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WHITE PAPER

Fourth-generation Data Center Fabrics

Leveraging a Distributed Service Architecture to Modernize Data Center Networks

By Bob Laliberte, Principal Analyst
Enterprise Strategy Group

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The Requirement to Modernize Enterprise Data Centers

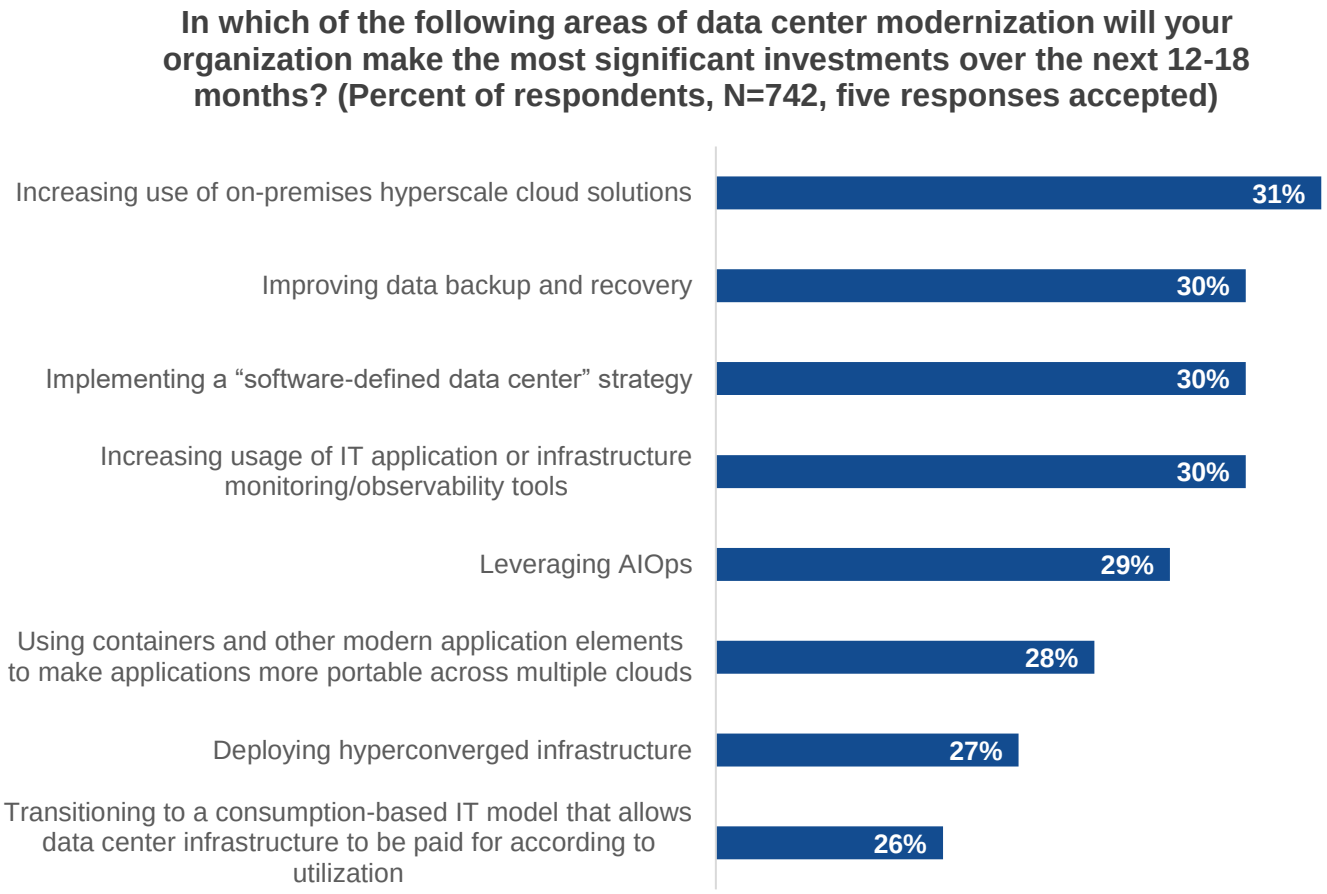
Organizations have been deploying new applications and lifting and shifting existing applications to public clouds for a number of years. However, there is still a significant portion of applications that remain in private data centers: According to research from TechTarget's Enterprise Strategy Group (ESG), on-premises applications still account for about half (51%) of available applications.[1] Many of these applications will never migrate to the cloud, and organizations might even see other applications repatriated from the cloud. Indeed, organizations are realizing that cloud-native applications don't have to reside in public clouds only. With that said, the experience of using the public cloud has made a permanent impression on the teams that have used it. As a result, organizations must modernize on-premises data centers so that they are more cloud-like, agile, and secure.

Organizations are taking steps to modernize on-premises data centers, with ESG research reporting that the top action being taken, cited by 31% of respondents, is leveraging on-premises hyperscale solutions in private data centers (see Figure 1).[2] However, most organizations don't have the convenience or budget to perform a wholesale replacement of their existing data center infrastructure. Practical realities dictate that organizations leverage their existing assets and evolve over time to keep costs in line and ensure uninterrupted application availability to customers and the business.

Part of this transformation to more cloud-like on-premises data centers includes shifting away from legacy hardware appliance-based technologies and adopting "software-defined data center" strategies, as reported by 30% of survey respondents.[3] While modernization is a key motivation for this shift, it also enables organizations to eliminate costly appliance-based services and increase agility. Another solution is deploying modern, cloud-native applications in the data center: 28% of organizations reported plans to use containers and other modern application elements for greater application portability.[4] As a result, operations teams will require the flexibility to connect to all workloads and deliver the appropriate application, network, and security services as needed.

[1] Source: Enterprise Strategy Group Complete Survey Results, *Distributed Cloud Series: The State of Infrastructure Modernization Across the Distributed Cloud*, August 2023.
[2] Source: Enterprise Strategy Group Research Report, *2023 Technology Spending Intentions Survey*, November 2022.
[3] Ibid.
[4] Ibid.

Figure 1. Modernizing On-premises Data Centers



Source: Enterprise Strategy Group, a division of TechTarget

Another important factor in modernizing on-premises data centers is sustainability. In fact, almost half (47%) of organizations surveyed cited that pressure to ensure environmental, social, and governance compliance is the highest for compute, network, and storage infrastructure in the data center. Furthermore, when asked which department was most affected by these efforts, more than half (57%) reported the IT department.[5] Organizations need to factor energy efficiency into any modernization plans, including reducing the number of CPUs required and leveraging software instead of hardware appliances.

Ensuring secure application environments becomes more difficult in a highly distributed environment. Combined with an ever-changing threat landscape, it is easy to understand why ESG research highlights that improving cybersecurity is the top justification for increased IT spend.[6] It is important to remember that while security is important, organizations can't afford to have it negatively affect performance, so solutions need to be in close proximity to the applications they protect.

Ultimately, as organizations modernize their on-premises data centers and embrace having distributed application environments (public cloud, colocation, edge sites), they need solutions that help drive greater operational efficiencies. Operations teams must support a highly distributed and complex environment that is constantly

[5] Source: Enterprise Strategy Group Complete Survey Results, *The Role of ESG Programs in IT Decision Making*, September 2022.
[6] Source: Enterprise Strategy Group Research Report, *2023 Technology Spending Intentions Survey*, November 2022.

changing. As a result, they need solutions that are more efficient, enabling teams to deliver services where and when they are needed, and as close to the applications as possible.

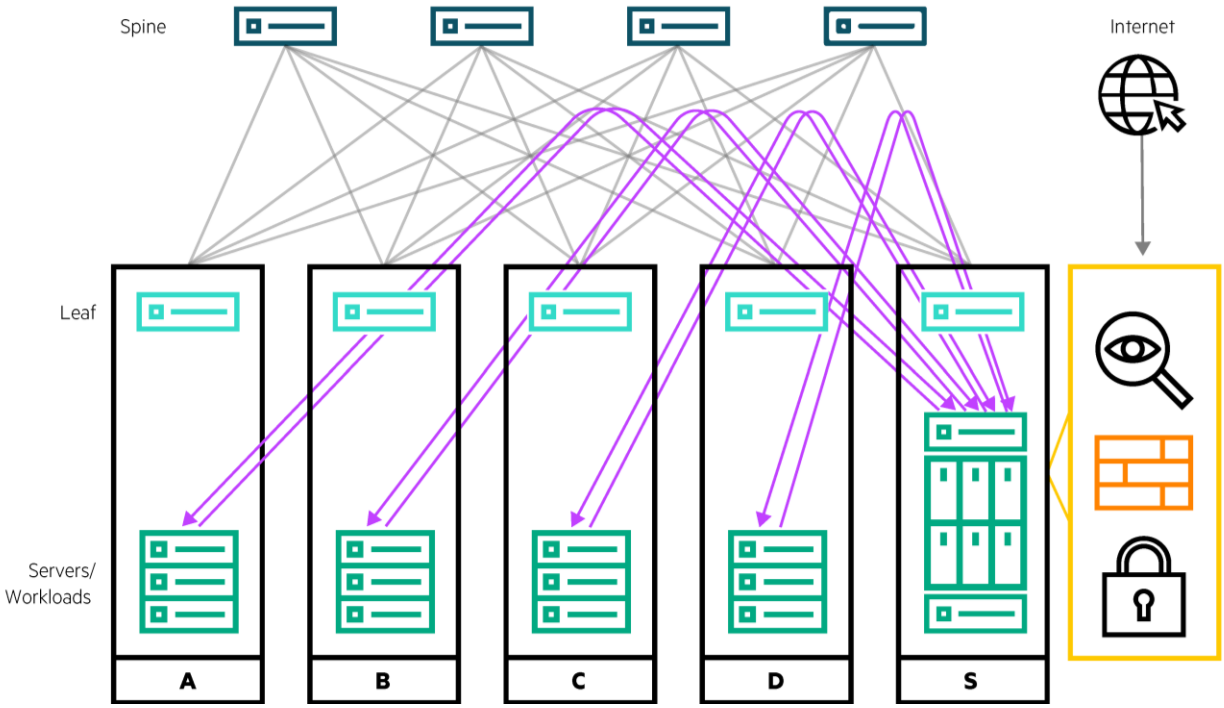
The process of modernizing or evolving an existing data center environment is not an easy one. Organizations will face a number of challenges.

Challenges of Modernizing Existing Data Center Environments

Transforming an existing on-premises data center is not an easy task. Most environments have legacy infrastructure that was not designed for modern applications and the services that support them. Because of this, organizations must overcome the following challenges:

- **Evolving vs. rip and replace.** Data centers are inherently complex and contain a mix of technologies, vendors, and operations teams. This makes it difficult to rip and replace the entire data center—not to mention that such an endeavor is extremely costly. The business requires mission-critical apps to be highly available, so the thought of a wholesale rip and replace of an IT environment is not practical. As a result, the efforts to modernize the data center are similar to that of rebuilding a plane while flying. Organizations will have to evolve the environment over time, as it is too expensive to shut down and completely rebuild. The goal of creating a public cloud-like experience is the same, but the time frame can vary.
- **Securely connecting private and public clouds.** Cloud native doesn't mean public cloud only; organizations are deploying modern application workloads in on-premises data centers that have to be connected to public clouds, colocation data centers, or edge locations. Because of this increased complexity, operations teams need solutions that enable them to easily and securely connect these workloads. In many cases, this will require replacing legacy implementations.
- **Reducing power consumption.** For several years, organizations have made commitments to reduce their carbon footprint, leverage clean energy, and provide data reporting on their progress. These are board- or C-suite-level initiatives. Given the power consumption of corporate data centers, reducing the amount of power used is a key focus area.
- **Legacy networks vs. modern applications.** Legacy networks struggle to accommodate modern applications and their services. Previous data center architectures only dealt with application data traveling north and south to storage arrays, users, or other locations. Modern applications require a lot of east-west traffic between or within servers. This makes it increasingly difficult to insert required application services for security, telemetry, or networking. Organizations have taken steps to simplify the network architecture, moving from three-tier to two-tier spine-leaf architecture, yet application services either remain in legacy appliances or are deployed as agents.

Figure 2. Challenges of Legacy Centralized Services Architecture



Source: HPE Aruba Networking

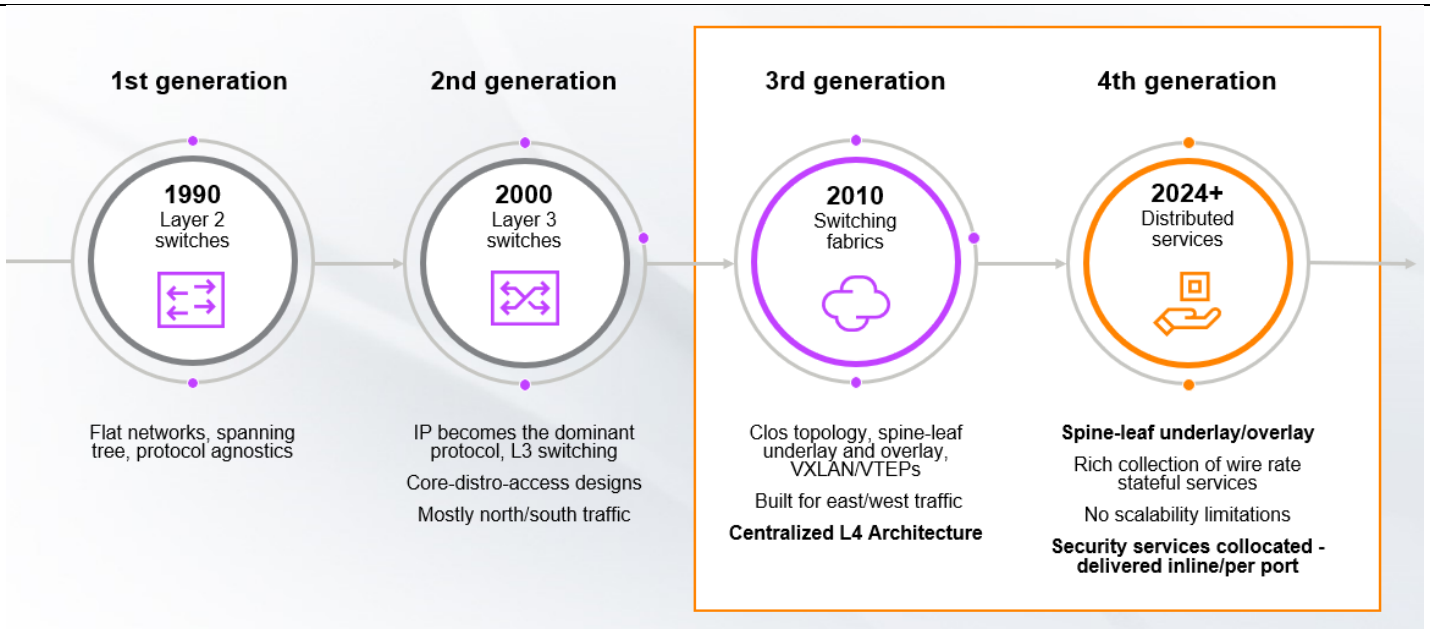
Deploying software on a server consuming CPU resources from applications consumes more power and could also require organizations to purchase additional servers, adding cost. Using appliances to run application services increases complexity and energy consumption while creating additional costs. This also impairs agility, as new appliances must be installed to scale (step function scaling with each box deployed). Depending on the distance from the application server, this could also affect application performance and, ultimately, user experience. This is due to the application traffic involved in traveling out the rack and into another rack where the appliances are deployed, and then back again (see above Figure 2).

To evolve data centers to adapt to modern application environments, organizations require simplified data center fabric architectures that are easy to deploy and manage. In addition, the network must also provide enhanced application services and ensure positive experiences.

HPE Aruba Networking Simplifies Fabric Architecture

To overcome these challenges and enable organizations to evolve their existing enterprise data centers to support modern application environments, HPE Aruba Networking has created a fourth-generation fabric architecture leveraging data processing units (DPUs) and application services that provide enhanced security, performance, and intelligence (machine learning) for these highly dynamic and distributed environments (see Figure 3).

Figure 3. HPE Aruba Networking's Fourth-generation Fabric Architecture



Source: HPE Aruba Networking

This innovative approach enables organizations to:

- Transform existing data center networks at their own pace, with minimal disruption, to create a dramatically simpler and more scalable architecture that supports modern application environments. This capability is enabled by a combination of new technology and software.
- Leverage HPE Aruba Networking cloud-based, centralized management with role-based access control to ensure that network, security, and DevOps teams have access to create and modify policies enabling self-service for application developers. This will create operational efficiencies and provide opportunities to automate provisioning and day-to-day changes.
- Take advantage of a DPU-based fabric architecture located in the top-of-rack (ToR) switch. This approach facilitates the deployment of application services—e.g., firewalls, DDoS, encryption, network address translation (NAT), and telemetry—as close as possible to the applications, without affecting application service. By deploying these services in ToR switches, organizations can remove the dedicated appliances for each service, thus reducing costs and power consumption. It also serves to optimize network performance and bandwidth, as traffic will be restricted to the rack and traversing the fabric to access appliance-based application services. Hyperscalers deploy similar technology within every server in their data centers.
- More easily monitor and manage the environment. Operations teams will have greater visibility into the modern applications and their traffic patterns, including east-west traffic. Distributing firewalls close to the applications will ensure higher levels of data security.
- Simplify fabric architectures. For organizations with existing data centers, wholesale rip-and-replace options are too costly and disruptive. However, adding this capability by simply deploying new ToR switches enables organizations to get the desired hyperscaler functionality without rebuilding the entire data center. This approach enables organizations to evolve at their own pace and create a simplified, cloud-like fabric with a distributed service architecture.

HPE Aruba Networking Distributed Service Switch

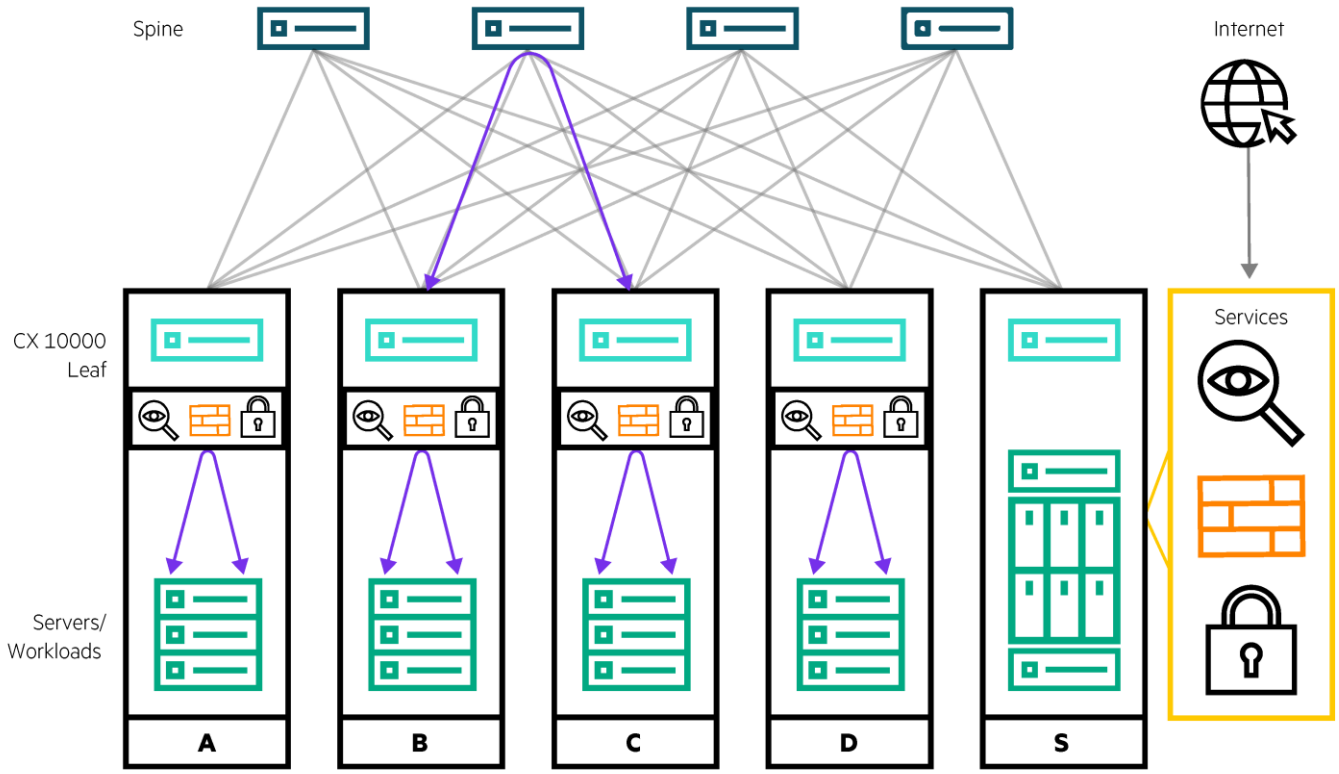
To enable organizations to transform their existing data centers to support modern applications and become more cloud-like, HPE Aruba Networking created an innovative, industry-first Distributed Service Switch: the HPE Aruba Networking CX 10000 with AMD Pensando. The concept behind this was to provide organizations with an evolutionary path to modernize their data center and not to force wholesale changes. Thus, the HPE Aruba CX 10000 enables organizations to modernize their existing data centers with a minimally disruptive, evolutionary process.

HPE Aruba Networking offers the CX 10000 as a 1 RU fixed form-factor switch that leverages both Broadcom and AMD Pensando processors. This enables it to not only perform its expected network fabric duties but also host application services. The switch supports both 48-port 25G and 6-port 100G connections. The HPE Aruba Fabric Composer (AFC) will serve as the primary interface as well as the network and security orchestration engine. The Aruba CX 10000 enables customers to expand a zero-trust architecture deeper into the data center, delivering 800G east-west stateful services across every switch port, dramatically scaling and strengthening the security of critical applications and workloads in on-premises data centers. Those stateful distributed services include firewalls, DDoS, encryption, NAT, and telemetry. Organizations can access these applications via the AFC to perform Day One configurations and/or detailed troubleshooting.

This innovative technology enables organizations to evolve their existing data center network and create a distributed services architecture (see Figure 4). Deploying CX 10000 switches as ToR, leaf, or access switches in the data center will enable stateful services for modern application east-west traffic without having to hairpin through an appliance and degrade performance. CX 10000 also improves security posture by applying zero-trust and microsegmentation services closer to the application. By not allowing untrusted east-west connections, security services can block threats that have originated within the data center or even the same rack. Organizations can also deploy CX 10000 edge routers in colocation facilities, which enables them to provide scalable and stateful 400G IPsec encryption, firewalls, NAT, and routing capabilities.

The CX 10000 can dramatically simplify and scale private-private 400G site-to-site IPsec handoff to either Azure ExpressRoute or AWS Direct Connect as more enterprises extend network, security, and telemetry capabilities outside their on-premises data center to outside locations such as colocation facilities, factories, branch locations, or public cloud edges.

Figure 4. Distributed Services Architecture for Existing Data Center Environments



Source: HPE Aruba Networking

Customers Report Benefits From Distributed Service Switch and Fourth-generation Architectures

Enterprise Strategy Group was able to interview HPE Aruba Networking customer DXC Technology, a global services company that owns and operates data centers globally for its own business as well as for its customers. According to Nitin Jain, director and global network services lead, DXC has hundreds of data centers under management today. Each environment has its own heterogeneous mix of devices. This includes an inventory of thousands of firewalls across multiple vendors and multiple technologies. Because of this, DXC has been focused on modernizing and standardizing data center operations over the last few years.

Regardless of whether DXC is providing services to a customer or for its own internal use, DXC sees two types of traffic that are traversing the network in the data centers: north-south traffic that enables network traffic access into the data center and access out of the data center, and east-west traffic within the data center. DXC reported that it can be challenging to have visibility across all this traffic, along with the ability to segment the traffic to provide the right level of access. Currently, this is accomplished using heterogeneous firewall environments.

That was the impetus to explore the HPE Aruba Networking Distributed Service Switch. According to Nitin Jain, "The Distributed Service Switch's capabilities are very important so we can enable stateful firewall features right at the port level in the switch itself. This was a very strong use case for us in terms of simplifying the architecture,

managing the overall state in a better way, and reducing the amount of network security infrastructure in the data center."

DXC is looking forward to using features such as IPsec and NAT in the switch. Using the Aruba Fabric Composer, the operations teams can push new policies to the fabric when and where they are needed. This level of orchestration will enable simplified operations and visibility into the east-west traffic, ensuring higher levels of observability as well.

Nitin Jain also stated, "The Distributed Service Switch will help to streamline the DXC data center architecture as well. Ultimately, this is really about changing the data center architecture from end to end. We are replacing the entire data center fabric with the CX 10000 switches and a combination of other switches. That will take us to a point where we could state that our data centers are at the cutting edge." DXC's implementation is delivered to customers in a solution called the Secure Network Fabric.

Nitin Jain stated that the transformation has enabled them to dramatically reduce the existing firewall footprint, along with the associated data center resources in terms of power, cooling, and space. DXC estimated that by deploying the Distributed Service Switch, it will be able to reduce its network security infrastructure by 83%. This will have the added benefit of reducing maintenance costs, power, and cooling, while freeing up space in the data center. Actual dollars saved will vary depending on the data center size but could easily add up to millions of dollars over five years.

The deployment has also resulted in better customer experiences and operational efficiencies. In fact, DXC claimed that, based on initial testing, it expects customer onboarding times to be reduced by as much as 60%. Visibility will also be greatly improved as well, especially for modern applications—representing approximately 35%-40% of on-premises data center applications—with the solution providing detailed end-to-end telemetry data. The deployment has also helped the DXC operations team manage the network fabric more efficiently because of the built-in orchestration.

Ultimately, for DXC, this is about solving the business problem. Nitin Jain stated, "We want to modernize the data center environment for our customers, to give them higher levels of security, the visibility they need, and network segmentation, which is greatly needed from both an east-west and north-south perspective."

Having itself deployed a distributed services architecture makes it easier for DXC to talk to customers. Nitin Jain stated, "So that's the beauty of deploying the Distributed Service Switch ourselves and then showcasing it to customers and telling them, 'This is how we would solve your problem,' rather than just deploying another box."

DXC cited that the time to transform is also in line with typical infrastructure refresh cycles. For small-size customers, it anticipates this time to be anywhere between four and six months; for medium-size customers, it's ranging between six and 12 months; and for large customers, the range is anywhere between 10 and 15 months. It further reported users getting comfortable using the technology and the orchestrator in as little as one to two months.

DXC also reported that, in order to provide secure connectivity for remote sites, it has been leveraging HPE Aruba Networking software-defined WAN (SD-WAN) solutions as part of its own data center modernization. Currently, it has deployed HPE Aruba's EdgeConnect as its software-defined networking solution in approximately 25%-50% of its locations. This is what it offers to its customers as well. After leveraging Aruba's EdgeConnect, DXC has observed a significant reduction of the MPLS footprint and an improved security posture.

DXC also mentioned that the latest security acquisition of Axis, combined with EdgeConnect, is a game changer. It believes that the combination of SD-WAN and Axis together provides a great end-to-end solution for customers that want to transform their WAN as well as their data center.

The Time to Start Modernizing Is Now

Organizations must modernize existing data centers to keep pace with today's complex, highly distributed environment and ever-expanding attack surface. However, they also have to be smart about this process. Unless they have the money and time to build brand-new data centers, they will have to take an evolutionary approach that ensures application availability—essentially rebuilding the plane while flying it. Unfortunately, most data centers still leverage outdated architectures that use individual appliances for each application or security service deployed on them. While this model worked well for legacy applications, it is complex, costly, and energy inefficient, and it can dramatically affect the performance and security of modern applications. A new DPU-enabled network fabric architecture can preserve existing investments in on-premises data centers while providing the scale, agility, security, and performance required for modern data centers.

To accomplish this, organizations must modernize their brownfield data center environments intelligently by deploying DPU-based network fabric architectures over time, with minimal disruption to operations (i.e., by employing regularly scheduled maintenance windows). The simplified fabric architecture will be easier to manage and more cost- and energy-efficient. This way, software-based application and security services can be delivered where and when they are needed.

Organizations that are planning or in the process of modernizing existing data centers need to evaluate how fourth-generation network fabrics enabled by HPE Aruba Networking's CX 10000 switch can be used to evolve data center fabrics with minimal disruption, while providing a simplified architecture, enhanced security, and improved performance. As the customer example highlighted, organizations can—in a relatively short period of time—dramatically reduce existing network security infrastructure, along with the associated power and cooling costs. Fourth-generation network fabrics will also provide greater visibility into modern application environments as well as enhanced security for east-west traffic, so organizations should get started on the process of modernizing their data centers now.

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contact@esg-global.com
www.esg-global.com