

Monitoring and Fault Correlation for Optical and IP Networks

Smarts OTM for
Optical Networks



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Value of Smarts



Automated Actionable Intelligence

- Pinpoint service-affecting problems in real time
- Quantify impact to prioritize action
- Model and update automatically to adapt to infrastructure changes

Cross-Domain Correlation

Correlate information, applications, infrastructure, virtual and business services across management silos

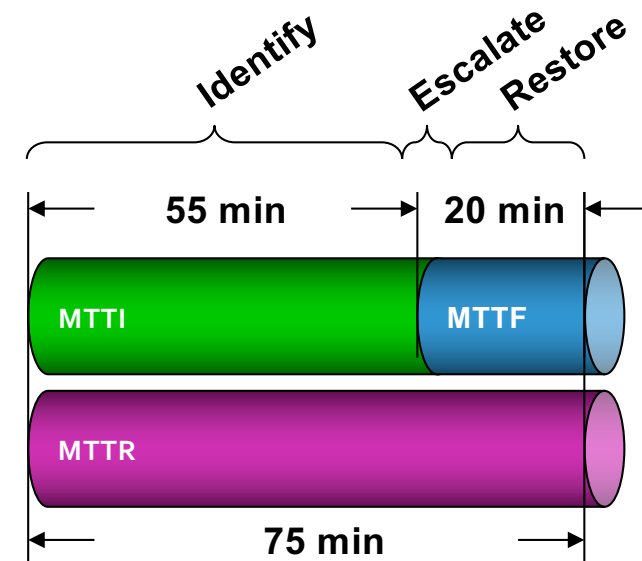
Business-Impact Analysis

Understand exactly how IT problems affect services and customers

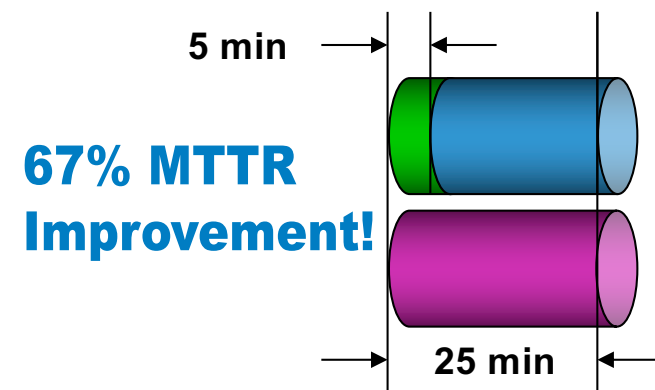
Value of Automated Root Cause Analysis



- 75% of the time to resolve a service affecting failure can be attributed to finding the source
- Accelerate resolution
 - Lower operational costs
- Terminology
 - MTI = Mean Time to Identify – the time to identify the cause of the incident
 - MTTF = Mean Time to Fix – the time to actually restore service once the cause is isolated
 - MTTR = Mean Time to Resolution



The Impact of Automated Analysis



Smarts



Discovery, monitoring and analysis of the infrastructure

Correlation

Uses model and Codebook to correlate events for all technologies

Topology

ECIM: EMC
Common Information
Model

1 ECIM Library

Service Subscriber

Hosted Application

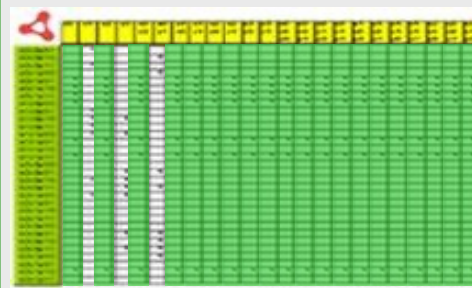
Switch

Server

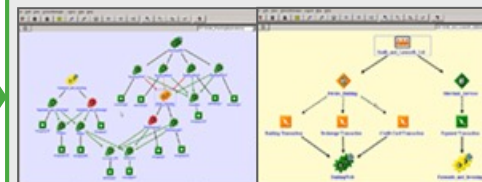
Router

Service Offering

4 Codebook Correlation

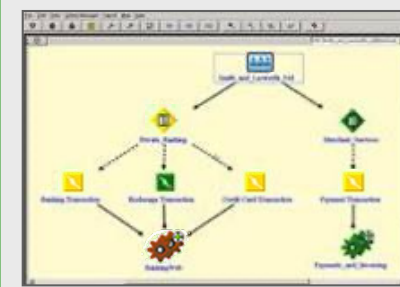


6 Root Cause



Business Impact

3 ECIM



2 Discovery

5 Event Collection

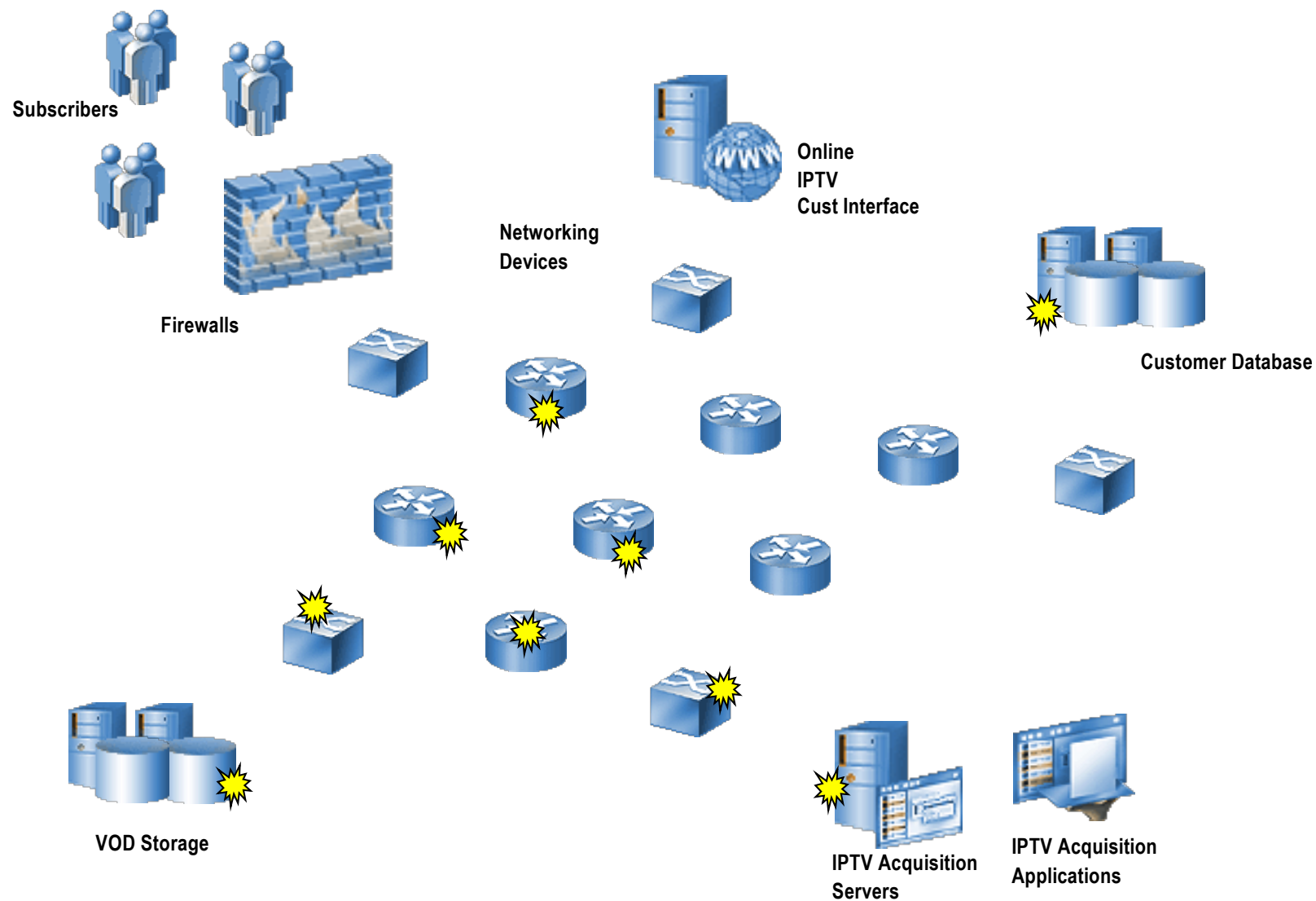
Collection

Discovery, mediation,
polling

Storage • Applications • Network • Virtualization • Server • Third-party • Security • Clouds



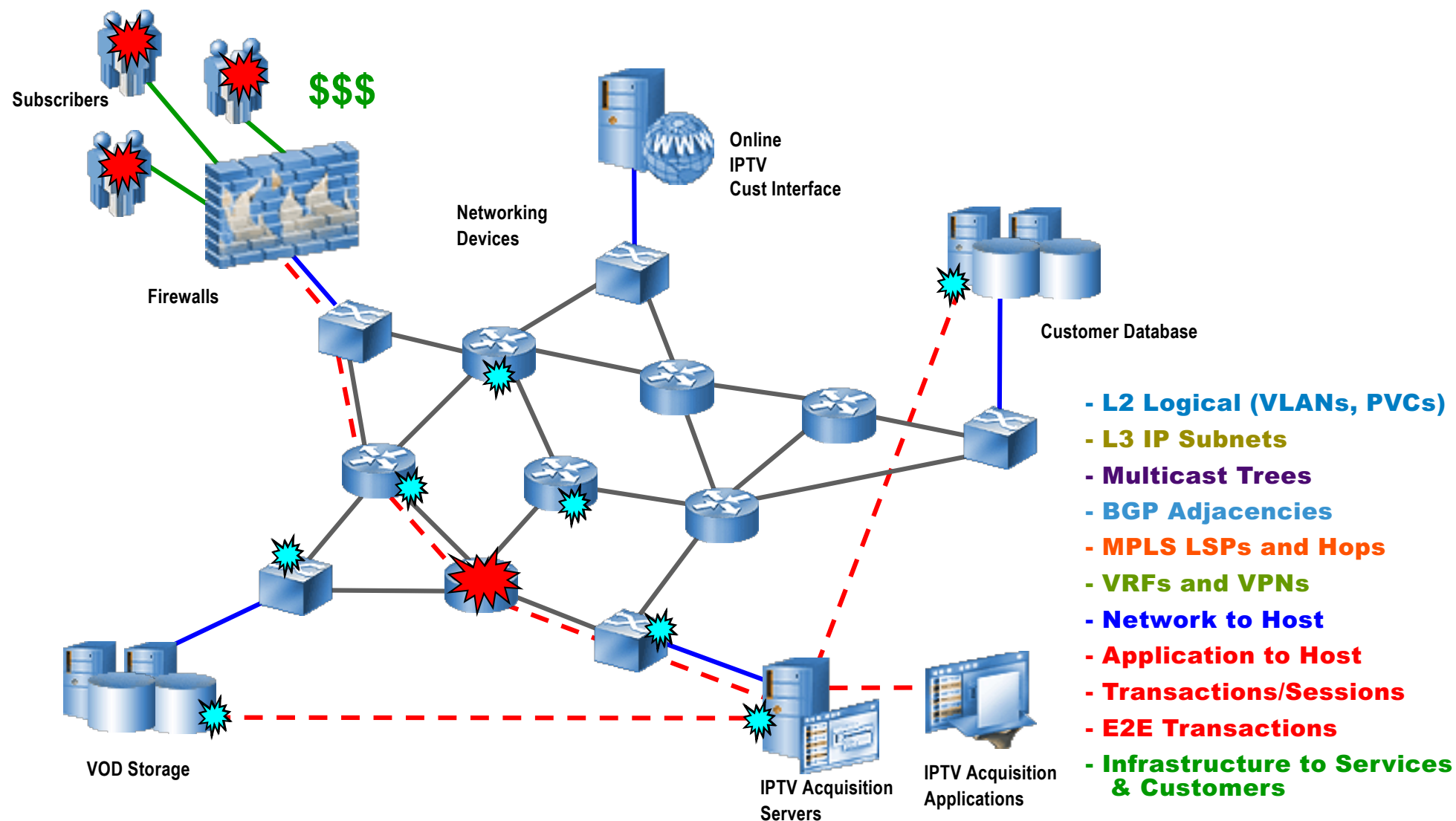
Smarts Topology Based Correlation





Smarts Topology Based Correlation

Multi-Layered Relationships



Results of Root Cause analysis



Notification Log Console

File Edit View Global Manager Event Log Help

SMARTS

- ApplicationService
- Cable
- ExternalDomain
- HierarchicalGroupManager
- Host
- InChargeDomain
- IPNetwork
- NetworkConnection
- Partition
- Router
- ServiceOffering
 - Institutional Investment
 - ConsistsOf
 - ApplicationService
 - Capital Markets
 - Subscribers
 - ServiceSubscriber
 - ACME Investment Group
 - Belarc-Smith Investors
 - RiteMon Financial Svcs
 - Merchant Services**
 - ConsistsOf
 - ApplicationService
 - Payments & Invoicing
 - Subscribers
 - ServiceSubscriber
 - Regis Industries
 - Smith & Lasworth Ltd
 - Private Banking
 - ConsistsOf
 - ApplicationService
 - Wealth Management
 - Subscribers
 - ServiceSubscriber
 - Mr Michael McAfee
 - Sir Osgood Marshall
 - Smith & Lasworth Ltd
 - ServiceSubscriber
 - Switch

Authentic Problems Default

Root Cause Problems

Ack...	Ticket ID	Class	Element Name	Event	Owner	Extension	Impact	Count	Last Notify
No	3207	Cable	LINK-IF-ercar...	Down	JMURPHY	BP 631-7609	70	2	25 Apr 14:50:09
Yes	3211	Host	ercpsvsyr3	Degraded	PJOHNSON	BP 703-4872	0	1	25 Apr 17:51:50

Customer Impacts Default

Business Impact Priorities

Acknowledged	Ticket ID	Name	Event	Service Manager	Extension	Last Notify
Yes	HD1839	Regis Industries	Impacted	Anne Klein	x7203	25 Apr 13:54:13
Yes	HD1837	Mr Michael McAfee	Impacted	David Weiss	x7311	25 Apr 13:52:04
No		Sir Osgood Marshall	Impacted	David Weiss	x7311	25 Apr 13:52:29
No	HD1845	Smith & Lasworth Ltd	Impacted	Dawn Jarrett	x7495	25 Apr 13:52:42

Service Impacts Default

Identify Affected Services

Acknowledged	Name	Event	Service Manager	Extension	Affected Customers	Last Notify
Yes	Merchant Services	Impacted	Sarah Jacobs	x7072	2	25 Apr 13:55:33
No	Private Banking	Impacted	John Miller	x7317	3	25 Apr 13:55:19

Events Default

Captured Symptoms

Acknowledged	Source	Class	Name	Event	Count	Last Notify
No	Concord	ApplicationService	Banks	Unavailable	1	25 Apr 14:02:39
No	Concord	ApplicationService	WMgmt	Degraded	1	25 Apr 13:56:03
No	Concord	ApplicationService	Banks	AtRisk	1	25 Apr 16:43:52
No	Concord	ApplicationService	PayInv	Degraded	1	25 Apr 13:56:19
No	Concord	ApplicationService	Banking3	Degraded	1	25 Apr 17:12:07
No	AM	Host	ercpsvsyr	Unresponsive	1	25 Apr 15:05:59
No	AM	Host	ercpsvsyr3	Unresponsive	1	25 Apr 17:04:46
No	AM	Host	ercpsvsyr2	Unresponsive	1	25 Apr 17:04:38
No	AM	Switch	ercaswsyr	Unresponsive	1	25 Apr 15:05:26

smarts Ready

Saved on: SMARTS, user: admin, as: brochure

Centralized Service Assurance Management

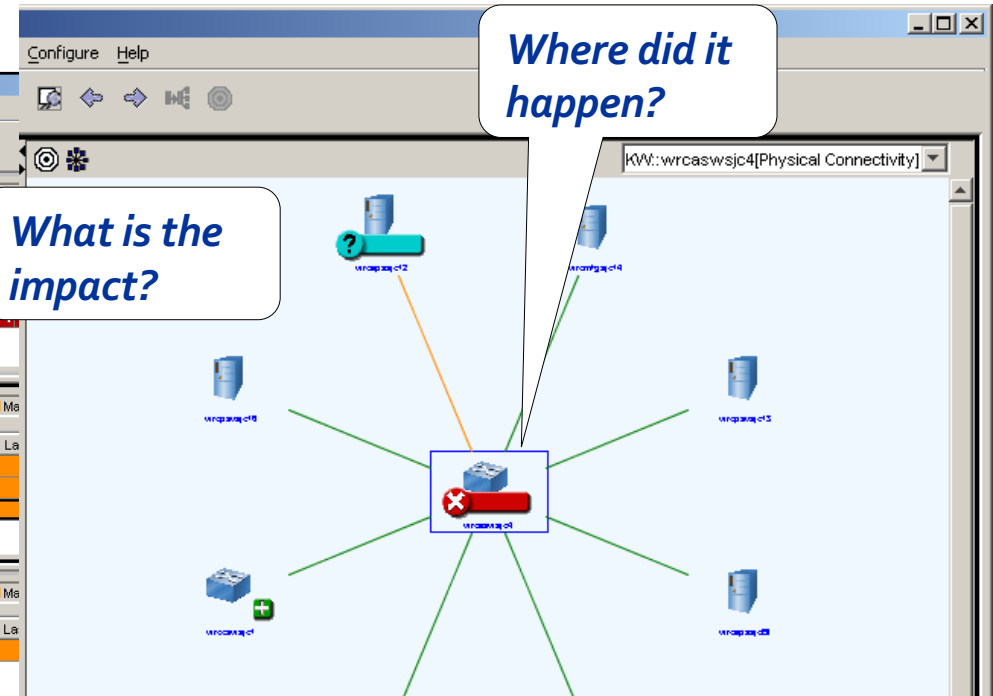


Single Focal Point for Monitoring, Analysis and Control

What happened?

Ac...	Ticket ID	Class	Name	Source	Event	Im...	Owner	Phone N...	C
No		Card	CARD-wrcaswsjc4/4	WestRegion	Down	1319			
No		Application	BankingApp/1	ASM	Down	1317			
No		Application	Payments_and_Invoicing/1	ASM	Down	3			
No		Session	KW->PMPoller	ASM	Down	1			

Where did it happen?



What is the impact?

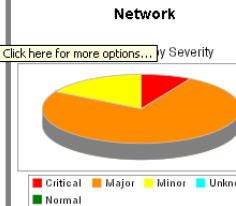
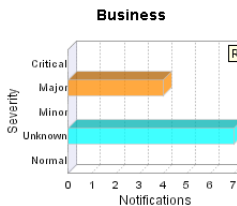
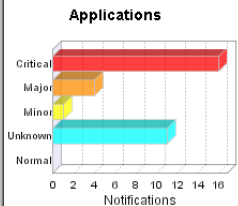
Ac...	Ticket ID	Name	Event	Account Rep	Phone Number	Est Repair Time	La
No		Mr_Michael_McAff...	Impacted	Phil Wiseman	x7311	25 Jan 12:12:54	
No		Sir_Osgood_Marsh...	Impacted	Phil Wiseman	x7311	25 Jan 12:12:54	
No		Smith_and_Laswor...	Impacted	Dawn Jarrett	x7495	25 Jan 12:12:54	

Why does it matter?

Ac...	Ticket ID	Name	Event	Account Rep	Phone Number	Est Repair Time	La
No		Mr_Michael_McAff...	Impacted	Phil Wiseman	x7311	25 Jan 12:12:54	
No		Sir_Osgood_Marsh...	Impacted	Phil Wiseman	x7311	25 Jan 12:12:54	
No		Smith_and_Laswor...	Impacted	Dawn Jarrett	x7495	25 Jan 12:12:54	

Acknowledged	Element Class	Class	Name	Event	Count	Est Repair Time	La
No	Session	Session	KW->PMPoller	Disconnected	1	25 Jan 12:13:51	
No	Application	Application	BankingWeb/1	Impacted	1	25 Jan 12:12:57	
No	Transaction	Transaction	BankingWeb/1...	TimedOut	1	25 Jan 12:12:52	
No							

InCharge Notification Summary							
File	Edit	View	InCharge Manager	Configure	Summary	Help	



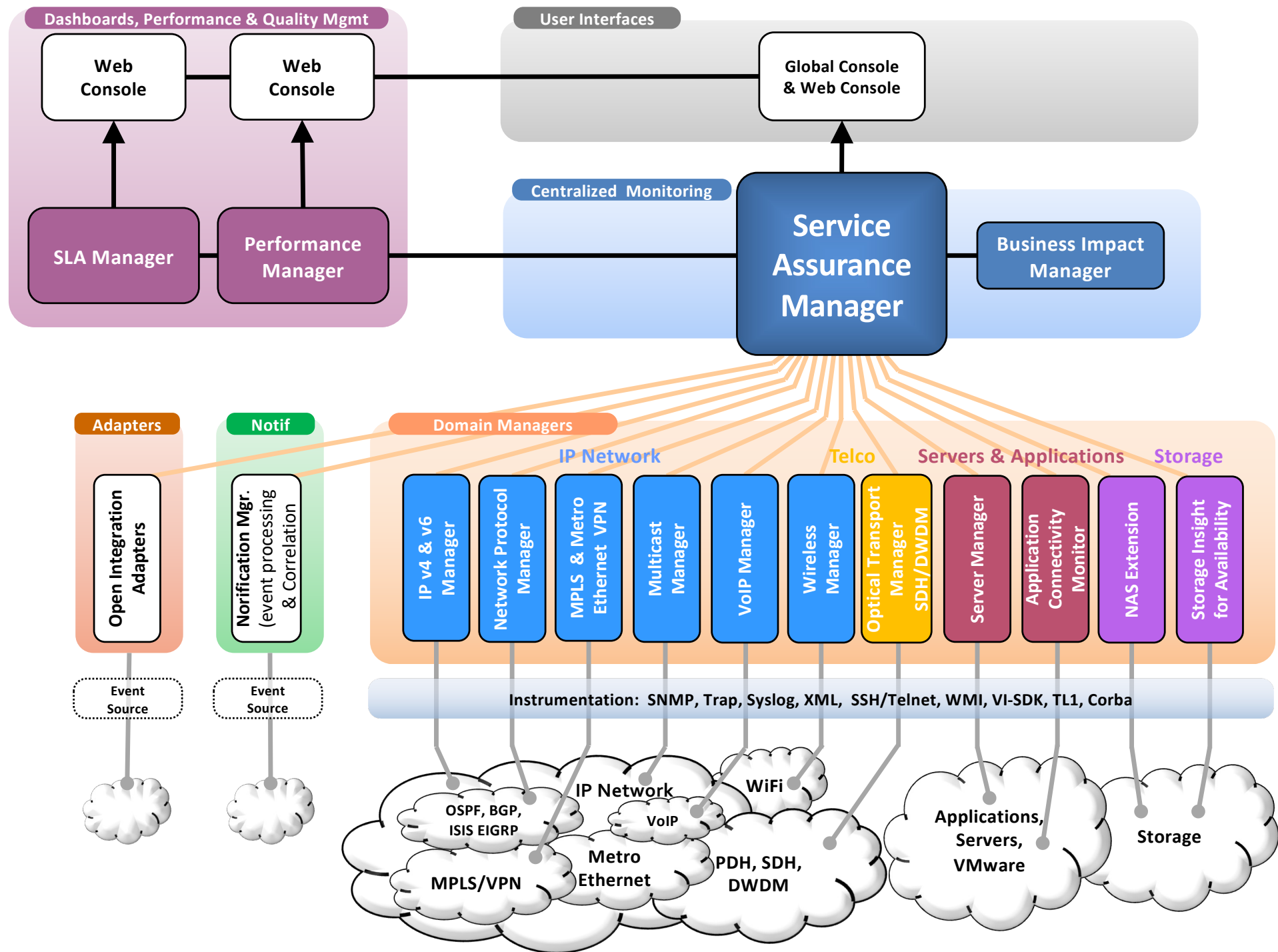
What else does it affect

Notification Properties			
Notification : Card Down [100% 27 Jan 07:54:47]			
Name : CARD-wrcaswsjc4/4			
General	Audit Log	Impact	Codebook: WestRegion Details
transaction	Class	Name	Impact
ServiceSubscriber	ServiceSubscriber	Sir_Osgood_Marshall	Impacted
ServiceSubscriber	ServiceSubscriber	Mr_Michael_McAffee	Impacted
ServiceSubscriber	ServiceSubscriber	Smith_and_Lasworth_Ltd	Impacted
ServiceOffering	ServiceOffering	Private_Banking	Impacted
Host	Host	wrcaswsjc12	Impacted
Cable	Cable	IF-wrcaswsjc12/1 (lan0 Sun 10/100Base-T)	Impacted
ApplicationCluster	ApplicationCluster	Estate_Planning	Impacted
ApplicationCluster	ApplicationCluster	BankingWeb	Impacted
ApplicationCluster	ApplicationCluster	Estate_Planning	Impacted
Application	Application	SysEDGE/3	Impacted
Application	Application	BankingWeb/2	Impacted
Application	Application	BankingApp/2	Impacted
Application	Application	SScope/2	Impacted
Application	Application	BankingWeb/4	Impacted
Application	Application	BankingWeb/1	Impacted
Application	Application	SScope/1	Impacted
Application	Application	BankingWeb/3	Impacted

Smarts Optical Transport Manager



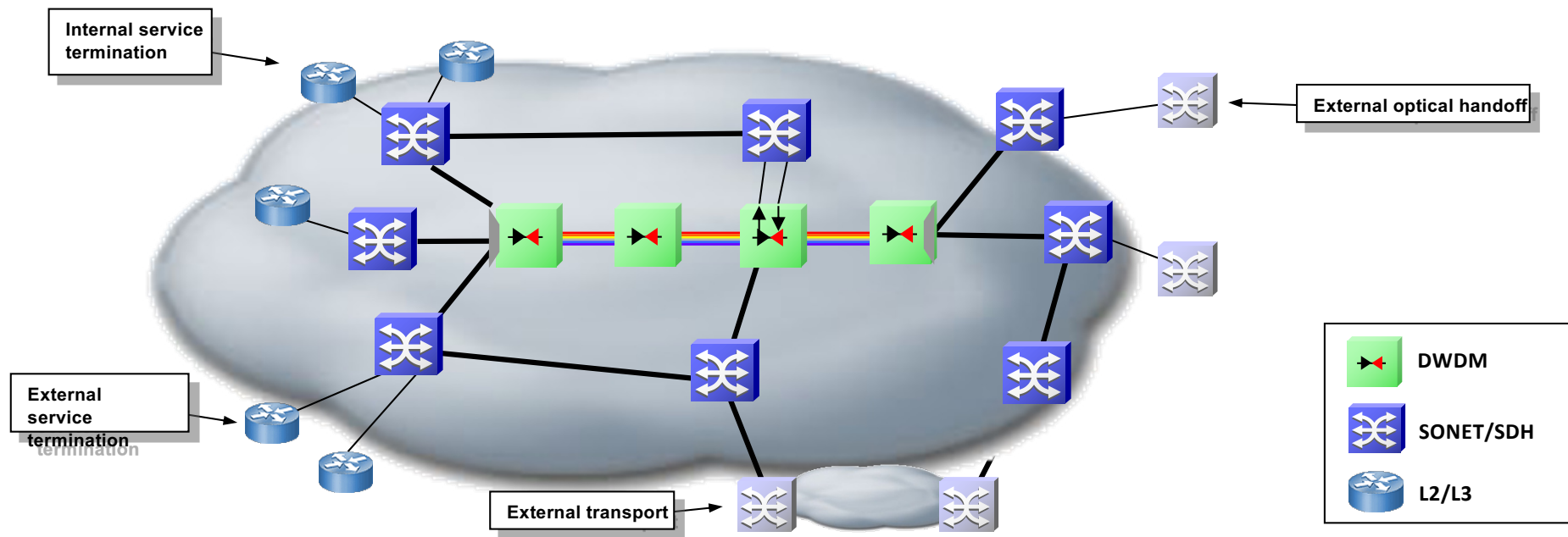
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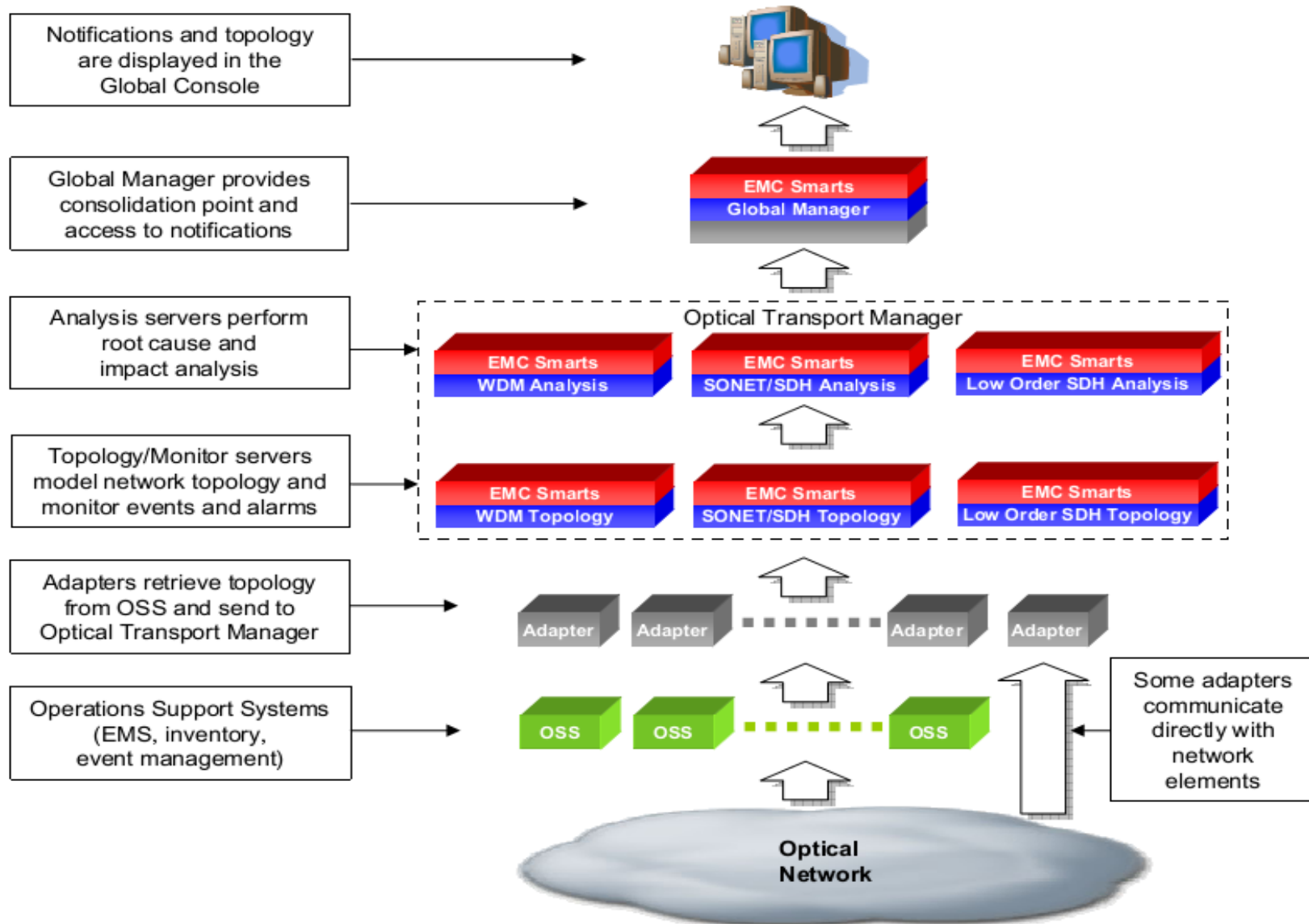
OTM Functionality Overview



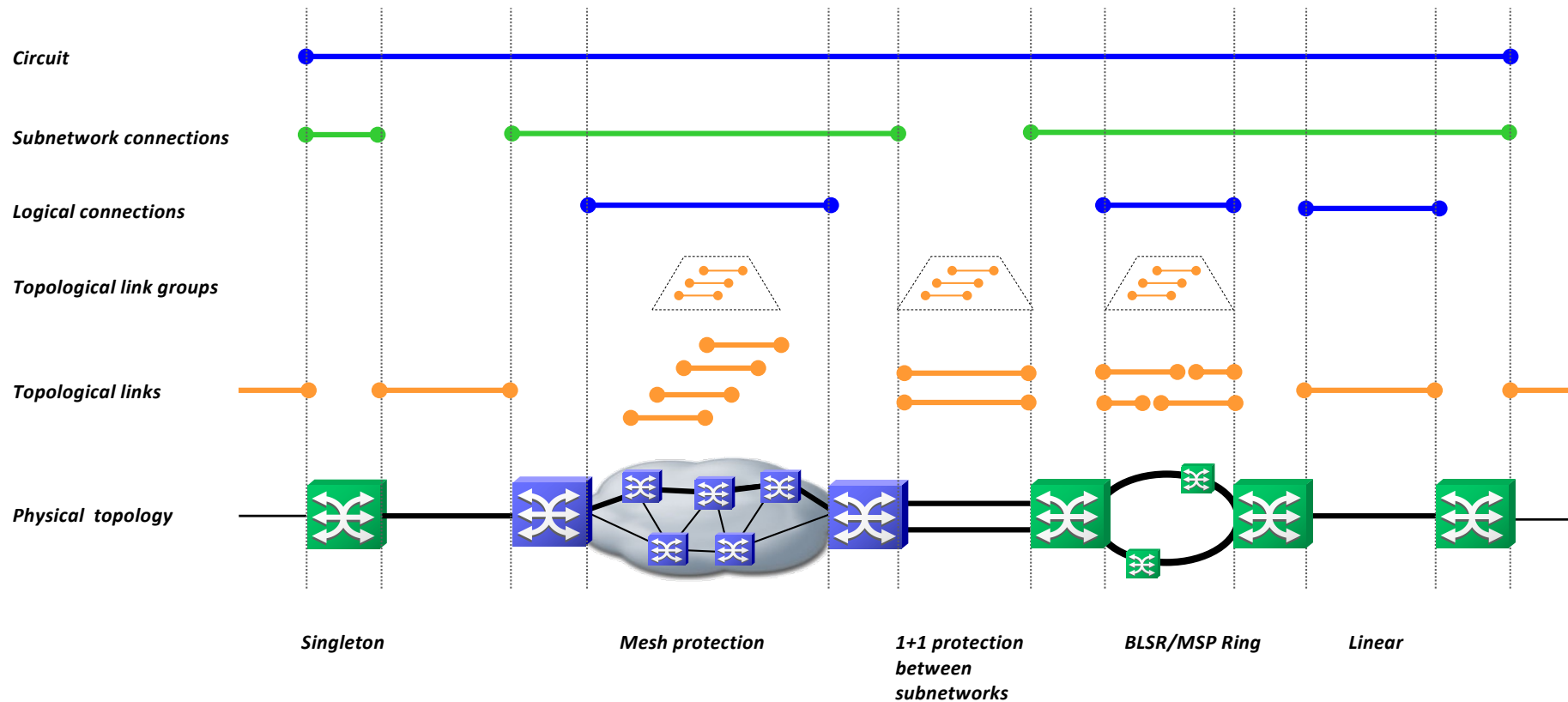
- **Transports**
 - DWDM
 - SDH
 - PDH
- **Multi-vendor Support**
- **Model**
 - Network element, card, physical/logical ports
 - Topological Links
 - SubNetwork Connections
 - Client Circuits, Trails
 - Protections
- **Analysis**
 - Optical root causes for
 - WDM
 - SDH
 - PDH
 - Optical root cause across layers all the transport layers WDM/OTN/SDH/PDH
 - Cross-Domain Correlation Optical to IP Network



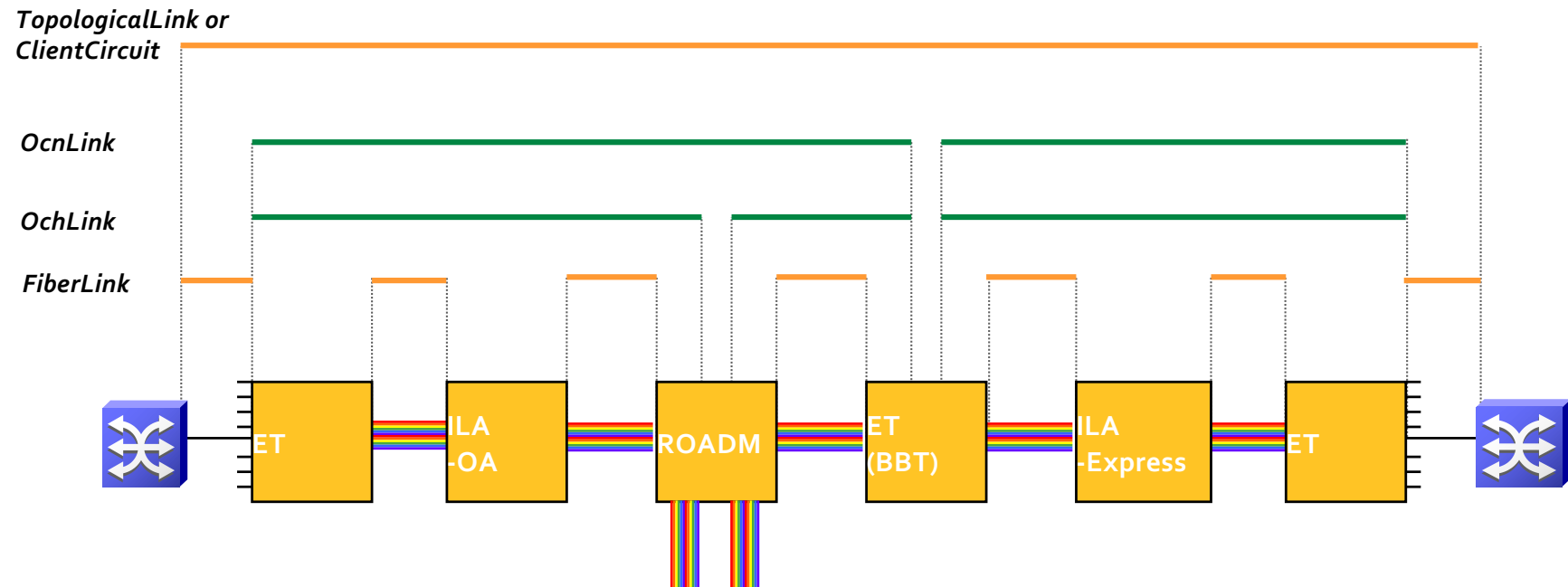
OTM Architecture



SDH Layered Model



WDM Model



SONET/SDH Network Element



WDM Network Element

ET – End Terminal

ILA-OA – In Line Amplifier-Optical Amplifier

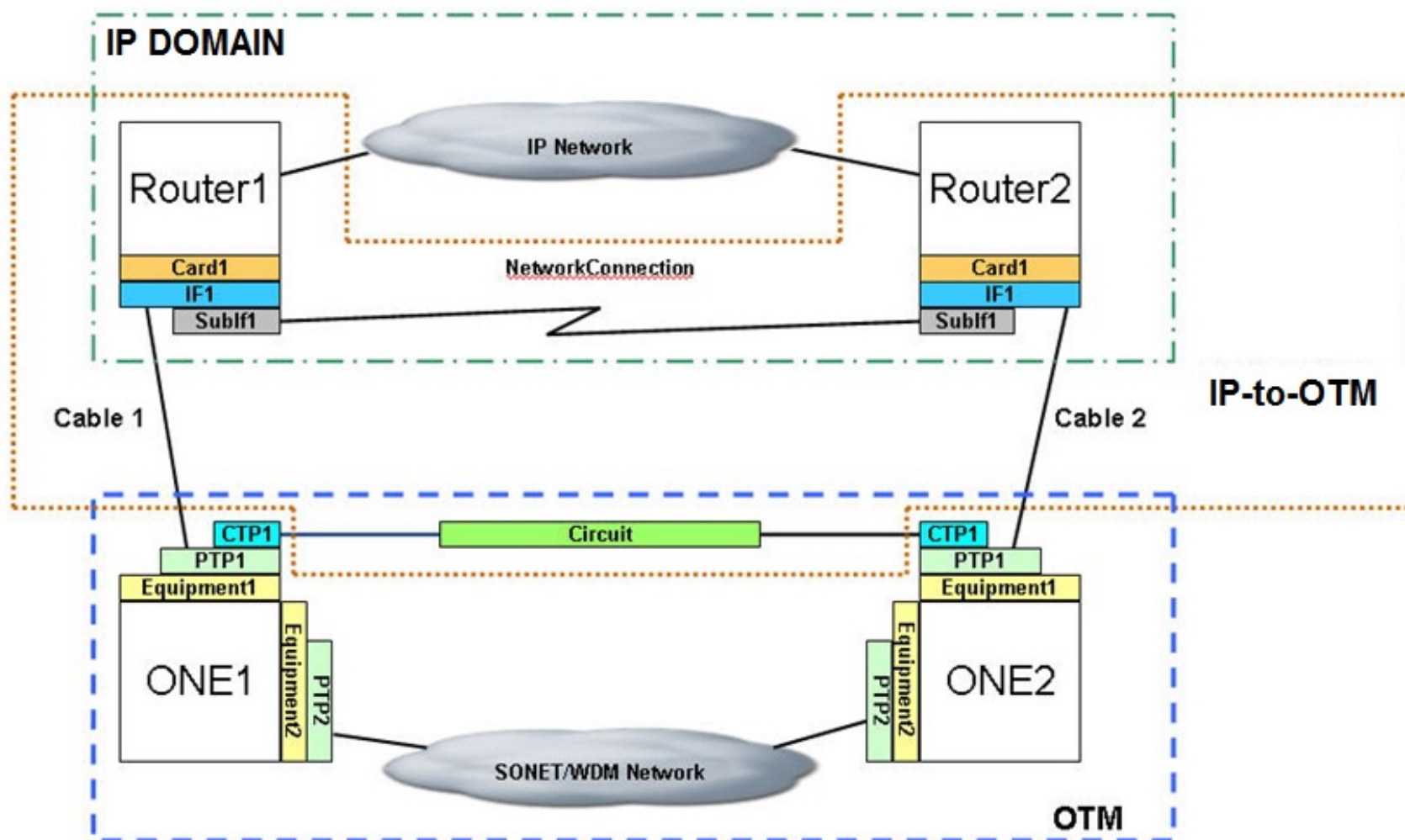
ILA-Express – In Line Amplifier-Express Node

ROADM – Reconfigurable Optical Add-Drop Multiplexer

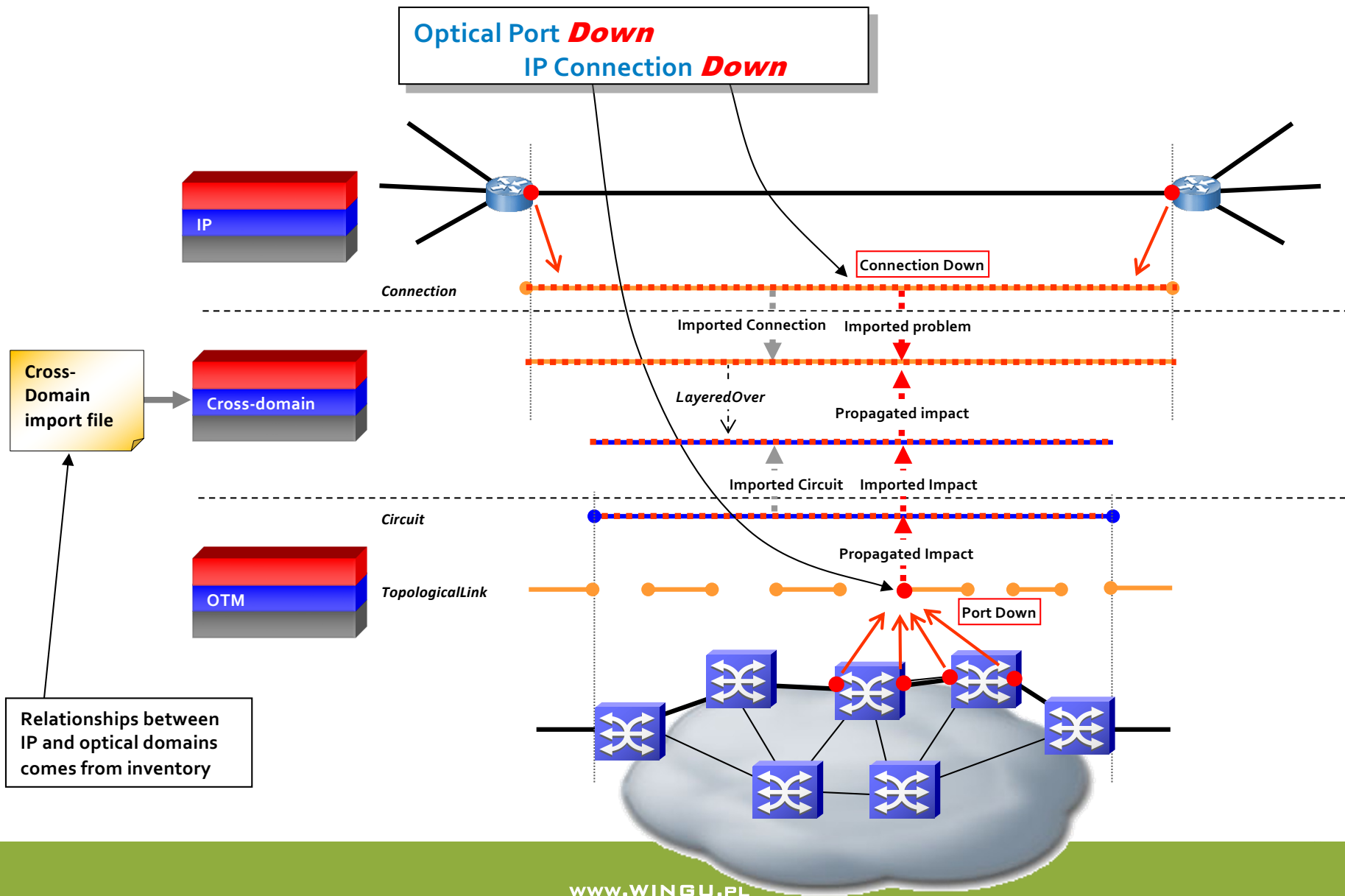
ET (BBT) – End Terminal with Back-to-back transponder



IP over OTM Topology Model



IP to OTM Cross-Domain Correlation



OTM System

Integration with

Huawei U2000

Nokia NFM-T

Infinera TNMS



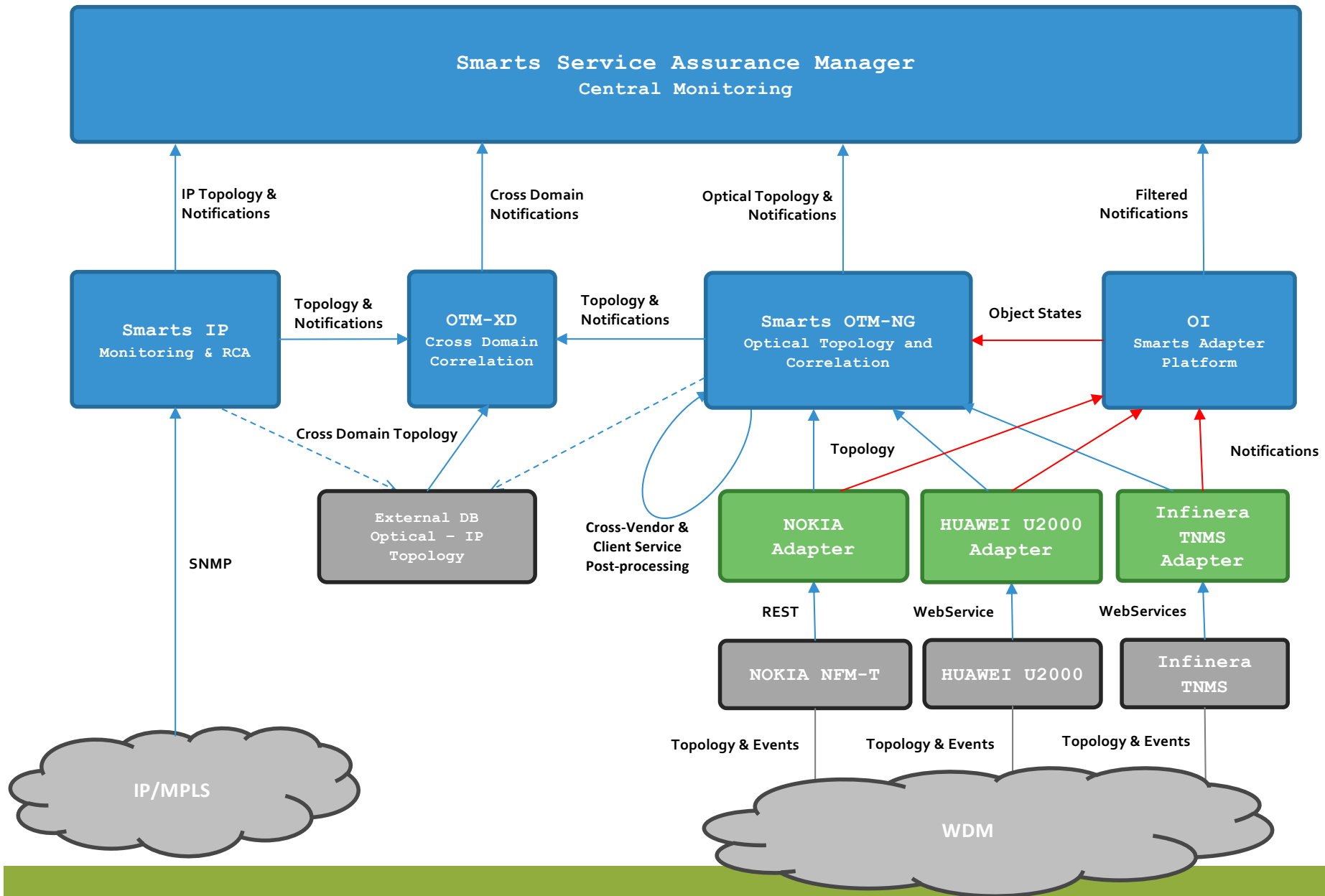
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System Configuration



- **EMC Smarts Service Assurance Manager** – integrates data from all domains and presents it to the users
- **EMC Smarts OTM Next Generation (OTM-NG)** – implements optical network model and root cause analysis
- **EMC Smarts IP Manager** – manages IP network
- **EMC Smarts IP OTM XD** - implements IP to Optical model allowing cross-domain correlation
- **OTM Adapters** - import optical topology into Smarts OTM
 - Huawei U2000 Adapter
 - Nokia NFM-T Adapter
 - Infinera TNMS Adapter

System Architecture

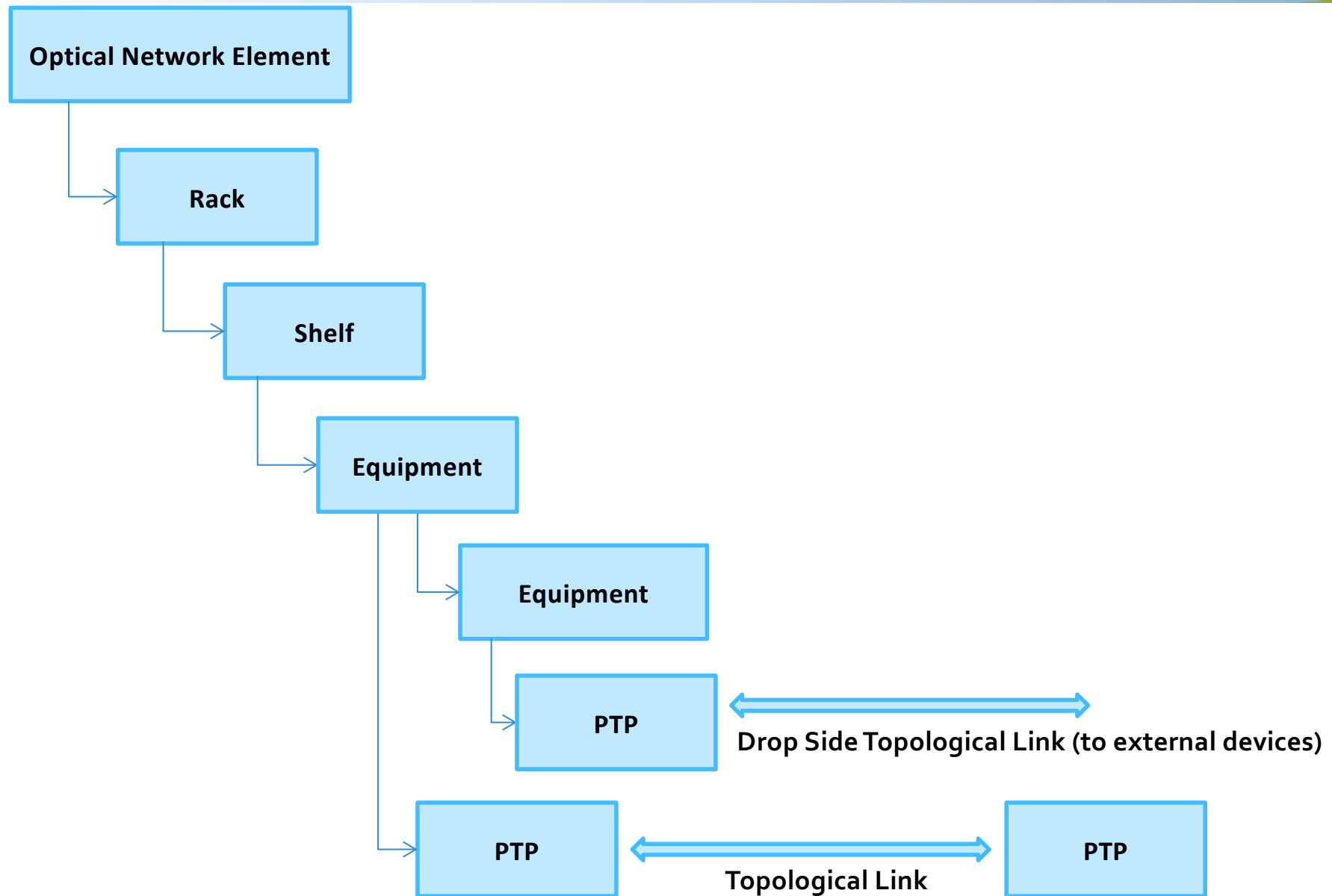


Huawei Adapter

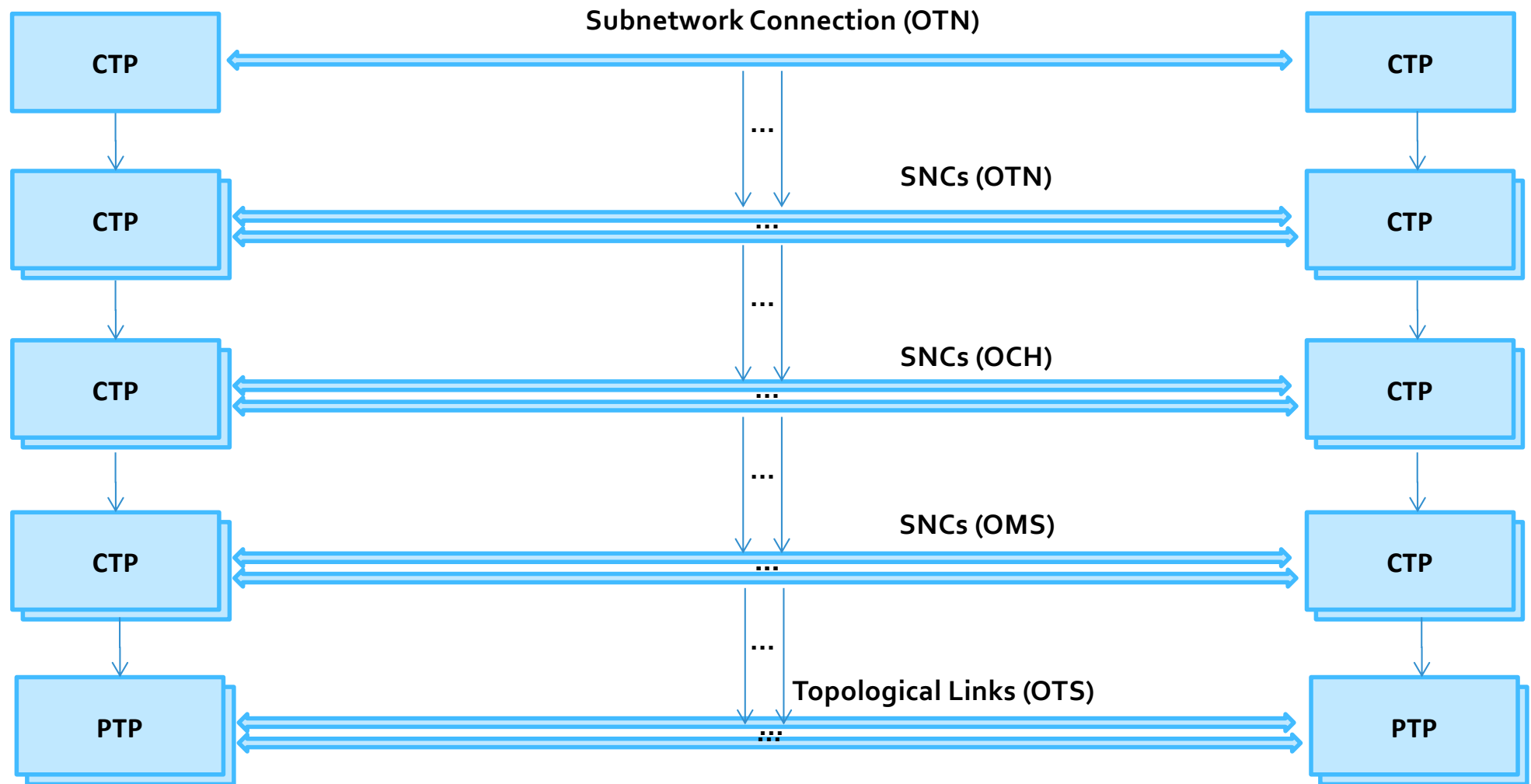


- Supports mapping of Huawei objects into Smarts OTM-NG Processes
Huawei Corba reports and creates objects in OTM repository
 - Optical Equipment
 - Optical Network Elements (Network Nodes)
 - Cards/Equipment
 - Ports
 - Topological Links
 - Internal within network nodes
 - External between network nodes
 - Subnetwork Connections (representing connections in different optical layers)
 - Routes for Subnetwork Connections (showing through which links the SNC goes)
- Processes Corba Notifications into Topology object states allowing topology based root cause analysis in OTM

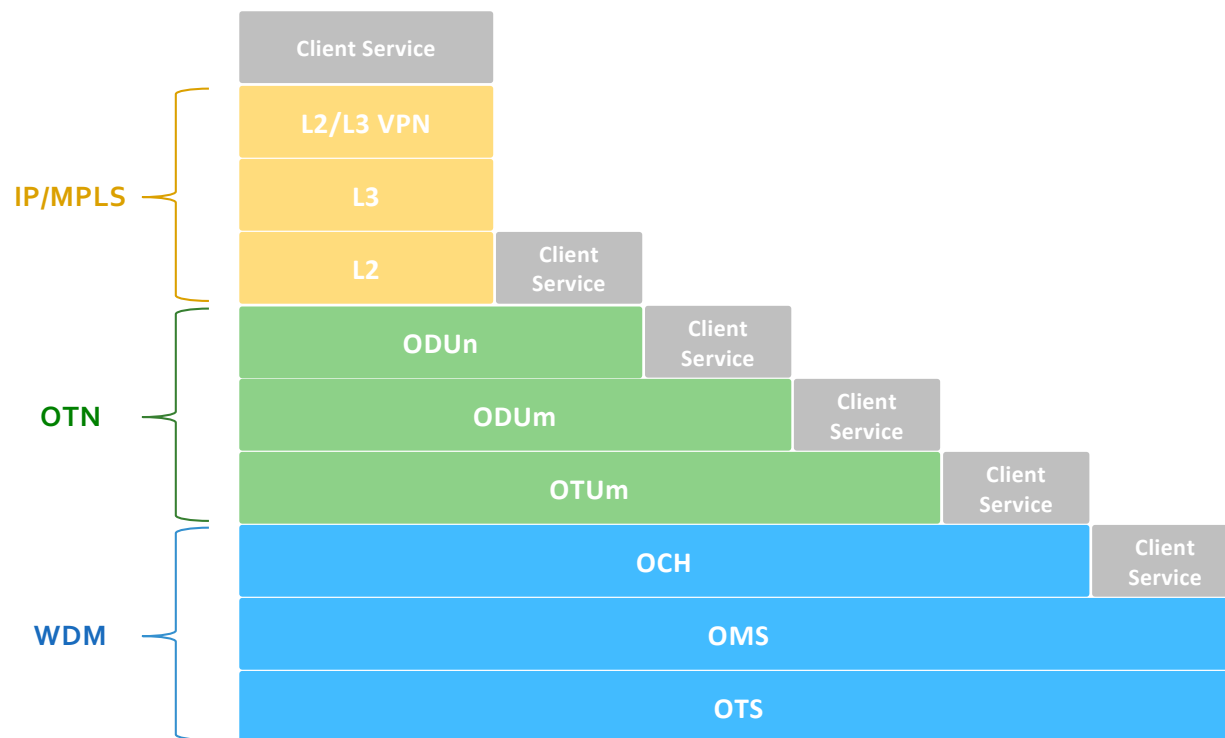
WDM-NG Physical Model based on MTOSI standard



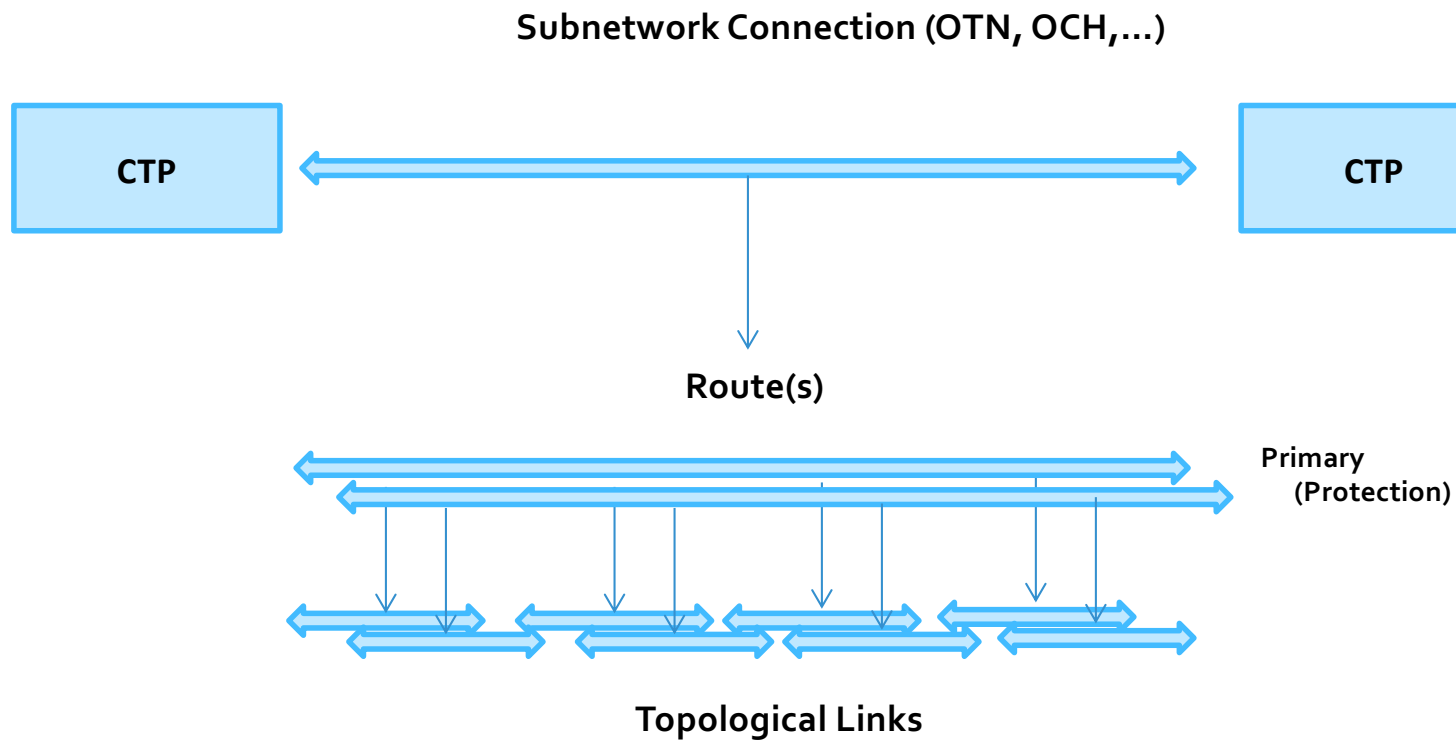
WDM-NG Hierarchical Model (based on MTNM)



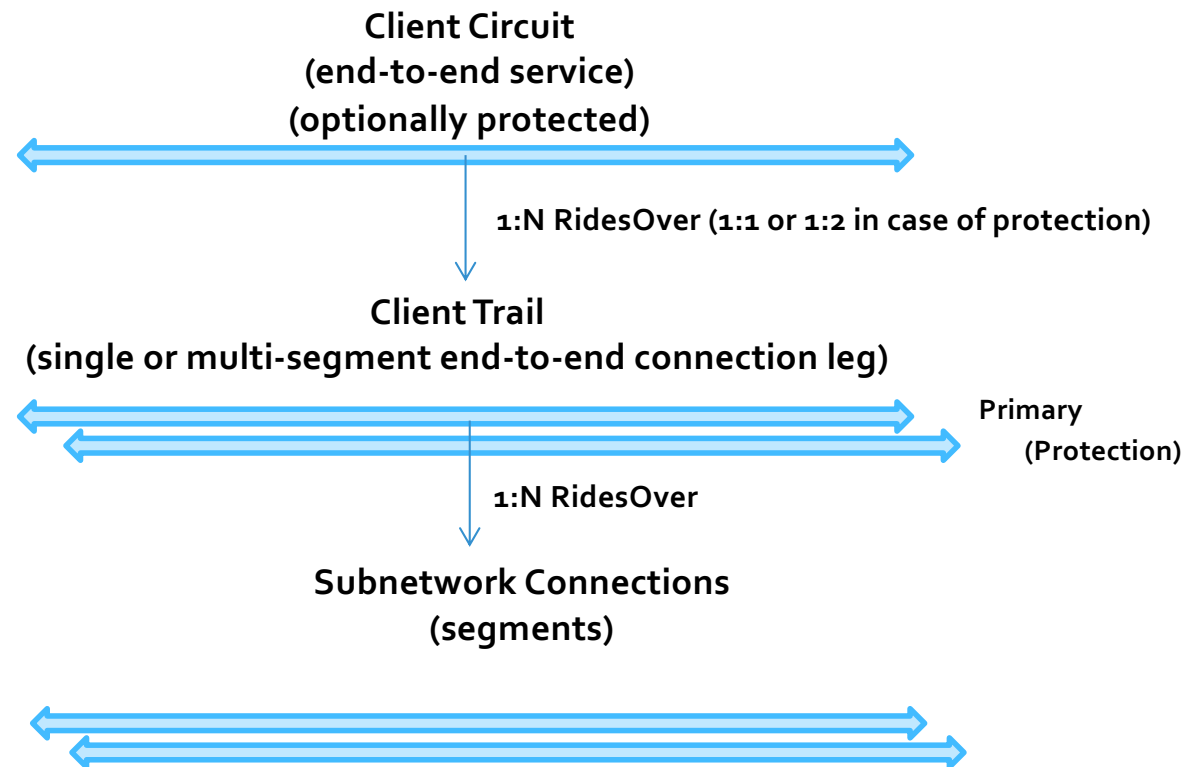
WDM-NG Hierarchical Model (based on MTNM)



WDM-NG “Routed” Model based on MTOSI



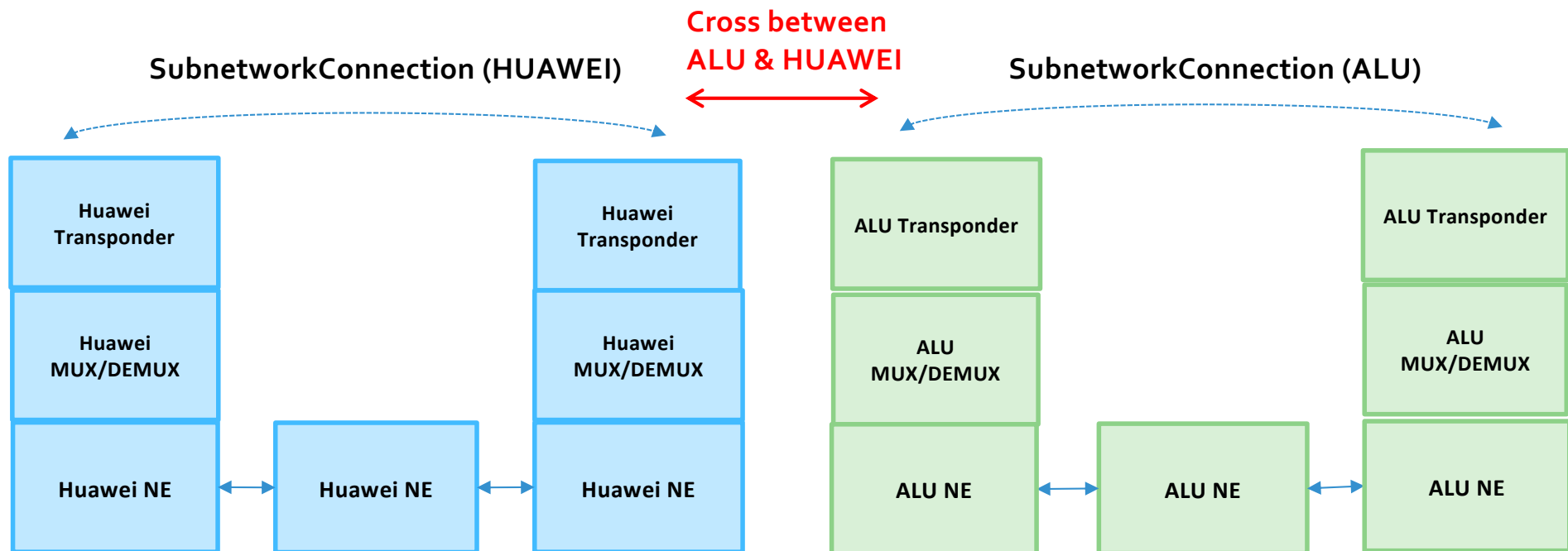
WDM-NG Service Model (Extension to MTOSI)



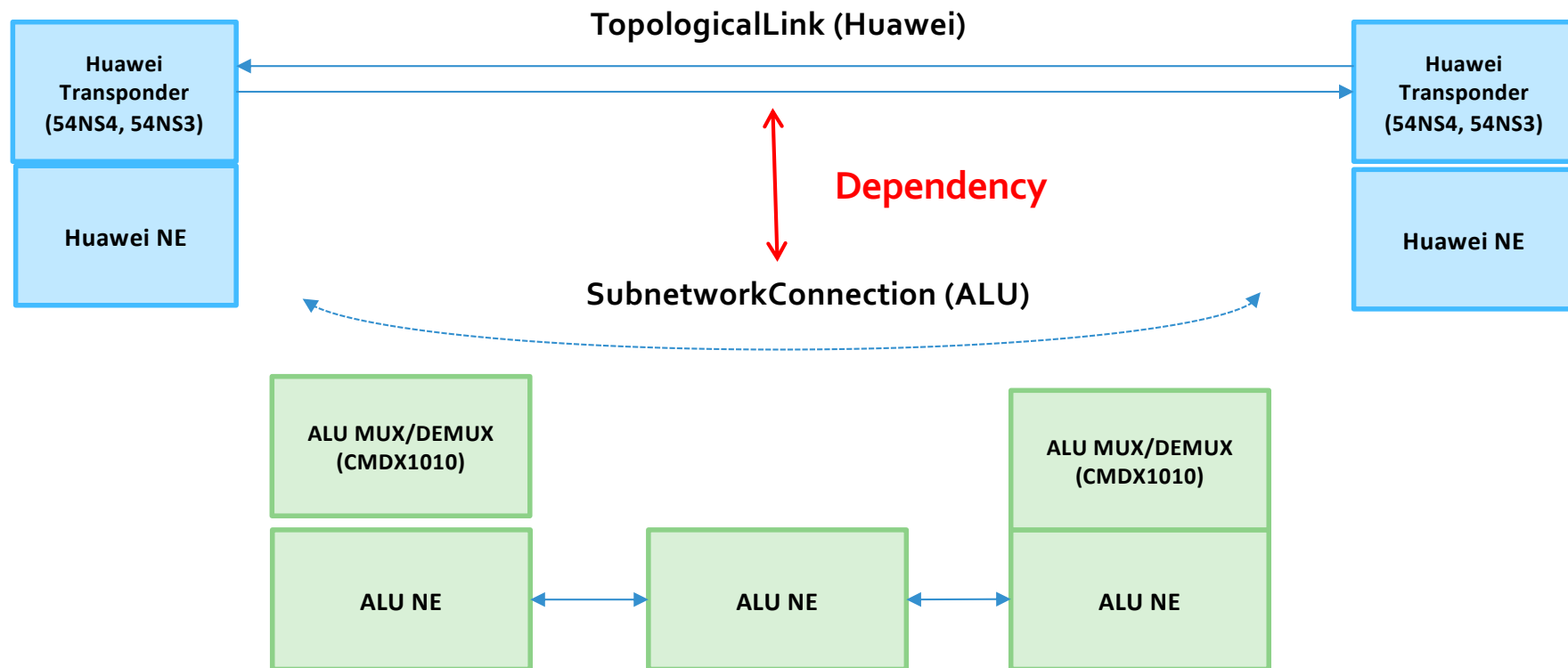
Multi-Vendor Client Trail



Two Segments Client Trail

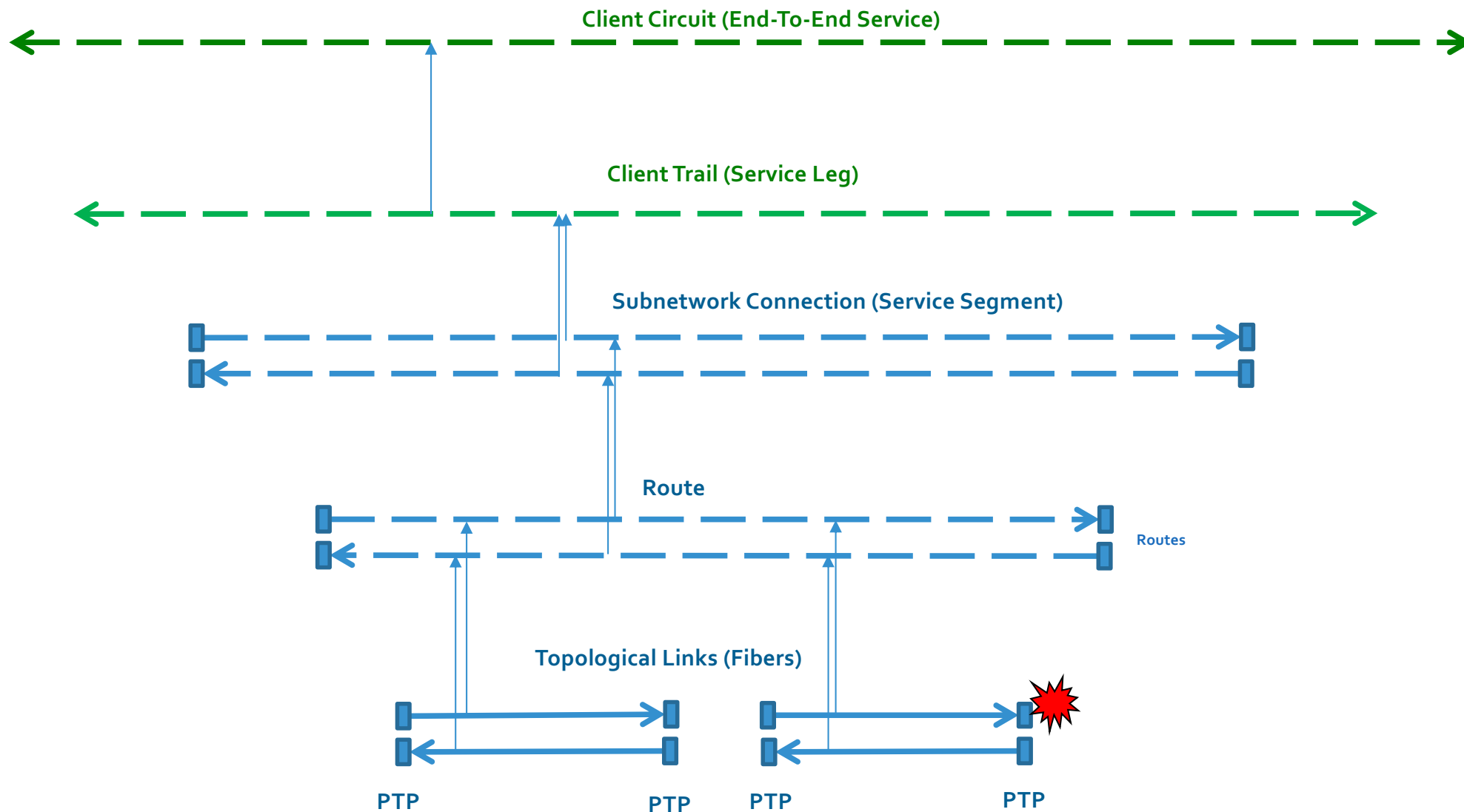


Another Cross-Vendor Topology

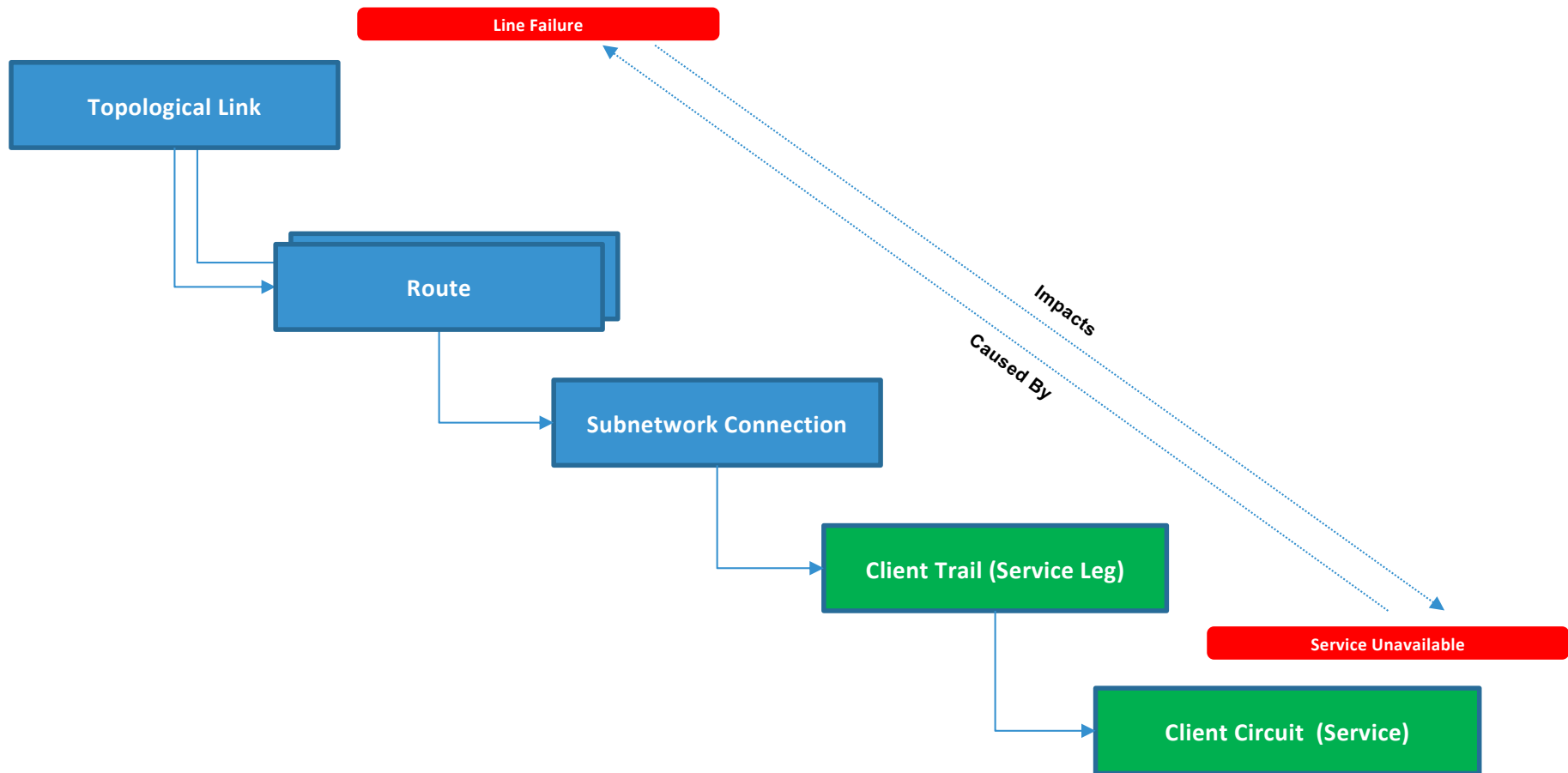




How does it work? An example



How does it work?



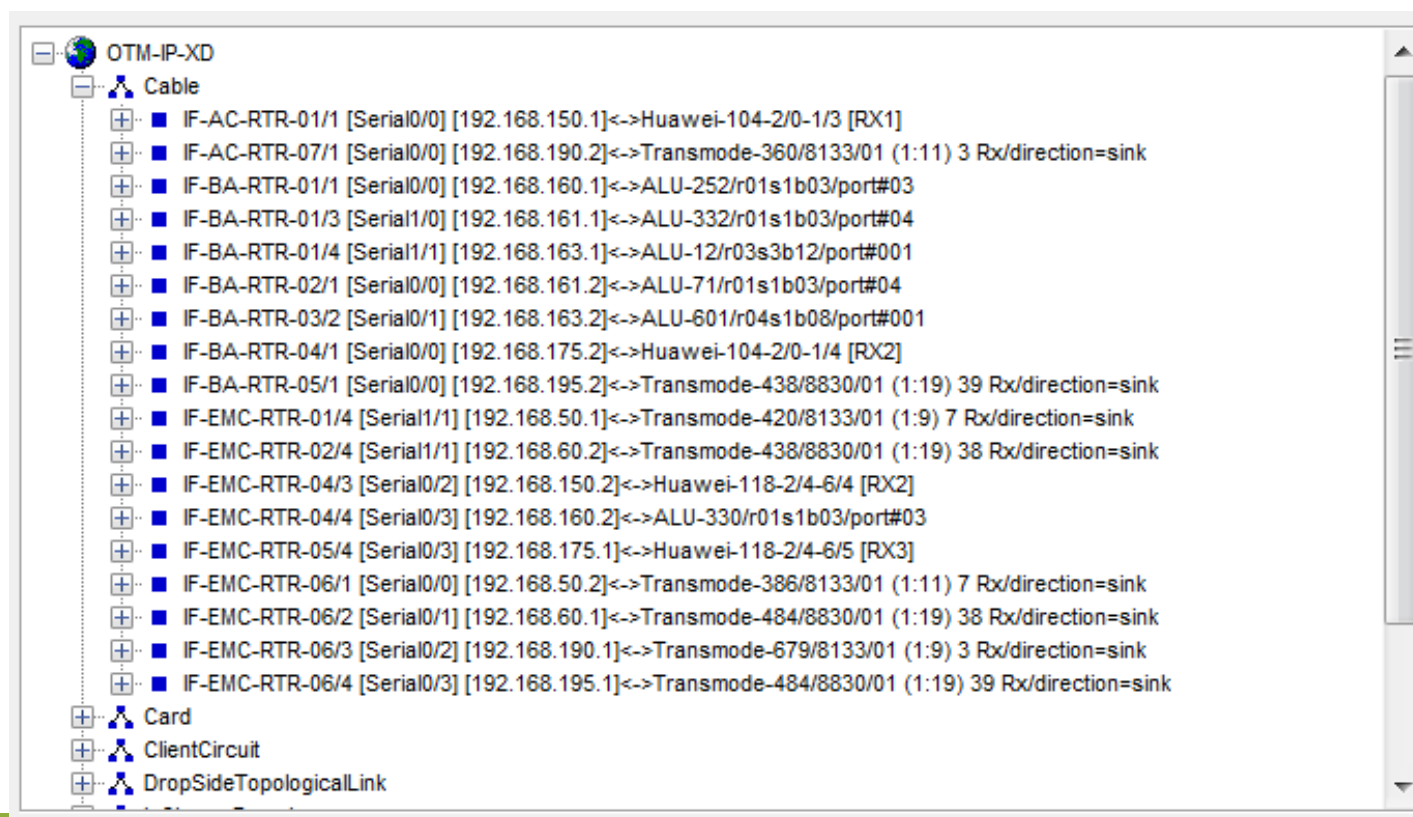


IP to Optical XD Topology for Cross Domain Correlation

- For each IP connection realized in Optical Network, we need import two cross-connections:

SITE_A_IP_INTERFACE;SITE_A_OPTICAL_INTERFACE

SITE_Z_IP_INTERFACE;SITE_Z_OPTICAL_INTERFACE



Demo

Based on real topology



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Device Equipment and Ports Listing



INCHARGE-SA::OpticalNetworkElement::Huawei-455

PTPs

Equipments

(151 entries) DisplayName	ResourceState	UserLabel	SerialNumber
Huawei-455-1/0-1 [58NS4]	WORKING	58NS4	
Huawei-455-1/0-10 [52UXCH]	WORKING	52UXCH	
Huawei-455-1/0-11 [52SCC]	WORKING	52SCC	
Huawei-455-1/0-13 [54NS4]	WORKING	54NS4	
Huawei-455-1/0-14 [13LSX]	WORKING	13LSX	
Huawei-455-1/0-15 [11LOA]	WORKING	11LOA	
Huawei-455-1/0-17 [54NS3]	WORKING	54NS3	
Huawei-455-1/0-19 [19-54NS3(STND)]	WORKING	19-54NS3(STND)	
Huawei-455-1/0-2 [58NS4]	WORKING	58NS4	
Huawei-455-1/0-20 [54TTX]	WORKING	54TTX	
Huawei-455-1/0-27 [58NS4]	WORKING	58NS4	

INCHARGE-SA::OpticalNetworkElement::Huawei-455

PTPs

Equipments

(1538 entries) DisplayName	ResourceState	UserLabel	IsDown
Huawei-455-1/0-1/1 [IN]	WORKING	IN	
Huawei-455-1/0-1/1 [OUT]	WORKING	OUT	
Huawei-455-1/0-13/1 [IN]	WORKING	IN	
Huawei-455-1/0-13/1 [OUT]	WORKING	OUT	
Huawei-455-1/0-14/1 [IN]	WORKING	IN	
Huawei-455-1/0-14/1 [OUT]	WORKING	OUT	
Huawei-455-1/0-14/3 [RX]	WORKING	RX	
Huawei-455-1/0-14/3 [TX]	WORKING	TX	
Huawei-455-1/0-15/1 [IN]	WORKING	IN	
Huawei-455-1/0-15/1 [OUT]	WORKING	OUT	
Huawei-455-1/0-15/10 [RX8]	WORKING	RX8	
Huawei-455-1/0-15/10 [TX8]	WORKING	TX8	
Huawei-455-1/0-15/201 [ClientLP1/ClientLP1]	WORKING	ClientLP1/ClientLP1	
Huawei-455-1/0-15/202 [ClientLP2/ClientLP2]	WORKING	ClientLP2/ClientLP2	
Huawei-455-1/0-15/203 [ClientLP3/ClientLP3]	WORKING	ClientLP3/ClientLP3	
Huawei-455-1/0-15/204 [ClientLP4/ClientLP4]	WORKING	ClientLP4/ClientLP4	
Huawei-455-1/0-15/205 [ClientLP5/ClientLP5]	WORKING	ClientLP5/ClientLP5	
Huawei-455-1/0-15/206 [ClientLP6/ClientLP6]	WORKING	ClientLP6/ClientLP6	
Huawei-455-1/0-15/207 [ClientLP7/ClientLP7]	WORKING	ClientLP7/ClientLP7	
Huawei-455-1/0-15/208 [ClientLP8/ClientLP8]	WORKING	ClientLP8/ClientLP8	
Huawei-455-1/0-15/3 [RX1]	WORKING	RX1	
Huawei-455-1/0-15/3 [TX1]	WORKING	TX1	
Huawei-455-1/0-15/4 [RX2]	WORKING	RX2	
Huawei-455-1/0-15/4 [TX2]	WORKING	TX2	
Huawei-455-1/0-15/5 [RX3]	WORKING	RX3	
Huawei-455-1/0-15/5 [TX3]	WORKING	TX3	
Huawei-455-1/0-15/6 [RX4]	WORKING	RX4	
Huawei-455-1/0-15/6 [TX4]	WORKING	TX4	
Huawei-455-1/0-15/7 [RX5]	WORKING	RX5	
Huawei-455-1/0-15/7 [TX5]	WORKING	TX5	
Huawei-455-1/0-15/8 [RX6]	WORKING	RX6	
Huawei-455-1/0-15/8 [TX6]	WORKING	TX6	
Huawei-455-1/0-15/9 [RX7]	WORKING	RX7	

Refresh

Browse

Save Table

Close

Detailed Device Configuration Tree



OTM-WDM-NG

OpticalNetworkElement

Huawei-455

ComposedOf

ComposedOfPTPs

ComposedOfRacks

Rack

Huawei-455-1

Huawei-455-2

ComposedOf

Shelf

Huawei-455-2/0

Huawei-455-2/1

Huawei-455-2/2

ComposedOf

Equipment

Huawei-455-2/2-1 [120LP]

Huawei-455-2/2-18 [11LOA]

ConnectedVia

PartOf

PartOfNE

PeerPTP

Realizes

PTP

Huawei-455-2/2-18/1 [IN]

Huawei-455-2/2-18/1 [OUT]

ConnectedVia

TopologicalLink

Huawei-455-2/2-18/1 [OUT] --> Huawei-455-2/3-1/15 [M14]

PartOfNE

RealizedBy

Huawei-455-2/2-18/10 [RX8]

Huawei-455-2/2-18/10 [TX8]

Huawei-455-2/2-18/201 [ClientLP1/ClientLP1]

Huawei-455-2/2-18/202 [ClientLP2/ClientLP2]

Huawei-455-2/2-18/203 [ClientLP3/ClientLP3]

Huawei-455-2/2-18/204 [ClientLP4/ClientLP4]

Huawei-455-2/2-18/205 [ClientLP5/ClientLP5]

Huawei-455-2/2-18/206 [ClientLP6/ClientLP6]

Huawei-455-2/2-18/207 [ClientLP7/ClientLP7]

Huawei-455-2/2-18/208 [ClientLP8/ClientLP8]

Huawei-455-2/2-18/3 [RX1]

Huawei-455-2/2-18/3 [TX1]

Huawei-455-2/2-18/4 [RX2]

Huawei-455-2/2-18/4 [TX2]

Huawei-455-2/2-18/5 [RX3]

Huawei-455-2/2-18/5 [TX3]

Instance "TopologicalLink::Huawei-455-2/2-18/1 [OUT] --> Huawei-455-2/3-1/15 [M14]"

Attributes

Name	Type	Value
AlarmLevel	int	-----
AlarmSuppression	boolean	-----
AutomaticSuppression	boolean	-----
ConnectionDirection	enum	CD_UNI
CreationClassName	string	TopologicalLink
DisplayClassName	string	TopologicalLink
DisplayName	string	Huawei-455-2/2-18/1 [OU...
ID	string	Huawei/T2000/Huawei/T...
IsONEDown	boolean	-----
IsPortDown	boolean	-----
IsRelatedCardDown	boolean	false
LayerRate	string	OCN
LF_Apriori	double	0.05
LF_Apriori_Set	boolean	false
LinkLevel	int	1
ManualSuppression	boolean	false
Name	string	TL-Huawei/T2000/Huaw...
NextAlarmLevel	int	-----
Owner	string	
PreviousAlarmLevel	int	-2147483648
Reference1	string	Huawei/T2000/2015-10-1...
Reference2	string	Internal
Reference3	string	
Resource State	enum	WORKING
ServiceName	string	Huawei/T2000
SystemName	string	TL-Huawei/T2000/Huaw...
UserLabel	string	

Apply

Refresh

Close

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Physical Links



OTM-WDM-NG

TopologicalLink

Huawei-74-2/1-16/1 [OUT] --> Huawei-455-2/3-16/1 [IN]

ConnectedSystems

OpticalNetworkElement

Huawei-455

Huawei-74

ConnectedTo

PTP

Huawei-455-2/3-16/1 [IN]

Huawei-74-2/1-16/1 [OUT]

ManagedBy

Next

Previous

Underlying

Route

Huawei-297-Huawei-692 (RKNRGY GRPUABYBTVN)-Och-L30

Huawei-297-Huawei-692 (RKNRGY GRPUABYBTVN)-ODU2 [W

Huawei-297-Huawei-692-OTU2-44616 [Work]

Huawei-455-2-Huawei-728-1 (RKNRGY GRPUABYBTVN)-Och-

Huawei-455-2-Huawei-728-1-ODU2-46399 [Work]

Huawei-455-2-Huawei-728-1-OTU2-46290 [Work]

SO#111224# Huawei-455-2-Huawei-728-1 (SERVICE SDH) [Wo

SO#111224# Huawei-455-2-Huawei-728-1 (SERVICE SDH)-ODI

SO#111268# Huawei-297-Huawei-692 (SERVICE SDH) [Work]

SO#111268# Huawei-297-Huawei-692 (SERVICE SDH)-ODU1 [V

SO#111830# Huawei-453-2-Huawei-455-2 (CLIENT 72)-Och-L4

SO#111844# Huawei-644-Huawei-297 (CLIENT 41) [Work]

SO#111844# Huawei-644-Huawei-297 (CLIENT 41)-Och-L53 [W

SO#111844# Huawei-644-Huawei-297 (CLIENT 41)-ODU2 [Wor

SO#111844# Huawei-644-Huawei-297 (CLIENT 41)-OTU2 [Wor

SO#111845# Huawei-644-Huawei-297 (CLIENT 41) [Work]

SO#111845# Huawei-644-Huawei-297 (CLIENT 41)-Och_L50 [V

SO#111845# Huawei-644-Huawei-297 (CLIENT 41)-ODU2 [Wor

SO#111845# Huawei-644-Huawei-297 (CLIENT 41)-OTU2 [Wor

SO#111846# Huawei-644-Huawei-297 (CLIENT 41) [Work]

SO#111846# Huawei-644-Huawei-297 (CLIENT 41)-Och-L51 [W

SO#111846# Huawei-644-Huawei-297 (CLIENT 41)-ODU2 [Wor

SO#111846# Huawei-644-Huawei-297 (CLIENT 41)-OTU2 [Wor

SO#111847# Huawei-453-2-Huawei-455-2 (SERVICE IP)-Och-L

SO#211114# ALU-695-ALU-554 (SERVICE INTERNAL_A)-Och-I

SO#211115# ALU-695-ALU-554 (SERVICE INTERNAL_A)-Och-I

Instance "TopologicalLink::Huawei-74-2/1-16/1 [OUT] --> Huawei-455-2/3-16/1 [IN]"

Name	Type	Value	Description
AlarmLevel	int	-----	no description available
AlarmSuppression	boolean	-----	no description available
AutomaticSuppression	boolean	-----	no description available
ConnectionDirection	enum	CD_UNI	???
CreationClassName	string	TopologicalLink	The name of the most-derived class of this instance.
DisplayClassName	string	TopologicalLink	???
DisplayName	string	Huawei-74-2/1-16/1 [OU...	???
ID	string	Huawei/T2000/Huawei/T...	???
IsONEDown	boolean	-----	???
IsPortDown	boolean	-----	no description available
IsRelatedCardDown	boolean	false	???
LayerRate	string	OTS	???
LF_Apriori	double	0.05	???
LF_Apriori_Set	boolean	false	no description available
LinkLevel	int	5	no description available
ManualSuppression	boolean	false	no description available
Name	string	TL-Huawei/T2000/Huaw...	Name of object
NextAlarmLevel	int	-----	no description available
Owner	string	-----	???
PreviousAlarmLevel	int	-----	no description available
Reference1	string	Huawei/T2000/2014-06-1...	no description available
Reference2	string	External	no description available
Reference3	string	-----	no description available
ResourceState	enum	WORKING	???
ServiceName	string	Huawei/T2000	Name of external server used for imported events and instru
SystemName	string	TL-Huawei/T2000/Huaw...	???
UserLabel	string	-----	???

Apply Refresh

Close

Client Circuits



OTM-WDM-NG

ClientCircuit

SO#111844# Huawei-644-Huawei-297 (CLIENT 41)

RidesOver

ClientTrail

SO#111844# Huawei-644-Huawei-297 (CLIENT 41)

aEnd

LayeredOver

RiddenBy

RidesOver

SubnetworkConnection

SO#111844# Huawei-644-Huawei-297 (CLIENT 41)

aEnd

ConnectedTo

EncapsulatedBy

ManagedBy

RiddenBy

RidesOver

Route

SO#111844# Huawei-644-Huawei-297 (CLIENT 41) [Work]

LayeredOver

DropSideTopologicalLink

TopologicalLink

Huawei-297/1-2/1 [OUT] --> Huawei-455-2/3-1/9 [M08]

Huawei-453-2/0-1/1 [OUT] --> Huawei-453-2/0-12/3 [AM1]

Huawei-453-2/0-12/2 [DM1] --> Huawei-453-2/0-15/4 [V]

Huawei-453-2/0-12/4 [OUT] --> Huawei-453-2/0-3/4 [V]

Huawei-453-2/0-14/2 [OUT] --> Huawei-453-2/0-12/1 [IN]

Huawei-453-2/0-14/5 [VO] --> Huawei-453-2/0-14/1 [IN]

Huawei-453-2/0-15/2 [OUT] --> Huawei-453-2/0-17/1 [IN]

Huawei-453-2/0-15/5 [VO] --> Huawei-453-2/0-15/1 [IN]

Huawei-453-2/0-16/1 [OUT] --> Huawei-74-1/0-16/1 [IN]

Huawei-453-2/0-16/3 [TC] --> Huawei-453-2/0-14/4 [V]

Huawei-453-2/0-17/9 [D08] --> Huawei-644/1-5/1 [IN]

Huawei-453-2/0-3/2 [OUT] --> Huawei-453-2/0-16/3 [RC]

Huawei-453-2/0-3/5 [VO] --> Huawei-453-2/0-3/1 [IN]

Huawei-455-2/3-1/1 [OUT] --> Huawei-455-2/3-3/2 [RE]

Huawei-455-2/3-13/4 [OUT] --> Huawei-455-2/3-4/7 [V]

Huawei-455-2/3-13/5 [DM1] --> Huawei-455-2/3-5/4 [V]

Huawei-455-2/3-16/1 [OUT] --> Huawei-74-2/1-16/1 [IN]

Huawei-455-2/3-16/3 [TC] --> Huawei-455-2/3-6/4 [V]

Huawei-455-2/3-17/9 [D08] --> Huawei-297/1-2/1 [IN]

Huawei-455-2/3-3/1 [OUT] --> Huawei-455-2/3-13/13 [AM1]

Huawei-455-2/3-3/2 [TE] --> Huawei-455-2/3-17/1 [IN]

Huawei-455-2/3-4/4 [OUT] --> Huawei-455-2/3-16/3 [RC]

Huawei-455-2/3-4/5 [TDC] --> Huawei-455-2/3-4/5 [RDC]

Huawei-455-2/3-4/8 [VO] --> Huawei-455-2/3-4/1 [IN]

Instance "ClientCircuit::SO#111844# Huawei-644-Huawei-297 (CLIENT 41)"

Attributes

Name	Type	Value
CreationClassName	string	ClientCircuit
DisplayClassName	string	ClientCircuit
DisplayName	string	SO#111844# Huawei-644...
ID	string	SO_111844
IsAtRisk	boolean	false
IsServiceAffected	boolean	false
IsServiceUnavailable	boolean	false
Name	string	CRCT-SO_111844
Owner	string	
Reference1	string	111844
Reference2	string	
Resource State	enum	WORKING
ServiceName	string	Exatel/OTM
SystemName	string	CRCT-SO_111844
UserLabel	string	

Apply Refresh

Close



Root Cause Analysis in the Optical Network

- Scenario 1 - Fiber Link fault in the Optical Network
 - Smarts shows a Line Failure notification as the Root Cause, and multiple Service Unavailability notifications correlated into it.
- Scenario 2 - Two independent faults in the Optical Network
 - Two independent Line Failures are identified as the Root Causes. Some of the services are affected by both failures - corresponding Service Unavailability notifications are linked to both root causes.



- Scenario 3 – Fiber Link fault in the Optical Network affects SDH & IP connectivity
 - Single Line Failure notification becomes the Root Cause for the link failures in the IP Network and client circuits in SDH. The IP and SDH faults are no more root causes; cross-domain correlation links them to the underlying WDM Optical Network fault.
- Scenario 4 – Fiber Link fault between an IP device and an Optical device
 - Cross-Domain correlation identifies a client fiber link as the new Root Cause of both: IP link fault and Optical Service Unavailability.

A stylized illustration of a person in silhouette running towards the right, holding a butterfly net. A butterfly is shown inside the net. The background is a light blue sky with two white clouds, and a green grassy field is at the bottom.

System shows single Optical Fault as the Root Cause

Notification Log - Default. Manager: INCHARGE-SA

Single Optical Root Cause affects 8 services

Critical

Major

Minor

Unknown

Normal

Se...	Ack...	IsRoot	Owner	Class	Impact	Name	Event
	No	Yes		FiberLink		8 3145742/1-1-1-1/OTS-Out-->3145729/1-1-113-7/OTS-In	LineFailure

[illegible]

Notification Log - Default. Manager: INCHARGE-SA			■ Critical ■ Major ■ Minor ■ Unknown ■ Normal						
Se...	Ack...	Class	Name	Event	Source	Count	Last Notify	First Notify	Las...
	No	FiberLink	...	LineFailure	OTM-WDM-ANALYSIS	3 06 lis 13:24:58	06 lis 12:04:27	06 lis 12:04:27	06 ...
	No	ClientCircuit	...	ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis 13:24:29	06 lis 12:04:11	06 lis 12:04:11	06 ...
	No	ClientCircuit	...	ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis 13:24:29	06 lis 12:04:11	06 lis 12:04:11	06 ...
	No	ClientCircuit	...	ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis 13:24:29	06 lis 12:04:11	06 lis 12:04:11	06 ...
	No	ClientCircuit	...	ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis 13:24:29	06 lis 12:04:11	06 lis 12:04:11	06 ...
	No	ClientCircuit	...	ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis 13:24:29	06 lis 12:04:11	06 lis 12:04:11	06 ...
	No	ClientCircuit	...	ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis 13:24:29	06 lis 12:04:11	06 lis 12:04:11	06 ...
	No	ClientCircuit	...	ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis 13:24:29	06 lis 12:04:11	06 lis 12:04:11	06 ...
	No	ClientCircuit	...	ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis 13:24:29	06 lis 12:04:11	06 lis 12:04:11	06 ...
	No	AmpInOtsPort	3145/29/1-1-113-7/Ots-in	LosEvent	OTM-WDM-ANALYSIS	3 06 lis 13:24:29	06 lis 12:04:11	06 lis 12:04:11	06 ...



Scenario 1 - Fiber Link fault – WDM View

Manager: INCHARGE-SA

INCHARGE-SA::WDM[Group Physical Connectivity]

INCHARGE-SA

- IP Network
- IP SubNet
- Optical Network
- SDH
- WDM

Notification Properties

Notification : FiberLink LineFailure [100% 06/11/15 15:50:49]

Name : 3145742/1-1-1-1/OTS-Out-->3145729/1-1-113-7/OTS-In

General Audit Log Impact

Class	Name	Event
ClientCircuit		ServiceUnavailable
ClientCircuit		ServiceUnavailable
ClientCircuit		ServiceUnavailable
ClientCircuit		ServiceUnavailable
ClientCircuit		ServiceUnavailable
ClientCircuit		ServiceUnavailable
ClientCircuit		ServiceUnavailable
ClientCircuit		ServiceUnavailable
ClientCircuit		ServiceUnavailable
AmpInOtsPort	3145729/1-1-113-...	LosEvent

Root Cause Impacts

Refresh Browse Containment Close

EMC Ready

** Not saved **

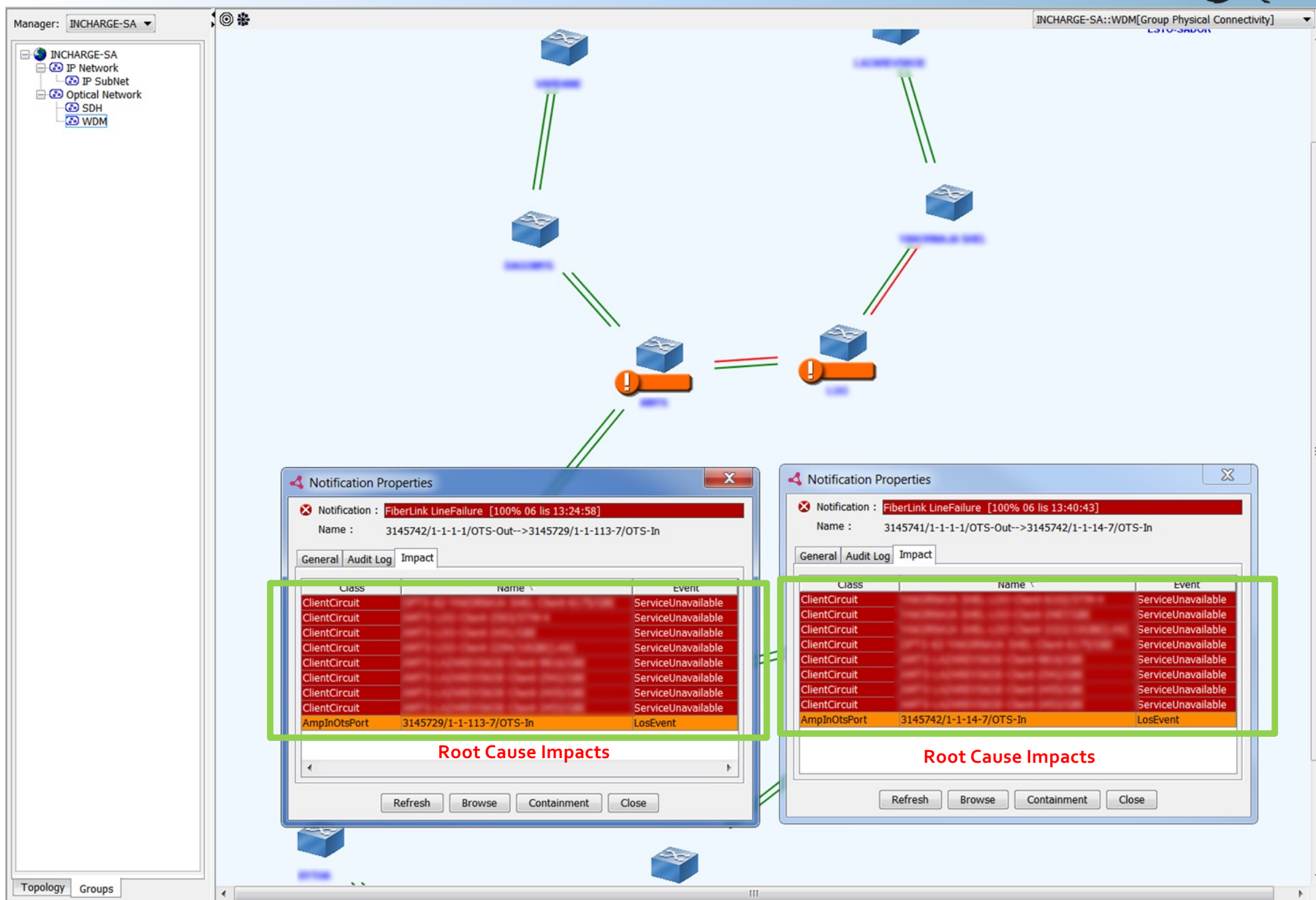
System shows two Optical Fault as the Root Causes

Notification Log - Default. Manager: INCHARGE-SA		Each of two Optical Root Causes affects 8 services				Critical Major Minor Unknown Normal	
Se...	Ack...	IsRoot	Owner	Class	Impact	Name	Event
	No	Yes		FiberLink	8	3145741/1-1-1-1/OTS-Out-->3145742/1-1-14-7/OTS-In	LineFailure
	No	Yes		FiberLink	8	3145742/1-1-1-1/OTS-Out-->3145729/1-1-113-7/OTS-In	LineFailure

[illegible]

Notification Log - Default. Manager: INCHARGE-SA						<div><div>Critical</div><div>Major</div><div>Minor</div><div>Unknown</div><div>Normal</div></div>				
Se...	Ack...	Class	Name	Event	Source	Count	Last Notify	First Notify	...	
	No	FiberLink	3145741/1-1-1-1/OTS-Out->3145742/1-1-14-7/OTS-In	LineFailure	OTM-WDM-ANALYSIS	2 06 lis	13:40:43	06 lis 12:15:32	...	
	No	FiberLink	3145742/1-1-1-1/OTS-Out->3145729/1-1-113-7/OTS-In	LineFailure	OTM-WDM-ANALYSIS	3 06 lis	13:24:58	06 lis 12:04:27	...	
	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	2 06 lis	13:40:42	06 lis 12:15:28	...	
	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	2 06 lis	13:40:42	06 lis 12:15:28	...	
	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	2 06 lis	13:40:42	06 lis 12:15:28	...	
	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis	13:24:29	06 lis 12:04:11	...	
	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis	13:24:29	06 lis 12:04:11	...	
	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis	13:24:29	06 lis 12:04:11	...	
	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis	13:24:29	06 lis 12:04:11	...	
	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis	13:24:29	06 lis 12:04:11	...	
	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis	13:24:29	06 lis 12:04:11	...	
	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis	13:24:29	06 lis 12:04:11	...	
	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis	13:24:29	06 lis 12:04:11	...	
	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis	13:24:29	06 lis 12:04:11	...	
	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	3 06 lis	13:24:29	06 lis 12:04:11	...	
	No	AmpInOtsPort	3145742/1-1-14-7/OTS-In	LosEvent	OTM-WDM-ANALYSIS	2 06 lis	13:40:42	06 lis 12:15:28	...	

Scenario 2 - Two independent faults in the Optical Network



Scenario 3 – Fiber Link fault in the Optical Network affects SDH & IP connectivity



System shows single Optical Fault as the Root Cause

Notification Log - Default. Manager: INCHARGE-SA

Single WDM Root Cause affects SDH & WDM services & IP connections

Critical Major Minor Unknown Normal

Se...	Ack...	IsRoot	Owner	Class	Impact	Name	Event
X	No	Yes		FiberLink	16	3145730/1-1-101-1/OTS-Out-->3145732/1-1-14-4/OTS-In	LineFailure

Notification Log - Default. Manager: INCHARGE-SA

List of affected WDM & SDH Client Services and IP connections

Critical Major Minor Unknown Normal

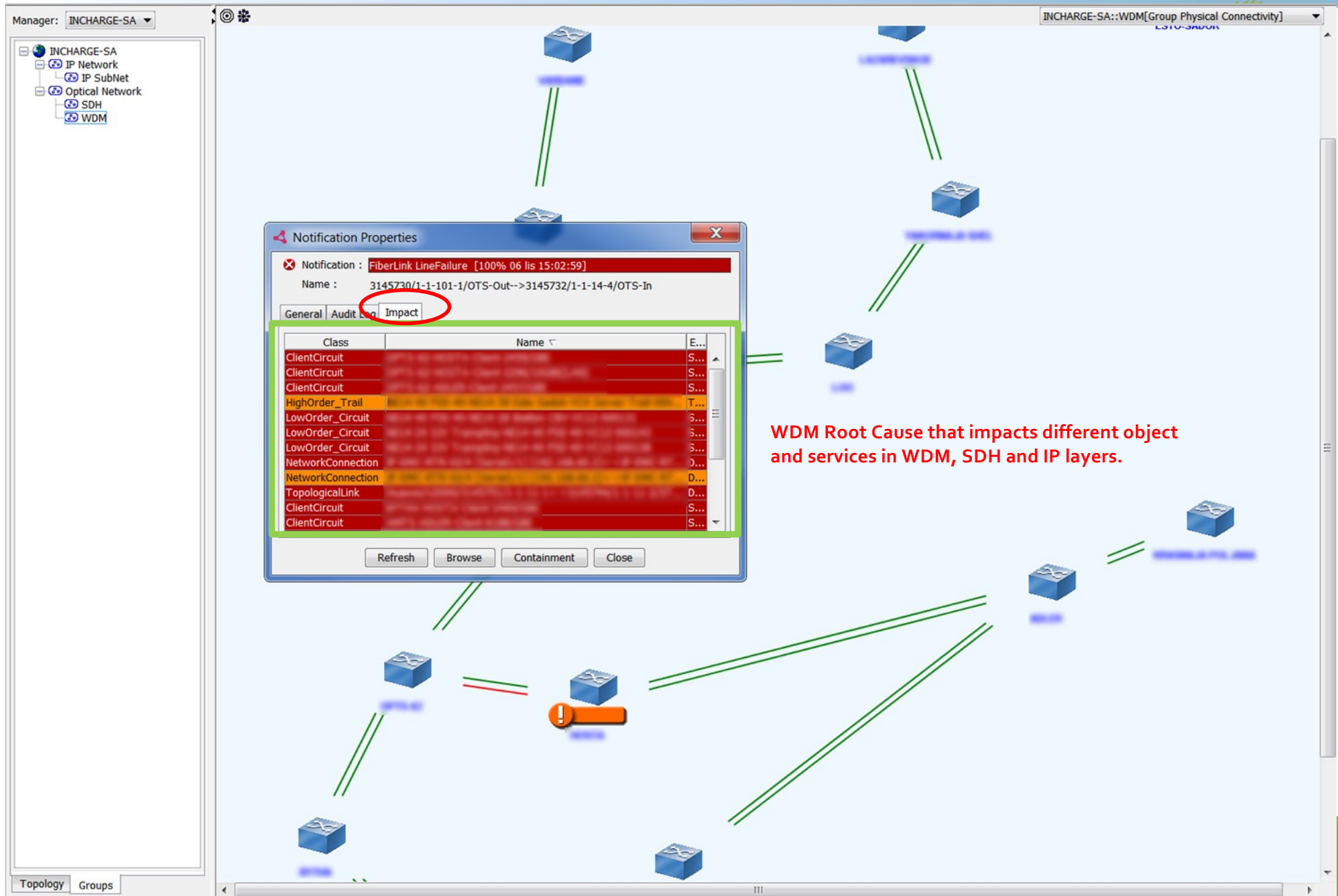
Se...	Ack...	Class	Name	Event	Source	Count	Last Notify	First Notify	Last...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	06 li...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	06 li...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	06 li...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	06 li...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	06 li...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	06 li...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	06 li...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	06 li...
X	No	NetworkConnection		Down	INCHARGE-AM-PM, OTM-IP-XD	9	06 lis 15:02:48	16 wrz 12:22:24	06 li...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	06 li...
X	No	ClientCircuit		ServiceUnavailable	OTM-IP-XD, OTM-WDM-ANALYSIS	6	06 lis 15:02:48	12 wrz 00:05:47	06 li...
X	No	LowOrder_Circuit		ServiceUnavailable	OTM-PDH-ANALYSIS	4	06 lis 15:02:47	11 wrz 10:48:27	06 li...
X	No	LowOrder_Circuit		ServiceUnavailable	OTM-PDH-ANALYSIS	4	06 lis 15:02:47	11 wrz 10:48:27	06 li...
X	No	LowOrder_Circuit		ServiceUnavailable	OTM-PDH-ANALYSIS	4	06 lis 15:02:47	11 wrz 10:48:27	06 li...

Notification Log - Default. Manager: INCHARGE-SA

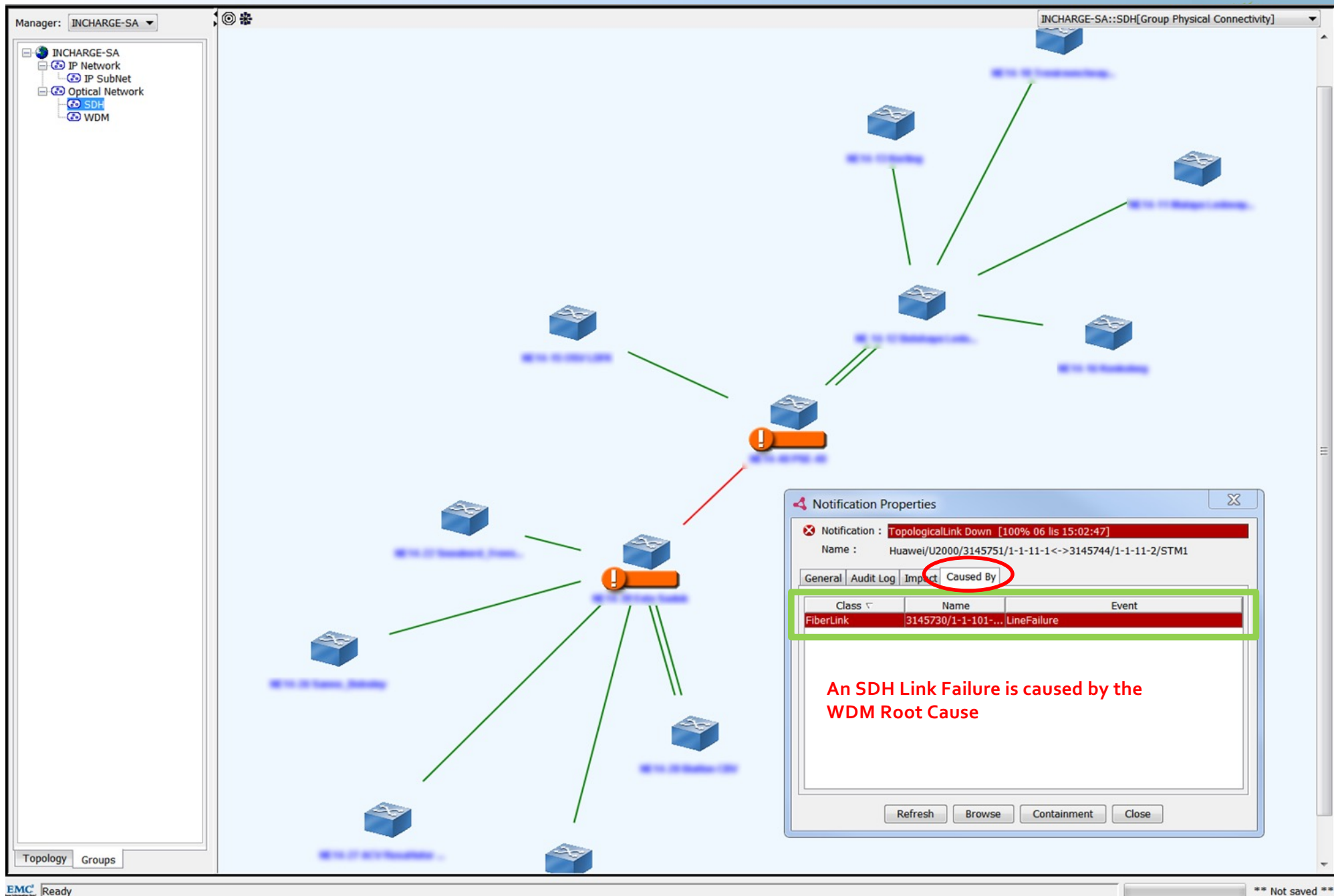
Critical Major Minor Unknown Normal

Se...	Ack...	Class	Name	Event	Source	Count	Last Notify	First Notify	...
X	No	FiberLink	3145730/1-1-101-1/OTS-Out-->3145732/1-1-14-4/OTS-In	LineFailure	OTM-WDM-ANALYSIS	4	06 lis 15:02:59	12 wrz 00:08:58	...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	...
X	No	ClientCircuit		ServiceUnavailable	OTM-IP-XD, OTM-WDM-ANALYSIS	6	06 lis 15:02:48	12 wrz 00:05:47	...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	...
X	No	NetworkConnection	IF-EMC-RTR-02/4 [Serial1/1] [192.168.60.2]<->IF-EMC-RTR-06/...	Down	INCHARGE-AM-PM, OTM-IP-XD	9	06 lis 15:02:48	16 wrz 12:22:24	...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	...
X	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	4	06 lis 15:02:48	12 wrz 00:08:41	...
X	No	LowOrder_Circuit		ServiceUnavailable	OTM-PDH-ANALYSIS	4	06 lis 15:02:47	11 wrz 10:48:27	...
X	No	LowOrder_Circuit		ServiceUnavailable	OTM-PDH-ANALYSIS	4	06 lis 15:02:47	11 wrz 10:48:27	...
X	No	LowOrder_Circuit		ServiceUnavailable	OTM-PDH-ANALYSIS	4	06 lis 15:02:47	11 wrz 10:48:27	...

Scenario 3 – Fiber Link fault – WDM View



Scenario 3 – Fiber Link fault – SDH View



Scenario 3 – Fiber Link fault – IP View



Manager: INCHARGE-SA

INCHARGE-SA::IP SubNet[Group Physical Connectivity]

INCHARGE-SA

- IP Network
 - IP SubNet
- Optical Network
 - SDH
 - WDM

Notification Properties

Notification : NetworkConnection Down [100% 06 lis 15:02:48]

Name : IF-EMC-RTR-02/4 [Serial1/1] [192.168.60.2]<->IF-EMC-RTR-06/2 [Serial0/1] [192.168.60.1]

General Audit Log Impact **Caused By** Codebook: INCHARGE-AM-PM Details

Class	Name	Event
FiberLink	3145730/1-1-101-1/OTS-Out-->3145732/1-1-14-4/OTS-In	LineFailure

An IP Link Failure is caused by the WDM Root Cause

Refresh Browse Containment Close

Topology Groups

EMC Ready

*** Not saved **



Scenario 4 – Fiber Link fault between an IP device and an Optical device

Smarts identifies that the root cause is between IP and Optical network

Notification Log - Default. Manager: INCHARGE-SA

Se...	Ack...	IsRoot	Owner	Class	Impact	Name	Event
✗	No	Yes		Cable		2IF-EMC-RTR-02/4 [Serial1/1] [192.168.60.2]<->3145735/1-1-26-3/RX1	Down

A Cross-Domain Root Cause is identified, which is a Cable Failure between an IP and a WDM device

Notification Log - Default. Manager: INCHARGE-SA

Affected WDM service and related IP Connection

Se...	Ack...	Class	Name	Event	Source	Count	Last Notify	First Notify	Last...
✗	No	NetworkConnection		Down	INCHARGE-AM-PM, OTM-IP-XD	10	06 lis 15:43:38	16 wrz 12:22:24	06 li...
✗	No	ClientCircuit		ServiceUnavailable	OTM-WDM-ANALYSIS	7	06 lis 15:43:10	12 wrz 00:05:47	06 li...

Notification Properties

Notification : Cable Down [100% 06 lis 15:43:18]
Name : IF-EMC-RTR-02/4 [Serial1/1] [192.168.60.2]<->3145735/1-1-26-3/RX1
Codebook: OTM-IP-XD

Class	Name	Event
TransponderInOc...		LosLoFEvent
NetworkConnection		DownOrFlapping
NetworkConnection		Down
FiberLink		LineFailure
ClientCircuit		ServiceUnavailable

Correlated both Optical and IP Failures

Notification Log - Default. Manager: INCHARGE-SA

Se...	Ack...	Class	Name	Event
✗	No	Cable		
✓	No	FiberLink		
✓	No	FiberLink		
✗	No	NetworkConnection		
✗	No	ClientCircuit		
✓	No	NetworkConnection		
✓	No	TransponderInOcnPort		
✓	No	FiberLink		

Notification Log - Default. Manager: INCHARGE-SA

Count	Last Notify	First Notify	Last...
3	06 lis 15:43:18	06 lis 12:59:37	06 ...
3	06 lis 15:43:14	06 lis 12:59:18	06 ...
3	06 lis 15:43:14	06 lis 12:59:18	06 ...
10	06 lis 15:43:38	16 wrz 12:22:24	06 ...
7	06 lis 15:43:10	12 wrz 00:05:47	06 ...
16	06 lis 15:43:10	11 wrz 12:04:45	06 ...
3	06 lis 15:43:10	06 lis 12:58:52	06 ...
3	06 lis 15:43:14	06 lis 12:59:18	06 ...



Thanks