Edge Computing Resource Management System: a Critical Building Block!
Initiating the debate via OpenStack

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Which Edge?

Domestic network

Enterprise network

Cloud Computing

Cloud latency > 100ms

Site 1

Inter sites latency [50-100ms]

Site 2

Micro/Nano DC

Intra sites latency < 10ms

Site 3

Edge Computing Sites

Site 4

Edge Computing Sites

Extreme Edge Frontier

Edge Frontier

Wired link ———

Wireless link ------
What do we seek?

- A resource manager with Admin & DevOps’ requirements in mind
  - Admin/Operator - aggregate, supervise and expose massively distributed infrastructure resources
  - DevOps - implement new kinds of services that may be deployed/managed on-demand
Requirements Classification

- Features expected by Admins & DevOps
- Classified into 5 levels (from L1, to L5)
- From simpler aspects (L1) to more complex ones (L5)

<table>
<thead>
<tr>
<th>Levels</th>
<th>Admin</th>
<th>DevOps</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1:</td>
<td>Operate/use any site</td>
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<tr>
<td>L2:</td>
<td>Operate/use several sites</td>
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<tr>
<td>L3:</td>
<td>Robustness (w.r.t). split brains</td>
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<tr>
<td>L4:</td>
<td>Multiple VIM environments</td>
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<tr>
<td>L5:</td>
<td>Multiple operators</td>
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</table>
OpenStack at the Edge

Single OpenStack

Master Site

Edge 2

Compute node q

Edge 3

Compute node q

Edge n

Multiple OpenStacks (Regions)

Edge Site 1

Keystone

Horizon

Nova

Glance

Neutron

Edge Site 2

Keystone

Horizon

Nova

Glance

Neutron

Edge Site n

Keystone

Horizon

Nova

Glance

Neutron
Top-down Approach

- Most existing solutions follow this approach
- A set of overlay components that interact with VIMs through existing APIs
- Expose own APIs to Admins/DevOPs
Top-down Approach

+ Often simpler to get started with
+ Independent VIM and overlay development
+ Faster time to market and faster adoption

- Duplication of VIM functions, state and/or data at the overlay level (and between sites)
- Current APIs may not allow you to do low level operations (e.g. L2)
Bottom-up Approach

- Native collaboration is baked into VIMs
- Any VIM can act as an entry point to the edge infrastructure
- Only academic proposals up to now
Bottom-up Approach

+ Minimal duplication of functions
+ Potential to fulfill all requirements

- Not easy
  - Needs to deal with data consistency challenges in a WAN environment
  - Requires an excellent expertise of the whole ecosystem
  - L4/L5 challenges on abstraction, data exposure policy, etc
  - Convince the community
Summary

The tip of the iceberg

- Requirements: classification at various levels
- OpenStack: unable to fulfill (today) all identified requirements
- Design options: a Top-Down vs Bottom-Up dilemma
  - Hybrid approach = Bottom-Up up to L3 + Top-Down for L4 and L5

Moving forward

- More requirements?
  - Beyond IaaS
  - Integration with Core and Mobile Networks
- Propose an architecture that mitigates development efforts
- ...
THANKS!

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