EMC® Smarts®
Optical Transport Manager

Version 9.4

XD Manager for OTM to IP User Guide

P/N 302-001-511
REV 01

EMC²

Copyright © 2004 - 2015 EMC Corporation. All rights reserved. Published in the USA.

Published January, 2015

EMC believes the information in this publication is accurate as of its publication date. The information is subject to change without notice.

The information in this publication is provided as is. EMC Corporation makes no representations or warranties of any kind with respect to the information in this publication, and specifically disclaims implied warranties of merchantability or fitness for a particular purpose. Use, copying, and distribution of any EMC software described in this publication requires an applicable software license.

EMC^2, EMC, and the EMC logo are registered trademarks or trademarks of EMC Corporation in the United States and other countries. All other trademarks used herein are the property of their respective owners.

For the most up-to-date regulatory document for your product line, go to EMC Online Support (https://support.emc.com).

CONTENTS

Chapter 1 Introduction

Overview of cross-domain management 6
XD Manager for OTM to IP architecture 8
Cross-domain analysis example 9

Chapter 2 XD Manager for OTM to IP Topology

Cross-domain topology 12
Topology creation 13
Multiple domain servers 24
Supported and unsupported NetworkConnections 24

Chapter 3 Event Processing

Event notification handling 30
Cross-domain failure scenarios 32

Appendix A Configuration

Appendix B Understanding the sm_edit Utility

Index

CHAPTER 1
Introduction

This chapter provides an overview of the topology, architecture, and correlation of events between the Optical Transport Manager domain and the IP Manager domain in the following sections:

- Overview of cross-domain management 6
- XD Manager for OTM to IP architecture 8
- Cross-domain analysis example 9

Overview of cross-domain management

Figure 1 shows an IP connection between two routers riding over an optical network.

In the IP domain, the logical connection exists between two interfaces, but the underlying optical network is unknown to the IP Domain Manager. The NetworkConnection element is discovered and managed by IP Manager.

In the Optical domain, the Circuit traversing the network (shown in bold) is managed by an OTM Domain Manager, but its purpose, and therefore impact, in the IP domain is unknown. The Circuit element is managed by Optical Transport Manager.

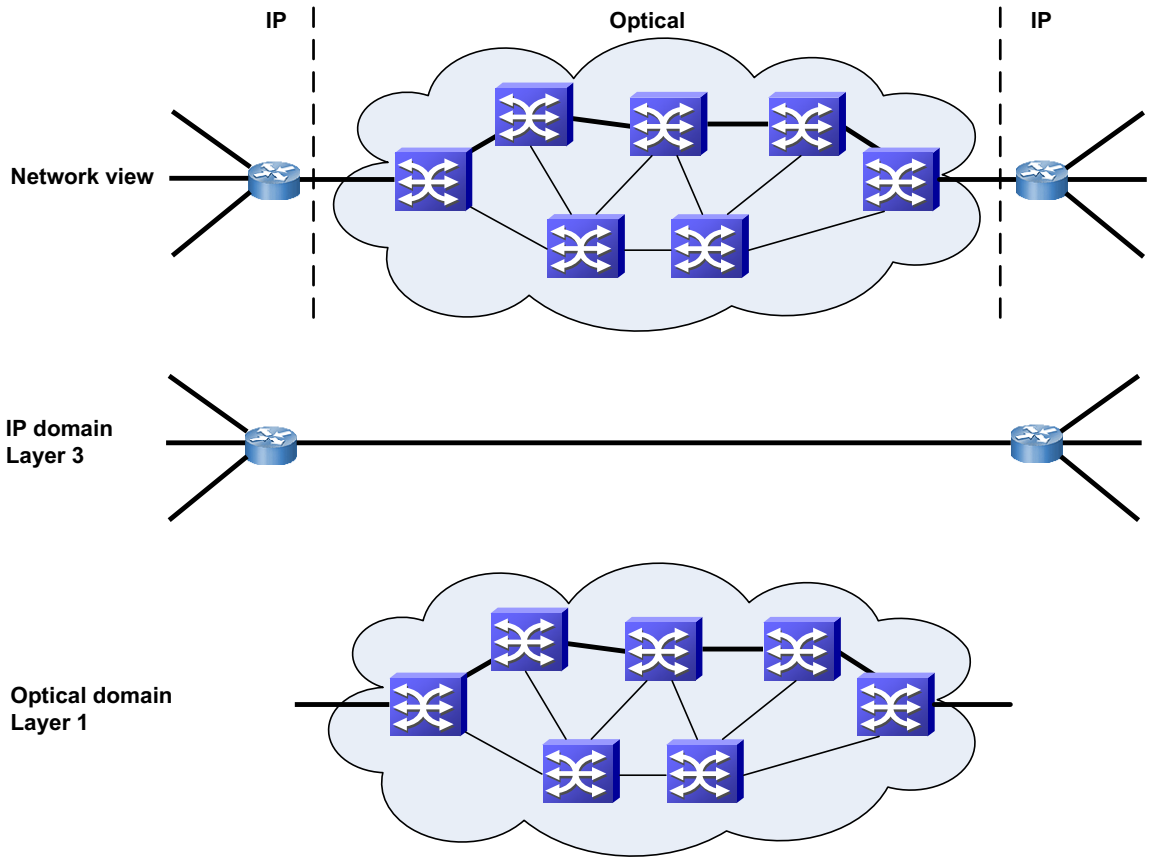

Figure 1 Cross-domain domains and OSI layers 1 and 3

Just as failures in the Optical domain may result in symptoms in the IP domain, failures in the IP domain may result in symptoms in the Optical domain. The XD Manager OTM to IP correlates failures in the Optical and IP domains to determine the actual root cause and associate the root cause to the impacts in other domains.

Layer 1 failures

The Layer 1 failures reported and analyzed by the Optical Transport Manager Domain Managers are:

- Equipment problems
- Fiber cuts

- Circuit pack failure
- Port failure
- And any other problems that cause the Layer 1 circuit to fail

Layer 1 circuits are circuits that transport two Layer 3 devices at the following service layers:

- DS3/VC3
- STS-3C/VC4
- STS-12C/VC4-4C
- STS-48/CVC4-16C
- STS-192C/VC4-64C
- OC-48/STM-16 (WDM wavelength)
- OC192/STM-64 (WDM wavelength)

Layer 3 failures

The Layer 3 failures reported and analyzed by the IP Manager include both physical and logical failures. An example of a logical failure is “IP Network Connection failure.”

Cross-domain correlation provides root cause analysis that takes into account the failures that occur in both Layer 3 and Layer 1 domains. The XD Manager OTM to IP provides root cause analysis that links failures to a single root cause in the Optical domain, the IP domain, or in the connection in between the optical and IP devices. In addition, the XD Manager OTM to IP identifies the entities that are impacted by the failures.

XD Manager for OTM to IP architecture

Figure 2 shows EMC products as they relate to XD Manager OTM to IP.

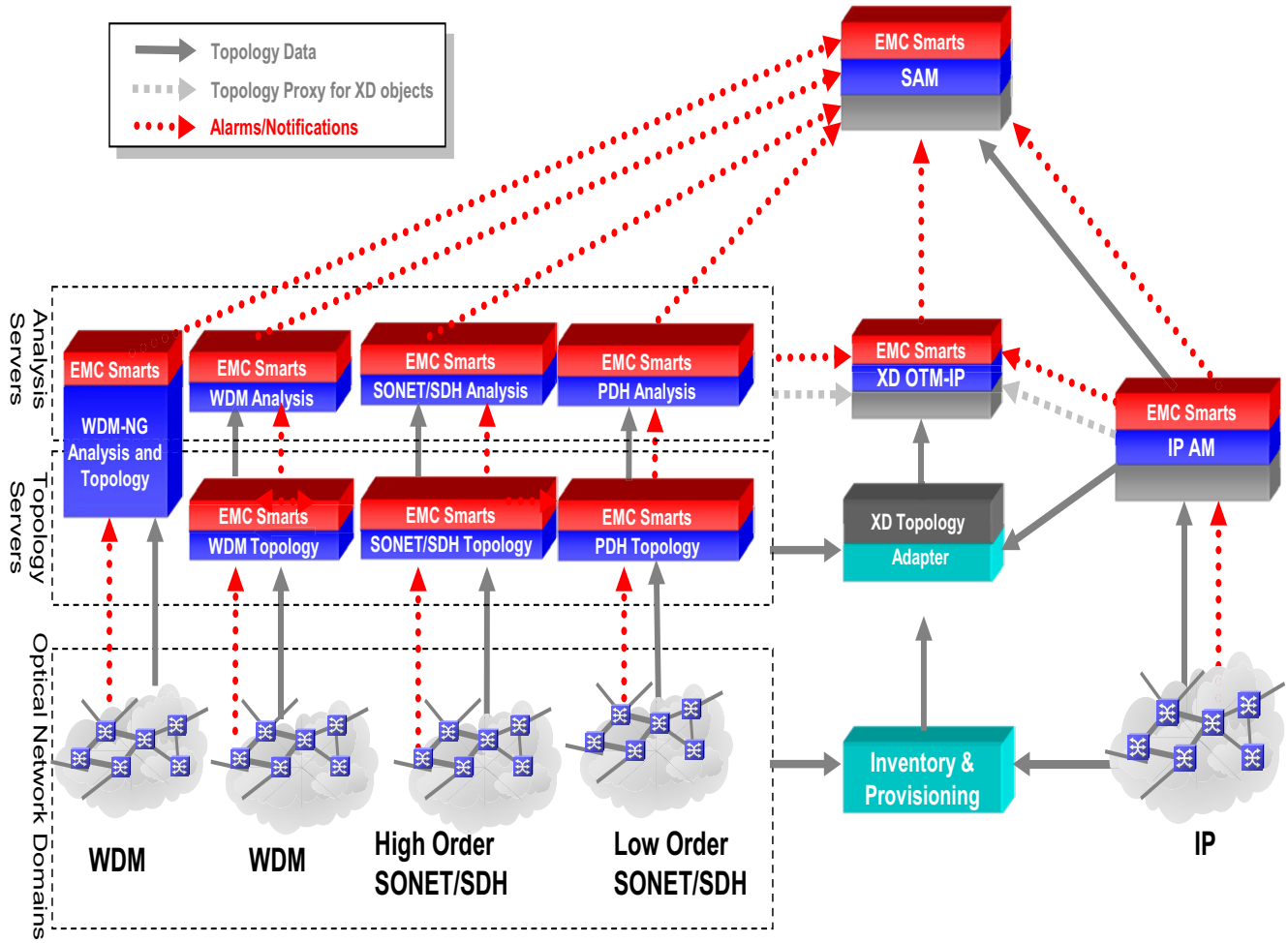

Figure 2 EMC Smarts Optical Transport Manager architecture

The XD Topology Adapter imports topology objects from OTM and IP as topology proxies. The XD Topology Adapter imports topology from IP and from OTM servers based on data from the client's Inventory and Provisioning database. The XD Topology Adapter imports only the topology elements related to the connection points between the IP and Optical Network.

XD Manager OTM to IP looks at topological data from the Topology Servers then imports the cross-domain topology proxy objects from the OTM Analysis Servers and IP.

As failures occur, analysis is done by IP and by the Optical Transport Manager Domain Managers. The output of this analysis is received by XD Manager OTM to IP which then correlates the root cause problem of the failure to Service Assurance Manager (SAM).

Domain managers

EMC Smarts Optical Transport Manager has four Domain Managers:

- WDM (Wavelength Division Multiplexing) - Monitors WDM optical network elements.
- SONET/SDH - Monitors SONET or SDH elements that are faster than 34M such as VC-3 and AU-4 protocols.
- PDH - Also known more accurately as Low-order SONET/SDH, this domain monitors SONET or SDH elements that are 6M or slower such as VC-2 and AU-2 protocols.
- WDM-NG (Next Gen) works with EMC M&R to collect data from EMS systems that support TMF 864.

Each Domain Manager (except WDM NG) consists of a pair of servers: Topology server and Analysis server. For WDM-NG, the Analysis & Topology servers are combined.

In a typical deployment, there may be multiple IP servers, SONET/SDH servers, WDM servers, and Low-order SONET/SDH (PDH) servers. There may also be multiple adapters. In Figure 2, the XD OTM-IP server appears to import topology from all Domain Managers. But, in larger networks, you may need a separate XD OTM-IP server deployed for IP-to-WDM, IP-to-WDM-NG, IP-to-PDH, and IP-to-SDH analysis.

Cross-domain analysis example

Initially, during topology creation, the XD Manager OTM to IP creates proxy object instances corresponding to object instances in the Optical Transport Manager and in the IP Manager. In this example we show a *TopologicalLink Down* problem in Optical Transport Manager impacting a NetworkConnection in the IP network.

The XD Manager OTM to IP imports OTM and IP technology related to the Circuit and NetworkConnection including the Circuit, NetworkConnection, Routers, Cards, and Interfaces. XD Manager OTM to IP also creates relationships between the Optical topology and the IP topology, such as a NetworkConnection is LayeredOver a Circuit.

In the example shown in Figure 3, a failure in the Optical network causes a failure in the ability to communicate between two IP Routers. In order for XD Manager OTM to IP to perform analysis, it monitors events in OTM and IP domains via remote instrumentation. In this case, OTM notifies TopologicalLink *Down*, and Circuit *ServiceUnavailable*. IP notifies NetworkConnection *Down*. XD Manager OTM to IP receives these events and determines the true root cause. It determines that TopologicalLink *Down* in OTM causes the NetworkConnection *Down* in IP and provides this to SAM. As a result, SAM shows the root cause as TopologicalLink *Down*, and an impact of NetworkConnection *Down* and Circuit *ServiceUnavailalble*.

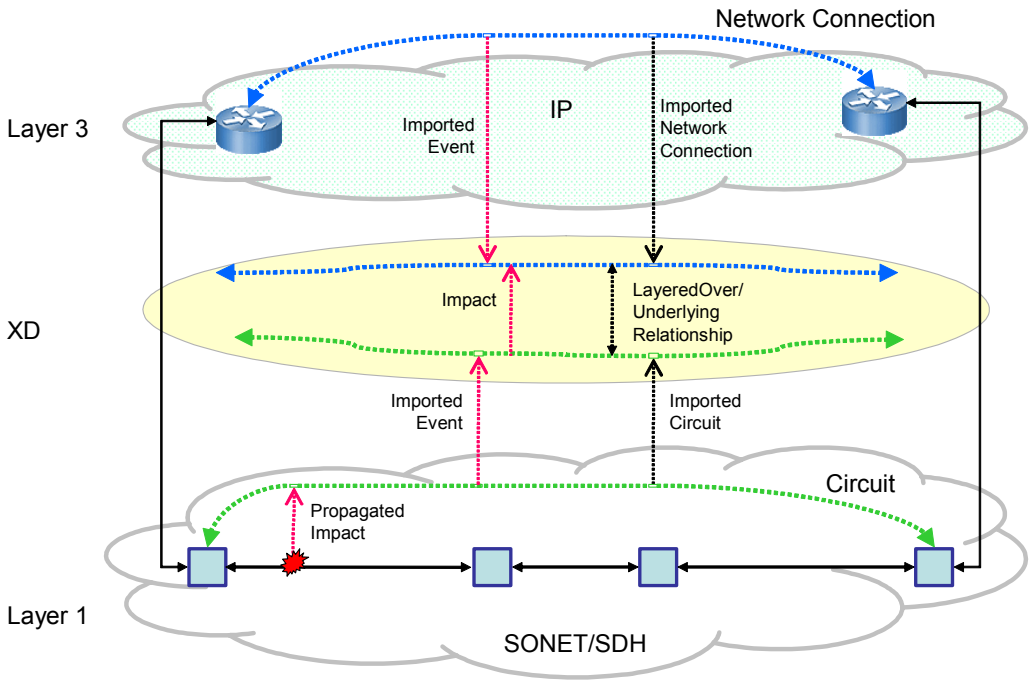

Figure 3 Cross-domain analysis example

CHAPTER 2
XD Manager for OTM to IP Topology

This chapter describes populating the topology of the XD Manager OTM to IP.

- Cross-domain topology 12
- Topology creation..... 13
- Multiple domain servers 24
- Supported and unsupported NetworkConnections 24

Cross-domain topology

The Optical Transport Manager collects and builds the optical network topology while the IP Manager collects and builds the IP network topology. In order to build the cross-domain topology, XD Manager for OTM to IP must be provided data relating customer circuits in the SDH, PDH and WDM domains to connections between Routers and Switches in the IP domain.

The data must specify Circuit information from OTM and related IP connection information from IP. The Circuit information may be specified in different ways including the Circuit name, and PTPs for the Circuit. The IP connection information includes the Routers, Switches and Interfaces or Ports connected to the Optical Circuit.

The XD Topology Adapter uses this data to import topology from Optical Transport Manager and IP Manager only for the above objects. Figure 4 on page 12 shows the topology imported into the XD Manager for OTM to IP.

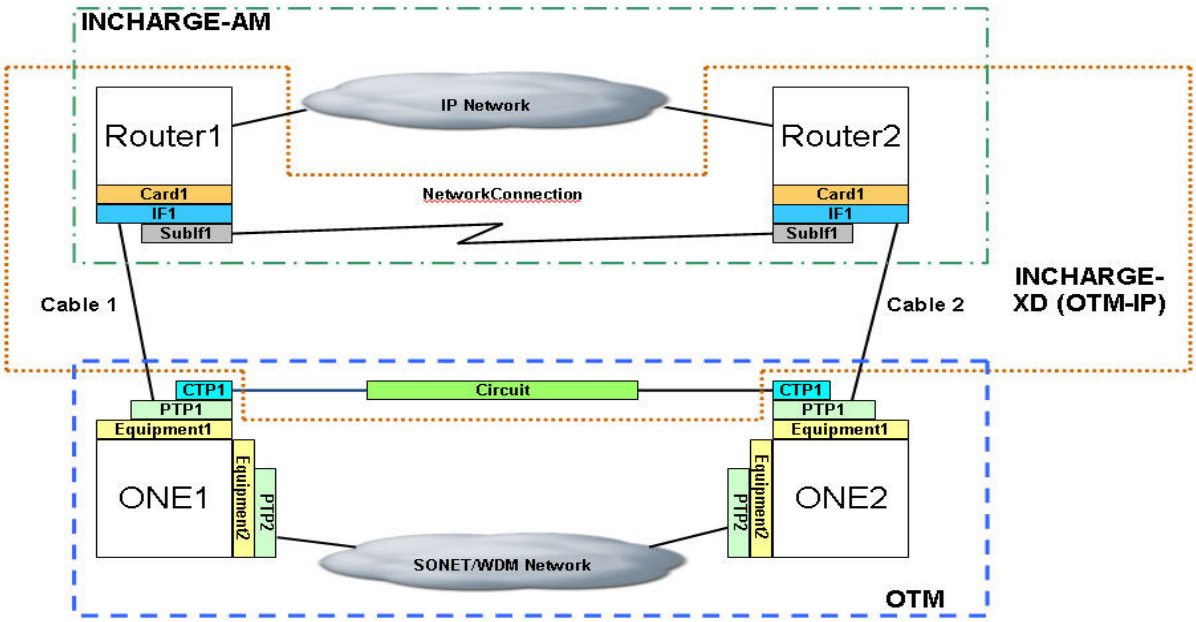

Figure 4 Objects imported into XD Manager for OTM to IP

The data collected from Optical Transport Manager is:

- The Circuit object
- The DropSideToplogicalLinks (for SDH, PDH, and WDM-NG)
- The edge FiberLinks (for WDM)

The data collected from IP Manager is:

- The connections between the Router Interfaces or Switches, which may be NetworkConnections, Cables, or TrunkCables.
- The Interfaces or Ports connected to the NetworkConnection or Cable
  - If applicable, a physical port or interface may be underlying the interface or port connected to the network connection

- The Cards realizing the Interfaces or Ports
- The Router or Switch containing the Interfaces, Ports, Cards

Topology creation

The XD Manager OTM to IP requires information on the connections between IP and OTM components. This information must be provided in a topology file. The topology file format is described in "XD Topology data format" on page 13.

The XD Topology Adapter is installed along with XD Manager OTM to IP

The topology file can be created from an external source such as the customer's proprietary inventory database and provisioning system.

The XD Topology Adapter processes this information and outputs the processed information to data tables within XD Manager for OTM to IP. XD Manager for OTM to IP reads the table data and interacts with IP and OTM to import the connections between IP devices that have related underlying SDH, PDH and WDM circuits.

Once the topology is created, XD Manager for OTM to IP monitors attributes/events in the Optical Transport Manager and IP Manager topologies using remote instrumentation.

XD Topology data format

The topology file can be easily created from the customer's cross-domain data using customer developed processing. For example, a customer may have their cross domain information in a provisioning database. They can develop a database download script that extracts the data from the database and format it into the specified format.

The following sections provide the layout of all the fields of data. There are several different data format options of mandatory and optional fields.

- "Topology data format for SDH, PDH, and WDM-NG servers" on page 14
- "Topology data format for WDM servers" on page 16

Topology data format for SDH, PDH, and WDM-NG servers

Table 1 on page 14 describes the data file format which must be used to provide OTM-IP connection information to XD Manager for SDH, PDH, and WDM-NG servers.

Table 1 XD Topology file format for SDH and PDH servers

Field No.	Field Name	Sample Value	Type	Comments
1	Record Type	ADD	String	This field is not specified at all for a full import, only for an incremental import. Valid values are “ADD” or “DELETE”
1	A-Router	Router1	String	IP A-side router. Required.
2	A-Router-IF	Se1/1	String	IP A-side router interface or switch port. Required. • If “IF-” or “PORT-” is prefixed, an actual instance name is assumed. • If “IF-” or “PORT-” is not prefixed, ICIM_ObjectFactory::findInterface or ICIM_ObjectFactory::findPort locates the interface or port.
3	A-ONE	Node1	String	A-side OpticalNetworkElement
4	A-ONE-Rack	1	Integer	Rack number of A-side OpticalNetworkElement
5	A-ONE-Shelf	1	Integer	Shelf number of A-side OpticalNetworkElement
6	A-ONE-Slot	1	Integer	Slot number of A-side OpticalNetworkElement
7	A-ONE-SubSlot	1	Integer	Subslot number of A-side OpticalNetworkElement. Optional.
8	A-ONE-PTP			A-side OpticalNetworkElement PhysicalTerminationPoint. This field is evaluated after A-ONE-CTP field 9.
		8	Integer	PTP number. Used when Rack, Shelf, and Slot are specified.
		PTP-ONE2/1-1-4-3	String	PTP instance name must start with “PTP-”. When specified, all other OTM fields 3-7, 9-14, 16 are ignored. Must be used with Z-ONE-PTP field 15.
		1-1-7-3	String	PTP AID (Access Identifier) A-ONE field 3 and Z-ONE field 10 must also be specified. All other OTM fields, 4-7, 9, 11-14, 16, must not be specified.

Table 1 XD Topology file format for SDH and PDH servers (continued)

Field No.	Field Name	Sample Value	Type	Comments
9	A-ONE-CTP			A-side OpticalNetworkElement ConnectionTerminationPoint. This field is evaluated before A-ONE-PTP field 8.
		1	Integer	CTP number. Used when Rack, Shelf, and Slot are specified.
		CTP-ONE2/1-1-4-3/3	String	CTP instance name must start with “CTP-”. When specifed, all other OTM fields 3-8, 10-16 are ignored. Must be used with Z-ONE-CTP field 16.
		1-1-7-3/1	String	CTP AID (Access Identifier) A-ONE field 3 and Z-ONE field 10 must also be specified. All other OTM fields, 4-8, 11-15, must not be specified.
10	Z-ONE	Node8	String	Z-side OpticalNetworkElement
11	Z-ONE-Rack	1	Integer	Rack number of Z-side OpticalNetworkElement
12	Z-ONE-Shelf	1	Integer	Shelf number of Z-side OpticalNetworkElement
13	Z-ONE-Slot	1	Integer	Slot number of Z-side OpticalNetworkElement
14	Z-ONE-SubSlot	1	Integer	Subslot number of Z-side OpticalNetworkElement. Optional.
15	Z-ONE-PTP			A-side OpticalNetworkElement PhysicalTerminationPoint. This field is evaluated after Z-ONE-CTP field 16.
		8	Integer	PTP number. Used when Rack, Shelf, and Slot are specified.
		PTP-ONE1/1-1-7-3	String	PTP instance name must start with “PTP-”. When specifed, all other OTM fields 3-7, 9-14, 16 are ignored. Must be used with A-ONE-PTP field 8.
		1-1-7-3	String	PTP AID (Access Identifier) A-ONE field 3 and Z-ONE field 10 must also be specified. All other OTM fields, 4-7, 9, 11-14, 16, must not be specified.

Table 1 XD Topology file format for SDH and PDH servers (continued)

Field No.	Field Name	Sample Value	Type	Comments
16	Z-ONE-CTP			A-side OpticalNetworkElement ConnectionTerminationPoint. This field is evaluated before Z-ONE-PTP field 8.
		1	Integer	CTP number. Used when Rack, Shelf, and Slot are specified.
		CTP-ONE1/1-1-7-3/1	String	CTP instance name must start with “CTP-”. When specifed, all other OTM fields 3-8, 10-16 are ignored. Must be used with A-ONE-CTP field 9.
		1-1-7-3/1	String	CTP AID (Access Identifier) A-ONE field 3 and Z-ONE field 10 must also be specified. All other OTM fields, 4-8, 11-15, must not be specified.
17	Z-Router	Router2	String	IP Z-side router. Required.
18	Z-Router-IF	Se1/1	String	IP Z-side router interface. Required. • If “IF-” or “PORT-” is prefixed, an actual instance name is assumed. • If “IF-” or “PORT-” is not prefixed, ICIM_ObjectFactory::findInterface or ICIM_ObjectFactory::findPort locates the interface or port.
19	Circuit-Name	Node1-Node8/140 MB	String	If specified, all other OTM fields (3-16) are ignored. Must not be specified if other OTM fields (3-16) are populated. If not specified with “CRCT-“prefix, “CRCT-” prefix will be added.

Topology data format for WDM servers

Table 2 on page 16 describes the data file format which must be used to provide OTM-IP connection information to XD Manager for WDM servers.

Table 2 XD Topology file format for WDM servers

Field No.	Field Name	Sample Value	Type	Comments
1	Record Type	ADD	String	This field is not specified at all for a full import, only for an incremental import. Valid values are “ADD” or “DELETE”
1	A-Router	qa-Vpls2	String	IP A-side router. Required.
2	A-Router-IF	IF-qa-Vpls2/26	String	IP A-side router interface or switch port. Required. • If “IF-” or “PORT-” is prefixed, an actual instance name is assumed. • If “IF-” or “PORT-” is not prefixed, ICIM_ObjectFactory::findInterface or ICIM_ObjectFactory::findPort locates the interface or port.
3	A-ONE	Node1	String	A-side OpticalNetworkElement

Table 2 XD Topology file format for WDM servers (continued)

Field No.	Field Name	Sample Value	Type	Comments
4	A-ONE-Rack	1	Integer	Rack number of A-side OpticalNetworkElement
5	A-ONE-Shelf	1	Integer	Shelf number of A-side OpticalNetworkElement
6	A-ONE-Slot	1	Integer	Slot number of A-side OpticalNetworkElement
7	A-ONE-SubSlot	1	Integer	Subslot number of A-side OpticalNetworkElement. Optional.
8	A-ONE-PORT			A-side OpticalNetworkElement PhysicalTerminationPoint. This field is evaluated after A-ONE-CTP field 9.
		8	Integer	PTP number. Used when Rack, Shelf, and Slot are specified.
		PORT-Node1/2-2-7/OCN-IN-1	String	PTP instance name must start with “PTP-”. When specified, all other OTM fields 3-7, 9-14, 16 are ignored. Must be used with Z-ONE-PTP field 15.
		1-2-2-7-OCN-IN-1	String	PTP AID (Access Identifier) A-ONE field 3 and Z-ONE field 10 must also be specified. All other OTM fields, 4-7, 9, 11-14, 16, must not be specified.
9	NA	NA	NA	NA
10	Z-ONE	Node5	String	Z-side OpticalNetworkElement
11	Z-ONE-Rack	5	Integer	Rack number of Z-side OpticalNetworkElement
12	Z-ONE-Shelf	2	Integer	Shelf number of Z-side OpticalNetworkElement
13	Z-ONE-Slot	2	Integer	Slot number of Z-side OpticalNetworkElement
14	Z-ONE-SubSlot	OCN-IN-1	Integer	Subslot number of Z-side OpticalNetworkElement. Optional.

Table 2 XD Topology file format for WDM servers (continued)

Field No.	Field Name	Sample Value	Type	Comments
15	Z-ONE-PORT			A-side OpticalNetworkElement PhysicalTerminationPoint. This field is evaluated after Z-ONE-CTP field 16.
		8	Integer	PTP number. Used when Rack, Shelf, and Slot are specified.
		PORT-Node5/2-2-8/OCN-IN-1	String	PTP instance name must start with “PTP-”. When specifed, all other OTM fields 3-7, 9-14, 16 are ignored. Must be used with A-ONE-PTP field 8.
		5-2-2-8-OCN-IN-1	String	PTP AID (Access Identifier) A-ONE field 3 and Z-ONE field 10 must also be specified. All other OTM fields, 4-7, 9, 11-14, 16, must not be specified.
16	NA	NA	NA	NA
17	Z-Router	qa-Vpls5	String	IP Z-side router. Required.
18	Z-Router-IF	IF-qa-Vpls5/3	String	IP Z-side router interface. Required. • If “IF-” or “PORT-” is prefixed, an actual instance name is assumed. • If “IF-” or “PORT-” is not prefixed, ICIM_ObjectFactory::findInterface or ICIM_ObjectFactory::findPort locates the interface or port.
19	Circuit-Name	TestCircuit	String	If specified, all other OTM fields (3-16) are ignored. Must not be specified if other OTM fields (3-16) are populated. If not specified with “CRCT-“prefix, “CRCT-” prefix will be added.

Order of input evaluation

The OTM Circuit information in the topology data file, may be specified in several different formats. The formats are the following and are evaluated in the order listed:

1. Circuit-Name, field 19. If this is specified, fields 3 - 16 values are ignored.
2. CTP instance names – A-ONE-CTP, field 9 and Z-ONE-CTP, field 16, contain CTP instance names starting with a “CTP-” prefix. Fields 3-8, and 10-15 values are ignored.
3. PTP instance names – A-ONE-PTP, field 8 and Z-ONE-CTP, field 15, contain PTP instance names starting with a “PTP-” prefix. Fields 3-7, 9-14, and 16 values are ignored.
4. Rack, Shelf and Slot numbers – A-ONE-Rack, Shelf, Slot, fields 4-6, and Z-ONE-Rack, Shelf, and Slot, fields 11-13. (A-ONE-SubSlot and Z-ONE-SubSlot are optional.)
5. CTP AID – A-ONE-CTP, field 9, for AID string.
6. PTP AID – A-ONE-PTP, field 8, for AID string.

Mapping of data to topology instances

- It is assumed that the A-Router and Z-Router name specified in the data file exactly matches an object name in the topology. If it does not match an object in the topology, a search is executed with the information given. There is a performance cost for this search.
- If the A-Router-IF and Z-Router-IF fields begins with "IF-" or “PORT-” it is assumed that this is the actual instance name. For example, “IF-network:162.129.50.13:shlf-1:cdSt-1: card:dtrCdSt-3:dtrCd:port-15.” If the field does not begin with "IF-" or “PORT-”, the logic performs a search within IP to locate the related interface. There is a performance cost for this search.
- A-ONE and Z-ONE logic assumes that the data specified in the file exactly matches the instance name in OTM.
- For A-Router-IF and Z-Router-IF, it is expected that the interface or port specified is either a physical interface/port or an interface/port connected to a NetworkConnection or Cable with an underlying Optical Circuit.
- If the A-Router-IF and Z-Router-IF specified are physical, it is assumed that there is only one NetworkConnection or Cable between A-Router and Z-Router related to these physical interfaces or ports, unless connections are layered over each other. If NetworkConnections or Cables are LayeredOver each other, then the lowest level NetworkConnection or Cable will be used.
- If there are multiple layers of NetworkConnections or Cables between A-Router-IF and Z-Router-IF, it is assumed that the data will specify either the physical interface/port or the interface/port connected to the lowest (closest to the physical level) of NetworkConnection or Cable.
- If a Circuit name is not specified and CTP information is not specified, it is assumed that there is only one Circuit related to the PTP information (A-ONE-PTP and Z-ONE-PTP) provided.
- If A-ONE-PTP is specified, it is assumed that Z-ONE-PTP is also specified.
- If A-ONE-CTP is specified, it is assumed that Z-ONE-CTP is also specified.
- In WDM, the values in the following fields should belong to entity TransponderInOcnPort:
  - A-ONE-Rack, Z-ONE-Rack
  - A-ONE-Shelf, Z-ONE-Shelf
  - A-ONE-Slot, Z-ONE-Slot
  - A-ONE-SubSlot, Z-ONE-SubSlot
  - A-ONE-Port, Z-ONE-Port

Note: CTP references are not applicable for WDM. The sub-slot field need not be populated and can be left blank.

- In WDM-NG, if Y-cable is configured, the client circuit will have two redundant paths represented as two ClientTrail instances in the WDM-NG topology. If a circuit is not specified then the end points specified (PTP/CTP) should correspond to any one of the paths.

Data separators

The field separator between fields is "|". It is used in the following notes and examples. The field separator is specified in the command line invoking the XD Adapter.

If there is no value for a given field, "||" (2 bars with no space between them) must be specified in the record.

If the last field, Circuit-Name, is not specified, the record must include a trailing "|".

There should not be any new line characters within the data fields.

The "|" character should not be present in the data within the fields.

Examples

Circuit-Name is specified. Fields 3 - 16 are ignored.

1. Most ONE fields are specified, but the values will be ignored

```
Router1|Se1|ONE1|1|1|7||3|1|ONE2|1|1|4||1|1|Router2|Se1|Circuit1
```

2. None of the ONE fields are specified.

```
Router1|Se1||||||||||||||Router2|Se1|Circuit1
```

CTP Instance Names are specified in fields 9 and 16. All other OTM related fields (fields 3-8, 10-15) are ignored.

3. Most other ONE fields are specified, but the values, will be ignored.

```
Router1|Se1|ONE1|1|1|7||3|CTP-ONE1/1-1-7-3/1|ONE2|1|1|4||1|
CTP-ONE2/1-1-4-1/1|Router2|Se1|
```

4. Only the CTP fields are specified.

```
Router1|Se1|||||||CTP-ONE1/1-1-7-3/1|||||||CTP-ONE2/1-1-4-1/1|
Router2|Se1|
```

PTP Instance Names are specified in fields 8 and 15. All other OTM related fields (fields 3-7, 9-14, 16) are ignored.

5. Most ONE fields are specified, but the values besides PTP will be ignored.

```
Router1|Se1|ONE1|1|1|7||PTP-ONE1/1-1-7-3||ONE2|1|1|4||PTP-ONE2/
1-1-4-1||Router2|Se1|
```

6. Only the PTP fields are specified.

```
Router1|Se1||||||PTP-ONE1/1-1-7-3|||||||PTP-ONE2/1-1-4-1||Router2|S
e1|
```

Rack, Shelf, Slot are specifed. The A-ONE and Z-ONE data is broken into components to find the PTP or CTP endpoints related to a circuit.

7. All ONE fields are specified.

```
Router1|Se1|ONE1|1|1|7|1|3|1|ONE2|1|1|4|1|1|1|Router2|Se1|
```

8. All ONE fields except the subslot fields are specified.

```
Router1|Se1|ONE1|1|1|7||3|1|ONE2|1|1|4||1|1|Router2|Se1|
```

9. All ONE fields except the CTP fields are specified.

```
Router1|Se1|ONE1|1|1|7|1|3||ONE2|1|1|4|1|1||Router2|Se1|
```

10. All ONE fields except the subslot and CTP fields are specified.

```
Router1|Se1|ONE1|1|1|7||3||ONE2|1|1|4||1||Router2|Se1|
```

CTP AIDs are specified.

11. The A-ONE-CTP and Z-ONE-CTP fields contain AIDs used to locate CTPs. A-ONE and Z-ONE fields (fields 3, 10) must also be specified. All other ONE fields must not be specified (fields 4-8, 11-15).

```
Router1|Se1|ONE1||||||1-1-7-3/1|ONE2||||||1-1-4-1/1|Router2|Se1|
```

PTP AIDs are specified.

12. The A-ONE-PTP and Z-ONE-PTP fields contain AIDs used to locate PTPs. The A-ONE and Z-ONE fields (fields 3,10) must also be specified. All other ONE fields must not be specified (fields 4-7, 9, 11-14, 16)

```
Router1|Se1|ONE1|||||1-1-7-3||ONE2|||||1-1-4-1||Router2|Se1|
```

Full and incremental topology import

The topology adapter allows for both full and incremental topology processing. The topology data file processed by the adapter must either be:

- A full topology data file, where the Record Type field is not included. In this case, the extra separator character must not be included.

  All existing topology in XD Manager for OTM to IP is assumed to be outdated. It will be replaced by the set of entries in the current data file. Any entry in the old topology not specified in the current data file will be deleted.

- An incremental topology data file, where all of the records have a Record Type field specifying either "ADD" or "DELETE".

  Only the connections specifically listed in topology file updated. For any given connection the file can contain, either one ADD, one DELETE, or a DELETE and an ADD record. There should never be multiple ADDs or DELETEs in a single data file related to the same connection. To modify a record there must be a DELETE record to delete the existing record, then an ADD record to add the modified version of the record.

Interface Lookup Script

To allow more flexibility in matching the customer's IP interface data to actual IP topology, the XD Topology Adapter provides for an interface lookup script. This is an ASL script to allow a customer or professional services to develop custom rules for locating interface objects by, for example, looking up an interface based on the interface DisplayName.

This script is executed by adding the `-DAMHookScript=<script.asl>` parameter in the command invoking the adapter. The XD topology adapter passes a table to the IP interface lookup script, `<script.asl>`. The IP interface lookup script may put data back into the table to point to the matching interface. The table contains keys with the value ‹aRouter›|‹aRouterIf›|‹zRouter›|‹zRouterIf›. The script uses these values to find the actual interface instance in the IP topology. When this instance is found, new values are inserted into the table in the same format: ‹newARouter›|‹newARouterIf›|‹newZRouter›|‹newZRouterIf›.

The following example will show how the interface lookup script might work.

The customer's provisioning system data contains the interface DisplayName field instead of the instance name field. In this example, the customer's cross-domain data contains interface DisplayNames Se1.0 for router1 and Se2.0 for router2 while the actual interface instance names are IF-router1/2 and IF-router2/5. The standard, built-in XD Manager lookup tries to use the interface DisplayName data to match the interface instance name in the topology. When the match is not found, the corresponding record is not processed.

Alternatively, the `-DAMHookScript=rules/icxd-ao/otm-ip-if-hook.asl` parameter is used to invoke the interface lookup script. The existing sample `otm-ip-if-hook.asl` script, provides a complete example for lookup based on matching the DisplayName field of interfaces on the specified Router (or Switch). Simple modifications may be made to this script to change lookup to a different field in an interface. Use sm_edit to edit the `otm-ip-if-hook.asl` file. (For information on using the sm_edit utility, see Appendix B, "Understanding the sm_edit Utility,")

The FIND_ROUTER_IF rule looks like this:

```
// Sample find logic to match the interface by the interface
// display name.
FIND_ROUTER_IF(router_name, if_name) do {
  router_obj=object();
  router_obj=object(router_name)?IGNORE;
  if (router_obj->isNull()) {

   router_obj=object_factory->findComputerSystem(router_name)?IGNORE;
  }
  if (!router_obj->isNull()) {
     foreach interface (router_obj->ComposedOf) {
        if_obj = object(interface);
        if (if_obj->isInstanceOf("ICIM_NetworkAdapter")) {
           disp_name = if_obj->DisplayName;
           logDebug("Checking if: ".if_name." ".disp_name);
           if (if_name == disp_name) {
              logDebug("Found if: ".if_name." ".disp_name);
              return if_obj;
           }
        }
     }
  }
  return object();
}
```

The script iterates through all interface instances in router1 to look for an interface with the DisplayName of Se1.0 and through all interface instances in router2 to look for an interface with the DisplayName of Se2.0. Once these are found, the lookup script table is updated to indicate that the Se1.0 interface is actually named IF-router1/2 and Se2.0 is actually named IF-router2/5. Then subsequent XD logic easily locates the correct interface and can process the XD entry.

The rule FIND_ROUTER_IF may be customized easily to change the logic to compare the data to the Description field of an interface instead, for example.

If you decide to create a new script instead of editing the existing one, the logic must follow the conventions of the sample, in that the script is passed a table with keys. The result table must be populated with the instance names of the interface objects, as explained above.

Invoking the topology adapter

To invoke the topology adapter:

```
?sm_adapter -s <xd_server_name>
--field-separator="|"
--output=otm-ip-topology-import.log
--file=<xd_data_file>
icxd-ao/otm-ip-topology-import.asl?
```

Note: ?indicates that this command must be typed as one line.

Or, to invoke the topology adapter with an interface lookup script:

```
?sm_adapter -s <xd_server_name>
--field-separator="|"
-DAMHookScript=icxd-ao/otm-ip-if-hook.asl
--output=otm-ip-topology-import.log
--file=<xd_data_file>
icxd-ao/otm-ip-topology-import.asl?
```

Note: ?indicates that this command must be typed as one line.

"Interface Lookup Script" on page 21 provides details about using the interface lookup script.

There will be some log messages related to this in the otm-ip-topology-import.log file, but most of the log messages related to XD Topology Adapter processing are written to the XD server log file.

Relationships in XD Manager

The following topology object and their relationships are created by XD topology processing based on the cross-domain data.

? ICXD_UnitaryComputerSystem
  - ConnectedVia NetworkConnection
  - ConnectedVia Cable
  - ComposedOf Card, NetworkAdapter

? NetworkConnection, Cable and TrunkCable (in the IP domain)
  - ConnectedTo Ports/IFs on Routers/Switches
  - LayeredOver Circuit
  - LayeredOver Cable

- ConnectedSystems - two Routers, Switches

? Cable (in the XD domain)

- ConnectedTo Port/IF on Router or Switch (not connected to ONE)
- LayeredOver DSTL
- Underlying NetworkConnection
- ConnectedSystems Router or Switch

? Card

- ComposedOf Card (for DaughterCard BaseCard)
- PartOf Router or Switch
- Realizes Port, IF (Physical only)

? NetworkAdapter (Port or Interface)

- ConnectedVia NetworkConnection
- ConnectedVia Cable
- RealizedBy Card
- PartOf Router or Switch
- Peer

? DropSideTopologicalLink or FiberLink

- Underlying Cable
- Underlying Circuit
- FiberLink PeerLink - to associate the In and Out FiberLinks together

? Circuit (HighOrder_Circuit, or ClientCircuit)

- Underlying NetworkConnection
- LayeredOver DSTL or FiberLink

Multiple domain servers

The EMC Smarts XD Manager for OTM to IP solution assumes that each XD Manager OTM to IP server will manage a unique subset of network connections. This means that if there are multiple servers, each will manage a unique set of NetworkConnections, Cables, or TrunkCables, layered over Circuits.

The XD Manager OTM to IP can manage a Circuit that has one end in a high-order SONET/SDH domain server and the other end in a low-order SONET/SDH domain.

Supported and unsupported NetworkConnections

In an IP network, two Routers are connected by a NetworkConnection, Cable or TrunkCable. The connection may be layered over an underlying set of OpticalNetworkElements (ONEs). Figure 4 on page 12 shows these relationships.

Supported NetworkConnection

In the IP Manager, the NetworkConnection may be connected to the Routers via Cards, Interfaces, and Sub-Interfaces. XD Manager OTM to IP supports several connection methods between the Router and NetworkConnection.

The following connections are supported.

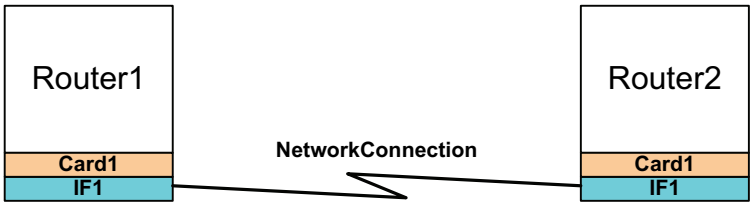

Figure 5 Interface to Interface connection

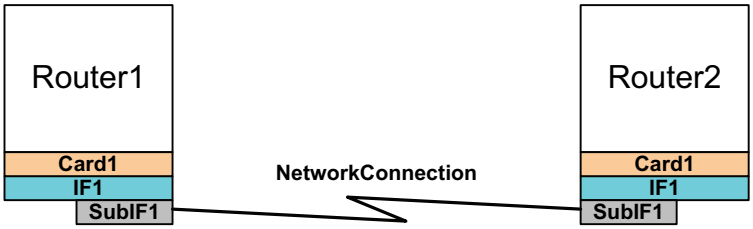

Figure 6 Sub-Interface1 to Sub-Interface1 connection

Additional levels of Sub-Interfaces are also supported.

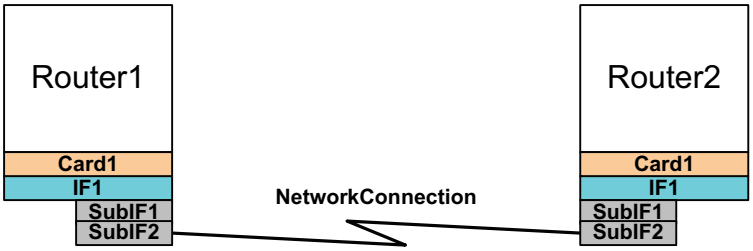

Figure 7 Sub-Interface2 to Sub-Interface2 connection

The connection in Figure 8 on page 26 is supported where the lowest level NetworkConnection, NetworkConnection1, shown in orange, is the only one managed by XD Manager OTM to IP. Compare with Figure 11 on page 27.

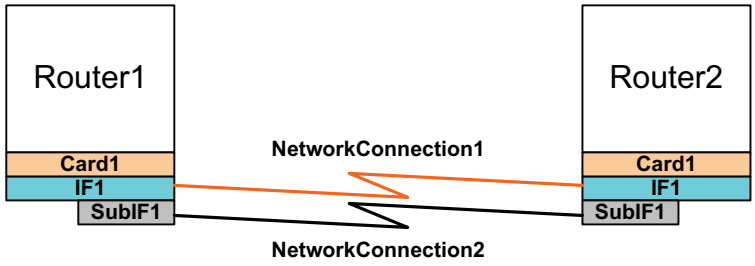

Figure 8 Lowest level connection only is supported with dual connections

In most cases there is symmetry in the devices used at either end of the NetworkConnection. But asymmetric connections like the example shown in Figure 9 on page 26 are also supported.

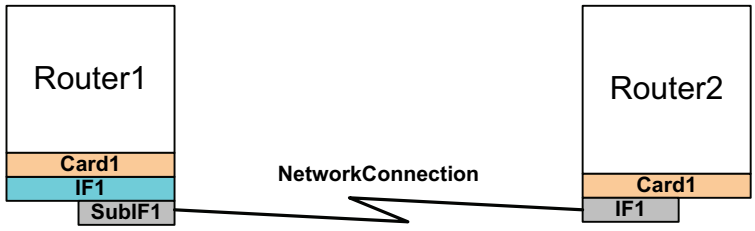

Figure 9 SubInterface to Interface asymmetric connection

The connection shown in Figure 10 on page 26 shows a Cable connecting the two switches via ports.

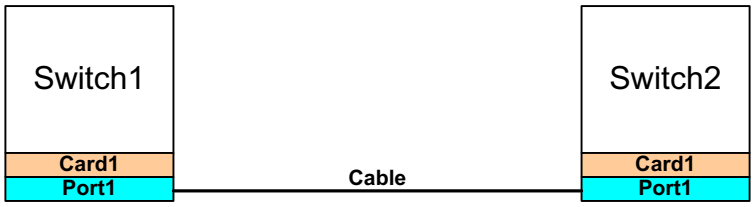

Figure 10 Cable connection

Unsupported NetworkConnections

The connection shown in Figure 11 is not supported if the NetworkConnection you want to manage, NetworkConnection2, shown in orange, is at a higher level (that is, at a higher logical level above the physical interface). NetworkConnection1 can be managed as shown in Figure 8 on page 26.

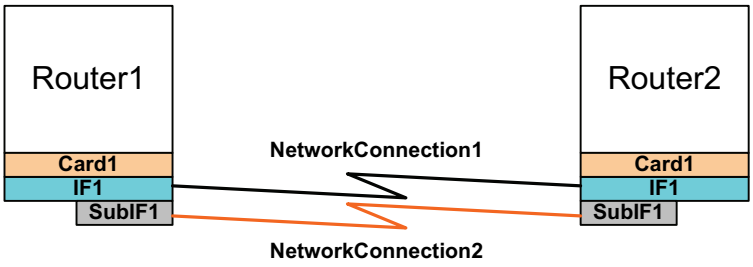

Figure 11 Higher-level connection not supported in dual connection

CHAPTER 3
Event Processing

This chapter describes how the XD Manager OTM to IP correlates notifications from both the Optical Transport Manager and the IP Manager to perform root-cause and impact analysis. It also describes scenarios that illustrate cross-domain correlation, in which the XD Manager OTM to IP correlates Layer 1 optical network failures to IP network connection failures.

? Event notification handling 30
? Cross-domain failure scenarios 32

Event notification handling

The analysis of the XD Manager OTM to IP product correlates the events from IP Manager and the events from Optical Transport Manager to determine the true root cause of the failure and notifies the failure in SAM.

For example, a failure in a Fiber in the Optical Network may result in Router Interfaces on either or both ends of the Routers connected to the Circuit being reported as Down. Within IP Manager, the analysis will indicate a failure in the NetworkConnection. Within one of Optical Transport Manager's domains, a FiberCut failure is notified to SAM. The XD Manager OTM to IP solution will correlate the fact that the NetworkConnection failure is caused by the FiberCut in the Optical circuit.

Red dotted lines in Figure 12 shows the path of alarms and notifications propagation among the components of XD Manager OTM to IP. These include the following:

- OTM Domain managers - Each consists of a pair of servers: Topology server and Analysis server. Topology servers collect elements and monitor their health. Analysis servers find root-causes and forward them to XD Manager OTM to IP and to Service Assurance Manager.
- IP discovers IP elements and monitors the IP domain. It forwards topology and notifications to XD Manager OTM to IP and SAM (Service Assurance Manager).
- SAM (Service Assurance Manager) - Collects the alarms and notifications from all OTM Analysis servers, XD Manager OTM to IP, andIP Manager. SAM provides end-to-end root cause and impact analysis and displays events on the Global Console.
- XD OTM-IP (XD Manager OTM to IP) - Contains overlapping elements from the Optical Transport Manager and IP Manager. It receives events, cross-correlate them, and forwards them to Service Assurance Manager.

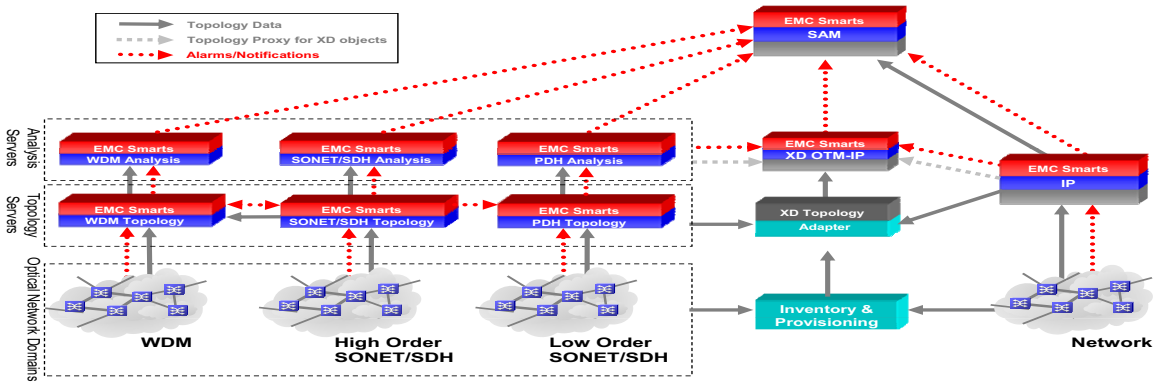

Figure 12 Optical Transport Manager architecture

OTM Domain managers

Each Domain Manager (except WDM-NG) consists of a pair of servers: OTM Topology server and OTM Analysis server. For WDM-NG, the Topology Server and the Analysis Server are combined into one server.

OTM Topology server

OTM Topology servers discover the elements of their respective domains. A portion of the discovered topology, necessary for cross-domain root-cause analysis, is passed to the associated OTM Analysis server.

Topology servers poll for the status of the Layer 1 and Layer 3 network elements in their respective domains.

Topology servers also interact with each other to share proxy objects of overlapping elements, copies of elements that are common to both domains.

Events are sent to the OTM Analysis server.

OTM Analysis server

OTM Analysis servers contain only the topological elements needed for root-cause analysis.

As events are sent from the OTM Topology server, the OTM Analysis server finds the root-cause and forwards the events to XD Manager OTM to IP and to Service Assurance Manager.

IP Manager

IP Manager discovers IP elements and protocols in the IP domain. Discovered elements can be used by the XD Topology Adapter to forward on to XD Manager OTM to IP.

IP Manager monitors the IP domain and forwards events to XD Manager OTM to IP and SAM (Service Assurance Manager).

Service Assurance Manager

The Global Manager, part of Service Assurance Manager (SAM), uses analysis information from the Optical Transport Managers (SONET/SDH, PDH, WDM, and WDM-NG Domain Managers) and the IP Managerto correlates and construct the final root-cause and impact analysis.

The Global Console displays alarms and notifications on its Notification Log screen when attached to the XD OTM-IP server.

When attached to one of the OTM Topology servers, the Global Console Topology Browser screen displays element of topology from IP or OTM servers.

XD Manager OTM to IP

Because its topology contains proxy objects of overlapping elements from Optical Transport Manager and IP Manager, XD Manager OTM to IP also receives events that effect these elements. Events are cross-correlated and forwarded to Service Assurance Manager.

The EMC Smarts XD Manager OTM to IP uses remote repository accessories to receive events from a Optical Transport Manager OTM Analysis server and the IP Manager. When events are received, these events are translated to set boolean attributes indicating the state of the device or connection. The following tables show events which are subscribed to and received by the XD Manager OTM to IP, and the corresponding attributes which are set as a result:

Table 3 Events imported into XD Manager OTM to IP from IP Manager

IP Device	Attribute set TRUE	Notification
Router Switch	IsDownInRemote	Down
	IsUnresponsiveInRemote	Unresponsive
Interface/Port	IsDownInRemote	Down
	IsLogicalDownInRemote	LogicalConnectionDown
Card	IsDownInRemote	Down
NetworkConnection Cable TruckCable	IsDownInRemote	Down

Table 4 Events imported into XD Manager OTM to IP from OTM SDH, PDH, WDM-NG

SDH Device	Attribute set TRUE	Notification
Circuit	IsServiceUnavailable	ServiceUnavailable
DropSideTopologicalLink	IsDownInRemote	Down

Table 5 Events imported into XD Manager OTM to IP from OTM WDM

WDM Device	Attribute set TRUE	Notification
Circuit	IsServiceUnavailable	ServiceUnavailable
FiberLink	IsLineDegraded	LineDegraded
	IsLineFailure	LineFailure

Note: In the XD model, LineFailure and LineDegraded are both treated as a failure of the FiberLink.

Cross-domain failure scenarios

To understand the cross-domain analysis, it is important to understand the analysis of the IP and OTM domains. In particular, in the IP domain there are several different possible analysis results as it relates to optical failures. The following are a set of cross domain analysis scenarios that are handled by the EMC Smarts XD Manager OTM to IP solution.

Note: These scenarios show one type of topology: two Routers, Interfaces, a Network Connection, SONET/SDH, and LO-SDH topology. The same scenarios also apply to Switches, Ports, a Cable, WDM, and WDM-NG topology.

Case 1 - Failure inside the optical network

This case covers a failure within the optical network (not on the edge of the optical network), such as Fiber cut, equipment (card) failure or port failure.

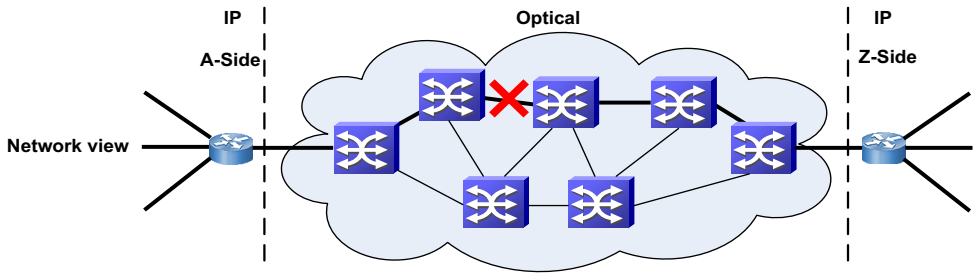

Figure 13 Case 1 - Failure inside the optical network

Depending on symptoms reported from the IP Manager, analysis may be:

- A-side or Z-side Router Down
- A-side or Z-side Router Interface Down
- IP NetworkConnection Down
- A-side or Z-side Router Interface LogicalConnectionDown

XD Manager OTM to IP analysis, in conjunction with Service Assurance Manager, is:

- Root cause: Fiber cut
- Impacts:
  - Circuit ServiceUnavailable and
  - IP Network Connection Down or
  - A-side or Z-side Router Down or
  - A-side or Z-side Router Interface Down

Case 2 – Failure on the edge of the optical network

This case covers a failure of Equipment or Port that connects to the edge IP Router.

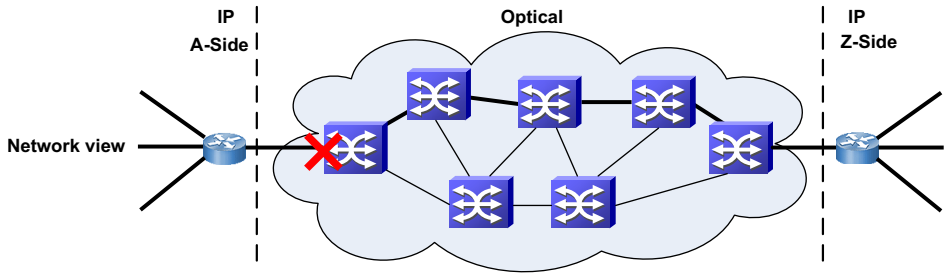

Figure 14 Case 2 – Failure on the edge of the optical network

Depending on symptoms reported from the IP Manager, analysis may be:

- A-side or Z-side Router Down
- A-side Router Interface Down
- IP NetworkConnection Down

XD Manager OTM to IP analysis, in conjunction with Service Assurance Manager, is:

- Root cause: Port or Equipment failure
- Impacts:
  - Circuit ServiceUnavailable and
  - IP Network Connection Down or
  - A-side or Z-side Router Down or
  - A-side Router Interface Down

Case 3 – Failure between the IP Router and the Optical network

This case covers a failure of a cable between an IP Router and the OpticalNetwork Element. This scenario also covers a failure in the Port or Interface in the IP Router. There is no distinguishing symptom between the IP Router Interface failure and a failure in the cable between the IP Router and the Optical Network Element.

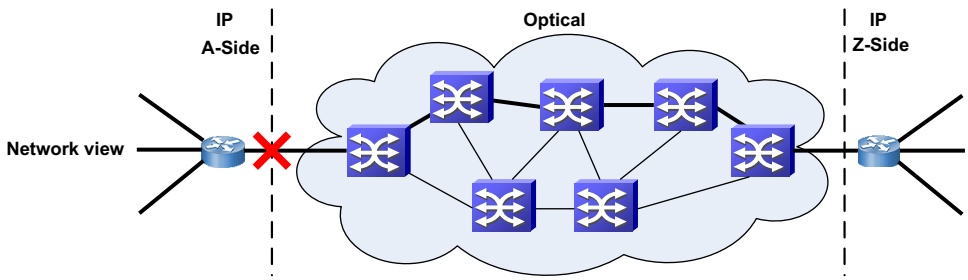

Figure 15 Case 3 – Failure between the IP Router and the Optical network

Depending on symptoms reported from the IP Manager, analysis may be:

- A-side or Z-side Router Down

- A-side Router Interface Down
- IP NetworkConnection Down

Optical Transport Manager analysis is:

- DropSideTopologicalLink Down (for SDH, PDH, and WDM-NG)
- FiberLink Down (for WDM)

XD Manager OTM to IP analysis, in conjunction with Service Assurance Manager, is:

- Root cause: Inter-Office Cable Down
- Impacts:
  - Circuit ServiceUnavailable and
  - IP Network Connection Down or
  - A-side or Z-side Router Down or
  - A-side Router Interface Down

Case 4 – Failure within the edge IP Router

This case covers a failure of a Card or Optical card on an edge IP Router.

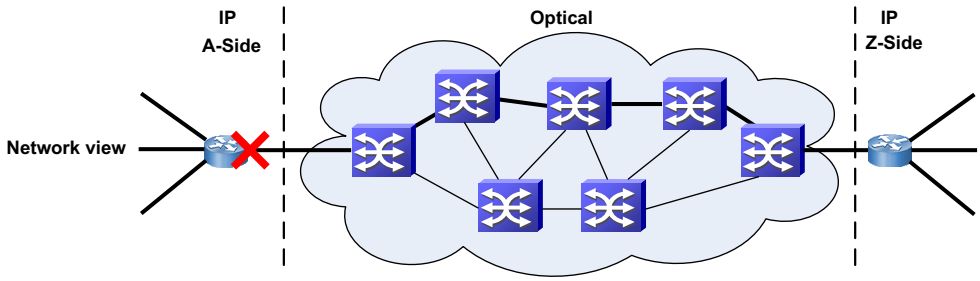

Figure 16 Case 4 – Failure within the edge IP Router

The IP Manageranalysis reports:

- Card or Optical Card on the IP Router Down

Optical Transport Manager analysis is:

- Circuit ServiceUnavailable and
- DropSideTopologicalLink Down (for SDH, PDH, or WDM-NG)
- FiberLink Down (for WDM)

XD Manager OTM to IP analysis, in conjunction with Service Assurance Manager, is:

- Root cause: IP edge Router Card or Optical card Down
- Impacts:
  - DropSideTopologicalLink Down (for SDH, PDH, WDM-NG)
  - FiberLink Down (for WDM)

- Circuit ServiceUnavailable

Case 5 – Failure of an edge IP Router

This case covers a failure of an edge IP Router.

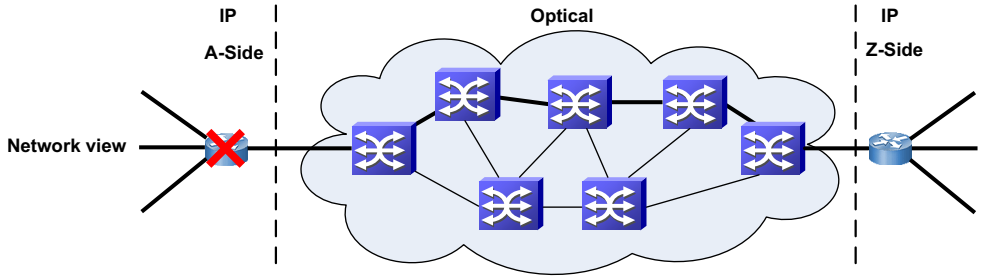

Figure 17 Case 5 – Failure on the edge IP Router

The IP Manager analysis reports:

? Router Down

Optical Transport Manager analysis is:

? Circuit ServiceUnavailable and

? DropSideTopologicalLink Down (for SDH, PDH, or WDM-NG)

? FiberLink Down (for WDM)

XD Manager OTM to IP analysis, in conjunction with Service Assurance Manager, is:

? Root cause: Router Down

? Impacts:

- Circuit ServiceUnavailable and
- DropSideTopologicalLink Down (for SDH, PDH, or WDM-NG)
- FiberLink Down (for WDM)

APPENDIX A
Configuration

This appendix provides instructions for configuring EMC Smarts XD Manager for OTM to IP for communication with the Optical Transport Manager and IP Manager servers which XD Manager for OTM to IP needs to get topology and events.

This appendix contains the follow sections:

- Prerequisites 38
- Starting the XD OTM to IP server manually 39
- Enabling the XD Manager OTM to IP in Service Assurance Manager 40
- Configuring the XD Manager OTM-to-IP AM 40
- Setting up two XD Manager for OTM to IP servers 42

Note: You must also configure the Global Manager component of the Service Assurance Manager for communication with the XD Manager for OTM to IP.

Prerequisites

Before you configure Global Manager for use with XD Manager for OTM to IP, the following components must be installed on appropriate hosts in your network:

- XD Manager for OTM to IP
- IP Manager
- Broker
- Global Console (optional, depending on your deployment)
- Global Manager

In addition, one or more server pairs of the Optical Transport Manager domain managers must be installed:

- Optical Transport Manager for SONET/SDH
  - Topology Server
  - Analysis Server
- Optical Transport Manager for PDH
  - Topology Server
  - Analysis Server
- Optical Transport Manager for WDM
  - Topology Server
  - Analysis Server
- Optical Transport Manager for WDM-NG
  - Topology Server and Analysis server are combined

Both Topology and Analysis servers must be installed, though the services can be started individually.

Server notes

- The XD Manager for OTM to IP does not need to be installed on the same host as the Optical Transport Manager.
- The XD Manager for OTM to IP, IP Manager, Service Assurance Manager, and Optical Transport Manager components must be registered with the same EMC Smarts Broker.
- XD Manager for OTM to IP must send its root cause events to a SAM Global Manager which also is receiving notifications from IP and OTM servers.
- A single installation of XD Manager for OTM to IP server can cross-correlate IP Manager with either WDM or WDM-NG or SONET/SDH and PDH. Cross-correlation of IP to WDM or WDM-NG must be managed on a separate XD Manager for OTM to IP.

Starting the XD OTM to IP server manually

If you did not install XD Manager OTM to IP as a service when you installed the EMC Smarts products suite, you may install the service manually. When installed as a service, it will start automatically upon system reboot; if not installed as a service you can issue a command to start and stop it as necessary.

EMC Corporation recommends that EMC Smarts products be installed as services whenever possible. Typical reasons to install products as services include the following conditions:

- During installation of the suite, you choose to start product components manually and now want to run the components as services.
- Multiple instances of a single product component running as a service are required. During installation, you can install only a single instance of a product component as a service.

To manually install a product as a service, use the sm_service install command with the appropriate set of options.

The *EMC Smarts System Administration Guide* provides a complete description of the command syntax.

Note: If you are running one instance of the OTM-XD server, the configuration file installed by default is for use with the OTM SONET servers (OTM-SDH / OTM-PDH). If the OTM-XD server is being configured for OTM-WDM to either run independent of the OTM-XD server or with the OTM SONET server, then a change in the configuration file is needed. When invoking the sm_service startup command, you must change the --config parameter. See "Setting up two XD Manager for OTM to IP servers" on page 42.)

```
? /opt/InCharge/otm/smarts/bin/sm_service install
  --force
  --unmanaged
  --name=OTM-IP-XD
  --startmode=runonce
  --description="EMC Smarts OTM IP XD Server"
  /opt/InCharge/otm/smarts/bin/sm_server
  --name=OTM-IP-XD
  --config=icxd-ao
  --port=0
  --subscribe=default
  --ignore-restore-errors
  --output ?
```

Note: ? indicates that this command must be typed as one line.

Enabling the XD Manager OTM to IP in Service Assurance Manager

Access the Global Manager Administration Console of the Service Assurance Manager to configure single or hierarchical SAM servers, IP servers, and OTM-XD for single or multiple servers. For complete information about the Global Manager Administration Console and Service Assurance configuration tasks, consult the *EMC Smarts Service Assurance Manager User Guide*.

Guidelines to configure OTM-XD with SAM

- If only a single SAM server is to be used, all the domains (the OTM-XD server, IP server, and OTM domains) involved with OTM-XD use can be connected to this SAM server.
- If multiple OTM-XD servers are to be used, a new domain server (for example, a server named OTM-IP-XD-WDM) for OTM-XD must be configured in SAM.
- If the SAM configuration is hierarchical, the following must be considered:
  - Both primary OTM-XD server (OTM-IP-XD) and the additional OTM-XD server (OTM-IP-XD-WDM) must connect to the presentation level SAM.
  - The SAM-OTM domain must be configured at the presentation level SAM.
  - The IP server can be configured to connect to a separate lower level SAM server that interfaces to the presentation level SAM.

Configuring the XD Manager OTM-to-IP AM

To support communications with the OTM and IP AM servers, the *domain.conf* file of the XD Manager OTM to IP must be edited.

Editing the domain.conf file

The *domain.conf* file is located in the BASEDIR/smarts/conf/icxd-ao directory. BASEDIR represents the installation directory for Optical Transport Manager.

To edit the configuration file, use the EMC Smarts sm_edit command. For information about sm_edit, see Appendix B, “Understanding the sm_edit Utility”.

Adding a domain to XD Manager OTM-to-IP AM

To configure XD Manager OTM to IP to communicate with the Optical Transport Manager servers and IP Manager servers, modify the existing domain server entries and comment out or delete the extra domain entries that do not apply to your configuration.

You must have one “InChargeDomain” entry for each server from which XD Manager OTM to IP will import topology or events.

1. From a command line, change to the BASEDIR/smarts/conf/icxd-ao directory.
2. Open *domain.conf* using **sm_edit**:

   ```
   # sm_edit domain.conf
   ```

   The file, when it first opens, looks like this:

   ```
   InChargeDomain::InChargeDomain_AM-1
   ```

```
{
Type = "AM"
DomainName = "AM-1"
}

InChargeDomain::InChargeDomain_OTM-SDH-TOPOLOGY
{
Type = "SDH-T"
DomainName = "OTM-SDH-TOPOLOGY"
}

InChargeDomain::InChargeDomain_OTM-SDH-ANALYSIS
{
Type = "SDH-A"
DomainName = "OTM-SDH-ANALYSIS"
}

InChargeDomain::InChargeDomain_OTM-PDH-TOPOLOGY
{
Type = "LOSDH-T"
DomainName = "OTM-PDH-TOPOLOGY"
}

InChargeDomain::InChargeDomain_OTM-PDH-ANALYSIS
{
Type = "LOSDH-A"
DomainName = "OTM-PDH-ANALYSIS"
}

InChargeDomain::InChargeDomain_OTM-WDM-TOPOLOGY
{
Type = "WDM-T"
DomainName = "OTM-WDM-TOPOLOGY"
}

InChargeDomain::InChargeDomain_OTM-WDM-ANALYSIS
{
Type = "WDM-A"
DomainName = "OTM-WDM-ANALYSIS"
}

InChargeDomain::InChargeDomain_OTM-WDM-NG {
    Type = "WDM-NG"
    DomainName = "OTM-WDM-NG"
}
```

3. Modify the object name, the name following InChargeDomain::, to the name of your IP Manager server. For example, change “InChargeDomain_AM-1” to “IP_Domain_East-1”.

   Note: Do not modify the parent part of the object name, that is, the “InChargeDomain::” part should remain as is.

4. Modify the AM DomainName for the IP AM server to a name appropriate to your system. This is the name of the IP AM server that the SAM Global Console will connect to.

5. Modify the DomainName of the OTM servers, for example "OTM-SDH-TOPOLOGY", to a name appropriate to your system. This is the name that the SAM Global Console will connect to.

When specifying OTM domains (except WDM-NG)**, both the analysis and topology/monitoring server for a given domain must be specified. For example, both OTM-SDH-TOPOLOGY, and OTM-SDH-ANALYSIS must be listed in domain.conf.**

6. Domain Type must be set as appropriate to match the 'ElementTypeGlob' specifications for the DXA import drivers defined in topo-driver.conf. The Type field should be one of the following:
   - “AM” for the IP Availability Manager server
   - “WDM-T” for the Optical Transport Manager WDM Topology server
   - “WDM-A” for the Optical Transport Manager WDM Analysis server
   - "LOSDH-T" for the Optical Transport Manager PDH Topology server
   - "LOSDH-A" for the Optical Transport Manager PDH Analysis server
   - “SDH-T” for the Optical Transport Manager SONET/SDH Topology server
   - "SDH-A" for the Optical Transport Manager SONET/SDH Analysis server
   - “WDM-NG” for the Optical Transport Manager WDM-NG combined server.

A given XD Manager for OTM to IP server can cross-correlate IP Manager with either SONET/SDH servers (low-order or high-order), WDM, or WDM-NG servers but not both. Low-order SONET/SDH (PDH) and high-order SONET/SDH servers are compatible with each other connecting to a single XD Manager for OTM to IP server.

7. Comment out or delete any domains which are not being used in your configuration.
8. Save and exit the *domain.conf* file. The modified version of the file is saved to the *BASEDIR/smarts/local/conf/icxd-ao* directory in the XD Manager OTM to IP installation area.

Setting up two XD Manager for OTM to IP servers

In order to set up two XD Manager OTM-to-IP AM servers, one for SDH/PDH and one for WDM, under the same OTM installation, follow the configuration procedures below. You will need to do this to have a single installation run two instances, one for SDH/PDH and one for WDM.

1. In the $BASEDIR/OTM/smarts/conf directory, create a icxd-ao-wdm sub-directory:

   ```
   mkdir icxd-ao-wdm
   ```

2. Copy all files under $BASEDIR/OTM/smarts/conf/icxd-ao to the new directory using the -p option to preserve rights and the -r option to include subdirectories.

   ```
   cp –pr icxd-ao/* icxd-ao-wdm
   ```

3. Repeat the above ‘cp –pr’ step to create a icxd-ao-wdm sub-directory in BASEDIR*/OTM/smarts/local/conf* as needed.
4. Configure cross-domain connections between IP and OTM SDH servers. Open *$BASEDIR/OTM/smarts/conf/icxd-ao/domain.conf* using **sm_edit**.

   ```
   sm_edit $BASEDIR/OTM/smarts/conf/icxd-ao/domain.conf
   ```

AM-1 represents the IP server. You can modify the AM-1 entry with the IP server name appropriate to your system

Comment out OTM-WDM-TOPOLOGY , OTM-WDM-ANALYSIS servers.

Save and close the file.

5. Configure cross-domain connections between IP and OTM WDM servers. Open *$BASEDIR/OTM/smarts/conf/**icxd-ao-wdm**/domain.conf* using **sm_edit**:

   ```
   sm_edit $BASEDIR/OTM/smarts/conf/icxd-ao-wdm/domain.conf
   ```

   AM-1 represents the IP server. You can modify the AM-1 entry with the IP server name appropriate to your system.

   Comment out OTM-SDH-TOPOLOGY, OTM-SDH-ANALYSIS, OTM-PDH-TOPOLOGY, and OTM-PDH-ANALYSIS entries.

   Save and close the file.

6. Configure the cross domain *icxd-ao-wdm/bootstrap.conf* file:

   ```
   sm_edit $BASEDIR/OTM/smarts/conf/icxd-ao-wdm/bootstrap.conf
   ```

   Change

   ```
   fileName = "$SM_SITEMOD/conf/icxd-ao/domain.conf
   ```

   to

   ```
   fileName = "$SM_SITEMOD/conf/icxd-ao-wdm/domain.conf
   ```

   Save and close the file.

Note: The above configuration procedures are general guidelines. Please contact EMC Support if further customizedconfiguration is needed.

Note: When invoking the sm_service startup command (as described in "Starting the XD OTM to IP server manually" on page 39) with different XD servers, you must change the `--`config=icxd-ao parameter to the name of the sub-directory containing the appropriate domain.conf file. In this case, "icxd-ao-wdm."

APPENDIX B
Understanding the sm_edit Utility

As part of the EMC Smarts deployment and configuration process, you need to modify certain files. User modifiable files include configuration files, rule set files, templates, and seed files that contain encrypted passwords. Original versions of these files are installed into appropriate subdirectories under the BASEDIR/smarts/ directory.

The original versions of files should not be altered. If a file must be modified, a new version should be created and then stored as a local copy of the file in BASEDIR/smarts/local or one of its subdirectories.

When EMC Smarts software requires one of these files, it is designed to first search for a modified file in BASEDIR/smarts/local or one of its subdirectories. If a modified version of a file is not found in the local area, EMC Smarts software then searches corresponding BASEDIR/smarts directories for the original version of the file.

To ease file editing and storage, EMC Corporation provides the sm_edit utility with every EMC Smarts product suite. When invoked, sm_edit opens the specified file in a text editor. This utility ensures that modified files are always saved to the appropriate local area and that non-local copies of all files remain unchanged. If an appropriate subdirectory does not exist for the file you are modifying, sm_edit creates the appropriate subdirectory before saving the modified file to that location. For files with header information set for encryption, sm_edit encrypts certain fields in the file. In addition, sm_edit preserves the file permissions of modified files, which helps ensure that important configuration files are not altered by unauthorized users.

Example **Modify ics.conf**

To use sm_edit from the command line, specify the file name and include the subdirectory under /local where the file resides. For example, to edit the ics.conf, enter:

```
# BASEDIR/smarts/bin> sm_edit conf/ics/ics.conf
```

In this example, sm_edit searches in the BASEDIR/smarts/local/conf/ics directory for the ics.conf file. If it finds the ics.conf file, it opens the file in a text editor. If sm_edit does not find the ics.conf file in the BASEDIR/smarts/local/conf/ics directory, it creates a local copy of the ics.conf file and writes it to the BASEDIR/smarts/local/conf/ics directory.

The *EMC Smarts System Administration Guide* provides additional information about the sm_edit utility, including how to configure the utility to use a specific editor.

INDEX

A
Adapters, multiple 9
Analysis server 31
Architecture 8

B
Broker 38

C
Configure, Global Manager 38
Configuring, ics.conf 37
Cross-domain analysis 32
Cross-domain architecture 8
Cross-domain event analysis 9

D
Domain manager 30, 38
Domain servers, multiple 24

E
Event notification 30
Events imported 32
Example 9

F
Failure, between IP Router and Optical network 34
Failure, Card or Optical card on an edge 35
Failure, edge of network 34
Failure, IP edge router 36
Failure, within optical network 33
Failures
    Layer 1 6
    Layer 3 7

G
Global Manager 31, 38

I
ics.conf File 37
Impact analysis 29
Imported events 32
IP Manager 31

O
Object relationships 23
Overview, cross-domain 6

R
Relationship, among objects 23
Root cause events 38
Root-cause analysis 29

S
Service Assurance Manager 31
sm_edit 45

T
Topology adapter 13
Topology server 31
Topology, imported 12