Services Migration to the Cloud

Service intelligence distributed across dedicated network elements

Enabler:
- High Performance COTS Hardware
- Hardware / Software Separation
- Virtualization

Opportunity:
- Service Elasticity
- Global Presence
- Speed to Market

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Software Defined Networking Today: Traffic Steering for Content Management & Distribution

- By subscriber based on subscriber policy
- By application type through content inspection
- By cache asset based on URL
- By destination based on RAN congestion signaling
- By server based on performance and availability
On detection of long-lived flow, SDN signals OpenFlow Controller
- OpenFlow Controller pushes explicit route to Hybrid OpenFlow Router
• **Problem Statement**
  - LTE/IMS network is not optimized for multi-tenancy and subscriber-less services

• **Solution Summary**
  - Leverage cloud computing technology
  - Leverage SDN
  - Build once, replicate multiple instances

• **Example Services**
  - M2M
  - “Private” IMS for Enterprise

### Next Generation Network Services

<table>
<thead>
<tr>
<th></th>
<th>Today</th>
<th>Tomorrow</th>
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<tbody>
<tr>
<td>Deployment Cycle:</td>
<td>12-24 months</td>
<td>Days</td>
</tr>
<tr>
<td>Failure Analysis:</td>
<td>Post Mortem</td>
<td>Predictive</td>
</tr>
<tr>
<td>Failure Domains:</td>
<td>Large; mainly geographic</td>
<td>Small topologies</td>
</tr>
<tr>
<td>Asset Utilization:</td>
<td>Typically 20%</td>
<td>&gt;80%</td>
</tr>
<tr>
<td>Geographic Scope:</td>
<td>Tied to Service Network</td>
<td>Global</td>
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<tr>
<td>Unit cost</td>
<td></td>
<td>10X decrease</td>
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### SDN/OF Gap Analysis

<table>
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<tr>
<th>SDN Requirement</th>
<th>Gap with Current Industry</th>
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<tbody>
<tr>
<td>Coordinated resource virtualization, aggregation, orchestration and optimization</td>
<td>Major gap is coordinated network and cloud computing orchestration</td>
</tr>
<tr>
<td>Abstractions and programming languages enabling higher-level service composition</td>
<td>Common form of abstract representation for applications, computing resources and networks will be needed.</td>
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<td>Use of dynamic multilayer network capabilities and abstraction to achieve pooling, scaling, optimization, and simplification</td>
<td>Global optimization may only be possible with a logically centralized system.</td>
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<tr>
<td>Protocol specifications for major aspects of SDN ecosystem while still leaving room for differentiation and experimentation</td>
<td>OpenFlow only solves part of the lower-layer networking problem.</td>
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<td>Operations functions to provision, monitor, diagnose and maintain services that are dynamically composed of network and compute resources.</td>
<td>No systems to enable stable, responsive and robust operation in a production environment.</td>
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Network Cloud Formation

• A collaboration to develop prototypes demonstrating the next generation network architecture based on cloud computing techniques and software defined networking.
• Core partners are providing resources, lab facilities, technical expertise.
• Other ecosystem partners are engaged based on functionality and alignment with the mission.

Ecosystem Partners

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Summary

• Verizon has deployed SDN as an overlay network for video distribution services

• Inefficiencies in this architecture can be alleviated through the integration of OpenFlow technologies

• For scale and flexibility, the SDN framework must support multiple VM domains, multiple network domains, and multiple services/applications with open, standard interfaces

• Significant gaps still exist to tightly couple and optimize the dynamic management of virtualized data center and network resources

• HP, Intel and Verizon are collaboratively standing up an innovation center to examine carrier-centric SDN use cases and help identify and close technology gaps