Towards a Globally Distributed Cloud

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Session on “Demand for an open testbed platform”
Federated 5G/SDN/NFV/MEC Testbed - Workshop
IEEE SDN Initiative & EIT Digital
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AGENDA

› 5G Exchange – Orchestration for multi-provider distributed cloud [slides based on 5GEx year 1 review presentation material]

› Edge computing
  – Distributed cloud deployment in 5G
  – Dataplane and execution environment
LEVELS OF DISTRIBUTION

› Multiple data centres
› Edge computing
  – Operator edge
  – Customer edge
› Multiple operators
Vision: One Stop Shop for End-to-end XaaS for Multiple Industries

From dedicated physical networks with dedicated control and dedicated services and resources for different applications...

...to a “network factory” where resources and network functions are traded and provisioned: new infrastructures and services are “manufactured by SW”

Unified Orchestration and Management Plane

Multi-provider, multi-domain
Industry Landscape

- Different efforts around multi-provider multi-domain orchestration
  - ETSI
    - NFV ISG: First consideration on multi-domain orchestration (ETSI GS NFV-IFA 009 V1.1.1)
  - ONF
    - Revisited SDN architecture includes inter-domain relationships (ONF TR-521)
    - Cross Stratum Optimization (CSO)
    - Carrier Grade SDN
  - IETF/IRTF
    - NFVRG and SDNRG groups
  - ITU-T IMT 2020
    - 5G architecture for non-radio networks
    - 5G network softwarization
    - 5G management and orchestration
  - 3GPP
    - 5G architecture for radio & mobile networks
5GEx “mission”

• Design and implement a 5G multi-provider orchestration framework
  – Significantly improving agility and speeding up deployment of new services
    • XaaS creation time from “90 days to 90 mins”
  – Creating opportunities for operators to buy, sell, and integrate XaaS in an automated and cost-effective manner

• Define and validate the 5G business actors and process, including economic and market mechanisms that promote efficiency of multi-domain services
  – Impact operator’s community by identifying new challenges or elaborating on known ones

• Build a pan European multi-site sandbox testbed
  – To assess the feasibility and performance of the proposed architecture and business models, by deploying the working end-to-end system built by 5GEx

• Standardize through strong industry participation of all major stakeholders
• Provide Open Source solutions
5GEx architecture at a Glance

5GEx focus

Multi-provider Orchestrator Administration A

Multi-provider Orchestrator Administration B

Multi-provider Orchestrator Administration C

Customer (Tenant)

Wholesale buyer interface

Business

Data

Management and orchestration plane

(Legacy) Control plane

Data plane

VIM

Network Controller

SDN nets.

Packet/Opti

Datacenter

Network Controller

Packet

Operator A administration

Operator B administration

Operator C administration

5GEx 1st Review: Overview

Sept 20, 2016
OTT wants to offer platform (API) with global support for a fancy new application
- E.g. CRUD application modules near a given location
  - Provides scalability for API provider
  - Provides better QoE for API consumers
- Platform operated in distributed cloud (or edge) computing environment
  - Platform implemented in VNFs
  - Resource requirements of platform depend on location, time of day/week and local events
5GEX Sandbox Testbed

Need to

- Isolate from, yet replicate, production networks
- Control plane access

- 13 Administrative domains
- Heterogeneous Environment
  - BGP+H-PCE domain / SDN domain
  - OpenStack/Vmware
  - OpenDaylight/Onos
- Emulate Interconnection using (GRE/IPSEC)
- Evolving towards ‘production like hierarchal bgp environment’
(Expected) Locations
Industrial Workshop focused on Carrier Network solutions (Spring/Summer 2017)
  - 5GEx multi-provider proof of concept solution
  - 5GEx Pan-European Sandbox up and running
  - Extensions to
    - 5G Innovation Platform (users)
    - Carrier interconnection (operators)

Ongoing activities
  - Draft Collaboration Agreement for 3rd parties to connect to the Sandbox
  - Making project contributions open-source: aim to provide reference PoC implementation for multi-provider network service orchestration
DISTRIBUTED CLOUD IN 5G: REASONS FOR CHANGE

› Virtualized RAN
  – New functional split allows some RAN functions to run in a virtualized environment
  – Flexible scalability and elasticity to minimize permanent peak rate dimensioning

› New deployment models
  – Gives control to operator to support various deployment models, e.g. centralized or distributed
  – Support co-location of RAN and Core function
  – Potential to provide added value services for third party applications

› Modular design
  – Current DUs capacity underutilized for many deployments
  – Modular design allows investing where it makes sense

› Use of merchant silicon
  – Reprogrammable hardware allows repurposing of earlier investments instead of throwing them out
VISION: DISTRIBUTED CLOUD DEPLOYMENT FOR 5G

- **Vision:** Distributed Cloud Deployment for 5G

  - Small Sites
  - Medium Sites
  - Large Sites

  - HW platform requirements
    - Modular building practice with flexibility in defining optimal deployments
    - Telecom rack depth (<400mm)
    - Environmentally hardened

Multi-purpose DC

Orchestration

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Requirements

› Shall support a plethora of VNF implementation types
  - VM
  - Container
  - In-line code
  - Switch internal
  - HW accelerator
› Shall have context and handover support in the API
› Shall not compromise on performance
  - Local optimizations e.g. zero-copy interfaces, direct interfaces, etc.
  - Optimized deployment via local orchestrator
  - Automatic scaling
5GEx in 5G Key Characteristics

- **High diversity** types of communication services;
- **Separation of concerns** data / control/ management / service;
- **Embedded native softwarization** in all planes;
- **Transition** form “network of entities” to “network of (virtual) functions / capabilities”;
- **On demand composition** of network functions and network capabilities;
- **Automation** in all network segments, network components, network elements, network and resource slices.
INNOVATION IN 5GEX

› A technical and business solution for multi-domain service orchestration and provisioning, inclusive of service discovery, bilateral negotiation and service assurance. The solution leverages the NFV architectural model and a new composite (computing and connectivity) cross-domain resource slicing.

› A set of APIs enabling service catalogue publishing/sharing, rapid provisioning and large scale invocation of composite services across multiple autonomous systems. The APIs map to reference points in the NFV MANO stack, and extend NFV services into multi-actor wholesale service offerings.

› A live sandbox interconnecting five leading European operators, enabling automated end-to-end orchestration of multi-party 5G services to undergo accelerated prototyping and piloting prior to market launch. The 5GEx sandbox will be evolved and become a living in-operation lab after the project end.