



Delivering Digital Transformation At Scale: Network Trends and Architectures

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Rohit Mehra, *Research Vice President, Network Infrastructure*

Brad Casemore, *Research Director, Datacenter Networks*

Nav Chander, *Research Manager, Enterprise Telecom*

Nolan Greene, *Sr Research Analyst, Network Infrastructure*

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

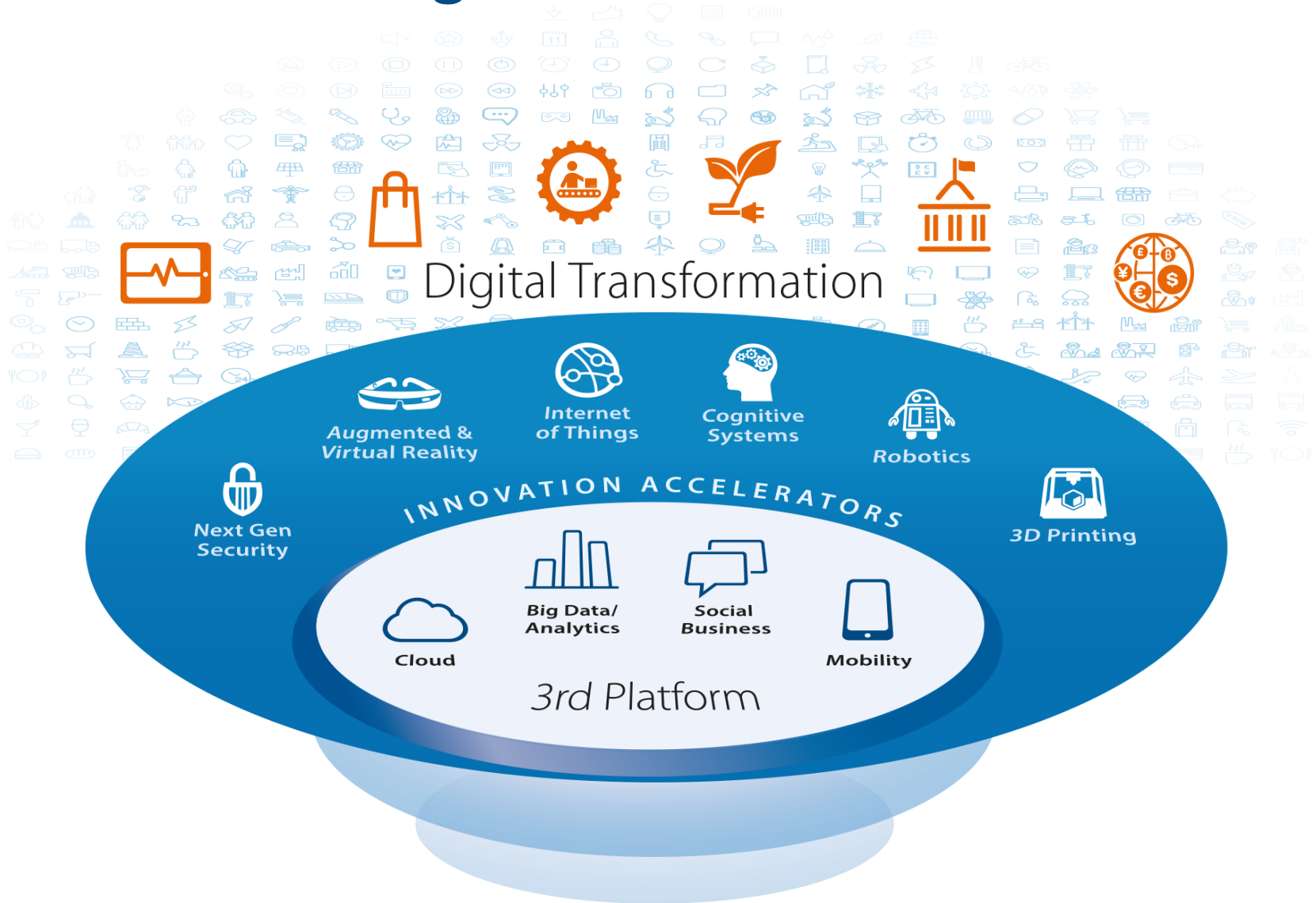


In this Digital Economy...

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



The Move to Digital Transformation



Digital Transformation is Upon Us...



Sirona 3.8
Biogeneric Dental
Impression System



Airbus A350



Sleep Number®
Mattresses

Cloud and IoT Driving Need for Scale

IoT and 3rd Platform of IT

Cloud

1. John Deere TomTom Salesforce IBM

2. GE Disney Schneider Electric

3. Data Sovereignty Google AWS

4. American Express Microsoft

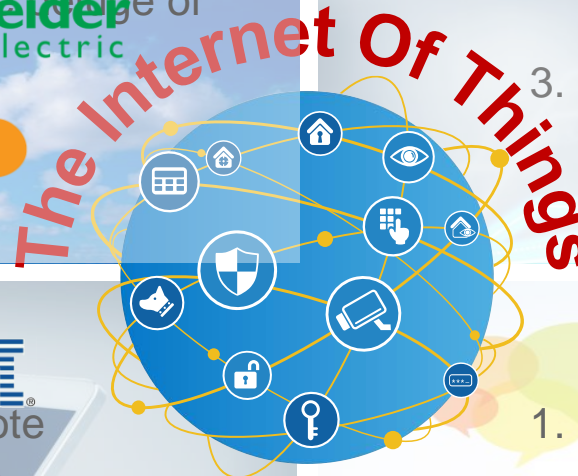
5. Security

Big Data/Analytics

1. Salesforce ORACLE Hewlett Packard Enterprise

2. Provide the engine for powering SAP Microsoft

3. Create Value Added Content IBM sas f



1. Connect endpoints from remote locations Salesforce SAP IBM

2. Activate IoT applications Citrix BlackBerry Apple

3. Establish networked IoT platforms Cisco Microsoft f

1. Automate responses from the connected endpoints Citrix IBM Salesforce

jive SAP TIBCO

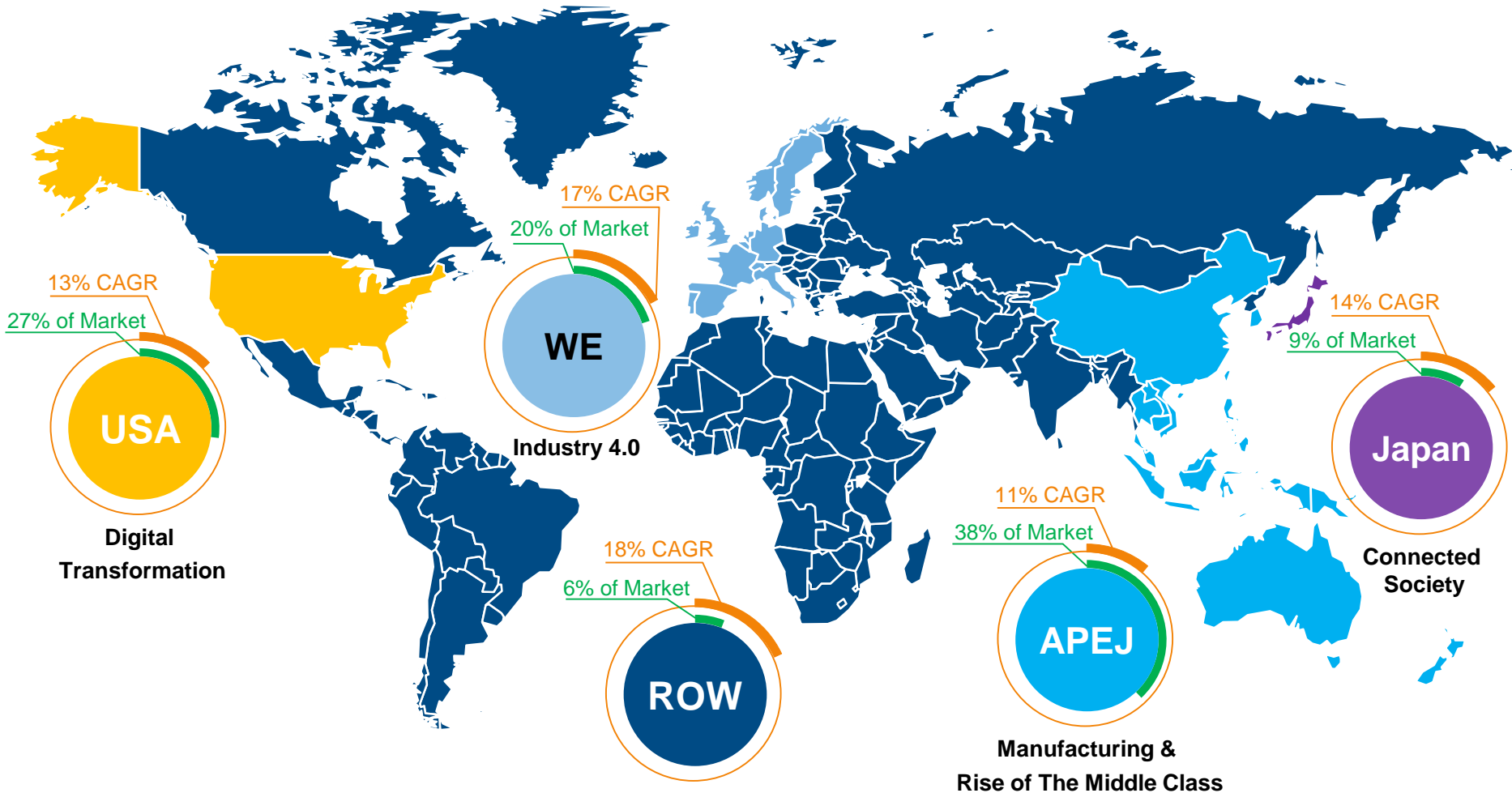
Cisco Microsoft f

Mobile

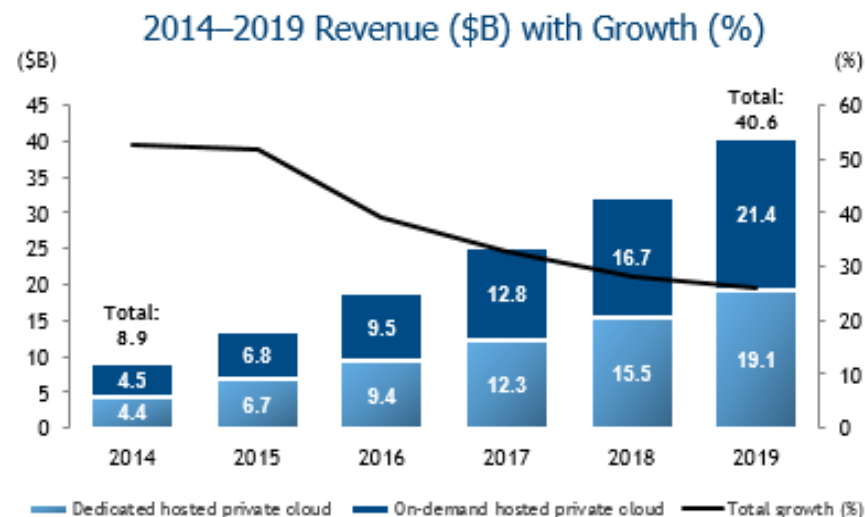
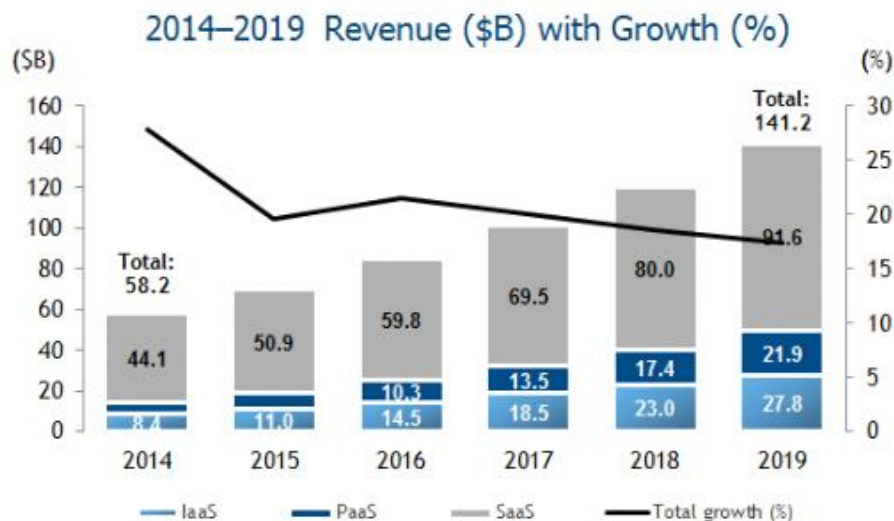
Social Business

The Internet of Things – 2020

\$1.46 T Market Opportunity



WW Cloud Services Market Opportunity



Selected Segment Growth Rate

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

Total
Market
CAGR
19.4%

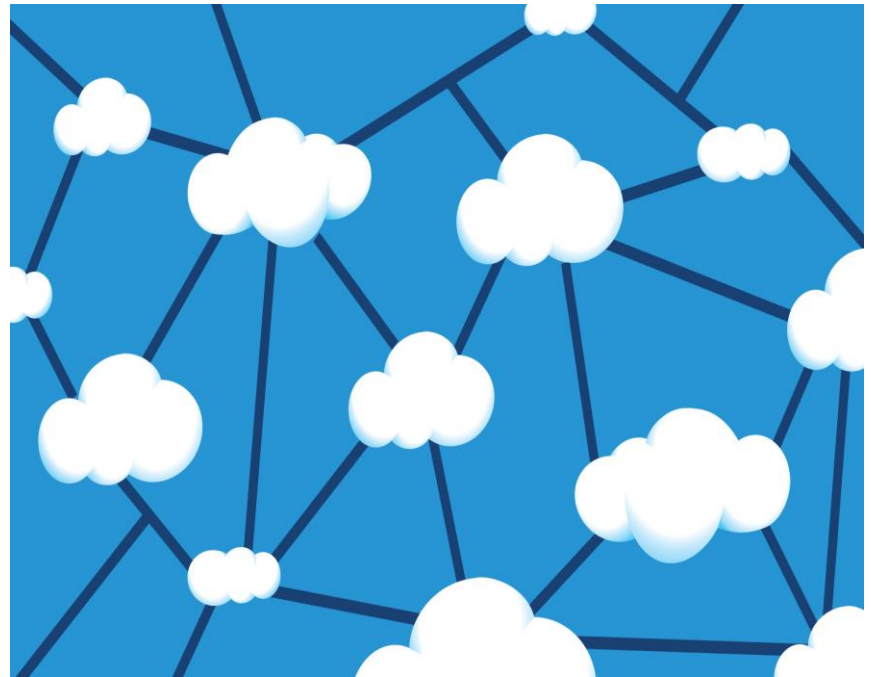
Selected Segment Growth Rate

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

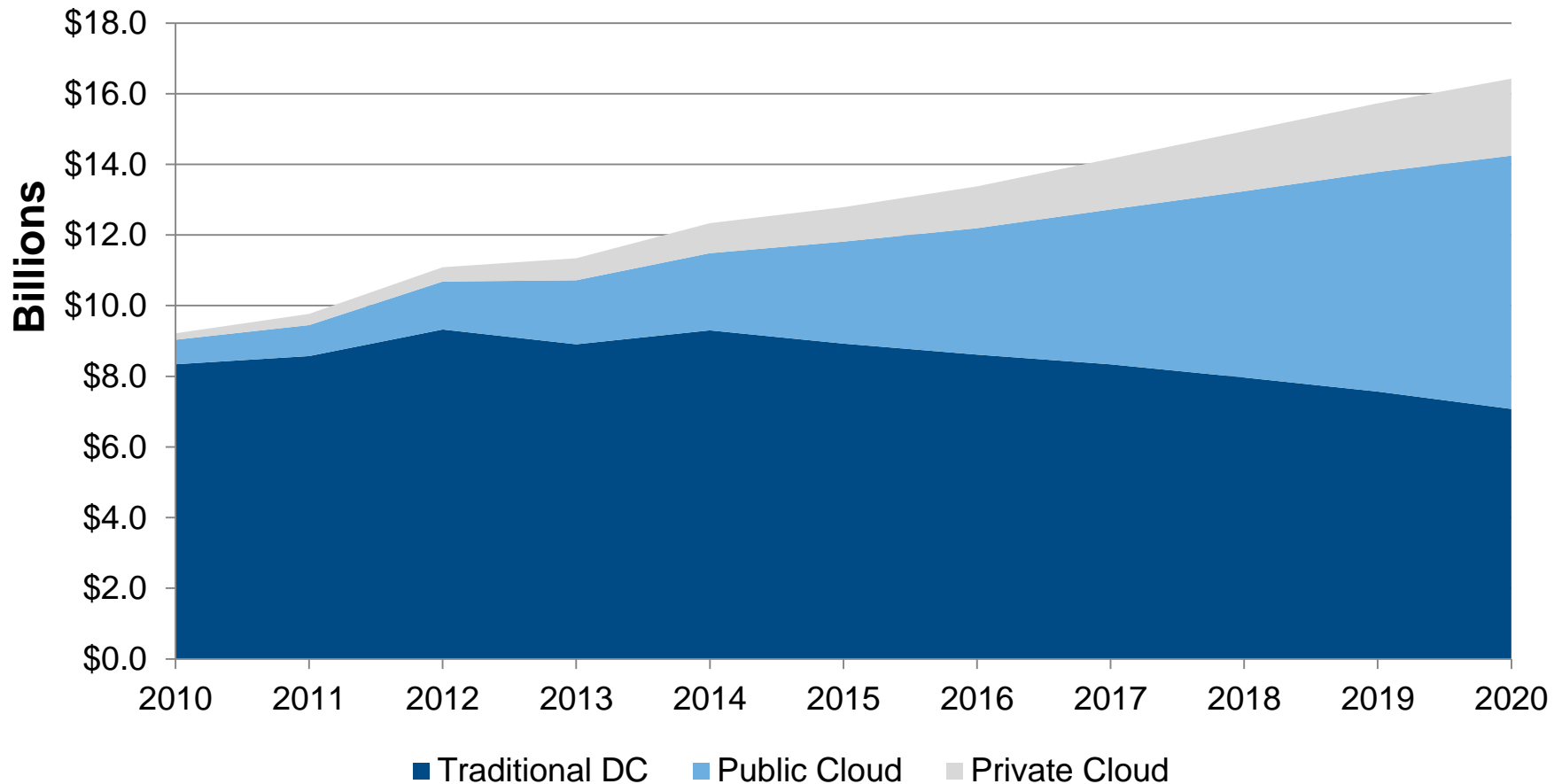
Total
Market
CAGR
35.4%

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.

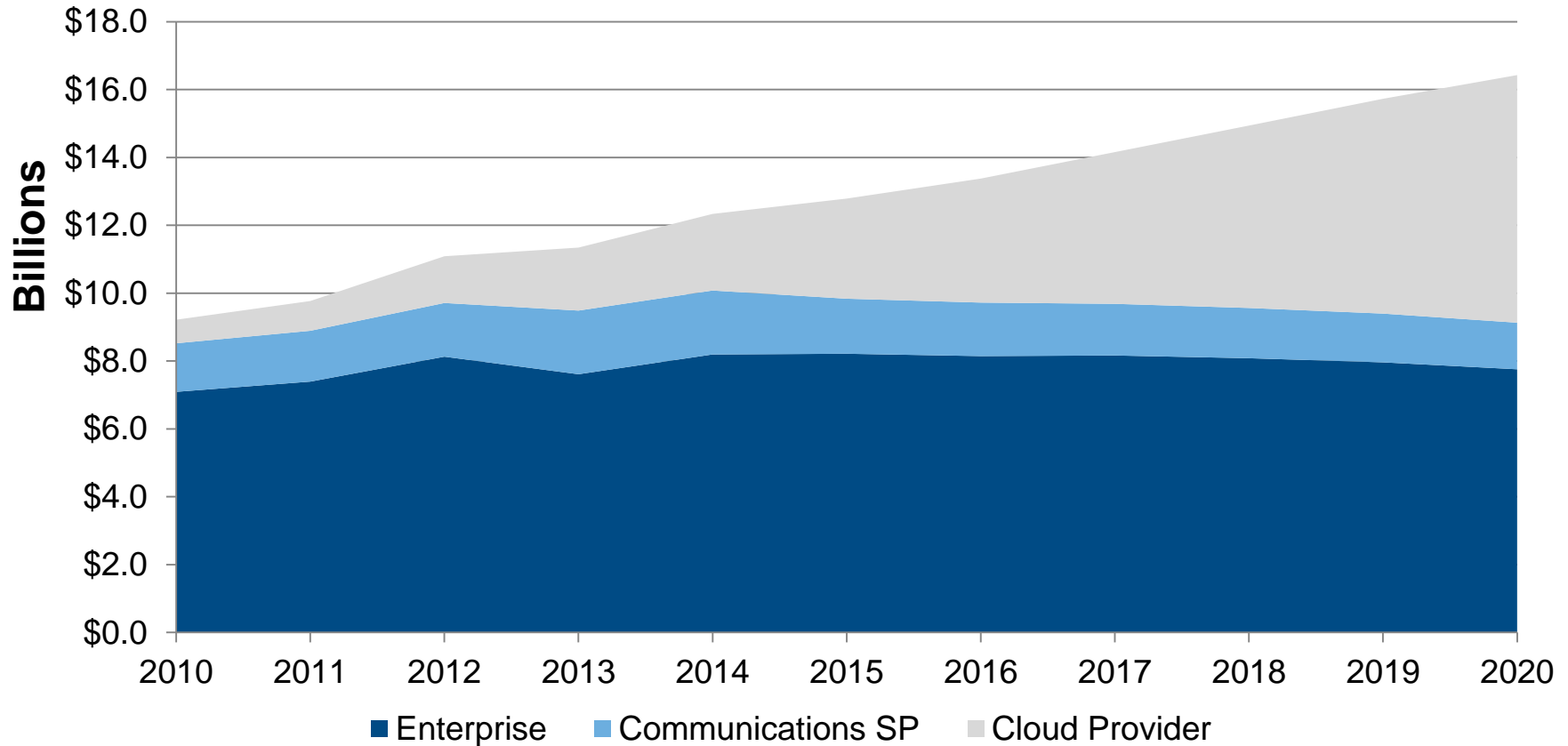


WW Datacenter Networks Market by Cloud Deployment, 2010-2020



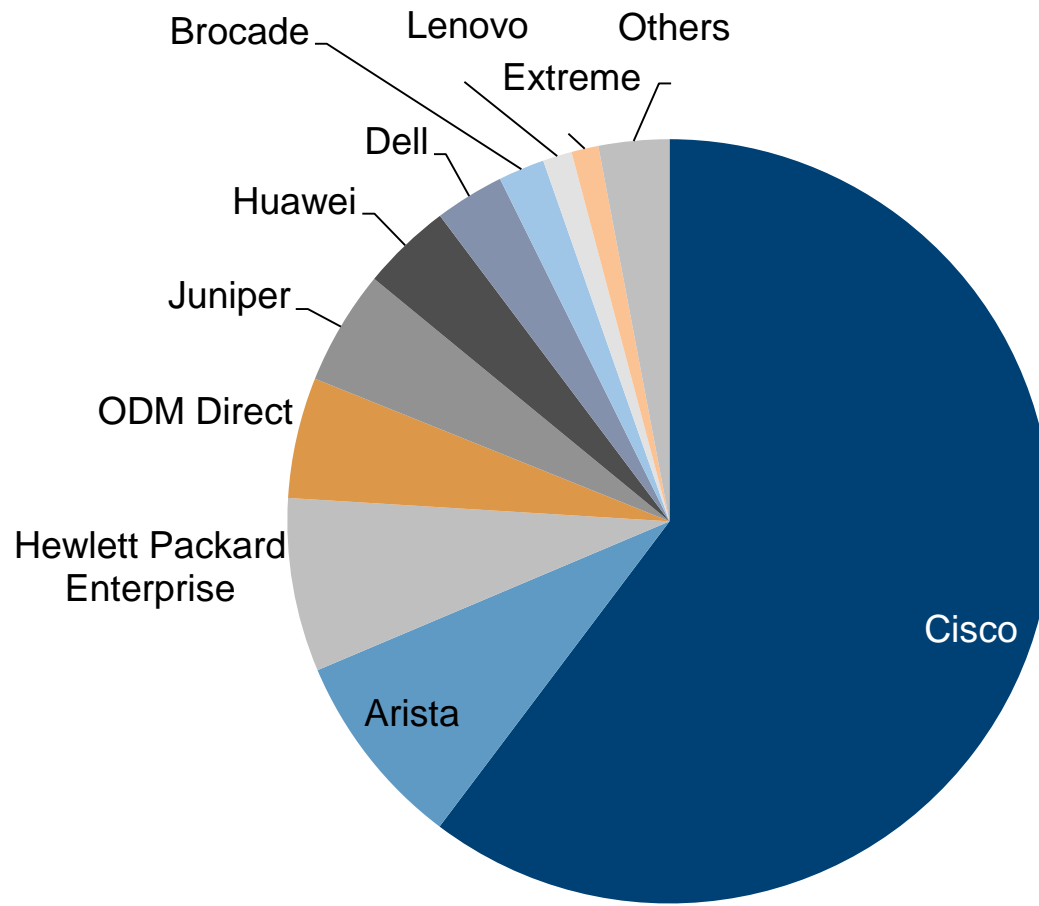
Source: IDC's Worldwide Datacenter Networks Qview, 4Q 2015 Release

WW Datacenter Networks Market by Deployment Type, 2010-2020

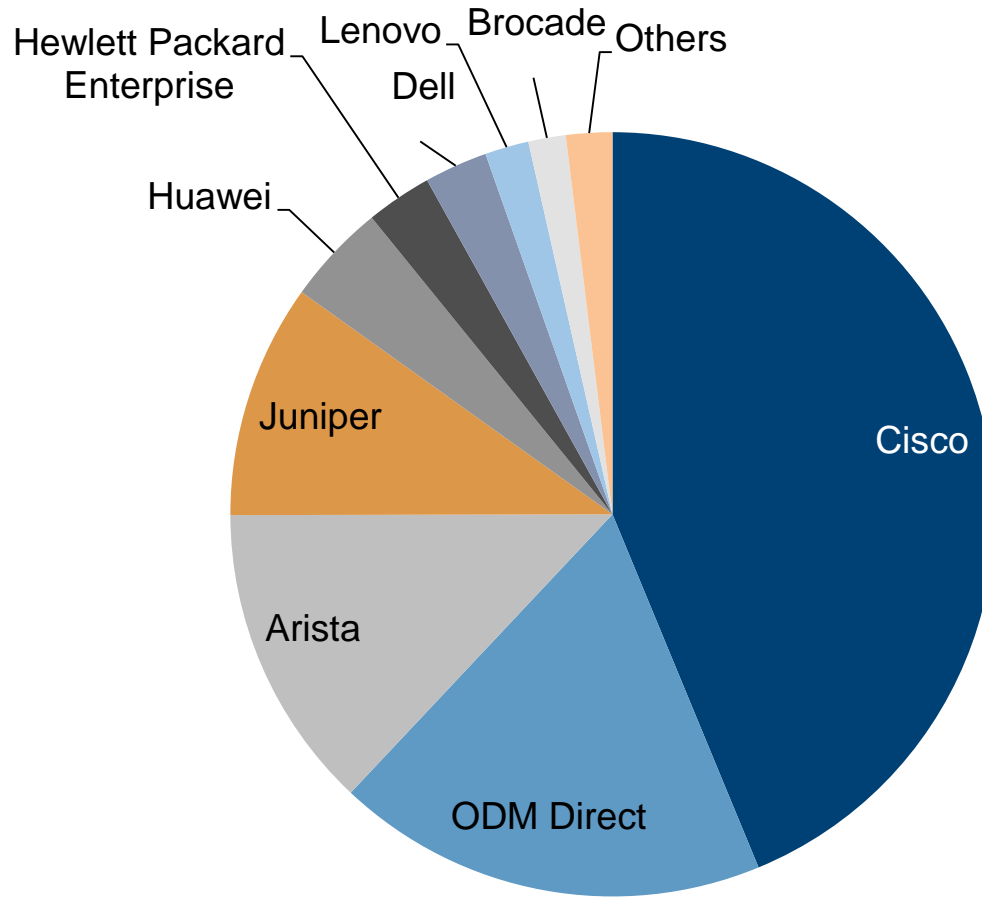


Source: IDC's Worldwide Datacenter Networks Qview, 4Q 2015 Release

Worldwide Datacenter Ethernet Switch Supplier Landscape, 2015



Worldwide Public Cloud Datacenter Ethernet Switch Supplier Landscape, 2015



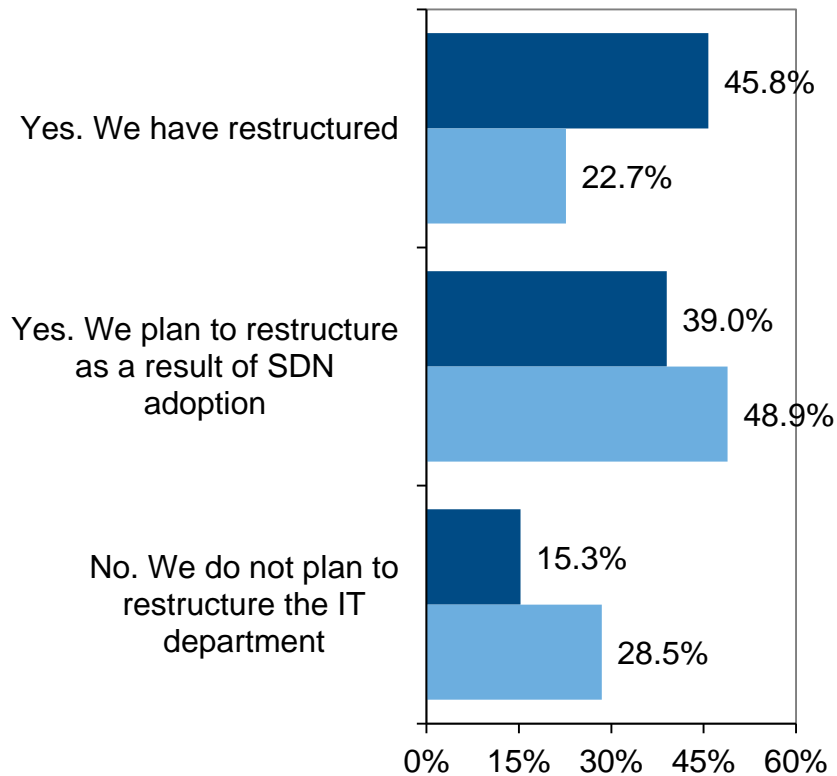
Primary Use Cases for SDN and Network Virtualization

- 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

Cloud and SDN Drive Move to DevOps

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?

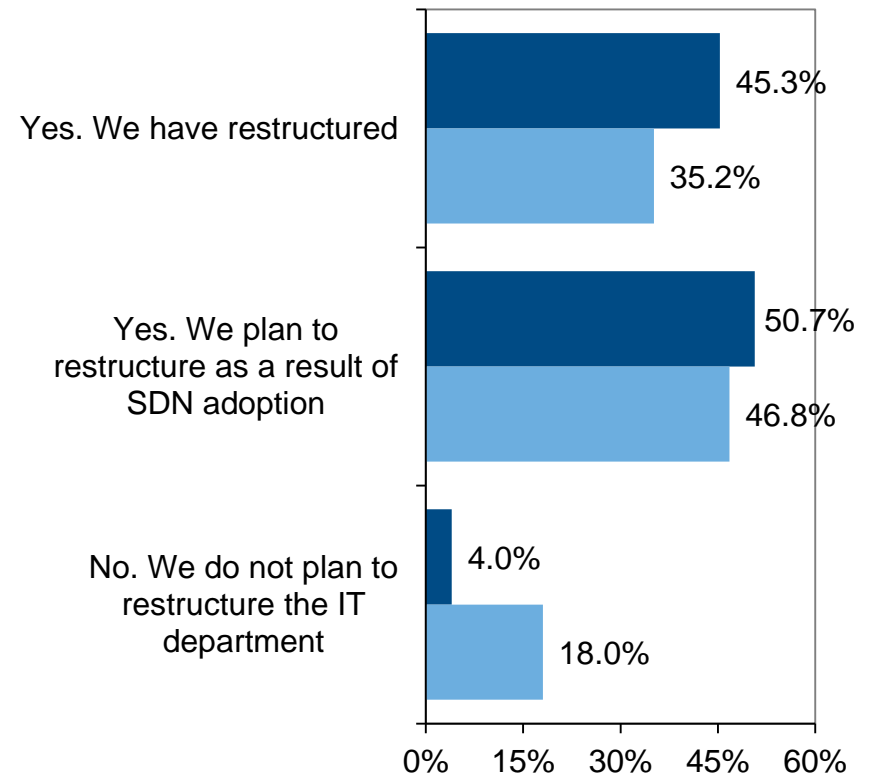
2014



■ Cloud Provider (N=59)

■ Enterprise (N=362)

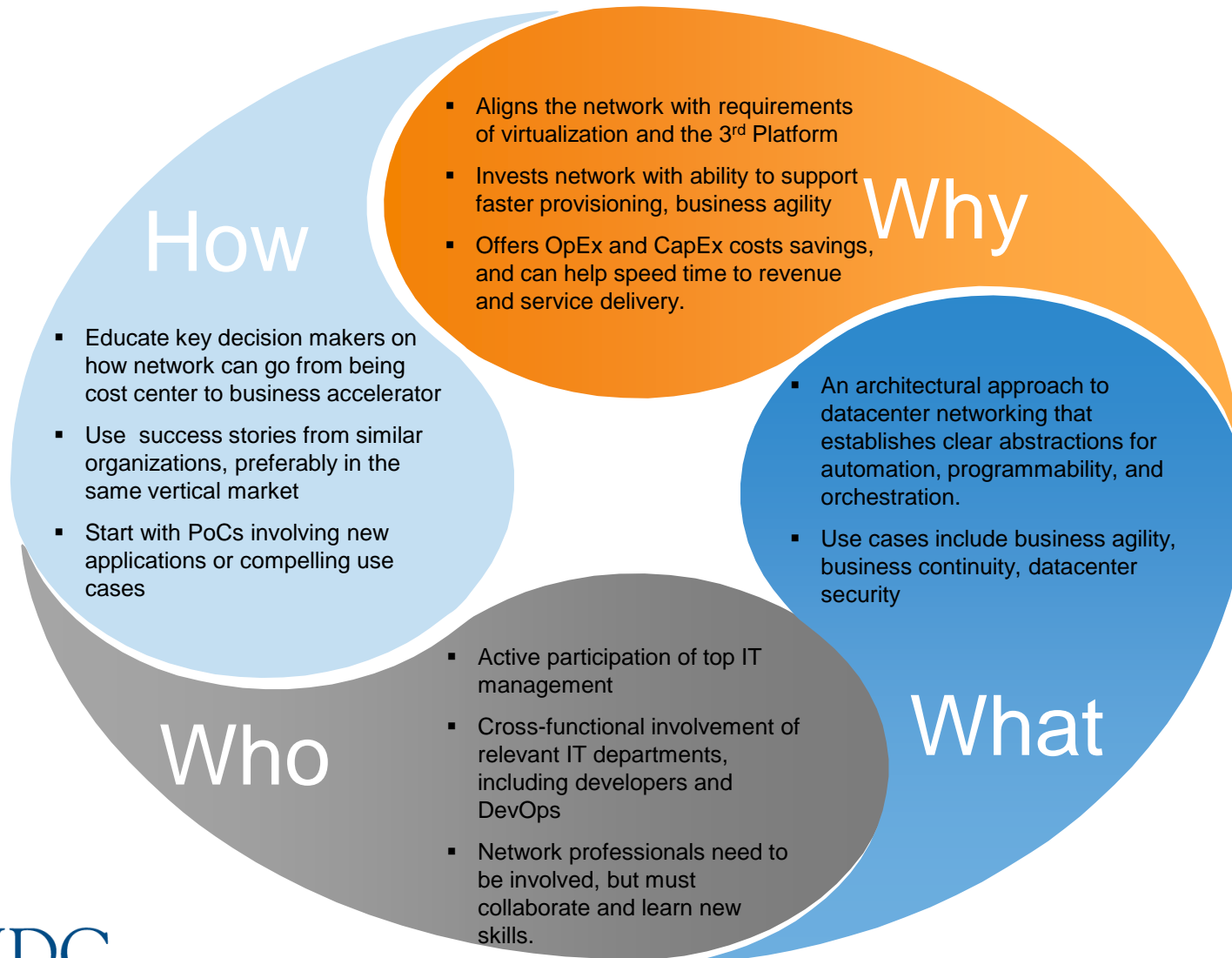
2015



■ Cloud Provider (N=75)

■ Enterprise (N=327)

SDN and Organizational Challenges



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

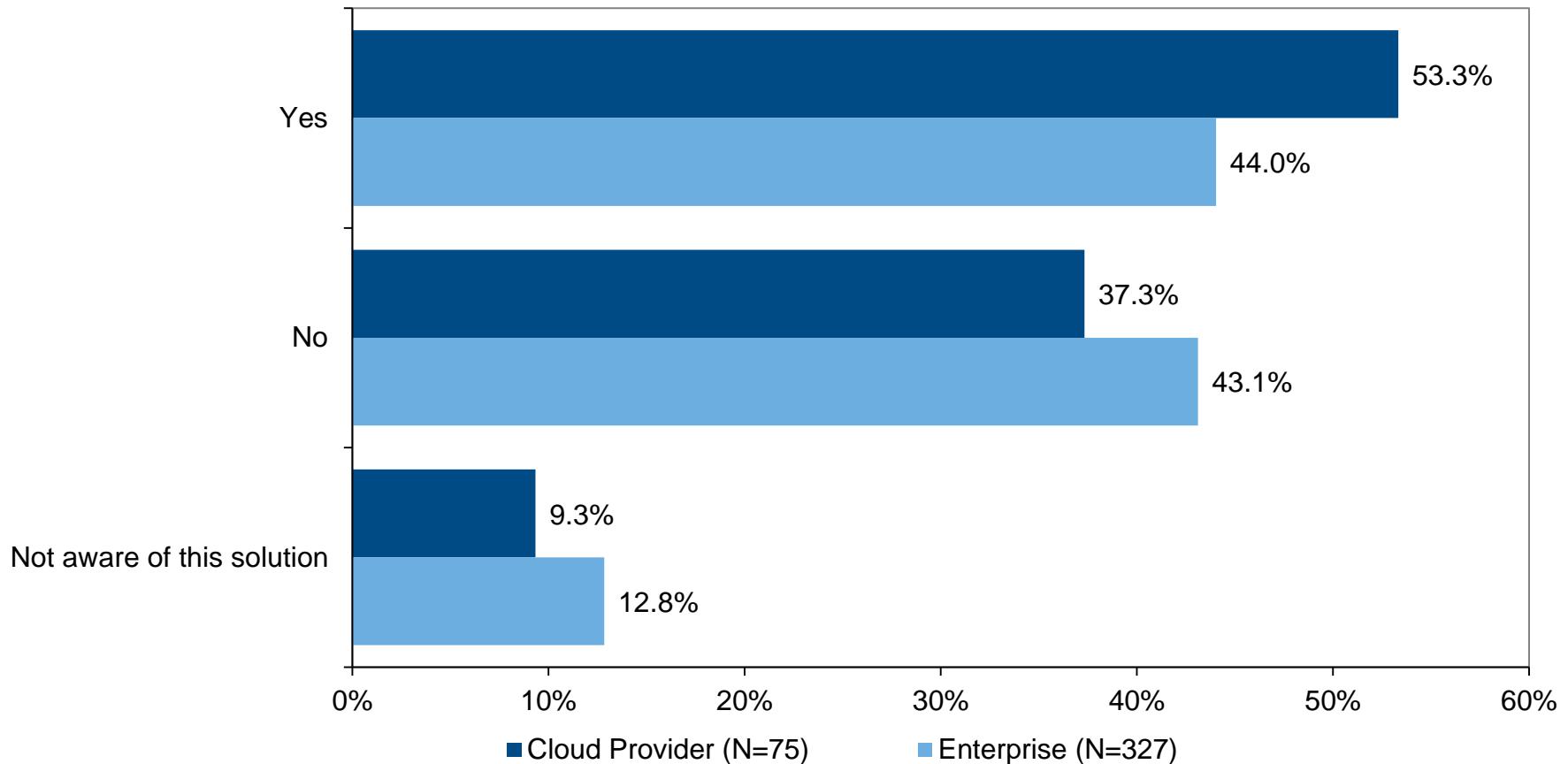


Network Disaggregation: Value Proposition, Addressable Market

- 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

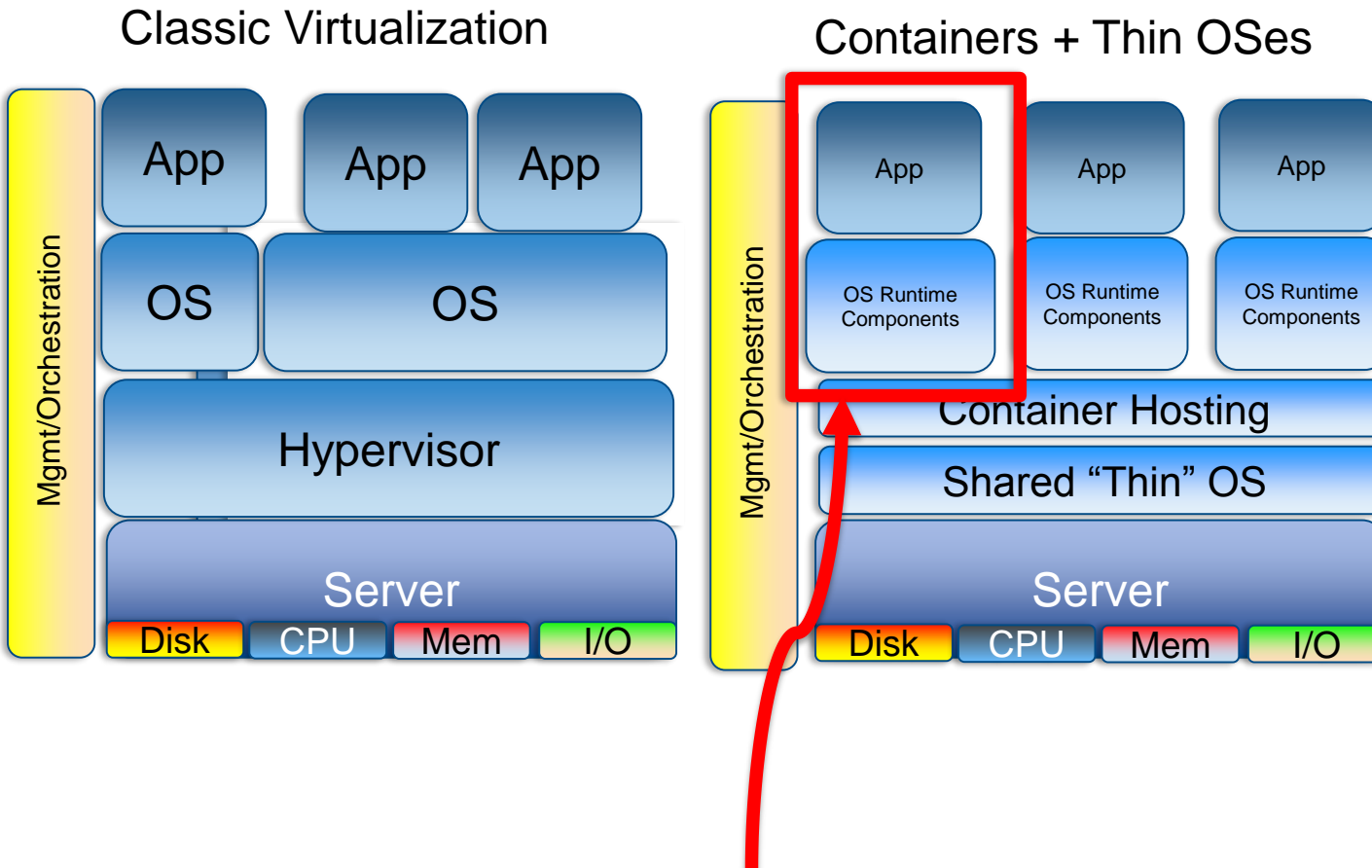
Q23. As part of your network architecture, have you considered a hardware-agnostic, third-party network operating system, such as one from Cumulus, Pluribus, Pica8 or Big Switch?



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



A "container"

- 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

Cloud-native applications give rise to container networking

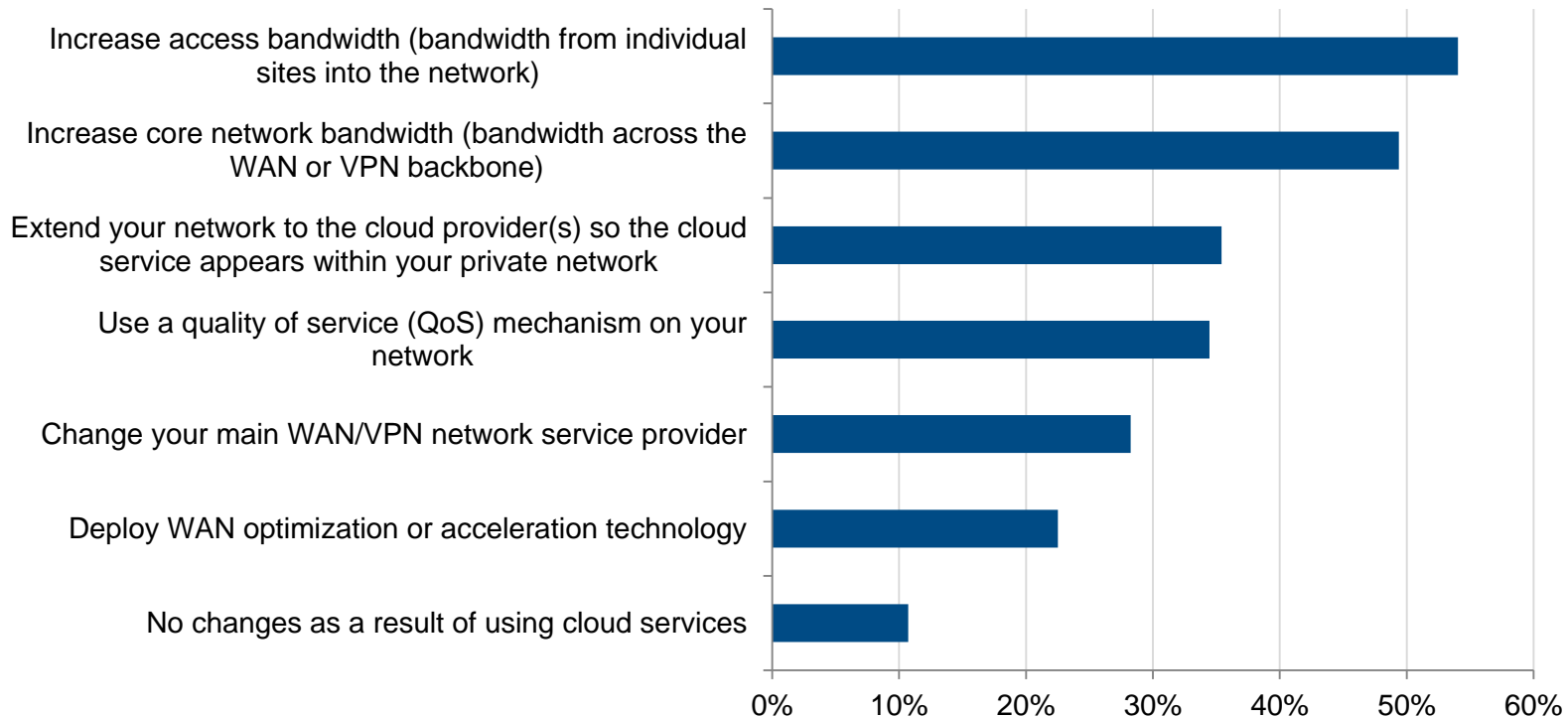
- Majors vendors and start-ups alike will strive to provide networking solutions, ranging from virtual and physical fabrics to network and security services.
- Datacenter-networking vendors will increasingly offer the ability to run containerized (Docker, etc.) applications on switches.
- Vendors of 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?



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Defining SD-WAN

- Hybrid WAN

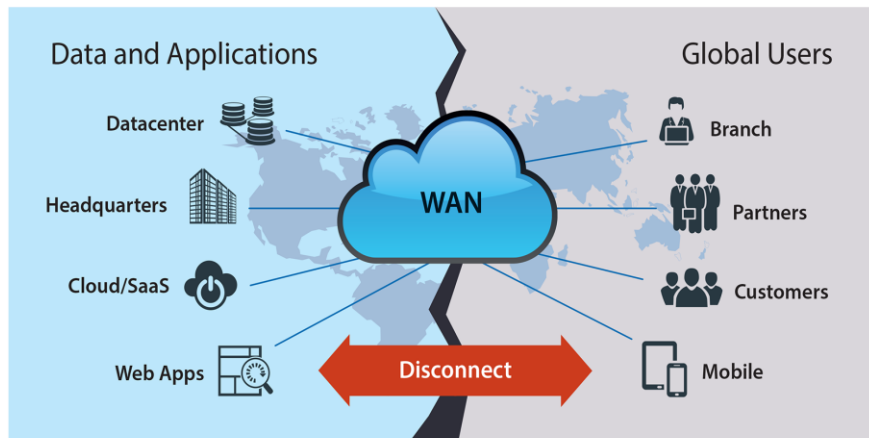
A hybrid WAN includes at least two WAN connections from each branch office, leveraging two or more different access technologies (MPLS, broadband Internet, 4G/LTE, etc.).

- 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

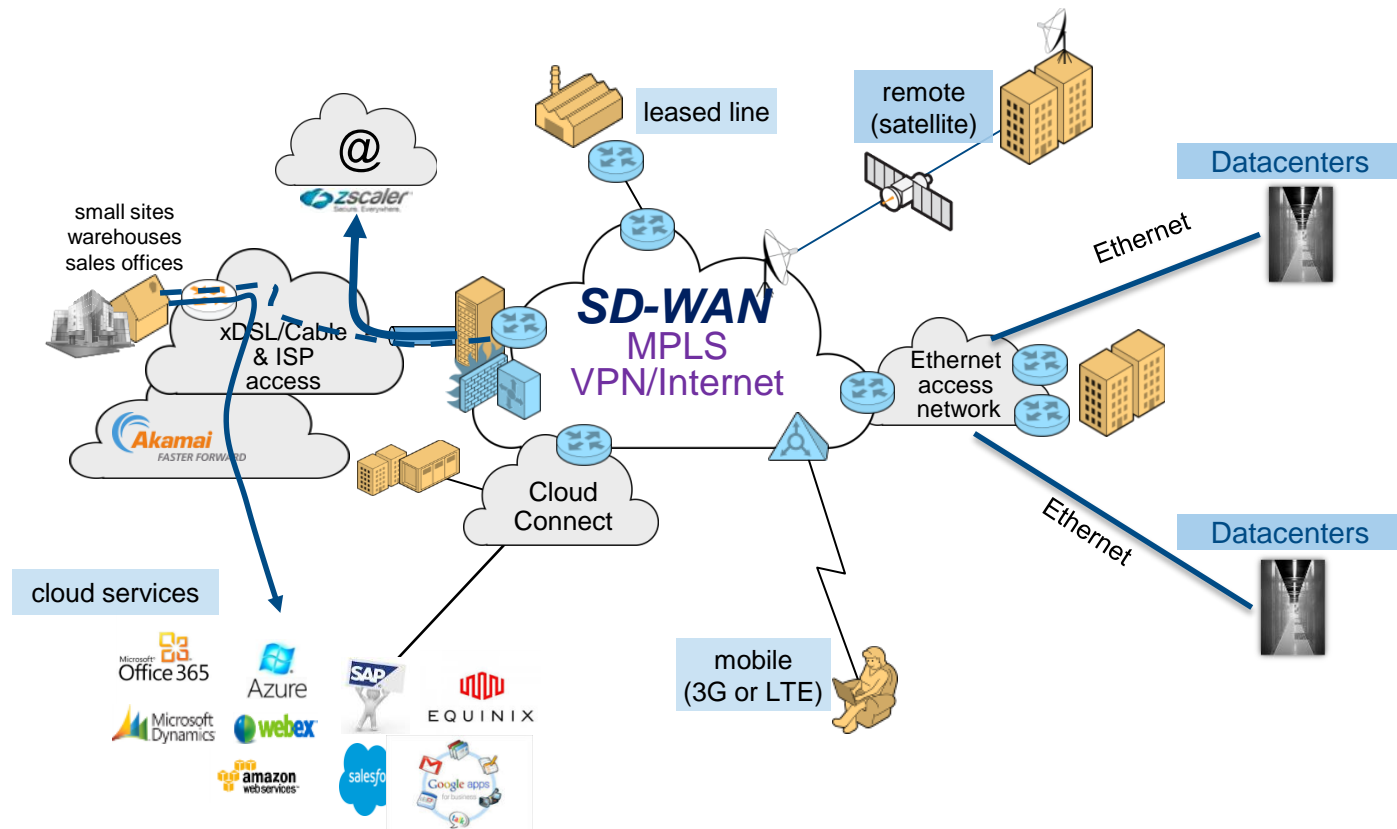
Evolving Requirements for Enterprise Cloud Connectivity



Enterprise WAN Requirements vs Internet-based Cloud Connectivity

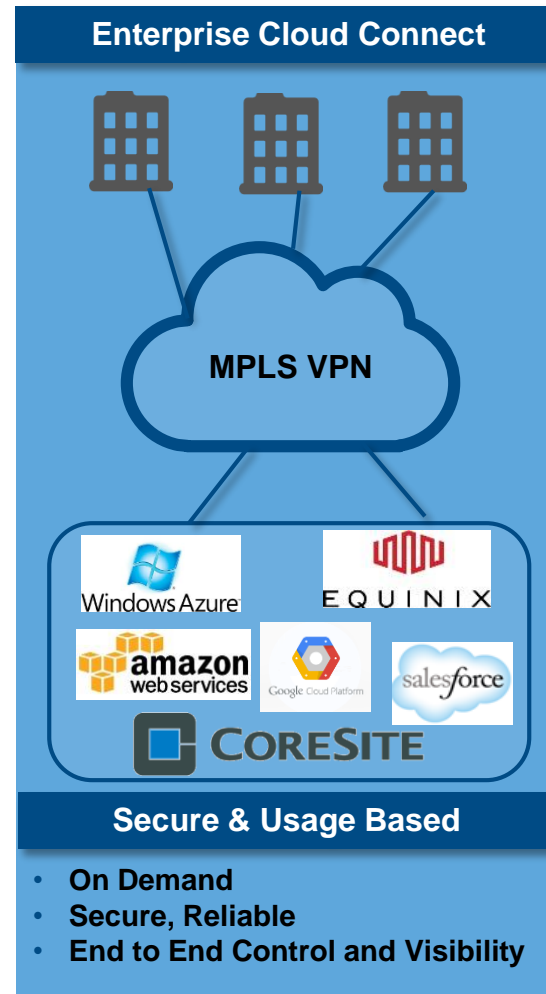
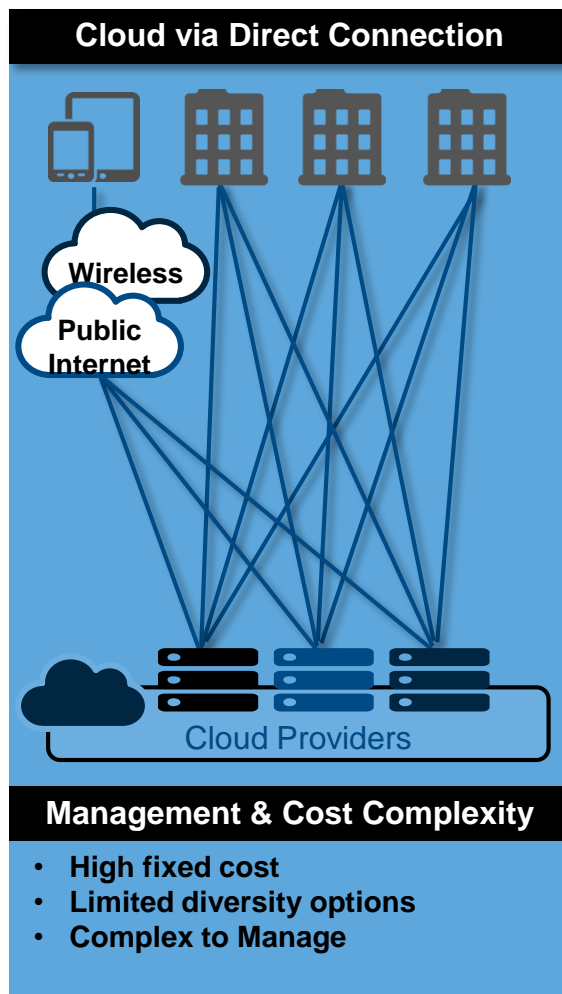
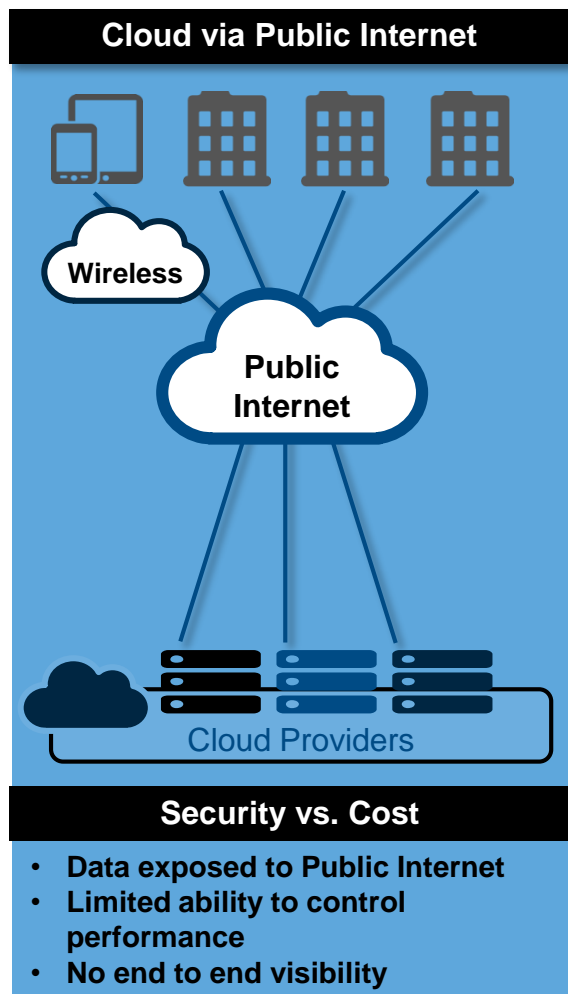
- Enterprise WANs are costly and complex to manage
 - 15% of IT budgets
- 40-60 % of enterprise data traffic is migrating from WANs to the internet
- Cloud drives requirement for increased WAN agility and flexibility
 - Use of different networks (Internet broadband, 4G/LTE, MPLS)
 - Automated provisioning
 - Specification and prioritization of network connection on per-application basis
 - Improved visibility

Evolving Enterprise Hybrid Networks



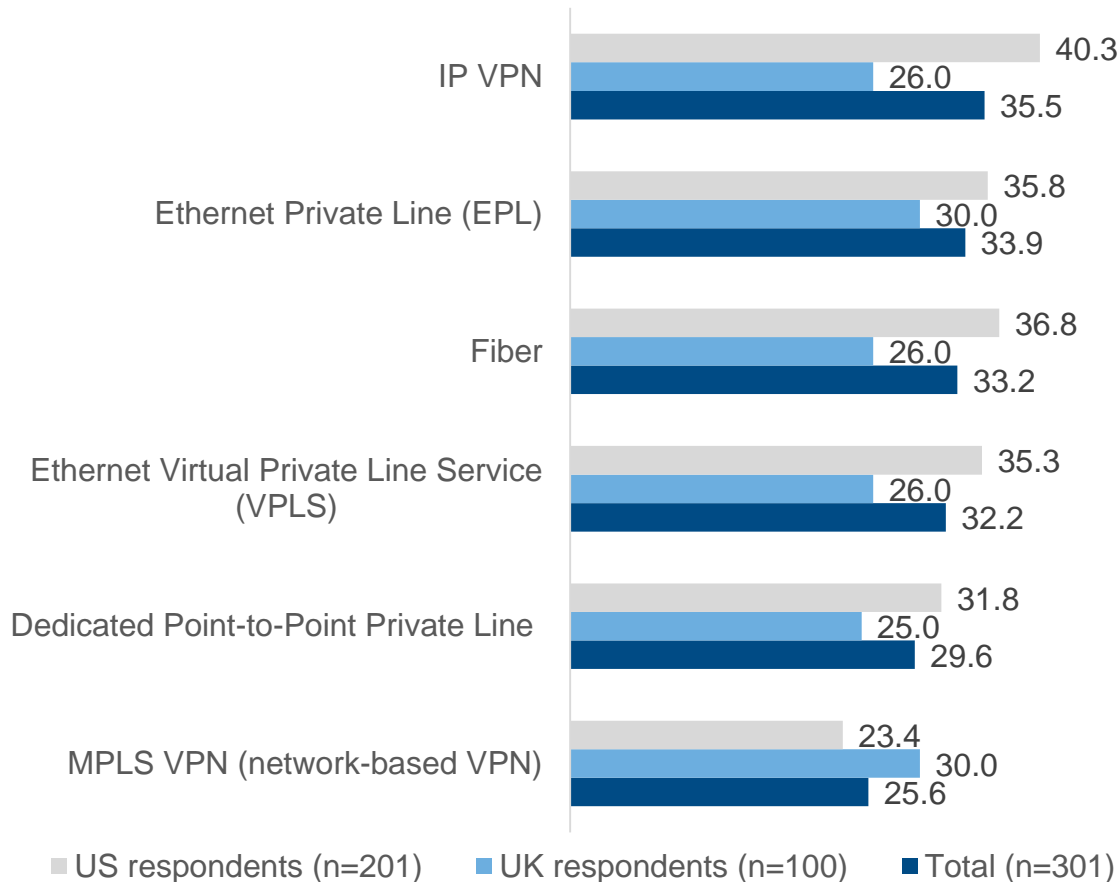
Connecting to Cloud-hosted applications driving SD-WAN

Cloud Connect Choices



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?

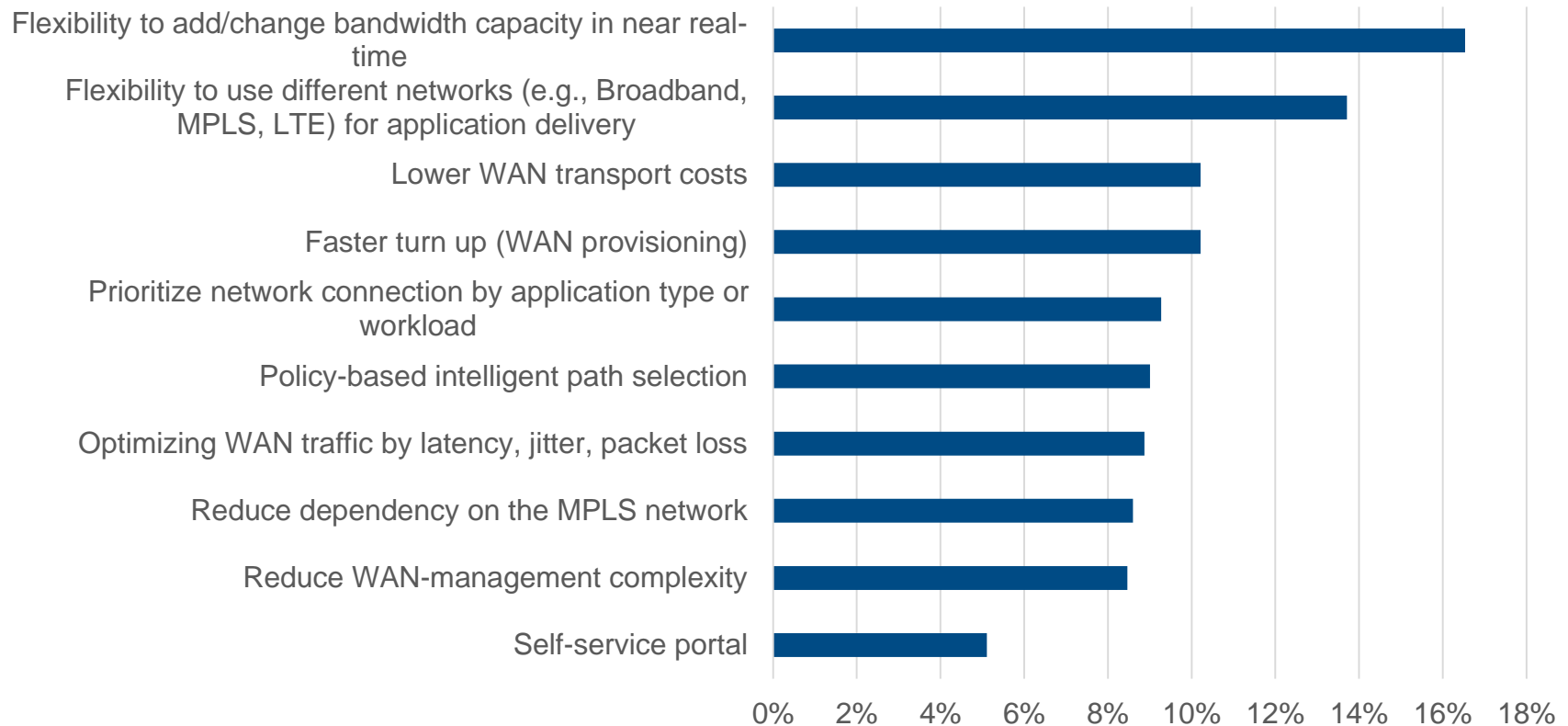


- Enterprises are using 2 or more technologies for network access
- MPLS and IP VPN are preferred by larger enterprises
- Ethernet connectivity is likely to increase
- Datacenter and Metro cloud service footprint impact

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



N=744

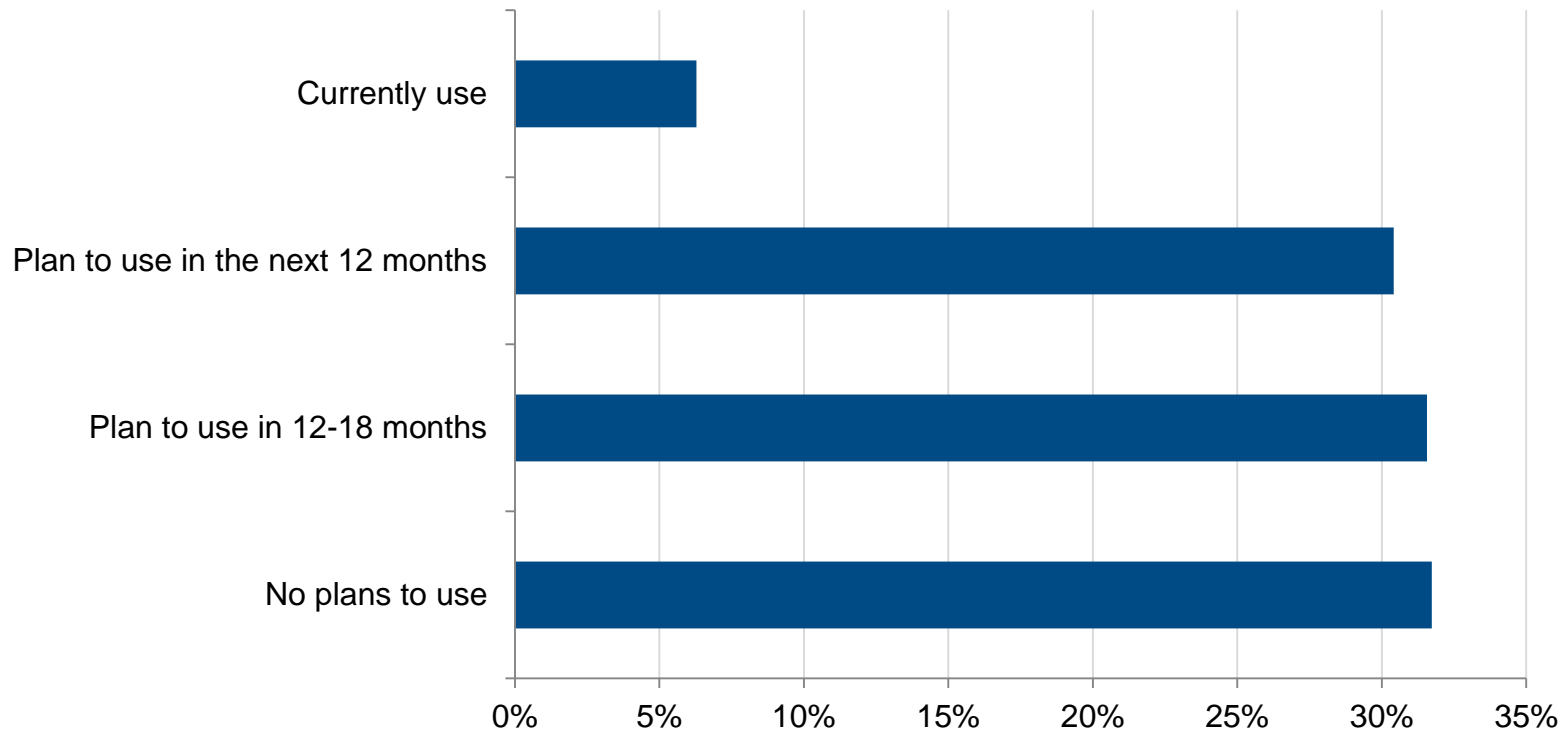
Base=Respondents indicated organization plan to migrate existing WAN/network connections to a SD-WAN alternative within or more 2 years

Notes:

Source: U.S. Enterprise Communications Survey, IDC, December, 2015

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

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



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

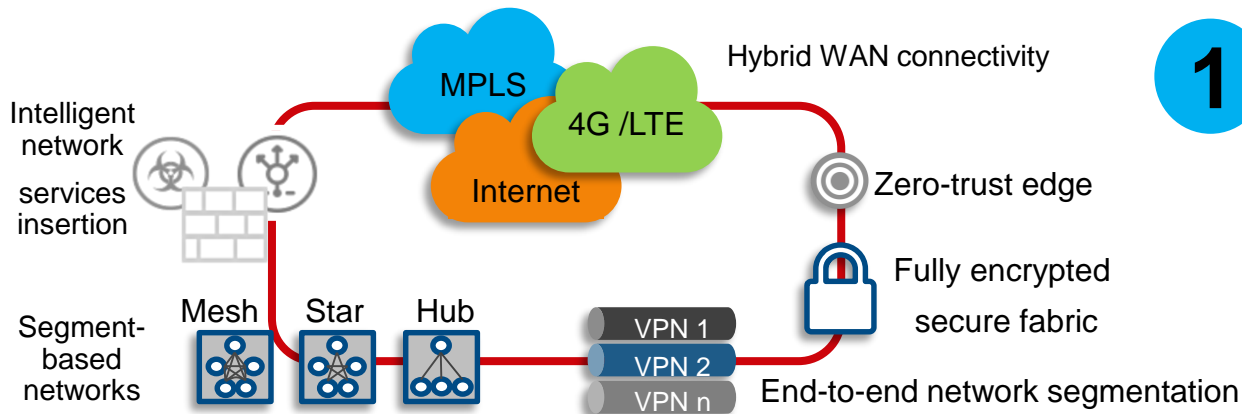
Automation, Orchestration and Operations
Monitoring and Visibility

3 Operational simplicity & ease

Business Logic and Compliance Policies

App Classification | WAN path control | Network QoS

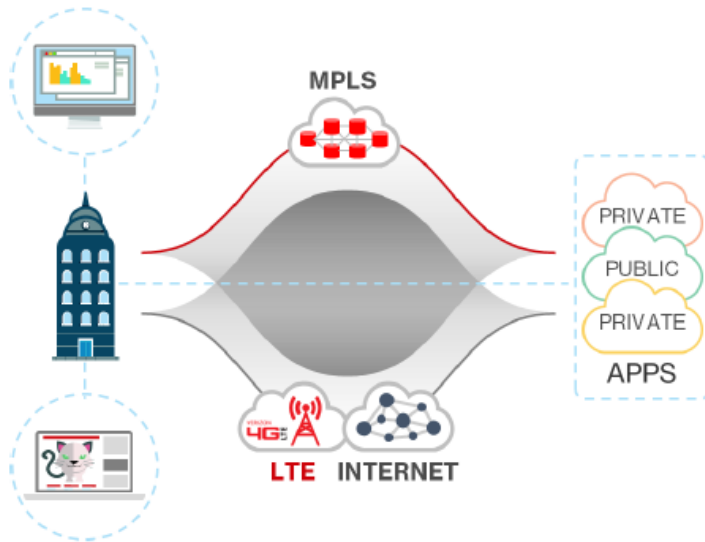
2 Application Aware Networking



1 Robust & Secure Infrastructure

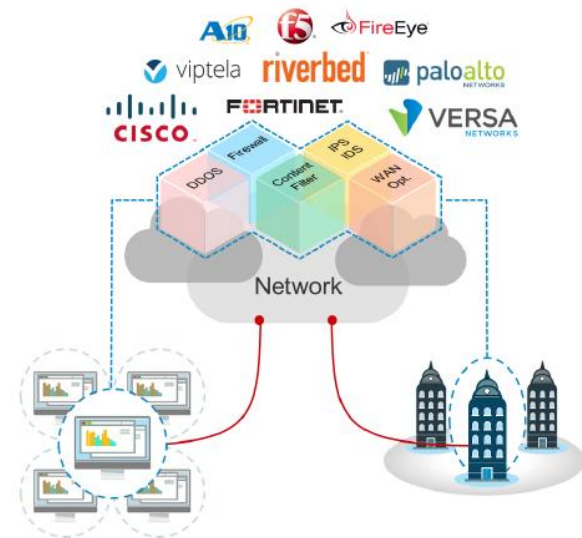
Evolution of Managed Services

Software Defined WAN



- Transport agnostic
- Manage App not CPE
- Agile Delivery

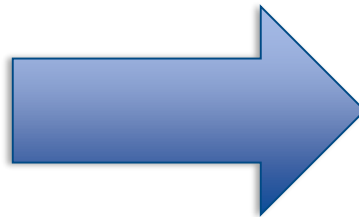
Network Function Virtualization



- Replace expensive CPE
- On-demand service pricing
- Manage virtual appliances (firewall, WanOp)

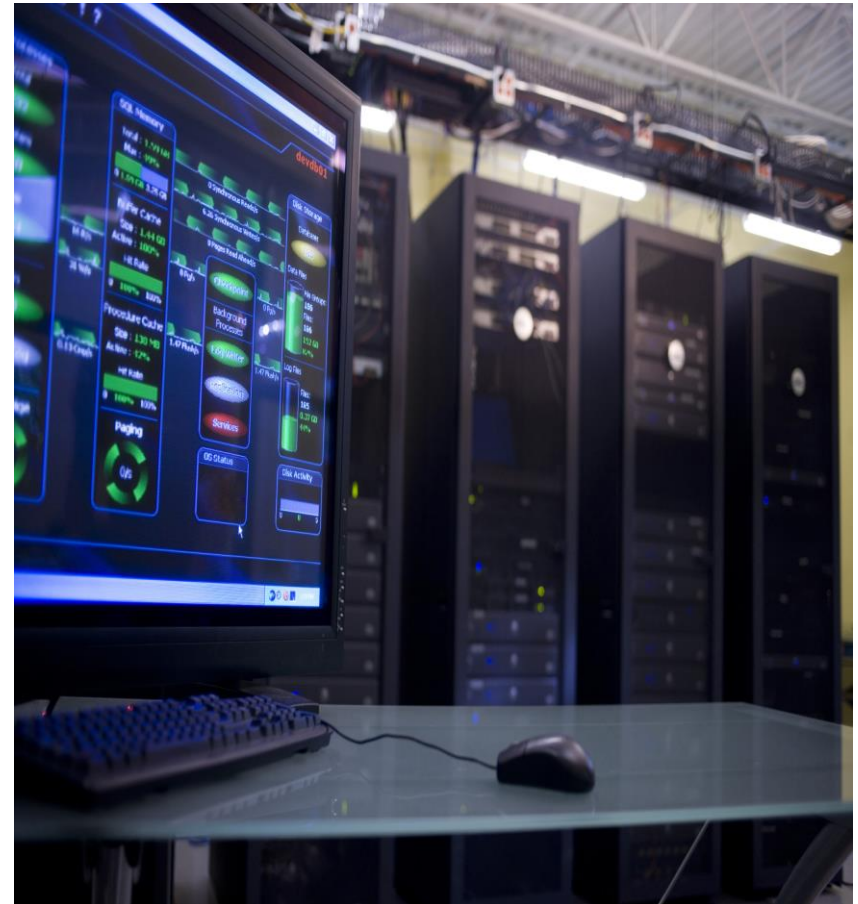
Renaissance of [Campus Network] Virtualization

- 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



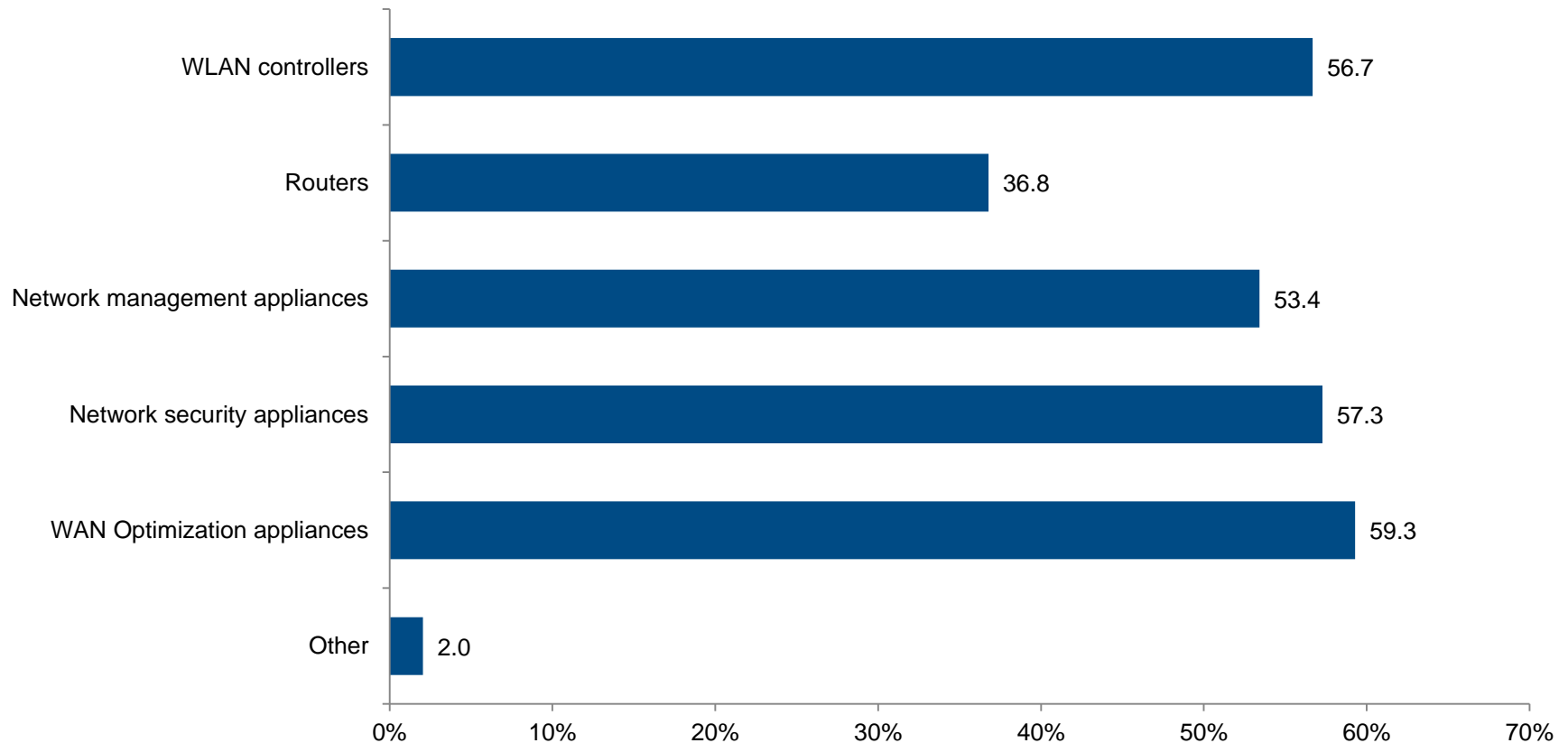
Enterprise Campus SDN Emerges

- 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)?



N = 240

Source: IDC Campus Network Innovation Survey, IDC, October, 2015

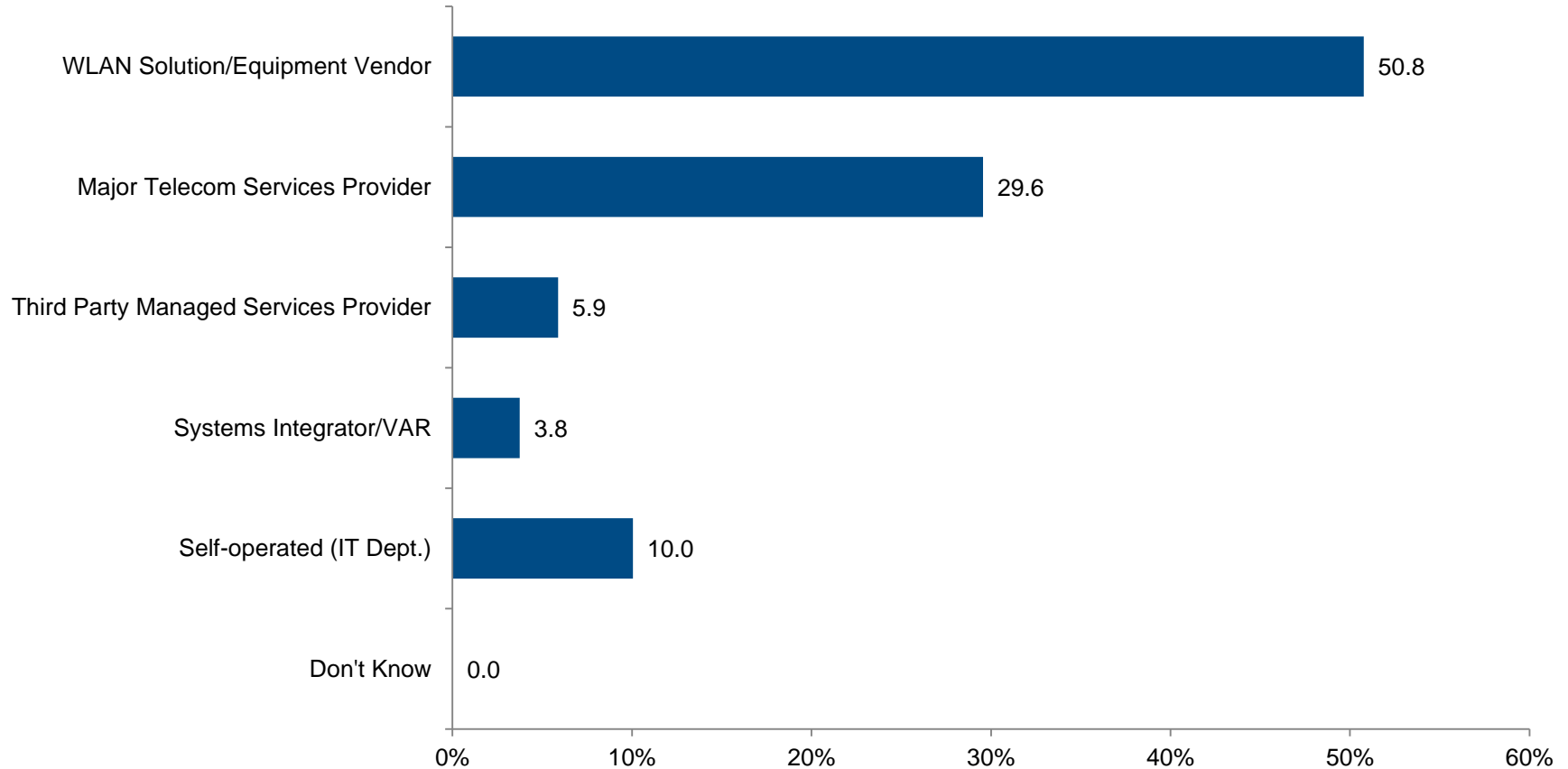
Cloud-Managed Networking Expands

- 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?

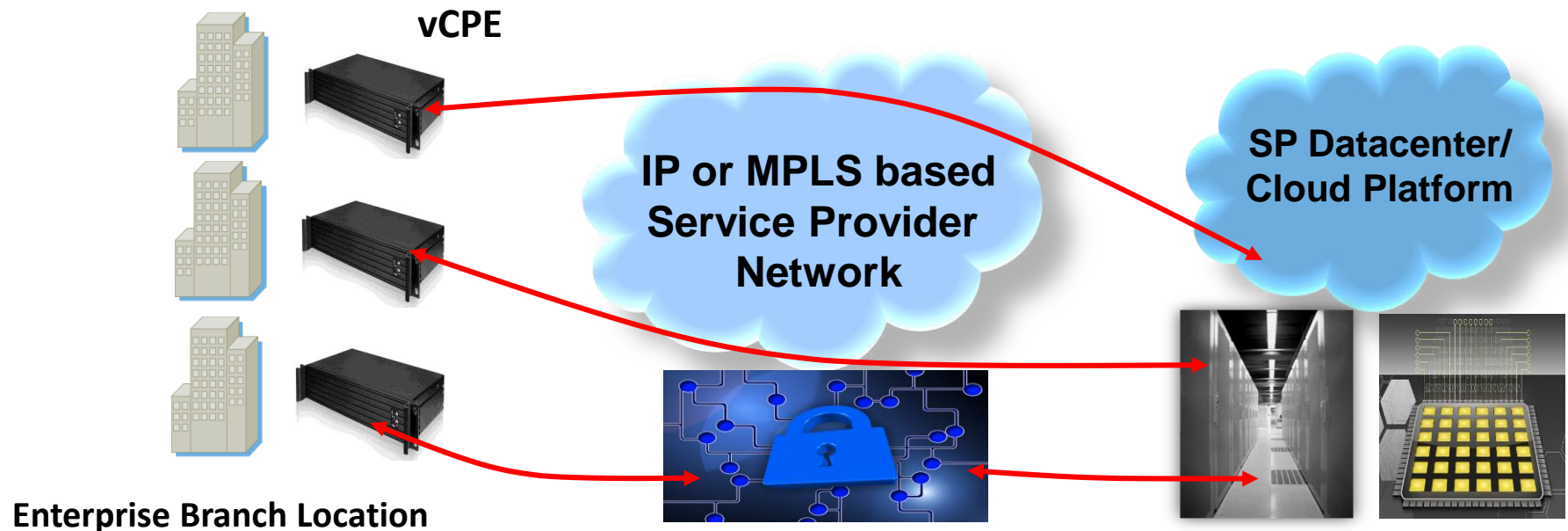


N = 198

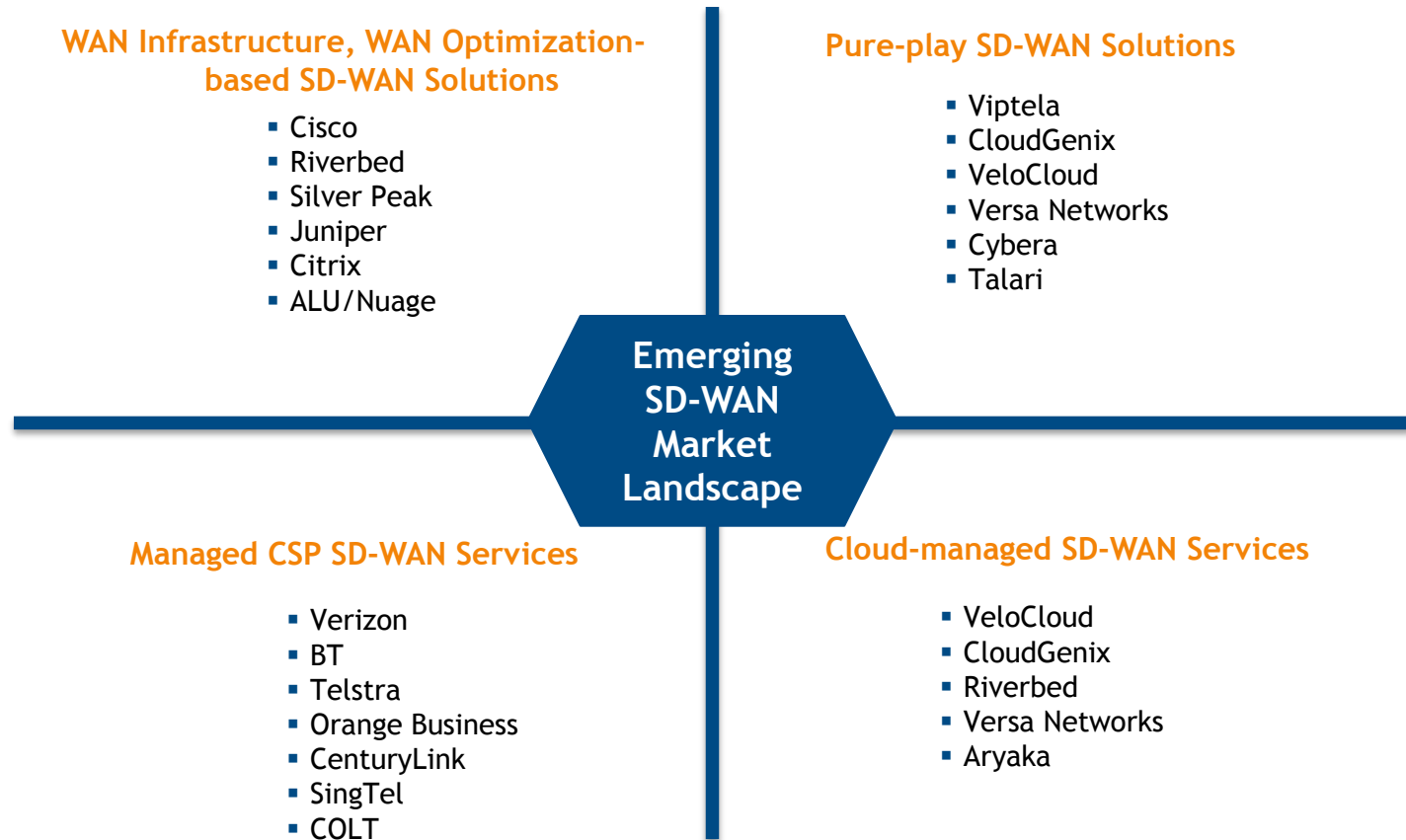
Source: IDC Campus Network Innovation Survey, IDC, October, 2015

Virtual/Cloud-Managed Enterprise CPE

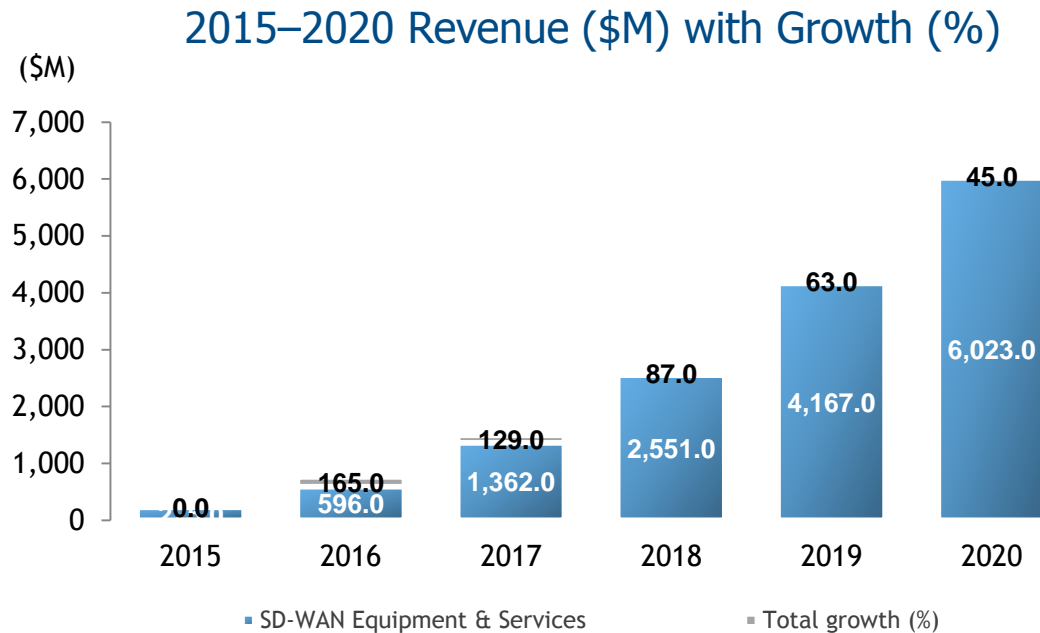
- Move enterprise network functions from on-premise, physical appliances to virtual, cloud-managed
 - Consolidates branch network technologies into one appliance/platform running multiple VNFs
- Provides simplicity, scalability, redundancy, and *agility*



Emerging SD-WAN Landscape



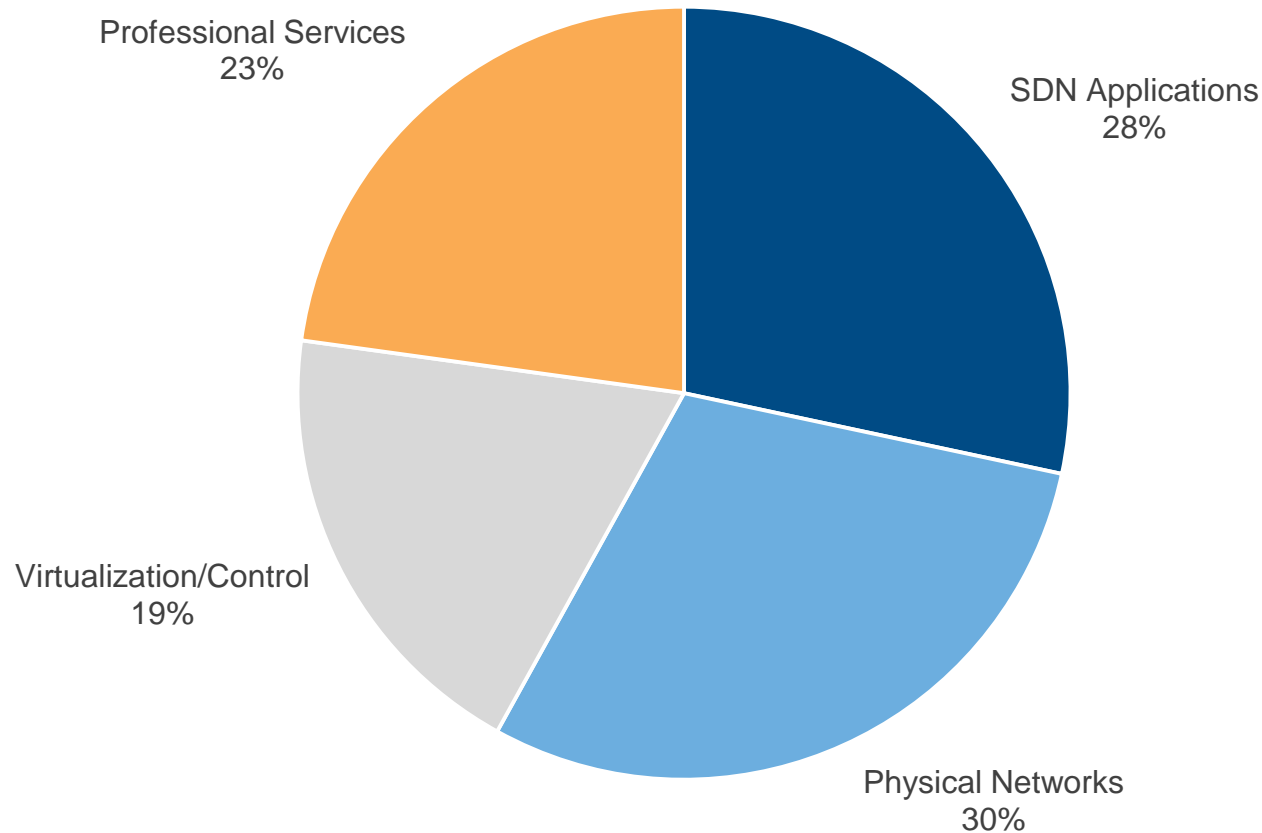
Worldwide SD-WAN Equipment & Services Revenue Forecast



Key Assumptions

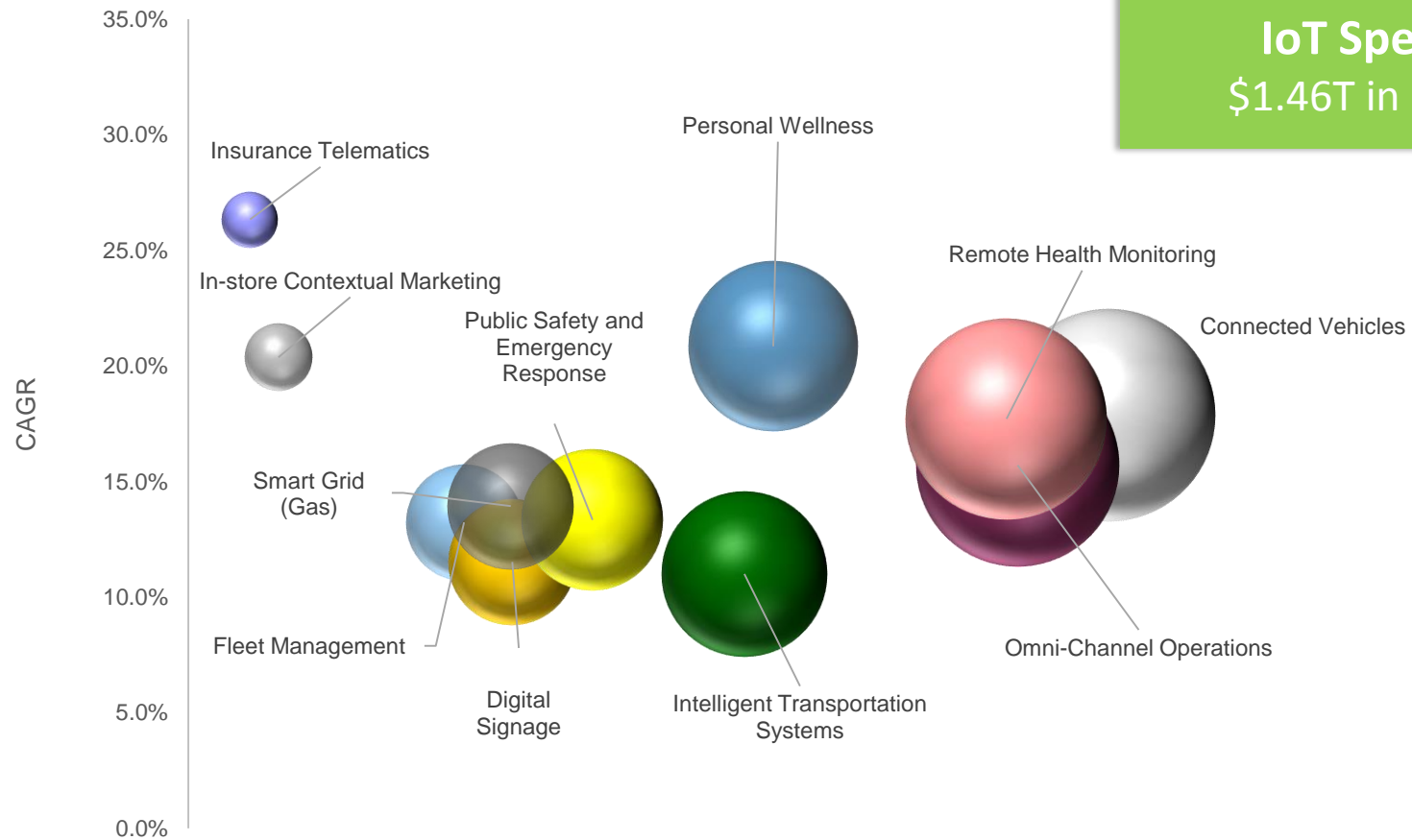
SD-WAN forecast includes WAN infrastructure hardware, software and managed services. This forecast does not include access or transport revenues associated with internet, MPLS , 4G or broadband services

WW Datacenter SDN Revenue 2020 Segmented – \$12.5 Billion



IoT Market in 2020:

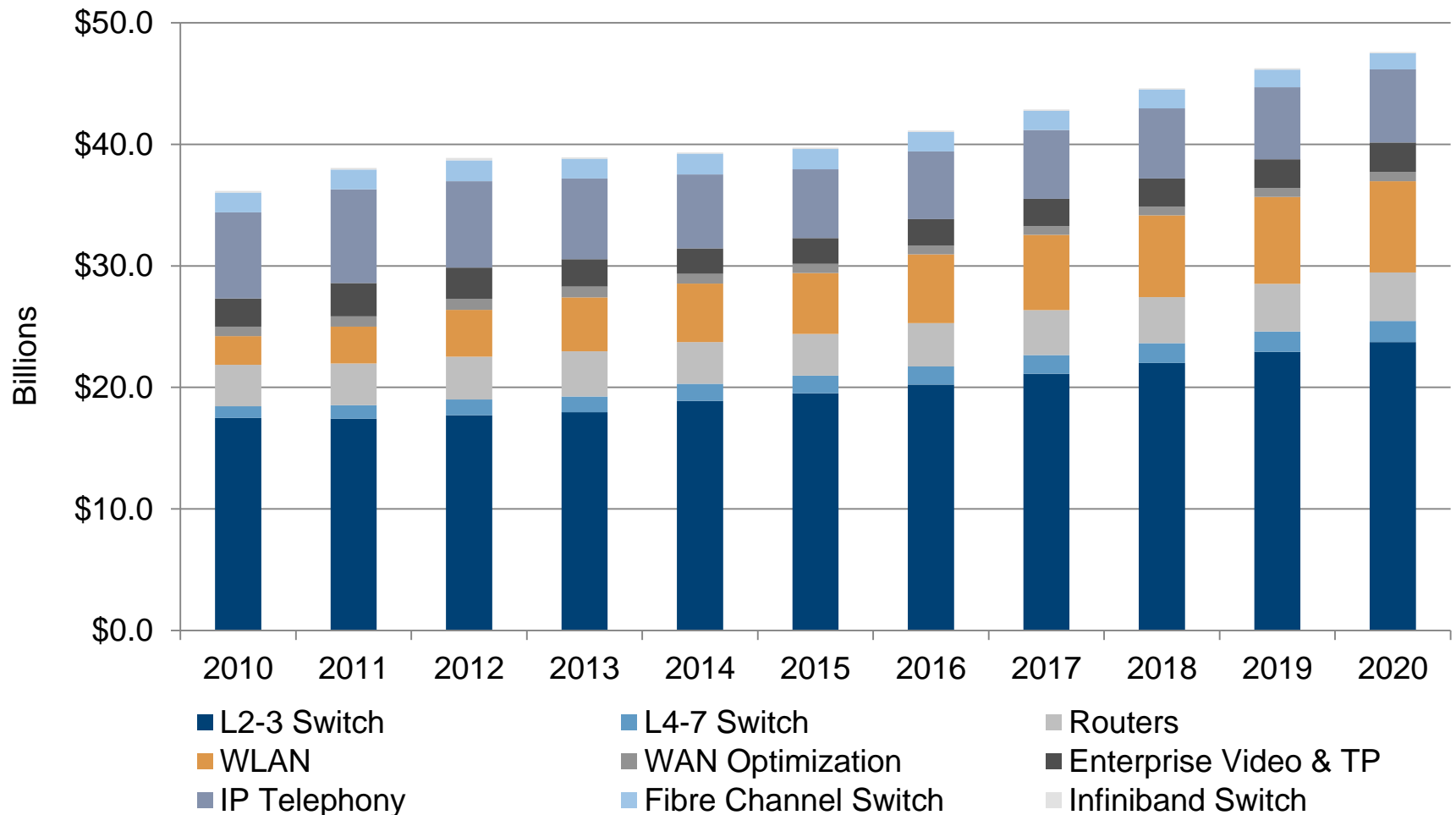
Consumers = High Growth, Enterprises = Most Spending



Bubble size = IoT Spending

#IDCMWC16

Worldwide Enterprise Network Infrastructure Forecast by Technology



Joining Us For Q&A...



Rohit Mehra

*Vice President,
Network Infrastructure
rmehra@idc.com*



Brad Casemore

*Research Director,
Datacenter Networks
bcasemore@idc.com*



Nolan Greene

*Sr Research Analyst,
Network Infrastructure
ngreene@idc.com*



Nav Chander

*Research Manager,
Enterprise Telecom
nchander@idc.com*