A proposal about single management platform for edge cloud

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What should Telco Operators care to build large-scale edge cloud?
Technical Points We Care

1. Diverse Hardware
   - x86
   - Customized Server
   - All-in-one rack
   - Bare metal
   - Acceleration hardware

2. Heterogeneous Cloud Platform
   - Container + K8S
   - VM + OpenStack
   - Container in VM

3. Centralized O&M and Resource Providing
   - Centralized O&M for distributed edge resource (HW & SW)
   - Resource application portal for 3rd-party applications

4. Orchestration
   - Simplified orchestration for IT App if needed
   - Orchestration and cooperation of IT App and telco network ability

5. SDN
   - SDN for edge

6. Service and MEC
   - Provide MEC ability for edge Applications
   - Provide ability of 5G wireless and core network
   - Cooperation between IT and CT services
Applications on cloud under testing: Cloud Game, Video, Face Recognition, VR/AR etc.

Infrastructure is still one of the most important layer on edge that needs attention

However, current edge hot spot is IOT, not many projects focuses on infrastructure layer
Requirements of providing infrastructure on edge
New requirements on edge infrastructure

Key points of providing infrastructure on edge:

- Centralized operation and management on multi-cloud environment
- Maintain basic operations on edge sites once lost connection

Sample Requirements

- User data management
  - Consistent data + different authorization
  - Single Sign on
- Site management
  - Add new site into management list
- Cloud resource management
  - Provide safe resource application API or portal
  - Manage heterogeneous cloud
- Image management
  - Image uploading and distribution on-demand
- Software management
  - OS, middleware, cloud platform patch, App uploading
- Hardware management
  - Operation on compute, network, storage, acceleration device
- FCAPS collection and report
  - Collect fcaps data from edge resource pools and report to whoever needs it
Test on platform selection
**Test Plan**

- **Purpose:** exploring structure and features of large-scale edge virtualization layer of telco operators

- **Major testing points:**
  - Lightweight OpenStack as controller for virtualization resources
  - Management and interoperability of multiple cloud on edge

- **Environment description:**
  - Two sites located 30 km away from each other with the latency of around 2ms
  - An edge system including 3 virtualization environments, centralized management ability among those environments
Platform Selection

3 different solutions have been tested:

- Enhanced Multi-Region (old-version StarlingX but with some close-source enhancement)
- Centralized OpenStack control with remote compute
- Independent lightweight OpenStack as VIM with external multi-cloud management system
# Features & Outcomes

<table>
<thead>
<tr>
<th>Solution</th>
<th>#1 Enhanced multi-region</th>
<th>#2 Centralized control with remote compute</th>
<th>#3 Independent lightweight with external multi-cloud management system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endpoints</td>
<td>Multiple for multi-region</td>
<td>Single for all edge</td>
<td>Single for all edge + vim_id</td>
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<tr>
<td>Consistent user data</td>
<td>Support (Sync DB)</td>
<td>Support (One DB)</td>
<td>Support (Outside DB)</td>
</tr>
<tr>
<td>Different quota on different site</td>
<td>Not Support</td>
<td>Not Support</td>
<td>Support</td>
</tr>
<tr>
<td>Requirement on DCI management network quality</td>
<td>Medium</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Difficulty of adding new sites</td>
<td>Medium (modify config)</td>
<td>High</td>
<td>Low (add link)</td>
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<tr>
<td>Image distribution</td>
<td>Sync to every region</td>
<td>One for all</td>
<td>Distribute on-demand</td>
</tr>
<tr>
<td>Heterogeneous cloud MGT</td>
<td>Not support</td>
<td>Not support</td>
<td>Support</td>
</tr>
<tr>
<td>Suitable scenario</td>
<td>Small-scale multi-cloud environment with reliable DCI network</td>
<td>Large-scale multi-cloud environment</td>
<td></td>
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<tr>
<td>Pros</td>
<td>Easiest Sync (DB, image, flavor)</td>
<td>Most lightweight; One SDN for multiple sites</td>
<td>Most flexible and reliable; Local O&amp;M</td>
</tr>
<tr>
<td>Cons</td>
<td>Not support local management; Require high network quality;</td>
<td></td>
<td>Introduced non-OpenStack multi-cloud management platform</td>
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</tbody>
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Outcomes come from test data and theoretical analysis.
Conclusions

- In the aspect of centralized resource utilization, all the three solutions support applying for resource at the center of edge (large edge in previous plots) and specifying VM locations
  - Multi-region $\rightarrow$ region
  - Centralized OpenStack control with remote compute $\rightarrow$ AZ
  - Independent lightweight OpenStack as VIM with external multi-cloud management system $\rightarrow$ vim/cloud

- In the aspect of centralized O&M and interoperability of multiple cloud, an external management system is recommended.
  - Hard to replying on pure OpenStack to achieve multi-cloud interoperability and O&M
  - E.g. different quota on different site, image distribution on-demand, SW/HW management
A platform for multiple edge cloud
A platform for multiple edge cloud

**NFVO/3rd-party App/...**
- Resource application portal/API

**Cloud provider & Maintainer**
- O&M portal

**NFVO/BOSS/3rd-party MGT system/...**
- Northbound interface (fcaps/resource usage)

- **User data management** (Single sign on/centralized user DB)
- **Software management** (CRUD of cloud-related SW and application)
- **Cloud resource management** (heterogeneous/multi-version/multi-vendor cloud)
- **Site management** (LCM of a newly-built edge cloud site)
- **Hardware management** (CRUD of HW resource)
- **Image management** (CRUD and distribution of image)

- **Performance management**
- **Account management**
- **Fault management**
- **Log management**
- **Configuration management**
Thank You!