

Application-Based Network Operations (ABNO)

<http://tools.ietf.org/html/draft-farrkingel-pce-abno-architecture-06>

IETF 88 – SDN RG

Daniel King (Editor)

Adrian Farrel (Editor)

Quintin Zhao

Victor Lopez

Ramon Casellas

Yuji Kamite

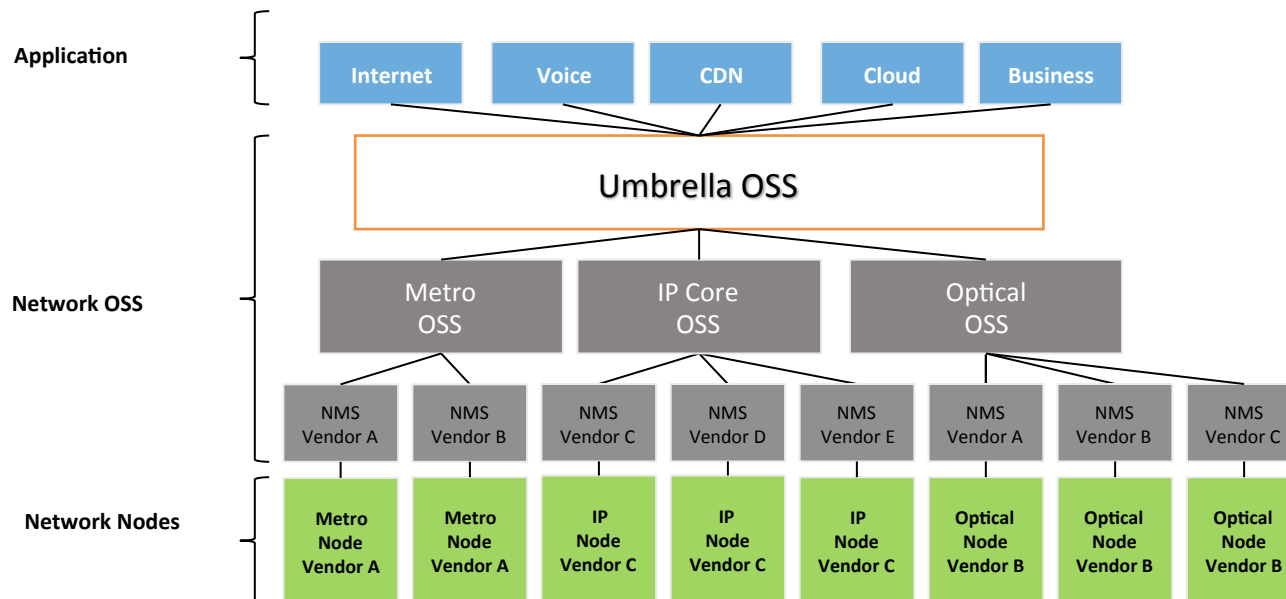
Yosuke Tanaka

Ina Minei

Young Lee

Control of Today's Networks

- Current network operation is not adapted to flexible networking
- Multiple manual configuration actions are needed for network nodes
- Network solutions from different vendors typically use specific OSS/NMS implementations
- Very long provisioning times
- Lack of network bandwidth flexibility and inefficient use of inherent function



Network Operation Requirements

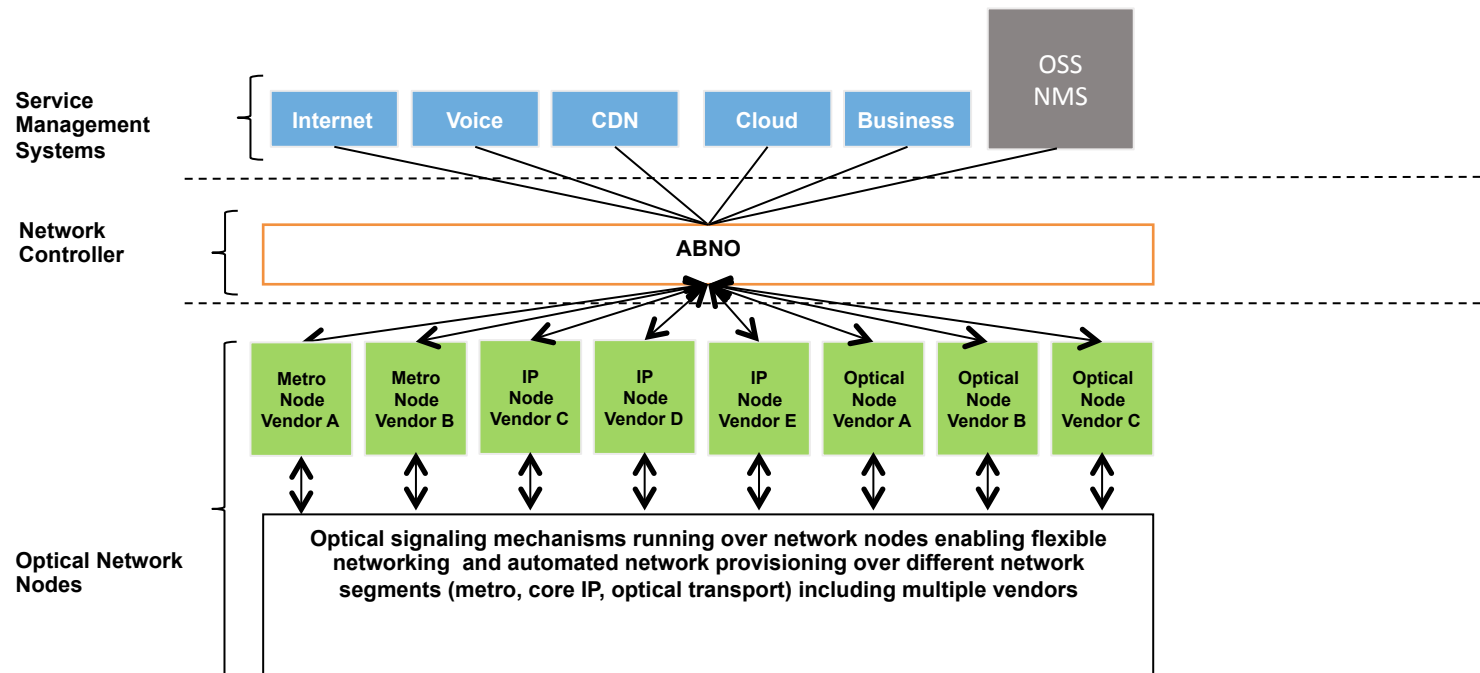
- The network does not need to be seen any longer as a composition of individual elements
- Applications need to be capable of interaction with the network
- Support of the next generation of variable and dynamic transport characteristics
- Automated deployment and operation of services.
 - “Create a new transport connection for me”
 - “Reoptimize my network after restoration switching”
 - “Respond to how my network is being used”
 - “Schedule these services”
 - “Resize tunnels”

Network Operation Framework Building Blocks

- Avoiding the mistake of a single “controller” architecture
 - As it encourages the expansion and use of specific protocols
- Discovery of network resources
- Network resource abstraction, and presentation
- Routing and path computation
- Multi-layer coordination and interworking
 - Multi-domain & multi-vendor network resources provisioning through different control mechanisms (e.g., Optical, OpenFlow, GMPLS, MPLS)
- Policy Control
- OAM and performance monitoring
- Leveraging existing technologies
 - What is currently available?
 - Must integrate with existing and developing standards

Application-Based Network Operations (ABNO)

- Application-Based Network Operation (ABNO) framework.
- “A PCE-based Architecture for Application-based Network Operations”
 - draft-farrkingel-pce-abno-architecture



Application-Based Network Operation (ABNO)

- “Standardized” components and co-operation.
- Policy Management
- Network Topology
 - LSP-DB
 - TED
 - Inventory Management
- Path Computation and Traffic Engineering
 - PCE, PCC
 - Stateful & Stateless
 - Online & Offline
 - P2P, P2MP, MP2MP
- Multi-layer Coordination
 - Virtual Network Topology Manager
- Network Signaling & Programming
 - RSVP-TE
 - ForCES and OpenFlow
 - Interface to the Routing System (I2RS)

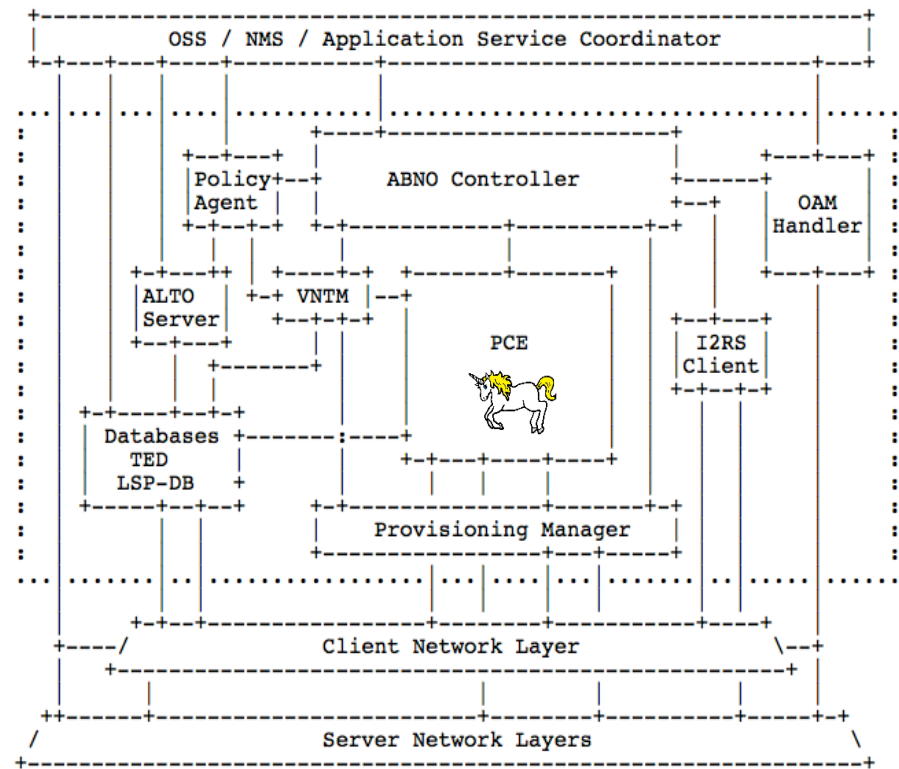


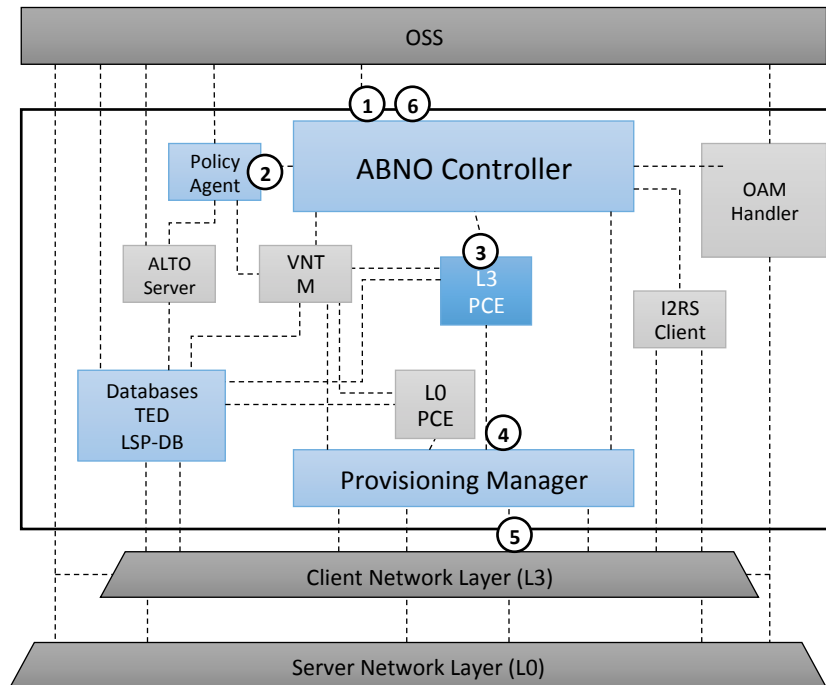
Figure 1: Generic ABNO Architecture

ABNO Use Cases

3. ABNO Use Cases	22
3.1 Inter-AS Connectivity	22
3.2 Multi-Layer Networking	28
3.2.1 Data Center (DC) Interconnection across MLNs	31
3.3 Make-Before-Break	35
3.3.1 Make-Before-Break for Re-optimization	35
3.3.2 Make-Before-Break for Restoration	36
3.3.3 Make-Before-Break for Path Test and Selection	37
3.4 Global Concurrent Optimization	39
3.4.1 Use Case: GCO with MPLS LSPs	40
3.5 Adaptive Network Management (ANM)	42
3.5.1. ANM Trigger	43
3.5.2. Processing request and GCO computation	43
3.5.3. Automated Provisioning Process	44
3.6 Pseudowire Operations and Management	45
3.6.1 Multi-Segment Pseudowires	45
3.6.2 Path-Diverse Pseudowires	47
3.6.3 Path-Diverse Multi-Segment Pseudowires	48
3.6.4 Pseudowire Segment Protection	49
3.6.5 Applicability of ABNO to Pseudowires	49
3.7 Cross-Stratum Optimization	50
3.7.1. Data Center Network Operation	50
3.7.2. Application of the ABNO Architecture	52
3.8 Other Potential Use Cases	54
3.8.1 Grooming and Regrooming	54
3.8.2 Bandwidth Scheduling	54
3.8.3 ALTO Server	55

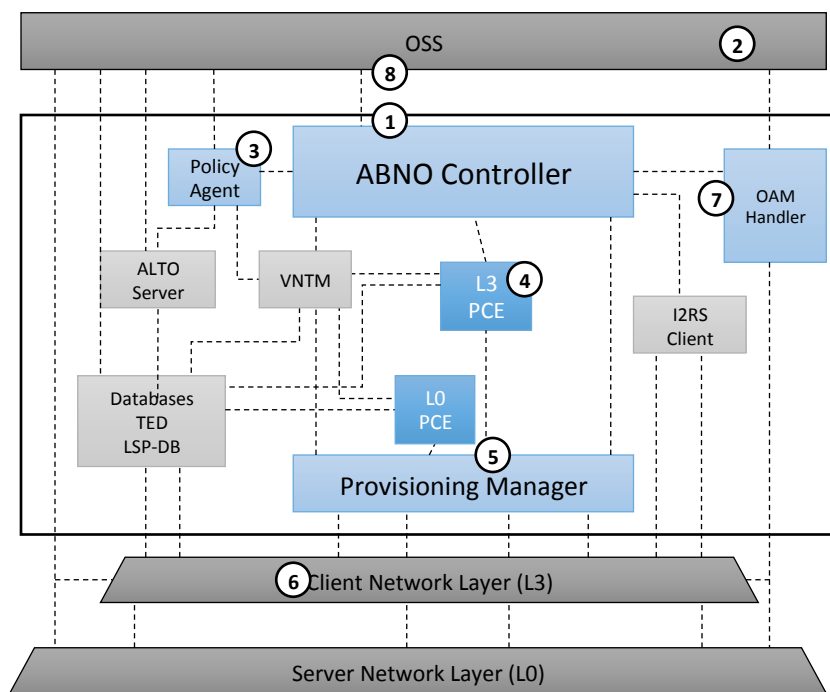
- The following slides present various use cases shaping the development of ABNO:
 - Multi-layer Path Provisioning
 - Multi-layer Restoration
 - Network Optimization after Restoration

ABNO - Multi-layer Path Provisioning (Path)



1. OSS requests for a path between two L3 nodes.
2. ABNO controller verifies OSS user rights using the Policy Manager.
3. ABNO controller requests to L3-PCE (active) for a path between both locations.
4. As L3-PCE finds a path, it configures L3 nodes using Provisioning Manager.
5. Provisioning manager configures L3 nodes using the required interface (RSVP-TE, OpenFlow, etc.).
6. OSS is notified that the connection has been set-up.

ABNO - Multi-Layer Restoration



1. Upon network failure, the OSS notifies the ABNO controller of all failed E-2-E connection and possible root cause.
2. NMS requests a new E-2-E connection.
3. ABNO controller verifies request via the Policy Manager.
4. ABNO controller requests to L3-PCE (active) for a path between both locations.
5. As L3-PCE finds a path, it configures L3 nodes using Provisioning Manager.
6. Provisioning Manager configures L3 nodes using the required interface (RSVP-TE, OpenFlow, etc.)
7. OAM Handler verifies new connectivity.
8. OSS is notified that the new IP links are up and tested (SNMP, etc.).

Next Steps for ABNO

- Further discussion on key components
 - Policy
 - Capability discovery and registration
 - Resilience
 - North-bound Interfaces
 - Use of Common Network Models
- Continued development and polishing of Use Cases
- Prototyping
 - European Commission Project FP7 IDEALIST