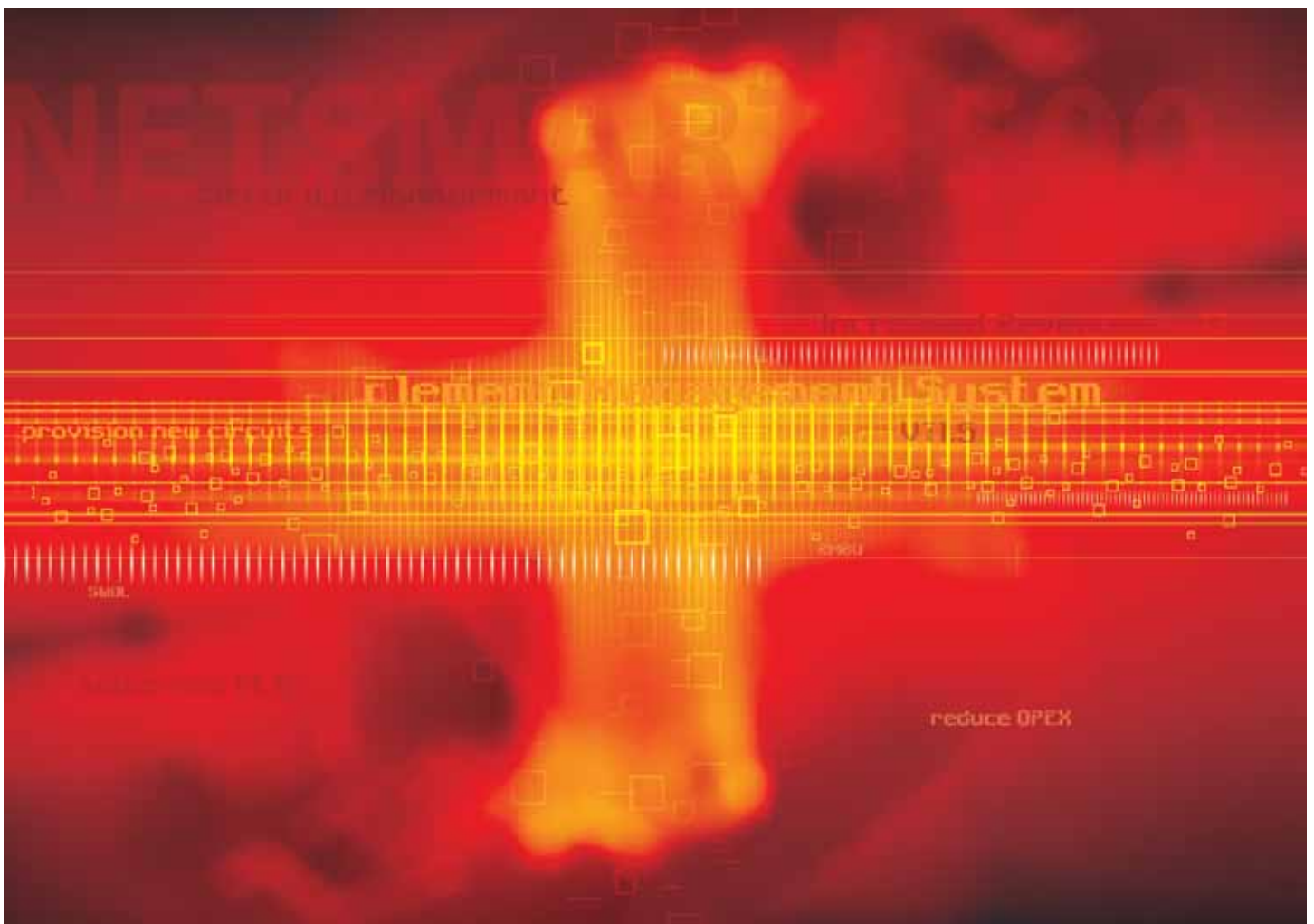# Optimizing Networks with Money Saving Features of the NETSMART® 1500 Network Management System

Introduction
In today's competitive marketplace, carriers are even more focused on reducing their OPEX, keeping CAPEX down and optimizing their network productivity. Addressing potential inefficiencies that can arise from managing large, complex networks has become an opportunity to substantially improve a carrier's financial health. Those carriers willing to seize this opportunity need a tool that enables more efficient network operation. Fujitsu provides this tool in the form of its powerful and scalable NETSMART® 1500 NMS.

The NETSMART 1500 NMS software centralizes the management of all Fujitsu SONET and DWDM transport solutions. The software empowers carriers to reduce their network operating expenses by reducing the time and complexity associated with day-to-day maintenance procedures. These maintenance procedures, such as loading new software into SONET or DWDM NEs, can be labor-intensive and therefore costly and potentially prone to human error. The NETSMART 1500 NMS software supports the transition from a distributed network model, where each central office performs its own maintenance and provisioning, to a centralized network model, where significant cost savings and service quality improvements can be realized.

A recent study by Fujitsu revealed that substantial OPEX reductions are easily realized by using NETSMART 1500 software for typical tasks such as:
  • Provisioning new circuits and connections
  • Downloading software and backing up NE database
  • Managing NE security
  • Implementing PCNs
  • Retrieval of performance monitoring data from NEs

By centralizing many typical maintenance and operational functions, Fujitsu demonstrates that operational expenses can be reduced while significantly increasing network survivability and security. Each carrier, and sometimes each individual network, operates differently, providing unique opportunities to improve efficiency. Yet, these functions are fairly common to all networks and can be quantified in a standard way to begin understanding how a management system can help reduce costs.

All carriers, despite unique network configurations, can optimize many operational functions. An unquantifiable aspect of network management also exists—persistent surveillance of the network and real-time information about the status of network bandwidth and performance. When combined, the savings and enhanced reliability of network operations using NETSMART 1500 software are tremendous.

Provisioning New Circuits and Connections
Today's focus is on building networks as demand dictates, optimizing the existing infrastructure and minimizing the operational cost associated with managing that infrastructure. Optical networks need constant routine maintenance and provisioning. Those carriers with no centralized provisioning capability will be challenged by inefficient, labor-intensive work processes to complete each task.

For your convenience, a list of acronyms can be found at the end of this document.

For example, circuit provisioning can occur several times a day and will often require a time-consuming, manual search of outdated paper records, databases or both to help find possible network resources or available network capacity. Once the available network capacity has been found, craft personnel from multiple offices must make provisioning updates to several NEs to complete a single circuit.

A telecommunications network exists to generate revenue. The only way to generate revenue is to create the circuits that will carry traffic. While this statement is simple and obvious, the fact is that a large amount of time and money is spent on planning, creating, maintaining and ultimately removing these circuits. Myriad tools have been developed to manage circuit creation, ranging from simple homegrown databases and spreadsheets to complex mainframe-based applications. The vast majority of these tools tend to lag behind new network technologies, often lacking the ability to manage, activate, and troubleshoot the circuits, and frequently creating routes based on outdated or manually entered inventory information. An effective management system holds current information and is able to engineer the route and activate, organize, track, and manage the circuit—and still be robust enough to respond to new technologies and topologies.

NETSMART 1500 NMS contains an ACM component designed with the aforementioned requirements in mind. The process of circuit creation involves finding a route between the two endpoints, confirming available bandwidth and then determining cross-connect requirements based on SONET protection. Additionally, the circuit must be designed to preserve as much network bandwidth as possible for future services. NETSMART 1500 software was designed to handle all of these considerations in a matter of seconds. The only input required from the user is the endpoints (A and Z points), the circuit bandwidth (e.g., VT1.5, STS-1, STS-3c, etc.) and the type or degree of protection (unprotected, protected, highly protected, preemptable). ACM then calculates the path, determines the cross-connects and presents this information to the user in a graphical display. Once the user inputs circuit notations, such as customer name and contact information, the circuit is ready to be implemented. No limitation exists on the number of rings traversed or the type of protection used (e.g., BLSR, UPSR, 1+1, 0:2), and the user is allowed to reroute the circuit if specific elements and time slots are desired. ACM also attempts to preserve high-order time slots (e.g., STS-3c, etc.) when creating paths and allows circuits to terminate on different interface types (e.g., DS1 ➤ DS3) to accommodate circuit handoff to a DCS or to another carrier.

NETSMART 1500 ACM software can activate the circuit immediately after the circuit is designed or maintain it in a pending state for later activation. If a circuit is maintained in this pending state, the time slots are reserved and other users are unable to enter cross-connects or create circuits that use these same time slots. Activating the circuit is a matter of a single click followed by confirmation that the circuit was activated and all cross-connects were entered. Any problems with activation are indicated for easy troubleshooting. All the activities performed on a circuit are tracked by the specific change made, the time and date, and the NETSMART 1500 user who made the change.

NETSMART 1500 NMS provides an interface designed to logically group circuits in a customizable tree view for circuit management and troubleshooting. ACM also includes a powerful search tool to locate circuits by any of the circuit attributes such as customer name, circuit name, contact name, etc. If a customer calls, the circuit details are available to the technician on demand as well as the circuit status and alarm state. Performance monitoring, configuration management and cross-connect management are all a single click away from any circuit view. The alarm to affected circuit report is another powerful troubleshooting tool. If an alarm is indicated on the GUI links, the user can immediately get a list of affected circuits to better gauge the impact of a problem. ACM can also import existing circuits and the associated data so these connections can be managed as well.

For simple connections involving only a few nodes, a technician located at a central office with visibility to each node can log on to each node and enter the cross-connections in about an hour. This scenario assumes that no travel time is required, the circuit path calculations are correct and the existing circuit data is accurate. By comparison, a technician in a NOC equipped with NETSMART 1500 NMS can set up an entire circuit in less than eight minutes no matter how complicated the path or the number of affected nodes. Additionally, NETSMART 1500 NMS maintains constant visibility to all network circuits so its data is never old or inaccurate. Not counting the data retrieval or design time associated with a manual circuit entry, an 800% time savings is realized using ACM.
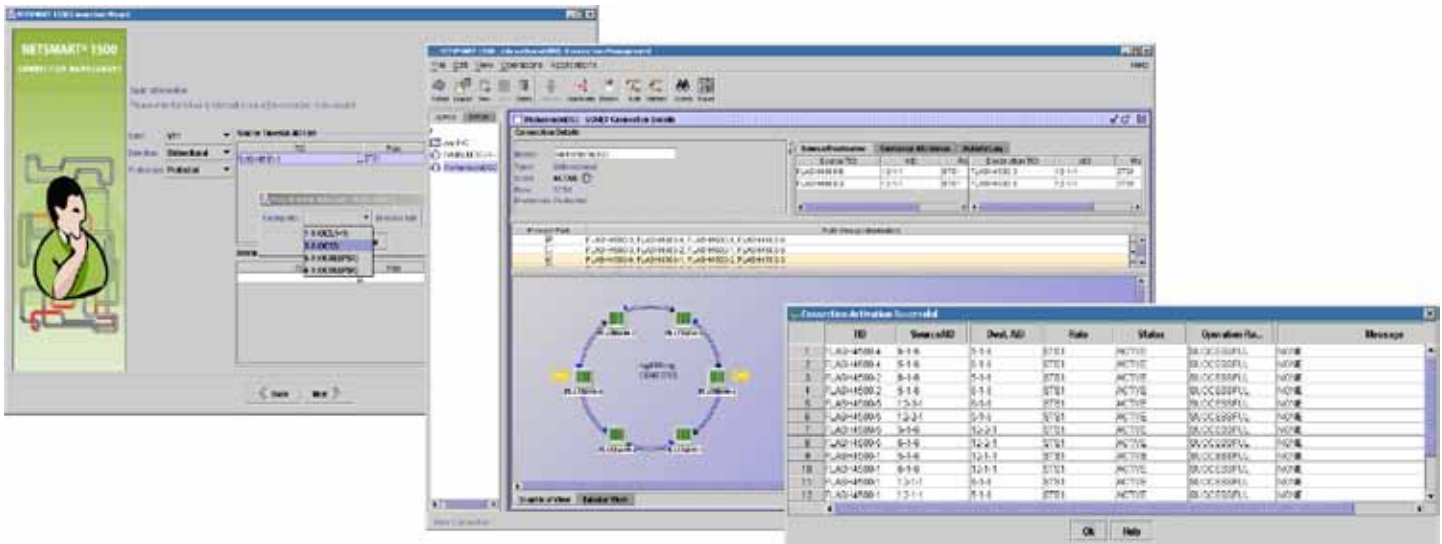

Figure 1: NETSMART 1500 ACM

Software Download and NE Database Backup

On the system maintenance side, the process can be even more cumbersome than allocating system resources. Identifying and locating individual network components that require an upgrade is a tedious and time-consuming process. In some cases, the time and expense involved is so large that maintenance is delayed or bypassed completely, which negatively affects the overall performance, capacity and security of the network. In the end, the carrier is forced to decide between risking the health of the network by ignoring system maintenance, or spending an inordinate amount of time and money to determine whether the network requires upgrading.

Downloading New Software Loads to Network Elements

Managing software loads for an entire network with a decentralized management structure is at best, challenging, and at worst, totally unfeasible. Most carriers strive to maintain their networks on the latest releases so that new NE features can be implemented quickly and new service revenue can be realized. Unfortunately, the complexity of managing the software loads quickly erodes the benefits.

The prospect of upgrading NE software loads within an optical network is usually met with a universal groan from maintenance personnel. This fact is especially true as the size of the network and the corresponding distance between NEs increases. Many times, the customer is forced to upgrade the network using a discrete approach to software download via craft tool or some other simple application. NETSMART 1500 software provides powerful tools for organizing, scheduling and performing software downloads. The user loads new software for NEs into the NETSMART 1500 server. Any user can then install the software on one node at a time or typically create a list of elements to receive the new software. Creating NE lists is a simple task as NETSMART 1500 software provides powerful database search tools that can sort elements based on product type, current software release, TID, etc. Once the list is created, the SWDL session can be executed immediately or scheduled via Task Manager for a later date.

The final and most powerful component of the software download process is RIPL, an advanced software algorithm developed by Fujitsu. RIPL analyzes the optical network, determines the most efficient means to distribute element software loads selected by the user and then manages the process. The RIPL algorithm first identifies the appropriate data connection and file transfer protocols (e.g., IP and FTP) and then initiates a file transfer to the gateway NEs to begin seeding the network. As the gateway nodes begin their internal file transfers, the RIPL algorithm initiates another file transfer, but this time from each gateway NE to each of the subtending nodes. This process continues in parallel until all the NEs have the new software and have fully processed the files. This high degree of parallel activity allows NETSMART 1500 software to dramatically accelerate the rate at which the software is distributed—with minimal input from the user.

The savings realized by using NETSMART 1500 NMS instead of a manual method is dramatic. A typical SWDL can take up to two hours per NE using a craft software tool at the local central office. NETSMART 1500 NMS can complete the same task on multiple NEs with just a few minutes of preparation time. Fujitsu studies show that, on average, most tasks on NETSMART 1500 software can be completed up to 500 times faster than with manual methods. This statistic translates into lower costs, as well as the deployment of new software in a single maintenance window rather than across weeks or even months.
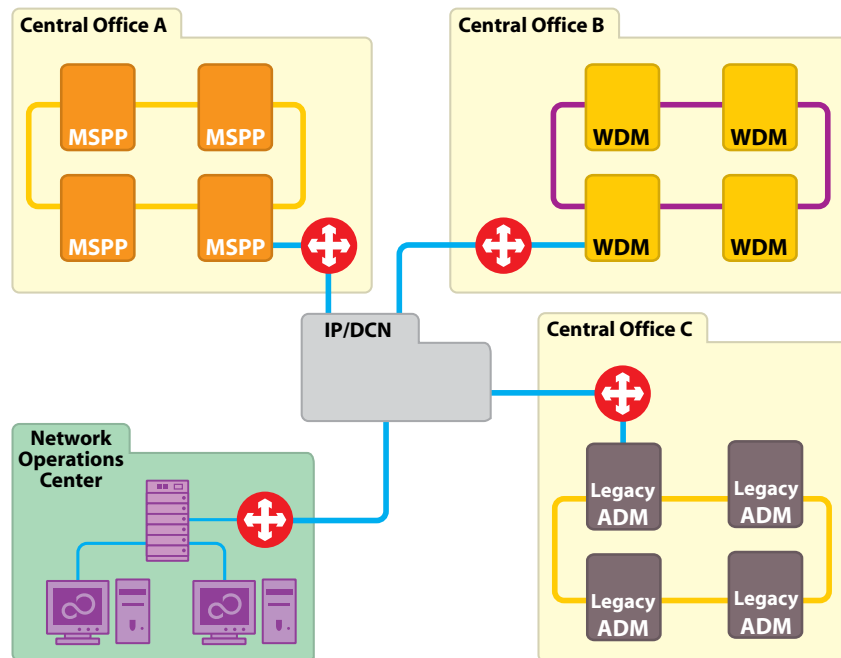
Figure 2: Software Distribution Using RIPL

Remote Memory Backup of NE Database

Certain facts of running a network are that outages and disasters will occur. Customers ultimately judge carriers by their ability to minimize risk and respond quickly when outages occur. Additionally, carriers need the ability to efficiently capture and restore an image of all provisioning data for each NE should a disaster strike due to flood, fire, vehicular accident or user error.

Recent events have heightened the need for a reliable system for restoring NEs after a disaster. Each Fujitsu NE has the ability to provide a digital snapshot of its provisioning database, called RMBU. Sadly, most carriers cannot afford the tremendous time and effort required for field technicians to perform manual NE backups on a regular basis. Even for relatively small networks, technicians in geographically distributed offices must log onto each NE and request a memory backup. Once complete, the files must be stored, preferably off site, in case the entire central office is affected by a disaster.

NETSMART 1500 NMS makes RMBU fast, inexpensive and easy—whether the network consists of 8 or 8,000 nodes. The process is simple: build a list of NEs, schedule the task and let NETSMART 1500 software do the rest. NETSMART 1500 software will automatically backup the database and store it in the software repository according to TID of the NE. NETSMART 1500 servers can be equipped with a tape backup system offering a third level of protection for the NE provisioning data. Also, the database files can be automatically exported to another system via FTP. This benefits disaster recovery efforts when restoring networks since database files are stored in an alternate location. The cost for NETSMART 1500 software to perform automated backup is less than 17¢ per month per NE.
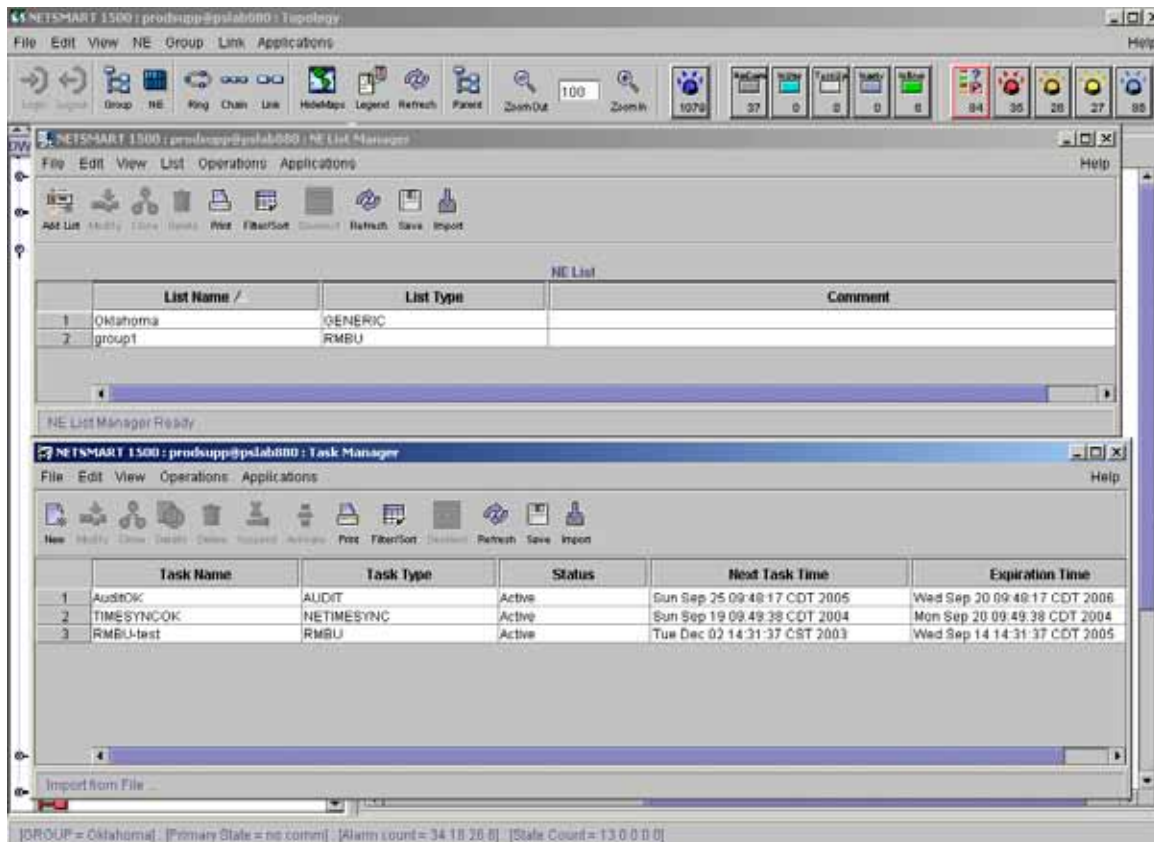
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Figure 3: Scheduling RMBU Using Task Manager

NETSMART 1500 software also performs RMR when necessary. RMR sends the stored database to the NE and then activates it. This process is much the same as SWDL except, instead of selecting a software load, the user selects a database file from the software repository. This process is a quick, simple, and accurate way to rebuild the NE database and restore service to the end customer. Fortunately, element restoration is not required very often. However, since NETSMART 1500 software keeps an automated backup, restoration can be performed in an hour or less. Compared with the research and manual provisioning required without NETSMART 1500 software, restoration could take one or more days to complete. Using NETSMART 1500 software translates into significantly lower restoration times and greater customer satisfaction.

Network Element Security Management
Along with database backups, another important factor in maintaining network integrity and survivability is access security. For the optical network, making a network secure means managing NE user accounts. Unauthorized user accounts present dangerous and potentially devastating backdoor access points to the network, which can be used by ill-meaning or unknowing individuals to bring down networks. As the network grows, creating, deleting, auditing, and reconciling the numerous UIDs and PIDs for every element in the network can be extremely time consuming.

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NETSMART 1500 NMS gives network security administrators the ability to consistently audit the entire network to discover and delete unauthorized user accounts. Administrators create typical accounts for the NEs including those used for craft personnel, managers, other users and/or NETSMART 1500 access. The user can apply the new UID and PID information to the element in addition to the existing information or delete all user accounts and replace them with only the profile information. Additionally, individual accounts can be searched out and changed or eliminated.

Issues of work stoppages, employee turnover, new employee additions and regular updates to individual user passwords can all be addressed using this component of the NETSMART 1500 software. Performing this operation with craft software at each central office would be extremely time consuming. This expense also restricts how often passwords can be updated—certainly not monthly. Also, craft tools do not have the capability to automatically audit the accounts within an NE. The craft user must clear all backdoor passwords from the elements to ensure compliance with security standards.

Research shows that when factoring in the cost of truck rolls, carriers will spend approximately $57 per NE each time a password change is required. By utilizing the NE User Security Manager feature in the NETSMART 1500 software, a user can audit and update the NE accounts for less than 35¢ per element for an astounding 16,000% reduction in operating expenses. NETSMART 1500 software increases the security of your network and frees internal resources to pursue other revenue-producing projects.
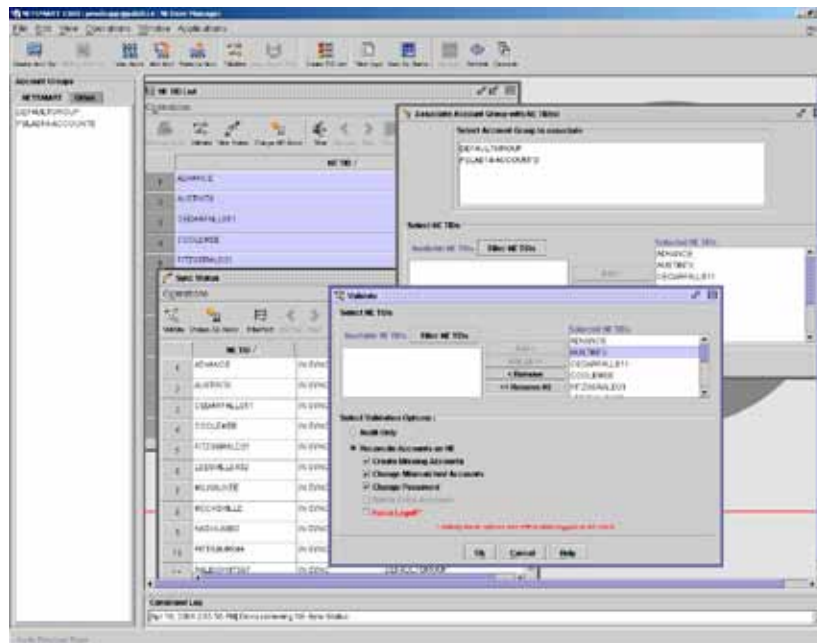

Figure 4: NE Security Manager User Interface

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Automated PCN Management

Operating a modern telecommunications network requires periodic hardware updates, upgrades and replacements. Fujitsu, like other equipment manufacturers, notifies customers of product changes with a PCN document. Some of the critical changes are done with updated software, but many require changing hardware. For networks without centralized visibility to the network, a manual search is required to find the affected hardware. This search can be done by logging onto nodes at local central offices or by searching through paper records, assuming they are accurate.

NETSMART 1500 NMS comes equipped with an Automated PCN Manager as well as electronic versions of all PCNs. The Automated PCN Manager can quickly provide the user with a report listing all the NEs affected by a PCN, along with the number of cards per element and the AID and CLEI of each card. Intelligent and customizable filtering capabilities allow the user to quickly sort through and prioritize report data according to criteria such as new/old CLEI, major system affected, PCN date and reason for change. Reports can also be exported to other applications using a variety of common formats (e.g., Microsoft® Excel®, Adobe® Acrobat®, plain text, comma-separated value). PCNs can be scheduled to download automatically directly from our partners' Web GUI. Now an orderly process of unit replacement can begin with the proper number of replacement units and no wasted trips to remote offices.

Research indicates that carriers can reduce the operating expense associated with identifying product changes by a factor of almost 30 through the use of the Automated PCN Manager. The Automated PCN Manager is incredibly valuable as a proactive tool and is also very helpful in the troubleshooting process. Users can narrow a PCN search to a group of NEs that may be experiencing problems, saving hours or days of troubleshooting time.
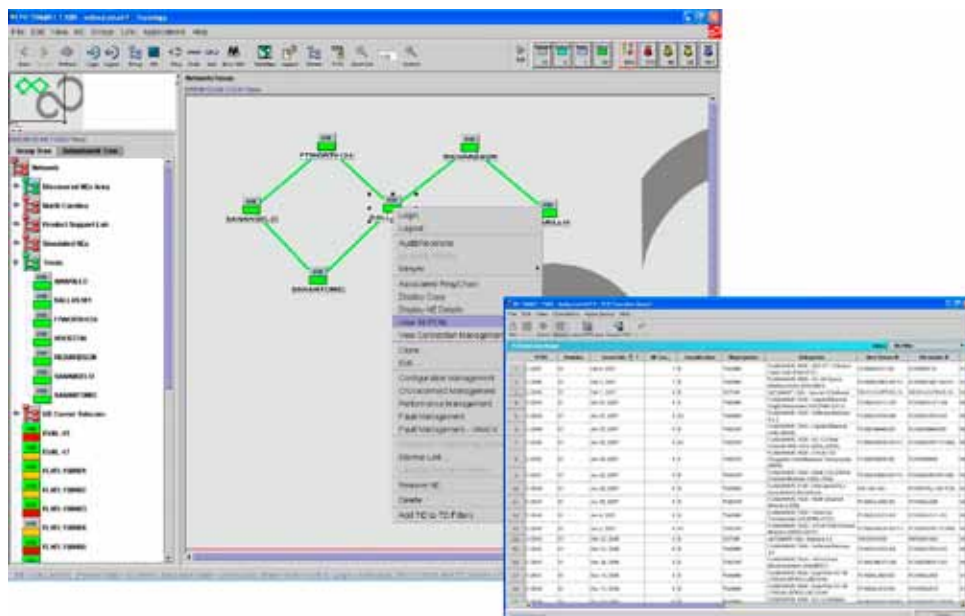

Figure 5: Results of a PCN Search with NE Details

Retrieving Performance Monitoring Data

From time to time, circuits can experience lost data, erratic performance or intermittent failures. These problems are frustrating to troubleshoot and can be extremely time consuming without management tools to process information. Each Fujitsu NE observes and records anomalies in circuit traffic as it passes through the node. This information is stored in performance monitoring registers within each element and can be invaluable in troubleshooting circuit problems. Logging into each affected node daily to retrieve data is time consuming enough without then having to sort and analyze the data.

Fortunately, NETSMART 1500 NMS comes equipped with PM data retrieval and analysis tools to assist users with this process. Since the NETSMART 1500 software is centrally located and connected simultaneously to all NEs, the NMS has the greatest visibility to PM data. The software includes tools to speed analysis of the element's data and graphical functions to display the data in a meaningful way. NETSMART 1500 software is also configured to display the information with a single time base. Displaying this information seems like a small issue until sorting through information from different nodes that are not set to the same day or time.

As an example of cost savings, an experienced technician can log onto an NE and retrieve PM data (the NE stores 24 hours of data) in less than 30 minutes. This process is easy if only one or two elements need analysis and if the errors have occurred in the last 24 hours, but this example is seldom the case. Compare this process to the less than 15 seconds per NE required to configure NETSMART 1500 NMS to automatically perform this task as often as necessary. Additionally, NETSMART 1500 software keeps historically consecutive files of months' or years' worth of performance data. The software also has sophisticated tools for data analysis and automated backup of performance data.
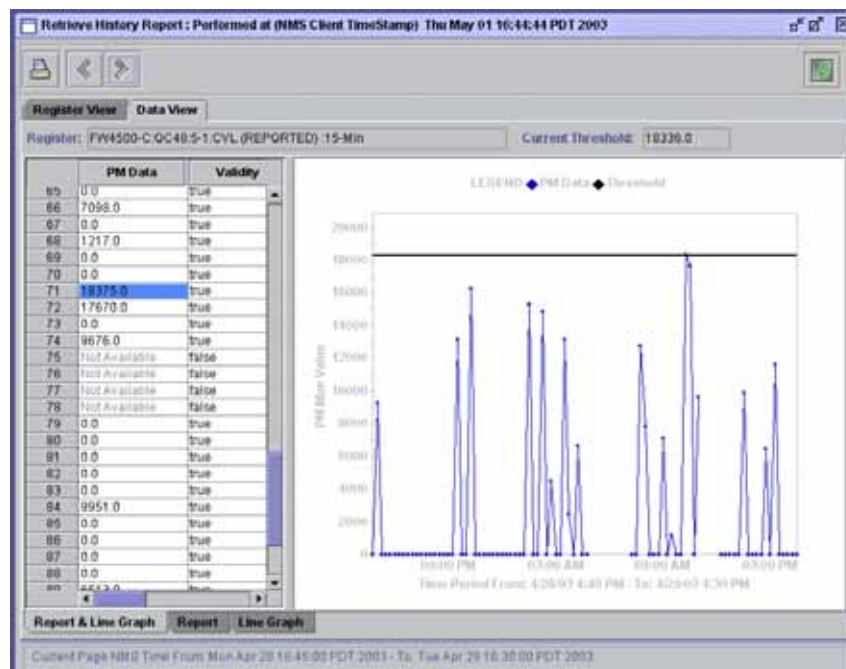

Figure 6: Performance Data in Tabular and Graphical Formats

Additional NETSMART 1500 Features

NETSMART 1500 software offers many additional features that contribute to reducing costs and improving network reliability:

- **Network Surveillance** – 24 x 7 x 365 network visibility for quicker response to outages or performance degradations
- **Network Partitioning** – Create custom layer views by subdividing systems into smaller domains and assign user roles to limit or constrain visibility
- **Identify Stranded Network Capacity** – Find circuits that have been disconnected by customers but only partially deactivated in the network
- **Current Information to Aid System Design and Engineering** – Improves accuracy of planning, design and budgeting of new networks or bandwidth expansions
- **Link to Higher-Level Operations Systems** – NETSMART 1500 software can interface with third-party network, inventory or services management systems
- **Secure Access to System Information** – Network information stored in the NETSMART 1500 software is user-password protected
- **Accurate and Rapid Equipment Inventory Reports** – Quickly identify any units affected by PCNs for fast and efficient replacement
- **Centralized Provisioning of NEs** – Establish consistent provisioning of all elements in a network
- **Protected Server Hardware** – Use the high-availability software module to enable working and protected servers
- **Secure Web Interface** – View system performance, alarm activity and download NETSMART 1500 client software from a secure Web site

Conclusion

Since expenses for operating complex optical networks must be reduced, carriers are looking for advanced and integrated software tools to make the management of the network more cost-effective. When network maintenance is performed regularly and more rapidly, network reliability is improved. NETSMART 1500 NMS software from Fujitsu offers enhanced network reliability while reducing operations costs. Day-to-day tasks can be automated, and advanced graphical interfaces reduce operator errors and speed delivery of revenue-generating services to customers. Network maintenance time is reduced through powerful network information search utilities and data analysis tools.

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Acronym	Descriptor
ACM	Automatic Connection Management
AID	Access Identifier
CAPEX	Capital Expense
CLEI	Common Language Equipment Identifier
DCS	Digital Cross-connect System
DWDM	Dense Wavelength Division Multiplexing
FTP	File Transfer Protocol
GUI	Graphical User Interface
IP	Internet Protocol
NE	Network Element
NMS	Network Management System
NOC	Network Operations Center
OPEX	Operating Expense
PCN	Product Change Notice
PID	Password Identifier
PM	Performance Monitoring
RIPL	Remote Intelligent Parallel Loading
RMBU	Remote Memory Backup
RMR	Remote Memory Restoration
SONET	Synchronous Optical Network
SWDL	Software Download
TID	Target Identifier
UID	User Identifier