MEF LSO: Connecting Open Source and Standards to implement and Deliver Dynamic Third Network Services
Introduction to MEF and to MEF LSO - SDNFV Service Orchestration

Dan Pitt, Senior Vice President, MEF
MEF Created the $80B* Carrier Ethernet Market

Goal is to leverage the MEF’s $80B CE base to evolve into orchestration + new services

*IHS Market Report
The Digital Economy

Complete Retooling of Networks for a Digital Economy

• A New Economy
• Hyper-connected
• On-Demand and Agile
• Assured and Secure
• Private and Public Clouds
• SaaS Applications
• Machine Automation
Intelligent Bandwidth
Agile, Assured and Orchestrated

Network-as-a-Service

- Application Services
- Security Services
- L3 VPN Services
- Carrier Ethernet Services
- Optical/Wavelength Services

Lifecycle Service Orchestration & Open APIs
MEF’s Vision of Network as-a-Service (NaaS)

Orchestrated Services

- E-Line
- E-LAN
- E-Tree
- E-Access
- E-Transit
- SECaaS
- App Services

Wavelength
Internet Access
L3 VPNs
IP Transit

Self-service Web Portal

Internet

Cloud Provider

Cloud Provider

Data Center

SDN
NFV
Legacy Networks

SDN
NFV
Legacy Networks

NaaS Service Provider “X”

NaaS Service Provider “Y”

Mobile

Residential

Enterprise
New Network Functionality - Agile/Dynamic, Assured and Orchestrated Services: Top Drivers and Challenges

What do you believe are the most important drivers and challenges for deploying agile/dynamic, assured and orchestrated services?

**Top Purchase Drivers**

% Key + Very Important Drivers

- #1 Faster service provisioning
- Rapid adjustments to existing services
- Ability for customer to scale bandwidth on-demand

88%

**Top Deployment Challenges**

% Serious + Major Challenges

- #1 Orchestration over multiple provider networks
- Inadequacy of current OSS/BSS systems
- Integration of new dynamic services with legacy services infrastructures

91%

How important for your company is the ability to offer orchestrated / on-demand connectivity services?

- **Orchestration over Own Network**
  - 69% of Service Providers surveyed say that the ability to deliver on-demand CE 2.0 Retail Ethernet connectivity over their own network is highest priority.

- **Orchestration over Multiple Networks**
  - 59% say the delivery of orchestrated, on-demand CE 2.0 Wholesale E-Access connectivity services over multiple provider is top priority.

---

**Source** (Joint MEF-Vertical Systems Group): Emerging Third Network Services Enabled by LSO, SDN and NFV Study (January 2017)
Survey of MEF Community – October 2016
LSO – Orchestrating Within and Between Providers

Self-service Web Portal

Customer Facing
Open APIs

Inter-Carrier
Open APIs

Network Operator 1

Network Operator 2

End-to-End Network-as-a-Service

MEF
MEF LSO Reference Framework

**FRAMEWORK**

Network Operator 1
- LSO Allegro
- LSO Cantata
- LSO Legato

Network Operator 2
- LSO Legato
- LSO Sonata
- LSO Interlude

**CAPABILITIES**

- Fulfillment
- Performance
- Control
- Assurance
- Usage
- Analytics
- Security
- Policy

**End-to-End Network-as-a-Service**

EMS: Element Management System  PNF: Physical Network Function  SOF: Service Orchestration Function
MEF PR LSO Sonata R1

MEF, TM Forum & Major Service Providers Are Standardizing LSO APIs for Orchestrated Services

AT&T, Orange, Colt, Comcast, Level 3, PCCW Global, Sparkle, Verizon, and CableLabs/Kyrio Lead Groundbreaking Effort to Create Worldwide Ecosystem Of Connected Networks.

For more information click here
Connecting Open Source & Standards - A New Agile Development Model

Pascal Menezes, CTO, MEF
# MEF’s Intra-Operator APIs and Open Initiatives

## Service Level Orchestration Open APIs

<table>
<thead>
<tr>
<th>Service Orchestration</th>
<th>Fulfillment</th>
<th>Performance</th>
<th>Policy</th>
<th>Security</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Assurance</td>
<td>Usage</td>
<td>Analytics</td>
</tr>
</tbody>
</table>

## Network Level Orchestration Open APIs

**Technology Domains**

- SD-WAN
- Data Center
- Packet WAN
- Optical Transport
- NFV
- Cloud Exchange
- 5G Wireless

**Orchestrated Services**

- E-Line
- E-LAN
- E-Tree
- E-Access
- E-Transit
- SECaaS
- App Services
- Wavelength
- Internet Access
- L3 VPNs
- IP Transit
MEF’s Inter-Operator APIs and Open Initiatives

Service Orchestration

Inter-Operator Open APIs

Service Orchestration

Inter-Operator Open APIs

Service Orchestration

Technology Domain

Serviceability
Ordering
Address Validation
... Others

Technology Domain

Technology Domain

Orchestrated Services

Services

E-Line
E-LAN
E-Tree
E-Access
E-Transit
Wavelength
Internet Access
L3 VPNs
IP Transit
SECaaS
App Services

AT&T Announcement
MEF & TM Forum Announcement
• Accelerate pace and relevance of MEF APIs and standards
  – Validate APIs/standards
  – Provide feedback into technical committees
  – Create open source reference implementations, libraries, toolsets
• Collaboration across SDOs and Open Source communities
  – Increase awareness, open discussions
  – Support for LSO APIs in relevant open source projects
  – Upstream contributions
• More running code!
What is MEFnet?

MEFnet is a physical and virtual hosting environment for the hardware and software components of OpenLSO and OpenCS implementations.

MEFnet will include OpenLSO and OpenCS instances comprised of solutions from Open Source Projects and Closed Source industry products.

MEFnet supports distributed and interconnected member and partner labs, and is accessible for LSO Hackathons and ongoing MEF development and testing work.
MEFnet Resources

Servers/VM’s
Virtual Machines provide high quality resources and flexibility

Labs
Extended capabilities delivered via third party agreements (e.g. member & partner labs)

Core Tools
MEFnet provides OS supporting services, development functions and local repositories

MEF Program
Management and Support

Extended capabilities delivered via third party agreements (e.g. member & partner labs)
MEF Software Development Community

- Internship for telecom university grad programs and their students
- Council of university professors to advise on program
- Special designation for interns in MEF branding for access into the job marketplace
- Additional information to be available at official launch
• To start the respective agile sprints to develop two sets of APIs to be used for orchestrating MEF-defined services (like E-Line, E-Access etc) at **LSO Sonata** and **LSO Presto** respectively that will culminate in publication of these open APIs during the course of 2017, and to ensure that they enable certification of orchestrated MEF-defined services.
Long Term Vision of LSO – Enterprise, CSP and Cloud
The NaaS Off-Net Internet Overlay Model

- **Self-service Web Portal**
- **Cloud APIs**
- **Cloud Orchestrator (CLO)**
- **Mission Critical Cloud Applications**
- **Broadband Local Loop Database**
- **East-West Sonata and Interlude APIs**
- **Presto APIs**
- **SD-WAN Controller**
- **NFV MANO**
- **SDN Controller**
- **SDN Switch**
- **UNI**

**CPE** - Customer Premise Equipment

**RO** - Resource Orchestrator

**GW** - Gateway

**Cloud  APIs**

---

**Internet ISP 1**

**Internet ISP 2**

**IP Fabric**

**SONET/SDH**

**Ethernet**

**PSTN**

**Wireless**

**Global Internet**

---

**RO - Resource Orchestrator**

**GW - Gateway**

**CPE - Customer Premise Equipment**
The Orchestration Landscape: Open Source Projects & Specifications

Rami Yaron VP, Strategy & Business Development, Telco Systems, Global Marketing Co-chair, MEF
MEF UNITE Program

Launched in late 2014 to coordinate internal & external engagement with Standards Development Organizations, Associations & Open Source Projects, to lead the industry migration to agile, assured and orchestrated services.
MEF AND PNDA COLLABORATION

Enabling LSO to realise the vision of reactive networking

The orchestration and control state from the layers of the LSO stack provides the context required for the analytics applications to provide meaningful insight.

The output from the analytics applications may be used to optimize the deployed services through feedback to the LSO orchestration and control functions.
Open Source Platform Convergence

AT&T's ECOMP created by AT&T and Amdocs
Service OnBoarding & design
Policies for Operations
Service Distribution (Model)
Customer Service order
Service instantiation
Operations & real-time monitoring
Industry White Paper of Third Network Services

Third Network Services

Lifecycle Service Orchestration

SDN and NFV Network Infrastructure

http://mef.net/tgn
Spirit of the Hackathon

• Collaborative, friendly competition
• Break down silos
• Share insights, tips, ideas
• Shared goals
  – Increase of pace and quality of LSO APIs and implementations
• Non-MEF members can participate
• Free
**History**

- GEN15
- PRESTO
- Euro16
- PRESTO, SONATA
- MEF16
- PRESTO, SONATA, LEGATO
OpenDaylight Unimgr Project

• User Network Interface Manager Plug-in (Unimgr)
• Provides data models and corresponding APIs
  – Used by applications and service orchestrators to configure and provision network services, e.g. Carrier Ethernet Services as defined by MEF
• Active development from Amartus, Cisco, HPE, Inocybe, ...
• Many southbound protocol plugins available via OpenDaylight
  – OVSDB, NETCONF, ...
• https://wiki.opendaylight.org/view/Unimgr:Main
Bumping versions by 0.0.1 for next dev cycle

[unimgr.git]/presto-api/src/main/yang/

```plaintext
drwxr-xr-x ..
-rw-r--r--  4782 mef-nrp-bandwidth-profile.yang  blob | history | raw
-rw-r--r--  11655 mef-nrp-specs.yang         blob | history | raw
-rw-r--r--  5806 mef-nrp-types.yang          blob | history | raw
-rw-r--r--   514 mef-unimgr-ext.yang         blob | history | raw
-rw-r--r--  5697 onf-core-network-module.yang blob | history | raw
-rw-r--r--  1191 onf-core-network-types.yang blob | history | raw
-rw-r--r--  2126 onf-core-specs.yang         blob | history | raw
```
### MEF Presto APIs via OpenDaylight Unimgr

#### API

<table>
<thead>
<tr>
<th>API</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ROOT</strong></td>
</tr>
<tr>
<td><code>expand all</code></td>
</tr>
<tr>
<td><code>collapse others</code></td>
</tr>
</tbody>
</table>

#### Parameters

<table>
<thead>
<tr>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>root</td>
</tr>
<tr>
<td><code>expand all</code></td>
</tr>
<tr>
<td><code>collapse others</code></td>
</tr>
</tbody>
</table>

#### GET

```
GET /config/onf-core-network-module:forwarding-constructs/forwarding-construct/
```

---

**Loading completed successfully**

---

### YangUI

- **Topology**
- **Nodes**
- **Yang UI**
- **Yang Visualizer**
Euro17 Hackathon – April 24-26, Frankfurt

- Projects for Euro17 Hackathon are being determined now
- For reference, here is the list of projects from previous hackathon
  - Micro-services enabling a pre-order marketplace for wholesale Carrier Ethernet services
  - Inter-carrier automated product ordering
  - MEF Legato YANG models exposed using Cisco NSO
  - Automated inter-carrier L2 and L3 service fulfillment and change
  - Carrier Ethernet service fulfillment using OpenDaylight and PNFs/VNFs via LSO Presto
- Join us in Frankfurt!
In Summary

• Leverage MEF’s $80B CE market as a platform for new innovation
• The digital economy requires Network-as-a-Service
• MEF is more then specs. Working with members and open source projects, we collaborate to provide reference implementation
• MEF is excited to collaborate with PNDA to innovate on the vision of a reactive network

www.MEF.net  www.MEF17.com  www.MEF.net/tgn
Q&A