Management of ASON-capable Network and its Control Plane

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Outline

- Benefit of ASON-capable Network
- Management Requirements
- How these requirements are being addressed
- Challenge and Issues
ASON Capabilities

- Automatic route design
  - Path computation done by the network

- Automatic connection management
  - Setup / Modification / Release
  - Restoration / Protection

- Automated resource management
  - Transport topology & capacity discovery
  - Connectivity verification


**ASON Benefits**

- **Simplified connectivity provisioning**  \(\downarrow\) \(\text{OPEX}\)
  - Path computation done by the network
  - Reduce complex planning and designs
  - Increase accuracy of the process

- **Efficient network resource utilization**  \(\downarrow\) \(\text{CAPEX}\)
  - Reduce static dedicated protection through dynamic shared restoration

- **Rapid service turn-up**  \(\uparrow\) \(\text{Revenue}\)
  - Timely support of bandwidth-on-demand services
  - Provide new revenue opportunities
ASON – An enabler for NGN realization

Transport stratum
- Access Network Functions
- Edge Functions
- Core Transport Functions
- Gateway Functions

Service stratum
- Application Functions
- Service User Profiles
- Transport User Profiles
- Network Attachment Control Functions
- Resource and Admission Control Functions

End-User Function
- Management Functions

Control
- Media Handling Functions

Management
- Network Attachment Control Functions
- Resource and Admission Control Functions

3rd Party Application Providers

Service User Profiles

Other Networks

Other

ANI

UNI

NNI
Context of ASON Management

- **Management plane**
  - Directs
  - Reports

- **Data communication network**
  - Supports

- **Control plane**
  - Directs
  - Reports

- **Transport plane**
  - Directs
  - Reports
Views of **Transport resources**

Relationship between the architectural entities in Transport plane, Management plane, and Control plane

**Transport entities**
- Adaptation function
- Trail Termination function
- CP: Connection point
- TCP: Termination connection point

**Management plane view**
- TTP: Trail Termination Point
- CTP: Connection Termination Point

**Control plane view**
- SNP: Subnetwork Point
- SNPP: SNP Pool
- SNPP Link

**ITU-T Workshop “NGN and its Transport Networks”**
Kobe, 20-21 April 2006
How ASON management is being addressed

Network Element

Control Plane

Transport Plane

TMF MTNM

G.7718

G.7718.1

EMS

NMS

SMS
G.7718 ASON Management requirements

- Configuration management
  - Control plane resources
    - Identifiers, addresses, protocol parameters (signaling & routing) ...
  - Routing areas
    - RA hierarchies, (dis)aggregation, assignment of CP resources
  - Transport resources (in control plane view)
    - (de)allocation, names and identifiers, discovery, topology, resource and capacity inventory
  - Call and connection
    - setup(SPC)/modification/release
  - Policy
- Fault management
  - Control plane components, resource/connection/call (service),
- Performance management
  - Control plane components
- Accounting management
  - Usage and call details record
- Security management
G.7718.1 – Routing service classes
G.7718.1 (cont.) – Signaling service classes
G.7718.1 (cont.) – Discovery service classes

**ControlPlaneService**
- administrativeState
- statusReporting: Boolean = disabled
- operationalState: Boolean = NA
- currentProblemList = empty list
- setStatusReporting()
- setAdministrativeState()

**NetworkElement**

**DCCCTP**
- 0..1
- {only MS and RS}

**TTP**
- 1

**DiscoveryService**
- 0..1

**TransportEntityCapabilityExchange**
- activeState
- remoteCapability
- negotiatedLocalCapability
- operationalState: Boolean = NA
- startTransportEntityCapabilityExchange()
- stopTransportEntityCapabilityExchange()

**LayerAdjacencyDiscovery**
- discoveryMessage
- discoveryState
- remoteEndPoint
- remoteDiscoveryAgent
- operationalState: Boolean = NA
- startLayerAdjacencyDiscovery()
- stopLayerAdjacencyDiscovery()
**TMF 513/608/814 – CP Management**

- Version 3.5 - CP & Ethernet management
  - TMF 513 - Requirements & Use cases
  - TMF 608 - Protocol-neutral model (UML)
  - TMF 814 - CORBA solution
- Adopt the v3.0 approach
  - Multi-layer
    - ML-RA (MLSN), ML-SNPP, ML-SNPP Link, ...
  - Re-use of SNC
    - Connection
- Call - for ASON and Ethernet management
G.805 Layered Model and MTNM Simplification
MTNM multi-layered Model

Basic ITU-T G.805 structures
- G.805 Adaptation
- G.805 Trail Termination
- G.805 Connection Point
- G.805 Termination Connection Point
- G.805 relationship
- G.805 relationship
- G.805 relationship (may be SNC)
- G.805 SNC (may be relationship)

MTNM Model
- PTP
- CTP
- SNC
- TerminationMode
- Naming/containment
EMS Domain = MLSN, Routing Area is not seen at NMS-EMS i/f, basic reference scenario #0

Routing Area Connection, modeled as a “network routed” SNC
MTNM Control plane management: Scenario #1

EMS Domain = MLSN of Routing Area type, centralized CC, reference scenario #1
MTNM Control plane management: Scenario #3

Three levels routing hierarchy, EMS Domain = top level MLSN of Routing Area type, centralized CC per Routing Area, reference scenario #3
Three levels routing hierarchy, one EMS per Routing Area of intermediate level, reference scenario #4

Routing Area 1
Top level MLSN

Routing Area 1.1
(level 1)

EMS Domain

EMS1
Connection controller
ASON Signalling
EMS2

Routing Area 1.2
(level 1)

NMS

Edge PTP, Dumb interface

SNC 1

End to End SNC

E-NNI interface

SNC 2

MTNM Control plane management: Scenario #4
MTNM Control plane management: Scenario #5

Three levels hierarchy, all MLRAs are wider than EMS Domain, distributed CC, reference scenario #5

EMS Domain 1

EMS Domain 2

EMS Domain n

Routing Area 1 (level 1)

Routing Area 1.1 (level 1)

Routing Area 1.2 (level 1)

Edge PTP, Dumb interface

SNC 1

SNC 2

MTNM Control plane management: Scenario #5

End to End SNC

Routing Area 1 Top level MLSN

E-NNI

E-NNI

E-NNI

E-NNI

NMS
Routing Area Island, reference scenario #6

- "legacy" MLSN
- EMS Domain
- Routing Area 1
  - Top level MLSN
- MLSN SNC
- Dumb Interface
  - SNPP Link (level 0), single ended
- Routing Area
  - Connection/SNC
- I-NNI
  - SNPP Link (level 1)
Use cases

MLRA Discovery and Inventory

- **Retrieve MLRA(s) (UC_4)**
  - `MLSN Mgr:: getMultiLayerSubnetwork ()` // given the name, return the object details
  - `Ems Mgr:: getAllMLRAs ()` // get all MLSNs which are RA, including routing nodes
  - `Ems Mgr:: getAllTopLevelSubnetworks ()` // both MLSN & MLRA

- **Retrieve MLRAs that are subordinate to a specified MLRA (UC_28)**
Use cases (cont.)

- **MLSNPP Link Discovery and Inventory**
  - Retrieve MLSNPP Links (UC_5)
  - Retrieve available MLSNPP Link capacity (UC_6)

- **MLSNPP Discovery and Inventory**
  - Retrieve MLSNPPs (UC_27)
  - Notify change in capacity available to the Control Plane - resulting from commissioning / decommissioning of resources (UC_1)
Use cases (cont.)

- Call Discovery and Inventory
  - Retrieve Calls and top level Connections supporting each Call (UC_7)
  - Retrieve details of a Call (UC_35)
  - Notify new Calls and Connections (SPC and SC) (UC_8)
  - Notify deleted Calls and Connections (SPC and SC) (UC_9)
Use cases (cont.)

- Call management
  - Establish a Call (UC_20)
  - Release a Call (UC_21)
  - Add connection(s) to an existing call (UC_22)
  - Remove connection(s) from with a call (UC_23)
  - Retrieve Calls and their top level Connections (UC_7)
  - Retrieve subordinate MLRA involved in the route of a Connection (UC_24)
  - Retrieve route details of a specified Call within a specified RA (UC_25)
  - Retrieve the ID/Name of the Call supported by a specified TP/SNPP/TNA (UC_26)
  - Set diversity and co-routing parameters of an existing call (UC_33)
Use cases (cont.)

**Provisioning**

- Assign UNI MLSNPP Link to a Signaling Controller (UC_10)
- Set UNI signaling protocol and parameters (UC_11)
- Modify signaling parameters (UC_11b)
- Enable the UNI signaling for a MLSNPP Link (UC_12)
- Disable the UNI signaling for a MLSNPP Link (UC_13)
- De-assign a UNI MLSNPP Link from a Signaling Controller (UC_14)
- Assign TNA Names to components of an MLSNPP (UC_15)
- Assign TNA Names to components of an MLSNPP Link (UC_32)
Challenge

- Issues for further study
  - Management plane (MP) and Control plane (CP) inter-working and integration
  - Transport resource allocation and migration
  - Maintenance of transport resources that are CP-allocated
  - Call & connection migration
  - ...

- Collaboration among forums (SG15, TMF, OIF, IETF)
  - SG15 & TMF: role and responsibility
  - SG15 & OIF: ASON architecture and requirements
  - SG15 & IETF: Protocols MIBs and info models