C H A P T E R **11**

Alarm Monitoring and Management

This chapter explains how to manage alarms with Cisco Transport Controller (CTC), which includes:

To troubleshoot specific alarms, refer to the *Cisco ONS 15600 SDH Troubleshooting Guide*.

11.1 Overview

CTC detects and reports SDH alarms generated by the Cisco ONS 15600 SDH and the larger SDH network. You can use CTC to monitor and manage alarms at the card, node, or network level. Default alarm severities conform to the ITU-T G.733 standard, but 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 to the *Cisco ONS 15600 SDH Troubleshooting Guide "Alarm Troubleshooting" chapter.*

Note ONS 15600 SDH alarms can also be monitored and managed through TL1 or a network management system (NMS).

11.2 Alarms, Conditions, and History

In the card, node, or network level CTC view, click the Alarms tab to display the alarms for that card, node or network. The Alarms window shows alarms in conformance to ITU-T G.733. 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.)

11.2 Alarms, Conditions, and History

Table 11-1 describes in the information in the Alarms window.

Table 11-1   Alarms Column Descriptions

Column	Information Recorded
Num	Quantity of alarm messages received; incremented automatically as alarms occur to display the current total of received error messages
Ref	A unique identification number assigned to each alarm to reference a specific alarm message that is displayed
New	Indicates a new alarm if checked[1]
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 access identifier (AID) for the alarmed object
Eqpt Type	Card type in this slot
Shelf	The shelf where the alarmed object is located. Visible in network view.
Slot	Slot where the alarm occurred (appears in the network view and node view)
Port	Port where the alarm occurred
Path Width	Indicates how many STSs are contained in the alarmed path. This information complements the alarm object notation, which is explained in the "Alarm Troubleshooting" chapter of the *Cisco ONS 15600 SDH Troubleshooting Guide*.
Sev	Severity level: Critical (CR), Major (MJ), Minor (MN), Not Alarmed (NA), Not Reported (NR)
ST	Status: Raised (R), Clear (C), Transient (T)
SA	When checked, indicates a service-affecting alarm
Cond	Error message/alarm name; alphabetically defined in the *Cisco ONS 15600 SDH Troubleshooting Guide*
Description	Description of the alarm

1. The user can click the Synchronize button to acknowledge the new alarm. Clicking the Delete Cleared Alarms button only deletes cleared alarms on the window.

Cisco ONS 15600 SDH Reference Manual, Releases 9.1 and 9.2.1

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Figure 11-1 shows the CTC node view Alarms window.

Figure 11-1   Viewing Alarms in CTC Node View
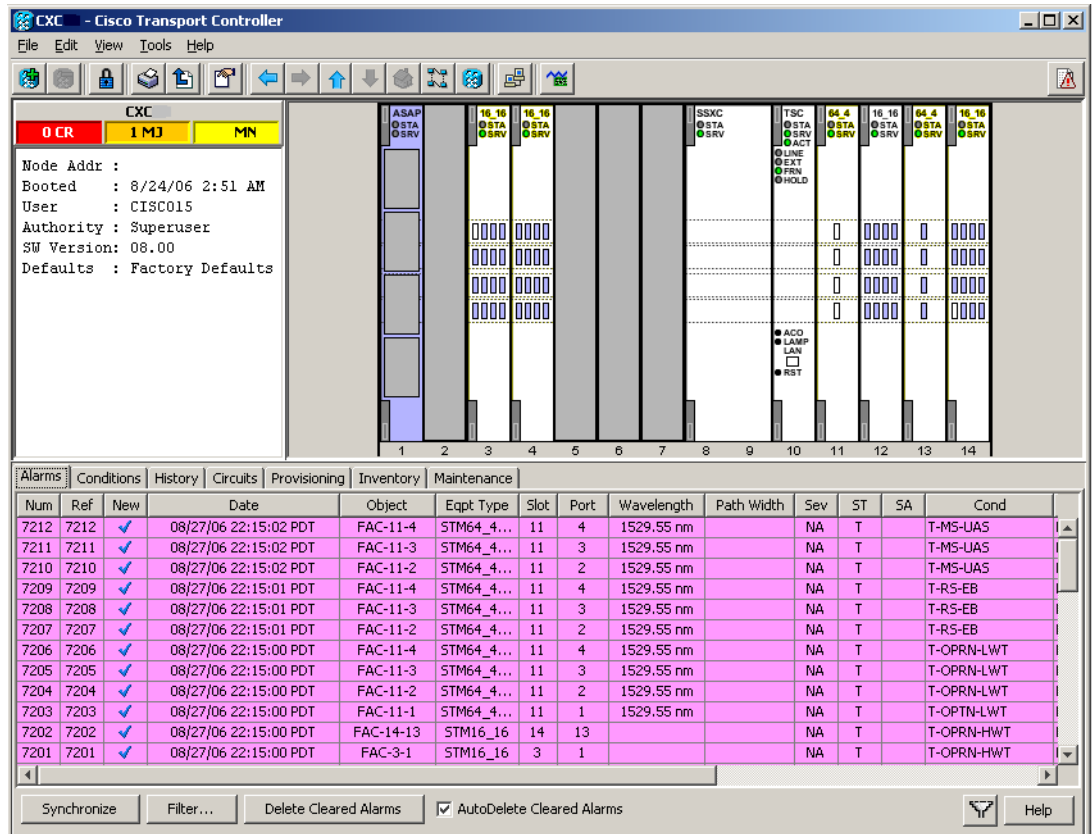
Alarms and conditions appear in one of five background colors, listed in Table 11-2, to communicate severity.

Table 11-2   Color Codes for Alarms and Conditions

Color	Description
Red	Critical alarm
Orange	Major alarm
Yellow	Minor alarm
Magenta (pink)	Event (NA)
Blue	Condition (NR)
White	Cleared alarm or event (C)

> **Note** Major and Minor alarms might appear yellow in CTC under certain circumstances. This is not due to a CTC problem but to a workstation memory and color utilization problem. For example, a workstation might run out of colors if many color-intensive applications are running. When using Netscape, you can limit the number of colors used by launching it from the command line with either the -install option or the -ncols 32 option.

Software Releases 7.0 and later have TL1 port-based alarm numbering that identifies an alarmed virtual container (VC) by its VC on a port rather than the VC on the optical card. The numbering is present in the VC alarm TL1 AID. The numbering scheme is described in Table 11-3.

Table 11-3   TL1 Port-Based Alarm Numbering Scheme

MON Object (Optical)	Syntax and Examples
STM1/4/16/64 VC	Syntax: VC-<Slot>-<Pim>-<Ppm>-<Port>-<STS> Ranges: VC-{1-4,11-14}-{1-4}-{1-4}-{1-n^1}-{1-n^2} Example: VC-1-1-1-1-6

1. Port number range varies by card type with a maximum of four.
2. Maximum VC number depends on the rate and size of the VC.

11.2.1 Alarm Window

Table 11-4 shows the actions you can perform in the Alarms window.

Table 11-4   Alarm Window

Button	Action
Filter	Allows you to change the display on 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 appear on the window. If you enable the Filter feature by clicking the Filter icon button in one CTC view, such as node view, it is enabled in the others as well (card view and network view).
Synchronize	Updates the alarm display. Although CTC displays alarms in real time, the Synchronize button verifies that CTC and the ONS 15600 SDH agree on current alarms. This is particularly useful during provisioning or troubleshooting.
Delete Cleared Alarms	Deletes alarms that have been cleared.
AutoDelete Cleared Alarms	If checked, CTC automatically deletes cleared alarms.

11.2.2 Alarm-Affected Circuits

You can determine which ONS 15600 SDH circuits are affected by a specific alarm by positioning the cursor over the alarm in the Alarm window and right-clicking. A shortcut menu appears (Figure 11-2).

Figure 11-2 Select the Affected Circuits Option for an Alarm
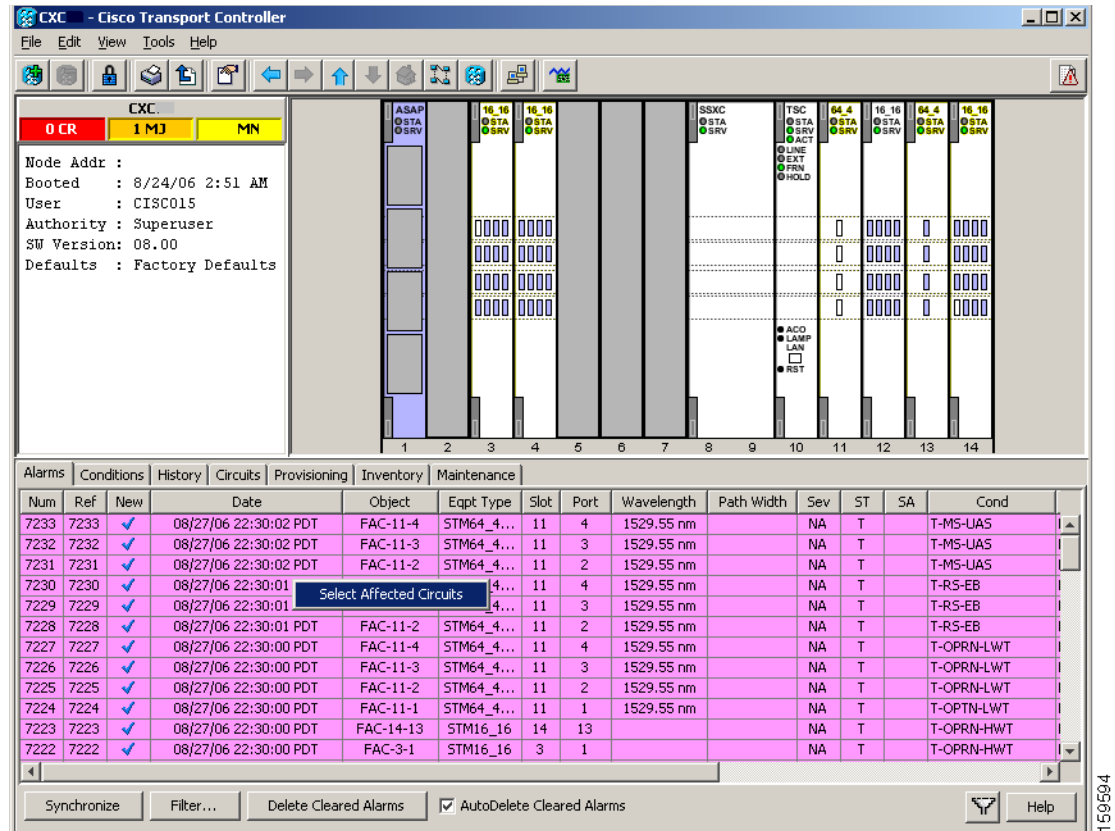
When the user selects the Select Affected Circuits option, the Circuits window opens to show the circuits that are affected by the alarm.

11.2.3 Conditions Window

The Conditions window displays retrieved fault conditions. A condition is a fault or status detected by ONS 15600 SDH hardware or software. When a condition occurs and continues for a minimum period, CTC raises a condition, which is a flag showing that this particular condition currently exists on the ONS 15600 SDH.

The Conditions window shows all conditions that occur, including those that are superseded by alarms. 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. Having all conditions visible can be helpful when troubleshooting the ONS 15600 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.

Fault conditions include reported alarms and Not Reported or Not Alarmed conditions. Refer to the trouble notifications information in the *Cisco ONS 15600 SDH Troubleshooting Guide* "Alarm Troubleshooting" chapter for more information about alarm and condition classifications.

11.2.4 Conditions Window Actions

Table 11-5 shows the actions you can perform in the Conditions window.

Table 11-5   Conditions Display

Button	Action
Retrieve	Retrieves the current set of all existing fault conditions, as maintained by the alarm manager, from the ONS 15600 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 icon button in the lower-right corner of the window that allows you to enable or disable the filter feature.

The current set of all existing conditions maintained by the alarm manager appears when you click the Retrieve button. The set of conditions retrieved is relative to the view. For example, if you click the button in the node view, node-specific conditions appear (Figure 11-3). If you click the Retrieve button in the network view, all conditions for the network (including ONS 15600 SDH nodes and other connected nodes such as ONS 15454 SDHs) appear, and the card view shows only card-specific conditions.

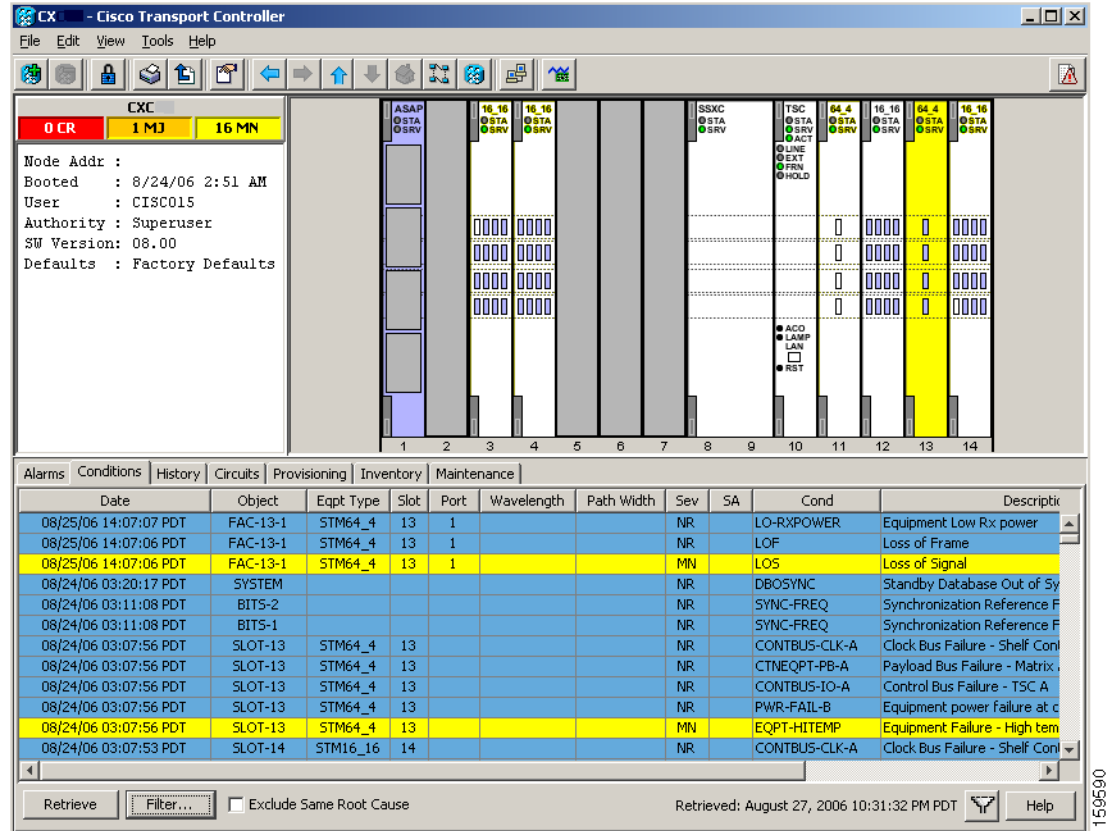*Figure 11-3* *Viewing Conditions in the Conditions Window*

Table 11-6 lists the Conditions window column headings and the information recorded in each column.

Table 11-6 *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 alarmed object
Eqpt Type	Card type in this slot (only displayed in the network view and node view)
Shelf	The shelf where the alarmed object is located. Visible in network view.
Slot	Slot where the condition occurred (only displayed in the network view and node view)
Port	Port where the condition occurred
Path Width	Width of the data path
Sev	Severity level: CR, MJ, MN, NA, NR
SA	When checked, indicates a service-affecting alarm
Cond	Condition name; alphabetically listed and defined in the "Alarm Troubleshooting" chapter of the *Cisco ONS 15600 SDH Troubleshooting Guide*
Description	Description of the condition

11.2.5 History Window

The History window displays historical alarm data. It also displays conditions, which are Not Alarmed activities such as timing changes and threshold crossings. For example, protection-switching events or performance-monitoring threshold crossings appear here. The ONS 15600 SDH can store up to 3,000 total alarms and conditions: 750 Critical alarms, 750 Major alarms, 750 Minor alarms, and 750 conditions. When the limit is reached, the ONS 15600 SDH begins replacing the oldest items. The History window presents several alarm history views:

- The History > Session window appears in network view, node view, and card view (Figure 11-4). It shows alarms and conditions that have occurred during the current user CTC session.

- The History > Shelf window appears only in node view. It shows the alarms and conditions that have occurred on the node since CTC software was originally activated for that node.

- The History > Card window appears only in the card view. It shows the alarms and conditions that have occurred on the card since CTC software was installed on the node.

Note In the Preference dialog box General tab, the Maximum History Entries value applies to only the Session window.

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.
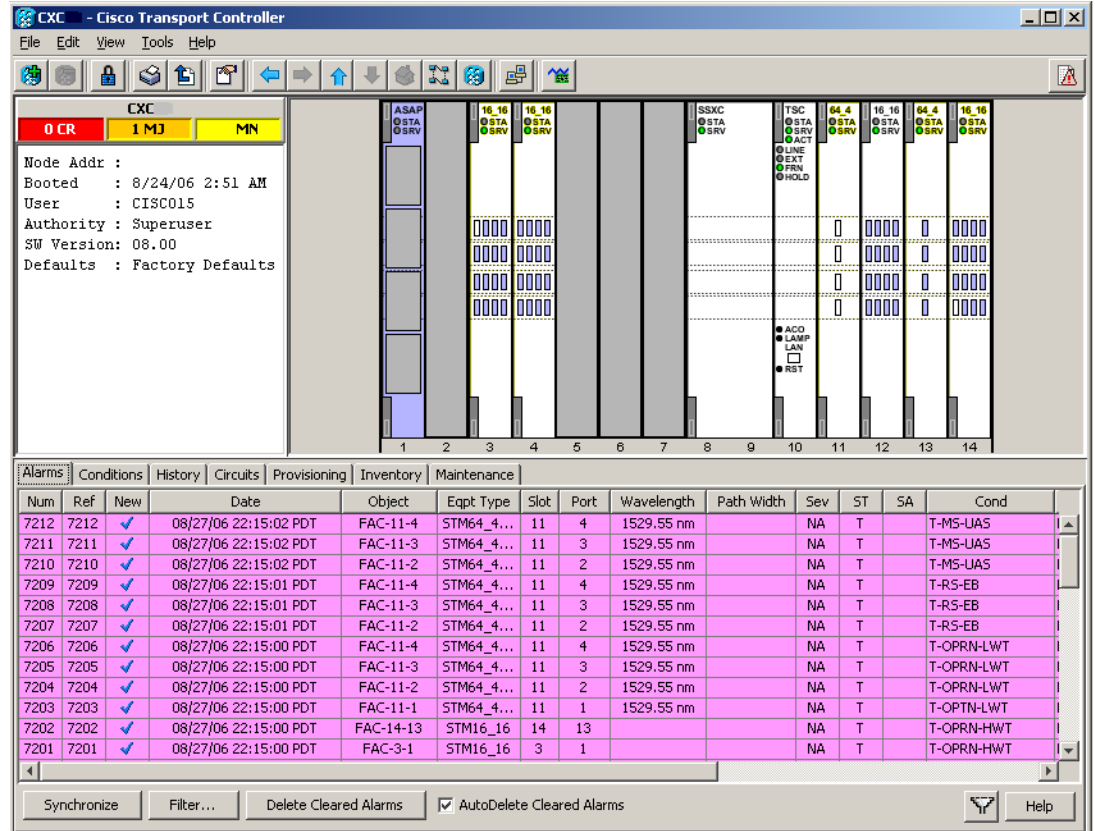
Figure 11-4   Viewing All Alarms Reported for a Node

Table 11-7 describes the information in the History window.

Table 11-7   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 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
Eqpt Type	Card type in this slot (only displays in network view and node view)
Shelf	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
Path Width	Width of the data path
Sev	Severity level: CR, MJ, MN, NA, NR

Table 11-7   History Column Description (continued)

Column	Information Recorded
SA	When checked, indicates a service-affecting alarm
ST	Status: R (raised), C (cleared), T (transient)
Description	Description of the condition
Cond	Condition name

11.2.6 Alarm History Actions

You can retrieve and view the history of alarms and conditions, as well as Transient conditions (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). For more information about Transient conditions, refer to the "Transient Conditions" chapter in the *Cisco ONS 15600 SDH Troubleshooting Guide*.

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. When 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.

11.3 Alarm Profiles

The alarm profiles feature allows you to change default alarm severities by creating unique alarm profiles for individual ONS 15600 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 network element (NE), and cannot be edited. The reserved Default profile contains ITU-T G.733 severities. 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 have been stored as files from elsewhere in the network onto the local PC or server hard drive where CTC resides, you can utilize 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.

11.3.1 Alarm Profile Window

Alarm profiles are created in the network view using the Provisioning > Alarm Profiles tab. A default alarm profile (in the Default column) is preprovisioned for every alarm. After loading the default profile on the node, you can use the Clone feature to create new profiles based on the default alarm profile. After the new profile is created, the Alarm Profiles window shows the default profile and the new profile (Figure 11-5).

Figure 11-5   Node View Alarm Profiles Window Showing the Default Profiles of Listed Alarms
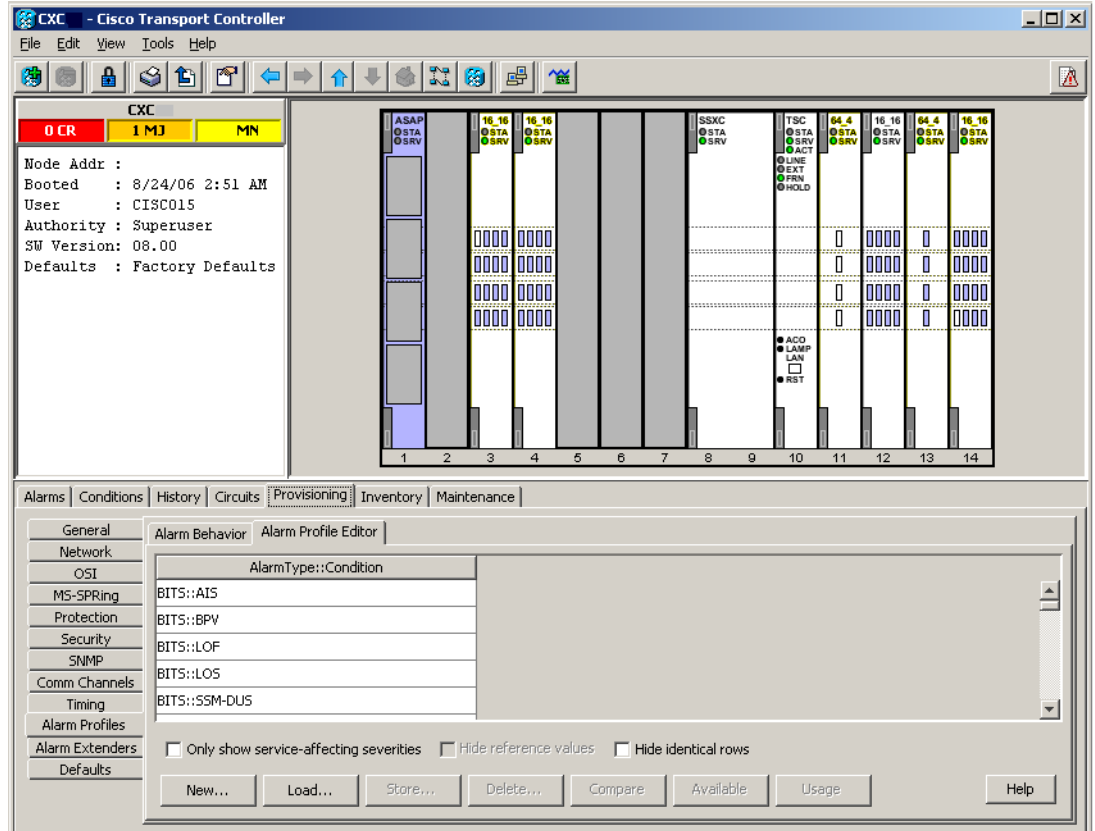
11.3.2 Alarm Profile Buttons

The Alarm Profiles window has six buttons at the bottom. Table 11-8 describes each of the alarm profile buttons.

Table 11-8   Alarm Profile Buttons

Button	Description
New	Adds a new alarm profile.
Load	Loads a profile to a node or a file.
Store	Saves profiles on a node (or nodes) or in a file.
Delete	Deletes profiles from a node.
Compare	Displays differences between alarm profiles (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).

11.3.3 Alarm Profile Editing

Table 11-9 describes the five profile-editing options available when you right-click an alarm item in the profile column (such as Default).

Table 11-9 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 new 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.

11.3.4 Alarm Severity Option

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
- Transient (T)

Transient and Use Default severity levels only appear in alarm profiles. They do not appear when you view alarms, history, or conditions.

11.3.5 Row Display Options

In the network view, the Alarm Profiles window has 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 unavailable. 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.

11.3.6 Alarm Profile Actions

In CTC node view, the Provisioning > Alarm Profiles > Alarm Profile Editor window displays alarm profiles for the node, and in card view this windows displays the alarm profiles for the selected card.

Alarm profiles form a hierarchy. A node-level alarm profile applies to all cards in the node except cards that have their own profiles. A card-level 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-level view, you can apply profile changes on a port-by-port basis for all ports on that card. Figure 11-6 shows an STM-16 card view of an alarm profile.

Figure 11-6   Alarm Profile on an STM-16 Card
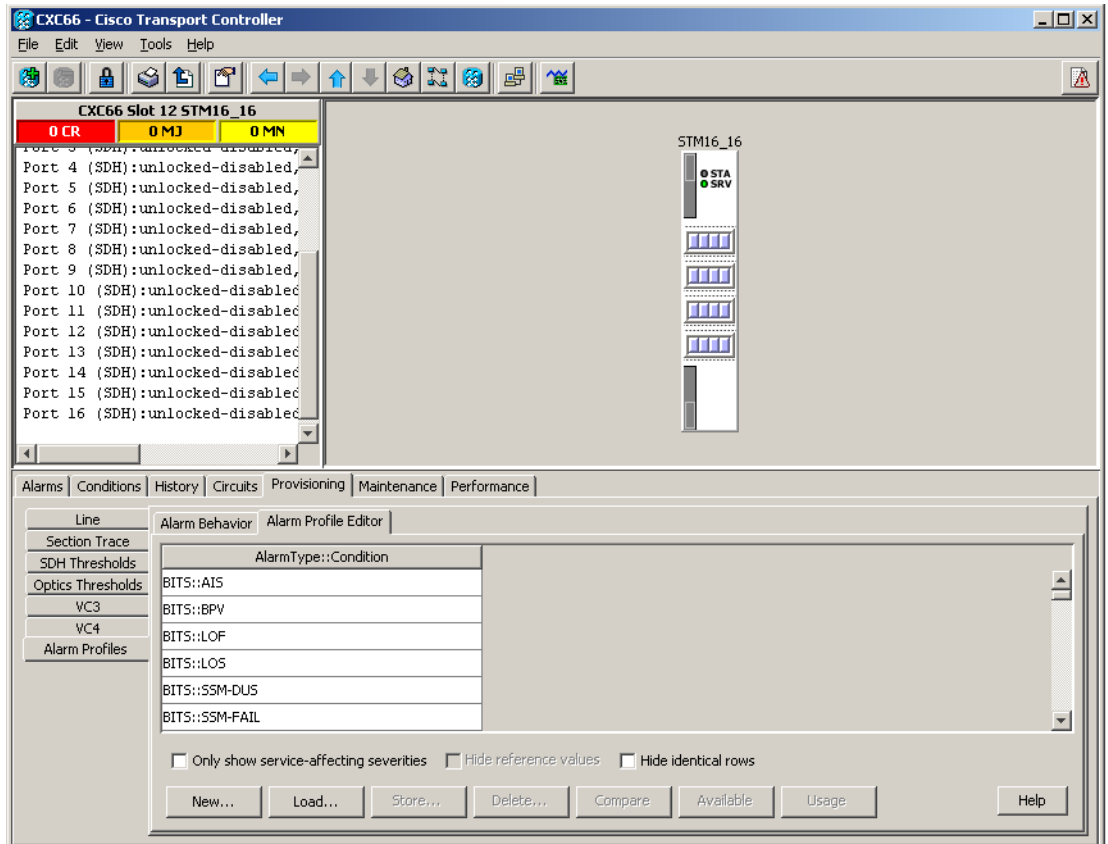
11.4 Alarm Filter

Alarm display can be filtered to keep particular alarm severities, or alarms that occur between certain dates, from appearing in the Alarms window (Figure 11-2 on page 11-5). You can set the parameters of the filter by clicking Filter at the bottom-left of the Alarms window. You can turn the filter on or off by clicking the Filter icon button 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 makes the filter active the next time your user ID is activated.

11.5 Alarm Suppression

The following sections explain alarm suppression features for the ONS 15600 SDH.

11.5.1 Alarms Suppressed for Maintenance

When you place a port in Locked,maintenance administrative state, this raises the alarm suppressed for maintenance (AS-MT) alarm in the Conditions and History windows 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 Unlocked,automaticInService administrative state, the AS-MT alarm is resolved in all three windows. Suppressed alarms remain raised in the Conditions window until they are cleared.

11.5.2 Alarms Suppressed by User Command

In the Provisioning > Alarm Profiles > Alarm Behavior tab, the ONS 15600 SDH has 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 alarm. The AS-CMD alarm, like the AS-MT alarm, appears in the Conditions, and History 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 alarm is cleared from all three windows.

Note AS-MT can be seen in the Alarms window if you set the Filter dialog box to show NA severity events.

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.

Note When an entity is put in the Locked,maintenance administrative state, the ONS 15600 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.ReportLoopbackConditionsOnPortsIn Locked,maintenance to TRUE on the NE Defaults tab.

11.6 External Alarms and Controls

External alarm inputs are used for external sensors such as open doors and flood sensors, temperature sensors, and other environmental conditions. External control outputs 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.

You provision external alarms and controls in the node view Maintenance > Alarm Extenders window. Up to 16 external alarm inputs and 16 external controls are available. The external input/output contacts are located on the CAP/CAP2 attached to the ONS 15600 SDH backplane.

11.6.1 External Alarm Input

You can provision each alarm input separately. Provisionable characteristics of external alarm inputs include:

- Alarm type
- Alarm severity (CR, MJ, MN, NA, and NR)
- Alarm-trigger setting (open or closed)
- Virtual wire associated with the alarm
- CTC alarm log description (up to 63 characters)

11.6.2 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
- 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.

11.6.3 Virtual Wires for External Alarms in Mixed Networks

Virtual wires route external alarms to one or more alarm collection centers in a network. External alarms can be assigned to virtual wires in networks containing only ONS 15600 SDHs or in mixed networks containing ONS 15600 SDHs and ONS 15454 SDHs. You can view virtual wires in the CTC node view Maintenance > Alarm Extenders > Virtual Wires window.

When using virtual wires, you can:

- Assign different external devices to the same virtual wire.
- Assign virtual wires as the trigger type for different external controls.

The ONS 15600 SDH supports 16 virtual wires. The ONS 15454 SDH support four virtual wires. In mixed ONS 15600 SDH/15454 SDH networks, CTC displays the virtual wire information differently based upon where it is viewed.

Figure 11-7 shows an ONS 15600 SDH Virtual Wires window with a DCC connection to an ONS 15454 SDH node. The Virtual Wires window shows 10 virtual wire columns, but 16 are available. The first 12 are available for other ONS 15600 SDHs. Only the last four are available for the ONS 15454 SDH, because it can only support four virtual wires.

Figure 11-7 *Virtual Wires Seen from an ONS 15600 SDH*