Cloud, SDN and the Evolution of Enterprise Networks

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Strategic Planning Assumptions

• Through 2017, the average enterprise network will see a **28% CAGR** for bandwidth due to the use of cloud computing, mobile devices and video.

• Through 2015, at least 50% of cloud deployments will suffer from business-impacting performance issues, requiring extensive **network redesign** to address them.
# Application Mapping — Key to Designing for Hybrid Cloud Environments

## Typical Practice

<table>
<thead>
<tr>
<th>Site Category</th>
<th>Site</th>
<th>Reliability Goal</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Data Center(s)</td>
<td>99.999%</td>
<td>Dual Ethernet and/or MPLS <strong>Plus</strong> Internet VPN</td>
</tr>
<tr>
<td>B</td>
<td>HQ/Plant</td>
<td>99.99%</td>
<td>Ethernet and/or MPLS <strong>Plus</strong> Internet VPN</td>
</tr>
<tr>
<td>C</td>
<td>Regional Office</td>
<td>99.9%</td>
<td>MPLS <strong>Plus</strong> 3G/4G or DSL Backup</td>
</tr>
<tr>
<td>D</td>
<td>Small Office/Teleworker</td>
<td>99%</td>
<td>Internet VPN <strong>Plus</strong> 3G/4G Backup</td>
</tr>
</tbody>
</table>

## Recommended Practice

<table>
<thead>
<tr>
<th>Application</th>
<th>Performance Needs</th>
<th>Reliability Goal</th>
<th>Users</th>
<th>Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telepresence</td>
<td>Low Latency and Loss</td>
<td>99.9%</td>
<td>4 x HQ Suites 3 x Partner Companies</td>
<td>Peer to Peer</td>
</tr>
<tr>
<td></td>
<td>Application-level SLA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ERP</td>
<td>Application-level SLA</td>
<td>99.9%</td>
<td>Sales and Order Entry, Large and Regional Offices</td>
<td>Private Cloud</td>
</tr>
<tr>
<td></td>
<td>Response Time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VoIP</td>
<td>Low Latency and Loss</td>
<td>99.9%</td>
<td>All</td>
<td>Peer to Peer</td>
</tr>
<tr>
<td></td>
<td>MOS Score SLA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Email</td>
<td>Best Efforts</td>
<td>99%</td>
<td>All</td>
<td>Public Cloud</td>
</tr>
</tbody>
</table>

- The networking function must get buy-in from the business for these decisions.
- Achieving 99.999% availability can cost 100 times more than 99.0% availability.
- Hybrid networks can support different SLAs for different applications at the same location.
- SLAs will vary from network to application level for different applications.
Hybrid Cloud Services Increase the Pace of Change in the Enterprise Network

- Distant Cloud Centers — Higher Latency
- Internet Hosted Services — Variable Performance
- Chaotic Traffic Flows — Unpredictable Performance
- Cloud Providers That Will Not Allow Direct Connection to Their Centers — No End-to-end Visibility

All Must Be Resolved With Little or No Notice
Evolving the WAN to Support Cloud IT Delivery

Front End — Cloud to User:
• Improve Internet Connectivity
• Revisit WAN Resilience
• Create Portable Suite of Virtual Network Appliances for IaaS
• Deploy Network-based WAN Optimization for SaaS

Back End — Enterprise DC to Cloud:
• High Capacity Low Latency Networks
• Bandwidth on Demand (SDN?)
• High Performance WAN Optimization

Network Service Providers have been slow to respond to enterprises cloud networking needs — focusing on their own cloud offerings — forcing enterprises to assemble their own solutions
The Hybrid WAN needs Gateways (and NFV)

- MPLS to Internet Gateways
  - For outbound internet – needs SWG
  - For inbound VPN tunnels
  - For remote access

- Cloud/POP based WAN optimization

- Possibly cloud/POP based:
  - Routers
  - Zoning firewalls
  - WLAN/NAC controllers
  - ADCs

- Location, location, location
  - Services must be globally distributed, with VERY smart routing
Cloud Delivery Will Require You to Make Greater Use of Standards

**Best Practices**

- Design and plan for networks with several zones.
- Use standard protocols wherever possible, to enable agility.
- Expect to revisit security process every 12 months.
- Accept peering and integration as potential strategies.
- External sourcing can be a way to force standardization!
Virtual Network Appliances — Needed When Moving Applications to IaaS

Pre-configured appliance suite should be ready to deploy on demand:

- Enterprises need to obtain access to an appropriate suite of virtual appliances
- Existing appliance vendors should be preferred for consistency
- Correct configurations need to be determined and tested
The Application Delivery Network — Building the New Architectural Layer

All Devices

- Computer
- Tablet
- Phone

All Interactions
- User to App
- App to App
- User to User

All Apps
- Browser (HTML)
- Collaboration (SIP)
- Thin Client (TS)
- Virtual Desktop (HVD)
- App to App (XML)

All Deployments
- Intranet
- Internet
- Cloud
- Hybrid

All Locations

All Users
- Employees
- Customers
- Business Partners

It's about providing a broad set of services

Doesn't have to start with LB
The biggest benefit of virtualization and cloud computing: *Increased data center agility.*

The biggest barrier to this agility: *Network provisioning time*
SDx = Software-defined anything (SDx) is a collective term that encapsulates the growing market momentum for improved standards for infrastructure programmability and data center interoperability driven by automation.
We need a new Data Center Network Architecture so we can:

- Significantly improve network operations agility.
- Reduce the time required to provision network resources for a new VM from weeks to minutes.
  - Eliminating the “human middleware”
- Bridge the gap between applications and the network
- Have a multipath network topology to enable support for both north-south and east-west traffic
SDN Definition: A new approach to designing, building and operating networks

- Control plane is **decoupled** from the data plane and is logically centralized.

- Communication between network devices and the SDN controller use communication protocols that may be open or proprietary (**southbound** interface).

- SDN controller supports an open interface to allow external programmability of the environment (**northbound** interface).

Source: Ending the Confusion About Software-Defined Networking: A Taxonomy ID:G0024859
What is the value of SDN?

- **Agility:** Allows for external control and automation of the network
  - Automated provisioning
  - Virtualization orchestration
  - Service Chaining

- **Management:** Improves operational efficiencies

- **Cost:** Promises ability to leverage low-cost hardware (i.e., "white-box" switches)

- Decoupling network software and hardware can increase **innovation in each layer**

- Enterprises, hosting companies and network service providers will each prioritize these benefits differently.
The SDN Stack — A New Network Model

Policy Management and Enforcement Engine

- Compute (Phys or Virt)
- Application Delivery
- Security (FW/IDS/IPS/WAF)
- Storage (Block/File/Object)
- WAN Optimization

- Net work Virtualization
- WAN Traffic Engineering
- Service Chaining (Constraint-based Paths)
- WAN Path Resiliency
- Other Applications

SDN Controller (Network Abstraction, Topology Database, Policy Mapping)

Data Plane (Physical or Virtual Switches)
SDN Deployment Models

1. Device-based SDN deployment
   - Network Virtualization
   - WAN Traffic Engineering
   - Service Chaining
   - Other Applications
   - APIs
   - SDN Controller
   - Network Abstraction
   - Topology Database, Policy Mapping

2. Overlay-based SDN deployment
   - Network Virtualization
   - WAN Traffic Engineering
   - Service Chaining
   - Other Applications
   - APIs
   - SDN Controller
   - Network Abstraction
   - Topology Database, Policy Mapping

3. Hybrid-based SDN deployment
   - Network Virtualization
   - WAN Traffic Engineering
   - Service Chaining
   - Other Applications
   - APIs
   - SDN Controller
   - Network Abstraction
   - Topology Database, Policy Mapping
   - Existing IP Network (Switches and Routers)

- Device Control Protocol
- Data Plane
- Switches and Routers, etc.
Where does the ADC Fit in? 
**Integrating the Services Layer**

- Services layer includes L4-L7 Services such as ADC, Firewall, WOC, DLP, IDS/IPS etc.
- Simplification of services provisioning (service chaining)
- Evolution from course-grain implementation of services to more fine-grain
- Examples and leading indicators
  - Per Application ADCs
  - Security Architectures changing
Recommendations

✓ Map your applications, immediately
  ✓ Especially their availability and performance needs and where they will be hosted

✓ Develop a portfolio of techniques to optimize the performance of different types of cloud services synchronized with your enterprise's cloud adoption
  ✓ Software-based products for IaaS
  ✓ Solutions embedded in cloud services
  ✓ Proximity solutions where full access is not possible

✓ Explore the potential benefits and risks that SDN will bring to your organization.
  ✓ Beware of SDN-washing.

✓ Don't get hung up on architectural purity. Focus on achieving improved manageability and agility
  ✓ Look beyond the tactical to ensure solutions can evolve to meet the organizations longer term needs

✓ SDN has the potential to generate organizational disruption. Begin to integrate server, network and storage teams
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