Delivering Digital Transformation At Scale: Network Trends and Architectures

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Agenda

- Digital Transformation
  - Cloud and IoT Driving Need for Scale
- Datacenter Networks - Impact from the Growth of Cloud
- SD-WAN & Cloud Connectivity
- Cloud-Managed Enterprise
- Final Thoughts
In this Digital Economy...

Organizations adapt to changes in their ecosystem by leveraging digital technologies to create digitally enhanced, customer centric business models.

Create new customer experiences
Improve operational efficiencies
Generate new revenue streams
Rapidly respond to changing conditions

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Digital Transformation is Upon Us...

Cloud and IoT Driving Need for Scale
IoT and 3rd Platform of IT

Cloud
1. Scalable resources from networked endpoints
2. Scalability and flexibility for the deluge of data from endpoints
3. Data Sovereignty
4. GRC
5. Security

Big Data/Analytics
1. Enable real-time decision making
2. Provide the engine for powering new data sources
3. Create value added content

Mobile
1. Connect endpoints from remote locations
2. Activate IoT applications
3. Establish networked IoT platforms

Social Business
1. An outlet for automated responses from the connected endpoints to interested users

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The Internet of Things – 2020

$1.46 T Market Opportunity

USA
13% CAGR
27% of Market
Digital Transformation

WE
17% CAGR
20% of Market
Industry 4.0

ROW
18% CAGR
6% of Market

APEJ
11% CAGR
38% of Market
Manufacturing & Rise of The Middle Class

Japan
14% CAGR
9% of Market
Connected Society

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WW Cloud Services Market Opportunity

2014–2019 Revenue ($B) with Growth (%)

Selected Segment Growth Rate

- IaaS CAGR 27.0%
- PaaS CAGR 30.6%
- SaaS CAGR 15.8%

Total Market CAGR 19.4%

Selected Segment Growth Rate

- On-demand hosted private cloud 36.8%
- Dedicated hosted private cloud 33.9%

Total Market CAGR 35.4%

* Source: IDC Public Cloud Services Tracker & Hosted Private Cloud Services
Public cloud has major and growing impact on datacenter networking in 2016

- Growth of major public-cloud players, led by hyperscale, commands greater attention from the networking supply chain, from vendors of Ethernet merchant silicon to ODM and OEM switch vendors.

- Innovations in the public cloud, from containers to ODM switching and network disaggregation, are gradually making their way to the broader market.
WW Datacenter Networks Market by Cloud Deployment, 2010-2020

Source: IDC’s Worldwide Datacenter Networks Qview, 4Q 2015 Release
WW Datacenter Networks Market by Deployment Type, 2010-2020

Source: IDC’s Worldwide Datacenter Networks Qview, 4Q 2015 Release
Worldwide Datacenter Ethernet Switch Supplier Landscape, 2015

- Cisco
- Arista
- Hewlett Packard Enterprise
- Juniper
- Huawei
- Dell
- Extreme
- Lenovo
- Brocade
- ODM Direct
- Others

N=$8.75 Billion
Source: Worldwide Datacenter Networks Qview, 4Q 2015 Release

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Worldwide Public Cloud Datacenter Ethernet Switch Supplier Landscape, 2015

- Cisco
- ODM Direct
- Arista
- Huawei
- Lenovo
- Brocade
- Others
- Hewlett Packard Enterprise
- Dell
- Juniper

N=$2.35 Billion
Source: Worldwide Datacenter Networks Qview, 4Q 2015 Release
Primary Use Cases for SDN and Network Virtualization

- Drivers are increased server virtualization and adoption of 3rd Platform, especially cloud

- Primary use cases are . . .
  - Business and Operational Agility – automate and accelerate network provisioning, speed service delivery
  - Security – microsegmentation to provide east-west security in virtualized datacenter, security analytics
  - Business continuity/disaster recovery
Q9. As a result of adoption of cloud and SDN, has your organization or does your organization plan to restructure your IT department toward more of a developer operations (DevOps) model?

Source: SDN Survey, IDC, September, 2015
SDN and Organizational Challenges

**Why**
- Aligns the network with requirements of virtualization and the 3rd Platform
- Invests network with ability to support faster provisioning, business agility
- Offers OpEx and CapEx costs savings, and can help speed time to revenue and service delivery.

**What**
- An architectural approach to datacenter networking that establishes clear abstractions for automation, programmability, and orchestration.
- Use cases include business agility, business continuity, datacenter security

**Who**
- Active participation of top IT management
- Cross-functional involvement of relevant IT departments, including developers and DevOps
- Network professionals need to be involved, but must collaborate and learn new skills.

**How**
- Educate key decision makers on how network can go from being cost center to business accelerator
- Use success stories from similar organizations, preferably in the same vertical market
- Start with PoCs involving new applications or compelling use cases

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Analyze the Future
Open-Source Networking: Vendors Must Look for Sustainable Value Creation

- Community counts, it will decide winners and losers
- Traditional SPs leverage open-source networking for cost savings, operational efficiencies, scale their businesses cost-effectively
- Vendors must integrate with open source/open systems where appropriate, focus on areas where they can add value and differentiate – application policy, analytics, enhanced-management software, and security
  - Not just bottom of the networking stack
Network Disaggregation: Value Proposition, Addressable Market

• Savings on CapEx, OpEx, biz and operational agility
  • Run NOS on standardized network hardware provided by multiple vendors
  • Simplified management
  • Reduced vendor lock-in
  • Reduced software/maintenance costs

• Addressable market:
  • Large datacenters and/or datacenters that are critical to business success (faster service delivery, agile delivery of new services, etc.)
  • Datacenters where network changes occur relatively frequently
  • Linux, DevOps shops, even relatively small ones
Network Disaggregation Gets Mindshare

Q23. As part of your network architecture, have you considered a hardware-agnostic, third-party network operating system, such as one from Cumulus, Pluribus, Pica8 or Big Switch?

<table>
<thead>
<tr>
<th></th>
<th>Cloud Provider (N=75)</th>
<th>Enterprise (N=327)</th>
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<tbody>
<tr>
<td>Yes</td>
<td>53.3%</td>
<td>44.0%</td>
</tr>
<tr>
<td>No</td>
<td>37.3%</td>
<td>43.1%</td>
</tr>
<tr>
<td>Not aware of this solution</td>
<td>9.3%</td>
<td>12.8%</td>
</tr>
</tbody>
</table>

Source: SDN Survey, IDC, September, 2015
What’s Next for Disaggregation

- More innovation from OCP
  - More merchant silicon, more switches, and – temporarily, at least -- more NOSes, from big and small players alike.
- Choice is good, unless it becomes paralyzing
  - Shakeout will ensue inevitably
- Increased composability/modularity of NOS offerings
  - Pay only for what you need, no extraneous features
- Much depends on how consumable major IT players (Dell, HPE, Lenovo) make it
  - Test of commitment to market, opportunity
Containers Are Another Form of Application Abstraction

- Containers do not duplicate/replicate base system software including the OS
- Application-specific “dependencies” are packaged into the “container”
- Hosting engine required to abstract the container from other containers
- Is this virtualization? Yes … but more in the context of Java than in the context of VMware / Hyper-V / KVM

Containers + Thin OSes

A “container”

Source: IDC
Cloud-native applications give rise to container networking

- Majors vendors and start-ups alike will strive to provide networking solutions, ranging from virtual and physical fabrics to network and security services.

- Datacenter-networking vendors will increasingly offer the ability to run containerized (Docker, etc.) applications on switches.

- Vendors of ADCs will modify and enhance their products and technologies to meet the evolving requirements for containers and micro-services.
Cloud Brings Changes to the WAN
Driving Need for SD-WAN

Q. You mentioned that you currently use cloud IaaS and/or SaaS. What changes have you made or do you expect to make to your WAN as a result of your organization's cloud computing usage?

- Increase access bandwidth (bandwidth from individual sites into the network)
- Increase core network bandwidth (bandwidth across the WAN or VPN backbone)
- Extend your network to the cloud provider(s) so the cloud service appears within your private network
- Use a quality of service (QoS) mechanism on your network
- Change your main WAN/VPN network service provider
- Deploy WAN optimization or acceleration technology
- No changes as a result of using cloud services

N=644
Base=Respondents currently using IaaS/SaaS cloud computing services/technologies

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Defining SD-WAN

- **Hybrid WAN**
  A hybrid WAN includes at least two WAN connections from each branch office, leveraging two or more different access technologies (MPLS, broadband Internet, 4G/LTE, etc.).

- **SD-WAN**
  SD-WAN leverages hybrid WANs, but includes a centralized, application-based policy controller; analytics for application and network visibility; a software overlay that abstracts and secures underlying networks; and an optional SD-WAN forwarder (routing capability) that together provides intelligent path selection across WAN links, based on application policies defined on controller.
Demand Drivers for SD-WAN

- Enterprise WANs are costly and complex to manage
  - 15% of IT budgets

- 40-60% of enterprise data traffic is migrating from WANs to the internet

- Cloud drives requirement for increased WAN agility and flexibility
  - Use of different networks (Internet broadband, 4G/LTE, MPLS)
  - Automated provisioning
  - Specification and prioritization of network connection on per-application basis
  - Improved visibility
Evolving Enterprise Hybrid Networks

Connecting to Cloud-hosted applications driving SD-WAN
Cloud Connect Choices

Cloud via Public Internet
- Wireless
- Public Internet
- Security vs. Cost
  - Data exposed to Public Internet
  - Limited ability to control performance
  - No end to end visibility

Cloud via Direct Connection
- Wireless
- Public Internet
- Management & Cost Complexity
  - High fixed cost
  - Limited diversity options
  - Complex to Manage

Enterprise Cloud Connect
- MPLS VPN
- Secure & Usage Based
  - On Demand
  - Secure, Reliable
  - End to End Control and Visibility
**Types of Cloud Connectivity**

Q. What specific type(s) of connectivity are you using/do you plan to use to enable end user connectivity to the cloud?

- Enterprises are using 2 or more technologies for network access
- MPLS and IP VPN are preferred by larger enterprises
- Ethernet connectivity is likely to increase
- Datacenter and Metro cloud service footprint impact

<table>
<thead>
<tr>
<th>Connectivity Type</th>
<th>US respondents (n=201)</th>
<th>UK respondents (n=100)</th>
<th>Total (n=301)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP VPN</td>
<td>26.0</td>
<td>35.5</td>
<td>40.3</td>
</tr>
<tr>
<td>Ethernet Private Line (EPL)</td>
<td>30.0</td>
<td>33.9</td>
<td>35.8</td>
</tr>
<tr>
<td>Fiber</td>
<td>26.0</td>
<td>33.2</td>
<td>36.8</td>
</tr>
<tr>
<td>Ethernet Virtual Private Line Service (VPLS)</td>
<td>26.0</td>
<td>32.2</td>
<td>35.3</td>
</tr>
<tr>
<td>Dedicated Point-to-Point Private Line</td>
<td>25.0</td>
<td>29.6</td>
<td>31.8</td>
</tr>
<tr>
<td>MPLS VPN (network-based VPN)</td>
<td>23.4</td>
<td>30.0</td>
<td>25.6</td>
</tr>
</tbody>
</table>

N=301
Base: All respondents
Key SD-WAN Considerations

Q. Which of the following attributes of an SD-WAN service or solution are the most important considerations when choosing an SD-WAN solution for branch office connectivity? Rank order from 1 to 5 with 1 the most important.

Total

- Flexibility to add/change bandwidth capacity in near real-time
- Flexibility to use different networks (e.g., Broadband, MPLS, LTE) for application delivery
- Lower WAN transport costs
- Faster turn up (WAN provisioning)
- Prioritize network connection by application type or workload
- Policy-based intelligent path selection
- Optimizing WAN traffic by latency, jitter, packet loss
- Reduce dependency on the MPLS network
- Reduce WAN-management complexity
- Self-service portal

N=744
Base=Respondents indicated organization plan to migrate existing WAN/network connections to a SD-WAN alternative within or more 2 years
Notes: Source: U.S. Enterprise Communications Survey, IDC, December, 2015

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Nearly 70% Expect to Use SD-WAN in Next 18 Months

Q. Does your organization currently use or plan to use SD-WAN?

- Currently use
- Plan to use in the next 12 months
- Plan to use in 12-18 months
- No plans to use

N = 605
Base=All Respondents
Notes: Managed by IDC's Quantitative Research Group.; Data Not Weighted; Use caution when interpreting small sample sizes.
Source: Software-Defined WAN (SD-WAN) Survey, IDC, April, 2016
CSP SD-WAN Managed Services

1. Robust & Secure Infrastructure
   - Intelligent network services insertion
   - Segment-based networks
   - Hybrid WAN connectivity
   - Fully encrypted secure fabric
   - End-to-end network segmentation
   - Zero-trust edge

2. Application Aware Networking
   - Business Logic and Compliance Policies
     - App Classification
     - WAN path control
     - Network QoS

3. Operational simplicity & ease
   - Automation, Orchestration and Operations
   - Monitoring and Visibility
Evolution of Managed Services

Software Defined WAN

- Transport agnostic
- Manage App not CPE
- Agile Delivery

Network Function Virtualization

- Replace expensive CPE
- On-demand service pricing
- Manage virtual appliances (firewall, WanOp)
Renaissance of [Campus Network]
Virtualization

- Interest growing in virtualized converged branch networking architectures
  - SDN ignites interest and enables network virtualization
- “Enterprise” NFV garners attention
  - Routing, firewalling, and other functions
- Virtualization feeds cloud-managed networking and vice-versa- in a virtuous cycle
Enterprise Campus SDN Emerges

- Some vendors have introduced solutions (e.g. Cisco, Avaya, NEC)
  - Early adopters will be vital in showcasing ROI/viability
- New architectures meet old campus challenges
  - Bandwidth/Performance
  - Application agility
  - Security
- Datacenter SDN and SD-WAN helping IT understand potential benefits of Campus SDN
  - Appliance virtualization
  - End-to-end visibility
  - Automation and programmability
Virtualized Network Appliances Viewed Favorably

Q. Has/Will the adoption of SDN cause your organization to reassess or redeploy any of the following physical appliances as virtual appliances (software)?

- WLAN controllers: 56.7%
- Routers: 36.8%
- Network management appliances: 53.4%
- Network security appliances: 57.3%
- WAN Optimization appliances: 59.3%
- Other: 2.0%

N = 240
Source: IDC Campus Network Innovation Survey, IDC, October, 2015
Cloud-Managed Networking Expands

- Success of cloud-managed WLAN gives green light for delivering other networking services through the cloud

- LAN, WAN, Unified Wired and Wireless
  - Integrated capabilities can include firewall, content management, VPN, WAN Optimization, application visibility

- Similar benefits to cloud-managed WiFi
  - Centralized IT for distributed/branch enterprises
  - Opex-based subscription model

- A new way to deliver unified networking
  - Integrated security recognized as critical
Many Delivery Paths for Cloud-Managed Networking

Q. Who manages and operates your Cloud-managed WLAN infrastructure?

- WLAN Solution/Equipment Vendor: 50.8%
- Major Telecom Services Provider: 29.6%
- Third Party Managed Services Provider: 5.9%
- Systems Integrator/VAR: 3.8%
- Self-operated (IT Dept.): 10.0%
- Don't Know: 0.0%

N = 198
Source: IDC Campus Network Innovation Survey, IDC, October, 2015
Virtual/Cloud-Managed Enterprise CPE

- Move enterprise network functions from on-premise, physical appliances to virtual, cloud-managed
  - Consolidates branch network technologies into one appliance/platform running multiple VNFs
- Provides simplicity, scalability, redundancy, and agility
Emerging SD-WAN Landscape

WAN Infrastructure, WAN Optimization-based SD-WAN Solutions
- Cisco
- Riverbed
- Silver Peak
- Juniper
- Citrix
- ALU/Nuage

Pure-play SD-WAN Solutions
- Viptela
- CloudGenix
- VeloCloud
- Versa Networks
- Cybera
- Talari

Managed CSP SD-WAN Services
- Verizon
- BT
- Telstra
- Orange Business
- CenturyLink
- SingTel
- COLT

Cloud-managed SD-WAN Services
- VeloCloud
- CloudGenix
- Riverbed
- Versa Networks
- Aryaka

Source: IDC, 2016
Worldwide SD-WAN Equipment & Services Revenue Forecast

2015–2020 Revenue ($M) with Growth (%)

Key Assumptions

SD-WAN forecast includes WAN infrastructure hardware, software and managed services. This forecast does not include access or transport revenues associated with internet, MPLS, 4G or broadband services.

Source: IDC, 2016
WW Datacenter SDN Revenue 2020
Segmented – $12.5 Billion

- SDN Applications: 28%
- Physical Networks: 30%
- Virtualization/Control: 19%
- Professional Services: 23%
IoT Market in 2020:
Consumers = High Growth, Enterprises = Most Spending

IoT Spend
$1.46T in 2020

Worldwide Enterprise Network Infrastructure Forecast by Technology
Joining Us For Q&A…

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