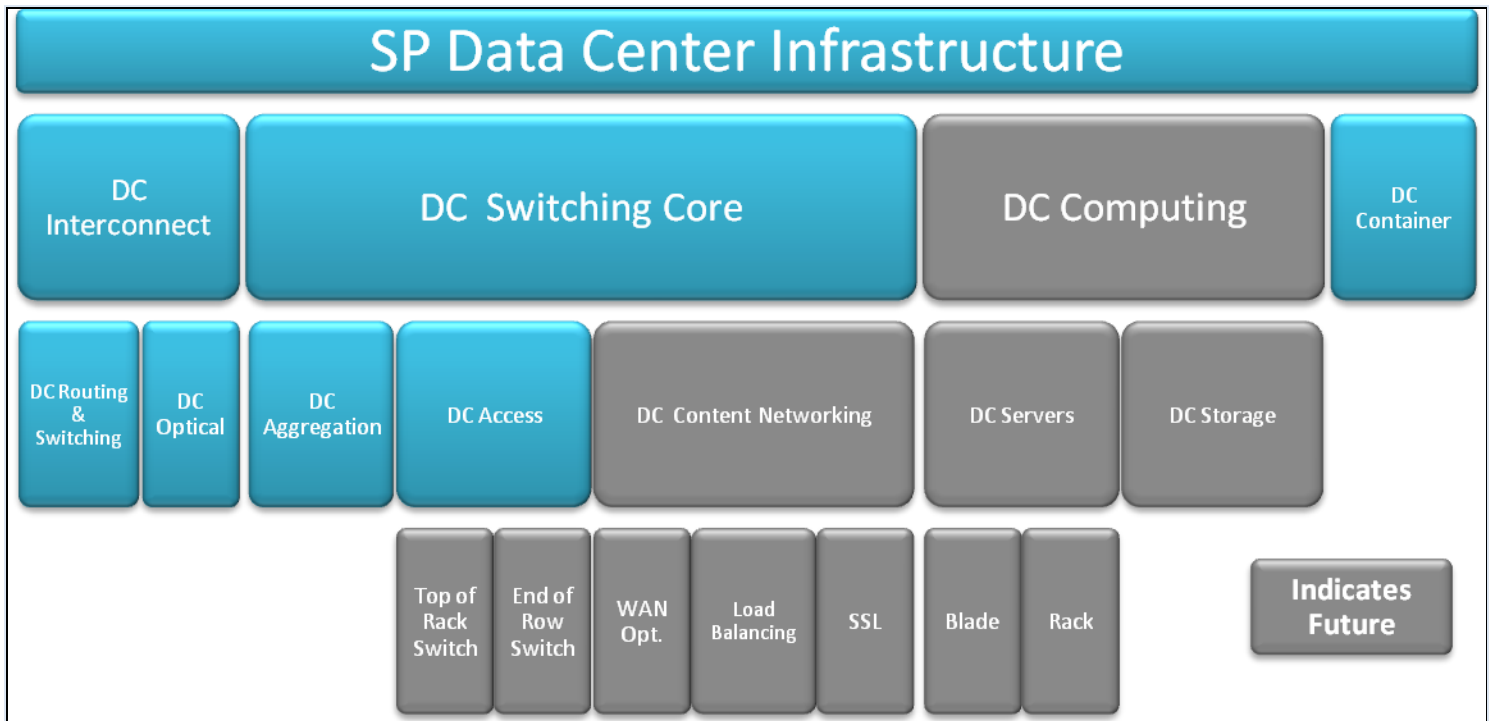


# Service Provider Data Center Infrastructure

## Segmentation



ACG Research Service Provider Data Center Segmentation

ACG's Service Provider Data Center Infrastructure service monitors and analyzes companies and technologies; strategies for hardware, platforms and emerging technologies; and transformation strategies for data center operators. Service includes:

- PTT data center providers
- Content service providers
- Cloud service providers (IaaS, PaaS, SaaS)
- Cable provider data center
- Internet exchange data centers
- Internet service provider data centers
- Container data centers

Coverage includes:

- Routers
- Switches
- Content networking (WAN optimization, load balancing and SSL)

- Computing (servers and storage)
- Ethernet architecture
- Billing and revenue management
- Provisioning
- Fulfillment and assurance
- Network management
- Operations support
- Customer experience
- Predictive analytics
- Managed services

**Service Provider Data Center Infrastructure** focuses on switching and routing technologies/products used by service providers at the access, aggregation, Internet services edge and metro optical interconnects of the provider network to provide Internet services.

Technologies covered:

- IP routing systems
- MPLS OSPF
- BGP
- ACL and VPN based systems
- L2/L3 switching
- Metro WDM
- Servers, storage
- Content networking

### **What Are Some of the Network Challenges and Trends Facing Operators?**

Operators are dealing with multiple platform and network issues: growing requirements for new data center services, content service providers (B2C and B2B) extending into cloud-based data centers, voice and video services, shrinking revenue from wireline services, efficient delivery of data to smart phones driving new data service requirements, emerging competition from utility and cable providers — to name just a few. Simultaneously, they also must deal with the additional challenge of reducing costs, increasing ARPU, and reducing churn. To meet these challenges, operators are turning to vendors to develop faster, smarter, and more efficient networks.

## **Why Is Understanding the Data Center Routing and Switching Market Important for Operators?**

Rapidly changing and dynamic operating environments are driving operators to take a hard look at how they do business and adapt their business models, operations, networks, and relationships to meet these changes. As data center networks migrate to flatter, layer 2 networks, new designs are being implemented to reduce costs and complexity. In addition, layer 3 aggregation switches have IP/MPLS, BGP and 40/100G connections to support these flatter networks. The content service providers have adopted these new switching/routing architectures that are putting additional pressure on service providers to think through data-oriented services for enterprise and consumer customers. Decision makers require unbiased, competitive intelligence and sound analysis before they can make strategic business and infrastructure decisions about their data center networks.

## **What Is the Competitive Environment for Service Providers and Carriers?**

In some cases service providers are now competing with content service providers that are generating enormous revenues and profit from their core businesses. In addition, utility and cable operators are providing new services to business and consumer clients, siphoning away critical revenue from the PTTs. “Best effort” Internet traffic requires incumbent carriers to rethink the way they are delivering content to their target customers.

## **How Can Vendors Benefit from this Competitive Environment?**

Service providers are demanding data center equipment that will address MPLS, OSPF, BGP, ACL, QoS, content services, diagnostics, performance monitoring, and end-to-end service. Those innovative vendors that can develop equipment and products that meet these requirements as well as address consumers’ requirements for service quality, reliability, high-availability, and compatibility will lead the pack in capturing market and revenue share.

## *Definitions & Product Mapping*

### **DATA CENTER INTERCONNECT**

The primary role of the data center interconnect is to provide an on-ramp to the Internet. This connection point in the Internet data center (IDC) provides redundant BGP paths to either diverse multi-paths within a service providers’ backbone or to multiple Tier 1 service providers’ backbones to high availability of IP packet transit.

### **INTERNET CORE ROUTING**

Core routers are next-generation Terabit routers providing service providers with high-density 10/40/100G interfaces, scalability, flexibility, availability and redundant features. Key features include

but are not limited to IP-Based Network Interworking, IPv4/IPv6 Routing, MPLS TE, Intra-AS BGP4, OSPF, RSVP-TE, QoS, NetFlow/sFlow dedicated Internet access, Terabit packet forwarding rates, and robust scalability.

- Alcatel-Lucent (7750)
- Cisco (CRS-1, CRS-3)
- Huawei (NetEngine 5000E)
- Juniper (T640, T1600)
- Brocade (MLX 16, 32)
- ZTE (ZXR10 T1200)

### **INTERNET CORE EDGE SERVICES**

MultiService Edge Routers (MSER) enables legacy ATM/FR networks to internetwork and route over an IP core. Also, routes and aggregates traffic at the edge. Key features include: Aggregation of multiple access types (ATM, FR, leased line/private line, and Ethernet), Interworking with MPLS (IEEE Martini draft), IP VPN (RFC 2547), IPTV (QoS, multicast), NetFlow/sFlow, Internet access, hierarchical QoS.

- Alcatel-Lucent (% of 7710, % of 7750)
- Cisco (ASR 1000, ASR 5000, % of ASR 9000, CRS-1, CRS-3)
- Huawei (% of NetEngine40, % of NetEngine80, % of NetEngine80E)
- Juniper (T320, T640, T1600, % of M series, (% of M320, M40e)
- Brocade (MLX 4, 8; NetIron XMR 4000, 8000)
- Ericsson (% of SmartEdge)
- Tellabs (% of 8600, % of 8800)
- ZTE (ZXR10 T8000; M6000)

### **DC OPTICAL (METRO WDM)**

In metropolitan center, where a service provider has more than one data center, WDM equipment is connected to the switching core to provide extended LAN services over dark fiber. WDM allows for efficient use of limited availability of dark fiber while providing for sub 50ms failover, which is critical for maintaining application session state connectivity.

- ADVA
- Alcatel-Lucent
- Ciena
- Cisco
- ECI Telecom
- Ericsson
- Fujitsu
- Huawei
- Infinera
- NEC

- NokiaSiemens
- Tellabs
- Transmode
- ZTE
- Others (includes BTI/Meriton, MRV)

### **DC SWITCHING CORE**

The switching core within an IDC is based on high-density, high-performance, high-reliable Terabit switch/routers. The primary purpose of this layer within an IDC is to 1) provide transit to and from the Internet core routers (north/south) of an IDC; 2) and/or intra data center server to server IP data exchanges; 3) and/or transit to the metro optical edge if multiple IDCs reside in the same metropolitan area. The traffic flows within the IDC (east/west) are often determined by the size of the server farms or “pods” within an IDC. All ports in this switching layer are 10G and soon will be 40G/100G. Key features include but are not limited to: IPv4/IPv6 Routing, MPLS TE, Intra-AS BGP4, OSPF, IS-IS, RSVP-TE, QoS, Multicast, DCB, OpenFlow, M-LAG, VPLS, NetFlow/sFlow, Terabit packet forwarding rates, and robust scalability.

### **DC AGGREGATION**

Depending on the size of an IDC, the aggregation layer can be a high density, providing north/south traffic flow or collapsed into the DC switching core. This is often dependent on the size of the server farms and the density of the switch/routers.

- Alcatel-Lucent (OmniSwitch 10000, 7450 ESS)
- Arista Networks (7508)
- Brocade (MLX 16, 32; NetIron XMR 16000, 32000)
- Cisco (Nexus 7018, 7010)
- Dell (Force10 – E1200, E600)
- Extreme (BlackDiamond 8800; X8)
- Force10 (Z9512; E1200, E600)
- HP (A12518, A12508, A9512)
- Huawei (Quidway 9312)
- Juniper (EX8216, EX8208)
- Melanox (Vantage 8500)
- ZTE (ZXR10 8912E, 8908E)

### **DC ACCESS**

This is the area of the data center where the servers connect to the network. Servers, today, have standard 1G network interface cards (NICs). Some high-performance applications require 10G NICs and some high-performance computing networks require 40G NICs. The network equipment connecting to the servers ideally are 1 rack unit (RU) with 48x1G ports or 48x10G ports. Since there are generally 40x1 RU servers per seven-foot rack in a data center, you need at least 40 ports to the servers with uplinks to

the aggregation/core layer within the data center. Uplinks from the 1G access layer switches to the aggregation/core switching should preferably have 4x10G ports to minimize oversubscription at the access layer in the data center.

### **TOP OF RACK (FIXED)**

Top of Rack L2 switches enables racks of servers with 1G/10G/40G interfaces to interconnect over a flat L2 or meshed fabric network. Also, fast failover or dynamic congestion management uplink or meshed connections is critical for minimizing end to end server to server latency. Key features include: Aggregation of multiple access types (1/10/40G ports), line rate throughput, low latency ingress to egress, data center bridging, open flow, trill, no oversubscription of uplinks.

- Alcatel-Lucent (OmniSwitch 6900, 6850E)
- Arista Networks (7100, 7050, 7048)
- Brocade (NetIron CES 2048, VDX 6720-60)
- Cisco (Nexus 5000, 4000, 3000, 2000; Catalyst 4900)
- Dell (PowerConnect 6248)
- Enterasys (Securestack, Matrix E-1, N)
- Extreme (Summit X670, X650, X480)
- Force10 (S4810, S60, S55)
- HP (ProCurve A5800)
- Huawei (Quidway S5300, S6300)
- IBM (BladeNetwork Tech)
- Juniper (EX4200, 4500)
- Mellanox (Vantage 6024, 6048)
- ZTE (ZXR10 8912E, ZXR10 8908E)

### **END OF ROW SWITCHES (MODULAR)**

End of row Layer 2 switches enable the cabling of multiple racks of servers to the end of the equipment racks, consolidating the server to access switch cable runs. The number of servers (normally 40 per rack) times the number of racks requires a chassis-based solution to be installed at the end of the rack. The cumulative number of downlinks or bandwidth to the servers must be equal or greater than the cumulative bandwidth connecting to the aggregation/core layer in the data center. This is an ideal design if there is a great deal of rack-to-rack communication between the servers. The backplane of the end of row chassis can be utilized for non-blocking communication between the servers within this contiguous pod of racks. Key features include: Aggregation of multiple access types (1/10/40G ports), line rate throughput, low latency ingress to egress, data center bridging, open flow, trill, no oversubscription of uplinks.

- Alcatel (Omniswitch, 8000/9000 Series)
- Arista Networks (7508)
- Brocade (Fast Iron, Big Iron, Super X)
- Cisco (Nexus 7000, 2000; Catalyst 6500)

- Enterasys (S-Series, S4, S6, S8)
- Extreme (BlackDiamond 6800, 10000, 12000, Alpine)
- Force10 (E600i, C300)
- Huawei Quidway 65xx, 85xx Series)
- HP (ProCurve)
- Juniper (EX 4200, 4500)
- Mellanox (Vantage 8500)
- ZTE (ZXR10 8912E, ZXR10 8908E)

### **DC CONTENT NETWORKING**

Content networking switches are typically used for load balancing among groups of servers. Load balancing can be performed on HTTP, HTTPS, VPN, or any TCP/IP traffic using a specific port. Load balancing often involves NAT so that the client of the load balanced service is not fully aware of precisely which server is handling requests. Some of the layer 4–7 switches can perform NAT at wire speed. Also, content switches can often be used to perform standard operations, such as SSL encryption/decryption, to reduce the load on the servers receiving the traffic or to centralize the management of digital certificates.

### **DC LOAD BALANCING**

Ethernet data center content services are high-end Ethernet content filters that provide Layer 2 connectivity and Layer 3 features to provide Ethernet services.

- A10 (AX 5200, AX1000)
- Brocade (ServerIron ADX 1000, 4000, 10000)
- Cisco (CSS11000, 115xx, 6500 w/ CSM, 1140)
- Citrix (NetScaler SDX 17500, 19500 and 21500; MPX Series)
- F5 (VIPRION 4400, 2400; Big IP Series)
- Radware (Application Director, Application Xcelerator)
- SilverPeak
- Top Layer (5500, IDS Balancer)

### **DC WAN OPTIMIZATION**

Wide area network (WAN) optimization is often used interchangeably with WAN optimization controller (WOC) and WAN acceleration. WAN describes the idea of increasing TCP data-transfer efficiencies across public Internet or private WANs.

- A10 (EX2110, EX1100)
- Bluecoat (ProxySG 300, 600, 900, 9000)
- Cisco (CSS11500; 6500 w/ CSM; WAVE Series)
- Citrix (NetScaler SDX 17500, 19500 and 21500; MPX Series)
- F5 (BigIP Series)

- Juniper (WXC Series)
- Riverbed (Steelhead Series)
- SilverPeak (NX Series)

### **DC SSL**

Secure sockets layer (SSL) is a cryptographic protocol that provides communication security for transactions over the Internet.

- Bluecoat (ProxySG Series)
- F5 (BigIP Series)
- HP (TippingPoint S1500)
- Juniper (SA Series)

### **DC COMPUTING**

DC computing is made up of server farms or clusters of servers providing the computational requirements of an enterprise or service provider. Server farms often have backup servers, which can take over the function of primary servers in the event of a primary server failure. Server farms are typically colocated with the network switches and/or routers communicating between the different parts of the cluster and the users of the cluster. The computers, routers, switches, power supplies, and related electronics are typically mounted on 19 inch racks in a data center.

### **DC SERVERS**

Dedicated or virtualized server hardware provides the computational component of the data center. DC computing is focused on the general purpose computing capabilities found in a data center. It does not track specialized server appliances that provide specialized networking capabilities. DC computing can be standalone servers, rack servers or blade servers. There is no specific breakout by performance or operating system.

### **DC BLADES**

A blade server is a stripped down server computer with a modular design optimized to minimize the use of physical space and energy. Whereas a standard rack-mount server can function with (at least) a power cord and network cable, blade servers have many components removed to save space, minimize power consumption and other considerations. They still have all the functional components and are considered a computer. A blade enclosure, which can hold multiple blade servers, provides services such as power, cooling, networking, various interconnects and management. Together, blades and the blade enclosure form the blade system.

- Cisco
- Dell
- Fujitsu
- HP
- Huawei/Symantec

- IBM
- Oracle
- Super Micro

### **DC RACKS**

A rack server is a headless computer serving specific computational needs of an organization. The connectivity between rack servers is provided by the end of row top-of-rack network devices that provide the movement of information from one machine to another or to the user and/or application requesting the information.

- Dell
- Fujitsu
- HP
- Huawei/Symantec
- IBM
- Oracle
- Super Micro

### **DC STORAGE**

Data center storage refers to the storage of data on hard drives within a storage subsystem that can be accessed through the I/O channel between the server and storage system. Storage does not define the differences between SAN, NAS or iSCSI.

- Dell
- EMC
- HP
- Hitachi Data Systems
- Huawei/Symantec
- IBM
- NetApp
- Oracle

### **DC CONTAINERS**

Container data centers (CSCs) are a self-contained, environmentally efficient data that contain a complete data center within a 40 foot container. Easily transported by flat bed truck, rail or ship, CDCs only require external power and communication connectivity to be up and running. Some data centers today are being built to accept CDCs

- Cisco (Containerized Data Center)
- Huawei (CDC)
- IBM (Portable Modular Data Center)

- SGI (ICE Cube CDC)
- Oracle (Black Box CDC)

*ACG focuses on providing market analysis and consulting to help service providers and vendors monetize their existing infrastructures and increase operational efficiency and profitability. Through ROI and TCO analysis, product and service message testing, and business model review, reports and forecasts, ACG gives you strategic and tactical advice, services and products, and timely answers so that you can better understand market dynamics and grow your telecom operations more efficiently and profitably. We help you make business decisions with confidence!*

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