend.15min.FC	10 (count)	0 - 72
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vc4.farend.15min.SES	3 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vc4.farend.15min.UAS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vc4.farend.1day.ES	100 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vc4.farend.1day.FC	40 (count)	0 - 6912
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vc4.farend.1day.SES	7 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vc4.farend.1day.UAS	10 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vc4.nearend.15min.ES	12 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vc4.nearend.15min.FC	10 (count)	0 - 72
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vc4.nearend.15min.SES	3 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vc4.nearend.15min.UAS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vc4.nearend.1day.ES	100 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vc4.nearend.1day.FC	40 (count)	0 - 6912
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vc4.nearend.1day.SES	7 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vc4.nearend.1day.UAS	10 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vclo.farend.15min.ES	65 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vclo.farend.15min.FC	10 (count)	0 - 72
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vclo.farend.15min.SES	10 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vclo.farend.15min.UAS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vclo.farend.1day.ES	648 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vclo.farend.1day.FC	40 (count)	0 - 6912
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vclo.farend.1day.SES	100 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vclo.farend.1day.UAS	10 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vclo.nearend.15min.ES	65 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vclo.nearend.15min.FC	10 (count)	0 - 72
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vclo.nearend.15min.SES	10 (seconds)	0 - 900
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vclo.nearend.15min.UAS	10 (seconds)	0 - 900

Table C-4 E1_63_E3_DS3_3 Card Default Settings (continued)

Default Name	Default Value	Default Domain
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vclo.nearend.1day.ES	648 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vclo.nearend.1day.FC	40 (count)	0 - 6912
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vclo.nearend.1day.SES	100 (seconds)	0 - 86400
E1-63-E3-DS3-3.E1-PORT.pmthresholds.vclo.nearend.1day.UAS	10 (seconds)	0 - 86400
E1-63-E3-DS3-3.E3-PORT.config.AINSSoakTime	08:00 (hours:mins)	00:00; 00:15; 00:30 .. 48:00
E1-63-E3-DS3-3.E3-PORT.config.SDBER	1.00E-07	1E-5; 1E-6; 1E-7; 1E-8; 1E-9
E1-63-E3-DS3-3.E3-PORT.config.SFBER	1.00E-04	1E-3; 1E-4; 1E-5
E1-63-E3-DS3-3.E3-PORT.config.SendAISOnFacilityLoopback	TRUE	TRUE; FALSE
E1-63-E3-DS3-3.E3-PORT.config.SendAISOnTerminalLoopback	TRUE	TRUE; FALSE
E1-63-E3-DS3-3.E3-PORT.config.State	unlocked; automaticInService	unlocked; locked; disabled; locked; maintenance; unlocked; automaticInService
E1-63-E3-DS3-3.E3-PORT.pmthresholds.line.nearend.15min.CV	387 (BPV count)	0 - 29700
E1-63-E3-DS3-3.E3-PORT.pmthresholds.line.nearend.15min.ES	25 (seconds)	0 - 900
E1-63-E3-DS3-3.E3-PORT.pmthresholds.line.nearend.15min.LOSS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.E3-PORT.pmthresholds.line.nearend.15min.SES	4 (seconds)	0 - 900
E1-63-E3-DS3-3.E3-PORT.pmthresholds.line.nearend.1day.CV	3865 (BPV count)	0 - 2851200
E1-63-E3-DS3-3.E3-PORT.pmthresholds.line.nearend.1day.ES	250 (seconds)	0 - 86400
E1-63-E3-DS3-3.E3-PORT.pmthresholds.line.nearend.1day.LOSS	10 (seconds)	0 - 86400
E1-63-E3-DS3-3.E3-PORT.pmthresholds.line.nearend.1day.SES	40 (seconds)	0 - 86400
E1-63-E3-DS3-3.E3-PORT.pmthresholds.path.nearend.15min.ES	25 (seconds)	0 - 900
E1-63-E3-DS3-3.E3-PORT.pmthresholds.path.nearend.15min.SES	4 (seconds)	0 - 900
E1-63-E3-DS3-3.E3-PORT.pmthresholds.path.nearend.15min.UAS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.E3-PORT.pmthresholds.path.nearend.1day.ES	250 (seconds)	0 - 86400
E1-63-E3-DS3-3.E3-PORT.pmthresholds.path.nearend.1day.SES	40 (seconds)	0 - 86400
E1-63-E3-DS3-3.E3-PORT.pmthresholds.path.nearend.1day.UAS	10 (seconds)	0 - 86400
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.15min.BBE	25 (count)	0 - 2159100
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.15min.EB	15 (count)	0 - 7200000
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.15min.ES	12 (seconds)	0 - 900
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.15min.SES	3 (seconds)	0 - 900

Table C-4 E1_63_E3_DS3_3 Card Default Settings (continued)

Default Name	Default Value	Default Domain
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.15min.UAS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.1day.BBE	250 (count)	0 - 207273600
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.1day.EB	125 (count)	0 - 691200000
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.1day.ES	100 (seconds)	0 - 86400
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.1day.SES	7 (seconds)	0 - 86400
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.farend.1day.UAS	10 (seconds)	0 - 86400
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.15min.BBE	25 (count)	0 - 2159100
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.15min.EB	15 (count)	0 - 7200000
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.15min.ES	12 (seconds)	0 - 900
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.15min.SES	3 (seconds)	0 - 900
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.15min.UAS	10 (seconds)	0 - 900
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.1day.BBE	250 (count)	0 - 207273600
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.1day.EB	125 (count)	0 - 691200000
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.1day.ES	100 (seconds)	0 - 86400
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.1day.SES	7 (seconds)	0 - 86400
E1-63-E3-DS3-3.E3-PORT.pmthresholds.vc4.nearend.1day.UAS	10 (seconds)	0 - 86400

C.3.3.4 Ethernet Card Default Settings

Table C-6 lists the CE-MR-6, CE-100T-8, and ML-100T-8 card default settings for the ONS 15310-MA SDH.

Table C-5 CE-MR-6, CE-100T-8, and ML-100T-8 Card Default Settings

CE-100T-8.config.AINSSoakTime	08:00 (hours:mins)	00:00; 00:15; 00:30 .. 48:00
CE-100T-8.config.State	locked; disabled	unlocked; locked; disabled; locked; maintenance; unlocked; automaticInService
CE-100T-8.etherPortConfig.802-1Q-VlanCoS	7 (count)	0 - 7
CE-100T-8.etherPortConfig.IP-ToS	255 (count)	0 - 255
CE-100T-8.etherPortConfig.liTimer	200 (ms)	200 - 5000
CE-MR.config.AINSSoakTime	08:00 (hours:mins)	00:00; 00:15; 00:30 .. 48:00
CE-MR.config.State	locked; disabled	unlocked; locked; disabled; locked; maintenance; unlocked; automaticInService
CE-MR.etherPortConfig.802-1Q-VlanCoS	7 (count)	0 - 7
CE-MR.etherPortConfig.IP-ToS	255 (count)	0 - 255
CE-MR.etherPortConfig.liTimer	200 (ms)	200 - 5000

Table C-6 Ethernet Card Default Settings

Default Name	Default Value	Default Domain
CE-100T-8.config.AINSSoakTime	08:00 (hours:mins)	00:00; 00:15; 00:30 .. 48:00
CE-100T-8.config.State	locked; disabled	unlocked; locked; disabled; locked; maintenance; unlocked; automaticInService
CE-100T-8.etherPortConfig.802-1Q-VlanCoS	7 (count)	0 - 7
CE-100T-8.etherPortConfig.IP-ToS	255 (count)	0 - 255
CE-100T-8.etherPortConfig.liTimer	200 (ms)	200 - 5000
CE-MR.config.AINSSoakTime	08:00 (hours:mins)	00:00; 00:15; 00:30 .. 48:00
CE-MR.config.State	locked; disabled	unlocked; locked; disabled; locked; maintenance; unlocked; automaticInService
CE-MR.etherPortConfig.802-1Q-VlanCoS	7 (count)	0 - 7
CE-MR.etherPortConfig.IP-ToS	255 (count)	0 - 255
CE-MR.etherPortConfig.liTimer	200 (ms)	200 - 5000
ML100T.config.PreServiceAlarmSuppression	FALSE	TRUE, FALSE
ML100T.config.SoakTime	08:00 (hours:mins)	00:00, 00:15, 00:30 .. 48:00
ML100T.ios.consolePortAccess	TRUE	TRUE, FALSE
ML100T.ios.radiusServerAccess	FALSE	TRUE, FALSE

C.4 Cisco ONS 15310-MA SDH Node Default Settings

Table C-7 on page C-31 lists the node-level default settings for the Cisco ONS 15310-MA SDH. Cisco provides the following types of node-level user-configurable defaults:

- Circuit settings—Set the administrative state and Linear Multiplex Section Protection circuit defaults.
- General settings—Set general node management defaults, including whether to use DST, whether to insert AIS-LO in each VC low-order path when the carrying VC high-order path crosses the SD path BER threshold, the IP address of the NTP/SNTP server to be used, the time zone where the node is located, the SD path BER value, the defaults description, whether to raise a condition on an empty card slot, whether automatic autonomous TL1 reporting of PM data is enabled for cross-connect paths on the node, whether or not to allow ports to be disabled when they are providing services (when the default is set to FALSE users must remove or disable the services first, then put the ports out of service), and whether to report loopback conditions on ports with an locked, maintenance service state.
- Network settings—Set whether to prevent the display of node IP addresses in CTC (applicable for all users except Superusers), default gateway node type, and whether to raise an alarm when the backplane LAN cable is disconnected.
- OSI settings—Set the OSI main setup, GRE tunnel, LAP-D, the router subnet, and the TARP settings.

- 1+1 and Optimized 1+1 protection settings—Set whether or not protected circuits have bidirectional switching, are revertive, and what the reversion time is; set optimized 1+1 detection, recovery, and verify guard timer values.
- Legal Disclaimer—Set the legal disclaimer that warns users at the login screen about the possible legal or contractual ramifications of accessing equipment, systems, or networks without authorization.
- Security Access settings—Set default security settings for LAN access, shell access, serial craft access, EMS access (including IIOP listener port number), TL1 access, and SNMP access.
- Security Grant Permissions—Set default user security levels for activating/reverting software, PMC learning, database restoring, and retrieving audit logs.
- Security RADIUS settings—Sets default RADIUS server settings for the accounting port number and the authentication port number, and whether to enable the node as a final authenticator.
- Security Policy settings—Set the allowable failed logins before lockout, idle user timeout for each user level, optional lockout duration or manual unlock enabled, password reuse and change frequency policies, number of characters difference that is required between the old and new password, password aging by security level, enforced single concurrent session per user, and option to disable inactive user after a set inactivity period.
- Security Password settings—Set when passwords can be changed, how many characters they must differ by, whether or not password reuse is allowed, and whether a password change is required on first login to a new account; set password aging enforcement and user-level specific aging and warning periods; set how many consecutive identical characters are allowed in a password, maximum password length, minimum password length, minimum number and combination of nonalphabetical characters required, and whether or not to allow a password that is a reversal of the login ID associated with the password.
- BITS Timing settings—Set the AIS threshold, coding, framing, State, and State Out settings for BITS-1 and BITS-2 timing.
- General Timing settings—Set the mode (External, Line, or Mixed), quality of reserved (RES) timing (the rule that defines the order of clock quality from lowest to highest), revertive, reversion time, and synchronization status messaging (SSM) message set for node timing.

Note Any node level defaults changed using the **Provisioning > Defaults** tab, changes existing node level provisioning. Although this is service affecting, it depends on the type of defaults changed, for example, general, and all timing and security attributes. The "Changing default values for some node level attributes overrides the current provisioning." message is displayed. The Side Effects column of the Defaults editor (right-click a column header and select **Show Column > Side Effects**) explains the effect of changing the default values. However, when the card level defaults are changed using the **Provisioning > Defaults** tab, existing card provisioning remains unaffected.

Note For more information about each individual node setting, refer to the "Change Node Settings" chapter of the *Cisco ONS 15310-MA SDH Procedure Guide*.

Note For Cisco ONS 15310-MA SDH CTC level default settings refer to the "C.2 CTC Default Settings" section on page C-2.

Table C-7 ONS 15310-MA SDH Node Default Settings

Default Name	Default Value	Default Domain
NODE.circuits.State	unlocked; automaticInService	unlocked;locked; disabled; locked; maintenance; unlocked; automaticInService
NODE.circuits.sncp.HO_SDBER	1.00E-06	1E-5; 1E-6; 1E-7; 1E-8; 1E-9
NODE.circuits.sncp.HO_SFBER	1.00E-04	1E-3; 1E-4; 1E-5
NODE.circuits.sncp.LO_SDBER	1.00E-06	1E-5; 1E-6; 1E-7; 1E-8; 1E-9
NODE.circuits.sncp.LO_SFBER	1.00E-04	1E-3; 1E-4; 1E-5
NODE.circuits.sncp.ProvisionWorkingGoAndReturnOnPrimaryPath	TRUE	TRUE; FALSE
NODE.circuits.sncp.ReversionTime	5.0 (minutes)	0.5; 1.0; 1.5 .. 12.0
NODE.circuits.sncp.Revertive	FALSE	TRUE; FALSE
NODE.circuits.sncp.SwitchOnPDIP	FALSE	TRUE; FALSE
NODE.general.AllowServiceAffectingPortChangeToDisabled	TRUE	FALSE; TRUE
NODE.general.AutoPM	FALSE	FALSE; TRUE
NODE.general.BackupNtpSntpServer	0.0.0.0	IP Address
NODE.general.DefaultsDescription	Factory Defaults	Free form field
NODE.general.InsertAISVOnSDP	FALSE	TRUE; FALSE
NODE.general.NtpSntpServer	0.0.0.0	IP Address
NODE.general.RaiseConditionOnEmptySlot	FALSE	TRUE; FALSE
NODE.general.ReportLoopbackConditionsOnOOS-MTPorts	FALSE	FALSE; TRUE
NODE.general.SDPBER	1.00E-06	1E-5; 1E-6; 1E-7; 1E-8; 1E-9
NODE.general.TimeZone	(GMT-08:00) Pacific Time (US & Canada), Tijuana	(For applicable time zones, see Table C-4 on page C-21.)
NODE.general.UseDST	TRUE	TRUE; FALSE
NODE.network.general.AlarmMissingBackplaneLAN	FALSE	TRUE; FALSE
NODE.network.general.CtcIpDisplaySuppression	FALSE	TRUE; FALSE
NODE.network.general.GatewaySettings	None	None; ENE; GNE; ProxyOnlyNode
NODE.osi.greTunnel.OspfCost	110	110 - 65535

Table C-7 ONS 15310-MA SDH Node Default Settings (continued)

Default Name	Default Value	Default Domain
NODE.osi.greTunnel.SubnetMask	24 (bits)	8; 9; 10 .. 32
NODE.osi.lapd.MTU	512	512; 513; 514 .. 1500
NODE.osi.lapd.Mode	AITS	AITS; UITS
NODE.osi.lapd.Role	Network	Network; User
NODE.osi.lapd.T200	200 (ms)	200; 300; 400 .. 20000
NODE.osi.lapd.T203	10000 (ms)	4000; 4100; 4200 .. 120000
NODE.osi.mainSetup.L1LSPBufferSize	512 (bytes)	512 - 1500
NODE.osi.mainSetup.NodeRoutingMode	End System	End System; Intermediate System Level 1
NODE.osi.subnet.DISPriority	63	1; 2; 3 .. 127
NODE.osi.subnet.ESH	10 (sec)	10; 20; 30 .. 1000
NODE.osi.subnet.IIH	3 (sec)	1; 2; 3 .. 600
NODE.osi.subnet.ISH	10 (sec)	10; 20; 30 .. 1000
NODE.osi.subnet.LANISISCost	20	1; 2; 3 .. 63
NODE.osi.subnet.LDCCISISCost	40	1; 2; 3 .. 63
NODE.osi.subnet.SDCCISISCost	60	1; 2; 3 .. 63
NODE.osi.tarp.L1DataCache	TRUE	FALSE; TRUE
NODE.osi.tarp.LANStormSuppression	TRUE	FALSE; TRUE
NODE.osi.tarp.LDB	TRUE	FALSE; TRUE
NODE.osi.tarp.LDBEntry	5 (min)	1 - 10
NODE.osi.tarp.LDBFlush	5 (min)	0 - 1440
NODE.osi.tarp.PDUsL1Propagation	TRUE	FALSE; TRUE
NODE.osi.tarp.PDUsOrigination	TRUE	FALSE; TRUE
NODE.osi.tarp.T1Timer	15 (sec)	0 - 3600
NODE.osi.tarp.T2Timer	25 (sec)	0 - 3600
NODE.osi.tarp.T3Timer	40 (sec)	0 - 3600
NODE.osi.tarp.T4Timer	20 (sec)	0 - 3600
NODE.osi.tarp.Type4PDUDelay	0 (sec)	0 - 255
NODE.protection.lmsp.BidirectionalSwitching	FALSE	TRUE; FALSE
NODE.protection.lmsp.ReversionTime	5.0 (minutes)	0.5; 1.0; 1.5 .. 12.0
NODE.protection.lmsp.Revertive	FALSE	TRUE; FALSE

Table C-7 ONS 15310-MA SDH Node Default Settings (continued)

Default Name	Default Value	Default Domain
NODE.security.dataComm.CtcBackplaneIpDisplaySuppression	TRUE	FALSE; TRUE when isSecureModeSupportedOnControlCard TRUE; (NOT SUPPORTED) when isSecureModeSupportedOnControlCard FALSE
NODE.security.dataComm.DefaultTCCEthernetIP	10.0.0.1	IP Address
NODE.security.dataComm.DefaultTCCEthernetIPNetmask	24 (bits)	8; 9; 10 .. 32
NODE.security.dataComm.SecureModeLocked	FALSE	FALSE; TRUE when isSecureModeSupportedOnControlCard TRUE; (NOT SUPPORTED) when isSecureModeSupportedOnControlCard FALSE
NODE.security.dataComm.SecureModeOn (May reboot node)	FALSE	FALSE; TRUE when isSecureModeSupportedOnControlCard TRUE; (NOT SUPPORTED) when isSecureModeSupportedOnControlCard FALSE
NODE.security.dataComm.isSecureModeSupportedOnControlCard	TRUE	FALSE; TRUE
NODE.security.emsAccess.AccessState	NonSecure	NonSecure; Secure
NODE.security.emsAccess.IIOPListenerPort (May reboot node)	57790 (port #)	0 - 65535
NODE.security.grantPermission.ActivateRevertSoftware	Superuser	Provisioning; Superuser
NODE.security.grantPermission.PMClearingPrivilege	Provisioning	Provisioning; Superuser
NODE.security.grantPermission.RestoreDB	Superuser	Provisioning; Superuser

Table C-7 ONS 15310-MA SDH Node Default Settings (continued)

Default Name	Default Value	Default Domain
NODE.security.grantPermission.RetrieveAuditLog	Superuser	Provisioning; Superuser
NODE.security.idleUserTimeout.Maintenance	01:00 (hours:mins)	00:00; 00:01; 00:02 .. 16:39
NODE.security.idleUserTimeout.Provisioning	00:30 (hours:mins)	00:00; 00:01; 00:02 .. 16:39
NODE.security.idleUserTimeout.Retrieve	00:00 (hours:mins)	00:00; 00:01; 00:02 .. 16:39
NODE.security.idleUserTimeout.Superuser	00:15 (hours:mins)	00:00; 00:01; 00:02 .. 16:39
NODE.security.lanAccess.LANAccess (May disconnect CTC from node)	Front & Backplane	No LAN Access; Backplane Only; Front Only; Front & Backplane
NODE.security.lanAccess.RestoreTimeout	5 (minutes)	0 - 60
NODE.security.legalDisclaimer.LoginWarningMessage	<html> WARNING This system is restricted to authorized users for business purposes. Unauthorized<p>access is a violation of the law. This service may be monitored for administrative<p>and security reasons. By proceeding; you consent to this monitoring.	Free form field
NODE.security.other.DisableInactiveUser	FALSE	FALSE; TRUE

Table C-7 ONS 15310-MA SDH Node Default Settings (continued)

Default Name	Default Value	Default Domain
NODE.security.other.InactiveDuration	45 (days)	1; 2; 3 .. 99 when nothing TRUE; 45 when nothing FALSE
NODE.security.other.PreventInactiveSuperuserDisable	FALSE	TRUE; FALSE
NODE.security.other.SingleSessionPerUser	FALSE	TRUE; FALSE
NODE.security.passwordAging.EnforcePasswordAging	FALSE	TRUE; FALSE
NODE.security.passwordAging.maintenance.AgingPeriod	45 (days)	20 - 90
NODE.security.passwordAging.maintenance.WarningPeriod	5 (days)	2 - 20
NODE.security.passwordAging.provisioning.AgingPeriod	45 (days)	20 - 90
NODE.security.passwordAging.provisioning.WarningPeriod	5 (days)	2 - 20
NODE.security.passwordAging.retrieve.AgingPeriod	45 (days)	20 - 90
NODE.security.passwordAging.retrieve.WarningPeriod	5 (days)	2 - 20
NODE.security.passwordAging.superuser.AgingPeriod	45 (days)	20 - 90
NODE.security.passwordAging.superuser.WarningPeriod	5 (days)	2 - 20
NODE.security.passwordChange.CannotChangeNewPassword	FALSE	TRUE; FALSE
NODE.security.passwordChange.CannotChangeNewPasswordForNDays	20 (days)	20 - 95
NODE.security.passwordChange.NewPasswordMustDifferFromOldByNCharacters	1 (characters)	1 - 5
NODE.security.passwordChange.PreventReusingLastNPasswords	1 (times)	1 - 10
NODE.security.passwordChange.RequirePasswordChangeOnFirstLoginToNewAccount	FALSE	TRUE; FALSE
NODE.security.passwordComplexity.IdenticalConsecutiveCharactersAllowed	3 or more	0-2; 3 or more
NODE.security.passwordComplexity.MaximumLength	20	20; 80
NODE.security.passwordComplexity.MinimumLength	6	6; 8; 10; 12
NODE.security.passwordComplexity.MinimumRequiredCharacters	1 num; 1 letter & 1 TL1 special	1 num; 1 letter & 1 TL1 special; 1 num; 1 letter & 1 special; 2 each of any 2 of num; upper; lower & TL1 special; 2 each of any 2 of num; upper; lower & special
NODE.security.passwordComplexity.ReverseUserIdAllowed	TRUE	TRUE; FALSE
NODE.security.radiusServer.AccountingPort	1813 (port)	0 - 32767
NODE.security.radiusServer.AuthenticationPort	1812 (port)	0 - 32767
NODE.security.radiusServer.EnableNodeAsFinalAuthenticator	TRUE	FALSE; TRUE
NODE.security.serialCraftAccess.EnableCraftPortA	TRUE	TRUE; FALSE
NODE.security.serialCraftAccess.EnableCraftPortB	TRUE	TRUE; FALSE

Table C-7 ONS 15310-MA SDH Node Default Settings (continued)

Default Name	Default Value	Default Domain
NODE.security.shellAccess.AccessState	NonSecure	Disabled; NonSecure; Secure
NODE.security.shellAccess.EnableShellPassword	FALSE	TRUE; FALSE
NODE.security.shellAccess.TelnetPort	23	23 - 9999
NODE.security.snmpAccess.AccessState	NonSecure	Disabled; NonSecure
NODE.security.tl1Access.AccessState	NonSecure	Disabled; NonSecure; Secure
NODE.security.userLockout.FailedLoginsAllowedBeforeLockout	5 (times)	0 - 10
NODE.security.userLockout.LockoutDuration	00:30 (mins:secs)	00:00; 00:05; 00:10 .. 10:00
NODE.security.userLockout.ManualUnlockBySuperuser	FALSE	TRUE; FALSE
NODE.timing.bits-1.AISThreshold	DUS	G811; STU; G812T; G812L; SETS; DUS
NODE.timing.bits-1.AdminSSMIn	STU	G811; STU; G812T; G812L; SETS; DUS
NODE.timing.bits-1.CableType	120 ohm	75 ohm; 120 ohm
NODE.timing.bits-1.Coding	HDB3	HDB3; AMI when FacilityType E1; N/A when FacilityType 2MHz
NODE.timing.bits-1.CodingOut	HDB3	HDB3; AMI when FacilityTypeOut E1; N/A when FacilityTypeOut 2MHz; AMI when FacilityTypeOut 6MHz
NODE.timing.bits-1.FacilityType	E1	E1; 2MHz
NODE.timing.bits-1.FacilityTypeOut	E1	E1; 2MHz

Table C-7 ONS 15310-MA SDH Node Default Settings (continued)

Default Name	Default Value	Default Domain
NODE.timing.bits-1.Framing	FAS+CAS+ CRC	FAS+CRC; FAS+CAS; FAS+CAS+CRC; FAS; Unframed when FacilityType E1; N/A when FacilityType 2MHz
NODE.timing.bits-1.FramingOut	FAS+CAS+ CRC	FAS+CRC; FAS+CAS; FAS+CAS+CRC; FAS; Unframed when FacilityTypeOut E1; N/A when FacilityTypeOut 2MHz
NODE.timing.bits-1.SaBit	SA Bit 4	SA Bit 4; SA Bit 5; SA Bit 6; SA Bit 7; SA Bit 8 when FacilityType E1; N/A when FacilityType 2MHz
NODE.timing.bits-1.State	unlocked	unlocked; locked; disabled
NODE.timing.bits-1.StateOut	unlocked	unlocked; locked; disabled
NODE.timing.bits-2.AISThreshold	DUS	G811; STU; G812T; G812L; SETS; DUS
NODE.timing.bits-2.AdminSSMIn	STU	G811; STU; G812T; G812L; SETS; DUS
NODE.timing.bits-2.CableType	120 ohm	75 ohm; 120 ohm
NODE.timing.bits-2.Coding	HDB3	HDB3; AMI when FacilityType E1; N/A when FacilityType 2MHz

Table C-7 ONS 15310-MA SDH Node Default Settings (continued)

Default Name	Default Value	Default Domain
NODE.timing.bits-2.CodingOut	HDB3	HDB3; AMI when FacilityTypeOut E1; N/A when FacilityTypeOut 2MHz
NODE.timing.bits-2.FacilityType	E1	E1; 2MHz
NODE.timing.bits-2.FacilityTypeOut	E1	E1; 2MHz
NODE.timing.bits-2.Framing	FAS+CAS+ CRC	FAS+CRC; FAS+CAS; FAS+CAS+CRC; FAS; Unframed when FacilityType E1; N/A when FacilityType 2MHz
NODE.timing.bits-2.FramingOut	FAS+CAS+ CRC	FAS+CRC; FAS+CAS; FAS+CAS+CRC; FAS; Unframed when FacilityTypeOut E1; N/A when FacilityTypeOut 2MHz
NODE.timing.bits-2.SaBit	SA Bit 4	SA Bit 4; SA Bit 5; SA Bit 6; SA Bit 7; SA Bit 8 when FacilityType E1; N/A when FacilityType 2MHz
NODE.timing.bits-2.State	unlocked	unlocked; locked; disabled
NODE.timing.bits-2.StateOut	unlocked	unlocked; locked; disabled
NODE.timing.general.Mode	External	External; Line; Mixed
NODE.timing.general.ReversionTime	5.0 (minutes)	0.5; 1.0; 1.5 .. 12.0
NODE.timing.general.Revertive	FALSE	TRUE; FALSE

C.4.1 Time Zones

Table C-8 lists the time zones that apply for node time zone defaults. Time zones in the table are ordered by their relative relationships to Greenwich Mean Time (GMT), and the default values are displayed in the correct format for valid default input.

Table C-8 Time Zones

Time Zone (GMT +/– Hours)	Default Value
GMT-11:00	(GMT-11:00) Midway Islands, Samoa
GMT-10:00	(GMT-10:00) Hawaiian Islands, Tahiti
GMT-09:00	(GMT-09:00) Anchorage - Alaska
GMT-08:00	(GMT-08:00) Pacific Time (US & Canada), Tijuana
GMT-07:00	(GMT-07:00) Mountain Time (US & Canada)
GMT-07:00	(GMT-07:00) Phoenix - Arizona
GMT-06:00	(GMT-06:00) Central Time (US & Canada)
GMT-06:00	(GMT-06:00) Mexico City
GMT-06:00	(GMT-06:00) Costa Rica, Managua, San Salvador
GMT-06:00	(GMT-06:00) Saskatchewan
GMT-05:00	(GMT-05:00) Bogota, Lima, Quito
GMT-05:00	(GMT-05:00) Eastern Time (US & Canada)
GMT-05:00	(GMT-05:00) Havana
GMT-05:00	(GMT-05:00) Indiana (US)
GMT-04:00	(GMT-04:00) Asuncion
GMT-04:00	(GMT-04:00) Caracas, La Paz, San Juan
GMT-04:00	(GMT-04:00) Atlantic Time (Canada), Halifax, Saint John, Charlottetown
GMT-04:00	(GMT-04:00) Santiago
GMT-04:00	(GMT-04:00) Thule (Qaanaaq)
GMT-03:30	(GMT-03:30) St. John's - Newfoundland
GMT-03:00	(GMT-03:00) Brasilia, Rio de Janeiro, Sao Paulo
GMT-03:00	(GMT-03:00) Buenos Aires, Georgetown
GMT-03:00	(GMT-03:00) Godthab (Nuuk) - Greenland
GMT-02:00	(GMT-02:00) Mid-Atlantic
GMT-01:00	(GMT-01:00) Azores, Scoresbysund
GMT-01:00	(GMT-01:00) Praia - Cape Verde
GMT 00:00	(GMT 00:00) Casablanca, Reykjavik, Monrovia
GMT	(GMT) Greenwich Mean Time
GMT 00:00	(GMT 00:00) Dublin, Edinburgh, London, Lisbon
GMT+01:00	(GMT+01:00) Amsterdam, Berlin, Rome, Stockholm, Paris
GMT+01:00	(GMT+01:00) Belgrade, Bratislava, Budapest, Ljubljana, Prague

Table C-8 Time Zones (continued)

Time Zone (GMT +/– Hours)	Default Value
GMT+01:00	(GMT+01:00) Brussels, Copenhagen, Madrid, Vienna
GMT+01:00	(GMT+01:00) Sarajevo, Skopje, Sofija, Vilnius, Warsaw, Zagreb
GMT+01:00	(GMT+01:00) West Central Africa, Algiers, Lagos, Luanda
GMT+01:00	(GMT+01:00) Windhoek (Namibia)
GMT+02:00	(GMT+02:00) Al Jizah, Alexandria, Cairo
GMT+02:00	(GMT+02:00) Amman
GMT+02:00	(GMT+02:00) Athens, Bucharest, Istanbul
GMT+02:00	(GMT+02:00) Beirut
GMT+02:00	(GMT+02:00) Cape Town, Harare, Johannesburg, Pretoria
GMT+02:00	(GMT+02:00) Jerusalem
GMT+02:00	(GMT+02:00) Kaliningrad, Minsk
GMT+03:00	(GMT+03:00) Aden, Antananarivo, Khartoum, Nairobi
GMT+03:00	(GMT+03:00) Baghdad
GMT+03:00	(GMT+03:00) Kuwait, Riyadh
GMT+03:00	(GMT+03:00) Moscow, St. Petersburg, Novgorod
GMT+03:30	(GMT+03:30) Tehran
GMT+04:00	(GMT+04:00) Abu Dhabi, Mauritius, Muscat
GMT+04:00	(GMT+04:00) Aqtau, T'bilisi
GMT+04:00	(GMT+04:00) Baku
GMT+04:00	(GMT+04:00) Yerevan, Samara
GMT+04:30	(GMT+04:30) Kabul
GMT+05:00	(GMT+05:00) Chelyabinsk, Prem, Yekaterinburg, Ufa
GMT+05:00	(GMT+05:00) Islamabad, Karachi, Tashkent
GMT+05:30	(GMT+05:30) Calcutta, Mumbai, New Delhi, Chennai
GMT+05:45	(GMT+05:45) Kathmandu
GMT+06:00	(GMT+06:00) Almaty
GMT+06:00	(GMT+06:00) Colombo, Dhaka, Astana
GMT+06:00	(GMT+06:00) Novosibirsk, Omsk
GMT+06:30	(GMT+06:30) Cocos, Rangoon
GMT+07:00	(GMT+07:00) Bangkok, Hanoi, Jakarta
GMT+07:00	(GMT+07:00) Krasnoyarsk, Norilsk, Novokuznetsk
GMT+08:00	(GMT+08:00) Irkutsk, Ulaan Bataar
GMT+08:00	(GMT+08:00) Beijing, Shanghai, Hong Kong, Urumqi
GMT+08:00	(GMT+08:00) Perth
GMT+08:00	(GMT+08:00) Singapore, Manila, Taipei, Kuala Lumpur
GMT+09:00	(GMT+09:00) Chita, Yakutsk

Table C-8 Time Zones (continued)

Time Zone (GMT +/– Hours)	Default Value
GMT+09:00	(GMT+09:00) Osaka, Sapporo, Tokyo
GMT+09:00	(GMT+09:00) Palau, Pyongyang, Seoul
GMT+09:30	(GMT+09:30) Adelaide, Broken Hill
GMT+09:30	(GMT+09:30) Darwin
GMT+10:00	(GMT+10:00) Brisbane, Port Moresby, Guam
GMT+10:00	(GMT+10:00) Canberra, Melbourne, Sydney
GMT+10:00	(GMT+10:00) Hobart
GMT+10:00	(GMT+10:00) Khabarovsk, Vladivostok
GMT+10:30	(GMT+10:30) Lord Howe Island
GMT+11:00	(GMT+11:00) Honiara, Magadan, Soloman Islands
GMT+11:00	(GMT+11:00) Noumea - New Caledonia
GMT+11:30	(GMT+11:30) Kingston - Norfolk Island
GMT+12:00	(GMT+12:00) Andyra, Kamchatka
GMT+12:00	(GMT+12:00) Auckland, Wellington
GMT+12:00	(GMT+12:00) Marshall Islands, Eniwetok
GMT+12:00	(GMT+12:00) Suva - Fiji
GMT+12:45	(GMT+12:45) Chatham Island
GMT+13:00	(GMT+13:00) Nuku'alofa - Tonga
GMT+13:00	(GMT+13:00) Rawaki, Phoenix Islands
GMT+14:00	(GMT+14:00) Line Islands, Kiritimati - Kiribati

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