Orchestration And Management Key Enabler for E2E Slicing

E2E 5G X-Domain Slicing

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APJC Architecture

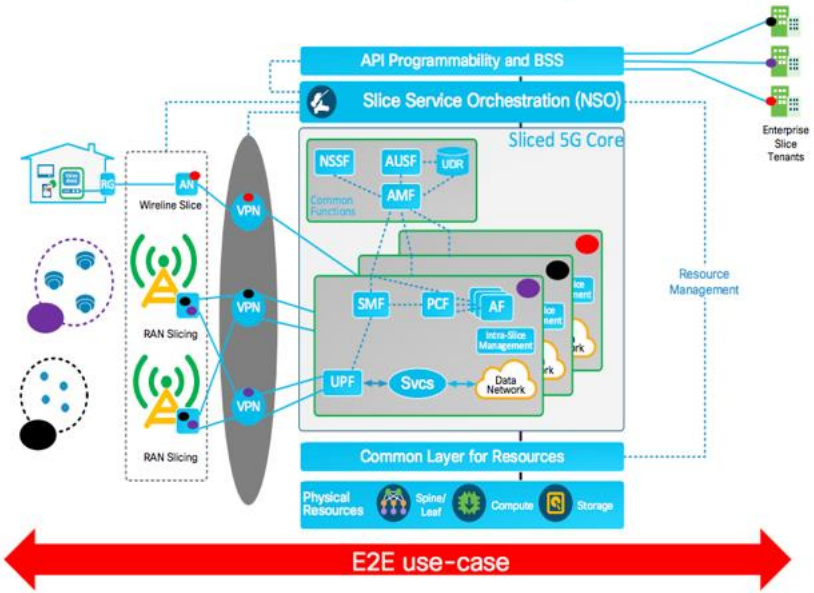
Current Understanding of E2E 5G Slicing

Agenda

- Introduction
- State of Standards
- Domain Building Blocks
- E2E Slicing Architecture Framework
- E2E Slicing Workflow
- Key Message

5G Perspective of E2E Slicing
E2E Business Service

Network Slicing is fundamentally an end-to-end **partitioning of the network resources and network functions** so that selected applications/services/connections may **run in isolation** from each other and for a **specific business purpose**

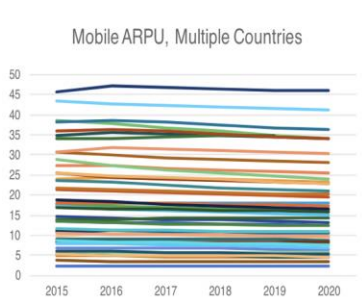


Benefits

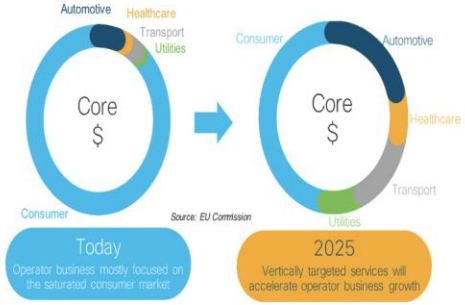
- Each separable business operation can be efficiently and reliably run on a network slice
  - Alternate policy and charging structure
  - Unique service assurance characteristics
  - Increased service security
- Infrastructure orchestration manages the complexity driven by the requirements of each slice
  - Leverages the SP distributed DCs and Footprint
  - Each slice can have its own MANO/OSS environments
- New service introductions are quicker
  - Slicing has a significant reduction in regression testing cycles
  - Isolation eliminates effects of rogue applications (E.g. M2M)
  - Smaller failure groups imply no single "too big to fail" node

Why 5G Slicing Matters in 5G
E2E Business Service

5G Business Proposition



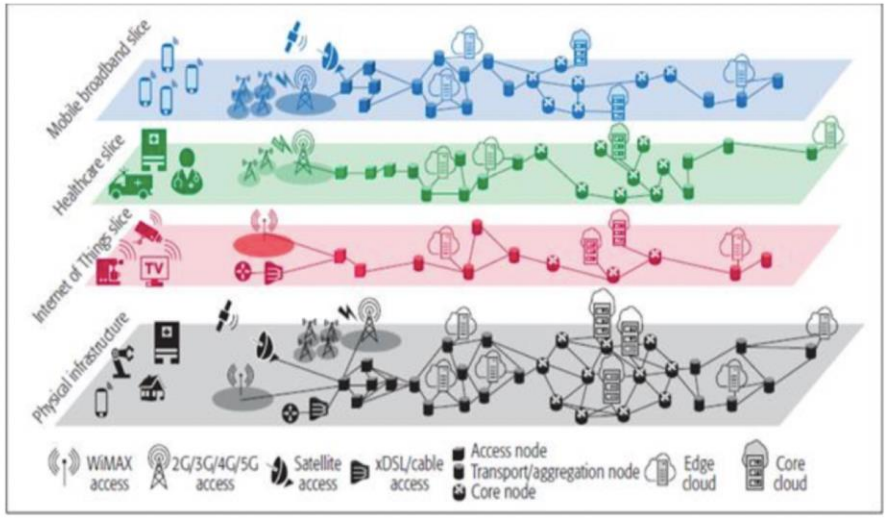
Consumer ARPUs are Declining or Flat



B2B or B2B2x Market Has Future Growth

Low Latency for better QOE and to Enable New Applications, ***Customer Experience*** Transformation

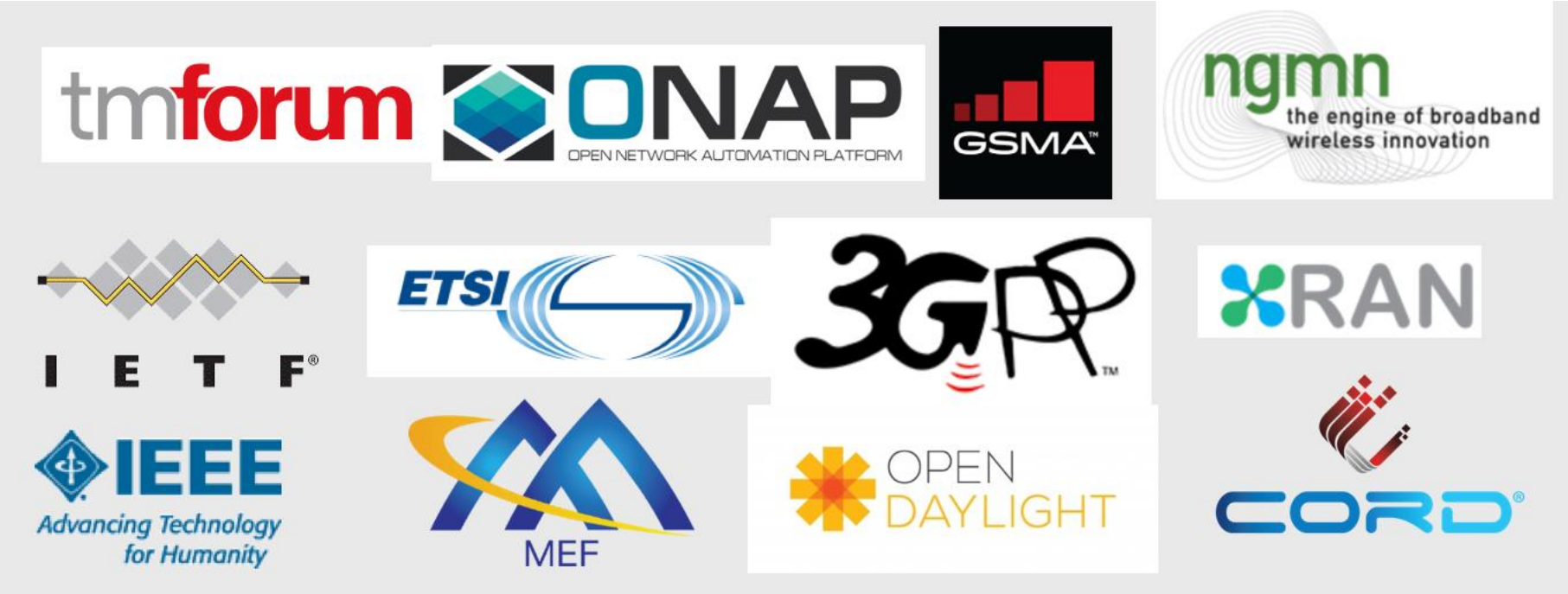
Network Slicing As A Service for Ent/Vertical Market



5G Network Slicing key enabler for monetizing new Ent/Vertical market services and reduce complexity for Operators

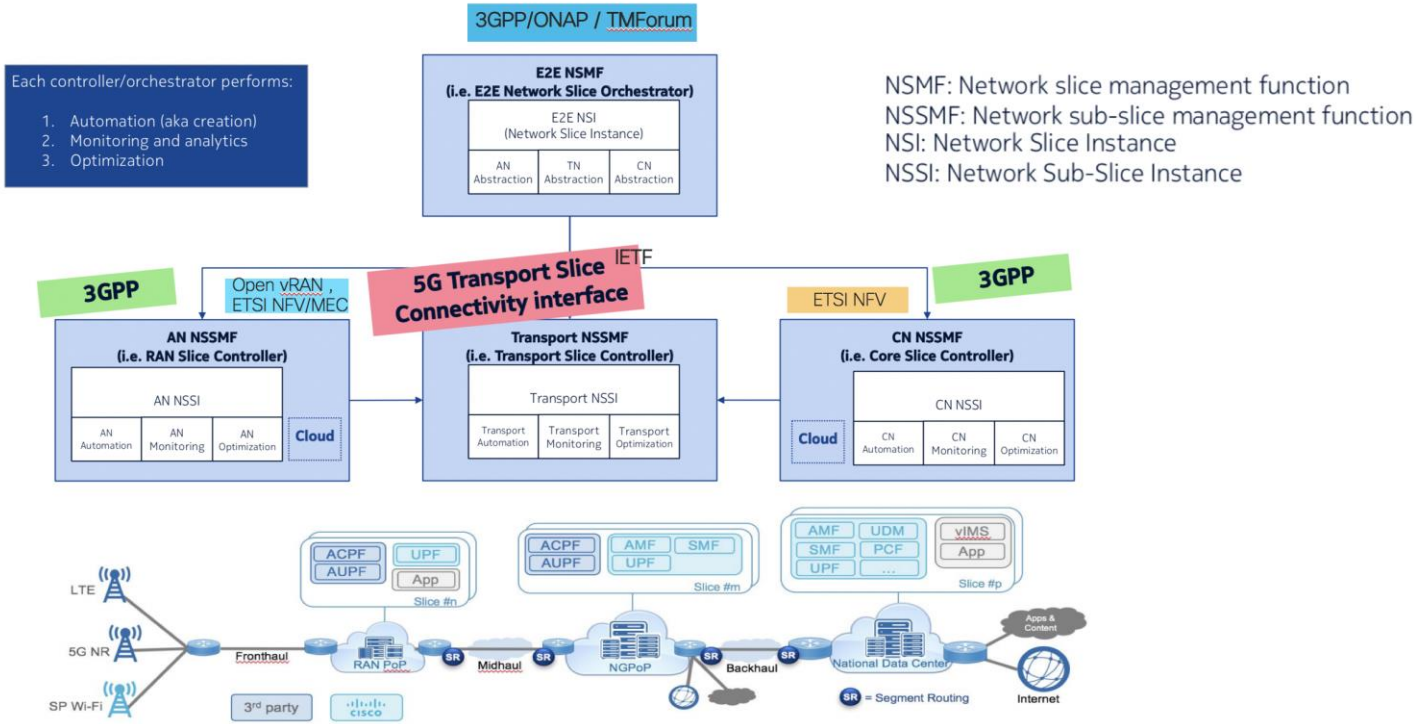
Standards

Standard Bodies And Open Source Projects Involved in 5G E2E Slicing



All the good work happening across standard bodies contribute to achieve E2E Slicing

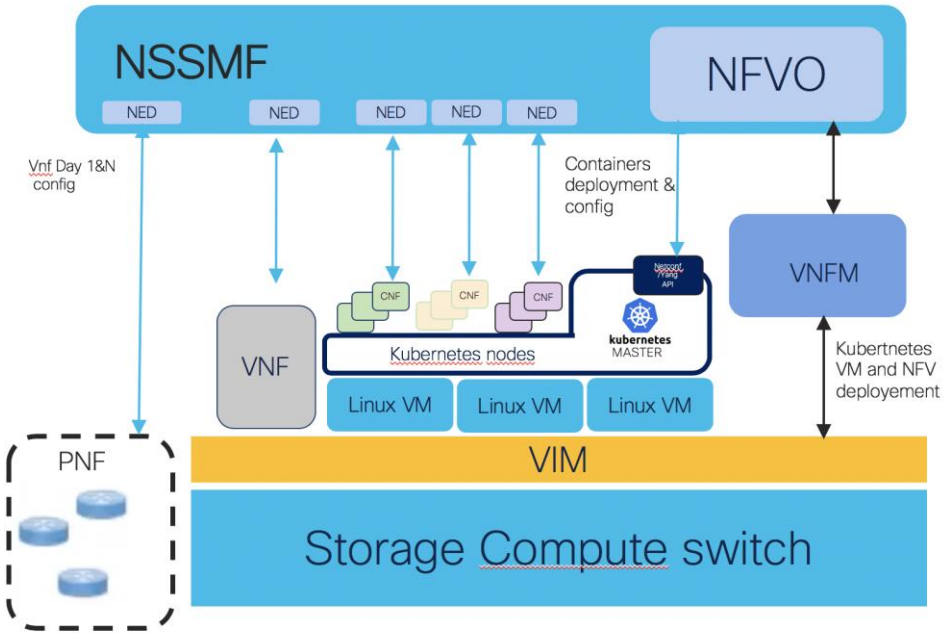
Standards Mapped to Domain Building Blocks



Core Slice | RAN Slice | Transport Slice
3GPP Slice = Core Slice + RAN Slice

Domain Building Blocks

3GPP 5G Core Slice (1)
5G Cloud Native And Domain Orchestration



Service and VNF Design and Onboarding

- VNF Onboarding based on standard VNFD (Tosca/Yang)
- NSD Designer and Model driven SDN definition
- VNF and NSD Catalogue

VNF Instantiation & Life Cycle Management

- Create & Manage VNF a NSD info
- Generic VNF for VNF life cycle Management (Instantiate day0 config , scale in & out)

Slice / Services/ VNFs configuration

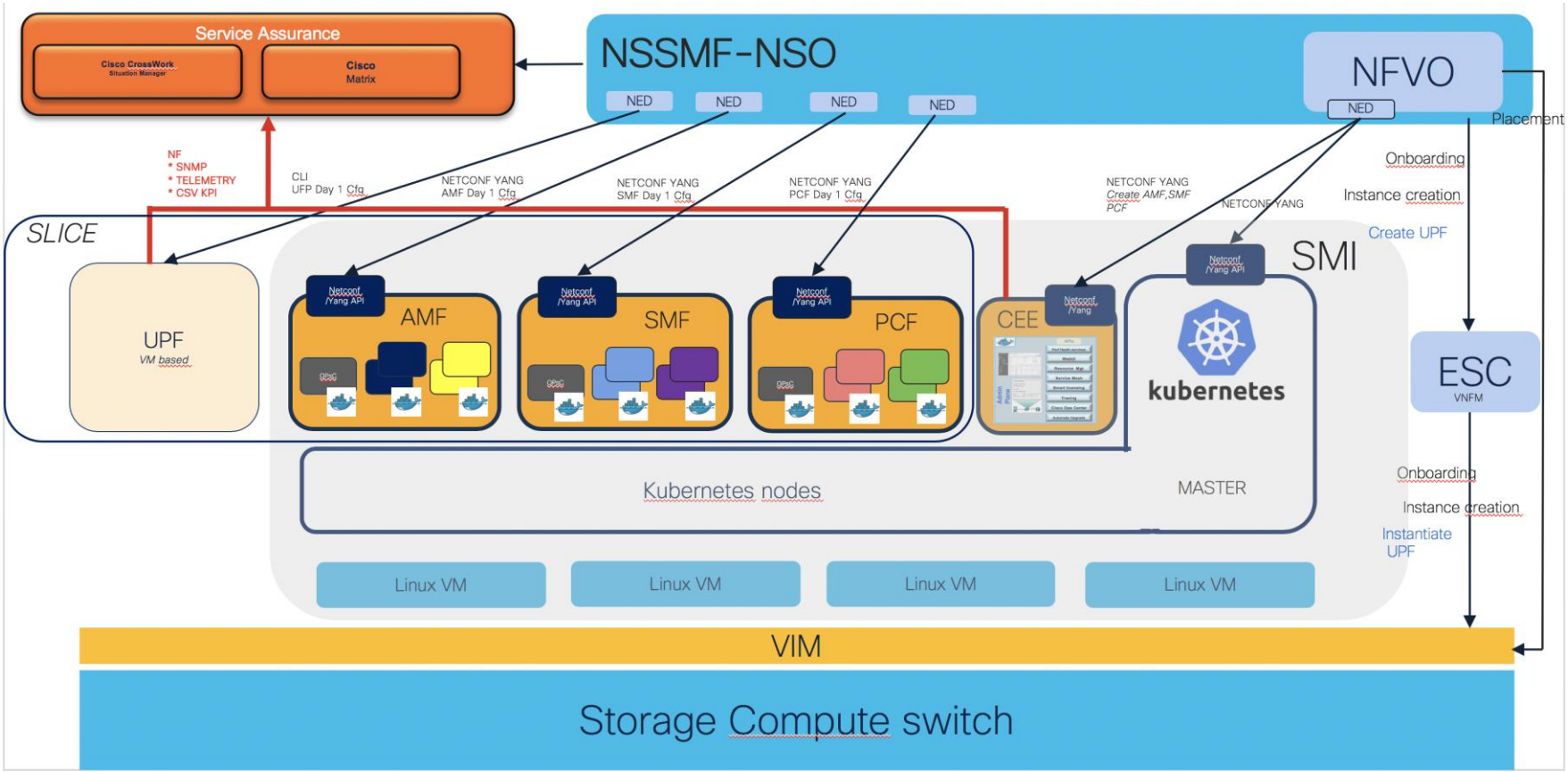
- Day1 & N VNF Configuration
- Network transport Day1 & N Config
- Network transport optimization

Automate Service Assurance

- Automate VNF Slice onboarding in the Assurance
- Enrich Assurance system with Slice and Service details
- Automate remediation based on Assurance trigger

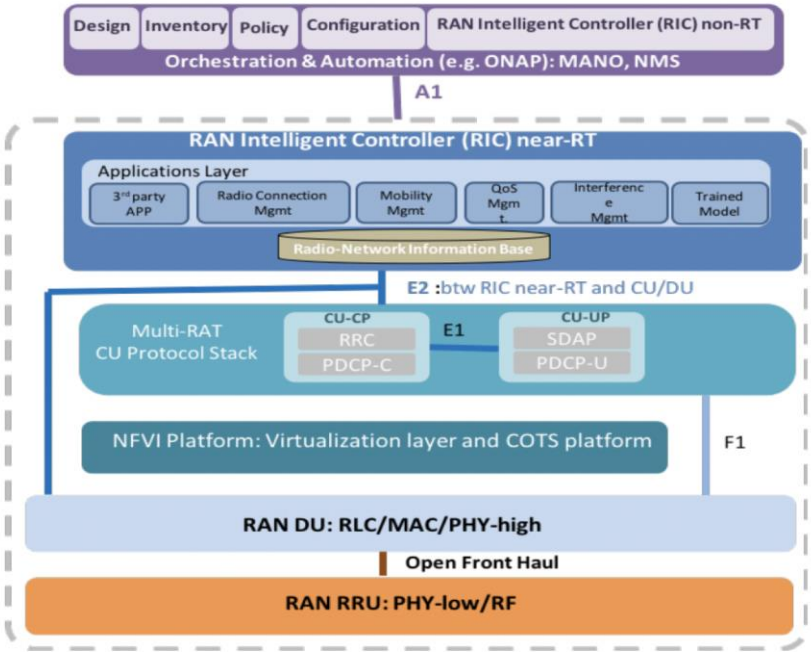
3GPP 5G Core Slice (2)

5G Cloud Native And Domain Orchestration



3GPP 5G RAN Slice (1)
Open RAN Reference Architecture

O-RAN Reference Architecture

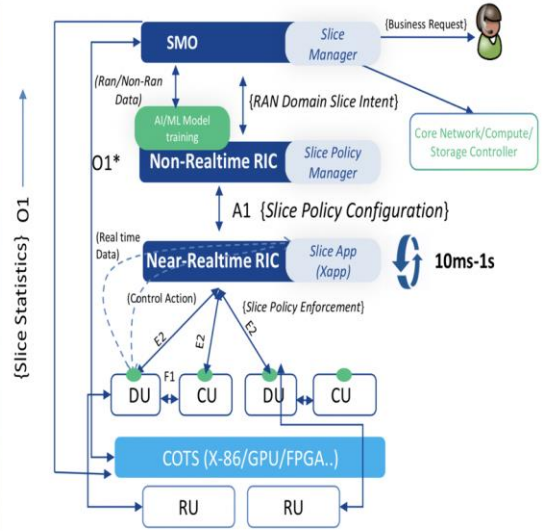


O-RAN Orchestration And Management Interfaces

O1*/O1/A1/E2 Interfaces

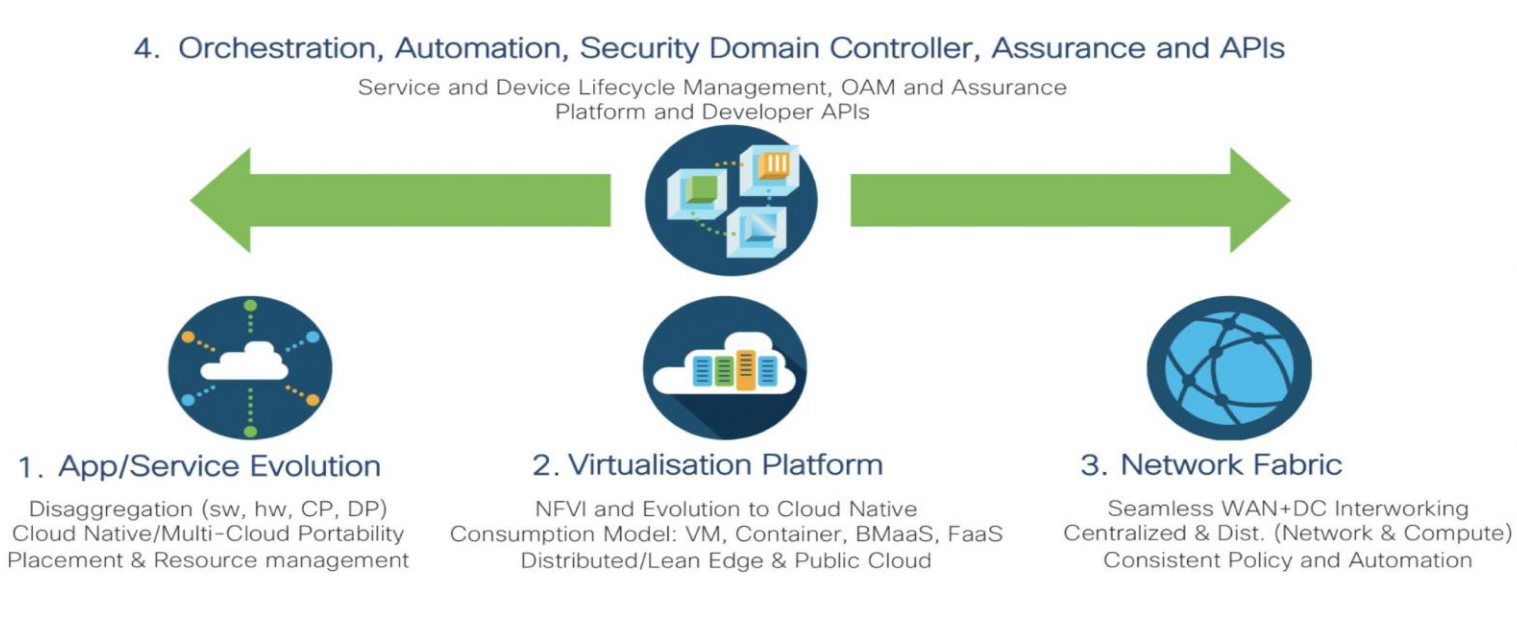
- **O1***
  - NFVI related LCM Management of virtual E2 nodes and the Control Plane components.
- **O1**
  - FCAPS of E2 Nodes (Fault, Configuration, Accounting, Performance, Security), Non-Realtime and Real time RIC.
  - Data subscription interface from E2 nodes (DU/CU).
- **A1**
  - Application specific Policy, Intent, Trigger and Data Management
  - AI/ML Model Management
  - Application specific Enrichment Data to Near-RT RIC
- **E2**
  - Policy to control mapping
  - Control Management
  - E2 Node Data Subscription to X-APPs

Life cycle showing the use of these three Interfaces for Slice Management



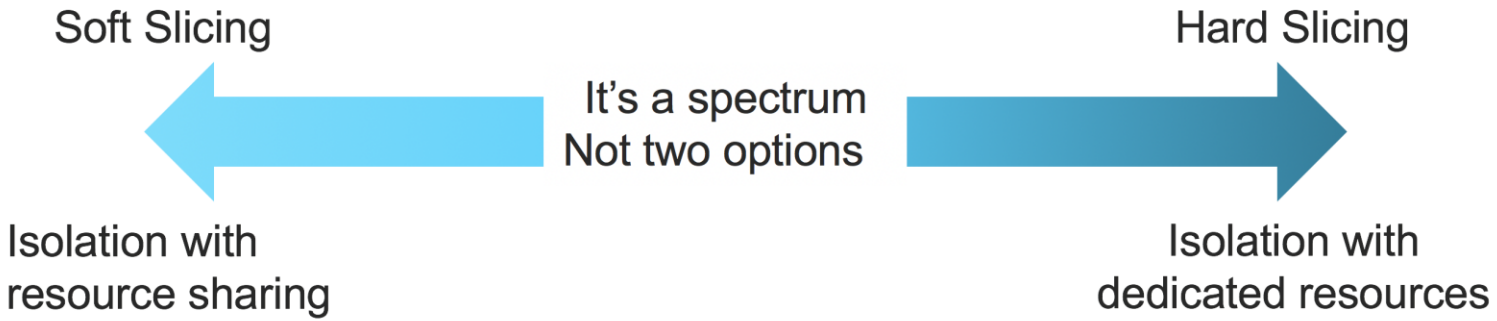
3GPP 5G RAN Slice (2)

Intelligent Programmable Software Centric Infrastructure



Intelligent programmable software centric Infrastructure with right Horizontal cloud platform and Orchestration / Automation framework is the key enabler for RAN slicing

Transport Slice (1)
Soft vs Hard Slice



- Term coined in IETF
- Hard slicing: Resources dedicated to a specific NSI.
- Soft slicing: Resources are shared but NSIs don't interface with each other.
- Not an architecture, NOR is there a feature list for hard / soft transport slices

(see Network Slicing Architecture draft-geng-netslices-architecture-00)

Transport Slice (2)

Integrated Programmable Transport + DC Fabric (ACI+Segment Routing)

Design Building Blocks

End to End Slicing

Providing end to end automation of network slice from transport and extending it in datacenter domain.

Automation & Assurance

End to End Provisioning with NSO and Assurance with Crosswork Framework.

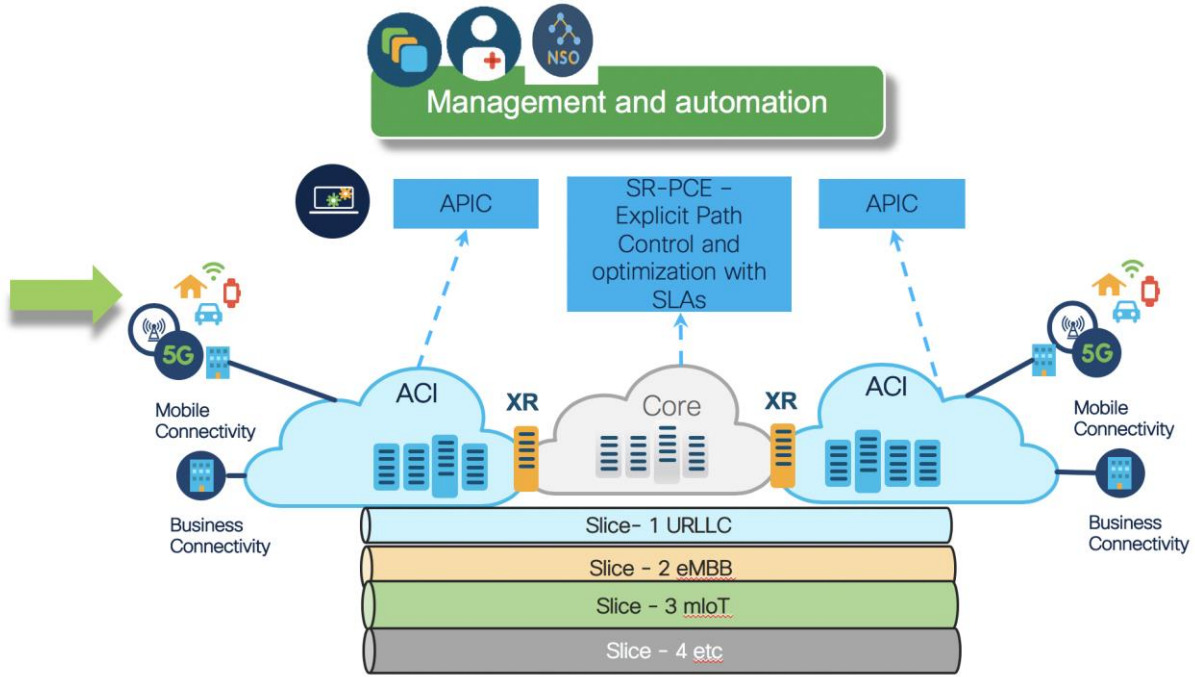
Segment Routing

Unified Forwarding Plane with Explicit Path Control and Traffic Engineering in transport domain

BGP VPN

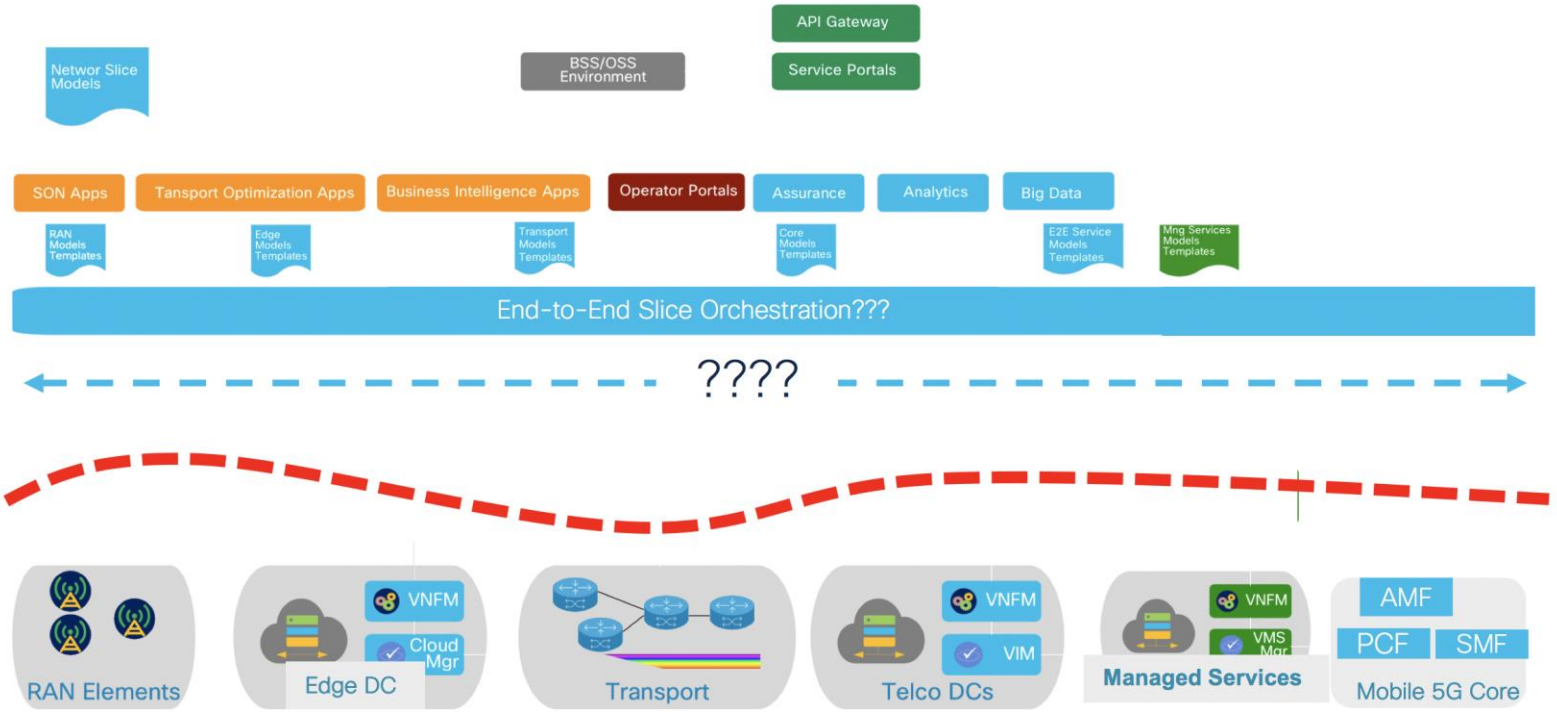
Unified Service Control Plane for L2 and L3 VPNs

End-to-End Design

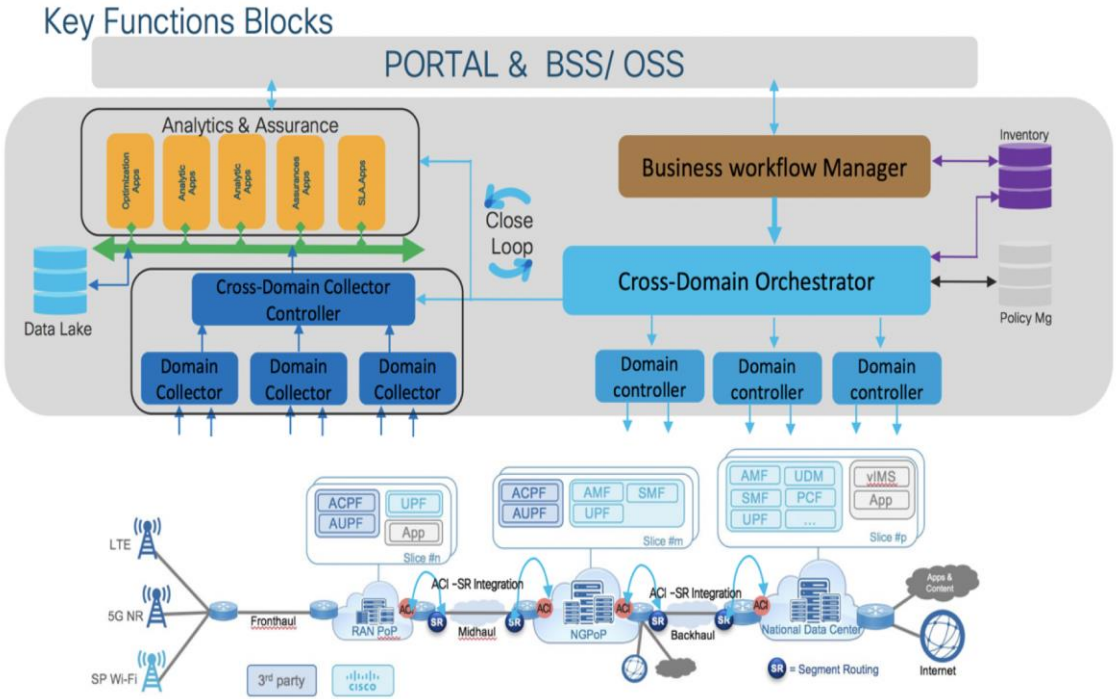


E2E Slicing Architecture Framework

Problem Statement – Working in Silo's



E2E Slicing Architecture Framework



NOTE: Best practice to have domain level orchestration/automation and assurance framework strategy addressing domain level use cases and Integration to X-Domain

Architecture Building Blocks

X-Domain Service Orchestration And Management :

- Portal (Customer Facing , Operations)
- OSS/BSS
- Workflow Manager
- E2E Cross-Domain Orchestrator
- Cross Domain Collector
- Service Assurance – PM , FM
- Dynamic Inventory
- Policy Engine

Cloud-Native Domain :

- Telco Cloud Platform –VNF –OS , CNF:K8's
- NSSMF / ETSI MANO –NFVO , GVNFM
- Assurance – PM, FM
- 5G SA CP/DP workloads (5G CP NF's , UPF)

Integrated Transport And Fabric Domain :

- DC Fabric
- E2E SR (FH/BH/Core)
- SR-PCE
- SDN Controller
- Orchestrator (NSSMF)
- Assurance – PM , FM

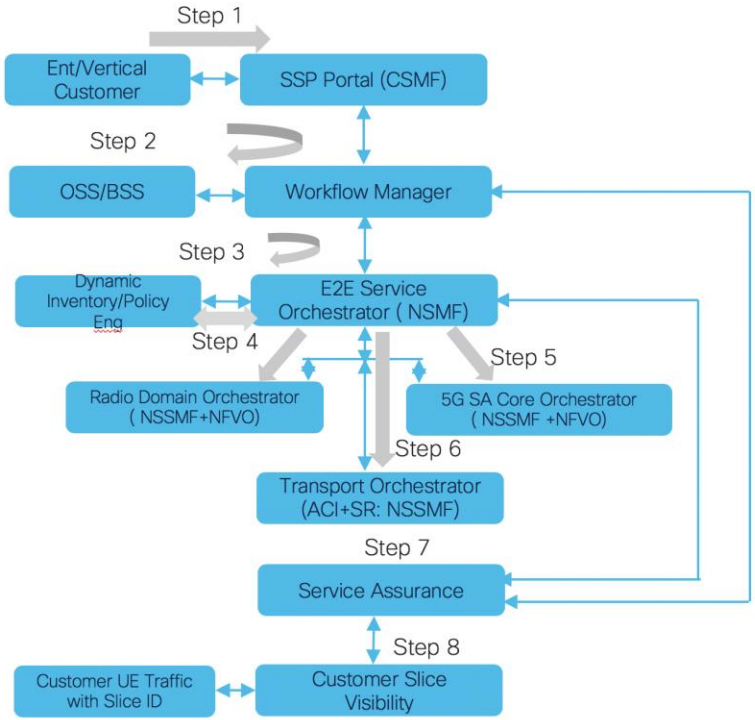
RAN/Edge Cloud Domain

- vCU , vDU , RU
- Radio Intelligent Controller
- ETSI MANO , NFVI
- DC Fabric

E2E Workflow

E2E Slicing Workflow

E2E Slicing Architecture Framework



E2E Workflow

Step 1 : Customer i/p's SLA based service requirements

Step 2 : OSS/BSS team validates service based SLA requirements and further decomposes to 3GPP service Requirements & Transport service Requirements .Allocate S-NSSAI and pre-provision in UDM & NSSF . ACI fabric DSCP mapped to SR SLA's

Step 3 : Workorders generated for 3GPP service and Transport service requirement's .Operations team feeds the information to E2E service orchestrator using operational portal (REST API)

Step 4 :E2E Service Orchestrator converts 3GPP service and Transport service requirement's to 3GPP network slice requirement's (3GPP NSI/NST) and Transport network slice requirement's (Transport NSI/NST) .E2E SO validates slice profile with policy engine and creates Slice profile /NSI/NST in dynamic inventory .

Step 5:E2E Service Orchestrator further decomposes 3GPP slice requirements :NSI /NST to Radio Access slice NSSI/NSST & 5G SA Core slice NSSI/NSST and trigger API calls to respective domain NSSMF's .NFVO will handle the LCM of the VNF's/CNF's .VIM to ACI integration will help to provision the underlay fabric

Step 6 :Once 3GPP network slice successfully provisioned , E2E SO trigger API call to Transport domain NSSMF to provision consistent SLA based slice across ACI & SR fabric

Step 7 :E2E Service Orchestrator trigger API call to service assurance components and update the slice details .Assurance systems start monitoring the newly created slices

Step 8 :Based on customer UE slice id's traffic get redirected to the dedicated slices created for that customer & at any point of time customer can view the service assurance aspects of the slice

Key Message

Key Message

Intelligent Open Programmable Software Centric Orchestrated and Management Infrastructure is the key enabler to achieve E2E Slicing outcome and Cisco has the right solution and expertise to make this happen

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Thank you