E2E Network Slicing use case: Overview & Istanbul Release Demo

Participants: CMCC, Wipro, STL, Huawei, AT&T, IBM, LTTS, DT, TIM, QCT, Amdocs, Tech Mahindra, Reliance Jio, Tencent, China Telecom, highstreet technologies

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E2E Network Slicing: Objectives

Objectives

1. Implement ONAP-based Slice Management functions defined by 3GPP (CSMF + NSMF + NSSMF)
2. Demonstrate e2e slice design, instantiation and operation, including RAN, Core and Transport slice sub-nets
3. Provide flexible architecture choices to operators for deployment scenarios (ONAP based xMF or 3rd party xMF)

Lifecycle of a Network Slice Instance

- Preparation
  - Design
  - On-boarding
  - Network environment preparation

- Commissioning
  - Creation

- Operation
  - Supervision
  - Reporting
  - Modification
  - De-activation

- Decommissioning
  - Termination

Frankfurt/Guilin scope

Focus area for Honolulu, Istanbul and beyond

- Design and pre-provision: Creation of necessary slice/slice sub-net templates.
- Instantiation/Configuration, Activation/Deactivation and deallocation/termination of NSIs, including its constituent NSSIs (RAN, Core and Transport).

Ref.: 3GPP TS 28.530
E2E Network Slicing - Supported Architectures

1. 
   - OSS/BSS/Apps
   - TMF APIs
   - CSMF (ONAP)
   - Internal call
   - NSMF (ONAP)
   - Internal call
   - NSSMF(s) (ONAP)
   - xNFs

2. 
   - OSS/BSS/Apps
   - TMF APIs
   - CSMF (ONAP)
   - Internal call
   - NSMF (ONAP)
   - Standard APIs
   - NSSMF(s)
   - xNFs
   - 3rd party component
E2E Network Slicing: Architecture & Interfaces

- **OSS/NB System**
- **CSMF**
- **NSMF**
- **ONAP**
- **Transport Network Configurations**

- **3rd Party RAN NSSMF**
- **RAN NSSMF**
- **TN NSSMF**
- **Core NSSMF**

Align with:
- 3GPP
- TSCi (IETF)
- 3GPP/O-RAN
- TMF

To be aligned with 3GPP

- **RU**
- **TN**
- **DU**
- **CN**
- **Core Slice Subnet**

- **RAN Slice Subnet**
- **Front Haul**
- **Mid Haul**
- **Back Haul**

- **Near RT-RIC**

- **Transport Slice Subnet 1**
- **Transport Slice Subnet 2**
- **Transport Slice Subnet 3**
**RAN & Transport Subnet: Interaction Scenario 1**

1. **RAN NSSMF** should be responsible for the determination of the **Slice Profile of FH, MH and RAN NFs**.
2. **RAN NSSMF** should be responsible for the entire RAN subnet comprising FH and MH (stitching together, CL actions, etc.)

- **TS_1** is the backhaul transport slice; **TS_3**, fronthaul; **TS_4**, midhaul.
- **TN MD** (T-NSSMF) receives **TS_1** from **NSMF** (step 3), and **TS_3** and **TS_4** from **RAN NSSMF** (step 1b-i).
- **TN MD** then configures backhaul (3a), fronthaul (1b-ii), and midhaul (1b-iii), respectively.

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**Preferred option by O-RAN & ONAP internal RAN NSSMF**
**RAN & Transport Subnet: Interaction Scenario 2**

- **TS_1** is backhaul transport slice; **TS_3**, fronthaul; **TS_4**, midhaul.
- **TN MD** (T-NSSMF) receives **TS_1**, **TS_3** and **TS_4** from NSMF (step 3).
- **TN MD** then configures backhaul (3a-i), fronthaul (3a-ii), and midhaul (3a-iii), respectively.

NSMF shall be responsible for determination of Slice Profile of FH, MH and RAN NFs.
NSMF shall be responsible for stitching together e2e slice including FH and MH.
• E2E Network slicing with internal NSSMFs **(Option 1)**
  – *Istanbul Release Update:* Integration with NSMF and NSSMFs for shared and non-shared slices is completed; Integration with the ACTN Simulator is done
  – *Achieved in Honolulu Release:* E2E Slicing with external Core NSSMF Simulator was done, ACTN Simulator was bypassed.

• E2E Network slicing with external Core & RAN NSSMFs **(Option 2)**
  – *Istanbul Release Update:* Slice reuse is implemented and tested; OOF solution is incorporated and considered for E2E Slice termination
  – *Achieved in Honolulu Release:* E2E Slice creation was done; termination was completed without OOF involvement

• NSMF driven Transport (FH, MH) Slices **(New)**
  – NSMF is responsible for E2E slice including the TN - FH & MH slices
Istanbul Release Highlights

- **CPS Integration (New)**
  - CPS is used in place of Config DB for RAN slice reuse, activate/deactivate and terminate scenarios

- **Closed Loop**
  - **Istanbul Release Update**: E2E Closed loop testing is completed. CPS is integrated in the closed loop flow except for applying the new configurations to RAN slice.
  - **Achieved in Honolulu Release**: Closed loop with Config DB was completed; PM data generation was skipped, directly data was fed to PM Mapper

- **KPI Monitoring**
  - **Istanbul Release Update**: Policy driven KPI computation is implemented
  - **Achieved in previous releases**: KPI computation formula was read from app-config

H-release:
# Demo Items

<table>
<thead>
<tr>
<th>S.No</th>
<th>Scenarios</th>
<th>Lab Environment</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>E2E Slice creation with internal CORE, RAN and TN NSSMFs</td>
<td>Win Lab, Rutgers University</td>
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<tr>
<td>2</td>
<td>E2E Slice Reuse with CPS integration (with internal CORE, RAN and TN NSSMFs)</td>
<td>Win Lab, Rutgers University</td>
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<tr>
<td>3</td>
<td>Option2 (External NSSMFs) - E2E slice reuse, termination</td>
<td>Win Lab, Rutgers University</td>
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<tr>
<td>4</td>
<td>NSMF driven TN Slices - E2E slice creation</td>
<td>Internal Lab, Wipro</td>
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**Internal Demo Artifacts:** [https://wiki.onap.org/display/DW/Istanbul+Release+Tracks+-Demo+Artifacts](https://wiki.onap.org/display/DW/Istanbul+Release+Tracks+-Demo+Artifacts)
E2E Network Slicing - Demo
Pending Commits or JIRAs

- https://jira.onap.org/browse/SDNC-1654
- https://gerrit.onap.org/r/c/so/+/125737
- https://jira.onap.org/browse/SO-3835
# E2E Network Slicing Alignment with SDOs

<table>
<thead>
<tr>
<th>Standards Body</th>
<th>Alignment Reference(s)</th>
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| **3GPP (Rel. 16)** | - TS 28.530 (Concepts, requirements)  
- TS 28.531 (Slice and Slice sub-net LCM)  
- TS 28.541 (Network Resource Models)  
- TS 23.501 (Procedures in Control Plane)  
- TS 28.552 and TS 28.554 (PM and KPIs) |
| **TMF** | - TMF 641 (Service Order – CSMF NB)  
- TMF 628 (PM and KPI monitoring – just started) |
| **ETSI** | - ZSM 002 ZSM Framework  
- ZSM 003 E2E Network Slicing Architecture  
- ZSM 009 Closed-loop Automation |
| **IETF** | - draft-rokui-5g-ietf-network-slice-00  
- draft-ietf-teas-actn-vm-yang  
- RFC 8795: YANG models for TE topologies |
| **O-RAN** | - O1 (RAN Configuration, notifications, PM data) – in progress  
- O2 (not started yet)  
- A1 – just started  
- RAN architecture and functional split (Non-RT RIC, Near-RT RIC, SMO) – in progress |