Product Overview

This section describes the functionality and the features of the ONS 15302.

2.1 Functional Overview

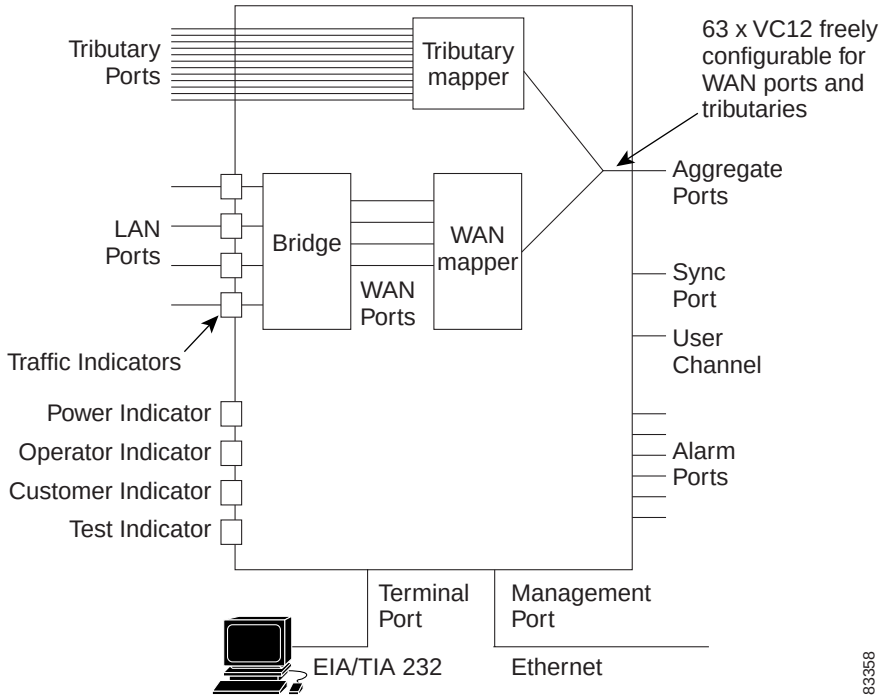
The Cisco ONS 15302 is an integrated access device for use in fiber optic networks. The ONS 15302 combines Ethernet- and TDM-traffic inside an SDH STM-1 frame structure that can be easily carried across the network. The bandwidth of the Ethernet channel is configurable up to 100 MBits/s (Mbps) true wire-speed. The Ethernet part of the Cisco ONS 15302 consists of a bridge, (Figure 2-1).

Each tributary interface is mapped into a VC-12 container while the WAN traffic is mapped into a configurable number of VC-12 containers. Because the latter mapping is proprietary, the Ethernet-WAN traffic generation and termination must be realized in a Cisco device in both ends of a connection.

The ONS 15302 management solution is based on an embedded SNMP agent. A graphical user interface (GUI) based element manager application can be used as a craft terminal and for remote supervision of ONS 15302 devices. The ONS 15302 also provides a simple VT100 command line interface (ONSCLI) for direct communication with the embedded SNMP agent.

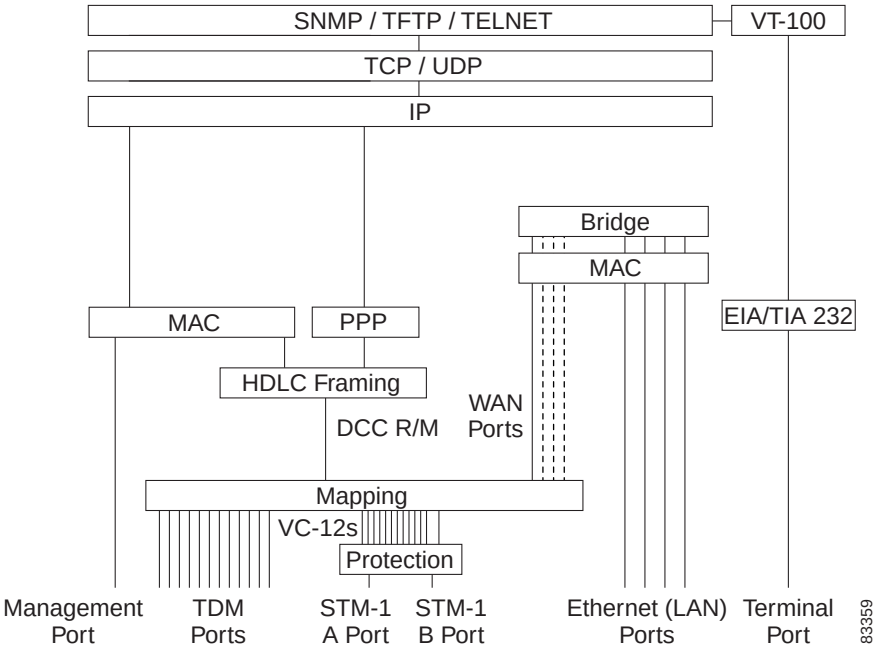
The ONS 15302 STM-1 port is fully compatible in existing SDH Transport Networks.

Figure 2-1 ONS 15302 Functional Overview



From an element management perspective, the ONS 15302 is a multi-protocol machine with several types of interfaces as shown in Figure 2-2.

Figure 2-2 Functional Model for the ONS 15302



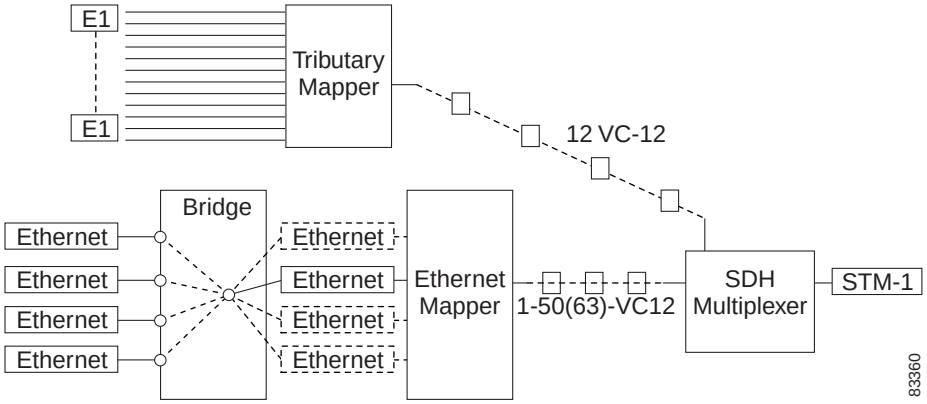
2.2 Features

2.2.1 SDH Multiplexing and Mapping

The aggregate interface supports only terminal multiplexer functions, and 63xVC-12 mapping.

Figure 2-3 shows the internal structure of ONS 15302. The bridge receives an Ethernet frame/IP datagram on one of the ports and decides on which port to send it out. The Ethernet Mapper converts between Ethernet frames and VC-12s while the Tributary Mapper converts between E1 signals and VC-12s. The SDH Multiplexer is responsible for the multiplexing of VC-12s into STM-1. The VC-12s are sent to and received from either the Tributary Mapper or the Ethernet Mapper.

Figure 2-3 Multiplexing and Mapping in the ONS 15302

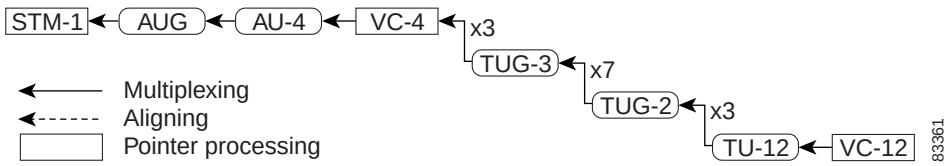


The WAN traffic is mapped into a number of VC-12 containers in a round robin fashion with an inverse multiplexer function. The Ethernet traffic is mapped into one or a number of VC-12 containers.

It is possible to have one to four WAN channels in the ONS 15302. The total bandwidth for one WAN channel can not be greater than 100 Mbit/s (Mbps) or 50xVC-12 containers.Up to 63xVC-12 containers may be used for WAN traffic if more than one WAN channel is used.

The ONS 15302 can utilize all 63xVC-12, it is just a matter of hardware. When a WAN module is inserted you have 4xWAN ports, which can freely be configured 50xVC-12 container, though still limited to a total amount of 63. If any E1 interfaces are needed this will of course affect available containers for Ethernet (Figure 2-4).

Figure 2-4 Multiplexing Structure in STM-1



The mapping between the tributary interfaces and the WAN port is fully flexible. An example of mapping is shown in Table 2-1.

Table 2-1 Example of a Mapping Scheme for ONS 15302

VC-12 (KLM)	Linked to
1.1.1	TRIBUTARY (1)
2.1.1	TRIBUTARY (2)
3.1.1	TRIBUTARY (3)
1.2.1	TRIBUTARY (4)
2.2.1	TRIBUTARY (5)
3.2.1	TRIBUTARY (6)
1.3.1	TRIBUTARY (7)
2.3.1	TRIBUTARY (8)
3.3.1	WAN-PORT (Only one WAN port is used)
1.4.1	WAN-PORT (Only one WAN port is used)
2.4.1	WAN-PORT (Only one WAN port is used)
... and so forth until ...	
3.5.3	WAN-PORT (Only one WAN port is used)
1.6.3	WAN-PORT (Only one WAN port is used)
2.6.3	TRIBUTARY (9)
3.6.3	TRIBUTARY (10)
1.7.3	TRIBUTARY (11)
2.7.3	TRIBUTARY (12)
3.7.3	Unused

The VC-12 containers can be freely allocated to the different WAN ports or the tributary ports.

2.2.2 Protection

The ONS 15302 offers 1+1 linear Multiplex Section Protection (MSP). The protocol used for K1 and K2 (b1-b5) is defined in ITU-T G.841, clause 7.1.4.5.1. The protocol used is 1+1 bi-directional switching compatible with 1:n bi-directional switching.

The operation of the protection switch is configurable as described in Table 2-2.

Table 2-2 Protection Switch Parameters

Parameters	Description	Default Settings
MSP Status	• Enabled • Disabled	Disabled
Protection Type	• Unidirectional • Bidirectional	Unidirectional
Operation Type	• Enabled • Disabled	Enabled

Table 2-2 Protection Switch Parameters (continued)

Parameters	Description	Default Settings
Wait to restore time	Number of seconds to wait before switching back to the preferred link after it has been restored	300 seconds
Working Port	Identifier of the preferred working link	—
Switching Command for active port	• Clear • Lockout of Protection, • Forced Switched to Protection • Forced Switched to Working • Manual Switched to Protection • Manual Switched to Working • Exercise • No-Command	No-Command
Active Port	Identifier of the active link	—
Local Request	Local request contained in K1 byte	—
Local Request Channel		—
Remote Request	Remote request contained in K1 byte	—
Remote Request Channel		—

2.2.3 Performance Monitoring

The ONS 15302 offers full G.826 performance monitoring at the RS, MS, VC-4, and VC-12 levels in the SDH hierarchy. This includes B1 near end in RSOH section, B2 near and far end in MSOH section, B3 near and far end at VC-4 level and BIP-2 near and far end at VC-12 level.

The ONS 15302 calculates excessive error and degrade signal defects assuming Poisson distribution of errors, according to ITU-T G.826.

The excessive error defect (dEXC) is detected if the equivalent BER exceeds a preset threshold of 10 exp –5, and be cleared if the equivalent BER is better than 10 exp –6, according to ITU-T G.806.

The degraded signal defect (dDEG) is detected if the equivalent BER exceeds a preset threshold of 10 exp –X, where x=6,7,8 or 9. The dDEG is cleared if the equivalent BER is better than 10 exp –(X+1), according to ITU-T G.806.The threshold is individually configurable for the different levels in the SDH hierarchy, from 10 exp –6 to 10 exp –9.

2.2.4 Synchronization

ONS 15302 can synchronize to the following sources:

- An STM-1 interface (working link or backup link)
- The dedicated 2048 kHz sync input (Sync Port)

- A tributary port
- A local oscillator

Tributary synchronization is only relevant when in PRA mode at the chosen tributary.

The synchronization source is a configurable parameter. If it is impossible to synchronize to the selected source, an alarm will be raised, and the system will automatically switch to free running, that means the local oscillator.

Switchback to the selected source is performed automatically whenever it becomes possible again. The alarm is cleared when the switchback is successful.

The ONS 15302 operates in three different modes:

- Locked
- Holdover
- Free running

The default synchronization source is the local oscillator. The tolerance for this oscillator is +/– 10 ppm. ONS 15302 also provides a 2048 kHz sync output for synchronization of external equipment.

Note The ONS 15302 does not support SSM signaling in the S1 byte.

Note Holdover mode and free running mode are different modes, the administrative source is different than the operational, and will change when source is available. The performances are the same as the internal oscillator.

2.3 Switch Features (Bridging)

The bridge is a transparent multi port remote Ethernet bridge as specified in IEEE 802.3. The Bridge consists of four LAN ports and four WAN port. Each port may have its own MAC address, but in most configurations one MAC address for the whole bridge is sufficient. The four LAN ports support 10/100BaseT Ethernet for UTP cables. Both 10 Mbit/s (Mbps) and 100 Mbit/s (Mbps) are supported with auto negotiation. The LAN ports are compatible with IEEE 802.3.

The bridge supports the following features:

- MAC switching
- Self learning MAC Addresses
- Static MAC entries
- Support of up to 24k MAC addresses
- Automatic Ageing for MAC addresses
- MAC Multicast
- Transparent Bridging
- VLAN by Port and VLAN by Port and Protocol
- Full IEEE 802.1Q VLAN tagging compliance
- Head of Line Blocking
- Back pressure and flow control Handling

- IGMP snooping
- Spanning Tree Protocol (STP) per device
- STP per VLAN
- Mirroring Port
- IEEE 802.1p priorities
- GARP VLAN registration protocol (GVRP)

2.4 TDM Features

2.4.1 Tributary Ports

ONS 15302 provides 12 120 ohm 2.048 MHz Tributary Ports on the customer side. 75 ohm operation is supported by adding an external balun.

Each Tributary Port can be individually configured to run in one of the following modes:

- G.703 Transparent (TRA)
- ISDN Primary Rate Access (PRA)

Note PRA is implemented according to ETS 300011 and ETS 300233. The ONS 15302 can only implement the PRA NTE functions.

2.4.1.1 Transparent Transmission Mode.

In this mode 2.048 Mbit/s plesiochronous data and timing are transferred independently of frame structure. The two directions of transmission are completely independent of each other.

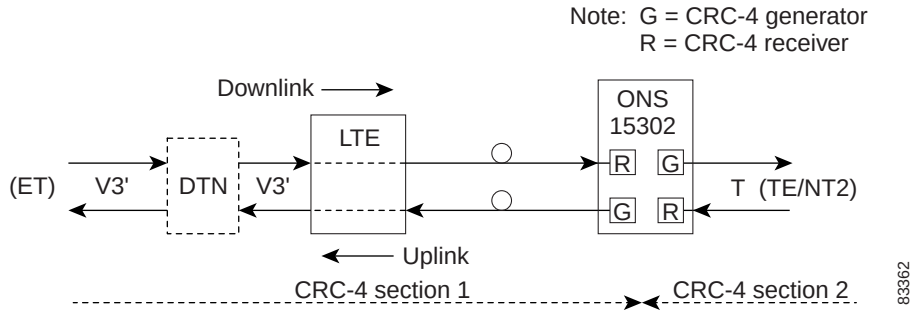
Downstream AIS is generated on loss of signal or loss of optical frame alignment.

2.4.1.2 ISDN Primary Rate Access (PRA) Transmission Mode.

The functional layout compliant to pr. ETS 300 233 is shown in below.

DTN	Digital Network
V3' and V3	ISDN Reference Points, Exchange Termination Interface
T	ISDN Reference Point, Customer Interface
Downlink	Signal direction from Exchange Termination (ET)
Uplink	Signal direction to Exchange Termination (ET)

Figure 2-5 ONS 15302 ISDN PRA Configuration



2.4.2 Downlink Transfer

The LTE is transparent to the 2 Mbit/s (Mbps) signal. However, monitoring the G.704 multiframe format is performed for detection of loop back 1 command from the Exchange Termination (TS 0 bit Sa6).

The NTE terminates CRC-4 section 1 by the Receiver (R) circuits, which pass the signal to the Generator (G) circuits with indication of basic frame start. The G circuits generate new TS 0 basic frame and multiframe to CRC-4 section 2, and pass transparently TS1 - TS31 and from TS 0 the RAI bit and the Sa-bits 4 to 8. AIS is generated to the TE on loss of signal and when R circuits have lost alignment to G.704 basic frames.

2.4.3 Uplink

The NTE terminates CRC-4 section 2 in the R circuits, which pass the signal to the G circuits with indication of basic frame start. The G circuits generate new TS 0 basic frame and multiframe to CRC-4 section 1 and pass transparently TS1- TS31 and from TS 0 the RAI bit and the Sa-bits 4,7 and 8.

The G circuits generate substituted frames to the ET on loss of signal or loss of alignment to basic G.704 frames from TE.

The LTE is transparent to the 2 Mbit/s (Mbps) signal.

On loss of optical line signal, the LTE generates an auxiliary pattern AUXP=1010.. to the ET.

2.4.4 Supervision by the Exchange Termination (ET)

The TS 0 bits Sa5 and Sa6 are used for supervision. Bit Sa5 being 0 downlink and 1 uplink, indicates the direction of transmission.

2.4.5 ET generated Downlink Sa6 Codes

Normal condition Sa6 = 0000

Loop back 1 command to LTE Sa6 = 1111

Loop back 2 command to NTE Sa6 = 1010

2.4.6 NTE generated Uplink Sa6 Codes

Table 2-3 Time Slot 0 Signalling in PRA Mode

Condition	Uplink report to ExchangeTermination	Comments
Normal Operation	Sa6 = 00XX RAI = 0 Sa5 = 1	XX reports bit errors related to CRC-4 section 2
AIS Received at V3	Sa6 = 1111 RAI = 1 Sa5 = 1	RAI Generated by TE
Loss of SignalV3 (FV3) Loss of line signalor downlink FA (FC5)	Sa6 = 1110 RAI = 1 Sa5 = 1	RAI Generated by TE
Loss of Signal at T (FC4)	Sa6 = 1100 RAI = 0 Sa5 = 1	The NTE generates substituted frames with RAI=0. Reporting of other failure conditions has priority.
Power failure (NTE dying gasp)	Sa6 = 1000 RAI = X Sa5 = 1	Reporting of this failure condition has the highest priority.
Loss of Line Signal at LTE (FC1)	AUXP	Auxiliary alarm indication pattern(1010..) generated by the LTE.
Loop back 1 activated by downlink Sa6=1111	Sa6 = 1111 RAI = 1 Sa5 = 0	The downlink signal is looped back fully transparently in the LTE.
Loop back 2 activated by downlink Sa6=1010	Sa6 = 00XX RAI = 1 Sa5 = 0	The TS1-TS31 and the TS 0 bits RAI, Sa4, 7 and 8 of the downlink signal are looped back by the NTE. Sa5 is changed to 0 by the NTE to indicate loop back condition.

2.4.7 Handling of CRC-4 Errors

CRC-4 errors detected in R circuits downlink and uplink are inserted as E bits to the ET and TE respectively.

If multiframe alignment is not obtained, the NTE reports all E bits 0 error.

Detected bit errors related to CRC-4 section 2 are reported to the ET by use of the two last bits of the Sa6 code in normal operational condition.

Table 2-4 CRC-4 Section 2 Bit

	Events	Sa6
a)	CRC-4 errors detected by the NTE:	0010

Table 2-4 CRC-4 Section 2 Bit (continued)

	Events	Sa6
b)	CRC-4 errors reported as E-bits from the TE:	0001
	a) + b) or no MF alignment to signal received from the TE:	0011

ITU-T Rec.G.706, ANNEX B is applied to CRC-4 section 2 which means that the NTE stops searching for MF alignment after a given period of time without further actions. Continuous Sa6 = 0011 indicates to the ET that quality information is not available from CRC-4 section 2.

2.5 Test Loops

Two test loops are provided per Tributary Port, one in the customer direction (LL3) and one in the network direction (LL2), (Figure 2-6). One Tributary Port can have only one loop activated at a time. The test loops can be activated, deactivated and monitored by the management system. The loop control logic depends on the tributary mode (TRA or PRA).

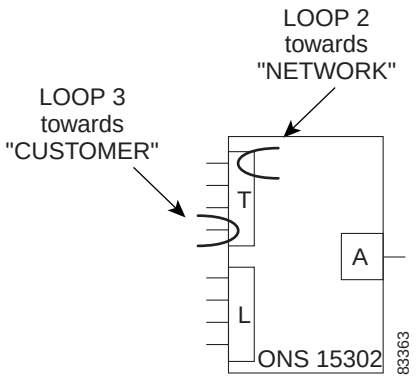
- In TRA mode the management system can operate the loops at any time as long as the port is enabled.
- In PRA mode the loops are supposed to be controlled by some exchange termination equipment (ET) via inband channel 0 control bits. In this mode it is not possible to operate the loops from the ONS 15302 management system.

It is possible to change the tributary mode regardless of the state of the loops. If the mode is changed, the loops will be cleared. The Test LED is on if any tributary loop is activated, regardless of the tributary mode.

To change the tributary mode, the loop must be cleared.

The Test Indicator LED is on if any tributary loop is closed, regardless of the tributary mode. This release does not support any monitor points.

Figure 2-6 Test Loops Schematic View



2.6 Alarm Ports

The ONS 15302 provides facilities to report four auxiliary alarm inputs for associated equipment, for example power unit failure, battery condition, cabinet door etc. These alarms are activated by an external loop between a pair of contacts.

The polarity of the auxiliary alarm input ports is a configurable parameter, this means alarm can be defined either as a loop closed or a loop open condition.

The alarms are reported to the management system. Each alarm input port may have an individual configurable textual description associated with it.

The ONS 15302 provides also support for two alarm output ports (Alarm out 1 and Alarm out 2) used to signal equipment alarms and traffic related alarms. Alarm out 1 and Alarm out 2 reflect the status of the operator LED and the customer LED respectively.

2.7 LED Indicators

The LED indicators are used to visualise the ONS 15302 status:

Table 2-5 LED Functionality on the WAN Module Side

Identity	Color	State On	State Flashing	State Off
PWR (Power)	Green	Presence of power	NA	Power failure
OPER (Operation)	Red	Alarm detected on aggregate interface	NA	No alarm detected on aggregate interface
CUST (Customer)	Red	Alarm detected on tributary or LAN interface	NA	No alarm detected on tributary or LAN interface
TEST (Test)	Yellow		One or more test are activated	
LAN 1	Green	Link is present	Traffic is present	Link down
LAN 2	Green	Link is present	Traffic is present	Link down
LAN 3	Green	Link is present	Traffic is present	Link down
LAN 4	Green	Link is present	Traffic is present	Link down

Table 2-6 LED Functionality on the Connector Array Side

Identity	Position	Color	State On	State Flashing	State Off
PWR (Power)		Green	Presence of power	NA	Power failure
OPER (Operation)		Red	Alarm detected on aggregate interface	NA	No alarm detected on aggregate interface

Table 2-6 LED Functionality on the Connector Array Side (continued)

Identity	Position	Color	State On	State Flashing	State Off
CUST (Customer)		Red	Alarm detected on tributary or LAN interface	NA	No alarm detected on tributary or LAN interface
TEST (Test)		Yellow		One or more test are activated	
LANn (n-1,2,3,4)	Left	Green	100 MBits/s (Mbps)	NA	NA
LANn (n-1,2,3,4)	Left	Yellow	10 MBits/s (Mbps)	NA	NA
LANn (n-1,2,3,4)	Right	Green	Link OK	Ethernet traffic in operation	Link down

2.8 User Channel

A transparent user channel is provided (F1 byte in RSOH) for transportation of general data. The interface is balanced RS485 and supports synchronous 64 kbit/s or asynchronous 19.2 kbit/s by configuration.

2.9 Automatic System Clock Setting

The ONS 15302 supports time protocol (RFC 868) for automatic date and time adjustment. To utilize this feature a TP server must be available in the network.

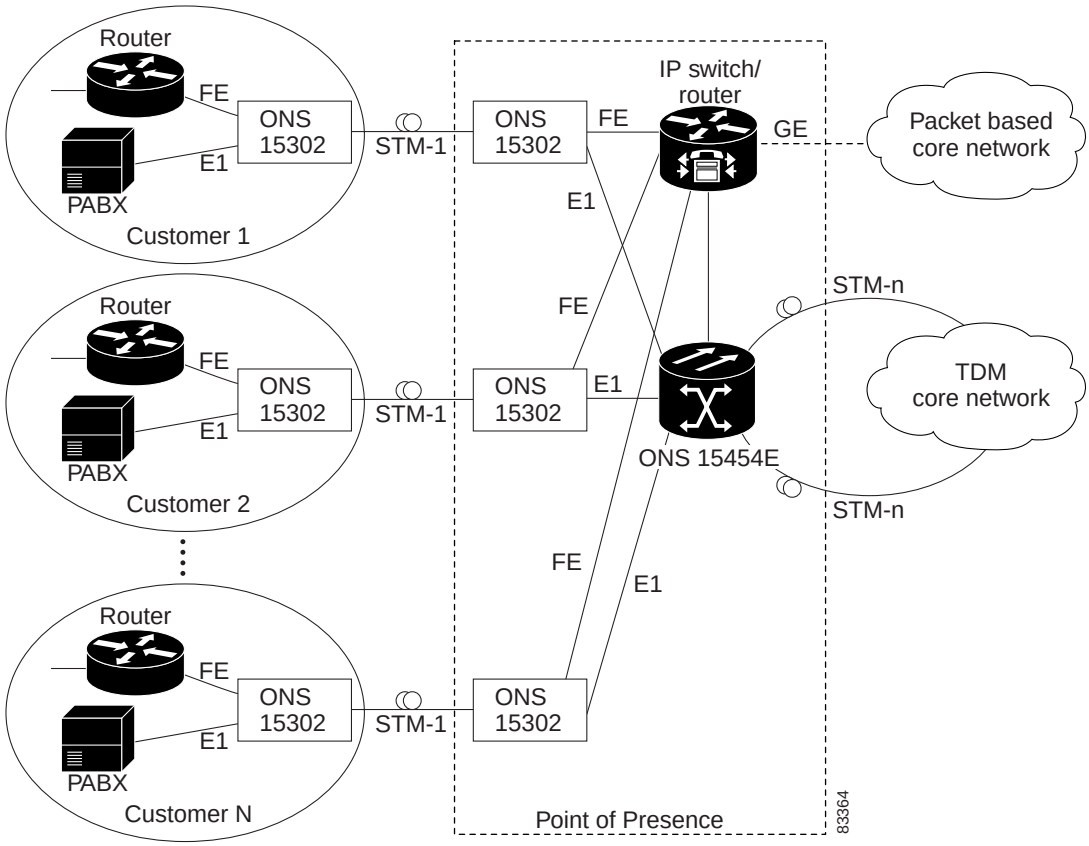
Because the time protocol provides UTC (GMT) only, and does not take into account the Day Light Saving Time (summer time), an additional parameter (UTC Delta) allows the user to get the local time. This parameter must be adjusted twice a year to take into account the Day Light Saving Time.

2.10 Applications

2.10.1 Back to Back Application

Normally the ONS 15302 at the customer site is connected to an ONS 15302 at the operator point of presence (PoP). A number of these systems can be connected in a star network and the Ethernet traffic is groomed by an Ethernet switch before it is transmitted to the core network. Figure 2-7 shows the layout of a typical system with the ONS 15302 incorporated. The network in this figure does not have a separate Ethernet backbone network, but this could easily be supported.

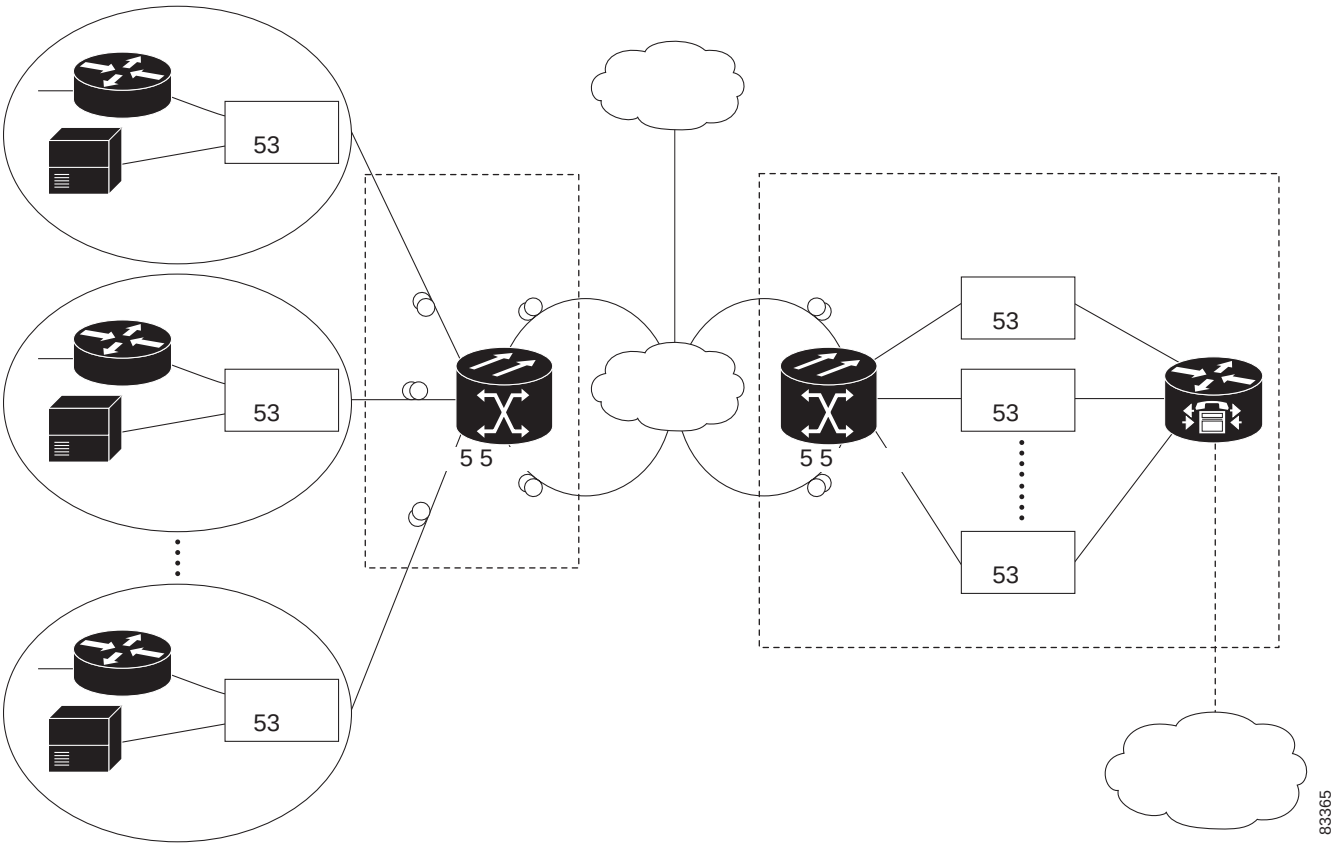
Figure 2-7 Back to Back Configuration across the Access Loop



2.10.2 Remote Back to Back Application

The ONS 15302 can also be directly connected to the SDH transport network if the operator wants to do Ethernet grooming at a different site as shown in the figure below.

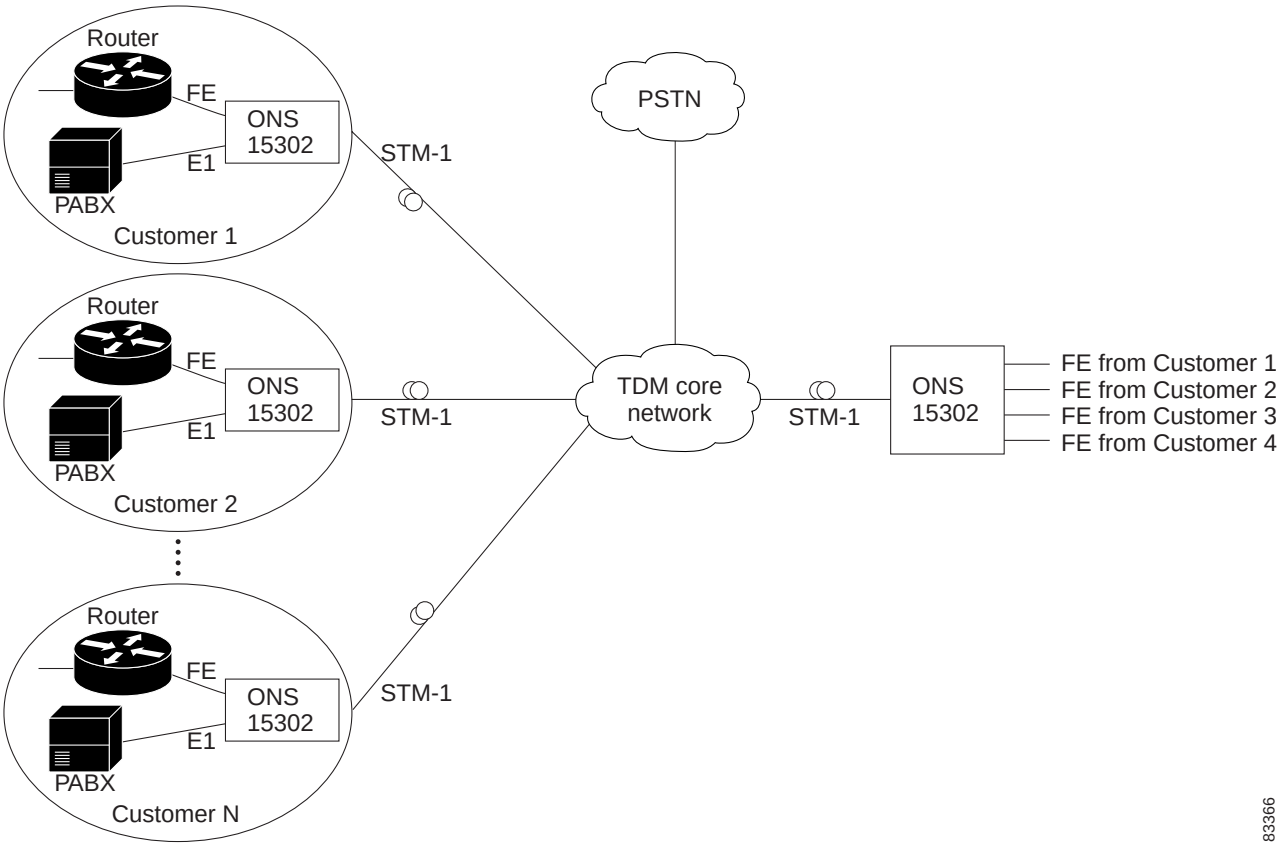
Figure 2-8 Typical System with no Local Grooming in the PoP



2.10.3 Headquarter Office to Branch Office

The ONS 15302 can be connected to four different ONS 15302 units without any additional Ethernet switch Figure 2-9.

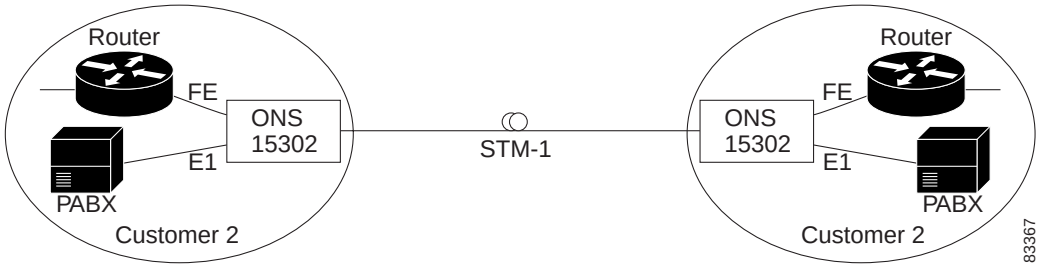
Figure 2-9 Typical System when connected to an ONS 15302



2.10.4 Campus Application

The ONS 15302 can also be connected back to back without any connection to external networks Figure 2-10.

Figure 2-10 Typical Network when used in a Campus Application



2.11 Management

The following main features are supported by the ONS 15302 management system:

- Alarm Handling
- Configuration Management
- Performance Monitoring
- Test Support
- Backup/Restore
- Software Download
- Security

The ONS 15302 management solution is based on an embedded SNMP agent, which can be accessed locally or from a remote management application.

Supported MIBs

The following standard Management Information Base are supported.

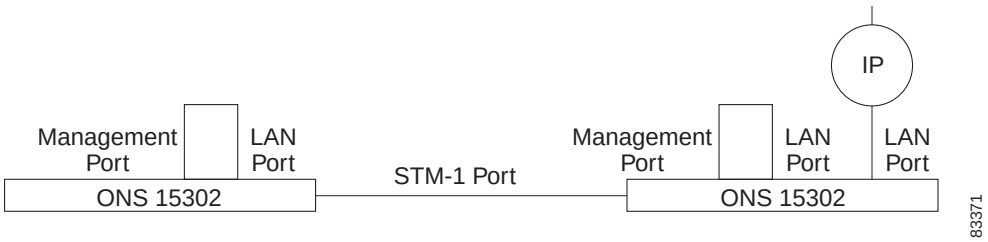
RFC 1213	Management Information Base for Network Management of TCP/IP based internets: MIB-II
RFC 1493	Definition of Managed Objects for Bridges.
RFC 1573	Evolution of the Interfaces Group of MIB-II
RFC 1757	Remote Network Monitoring Management Information Base (RMON)
RFC 2495	Definitions of Managed Objects for the DS1, E1, DS2 and E2 interface types.
RFC 2558	Definitions of Managed Objects for the SONET/SDH interface type.
ONS 15302 MIB	

2.11.1 Various ONSCLI Management Access Solutions

ONS 15302 is managed by means of the Optical Network System Command Line Interface (ONSCLI). ONSCLI is an ASCII based VT100 terminal interface. The ONS 15302 can be fully managed by means of the ONSCLI interface.

Figure 2-11 Local Management with ONSCLI

Figure 2-12 Possible Remote Management via In Band Traffic



(Looping remote LAN Port to Management Port. See Inband via one of the LAN Ports, page 2-18 for restrictions).

Note Only one session (local or remote) is allowed at a time.

2.11.2 Command Line Interface (ONSCLI)

ONS 15302 supports a serial EIA/TIA 232 interface called ONSCLI. ONSCLI is a line oriented ASCII based management interface, which provides a simple local connection to any VT100 compatible terminal. ONSCLI is protected by a password.

The ONS 15302 also supports the connection of a remote ONSCLI terminal over Telnet/IP.

2.11.3 Management Connectivity

A local Ethernet interface, called the Management Port, is available for connecting to a management DCN. This port is compatible with IEEE 802.3 and supports 10/100BaseT Ethernet for UTP cables.

If an ONS 15302 has no connectivity to the management DCN via the Management Port, mechanisms for transporting management information in the STM-1 DCC channel are provided.

The ONS 15302 management system is based on SNMP and an IP based DCN. However, if an IP based DCN is not available, ONS 15302 provides a mechanism for connecting via IpPPP based DCN.

2.11.3.1 Ways of Connecting to the Management DCN

ONS 15302 can connect to the management DCN in different ways:

Via the dedicated Ethernet Connector (Management Port)

This solution assumes that both ONS 15302s in a pair have local IP- or OSI connectivity.

Via a proprietary HDLC based Protocol in the STM-1 DCC (DCC-R or DCC-M)

This solution assumes that one of the two ONS 15302s in a pair has IP connectivity via the Management Port and that the DCC channel is transparent between the two devices. In this mode, packets received via the Management Port are broadcasted over the DCC HDLC if the MAC address is within the range assigned to Cisco.

Inband via one of the LAN Ports

In this case the Management Port must be physically connected to one of the LAN ports via an external HUB. The management traffic is carried over the Bridge WAN port. If the ONS 15302 device is not managed by the customer itself, the LAN port used for management must belong to a separate VLAN, this means only three ports are left for customer access.

IP Inband

IP inband means that LAN and WAN ports are carrying management traffic together with customer traffic. The configuration is described in 2.13DCN Configurations Supported, page 2-19.

When using IP inband, the management traffic can be routed or switched (using VLANs). If routed, the routing is carried out in hardware (FFT) if IP routing is enabled. Otherwise, IP forwarding is used, this means software based.

Every ONS 15302 has one and only one IP address allocated to it. ONS 15302 also keeps the IP address of its mate ONS 15302. This simplifies the toggling between two ONS 15302s in a pair. In addition, the flexibility above implies the actual DCN strategy must be decided and configured per device (parameters like DCC enable/disable, IP/HDLC etc.).

All ONS 15302 protocol stack options for implementing the above DCN strategies is illustrated in Figure 2-2.

2.12 DCN Features

The required DCN protocol support is shown in Figure 2-2.

The ONSCLI apply the standards in Table 2-7.

Table 2-7 Protocol Standards

Abbreviation	Standard
Bridge	IEEE 802.1d - Media Access Control Bridges, 1998 Edition Revision (incorporating IEEE 802.1p). The requirements in chapter 0 apply.
MAC / LLC	IEEE 802.x - Information Processing Systems - Local Area Networks
HDLC	ISO 4335 - High level Data Link Control (HDLC) procedures
IP	RFC 791 - Internetwork Protocol
RS-232	EIA/TIA 232
TCP	RFC 793 - Transmission Control Protocol (TCP)

Table 2-7 Protocol Standards

Abbreviation	Standard
UDP	RFC 768 - User Datagram Protocol (UDP)
PPP	RFC 1661 - The Point to Point Protocol

2.12.1 SDH DCC Channels

Both DCCR (Regenerator Section) and DCCM (Multiplexer Section) channels are supported independently. Note that both channels should not be active on the same port simultaneously, as this will result in looping of the traffic. Activation/deactivation of DCC channels is configurable on a per port basis.The SDH DCC IP/PPP transport mechanism supports only traffic on the DCC-R. The DCC-M is by default turned off, when the IP/PPP/DCC-R mode is enabled.

TELNET

Telnet sessions are possible via all paths of management traffic. Multiple Telnet sessions are not possible.

Security

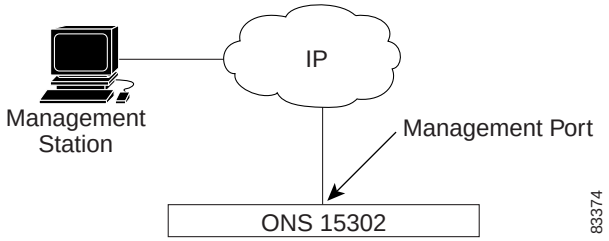
It is possible to restrict management access to the ONS 15302.

2.13 DCN Configurations Supported

2.13.1 DCN on Management Port

This configuration is applicable for users connecting an IP based DCN directly to the ONS 15302. For this type of connection, the management port is used.

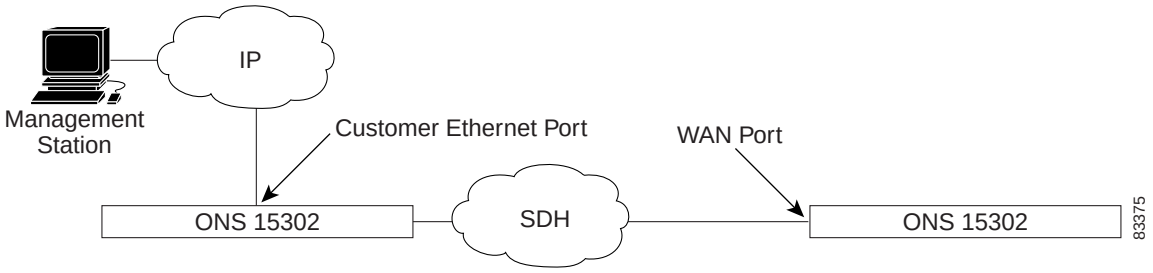
Figure 2-13 DCN on Management Port



2.13.2 DCN on customer Ethernet Port or WAN Port

This configuration is applicable if the user is connected to one of the customer Ethernet ports, or one of the WAN ports (in band management).

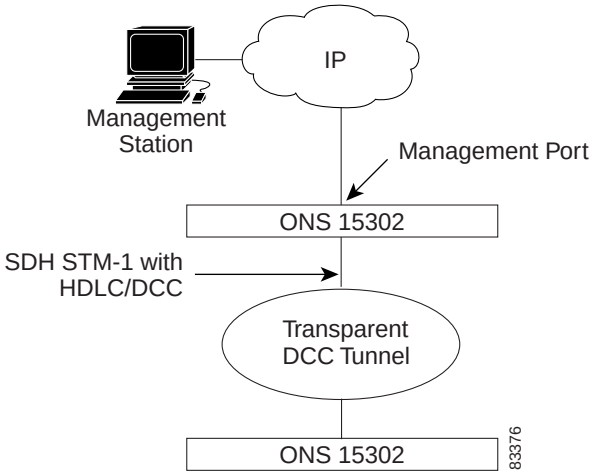
Figure 2-14 DCN on Customer Ethernet Port or WAN Port



2.13.3 Broadcasting over Management Port and HDLC- DCC

This configuration is applicable for a user having a subnet of Cisco devices and an IP based DCN connected to the management port of the ONS 15302.

Figure 2-15 Broadcasting over Management Port and HDLC- DCC



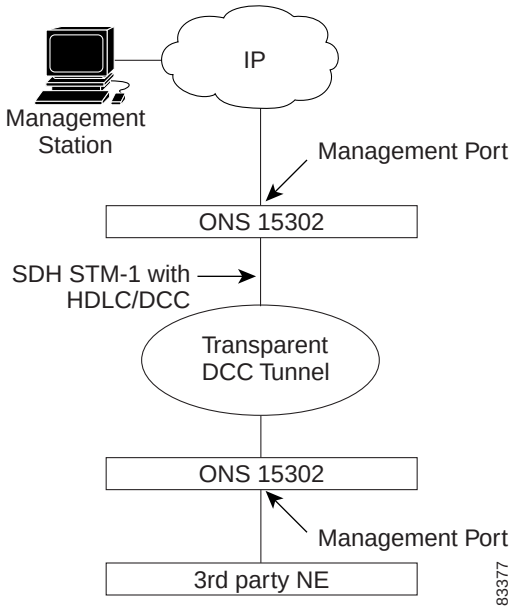
In order not to saturate the DCC with unnecessary traffic, a filtering mechanism for MAC frames can be enabled. If the filter is enabled, MAC frames received via the management port are broadcasted over DCC only if their destination MAC address is within the range assigned to a Cisco system. If the filter is disabled, all MAC frames (regardless their destination MAC address) received via the management port are broadcasted over DCC.

An ONS 15302 configured to broadcast management traffic over the management port and DCC (as described above) can be used to provide IP DCN connectivity to a 3rd party network element via its Management Port, provided than the filter mechanism for MAC frames is disabled. A typical configuration is described below.

To prevent indefinitely packet looping and/or packet proliferation, the following restrictions apply to the broadcast solution presented below

- Maximum one DCC per link (M– or R–).
- The broadcast solution can not be used in a (MSP) protection configuration that involves one (or more) radio hop(s).

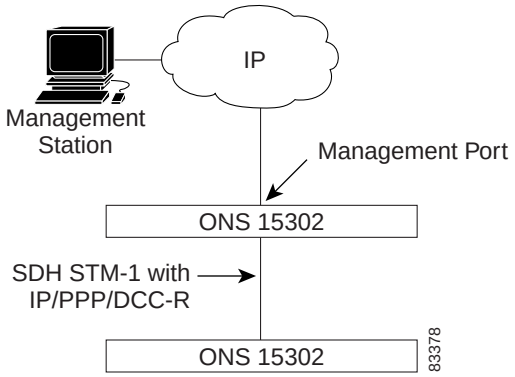
Figure 2-16 IP DCN connectivity to a 3rd Party Network Element



2.13.4 Routing between Management Port and IP/PPP DCC-R

This configuration is applicable for a user having a subnet of Cisco devices and an IP based DCN connected to the management port of the ONS 15302. This configuration allows PPP encapsulated IP management traffic to be transported over the DCC-R channel.

Figure 2-17 IP DCN connectivity to a 3rd Party Network Element



2.14 ONS 15302 Management

The description of the ONS 15302 management system refers to manageable objects as listed in Table 2-8.

Table 2-8 Managed Object

Object Name	#	Description
Device	1	The ONS 15302 unit itself
Bridge Port	8	The four LAN Ports plus the WAN Port mapped into the STM-1
Tributary Port	4	The 2048 kHz tributary interfaces
Aggregate Port	1	The optical STM-1 link
Auxiliary Port	4	The general purpose auxiliary interfaces
Bridge	1	Common Bridge functionality, like VLAN and Spanning Tree

2.15 Fault Management

2.15.1 Alarm Handling

The alarms are related to a managed object as defined in Table 2-8.

The ONS 15302 keeps a record of current and historical alarm events.

The list of current alarms contains the following parameters for each alarm:

- Timestamp
- Alarm Object (for example. Tributary Port 1, Aggregate Port)
- Alarm Identifier
- KLM value if applicable
- Port Affected
- Alarm Description

Port alarms are suppressed if the port itself is disabled. In order to avoid alarm flooding, alarms at different levels are correlated. Lower order alarms are suppressed if a more important alarm at a higher level is active.

In addition to the alarms, the ONS 15302 may generate a number of events. The events are not stored in the current alarm list, but they are appended to the historical alarm list in the same way as the alarms. The historical alarm list contains the same parameters per alarm as the current alarm list, and in addition the following parameter:

- Event Type (RAISED, CLEARED or EVENT)

Both the alarms and the events generate SNMP traps. The traps can be sent to a number of management stations. It is possible to turn SNMP trap sending on or off on a per manager basis. This is the only alarm filtering mechanism provided by the ONS 15302.

Note The bridge port LOSLA alarm is handled slightly different from the rest of the alarms. If a bridge port is unconnected or if it is forced down by the operator, it will cause a LOSLA event, which goes into the historical alarm list like other alarms. These alarms will, however, not cause a red LED to be lit, and they will not be stored in the current alarm list like the other alarms.

Note The LPPLM alarm is only supported for the VC-12 containers used by the tributary ports. It is not supported for the VC-12(s) constituting the WAN port.

Note The MSDEG and LPDEG alarms are based on the near end BER counters over 20 seconds intervals.

Table 2-9 Criterions for Turning Alarms On and Off

Alarm	ON	OFF
MSDEG	> 10 exp –7	< 10 exp –8
LPDEG	> 10 exp –6	< 10 exp –7

2.15.2 Alarm Severity

The Alarm Severity is configurable per alarm object. Default values are assigned automatically as shown in Table 2-11.

2.15.2.1 Alarm Definition

The list below contains all the alarms that are defined for the ONS 15302. For some of the Alarm IDs, the direction (RX or TX) is an integral part of the name. This terminology is used for the direction:

- RX: Downlink (from network to customer)
- TX: Uplink (from customer to network)

Table 2-10 ONS 15302 Alarms

Object-Id	Alarm-Id	Description	Default Severity
ONS 15302	HWFAIL	Hardware failure	Critical
	LOSSY	Loss of external synchronization (Sync port)	Minor
	SYNC-HOLDOVER	No sync source available	Major
	TEMP	Temperature exceeded threshold	Critical
	FAN	FAN failure	Major
ALARM	AUX	Alarm situation on alarm input port.	Warning
SDH	LOS	Loss of STM-1 signal	Critical
	LOF	Loss of frame alignment on the STM-1 signal.	Critical
	TD	Transmit Degrade on laser (not applicable with electrical interface).	Minor
	TF	Transmit fail on laser (not applicable with electrical interface).	Critical
	TIM	Trace Identifier mismatch	Critical

Table 2-10 ONS 15302 Alarms (continued)

Object-Id	Alarm-Id	Description	Default Severity
	CSF	Communication subsystem failure, DCCR communication failure.	Minor
	EXC	Excessive error defect	Major
	DEG	Degraded signal defect	Minor
MS	AIS	Alarm Indication signal.	Minor
	EXC	Excessive error defect.	Major
	DEG	Degraded signal defect.	Minor
	RDI	Remote Defect indication.	Minor
	CSF	Communication subsystem failure, DCCM communication failure.	Minor
MSP	MSP	Problem with MSP signalling with another NE across K1/K2 bytes.	Minor
AU4	LOP	Loss of pointer	Critical
	AIS	Alarm indication signal	Minor
VC-4	LOM	Loss of multiframe alignment	Critical
	UNEQ	Unequipped	Minor
	TIM	Trace identifier mismatch	Critical
	PLM	Payload mismatch	Critical
	EXC	Excessive error defect	Major
	DEG	Degraded signal defect	Minor
	RDI	Remote defect indication	Minor
TU12	AIS	Alarm indication signal	Minor
	LOP	Loss of pointer	Critical
VC-12	UNEQ	Unequipped	Minor
	TIM	Trace identifier mismatch	Critical
	PLM	Payload mismatch	Critical
	EXC	Excessive error defect.	Major
	DEG	Degraded signal defect.	Minor
	RDI	Remote defect indication	Minor
Tributary	LOSTX	Loss of signal	Critical
	AISRX	Alarm indication signal network side	Warning
	LFARX	Loss of frame alignment customer side	Major
	LFATX	Loss of frame alignment customer side	Major
	UNASS	Trib activated without mapping to an available VC-12	Critical
WAN port	WANDELAY	Differential VC-12 delay for the WAN port is greater than +/– 2 ms	Critical

2.15.3 Alarm Definitions

The different alarms together with their relations to the managed objectsare defined in Chapter 9, "Managed Object,"

2.15.4 Alarm Parameters

Table 2-11 defines the parameters associated with an alarm.

Table 2-11 Alarm Parameters

Parameter	Description
Timestamp	Date/Time of alarm event
Alarm Object	Object subject to alarm situation. Should contain both object type (class) and identification (instance).
Alarm Identifier	Short form alarm description, for example LOS
Alarm Description	Alarm description, for example Loss of signal
Alarm Severity	According to ITU-T X.733
Event Type	Raised, Cleared or Event. Applicable for alarm log only. Event means alarm with no duration.

The Alarm Severity is configurable per alarm object. Default values are assigned automatically.

2.15.5 Alarm Suppression

Alarms are suppressed if the object subject to alarm is disabled. It is possible to inhibit alarm reporting for a specific managed object. It is possible to inhibit all alarms from one ONS 15302. All SDH and PDH objects have two configurable persistency filters:

- Persistency filter alarm on: alarms must have been on for a certain amount of time before being reported.
- Persistency filter alarm off: alarms must have been off for a certain amount of time before being cleared.

In addition, the STM-1 interfaces follow the alarm suppression, (Table 2-12).

Table 2-12 Alarm Suppression

Object-Id	Alarm-Id	Suppress the following alarms
SDH	LOS	yes
	LOF	yes
RS	TIM	yes
	EXC	no
	DEG	no
MS	AIS	yes

Table 2-12 Alarm Suppression (continued)

Object-Id	Alarm-Id	Suppress the following alarms
	RDI	no
	EXC	no
	DEG	no
MSP	MSP	no
AU4	LOP	yes
	AIS	yes
VC-4	UNEQ	yes
	TIM	yes
	EXC	no
	DEG	no
	RDI	no
	PLM	yes
	LOM	yes
TU12	LOP	yes
	AIS	yes
VC-12	UNEQ	yes
	TIM	yes
	EXC	no
	DEG	no
	RDI	no
	PLM	yes
Tributary	AISRX	yes
	LFARX	yes

2.15.5.1 Alarm Suppression for Tributary Tx-Alarms

Table 2-13 Alarm Suppression for Tributary Tx-Alarms

Object-Id	Alarm-Id	Suppress the following alarms
Tributary	LOSTX	yes
LFATX	LFATX	yes

2.15.5.2 VC-4 Alarm Suppression for EXC/DEG

Table 2-14 VC-4 Alarm Suppression for EXC/DEG

Object-Id	Alarm-Id	Suppress the following alarms
VC-4	EXC	yes
	DEG	no

2.15.5.3 RS Alarm Suppression for EXC/DEG

Table 2-15 RS Alarm Suppression for EXC/DEG

Object-Id	Alarm-Id	Suppress the following alarms
RS	EXC	yes
	DEG	no

2.15.5.4 MS Alarm Suppression for EXC/DEG

Table 2-16 MS Alarm Suppression for EXC/DEG

Object-Id	Alarm-Id	Suppress the following alarms
MS	EXC	yes
	DEG	no

2.15.5.5 VC-12 Alarm Suppression for EXC/DEG

Table 2-17 VC-12 Alarm Suppression for EXC/DEG

Object-Id	Alarm-Id	Suppress the following alarms
VC-12	EXC	yes
	DEG	no

2.15.6 Alarm Collection

It is possible to view the alarms of all ONS 15302 devices present in the network, for example currently reachable from the management system. The ONS 15302 device stores a list of all current alarms and a log of alarm events. The size of the log of alarm events is 1000 entries.

2.15.7 Alarm Classification

It is possible for the operator to change the assignment of alarm severity for each pair of Object Type Alarm ID.

The possible severity levels are:

- WARNING
- MINOR
- MAJOR
- CRITICAL

2.15.8 Alarm Indication

The Customer LED on indicates that one or more Tributary alarms are on.

The Operator LED on indicates any alarm on, other than AUX alarms and Tributary alarms.

It is possible to define an alarm severity threshold for each LED defining which alarm severity shall turn on the corresponding LED.

2.16 Configuration Management

Backup and Restoration of Configuration Data

It is possible to back up the configuration data of an ONS 15302 device. It is possible to reload the configuration from the back up. The back up media must be a central repository.

Note This feature is only possible from a GUI based Element Manager.

Software Download (Remote Access)

It is possible to download a new software version to the ONS 15302 device. The download process does not influence traffic processing. The new software is used when booting after the next restart. The rebooting is always traffic affecting on IP traffic, but only traffic affecting on TDM traffic if the new software is changes in FPGAs.

Device Reset

It is possible to reset (reboot) the device with or without resetting the current configuration. Reboot does not affect the TDM traffic.

Managed Object Attributes

All attributes defined in the chapter Chapter 9, “Managed Object,” are available for read or read/write access by the management applications specified in “2.11.1Various ONSCLI Management Access Solutions” section on page 16.

2.17 Performance Monitoring

The performance monitoring functions specified inTable 2-18 is available in ONSCLI.

2.17.1 Aggregate Port

Table 2-18 defines the mapping between the dialogue parameters and MIB variables for the Aggregate Port Statistics submenu.

Table 2-18 Aggregate Port Statistics Parameter Mappings

Parameter	MIB variable(s)	Comment
Aggregate Port		Choice between A or B
Path/Section		Choice between RS, MS, VC-4, or VC-12
VC-12 (KLM)	axx155TribPortMapPort ifStack LowerLayer (rfc1573) axx155SdhVc12MoTable axx155WanVc12Klm	Only valid if Path/Section choice is VC-12.ifIndex of tributary.ifIndex of VC-12 connected to tributary.K.L.M value of VC-12 connected to tributary.K.L.M value of VC-12s connected to WAN.
Date/Time	rndManagedTime rndManagedDate	
Current Interval Time Elapsed	sonetMediumTimeElapsed (rfc2558)	
Current ES	sonetSectionCurrentESs (rfc2558)sonetLineCurrentESs (rfc2558)sonetPathCurrentESs (rfc2558)sonetVTCurrentESs (rfc2558)	Regenerator Section.Multiplex Section. VC-4. VC-12.
Current Far End ES	sonetFarEndLineCurrentESs(rfc2558) sonetFarEndPathCurrentESs(rfc2558) sonetFarEndVTCurrentESs(rfc2558)	Multiplex Section. VC-4. VC-12.
Current SES	sonetSectionCurrentSESs (rfc2558)sonetLineCurrentSESs (rfc2558)sonetPathCurrentSESs (rfc2558)sonetVTCurrentSESs (rfc2558)	Regenerator Section. Multiplex Section. VC-4. VC-12.
Current Far End SES	sonetFarEndLineCurrentSESs(rfc2558) sonetFarEndPathCurrentSESs(rfc2558) sonetFarEndVTCurrentSESs(rfc2558)	Multiplex Section.VC-4.VC-12.
Current BBE	sonetSectionCurrentBBEs sonetLineCurrentBBEs sonetPathCurrentBBEs sonetVTCurrentBBEs	Regenerator Section. Multiplex Section. VC-4. VC-12.
Current Far End BBE	sonetFarEndLineCurrentBBEs sonetFarEndPathCurrentBBEs sonetFarEndVTCurrentBBEs	Multiplex Section. VC-4. VC-12.

Table 2-18 Aggregate Port Statistics Parameter Mappings (continued)

Parameter	MIB variable(s)	Comment
Current UAS	sonetSectionCurrentUASs sonetLineCurrentUASs (rfc2558)sonetPathCurrentUASs (rfc2558)sonetVTCurrentUASs (rfc2558)	Regenerator Section. Multiplex Section. VC-4. VC-12.
Current Far End UAS	sonetFarEndLineCurrentUASs(rfc2558)s onetFarEndPathCurrentUASs(rfc2558)so netFarEndVTCurrentUASs(rfc2558)	Multiplex Section. VC-4. VC-12.
Index	sonetLineIntervalNumber (rfc2558) sonetPathIntervalNumber (rfc2558) sonetVTIntervalNumber (rfc2558)	Multiplex Section. VC-4. VC-12.
Timestamp	rndManagedTime rndManagedDate sonetMediumTimeElapsed (rfc2558) sonetLIneIntervalNumber (rfc2558) sonetPathIntervalNumber ((rfc2558) sonetVTIntervalNumber ((rfc2558)	Timestamp must be calculated from these values and index. Multiplex Section. VC-4. VC-12.
ES	sonetSectionIntervalESs (rfc2558) sonetLineIntervalESs (rfc2558) sonetPathIntervalESs (rfc2558) sonetVTIntervalESs (rfc2558)	Regenerator Section. Multiplex Section. VC-4. VC-12.
Far End ES	sonetFarEndLineIntervalESs(rfc2558) sonetFarEndPathIntervalESs(rfc2558) sonetFarEndVTIntervalESs(rfc2558)	Multiplex Section. VC-4. VC-12.
SES	sonetSectionIntervalSESs (rfc2558) sonetLineIntervalSESs (rfc2558) sonetPathIntervalSESs (rfc2558) sonetVTIntervalSESs (rfc2558)	Regenerator Section. Multiplex Section. VC-4. VC-12.
Far End SES	sonetFarEndLineIntervalSESs(rfc2558) sonetFarEndPathIntervalSESs(rfc2558) sonetFarEndVTIntervalSESs(rfc2558)	Multiplex Section. VC-4. VC-12.
BBE	sonetSectionIntervalBBEssonetLineInterv alBBEs sonetPathIntervalBBEssonetVTIntervalB BEs	Regenerator Section. Multiplex Section. VC-4. VC-12.
Far End BBE	sonetFarEndLineIntervalBBEs sonetFarEndPathIntervalBBEs sonetFarEndVTIntervalBBEs	Multiplex Section. VC-4. VC-12.
UAS	sonetSectionIntervalUASssonetLineInterv alUASs (rfc2558) sonetPathIntervalUASs (rfc2558) sonetVTIntervalUASs (rfc2558)	Regenerator Section. Multiplex Section. VC-4. VC-12.
Far End UAS	sonetFarEndLineIntervalUASs(rfc2558) sonetFarEndPathIntervalUASs(rfc2558) sonetFarEndVTIntervalUASs(rfc2558)	Multiplex Section. VC-4. VC-12.

2.17.2 Bridge Port

Performance counters for the Bridge ports (including the WAN port) are available for the manager via the following variables in the RMON MIB:

- etherStatsDropEvents
- etherStatsOctets
- etherStatsPkts
- etherStatsBroadcastPkts
- etherStatsMulticastPkts
- etherStatsCRCAlignErrors
- etherStatsUndersizePkts
- etherStatsOversizePkts
- etherStatsFragments
- etherStatsJabbers
- etherStatsCollisions
- etherStatsPkts64Octets
- etherStatsPkts65to127Octets
- etherStatsPkts128to255Octets
- etherStatsPkts256to511Octets
- etherStatsPkts512to1023Octets
- etherStatsPkts1024to1518Octets

As opposed to the Aggregate port counters, the Bridge port counters must be started and stopped by the operator.

ONS 15302 keeps no history records for the Bridge port counters.

2.18 Software Download (Local Access)

It is possible to load a new software version by means of a PC directly attached to the ONSCLI Port. This service requires local operator presence at the ONS 15302, (Chapter 5, “Troubleshooting”).

The file is loaded by means of the X modem protocol, and the transfer rate is 15.200 kbit/s.

Note Booting the system triggers local software download. Hence, the traffic is lost during the loading.

Table 2-19 SW Download Parameters

Parameters	Description
File Name	Software File to be downloaded

2.19 Security

The management access to the ONS 15302 is controlled by parameters in a community table. This table can only be modified by users with Super access rights. The parameters in the community table are only visible for Super users.

For each defined user, the following parameters must be provided:

- IP address
- Community string
- Access Right (READ-ONLY, READ-WRITE, SUPER)
- Traps (Enable or Disable)

One management station (IP address) may have several users with different access rights. These users are identified by means of the community string.

The ONSCLI access is controlled by means of a password, one for the local access and one for the Telnet access. A management station Super user can modify the ONSCLI password.

The ONSCLI user has Super access rights.

2.20 Management Logs

This subsection summarizes the various logs used for alarms, errors and statistics. As visualized in figure the figure Management logs.

In addition to the logs described below, the system provides logs for troubleshooting, containing detailed debug information. These logs are not available for normal users, and they are not specified in this document.

Figure 2-18 Management Logs

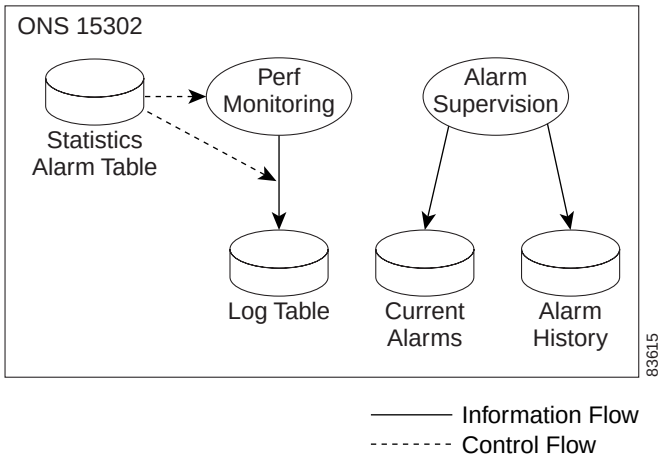


Table 2-20 Management Logs

Name	Location	Description
Statistics Alarm Table	ONS 15302	Controls the monitoring of Bridge and LAN port performance. It contains definition of threshold alarms and also decides if performance alarms shall be logged locally in Log Table, or sent as trap to the manager or both. This table corresponds to the RMON alarm table.
Log Table	ONS 15302	This table contains the logged performance alarms controlled by the Statistics Alarm Table. This table corresponds to the RMON log table.
Current Alarms	ONS 15302	This table contains all alarms currently on.
Alarm History	ONS 15302	This table contains a log of all events, including alarm events. The latest 1000 events are stored.