Panel: The Future of Datacenter Networking
Software-Defined Networking (SDN) for Datacenter Interconnect and Cloud Computing

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Evolution of cloud architectures

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource Virtualization inside Data Centers - economic savings -</td>
<td>Data Center Virtualization - infrastructure flexibility -</td>
<td>Network Virtualization - platform agility -</td>
</tr>
<tr>
<td>Utilization</td>
<td>Flexibility</td>
<td>Capacity on demand</td>
</tr>
<tr>
<td>Scalability</td>
<td>High availability</td>
<td>Adaptive infrastructure</td>
</tr>
<tr>
<td>Redundancy</td>
<td>Workload balancing</td>
<td>Dynamic service automation</td>
</tr>
</tbody>
</table>

2007 | 2010 | 2015
Long-Distance Datacenter Interconnect

- Datacenters are globally distributed and have to exchange / synchronize information

- Long distance carrier technology used for inter-DC networks
  - ROADM-based Long-haul, high capacity transmission, 10...100Gbit/s, 40/80/96 ch, ...

- Datacenter operators are their own transport network customers → more flexible network operation

- Increasing programmability and flexibility of intra-datacenter connectivity → increasing flexibility and programmability for the long-distance data center interconnectivity

Source: VMWare
Cloud Computing

• Datacenter and Web 2.0 service providers have increasing impact on Transport Network

• Cloud computing is currently decoupled from the transport networking control and operation

• Goal is to converge cloud computing and networking

• This required a more dynamic mode of control and operation and new functionality of the network such as network virtualization

→ Software Defined Networking

Source: VMWare
Software Defined Networking

- Open interface between a (centralized) control and the forwarding plane
- Key Goal: Network Virtualization
- Convergence of the virtualized networks with VMs in the data centers
- One possible solution: OpenFlow
  - focused on packet based networks (Ethernet, IP, MPLS Networks)
- Key benefit: Simplicity
- Main issues:
  - Scalability and security
  - Not well suited for circuit switched and optical networks yet
Network Virtualization and API’s

• Network resource sharing driven by specific use cases
  • Beyond today’s VPNs
  • Includes physical layer resource carve-out
  • Must be convenient and drive revenue opportunities

• Tools/mechanisms for carving out an entire virtual network topology from an existing physical network
  • Dynamically and rapidly reconfigure network infrastructure in response to specific use cases
  • Analogy to bringing up OS instances on a whim within cloud computing infrastructures
  • Examples present in Ethernet networks in datacenters using OpenFlow
  • How can the same functionalities be realized within a packet-optical transport network?

• APIs... Application Programming Interfaces
  • Applications aware of (virtualized) network resources
  • Able to dynamically reserve, reconfigure and release network components, to serve their specific needs
Modes of Operation

- **Network API (aka Big Fat Switch)**
  - Optical Network acts as one Virtual Switch
  - Plain packet-based OpenFlow Controller
  - Optical layer functionality is abstracted by single OpenFlow agent
  - internal signaling can be based on existing GMPLS control plane (OpenFlow UNI)

- **Network Element API**
  - Optical Network fully controlled by OpenFlow API
  - OpenFlow Controller and OpenFlow Protocol requires Optical extensions
  - OpenFlow agent on each NE models optical constraints
ADVA’s Activities towards SDON

- **Geysers**
  - green aware extensions on the industrial CP class solution
  - verification of interworking with legacy GMPLS-based virtualization mechanisms
    - slice of network as specified and fixed set of labels (wavelengths, time slots etc.)
    - slice of network as a number of unspecified labels

- **OpenFlow in Europe – Linking Infrastructure and Applications**

  First ROADM-based optical OpenFlow networking testbed developed in cooperation with University of Essex
Thank you

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