



ESG WHITE PAPER

Creating a Distributed Services Architecture in Existing Data Center Environments

How to Enhance Security, Performance, and Operational Efficiency

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Enterprise Data Centers Must Evolve

Modern application environments are growing. These cloud-native microservices architectures are steadily gaining ground in organizations globally. While the adoption of modern application environments is more aggressive in digital-native organizations, even well-established enterprises have recognized the value of these environments and are increasing their use of them.

While many associate cloud-native applications with only being deployed in the public cloud, that is not always the case with traditional enterprises. New applications and workloads will be highly distributed across private data centers, multiple public clouds, and edge locations. According to ESG research, 70% of organizations are running or plan to run cloud-native and container-based applications in hybrid environments.¹

Existing enterprise data centers need to evolve to provide modern services to these dynamic application environments. Ultimately, that means emulating hyperscale cloud-based environments in private enterprise data centers since most of the existing data center environments do not efficiently deliver services to these new applications. Solutions need to be deployed with minimal disruption, enable a stronger security posture, and considerably improve application performance, resulting in better user experiences at a significantly lower total cost of ownership. In fact, more than one-third (34%) of ESG survey respondents indicated they are significantly increasing their use of on-premises hyperscale cloud solutions as part of data center modernization efforts.²

Accommodating Growth, Improving Security, and Becoming Operationally Efficient

To attain a competitive edge and remain successful, organizations must be able to easily accommodate growth, enhance security, ensure consistent performance, and become operationally efficient.

Ability to accommodate growth. Despite off-loading applications and workloads to the cloud, the massive amount of enterprise-resident data continues to grow. On-premises data centers must be able to plan for and accommodate ever-increasing traffic.

Enhance security while also ensuring performance. With a rapidly changing application landscape, security functions previously located at the perimeter are now moving closer to applications (i.e., the traditional castle and moat model is no longer sufficient), with costly centralized security hardware incapable of supporting micro segmentation or agents deployed on hosts that impact performance. ESG research shows that nearly half of organizations (47%) see strengthening cybersecurity as a top business issue driving technology spending.³ Yet, these organizations must also be able to ensure both performance and robust security in a cost-effective manner. The well-established decision process of having to trade off strong security for network performance or vice versa is no longer acceptable.

Operational efficiency is key. It should come as no surprise that most organizations do not possess unlimited resources and budget. Consequently, as the IT environment becomes more distributed and complex, organizations must employ solutions that enable them to become more operationally efficient.

Leveraging centralized or cloud management tools is critical so existing IT staff can deliver better performance for applications and infrastructure systems across highly-distributed IT infrastructure and worker environments. This includes delivering services as close as possible to the applications and devices, generating data to improve performance and the user experience.

¹ Source: ESG Master Survey Results, [Trends in Modern Application Environments](#), December 2019.

² Source: ESG Research Report, [2021 Technology Spending Intentions Survey](#), January 2021.

³ Ibid.

Existing Data Center Environments Present Challenges

Organizations across industries are realizing that their legacy data center environments were not designed to deliver services easily, quickly, or cost-effectively to modern applications. (Today’s organizations face more complex IT environments and are unable to support microservices-based traffic patterns.)

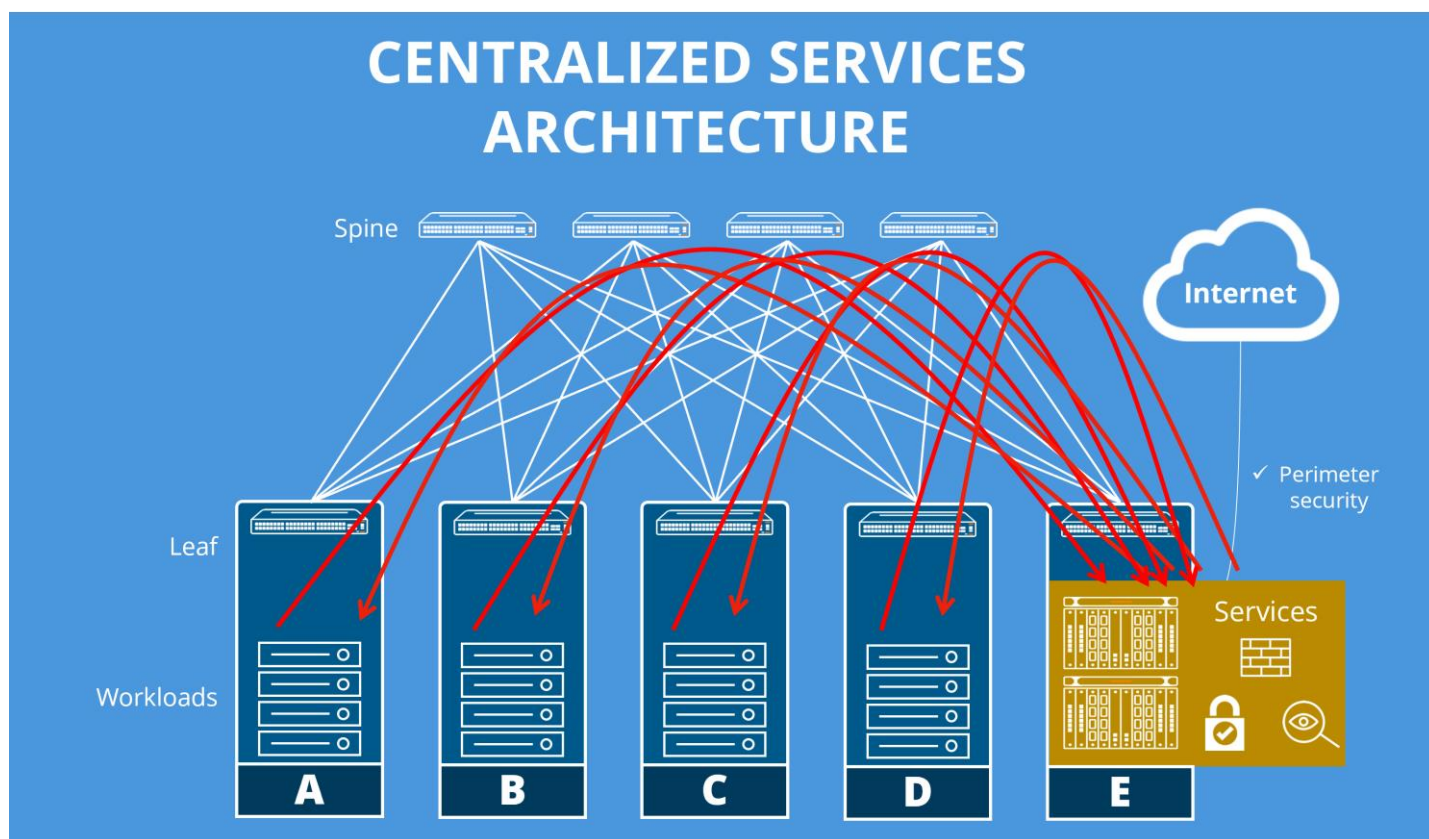
Complexity

IT complexity is clearly on the rise. Based on ESG research, 75% of organizations believe IT complexity has increased over the past two years (compared to 64% last year), with 21% describing IT as significantly more complex.⁴

Inability to Support Microservices-based Traffic Patterns

With the enormous amount of traffic moving east-west within a server or among servers, it is difficult (if not impossible) for IT to interject application services in legacy data center environments. While networks have evolved into two-tier, spine-leaf fabrics and have the capability to remove some complexity and latency, both application-level services and security services remain tethered to outdated architecture (see Figure 1).

Figure 1. Challenges of Legacy Centralized Services Architecture



Source: HPE Aruba

When moving from a three-tier to two-tier architecture, services are typically deployed on appliances and then require multiple hops from applications—but this model does not allow for efficient scaling to match demand generated from east-west traffic. As a result, IT must deploy additional appliances, increasing cost and complexity. Additionally, deploying

⁴ Ibid.

hardware limits agility unless IT over-provisions, compounding inefficiency and increasing costs. This legacy model still forces a tradeoff of security versus performance.

Furthermore, it's still common for security and network operations to use different tools. There is little, if any, integration among teams—creating further complexity and challenges for network management and security. System security is insufficient, and organizations require additional staff to manage the environment manually —without full visibility into the network.

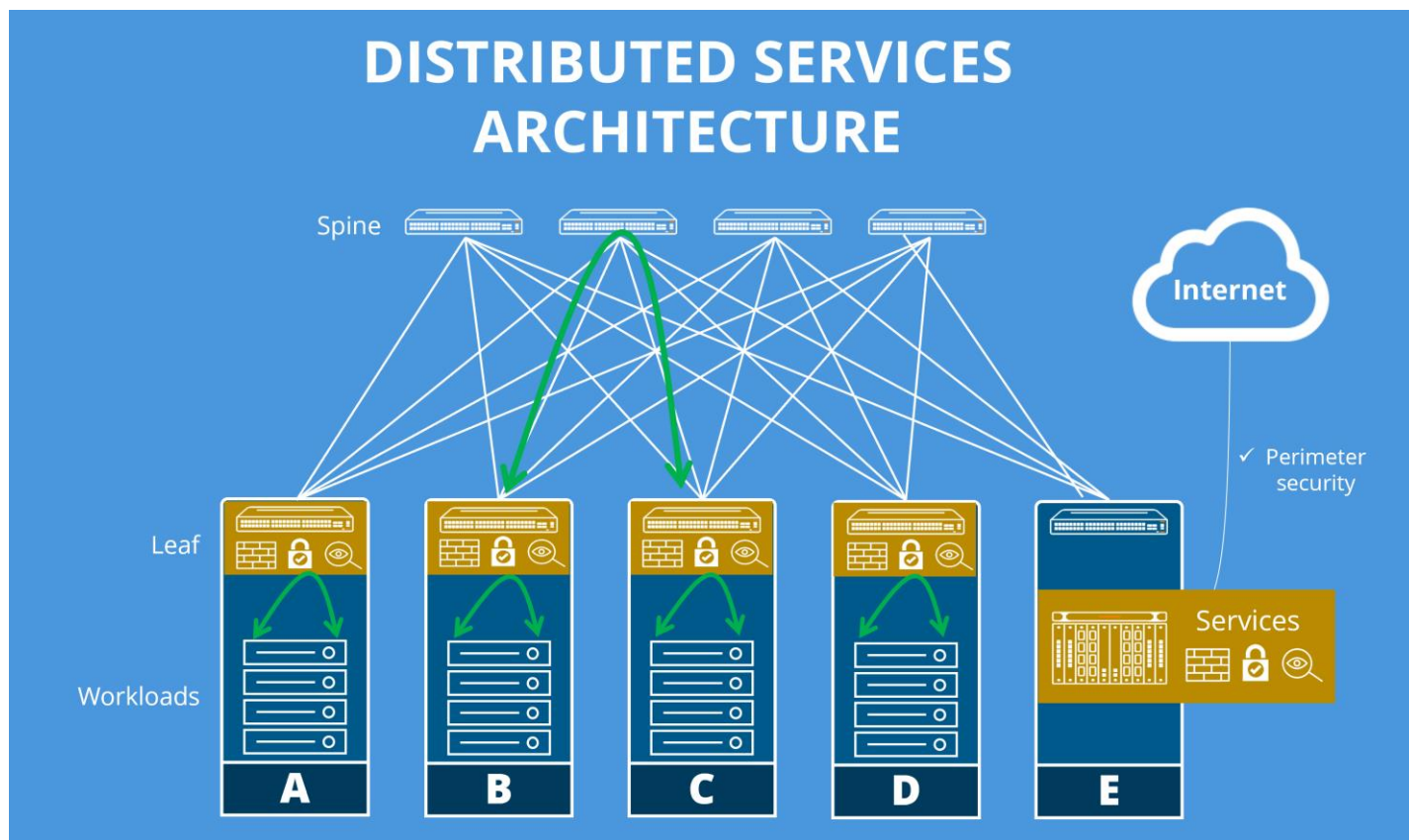
This scenario makes it extremely difficult to deploy and scale modern application environments. Organizations must be able to deliver consistently secure and positive user experiences across these modern environments—resulting in agile, efficient, hyperscaler-like capabilities in existing on-premises data centers. But how?

Creating a Modern Distributed Services Environment for Enterprises

To overcome these challenges and enable organizations to transform their existing enterprise data centers to better support modern application environments, a distributed services architecture is required.

A distributed services architecture moves or distributes the application and security services as close as possible to the applications themselves. Often, hyperscale cloud providers will leverage this architecture to optimize performance, enhance security, and reduce costs by deploying technology onto cards in the servers. While creating such an architecture may be feasible when building out new hyperscale cloud environments from the ground up, how can an enterprise with existing data centers take advantage of this leading-edge technology? For those environments, the logical place to start would be to deploy these services in the top-of-rack (ToR) leaf switch (see Figure 2). This way, enterprises can take advantage of a distributed services architecture without having to perform a costly, time-consuming forklift upgrade on the entire data center. In other words, it's non-disruptive.

Figure 2. Distributed Services Architecture for Existing Data Center Environments



Source: HPE Aruba

Top goals of a distributed services architecture for an enterprise data center include the following:

- Applies services as close as possible to applications, reducing latency and improving security.
- Eliminates appliance sprawl, lowering costs since additional infrastructure and associated maintenance are not needed. Existing service-specific appliances could be decommissioned or repurposed to support legacy environments.
- Optimizes network performance and bandwidth by reducing latency by deploying services in the top of rack switch, thereby enhancing user experience. This will also reduce the amount of traffic traversing the core network, thus providing improved performance there as well.
- Drives operational efficiencies for network and security operations teams since a single interface lets them access and manage services more easily.

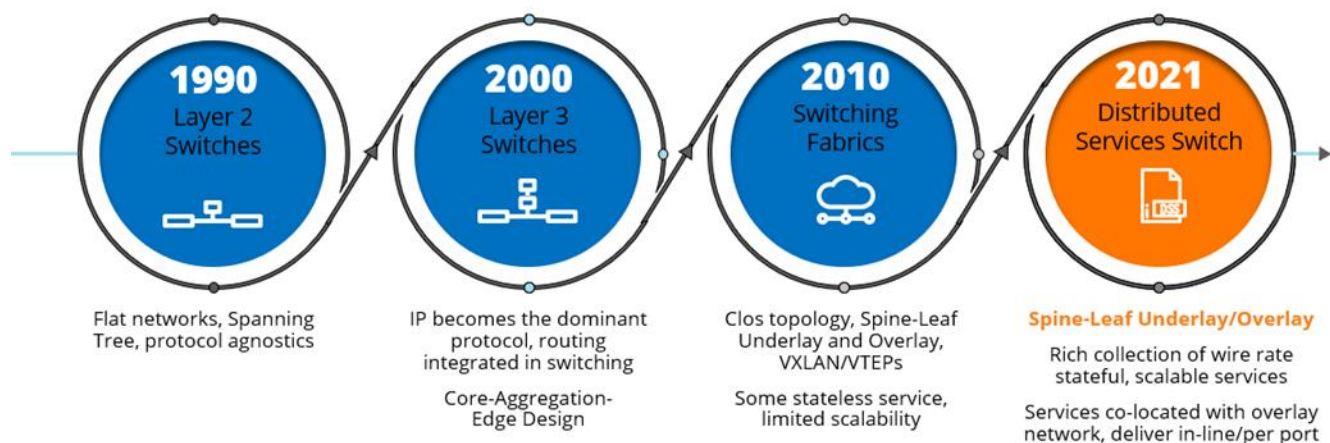
The Aruba Distributed Services Switch

To help organizations create hyperscale-like environments in their existing data centers, Aruba has partnered with Pensando Systems to create a new category of switches—the Aruba Distributed Services Switch.

Founded in 2017, Pensando Systems is pioneering distributed computing designed for the New Edge, powering application and security services to transform existing architectures into secure, ultra-fast environments demanded by next generation, modern applications.

The partnership has enabled network architectures to evolve to better support modern distributed services environments. Figure 3 highlights the evolution of switching architectures from the layer 2 switches of the 90s, to layer 3 switches and then switching fabrics, and then to today, with Aruba introducing distributed services switches to enable modern application environments.

Figure 3. Network Architecture Evolution



Source: HPE Aruba

These distributed services switches will play a significant role in enabling existing data centers as well as creating a robust distributed services environment for new data center deployments.

Aruba and Pensando Integration

The greenfield Aruba Distributed Services Switch integrates Aruba AOS-CX routing and switching technology with Pensando L4- L7 software services and data processing unit (DPU). Aruba created the new CX 10000 fixed form factor 1RU switch leveraging both Broadcom and Pensando processors. The CX 10000 switch supports both 48-port 25G and 6-port 100G connections. The Aruba Fabric Composer (AFC) will serve as the primary unified management engine for network and security orchestration.

The Aruba CX 10000 can help customers expand a zero trust architecture deeper into the data center, providing 800G east-west stateful services across every switch port, dramatically scaling and strengthening the security of critical applications and workloads.

The Aruba CX 10000 stateful services include firewalls, DDoS, encryption, network address translation (NAT), load balancing, and telemetry. Organizations are able to leverage the Pensando Policy and Services Manager (contextually launched from AFC), enabling SecOps teams to perform day one configurations and/or detailed troubleshooting. The combination of Aruba and Pensando technologies enables organizations to deliver unified network and security policies as well as telemetry information.

Benefits to the Organization

According to HPE Aruba, initial implementations of the Aruba CX 10000 with Pensando have demonstrated performance and scale at an order of magnitude over that of traditional L2/3 switches (see Figure 4). This means the Aruba CX 10000 has the ability to non-disruptively scale and create a more secure environment.

Figure 4. HPE Aruba and Pensando Switches Show Improvement to Scale and Performance

Service Metric ¹	Standard Leaf/L3 Switch	CX10000	Improvement
Stateful Firewall Policy Rules	N/A	1M	New
Stateless ACLs	8K	1M	~125x
NAT	8K	1M	~125x
IPsec Tunnels	10K	200K	~20x
IPsec Bandwidth	100G	800G	4x
Connections Per Second	N/A	4M	New

Delivering 800G Inline Performance For Stateful Services

¹ NAT and IPsec enabled via future software update

Source: HPE Aruba

HPE Aruba claims this new architecture has the ability to lower the total cost of ownership (TCO) since organizations will no longer need to buy or deploy additional function-specific appliances, and can stop paying for the maintenance and support or deployment of other legacy environments.

In addition, by deploying these services, organizations can virtually eliminate unnecessary network traffic and service chokepoints, gaining a simplified environment that offers higher availability of application services and applications. Organizations can also attain greater operational efficiencies due to unified network and security policy creation and automation, and achieve improved security by segmenting and delivering multitenancy at the application level.

How to Get Started/Initial Deployments

Organizations focused on implementing a distributed services architecture within their existing on-premises data centers can start by inserting Aruba CX 10000 Distributed Service Switches as ToR, leaf, or access switches. In doing so, the application, security, and telemetry services can be delivered much closer to the applications they are supporting. This will transform the environment and enable stateful services for modern application east-west traffic without needing to hairpin through a tiered network to a number of different appliances and back, degrading the performance in the process. This capability is a natural extension of Aruba's Edge Services Platform (ESP) vision, which was designed to unify, automate, and secure all network edge services across multiple domains including remote sites, branches, campuses, data centers, and provider colocations. The Aruba Fabric Composer (AFC) can serve as the primary unified management engine for network and security orchestration, and organizations can use AFC to quickly and easily turn up services leveraging a guided point

and click workflow and configuration wizard. This allows users to quickly and easily discover Aruba CX 10000 switches and ensure best practices for configuration and distributed services in three simple steps. Tight integration with Pensando Services Manager ensures consistent security policies

Additionally, with security perimeters dissolving, AFC plays an important role by applying zero trust and microsegmentation services closer to the application, which can dramatically improve an organization's security posture. In legacy castle and moat security architectures, once the moat has been breached, attackers have access to all the applications in the data center. In this new architecture, security services can block threats that have originated within the data center, or even in the same rack, by ensuring untrusted east-west connections are not allowed.

Organizations can also leverage an Aruba distributed services architecture to support secure, multi-cloud interconnects. By deploying an Aruba CX 10000 as an edge router in colocation facilities, organizations can employ scalable and stateful Internet Protocol Security (IPsec) encryption, firewalls, network address translation (NAT), and routing capabilities. Aruba claims that organizations deploying these solutions should expect to realize a 75% lower TCO, as well as greater levels of availability and improved security posture.

The Bigger Truth

As modern application environments gain ground, enterprises need to evolve their existing data centers to accommodate these new application architectures. However, most existing data centers still leverage outdated architectures that use individual appliances for each application and security service. While this model worked for legacy applications, it is inefficient and costly, and can dramatically hinder the performance and security of modern applications. A new architecture that lets organizations preserve existing investments in their on-premises data centers—while still providing the scale, agility, security, and performance to embrace modern applications—is required.

Hyperscale cloud providers distribute these modern application and security services as close as possible to the application—and now HPE Aruba, in partnership with Pensando, is enabling organizations to leverage this innovative technology to create a distributed services architecture in enterprise data centers and colocation facilities. The combination of HPE Aruba Switch and Router technologies, Aruba Fabric Controller with Pensando stateful software services, and programmable P4 DPUs lets organizations improve performance and scale their environments, while simultaneously reducing costs and creating operational efficiencies.

Organizations deploying cloud-native applications in existing data centers, or connecting to multiple public clouds, would benefit from exploring how the Aruba CX 10000 can be deployed in existing environments. It will cause minimal disruption, enable a stronger security posture, and considerably improve application performance, resulting in better user experiences at a significantly lower total cost of ownership.

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