

Managing Ethernet Network Interface Devices (E-NIDs)

Ethernet Network Interface Devices (E-NIDs) are commonly deployed at customer premises and managed via Management VLANs (MVLANS). The implementation of E-NID MVLANS can be challenging due to the variety of technologies in a typical service provider network. It is useful to explore strategies for managing E-NIDs with Fujitsu platforms.

Managing FLASHWAVE Platforms

The FLASHWAVE® 4100 ES, FLASHWAVE CDS and FLASHWAVE 9500 platforms are managed via TL1 commands from the NETSMART® 1500 Management System. Typically, the NETSMART 1500 is connected to the Local Communications Network (LCN) port of a FLASHWAVE 9500 as a Gateway Network Element (GNE). The GNE forwards TL1 commands to the appropriate network element.

When SONET links connect the FLASHWAVE components, the Data Communications Channel (DCC) in the SONET overhead passes the TL1 commands. When OTN links connect the FLASHWAVE components, the General Communications Channel (GCC) in the OTN overhead passes the TL1 commands. Figure 1 depicts these options.

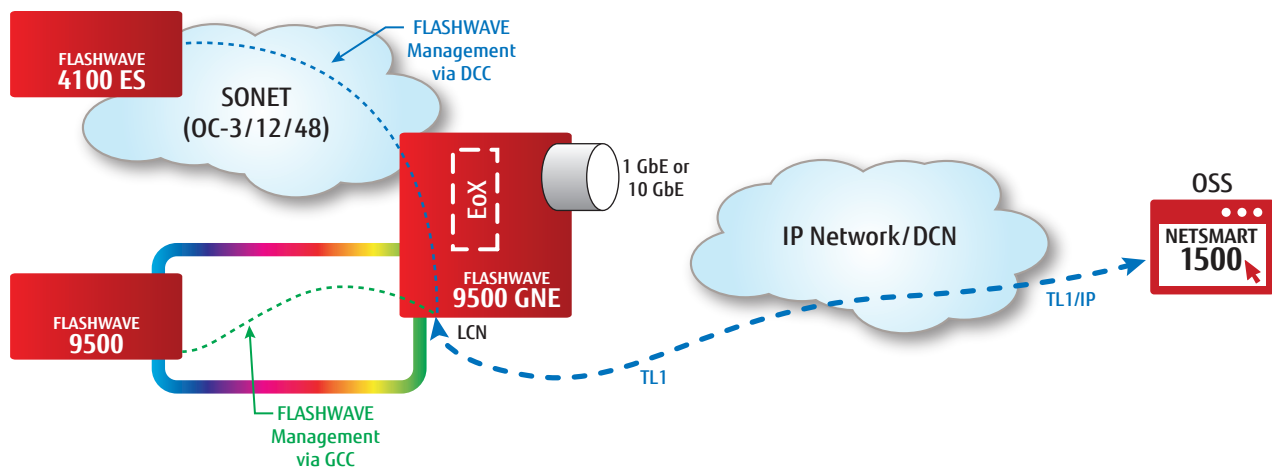


Figure 1: SONET- and DWDM-managed FLASHWAVE platforms

When Ethernet links connect FLASHWAVE components, an MVLAN is created in band to pass TL1 commands from the NETSMART 1500 to each FLASHWAVE network element (Figure 2).

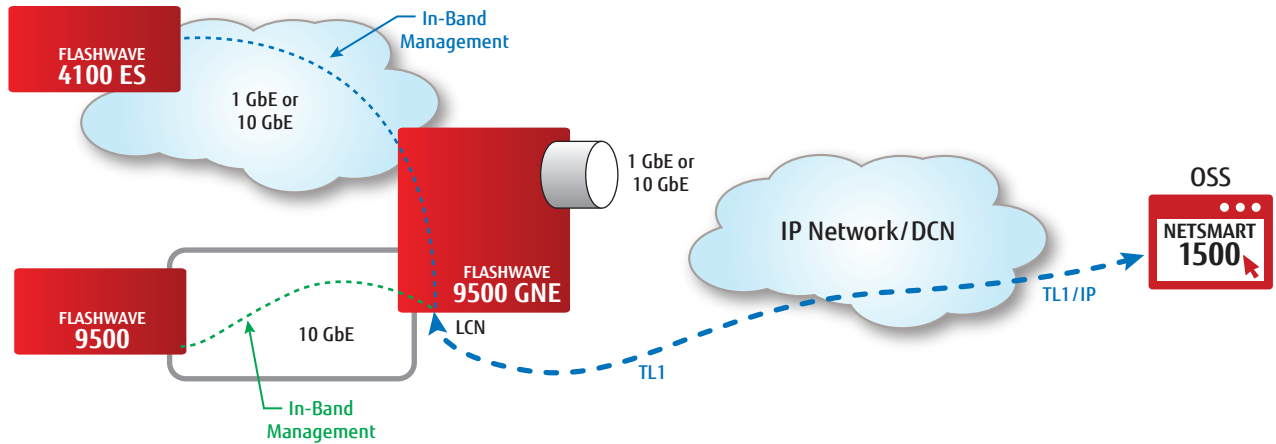


Figure 2: Ethernet-managed FLASHWAVE platforms

Managing E-NIDs that Subtend a FLASHWAVE 9500 Platform

Typical deployment architectures use E-NIDs at the customer premises. This is shown in Figure 3, where green arrows indicate the customer traffic path. These E-NIDs may be FLASHWAVE E-NIDs, say, multiple FLASHWAVE 9410 devices, or they may be third-party E-NIDs.

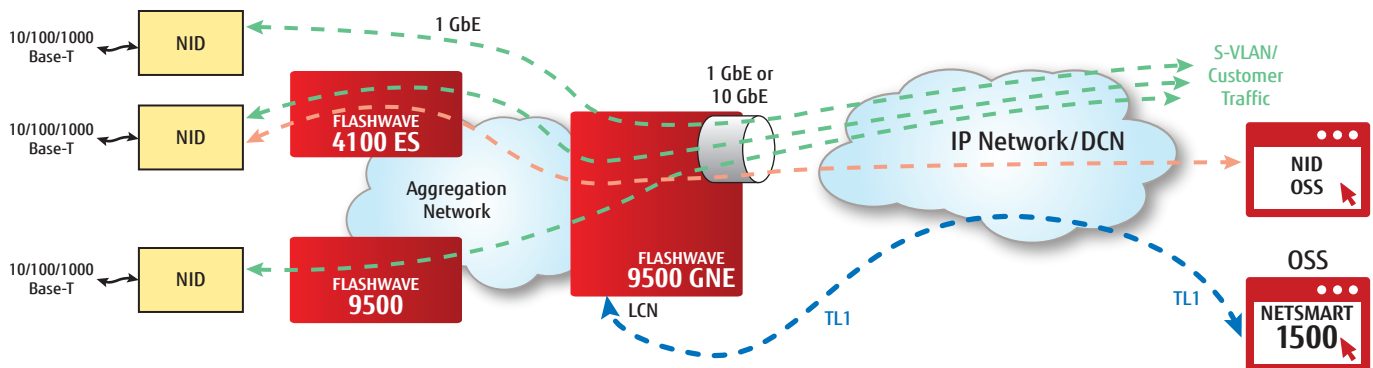


Figure 3: E-NIDs subtending a Fujitsu network

Most Ethernet E-NIDs use Simple Network Management Protocol (SNMP) via a management VLAN, not TL1, for provisioning. FLASHWAVE E-NIDs may be managed via NETSMART 1500, while other E-NIDs must be managed via a separate E-NID management system. Both NETSMART 1500 and the separate E-NID management system connect to the Fujitsu solution via Ethernet connections through the Data Communications Network (DCN). Unlike FLASHWAVE TL-1 management messages, which typically use DCC or GCC, E-NID SNMP management messages are in band with the bearer traffic. But how do management messages for the E-NIDs flow through the Fujitsu transport system to the DCN and the management system? That depends on how they are connected.

Fujitsu transport solutions use an Ethernet over Anything (EoX) Mapper in the FLASHWAVE 9500 for an Ethernet over SONET (EoS) aggregation network, as shown in Figure 4. The E-NIDs typically take the customer traffic and encapsulate it using Generic Functional Protocol (GFP) into a SONET frame. A SONET aggregation network then transports the SONET frames to the GNE. At the GNE—or one of the devices in the transport network—an EoX Mapper extracts the Ethernet frames from the SONET payload and passes those frames to the DCN via an Ethernet facility. Management frames use this same mechanism between the E-NIDs and the management system. Note that management messages for the FLASHWAVE platforms use the out-of-band DCC or GCC channels, whereas management messages for the E-NIDs are carried in band.

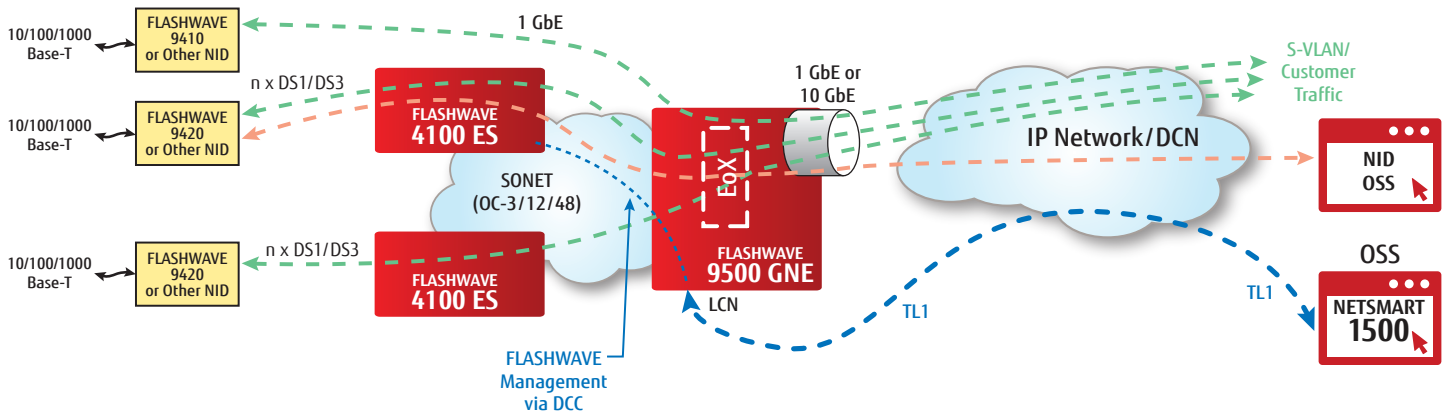


Figure 4: Managing E-NIDs via an EoS aggregation network

Fujitsu transport solutions use Ethernet facilities in the FLASHWAVE 9500 for an all-Ethernet aggregation network, as shown in Figure 5. In this case, the E-NIDs typically take the customer Ethernet traffic and send the Ethernet frames directly on the Ethernet connections. An Ethernet aggregation network then transports the frames to the GNE and subsequently to the DCN. Management frames use this same mechanism between the E-NIDs and the management system. Note that management messages for the FLASHWAVE platforms use the out-of-band DCC or GCC channels, whereas management messages for the E-NIDs are carried in-band in an MVLAN.

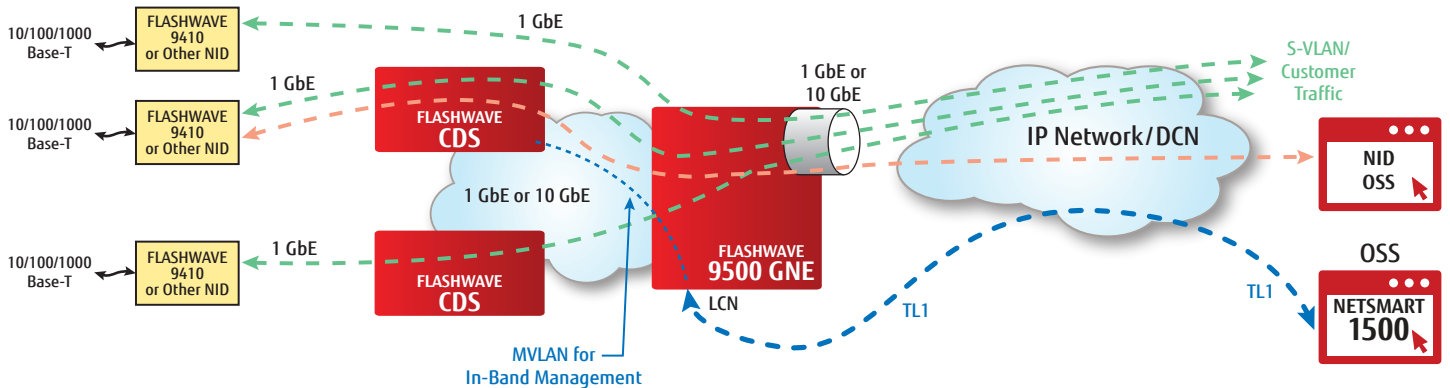


Figure 5: Managing E-NIDs via an Ethernet aggregation network

Managing E-NIDs that Subtend a FLASHWAVE 9500 with E-Line Services

With this understanding of the technology scenarios used to connect E-NIDs to the network, let's explore how the devices are managed.

Direct Connect to FLASHWAVE 9500

Each E-NID connected to an E-Line-based FLASHWAVE 9500 Layer 2 network expects management frames on the same VLAN. The FLASHWAVE 9500 E-Line-based Layer 2 network needs a unique VLAN for each E-NID, however, and this requirement is met manually.

The NETSMART 1500 or third-party E-NID management system sends SNMP E-NID management messages into the DCN to the FLASHWAVE 9500 to the in-band management accessed via the MVLAN of the customer E-NID. The SNMP messages are IP routed in the DCN. But the FLASHWAVE 9500 Layer 2 network switches traffic by VLAN tags via E-Line services. The DCN router that sends packets from the NETSMART 1500 or third party E-NID management system to the correct interface on the FLASHWAVE 9500 also adds the correct Customer VLAN (CVLAN) tag, and these tags must be unique. This is not automatic; the service provider must manage it, plan it, and provision it.

The FLASHWAVE 9500 must be provisioned to translate the VLAN that each E-NID expects to a unique VLAN that the Layer 2 network can use to direct the E-NID management system.

Upon receipt, the FLASHWAVE 9500 must translate the VLANs. Each E-NID expects management traffic on a specific VLAN, perhaps CVLAN 99. The transport network switches these messages based on unique VLAN tags. At some point in the network, the transport network must translate the unique VLAN tag to the expected VLAN tag. Figure 6 illustrates this with a FLASHWAVE 9500 and two E-NIDs, each of which expects management traffic on CVLAN 99. But the FLASHWAVE 9500 network requires unique VLAN tags. The diagram shows untagged traffic from the OSS to the DCN router, where a unique VLAN tag is pushed onto the frames—in this case, CVLAN 101 for the top E-NID and CVLAN 102 for the bottom E-NID. The FLASHWAVE 9500 then uses the unique CVLANs to switch the messages to the correct E-NID and, in the process, translate the VLAN for each E-NID to CVLAN 99.

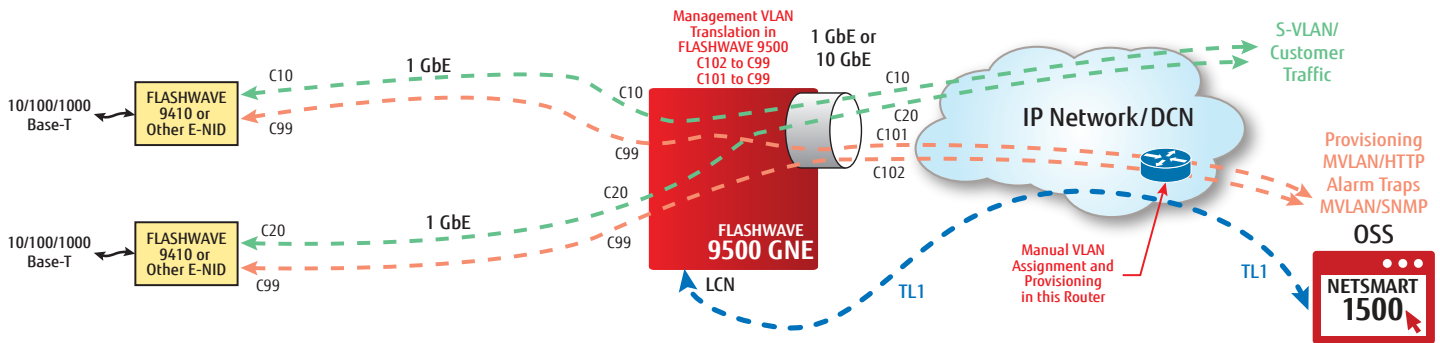


Figure 6: Managing direct-connect E-NIDs with E-Line (single management port)

Bearer traffic and management traffic can use either the same port or different ports. Figure 7 illustrates direct-connected E-NIDs with a dedicated management port. In this scenario, all management traffic uses specific ports, and bearer traffic uses other network ports. Regardless of the number of ports, the functionality of the DCN router remains the same, and the need for MVLAN translation continues in the FLASHWAVE 9500.

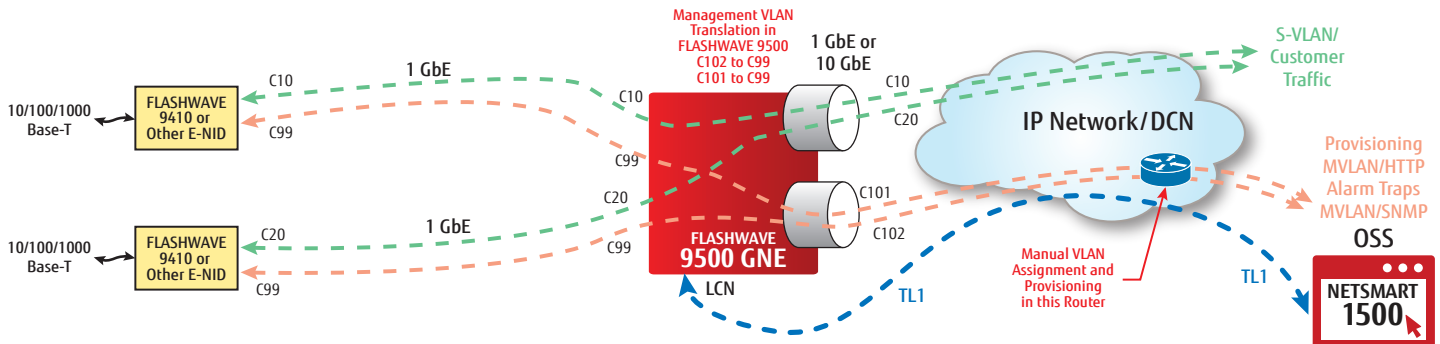


Figure 7: Managing direct-connect E-NIDs with E-Line (dedicated management port)

Subtended FLASHWAVE CDS

To facilitate E-NID management, the FLASHWAVE CDS incorporates a small bridge. The PMVLAN command in the FLASHWAVE CDS can be used to form an E-Tree for management. Instead of needing unique VLAN tags to manage each connected E-NID, the FLASHWAVE CDS requires just a single unique VLAN tag. Figure 8 shows there is a single VLAN to each FLASHWAVE CDS for management of the connected E-NIDs.

As previously described, the DCN router is manually provisioned for unique management VLAN tags. But the FLASHWAVE 9500 does not need to translate the management VLAN to each FLASHWAVE CDS. The translation function is performed in the bridge via the MVLAN feature on the FLASHWAVE CDS.

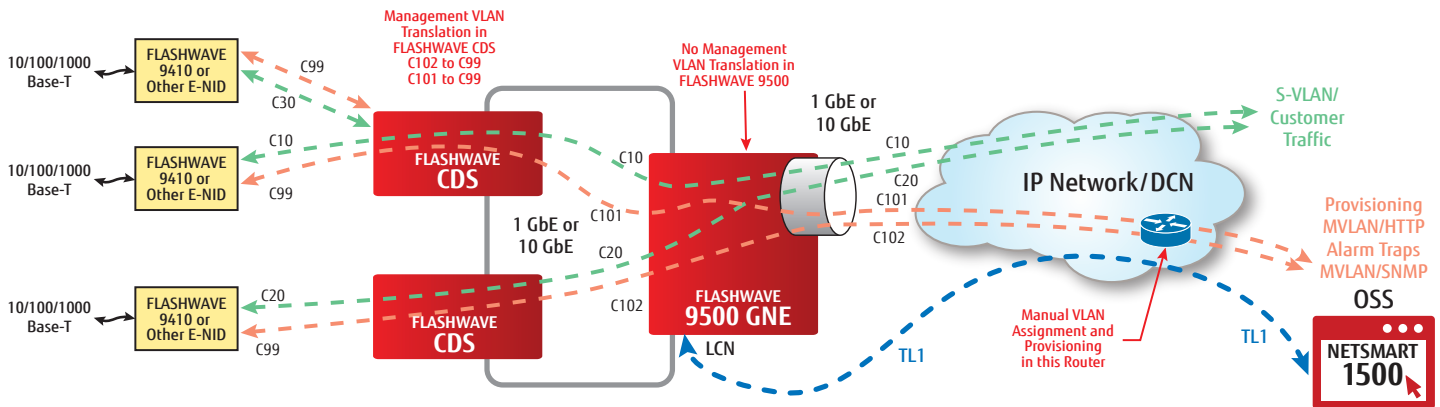


Figure 8: Managing E-NIDs through a FLASHWAVE CDS with a PMVLAN E-Line

Subtended FLASHWAVE 4100 ES

The need for complex, manual, and tedious VLAN management of E-NID management messages is not eliminated with a SONET Interoffice Facility (IOF), as shown in Figure 9. As per Figure 4, a SONET IOF uses EoS E-NIDs and a FLASHWAVE 4100 ES, or similar SONET platform, for SONET aggregation, and an EoX Mapper in the FLASHWAVE 9500 to extract and aggregate the Ethernet traffic. Unique VLAN tags continue to be used in the FLASHWAVE 9500 for switching added by the DCN router, and these VLANs still need to be translated to the management VLAN that the E-NID expects.

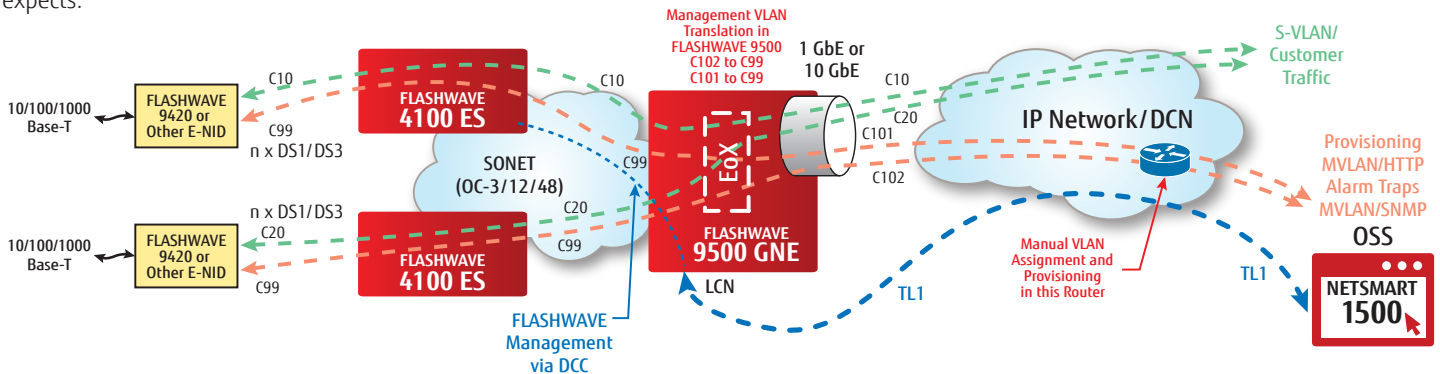


Figure 9: Managing EoS NIDs through a FLASHWAVE 4100 ES with E-Line

How E-LAN Services in FLASHWAVE 9500 Improve E-NID Management

Direct Connect to FLASHWAVE 9500

An earlier release of the FLASHWAVE 9500 added support for bridging and E-LAN services. An E-LAN can be used to simplify the management of E-NIDs. Everything is the same, except the E-LAN service switches management frames to the correct port.

The router in the DCN that routes packets from the NETSMART 1500 to the correct interface on the FLASHWAVE 9500 must add a unique CVLAN tag. There is no need for the FLASHWAVE 9500 to translate the VLANs. There is no management of VLAN tags in the DCN router or the FLASHWAVE 9500.

This much simpler and more elegant method to managing E-NIDs is illustrated in Figure 10, where no unique VLANs are assigned. The DCN router adds a single tag to the SNMP management messages. The E-LAN feature uses MAC addresses to forward SNMP messages to the correct E-NIDs.

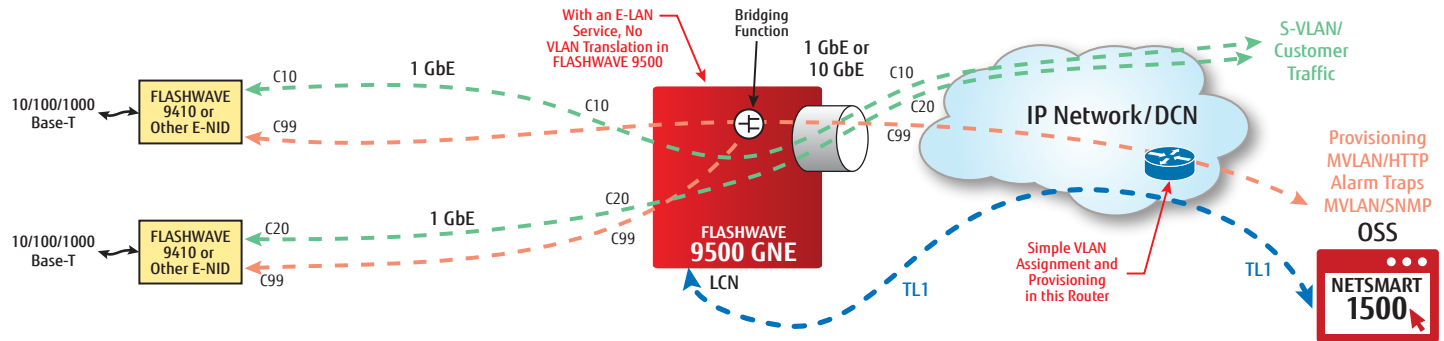


Figure 10: Managing direct-connect E-NIDs with E-LAN

Subtended FLASHWAVE CDS

Using an E-LAN is equally simple in a FLASHWAVE CDS Ethernet aggregation network. Everything is the same—the E-LAN service switches management frames to the correct port based on the MAC address. As shown in Figure 11, no manual VLAN translation is required in the DCN router, and no VLAN translation is required in the FLASHWAVE 9500. Note that the MVLAN command in the FLASHWAVE CDS is used to form an E-Tree for management of multiple E-NIDs connected to a FLASHWAVE CDS.

Figure 11 also shows how the FLASHWAVE 9500 platform’s bridging function can automatically direct management frames to the correct NID without manual VLAN manipulation. This function applies to Layer 2 E-Line and SONET aggregation networks.

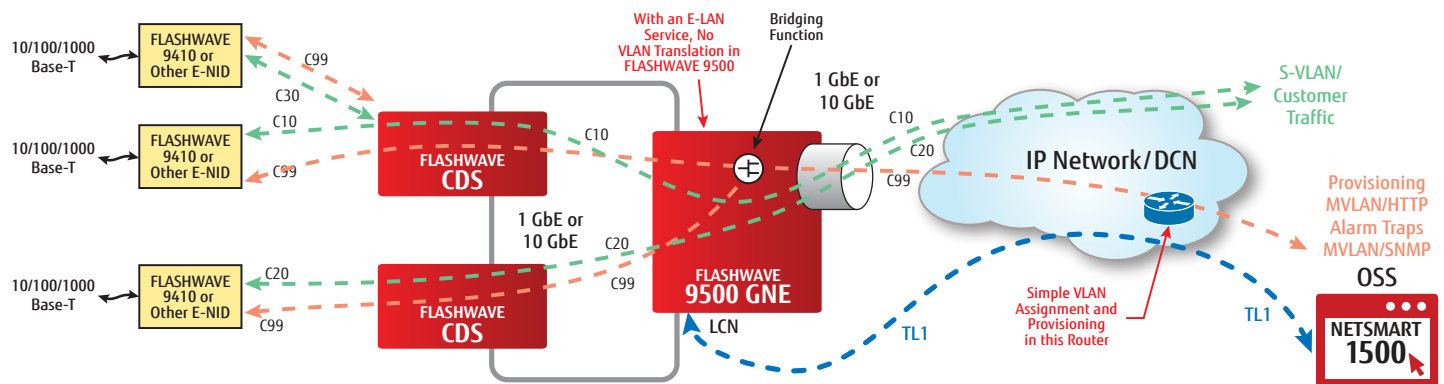


Figure 11: Managing E-NIDs through a FLASHWAVE CDS with E-LAN

Subtended FLASHWAVE 4100 ES

Similarly, an E-LAN simplifies E-NID management for a SONET IOF, as shown in Figure 12.

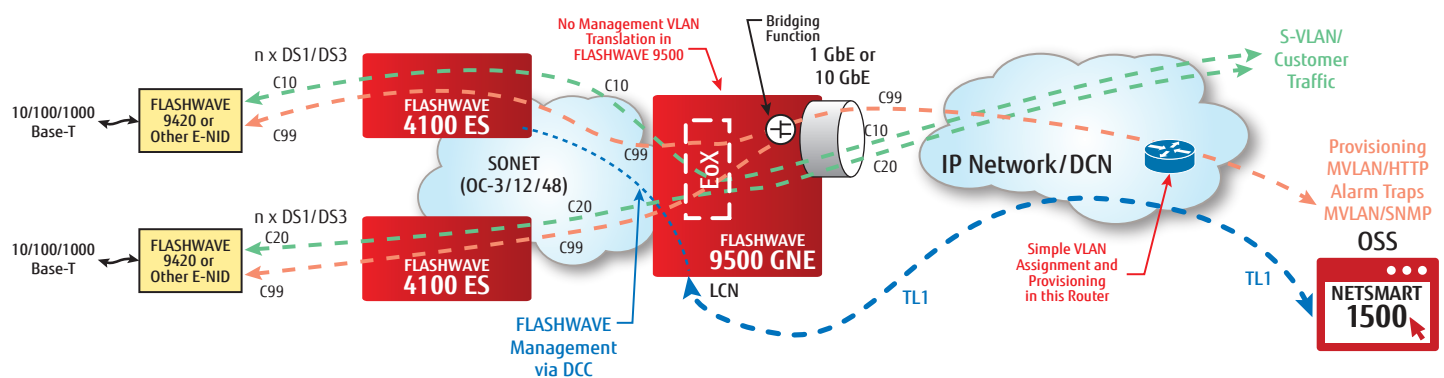


Figure 12: Managing EoS NIDs through a FLASHWAVE 4100 ES with E-LAN

Alarm Collection and Performance Monitoring

In addition to provisioning, comprehensive E-NID management also includes alarm and performance monitoring (PM) collection.

Although the NETSMART 1500 system manages FLASHWAVE platforms via TL1 commands, it can collect both SNMP and TL1 alarms and traps. E-NIDs generate SNMP alarms that the NETSMART 1500 collects and displays.

While the NETSMART 1500 can collect instantaneous alarms and PMs, its history, database, and report generation capabilities are limited. It is common for service providers to use a third-party PM collection system. The E-NIDs can send SNMP alarms and traps to multiple IP addresses. As Figure 13 shows, a third-party PM collection system can be added to the network. As with management, the use of E-Line requires only manual management of VLAN tags in the DCN router and the translation of those tags in the FLASHWAVE 9500. The use of an E-LAN in the FLASHWAVE 9500 greatly simplifies PM collection, just as it simplifies management.

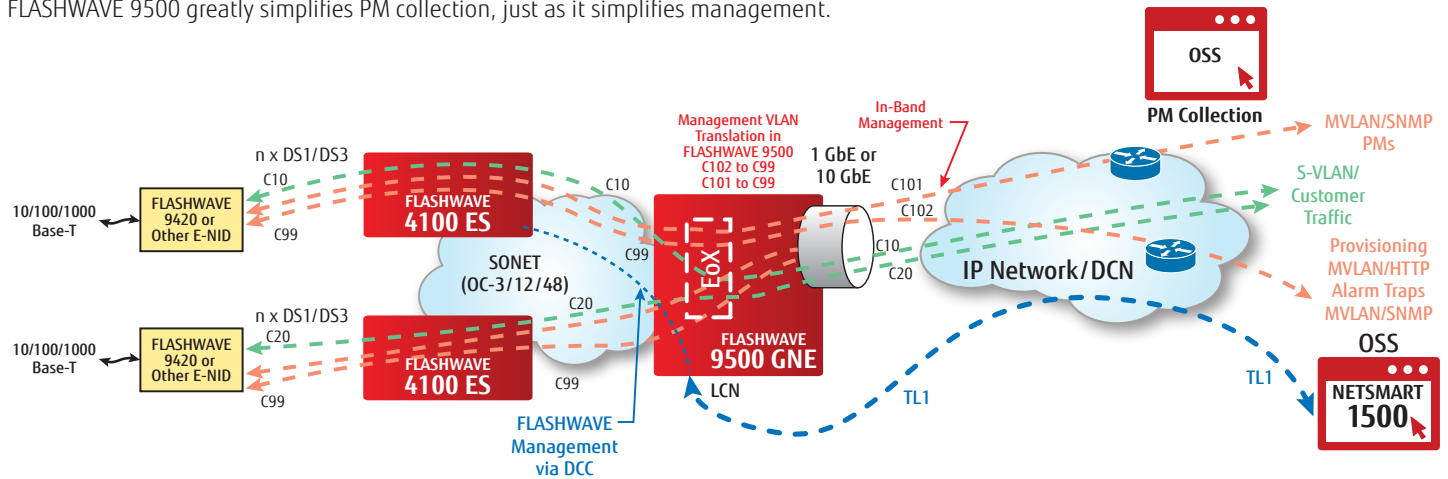


Figure 13: Third-party PM collection and reporting

Summary

E-NID management can be challenging and complex. Specifically, with an E-Line-based Layer 2 FLASHWAVE 9500 network, MVLANS must be manually selected, provisioned, translated, and tracked.

Fortunately, the E-LAN functions now available in the FLASHWAVE 9500 platform eliminate the need to manually select, provision, translate, and track MVLANS. These more elegant E-NID management capabilities can significantly reduce operational expenditures.

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