ETSI ZSM – ONAP
Architecture Collaboration

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Agenda

- Using the ETSI ZSM architecture for ONAP – Magnus Buhrgard
- Applying ZSM Framework to Transport Slicing Solution on ONAP - A Case Study – Henry Yu
- ETSI ZSM009-1, Closed loop automation – Enablers – Pedro Henrique Gomes
- Open discussion on collaboration opportunities – All
Using the ETSI ZSM architecture for ONAP

Magnus Buhrgard, Ericsson
ETSI ZSM Architecture

ZSM framework consumers

E2E Service Management Domain
- Management Functions
- Domain Integration Fabric
- E2E Orchestration
- E2E Intelligence
- E2E Analytics
- E2E Data Collection

Cross-domain Integration Fabric
- Domain Integration Fabric
- Domain Management
- Domain Control
- Orchestration
- Intelligence
- Analytics
- Data Collection

Domain Managed Infrastructure Resources
- Physical
- Virtual
- XaaS

Legend
- Offered set of ZSM services
- Consumed set of ZSM services
- Closed loops
ONAP Implementation options

E2E Service Management Domain

Management Domain

Cross-domain Integration Fabric

Data Services

Legacy Domain Management Services

Standardized MnS

Domain Integration Fabric

Management Functions

E2E Orchestration

E2E Intelligence

E2E Analytics

E2E Data Collection

Domain Integration Fabric

Data Services

Consumer

Standardized MnS

ZSM Management Services Adapter

Legacy Domain Management Services

Legacy Management Domain

Management Domain

Domain Control

Domain Orchestration

Domain Intelligence

Domain Analytics

Domain Data Collection
ONAP Implementation options

- E2E Service Management Domain
  - Mixed solution
    - ONAP components
- Cross-domain Integration Fabric
  - Standardized MnS
  - ONAP components
  - Standardized MnS
- Management Domain
  - Mixed solution
    - ONAP components
  - ZSM Management Services Adapter
  - Legacy Management Domain
  - Legacy Domain Services
- Cross-domain Data Services
  - ONAP components
Applying ZSM Framework to Transport Slicing Solution on ONAP – A Case Study

Henry Yu (Huawei)
Contents

• Background of Transport Slicing project on ONAP
• ZSM 003: Architectural framework for E2E Network Slicing
• ZSM 002: Design principles adopted by Transport Slicing
• ZSM collaboration and alignment with other SDOs
• Implementation of Transport Slicing on ONAP
• Future roadmap and further collaboration with ZSM
Transport Slicing started in Guilin release. Its objective is to provide transport services (i.e., TN NSSMF) which can be consumed by the E2E Network Slicing use case.

Some design requirements are (not a full list):

- **Modular design**: avoid monolithic systems; keep well-defined interfaces; self-contained and independently deployable solution.

- **Standards-based solution**: Interfaces/solutions are based on open standards

- **Flexible**: can satisfy different requirements; prefer federated solution

Our implementation adopts the ZSM framework, for it satisfies our design requirements and also aligns with our future roadmap.
ZSM 003: Architectural Framework for E2E Network Slicing

- ZSM 003 provides a specification of E2E Network Slicing management solutions and related management interfaces.
- Furthermore, it provides an architecture that identifies the components and specifies their functionalities and interfaces.
- It follows, therefore, that the solution to Transport Slicing (i.e., TN MD) is illustrated in the context of E2E network slicing.
- Thus, it is ideal to use ZSM 003 as the architectural framework for Transport Slicing.

ZSM architecture deployment example for network slicing management (source: ZSM 003)
ZSM 002: Design principles adopted by Transport Slicing

While ZSM 003 provides a specification for Transport Slicing functionality, as well as its interfaces, ZSM 002 provides the design principles on how to design such a solution (e.g., a management domain). Some of those principles are:

- **Model-driven, open interfaces.** Models are independent from the implementation.
- **Separation of concerns.** Decoupling of management domains and E2E Service Management domain. Avoid monolithic systems.
- **Intent-based interfaces.** Declarative interface. Hide complexity, technology, vendor-specific details away from user.
- **Designed for automation.** Zero-touch network.
- **Closed-loop management automation.**
ZSM collaboration and alignment with other SDOs

- ZSM stitches related work from different SDOs (e.g., TMF, 3GPP, IETF, BBF, etc.) and provides a federated solution.
- In other words, ZSM is a platform which integrates different standards and produces a unified and implementable solution, from which the ONAP network slicing use case may benefit.

Illustration of the relation between the scopes of ZSM and other groups (source: ZSM 003)
Adopting ZSM Framework on Transport Slicing

**Domain Integration Fabric**

- Transport NSSMF (TSC)

**Domain Functions**

- IP/MPLS Network Controller
- Optical Domain Controller
- NFVO

**TN MD Interface**

- TSC NBI: https://tools.ietf.org/html/draft-rokui-5g-transport-slice-00

- TS NBI-to-SBI Mapping Function for Transport Slice Realization
- TS Closed-loop Optimization Function
- TS Monitoring Function
- TS Notification Function
- TS Analytics Function
- TS Visualization Mgmt Function

**Unified L0-L3 Resource Abstraction and Mgmt**

- Any model such as: TE-MPLS-tunnel, TE-topology, L2SM, L3SM, ACTN etc.
- [Optional] Os-Ma-Nfvo (NFV IFA 013)

**YANG data**

Unified Resource Model

**TN Management Domain**

- IP/MPLS Network
- Optical Network
- NFVI-PoP

**E2E NS Controller**

- TSC NBI
- TN MD Interface

**Terminology**

- TS: Transport Slice
- TSC: Transport Slice Controller
- NBI: Northbound interfaces
- SBI: Southbound interfaces
- NFVO: NFV Orchestrator
- ACTN: Abstract & Control of TE Network
- NFVI: NFV Infrastructure
Implementation of Transport Slicing on ONAP

ONAP

CSMF

NSMF

TN NSSMF

Optical Domain Controller

EXT-APIs

UII

Policy

SDC

NSMF Work Flow

TN NSSMF Adaptor

Internal APIs (TSCi)

AAI

TS definition model (based on TSCi info model)

TS implementation models (e.g., te-topology, te-tunnel, etc.)

Existing ONAP code with modifications

New ONAP code for TN NSSMF Functionality

ONAP

OOF

SDNC

TSC NBI-to-SBI Mapping

ACTN MPI Adaptor (SBI)

Generic-resource-API

Optical domain controller

EXT-APIs

External interface of TSC NBI

TN NSSMF Work Flow

TS: Transport Slice
TSC: Transport Slice Controller
TSCi: Transport Slice Connectivity Interface
NBI: Northbound interfaces
SBI: Southbound interfaces
ACTN: Abstract & Control of TE Network
MDSC: Multi-Domain Service Coordinator
PNC: Physical Network Controller
ACTN MPI: ACTN MDSC to PNC Interface
AAI: Active and Available Inventory
OOF: ONAP Optimization Framework
SO: Service Orchestrator
SDNC: SDN Controller
SDC: Service Design and Creation
UII: Usecase User Interface
EXT-API: External API
TSC NBI-to-SBI Mapping

TS implementation models (e.g., te-topology, te-tunnel, etc.)

Existing ONAP code with modifications

New ONAP code for TN NSSMF Functionality

Optical domain controller

External interface of TSC NBI

TN NSSMF Work Flow

Internal APIs (TSCi)
Looking beyond Guilin release, we are looking for further collaboration with ZSM on closed-loop automation.

### Four Types of Closed-loop Automation

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Service provisioning and activation:</td>
<td>Days ➔ Minutes</td>
</tr>
<tr>
<td>②</td>
<td>Network planning and deployment:</td>
<td>Weeks ➔ Days</td>
</tr>
<tr>
<td>③</td>
<td>Network troubleshooting and restoration:</td>
<td>Hours ➔ Minutes</td>
</tr>
<tr>
<td>④</td>
<td>Traffic prediction based auto network planning:</td>
<td>Months ➔ weeks</td>
</tr>
</tbody>
</table>

#### 2017:
- L2 service
- L1 service
- Transport Slicing

#### 2018:
- New CPE online and deployment (and auto service activation)

#### 2019:
- L1 service

#### 2020:
- Transport Slicing

#### 2022+:
- Network performance prediction based service disruption prevention
ETSI ZSM009-1
Closed loop automation - Enablers

Presented by: • Pedro Henrique Gomes Ericsson | ETSI ZSM rapporteur

For: • Oct 15th 2020
Motivation

- Further specify how Closed Loop Automation can be realized within the ZSM framework
- Identify gaps and improve the ZSM framework
  - New management services and capabilities
  - Use case-agnostic enablers
  - Solutions to documented scenarios
- Enable the creation and execution of closed loops, as well as the integration and interoperability between closed loops within ZSM framework
- Influence other SDOs and open source projects
ZSM009 – Closed Loop (CL) Automation

• ZSM009-1 – Enablers
  • Enablers for closed loop automation for multiple use cases
  • Mainly divided into:
    • CL Governance
    • CL Coordination
  • Extension of ZSM framework with new management services and capabilities

• ZSM009-2 – Solutions
  • Solutions for end-to-end service and network automation
  • Based primarily on the scenarios of ZSM001
  • (Re)-uses the enablers specified in ZSM009-1

• ZSM009-3 – Advanced topics
  • Advanced topics, such as cognitive capabilities
  • Further details in a following presentation
But before that...

✔️ What is a Closed Loop?
   ✔️ Control mechanism that uses feedback signals to monitor and regulate itself with the objective of achieving a specific goal

✔️ What is Closed Loop Automation?
   ✔️ Combination of automated processes with a closed feedback loop
   ✔️ In management systems -> process that chains management services (data, analytics, policy, orchestration, etc.)
   ✔️ Autonomous systems that constantly monitor and assess the network and take corrective actions when the goals are not met

Ultimate goal: reduce human intervention, but still allow interactions with operators for goals definition and monitoring performance
CL in ZSM framework - Functional view

This represents:
Managed resource, or
Managed service, or
Managed closed loop
ZSM framework management services grouping

**Analytics**
- Provide insights based on collected data

**Data collection**
- Monitor the managed entities and provide live performance and fault data

**Intelligence**
- Provide specific decisions and recommendations
- AI models / Policies & Intents

**Orchestration**
- Automate workflows to handle lifecycle management of the managed entities

**Control**
- Individually steer the state of managed entities (resources and services)

**Analysis**
**Decision**
**Collection**
**Execution**
CL in ZSM framework - Deployment view

(E2E) Management Domain

- Governance
  - (Domain or E2E) Supporting
- Analysis
  - (Domain or E2E) Analytics
- Decision
  - (Domain or E2E) Intelligence

Domain Integration Fabric

- (Domain or E2E) Data Collection
  - Collection
- (Domain or E2E) Data Services
  - Knowledge
- (Domain or E2E) Orchestration & Control
  - Execution

managed entities

data

action
Closed loop governance

✔ Set of capabilities for external entities to manage the CL models and the lifecycle of CLs (design-time AND run-time)

✔ May also be used to retrieve information about the CL, e.g. performance and status

Lifecycle management of Closed Loops – Phases and activities
Closed loop coordination

✔ Set of capabilities that allows multiple CLs running within the ZSM framework to be coordinated (run-time)

✔ Main objective: improve the performance and the fulfilment of the CL goal(s)

✔ Focus on conflict detection and mitigation

✔ Pre-action and post-action coordination

✔ Delegation and escalation

✔ Information sharing between multiple CLs
What next?

✔️ Expected publication by Q4 2020 (stable draft v0.10.1)
✔️ Focus on aspects related to Closed Loop coordination
✔️ Further collaboration with ONAP
  ✔️ Ongoing control loop PoC
    ✔️ ONAP Control Loop in TOSCA PoC and Rel H evolution
    ✔️ https://wiki.onap.org/display/DW/TOSCA+Defined+Control+Loop+PoC+in+ONAP+Rel+G
Thank You