The Role of NMS in Intelligent Optical Networks

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Intelligent Optical Networking

• The technology itself is maturing………

• Intelligence in the network layer is desirable

• The open question is how far, how fast with intelligence

• Adoption and deployment depends on the carrier business case
  – Operational costs savings vs revenue growth
  – Costs, timing of shifting to a new paradigm
Operational Advantages of Intelligent Optical Networks?

• Rapid provisioning
  – Reduce service provisioning time and effort (point and click)
  – Equipment installation time accounts for majority of provisioning ‘delay’, so impact on overall provisioning times may be small
  – Cost associated with excess capacity vs. more rapid revenue flow

• Dynamic provisioning/load balancing
  – Automatic rearrangement of network resources to meet demand/relieve congestion
  – Essential for short term and time sensitive services
  – Assumes adequate network capacity at all locations
  – Effective congestion management requires integrated view of L2, L3 traffic and transport layer resources
Operational Advantages of Intelligent Optical Networks?

- Automatic discovery: ‘the network is the database’
  - Provides a current view of network configuration and inventory
  - Removes the problem of database inaccuracy ($B$)
  - Reduces the cost associated with retrieving inventory and synchronizing NMS databases
  - Missing piece: OXC-to-WDM connection mapping
  - Is link-level information available via OSPF enough?

- Rapid restoration
  - Automatic restoration of traffic in mesh-based networks
  - How fast is ‘fast enough’

- Fault detection, analysis, notification
  - Reduces fault analysis and management at NMS level?
  - No uniform approach
Connection Management in ION’s

No UNI

- NMS configures control-plane parameters
- NMS categorizes connection type:
  1) NMS routing, control-plane set-up
  2) control-plane routing and set-up
- NMS triggers set-up via EMS
- EMS provides update to NMS/CDB with data on connections
- NMS provides hooks for customer service mgt. (e.g., for optical VPNs)
Connection Management with Optical UNI

- NMS provides admission-control and policy-management functions for O-UNI connection requests; also provides hooks into billing
  - Policy management (may be centralized or distributed)
- NMS triggers connection set-up
End-to-end Connection Management

- Connection spans multiple subnetworks

- No UNI at either end
  - NS-Sig-NS
  - Sig-Sig-Sig with no E-NNI between subnets
  - Sig-Sig-Sig with E-NNI between one pair of subnets
  - Sig-Sig-Sig with E-NNI between all subnets

- UNI at one end
  - Sig-Sig-NS

- UNI at both ends
  - Sig-NS-Sig
  - Sig-Sig-Sig No E-NNI
  - Sig-Sig-Sig E-NNI between one pair of subnets
  - Sig-Sig-Sig with E-NNI between all subnets
**No UNI, no NNI, NS-Sig-NS**

- NMS computes end-end path: Identifies points P1, P2, P3, and P4 and routing in the two NS domains.
  - Needs routing info from Sig domain
- NMS/EMS establishes connections in NS domains
- NMS/EMS signals to P2 for connection to P3
- Signaling domain sends connection details to EMS (sent by P2)
ClientA UNI signals to P0 for path to ClientB

- P0/CNM provide admission control
  - does admission depend on availability of routes?

- UNI signaling to P0 triggers P0 to do inter-domain routing, which determines P1, P2, P3, and P4.
  - Does NMS provide any guidance on which subnetworks should be involved?

- P0 does I-NNI signaling to set up connection to P1
- P1 does E-NNI signaling to P2, which then routes and sets up connection to P3 using I-NNI.
- P3 does E-NNI signaling to P4, which then routes and sets up connection to P5 using I-NNI, and P5 does UNI signaling to Client.

- Each domain sends connection setup information to EMS, which update NMS, and P0 sends end-to-end connection info to NMS.
End-to-end Optical “Circuit”

- Involves multiple technologies
- Involves transport and switching *within* ION subnets
- OXC-xport link mapping not currently part of autodiscovery
Role of the NMS

Management of independent vendor control planes/subnets
  - facilitate carrier’s use of network intelligence

End-end connection/service management
  - with/without NNI and UNI
  - interworking of legacy and intelligent optical systems
  - multiple technologies

Policy management and control of 3rd-party access
  - admission control for optical UNI
  - resource partitioning among services and users

Handling of complex restoration events
NMS/EMS Issues

• Division of functionality
  – NMS routing, control-plane set-up vs. control-plane routing and set-up
  – Explicit routing capability in NMS vs in subnetwork
    • congestion management
    • survivability
  – NMS connection management DB--how much info
  – NMS polling vs EMS updates
  – Policy management/admission control centralized vs. distributed
  – Fault management: EMS capabilities vary widely

• NMS/EMS interfaces
  – Must be enabled to support intelligent optical networks
MTNM Scenarios for UNI & NNI

• A Preliminary list of questions
  – What are the Control Plane parameters that require configuration?
  – How does a UNI set-up request get passed from EMS to NMS?
  – How does EMS identify failed SNCs or Topological Links to NMS?
  – How does NMS query EMS for above information?
  – How does EMS represent an end-to-end call path?
  – How can dynamic source reroute and M:N shared path protection or pre-planned be addressed by MTNM?

• Additional work needed:
  – Analyze additional & more detailed scenarios
  – Compare with MTNM use cases (TMF 513, TMF 608)
  – Provide detailed requirements and use cases to TMF MTNM team

• New contribution to OIF OAM&P group
Myth vs Reality?

- Roll-out of intelligent optical networks in large scale networks will be paced by:
  - carrier economics, standards development
  - NE/EMS development
  - meeting service requirements?
  - resolution of NMS/EMS division of functionality for ION’s
  - updates to existing standards for NMS/EMS interfaces
  - support for other management functions (eg billing and policy management) are in place
  - end-to-end service and network management capabilities

- However ........
  - The full vision need not be realized in a single step, or at all!
  - Implementation of limited capabilities may have significant value and low barriers to deployment
  - Extremely attractive to greenfield (or ‘cap and grow’) deployments
  - Deployment will lead standards
Thank you!