ONAP
OPEN NETWORK AUTOMATION PLATFORM

## ONAP MDONS

# Blueprint Overview

ONAP Multi-Domain Optical Network Service (MDONS) Blueprint Cuts Opex and Improves Customer Experience

**OVERVIEW:**

- Automates optical services across CSPs
- Supports MEF, OpenROADM, and TAPI APIs
- Complements CCVPN to fully automate optical network-as-a-service

**CURRENT CHALLENGES:**

- Manual steps to create end-to-end optical services
- High OPEX and delayed revenue
- Sub-optimal customer experience

**SOLUTION:**

- ONAP orchestrates L0/1 optical networks across CSPs
- Unified management and scheduling of resources and services
- ONAP acts as a global orchestrator for optical domain controllers

"The MDONS blueprint allows network operators to automate the provisioning and activation of optical services within multi-domain, multi-vendor environments. The standards-based capabilities that we contributed to ONAP enable efficient management of cross-carrier inter-connections, resulting in reduced operational costs and faster service delivery"

– Raghavan Subramanian, Sr. Product Planner, Fujitsu Network Communications

# Overview

Optical Transport Networks (OTNs) are in high demand to build high bandwidth, flat, protocol agnostic networks to meet the growing demands arising from rapid digital transformation of our economy. Communication Service Providers (CSPs) are responding to this demand by offering network-as-a-service over optical networks that often span across CSPs or independent operating units within a CSP. See the CCVPN use case blueprint for more discussion on this topic.

# Problem

In order to offer service to customers with geographically diverse locations, CSPs often lease resources in networks where they do not have a presence ("off net"). This allows them to provide end-to-end service to their customers, but requires a manual and complex negotiation between CSPs that includes both the business arrangement and the actual service design and activation.

CSPs may also be structured such that they operate multiple networks independently and require similar transactions among their own networks and business units in order to provide an end-to-end service. The current state of the technology creates issues such as:

- High operational expenditure (OPEX): The manual steps required for CSP connections raise the overall cost of provisioning a service.
- Sub-optimal customer experience: Manual steps cause the time from the original request to a fully provisioned service to be unnecessarily long. This customer experience can certainly be improved.
- Delayed revenue: This same delay in activating a service pushes out revenue for the CSP.
- Lack of value add services: It is very difficult to add dynamic value add services when the implementation is largely manual.
- Lack of standards-based reference: Proprietary implementations in managing cross-domain operations leads to increased costs and vendor lock-in.

# Solution

The MDONS use case blueprint developed by the LF Networking's ONAP community solves many of these problems by automating the above-mentioned service activation and operations, that include service assurance and monitoring. Both MODNS and the Cross Domain and Cross Layer VPN (CCVPN) blueprints jointly address the optical network-as-a-service problem. While MDONS focuses on Layers 0 and 1, CCVPN focuses on Layers 2 and 3[1].

For those new to the project, Open Network Automation Platform (ONAP) is an open source project that provides a common platform for telecommunications, cable, and cloud operators and their solution providers to rapidly design, implement and manage differentiated services. ONAP provides orchestration, automation and end-to-end lifecycle management of network services. It includes orchestration, lifecycle management, and automation functionalities.

1 Layers 0 and 1 deal with the cabling and physical optical transmission while layers 2 and 3 deal with data link layer the network layer

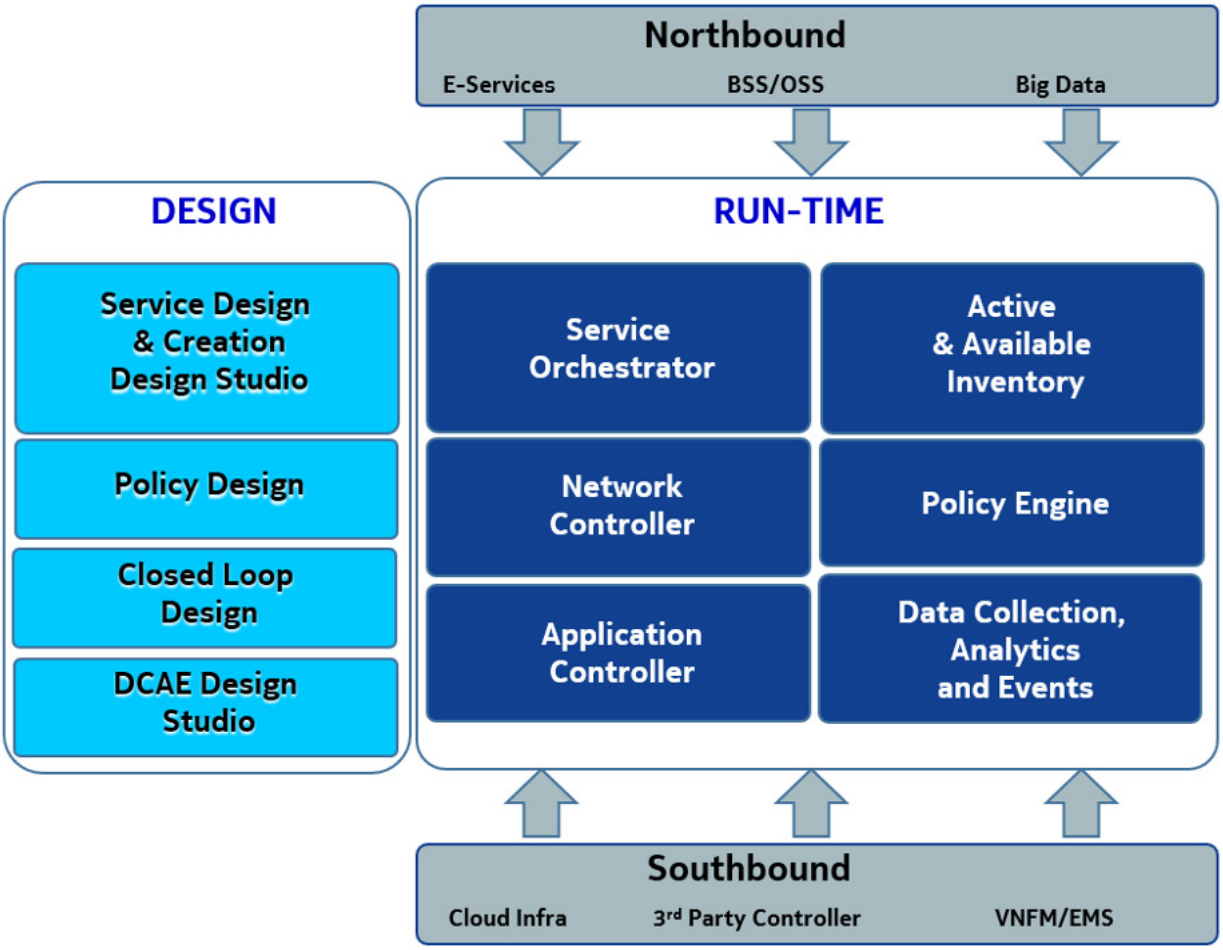


Figure 1: ONAP Functionality

ONAP is divided into two parts: design time and run time. The key design time project is Service Design & Creation (SDC) that allows users to design services, control loops, policies, and more. The run time projects include the Service Orchestrator for orchestration, a number of controllers for configuration and ongoing lifecycle management, Data Collection Analytics and Events (DCAE), and Policy.

In the MDONS blueprint, ONAP plays the role of lifecycle service orchestration where ONAP peers with another ONAP instance in a partner network and interacts with the local optical network through optical domain controller(s) via one of two standard APIs—ONF TAPI or OpenROADM. The goal of MDONS is to automate the service activation and operations (e.g. lifecycle management, service assurance, monitoring) and coordinate service requests between CSPs or independent operational units within a CSP.

The following figure illustrates an example of an MDONS implementation.

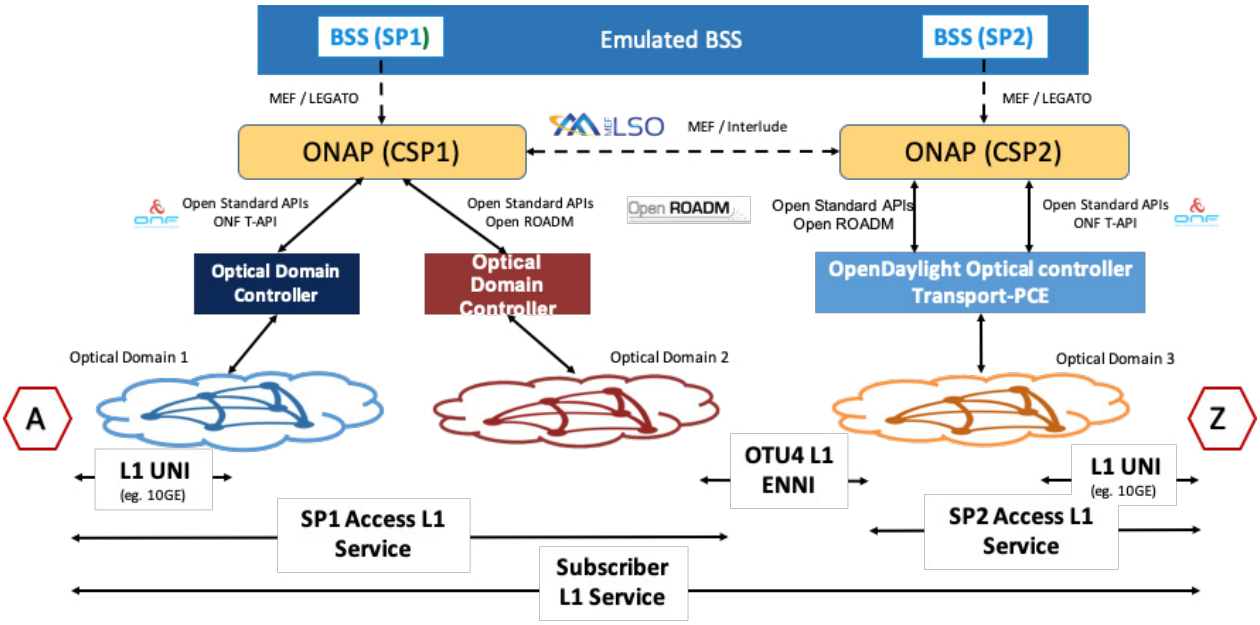


Figure 2: ONAP MDONS Blueprint Reference Diagram

In the above example, end point A is connected to an optical network service that spans two domains in CSP1 and one domain in CSP2. The provisioning, activation, and ongoing operational management of the entire network service from end-point "A" to end-point "Z" is performed by the MDONS service. In the case of CSP1, ONAP communicates with the two domain controllers shown in the diagram above. In one case, the communication is over the ONF TAPI API, while in the other case, the communication is over the OpenROADM API. The ONAP instance in CSP1 also communicates with the ONAP instance in CSP2 over the MEF Interlude API. In the case of CSP2, ONAP connects with one domain controller over either of the two APIs mentioned earlier, which in turn communicates with the optical domain. The northbound interface exposed by ONAP in both CSP1 and CSP2 is MEF Legato through which a BSS system can order services.

# Implementation Details

The goals of MDONS were to:

- Incorporate and harmonize with MEF L1 Subscriber and Operator service definitions for OTN
- Define end-to-end optical service workflow definitions and onboard optical domain network resources

- Align, harmonize, and reconcile common information/data models in ONAP to enable optical transport services design and instantiation
- Manage the optical transport domain through standard models/APIs such as OpenROADM or the ONF Transport API

The blueprint has been successfully developed to meet the above goals and the contributors have demonstrated A) 3rd party Domain controller on-boarding, B) optical network and resource discovery, C) L1 (OTN) intra-domain service creation/deletion using Open ROADM domain controller API, and D) L1 (OTN) inter-domain service creation/deletion using TAPI domain controller API.

The MDONS blueprint supports the following tasks:

- Resource on-boarding and service design
- Service deployment and configuration
- Service termination

The blueprint required work on several ONAP projects such as SDC, external API, SDN-C, A&AI, SO, and UUI. The table below shows the activities undertaken in each of these projects:

| Projects | Tasks |
|---|---|
| **SDC** | Define service template based on MEF L1 definitions<br>Define resources models for ENNI, UNI, Controllers |
| **SDN-C** | Discover Domain Topology & Resources<br>Create/delete intra-domain L1 service<br>Create/delete inter-domain L1 service<br>Create/delete intra-carrier L1 service |
| **A&AI** | Onboard domain controllers through ESR<br>Define service and resource models<br>Discover Domain Topology & Resources<br>Create/delete inter-domain links<br>Update service inventory |
| **SO** | Accept and validate L1 service request<br>Decompose L1 service request |
| **UUI** | Create/delete inter-domain links<br>Create/delete intra-domain L1 service<br>Create/delete inter-domain L1 service<br>Create/delete intra-carrier L1 service<br>Return success/failure to requestor |

Additionally, MDONS provided guidance and feedback to advance discussions in standards forums that included modeling work pertaining to the MEF L1 subscriber and operator service models, OpenROADM MSA service model updates, and adding OTN service control to transport PCE / the external OpenDaylight controller; driving unification of MEF, OpenROADM, and ONF TAPI models for open optical networking.

# Summary

ONAP is used to design, deploy, and manage the lifecycle of complex end-to-end OTN services. The key point demonstrated by MDONS is the peering of ONAP across CSPs and the use of industry standard APIs such as OpenROADM and TAPI to interact with the production ready domain controllers.

Early results (based on tests conducted by AT&T, Fujitsu, Orange) are encouraging: service deployment times have been slashed dramatically. In addition, the operations and management burden is reduced through automation, helping CSPs move from a break-fix mentality to a plan-build process.

ONAP helps fulfill the promise of automation for end-to-end network-as-a-service by applying MDONS in combination with other blueprints including CCVPN and 5G. By using ONAP for robust lifecycle management, the MDONS blueprint brings increased agility and cross-domain connectivity for CSPs.

# Resources

MDONS blueprint wiki page: wiki.onap.org/display/DW/Multi-domain+Optical+Network+Services