CNTT Edge - RA01 (OpenStack) Architecture - Scenario

This page is now not in use. Instead please refer to and add content to: PR #2118

- CNTT Hybrid Multi-Cloud Architecture (includes Edge)
- CNTT Edge Architecture

Topic Areas:

(RM Chapter 3 new section on Edge Computing w/o OpenStack specifics)

Edge deployment scenarios

Cloud Infrastructure (CI) deployment environment for different edge deployments:

Controlled: Indoors, Protected, and Restricted environments. Data Centers, Central Offices, Indoor venues. Operational benefits for installation and maintenance, and reduced need for hardening/ruggedized.

Exposed: Outdoors, Exposed, Harsh and Unprotected environments. Expensive rugged equipment

Cloud Infrastructure (CI) hardware type for different edge deployments:

Commodity/Standard: COTS, standard hardware designs and form factors. Deployed only in Controlled environments. Reduced operational complexity.

Custom/Specialised: non-standard hardware designs including specialised components, ruggetised for harsh environments and different form factors. Deployed in Controlled and/or Exposed environments. Operationally complex environment.

Cloud Infrastructure (CI) hardware specifications for different edge deployments:

CNTT Basic: General Purpose CPU; Standard Design.

CNTT Network Intensive: CNTT Basic + high speed user plane (low latency, high throughput); Standard Design.

CNTT Network Intensive+ : CNTT Network Intensive + optional hardware acceleration (compared with software acceleration can result in lower power use and smaller physical size); possible Custom Design.

CNTT Network Intensive++ : CNTT Network Intensive + required hardware acceleration; Custom Design.

Server capabilities for different edge deployments and the OpenStack services that run on these servers; the OpenStack services are containerised to save resources, intrinsic availability and autoscaling:

Control nodes host the OpenStack control plane components (subset of Cloud Controller Services), and needs certain capabilities:

OpenStack services: Identity (keystone), Image (glance), Placement, Compute (nova), Networking (neutron) with ML2 plug-in

Message Queue, Database server

Network Interfaces: management, provider and overlay

Compute nodes host a subset of the Compute Node Services:

Hypervisor

OpenStack Compute nova-compute (creating/deleting instances)

OpenStack Networking neutron-l2-agent, VXLAN, metadata agent, and any dependencies

Network Interfaces: management, provider and overlay

Local Ephemeral Storage

Storage Nodes host the cinder-volume service. Storage nodes are optional and required only for some specific Edge deployments that need large persistent storage:

Block storage cinder-volume

Storage devices specific cinder volume drivers

Cloud partitioning: Host Aggregates, Availability Zones

OpenStack Edge Reference Architecture provides more depth and details

Edge Deployments:

Small footprint edge device: only networking agents

Single server: deploy multiple (one or more) Compute nodes

Single server: single Controller and multiple (one or more) Compute nodes

HA at edge (at least 2 edge servers): Multiple Controller and multiple Compute nodes

SDN Networking support on Edge

(RM Potential Ch 2 as a specialised workoad type)

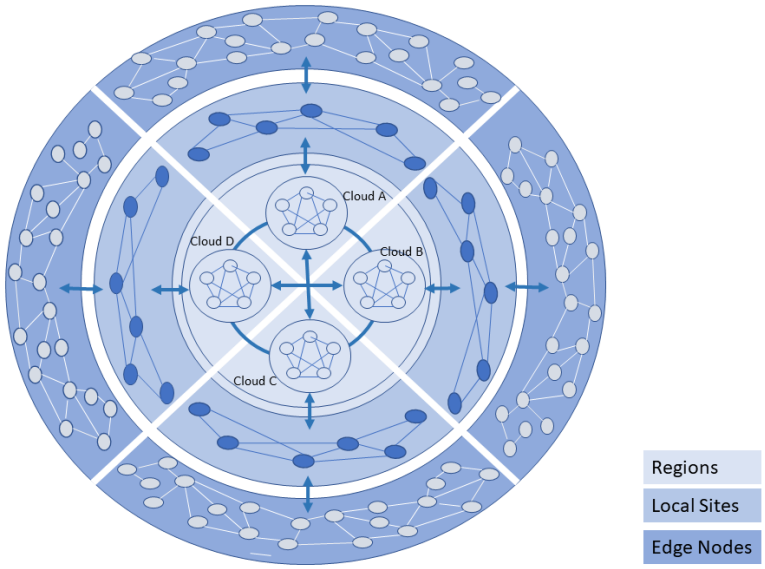
Network Function as a Service (NFaaS)

Higher level services such as Network Functions (includes composition of Network Functions to form higher level services) offered on Telco and other clouds (HCP, specialised, etc.). While here the discussion is about NFaaS, this is equally applicable to anything as a service (XaaS)

- NFaaS offered on one or more Cloud Services (Telco, HCP, others) including at the Edge
  - Network integration and Service Chaining
  - Security Considerations including delegated User Authentication & Authorization
  - Commercial arrangements including User Management

(RM Ch03 as a sub-section of Introduction)

Hybrid Multi-Cloud Enabled Edge Architecture



(PG: In the above diagram, replace "Local" with "Metro")

- The Telco Operator may own and/or have partnerships and network connections to utilize multiple Clouds
  - for network services, IT workloads, external subscribers
  - On Prem Private
    - Open source; Operator or Vendor deployed and managed | OpenStack or Kubernetes based
    - Vendor developed; Operator or Vendor deployed and managed | Examples: Azure on Prem, VMWare, Packet, Nokia, Ericsson, etc.
  - On Prem Public: Commercial Cloud service hosted at Operator location but for both Operator and Public use | Example: AWS Wavelength
  - Outsourced Private: hosting outsourced; hosting can be at a Commercial Cloud Service | Examples: Equinix, AWS, etc.
  - (Outsourced) Public: Commercial Cloud Service | Examples: AWS, Azure, VMWare, etc.
  - Multiple different Clouds can be co-located in the same physical location and may share some of the physical infrastructure (for example, racks)

Type	System Developer	System Maintenance	System Operated & Managed by	Location where Deployed	Primary Resource Consumption Models

Private (Internal Users)	Open Source	Self/Vendor	Self/Vendor	On Prem	Reserved, Dedicated
Private	Vendor | HCP	Self/Vendor	Self/Vendor	On Prem	Reserved, Dedicated
Public	Vendor | HCP	Self/Vendor	Self/Vendor	On Prem	Reserved, On Demand
Private	HCP	Vendor	Vendor	Vendor Locations	Reserved, Dedicated
Public (All Users)	HCP	Vendor	Vendor	Vendor Locations	On Demand, Reserved

- Each Telco Cloud consists of multiple interconnected Regions
- A Telco Cloud Region may connect to multiple regions of another Telco Cloud (large capacity networks)
- A Telco Cloud also consists of interconnected local sites (multiple possible scenarios)
- A Telco Cloud's local site may connect to multiple Regions within that Telco Cloud or another Telco Cloud
- A Telco Cloud also consists of a large number of interconnected edge nodes
- Edge nodes may be impermanent
- A Telco Cloud's Edge node may connect to multiple local sites within that Telco Cloud or another Telco Cloud; an Edge node may rarely connect to an Telco Cloud Region

(RM Ch03 the new Edge Section)

Comparison of Edge terms from various Open Source Efforts

	Characteristics											Othe	
CNTT Term?	**Compute**	**Storage**	**Networking**	**RTT***	**Security**	**Scalability**	**Elasticity**	**Resiliency**	**Preferred Workload** **Architecture**	**Upgrades**		**OpenStack**	**OPNFV Edge**
Regional Data Center (DC) Fixed	1000's Standardised >1 CPU >20 cores /CPU	10's EB Standardised HDD and NVMe Permanence	>100 Gbps Standardised	~100 ms	Highly Secure	Horizontal and unlimited scaling	Rapid spin up and down	Infrastructure architected for resiliency Redundancy for FT and HA	Microservices based Stateless Hosted on Containers	HW Refresh: ? Firmware: When required Platform SW: CD		Central Data Center	
Metro Data Centers Fixed	10's to 100's Standardised >1 CPU >20 cores /CPU	100's PB Standardised NVMe on PCIe Permanence	> 100 Gbps Standardised	~10 ms	Highly Secure	Horizontal but limited scaling	Rapid spin up and down	Infrastructure architected for some level of resiliency Redundancy for limited FT and HA	Microservices based Stateless Hosted on Containers	HW Refresh: ? Firmware: When required Platform SW: CD		Edge Site	Large Edge
Edge Fixed / Mobile	10's Some Variability >=1 CPU >10 cores /CPU	100 TB Standardised NVMe on PCIe Permanence / Ephemeral	50 Gbps Standardised	~5 ms	Low Level of Trust	Horizontal but highly constrained scaling, if any	Rapid spin up (when possible) and down	Applications designed for resiliency against infra failures No or highly limited redundancy	Microservices based Stateless Hosted on Containers	HW Refresh: ? Firmware: When required Platform SW: CD		Far Edge Site	Medium Edge
Mini-/Micro-Edge Mobile / Fixed	1's High Variability Harsh Environments 1 CPU >2 cores/CPU	10's GB NVMe Ephemeral Caching	10 Gbps Connectivity not Guaranteed	<2 ms Located in network proximity of EUD /IoT	Untrusted	Limited Vertical Scaling (resizing)	Constrained	Applications designed for resiliency against infra failures No or highly limited redundancy	Microservices based or monolithic Stateless or Stateful Hosted on Containers or VMs Subject to QoS, adaptive to resource availability, viz. reduce resource consumption as they saturate	HW Refresh: ? Firmware: ? Platform SW: ?		Fog Computing (Mostly deprecated terminology) Extreme Edge Far Edge	Small Edge

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*RTT: Round Trip Times
 EUD: End User Devices
 IoT: Internet of Things
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Glossary

- State of the Edge