



SDN Framework and APIs

Lyndon Ong
OIF Marketing Committee Co-Chair
Ciena

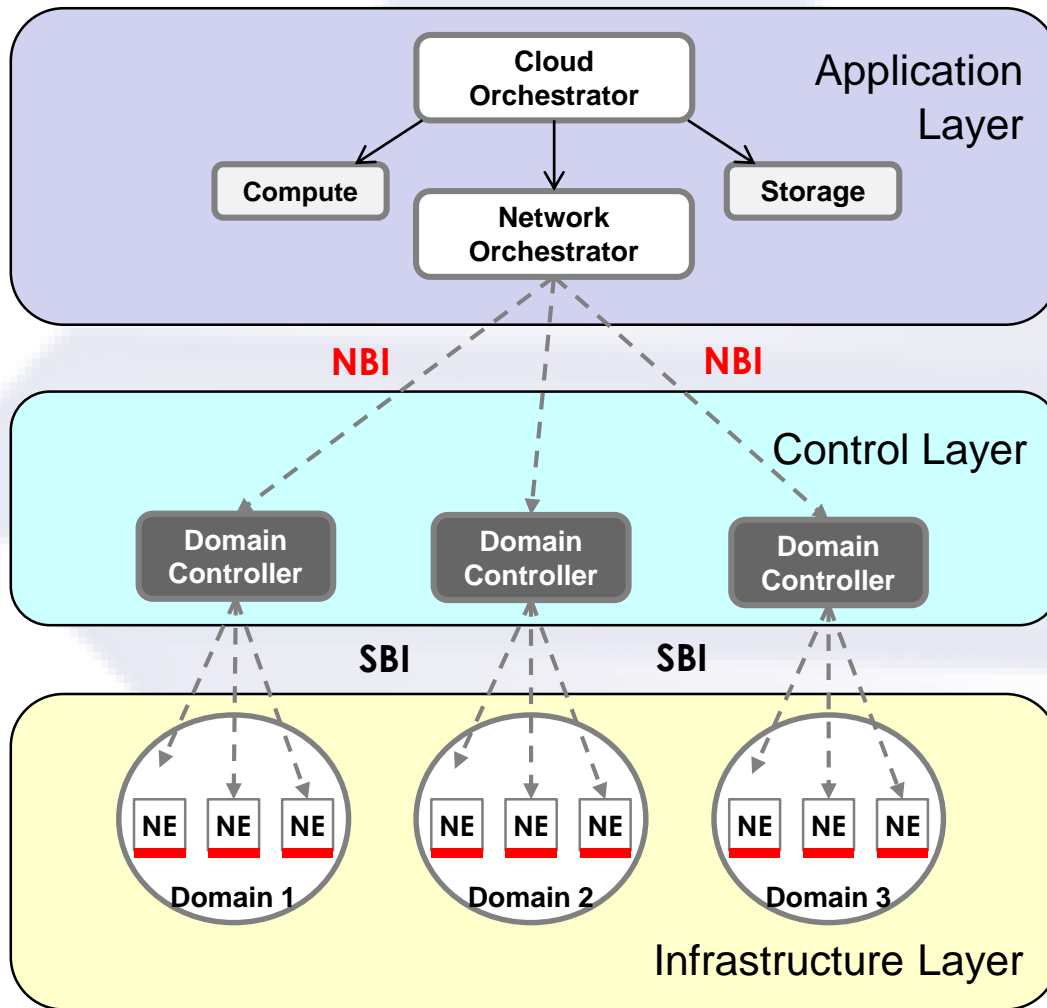
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OIF OPTICAL
INTERNETWORKING
FORUM

Multi-Domain Transport SDN Model

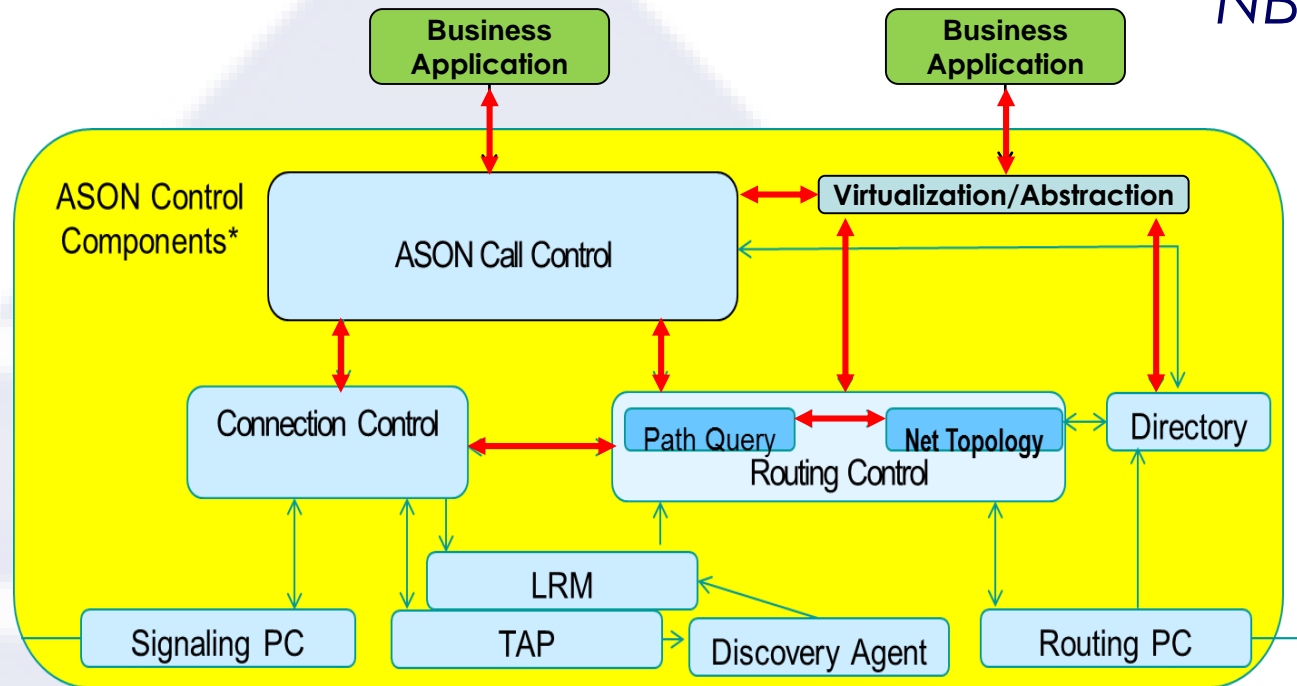
Multi-Domain Integration



Transport SDN framework for carrier networks

- **Used to unify diverse carrier domains**
 - multiple technology layers
 - multiple domains with differing control planes
 - greenfield and brownfield
- **Need for standards on application layer interface to control layer (SDN NBI)**

Framework for SDN APIs NB Interface



* Figure does not imply specific distribution of components, e.g., centralized or distributed

- **SDN - Opening up access to control components**
 - Call/Connection Control, Topology, Path Query, Virtualization
 - Replace internal, proprietary interfaces, decouple functions/SW
 - <http://www.oiforum.com/documents/framework-for-transport-sdn-components-and-apis>

Transport SDN Framework and APIs

- **Focus on work in OIF Transport SDN Framework and joint work between OIF and ONF on Transport API**

- **OIF Network & Operations Working Group**

- Objective: facilitate the development of interoperable networking and operations solutions for multi-technology networks

- Leadership: Peter Landon, BTI, Chair

- **OIF Interoperability Working Group (Network)**

- Objective: define and carry out proofs of concept multi-vendor interoperability trials of OIF Implementation Agreements

- Leadership: Jonathan Sadler, Coriant, Chair

- **OIF Carrier Working Group**

- Objective: develop requirements and guidelines for the services and functions to be supported by future optical networks

- Leadership: Vishnu Shukla, Verizon, Chair

- **ONF Open Transport Working Group**

- **Objectives**

- Develop *SDN* and *OpenFlow®* standard-based control capabilities for carrier transport networks.
 - Recent change: addition of Wireless Transport project

- **Leadership**: Lyndon Ong, Ciena, Chair

- **Work to date**

- Transport SDN Use Cases & Functional Requirements
- OpenFlow Extensions for Optical Transport
- 2014 Joint Demo with OIF

- **In Progress: T-API, Information Model & OpenFlow v1.1**

Achieving Common APIs

The Tools and Remaining Challenges

Existing Work

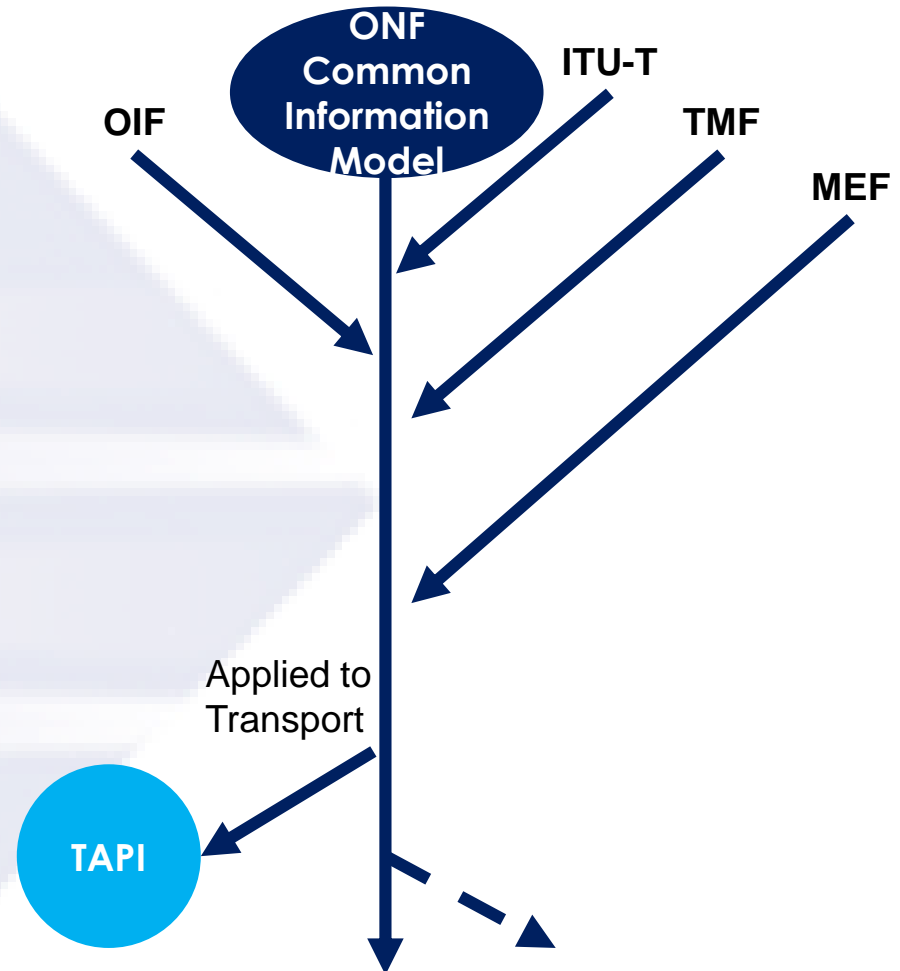
- Current API work is being done in fragmented silos
- Some linkage of APIs to existing protocol environments

Keys to achieving interoperable common APIs

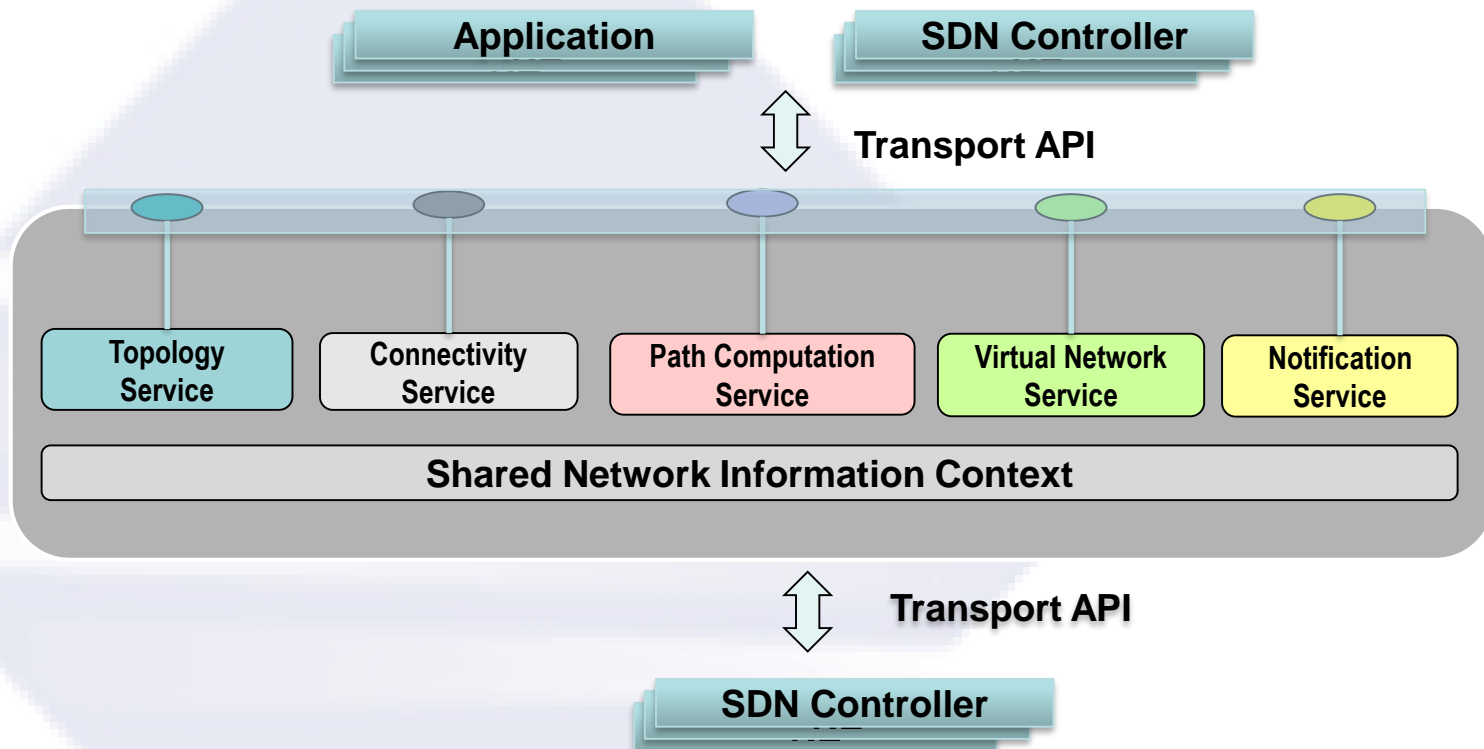
- Base work on common Information model and API specification
 - **Take advantage of ONF Common Information Model project - aligns ONF, ITU, TMF, MEF, OIF**
- Verify APIs provide the necessary functionality
 - **Use case review and convergent SDO work**
 - **Refinement for transport network applications**
 - **Prototype, demonstrate, implement!**

Common Information Model

- Defines a common object model for all types of Software Defined Networks
 - **Basic components like network resources, service constructs**
- Common agreements on modeling across SDOs
 - **ONF, ITU-T, TMF, MEF...**
- Apply Transport requirements to Common Info Model to create Transport API (TAPI)



Transport API Model



- Can be hierarchically applied – Parent controller to Child controller

OIF Transport API Project Overview

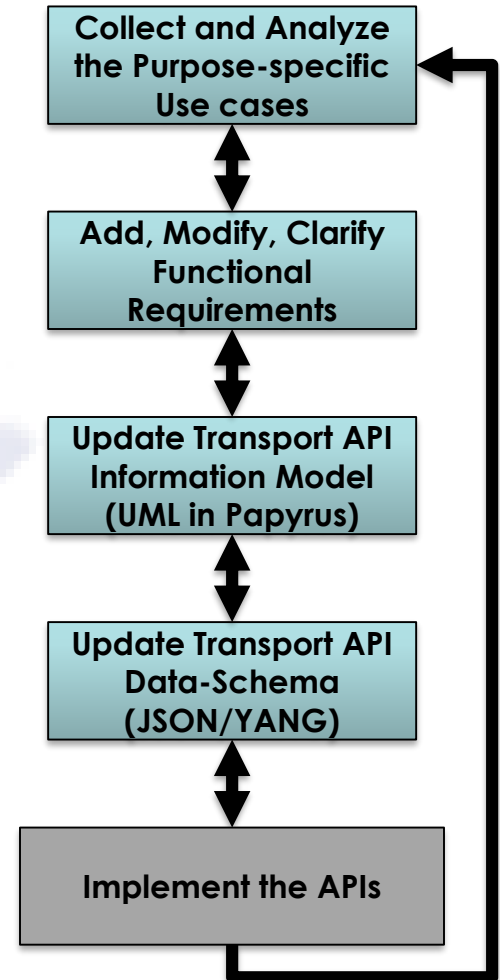
Collaborative Effort with ONF

- **Develop Use Cases and Functional Requirements**
 - **Basis of work**
- **Information Model**
 - **Based on and extends ONF Core IM**
- **Data Models/Schema**
 - **YANG model and JSON schema**
- <https://github.com/OpenNetworkingFoundation/ONFOpenTransport>
- **Implement, test, refine – “agile” process**

Software and Automation Tools

- **Englewood Open Source SW project**
 - <https://github.com/OpenNetworkingFoundation/ENGLEWOOD>
- **Eagle ONF Open Source Tools project**
 - <https://github.com/OpenNetworkingFoundation/EAGLE-Open-Model-Profile-and-Tools>

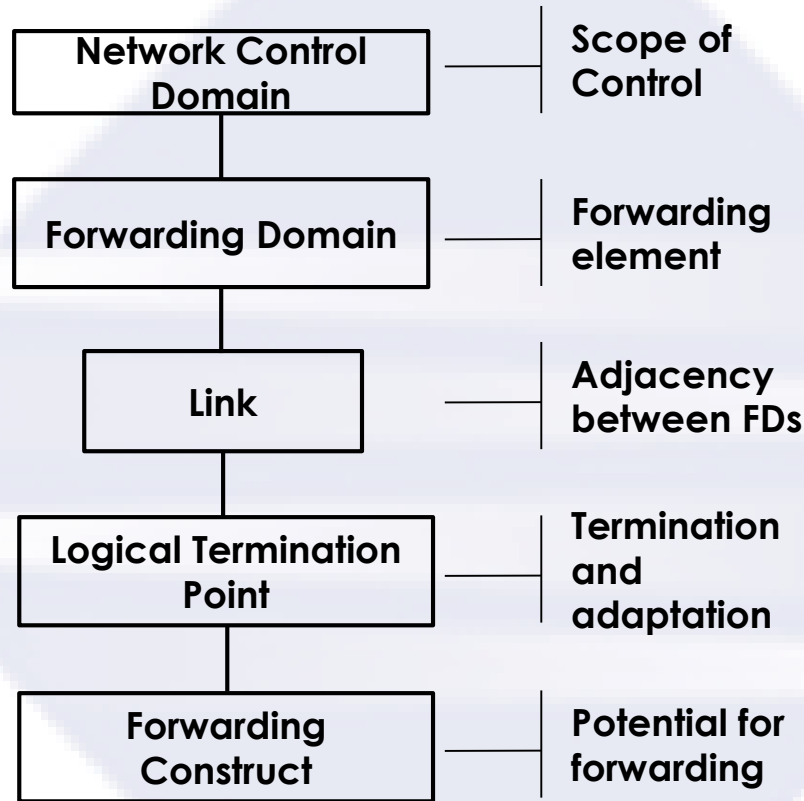
OIF Interop testing and IAs to follow



Connectivity Service Functional Requirements (draft)

TAPI_FR_0001	Create Connectivity Service
Description	<ul style="list-style-type: none"> • Causes creation of a <i>Forwarding-Construct</i> representing the <i>Service</i> request to connect the <i>Service-End-Points</i> within the shared <i>Context</i> between API Client and Provider • Returns Service ID to be used as reference for future actions • Initial definition will be for a basic point-to-point bidirectional service
Pre-conditions	<ul style="list-style-type: none"> • Requestor/Client has visibility of the set of <i>Service-End-Points</i> between which connectivity is desired within the <i>Context</i> • Requestor/Client has information about the types of connectivity available and constraints it can specify such as Service Level • Requestor/Client may be aware of other existing <i>Connectivity Services</i> and their IDs
Inputs	<ul style="list-style-type: none"> • List of <i>ServiceEnds</i> and details of each including <ul style="list-style-type: none"> – Role of the terminating <i>ServiceEndPoint</i> in the context of the <i>Service</i> – Directionality of the terminating <i>ServiceEndPoint</i> in the context of the <i>Service</i> – Reference (Name/ID) to terminating <i>ServiceEndPoint</i> • Connectivity Requirements such as Layer and Capacity • Connectivity Constraints such as Latency, Cost, etc • Start Time & End Time
Outputs	<ul style="list-style-type: none"> • Service ID • Operational State • Lifecycle State • Confirmation of Service Characteristics : See above inputs
Notifications	<p>Success/Failure Change of Operational State</p>
Error-conditions	<p>Service not supported Service input not supported Endpoint not recognized</p>
Post-conditions	
Sources	<p>Oif – cite specific documents Onf IETF</p>

Common Information Model (simplified)



- **Model of data plane resources in an SDN-enabled network**
 - **Technology agnostic**
 - **Recursive (Forwarding Domain may contain FDs)**
 - **Models static and dynamic elements**
 - **Extensible to different technologies and environments**

- **Implement and Demonstrate**
 - **OIF/ONF Demonstration**
- **Develop OIF Implementation Agreements**
 - **Select options from base TAPI spec in ONF**
 - **Specify formats and encoding agreements**
- **Iterate with more experience and use**