ESG Economic Validation

The Value of FlexPod Converged Infrastructure with Cisco UCS M5 Servers and NetApp AFF Storage

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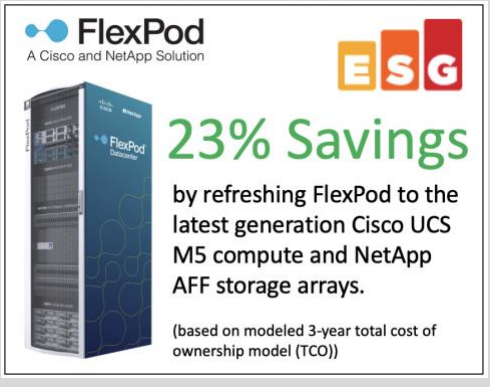
Executive Summary

FlexPod Converged Infrastructure provided by Cisco and NetApp are well-proven solutions that have transformed IT organizations by greatly simplifying and streamlining deployment, provisioning, management, and maintenance. But like any technology, converged solutions should be periodically refreshed to better meet the ever-increasing demands of modern workloads.

ESG validated the benefits that real-world customers have experienced by deploying the latest generation FlexPod powered by dense and powerful Cisco UCS M5 compute and NetApp AFF storage arrays with NVMe. Customers reported significant improvement to application performance, lower operational costs, and a simplified management experience. One customer even stated, *"I've been a system and network admin for 20 years and I've never seen such a dramatic improvement."*

ESG then created a modeled scenario that showed how an organization currently running a five-year old FlexPod based on Cisco UCS M3 compute nodes and NetApp FAS storage systems powered by HDDs could reduce expected costs by 23% over the next three years by refreshing to the latest generation FlexPod powered by Cisco UCS M5 compute and NetApp AFF storage. Despite the capital cost of refreshing the system, the operational savings provided by reduced power, cooling, floorspace, support and maintenance, and administrative costs would allow the organization to modernize its VDI platform while lowering costs and streamlining operations.



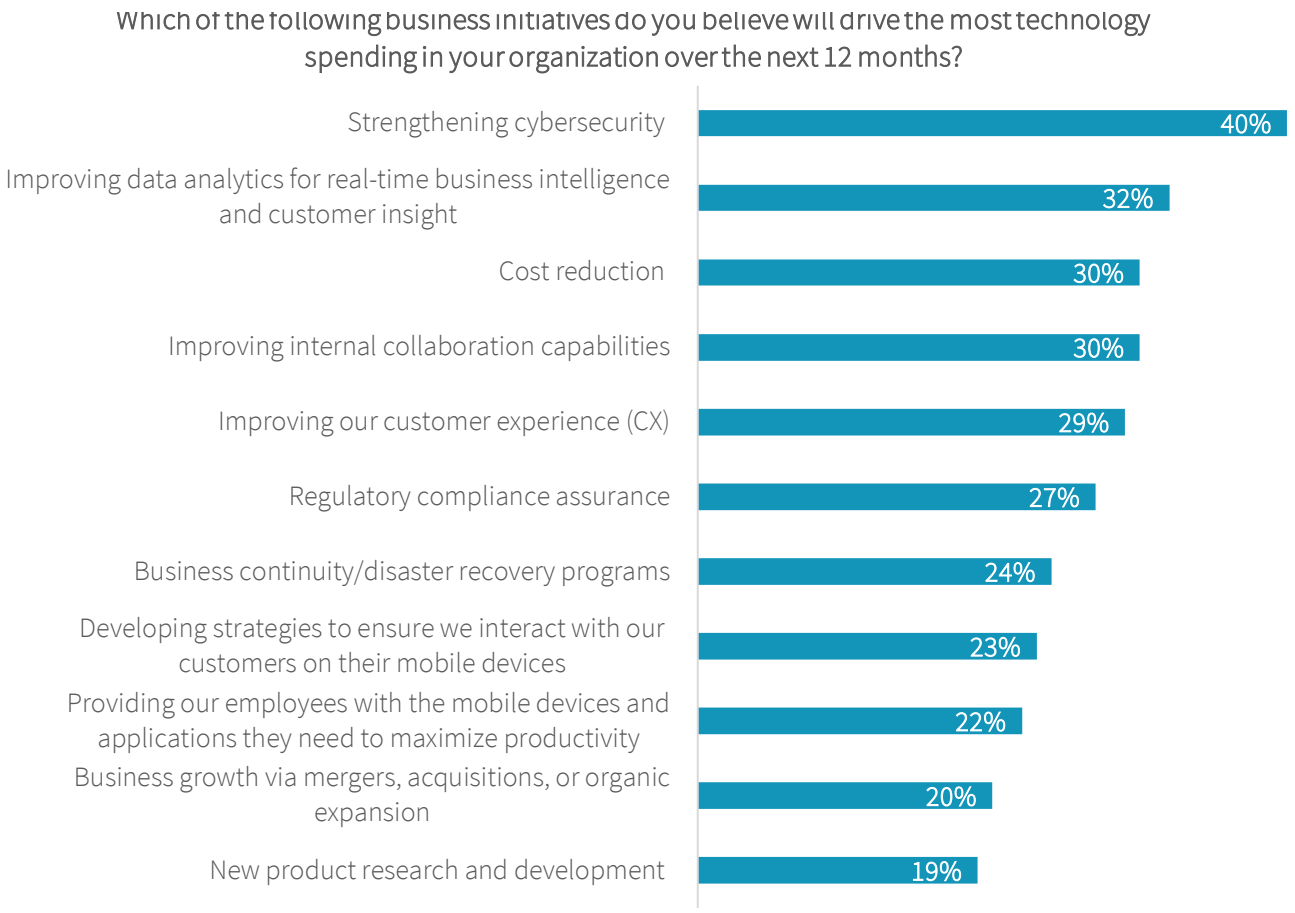
Introduction

This ESG Economic Validation focuses on the quantitative and qualitative benefits organizations can expect to realize when consolidating workloads and/or upgrading earlier generation FlexPod converged architecture systems to the latest generation FlexPod offerings based on Cisco UCS M5 compute and NetApp AFF storage systems.

Challenges

Almost every IT organization has been tasked with the goal of modernizing the data center in an effort to cost-effectively provide increased business agility, enhanced security, and improved decision-making capabilities. ESG research echoes this sentiment, with strengthening cybersecurity, improving data analytics for real-time business intelligence and customer insight, and cost reduction selected by the largest percentages of respondents as among the business initiatives that would drive the most technology spending at their organizations in 2019 (see Figure 1).[1]

Figure 1. Top Business Initiatives Driving Technology Spending



Source: Enterprise Strategy Group

In fact, these top three initiatives can go hand in hand. In addition to identifying new business opportunities, insight derived from next-generation analytics workloads can often identify areas of the IT infrastructure that are at risk as well as IT-related processes that can be optimized and streamlined, ultimately lowering operational cost to the organization. But next-generation analytics workloads like AI/ML require next-generation compute, memory, and storage resources at all

[1] Source: ESG Master Survey Results, *2019 Technology Spending Intentions Survey*, March 2019.

stages of the lifecycle to operate smoothly. In addition, even existing workloads such as server virtualization and VDI can be periodically updated to the latest versions of operating systems and applications that provide improved functionality to end-users but require faster and denser hardware to avoid slowing down the user experience.

Making an investment to replace or consolidate older hardware with newer technology that is denser and more powerful provides a platform that can accelerate existing workloads and run new workloads, while also lowering operational expenses over time. Predicting expected savings and benefits can be difficult, which makes it hard to determine the right time to upgrade your environment. A TCO analysis, built on credible and conservative assumptions, can help to make the decision easier.

The Solution: FlexPod, a Cisco and NetApp Solution Powered by UCS M5 Servers and AFF Storage

The FlexPod Datacenter with NetApp All-Flash FAS system is a converged infrastructure platform that combines best-of breed technologies from NetApp and Cisco into a powerful converged platform for enterprise applications. Like all FlexPod systems, the FlexPod Datacenter with NetApp All-Flash FAS comprises compute (database, virtualization, application, and unified management servers based on the Cisco UCS M5 platform), network (three-layer network and SAN technologies from Cisco), and storage (NetApp All-Flash FAS storage systems with NVMe) (see Figure 2).

Figure 2. Latest Generation FlexPod Converged Architecture

Source: Enterprise Strategy Group

The latest generation FlexPods are available with denser compute, network, and storage components that allow for greater consolidation for both standard three-tier architectures (silos consisting of servers, networking, and storage components) and earlier generation converged architectures. By refreshing earlier generation converged systems to the latest generation FlexPods, organizations can expect to reduce footprint, which in turn results in lower power, cooling, and floorspace costs. Additionally, fewer components to manage along with improved automation, management, and support capabilities help to reduce administrative overhead and streamline operations, resulting in faster time to value for the organization. The latest generation FlexPods are available with:

- Cisco UCS M5 Systems: The Cisco Unified Computing System (UCS) provides a flexible pool of compute and networking resources that can be dynamically allocated to workloads on demand. UCS M5 systems are available in three form factors (blade, rack, and storage) and contain more and faster CPU cores, memory, and multiple NVIDIA GPUs, along with more drive bays and higher-performance NVMe connectivity.

- **Cisco UCS and Nexus Networking:** Cisco UCS 6300/6400 series fabric interconnects support IP, storage, and management traffic at 10/25/40Gbps, and Cisco Nexus Data Center switches are available in a number of models that can scale to provide high performance, intelligence, and secure data center connectivity up to 400Gbps. With UCS SingleConnect technology, the quantity of cables required for connectivity can be reduced by up to 78%.

- **Cisco UCS Central and Intersight Software:** Cisco UCS Central provides global unified management of UCS instances and domains across all locations and enables automation of routine tasks. The Cisco Intersight software-as-a-service infrastructure management platform allows organizations to seamlessly scale to support infrastructure in the data center, at the edge, and at remote locations with less effort. Intersight helps reduce administrative overhead by simplifying firmware updates and by providing HCL validation and insight. It provides intelligent and proactive support integration with the Cisco technical assistance center (TAC) and integration with ServiceNow through a northbound API and Cisco TAC.

- **NetApp AFF Storage with NVMe:** NetApp All-Flash FAS (AFF) A-Series storage arrays can provide end-to-end NVMe delivering ultra-high levels of performance and scalability to help consolidate existing and next-generation workloads. NetApp storage arrays can be clustered to provide simplified migration, scalability, and management with deep application integration. Data reduction technologies such as deduplication, compression, and compaction allow greater consolidation of storage capacity for production workloads and are backed by NetApp's effective storage capacity guarantee. And NetApp storage arrays help to enable hybrid cloud strategies with deep integration and unified management with cloud technologies.

ESG Economic Validation: Refreshing to the Latest Generation FlexPod

ESG's Economic Validation process is a proven method for understanding, validating, quantifying, and modeling the economic value propositions of a product or solution. The process leverages ESG's core competencies in market and industry analysis, forward-looking research, and technical/economic validation. ESG reviewed case studies and conducted in-depth interviews with end-users to better understand and quantify how FlexPod converged architecture has helped to improve operations for their business, and how they would expect that refreshing existing deployments onto the latest generation FlexPods could provide even more benefit to their organization.

ESG's Economic Validation process revealed that replacing earlier generation FlexPods with denser and higher performing Cisco UCS M5 compute systems and NetApp AFF storage arrays with NVMe can provide significant cost savings and economic benefit opportunities. ESG found that refreshing their existing converged systems onto the latest generation FlexPod would be expected to help the organization in three primary areas: reducing costs related to traditional infrastructure and storage TCO, simplifying daily administration, and providing low, predictable latency for workloads.

ESG validated the benefits that had been realized by organizations that had deployed FlexPod with AFF through a series of customer interviews with end-users who had deployed FlexPods with All-Flash FAS storage arrays or had upgraded FlexPod storage systems from FAS systems based on HDDs to AFF systems. These organizations covered a range of industries including service providers, education, and healthcare.

Some of the FlexPod customers with whom ESG spoke had replaced compute solutions from other server vendors or previous generation Cisco UCS M3 servers with Cisco UCS M5 servers. These customers all agreed that the Cisco UCS M5 platform provided them with more compute power, more memory, and increased I/O connectivity per Rack-U, ultimately allowing them to deploy more VMs or compute power for analytics in the same amount of space as before. These customers felt that the cost to upgrade to the latest generation servers was well justified. These customers also revealed that replacing their previous storage solutions with NetApp AFF solutions had helped them eliminate storage performance issues and provided them with significant data reduction capabilities.

FlexPod Economic Overview

ESG's economic analysis revealed that the latest generation FlexPods powered by Cisco UCS M5 Servers and NetApp AFF storage arrays provided customers with significant savings and benefits in the following categories:

- Infrastructure-related Savings – Consolidating workloads and upgrading previous generation FlexPods onto FlexPods with denser compute and storage systems helps to lower operational costs by reducing the number of system components that must be deployed, significantly reducing power-, cooling-, and floorspace-related costs.
- Administration Savings – Fewer components means fewer systems to manage, monitor, secure, and maintain. Significant man-hour savings can be achieved for larger deployments and savings are multiplied with single pane of glass management and automation capabilities with UCS Central and cloud-connected support with Intersight.
- Faster Time to Value and Greater Business Agility – Faster deployment of systems, global insight, improved automation, and more compute and storage headroom to run next-generation workloads like AI/ML mean that IT organizations can better react to the needs of the business through quicker provisioning of resources for workloads, with fewer performance limitations.

Infrastructure-related Savings

ESG found that the latest generation FlexPods, when compared with FlexPods that were several generations old, were capable of providing significant consolidation benefits. By meeting the requirements of workloads with far fewer servers, switches, cables, and storage components; power, cooling, and floorspace costs can be significantly reduced.

- Improvement in compute density and performance – ESG validated that Cisco UCS M5 systems can provide up to ten times more compute power in the same form factor than previous generation M3 systems.
- Reduction in per-processor or per-server licensing costs – UCS M5 servers can handle more VMs per physical processor, providing savings for virtualization (and other software) licenses that are sold per-server or per-processor.

"We were able to grow the RAM in each blade when we needed to, and then add blades as we grew, and finally upgrade the blades to provide an even denser solution when workloads required it"

- Simplification of network infrastructure – By reducing the number of servers and storage components required and providing faster storage and network connectivity, the solution requires fewer switches and cables. This not only lowers cost, but also helps with airflow and reduces cooling costs.
- Improvement in storage density and performance – The latest generation AFF storage arrays from NetApp are able to take advantage of space efficiency technologies like deduplication and compression, even for production workloads. AFF provides ultra-low latency performance for all workloads without impacting other workloads. By replacing the storage requirements of workloads running on previous generation FlexPods based on spinning disk technology with AFF, organizations can potentially reduce the storage footprint by a factor of 11x or more. The consolidation also provides significant savings in power and cooling costs.

Administration Savings

With fewer physical components to manage, administrative burden is significantly reduced. By upgrading to the latest generation FlexPods and leveraging the latest software offerings, administrators who used to require far more compute, network, and storage infrastructure can spend less time performing daily management, monitoring, and maintenance tasks, freeing them up to be more productive and focus on other data center modernization efforts.

- Fewer physical components to manage – Administrators can save time deploying, cabling, labelling, inventorying, updating, and servicing hardware components.
- Improved efficiency of management software – ESG found that the latest software from Cisco and NetApp helped organizations perform repetitive daily management tasks faster, required fewer panes of glass, and were better integrated into their applications.

"We're spending far less time on hardware management—the equivalent of nearly two full-time employees. That's allowing us to focus 90 percent of our team's efforts on creating new tools and adding value."

- Less time spent provisioning and balancing storage – AFF storage from NetApp provides predictable low latency for all applications and allows storage efficiency technologies to be leveraged for production workloads. Administrators reported spending up to 85% more time provisioning storage for workloads, monitoring, and balancing storage for performance on non-AFF systems. With AFF, administrators did not have to worry about placing data on the optimal controller or storage media or keeping workloads from impacting the latency of production workloads.
- Simplified administration of hybrid cloud environments – The latest FlexPod environments are designed to complement a hybrid cloud strategy, making it simpler to leverage cloud storage for backup or tiering,

"Our FlexPod has stayed up rock solid since we installed it. It's been upgraded. It's been maintained. It just keeps working."

- Less time dealing with vendor support – FlexPod users spend far less time dealing with support calls across multiple vendors and reported improved uptime, simplified updates, and easier maintenance with FlexPod.
- Less time dealing with internal support calls – Customers reported that the improved uptime and application performance provided by the latest generation FlexPod made a big change to the end user-experience. One customer who previously dealt with frequent customer support complaint calls from end-users of an application reported, "We moved it to the FlexPod and all of the complaint calls just stopped."

Faster Time to Value and Greater Business Agility

By upgrading to the latest generation FlexPods, you will realize reduced operational expenses, but you will also benefit from the ability to run modern workloads today, or in the near future, that may not have been possible on the previous generation hardware. An investment in the latest generation FlexPod provides a more agile infrastructure capable of providing faster time to value when deploying new applications, and greater business agility to be able to provide the resources required to run next-gen analytics workloads like AI/ML or medical workloads such EHR, imaging, and PACS.

- Quicker provisioning of resources for new workloads – The latest generation FlexPods are based on denser, more powerful servers and NVMe flash storage that provide the headroom required to quickly deploy resources to handle almost any workload without the need to worry about balancing physical resources or moving workloads around to avoid impact to latency.

- Ability to provide the performance required for next-gen workloads – Without upgrading to the latest generation FlexPod, an organization simply may not have the capability to run workloads like AI/ML that require large amounts of processing power and memory and place a large burden on the storage system, potentially impacting production workloads.

"It handles everything that we can throw at it…There's days when it's just sitting there saying 'give me some more work to do' because the flash is so fast."

- Lower latency and increased performance for existing applications – By upgrading to the latest generation FlexPod, organizations may instantly see an increase in application performance, especially if they're migrated from slower compute resources and spinning disk. This "boost" can have a significant effect on end-user satisfaction and may help to alleviate periodic issues previously seen by end-users that were related to a "noisy neighbor."

- Improved business agility and flexible scalability – One of the benefits of FlexPod is that the components can be flexibly scaled independently as needed to meet the changing demands of the business. Storage controllers, disks, or enclosures can be added or even intermixed. Additional chassis, servers, or blades can be added, or existing components can be upgraded with more memory, GPUs, or localized storage as needed.

"We needed a foundational platform that is tightly integrated, easy to manage and scale, and ready to handle whatever workloads our customers put on it, like AI."

- Less time dealing with support – Customers whom we spoke with raved about the support experience that they had with FlexPod: "I have one number to call, there is no pointing of fingers, and then they own it—I can sleep at night knowing it would get resolved." Not having to spend time troubleshooting issues between compute, network, and storage vendors can save organizations significant effort while resolving issues in less time.

ESG Modeled Scenario: Virtual Desktop Infrastructure (VDI)

ESG leveraged the information collected through vendor-provided material, public and industry knowledge of economics and technologies, and the results of customer interviews to create a three-year TCO/ROI model that compares the expected costs of continuing to operate a FlexPod based on Cisco UCS M3 Servers and a FAS storage array populated with HDDs with upgrading to a FlexPod built with powerful Cisco UCS M5 Servers and NetApp AFF storage. The model compared the costs and benefits that would be expected when deploying and/or operating each converged infrastructure configuration in a VDI environment with a goal of quantifying the expected TCO savings that are made possible through the improved density, performance, and administration capability of the latest generation FlexPod with UCS M5 servers and AFF storage.

The model considered an existing VDI deployment hosting up to 2,000 Windows 7 desktops. The configuration was based on a Cisco Validated Design (CVD) published in 2014. The existing deployment consisted of two 5108 UCS Server Chassis,

each with eight B200M3 server blades (a total of 16 blades). Each blade contained two Intel E5-2680v2 10-core processors and 256 GB of memory. 418 TB of usable storage capacity was provided by two NetApp FAS3250 storage arrays, each with 12 DS2246 disk shelves populated with 900GB 10krpm SAS drives. ESG assumed that, of the available capacity, roughly 20% would be available and unused capacity, 30% would consist of snaps and backups, 25% would provide shared storage for applications and file services, and the remaining 25% would provide about 52 GB of persistent storage per Windows 7 desktop.

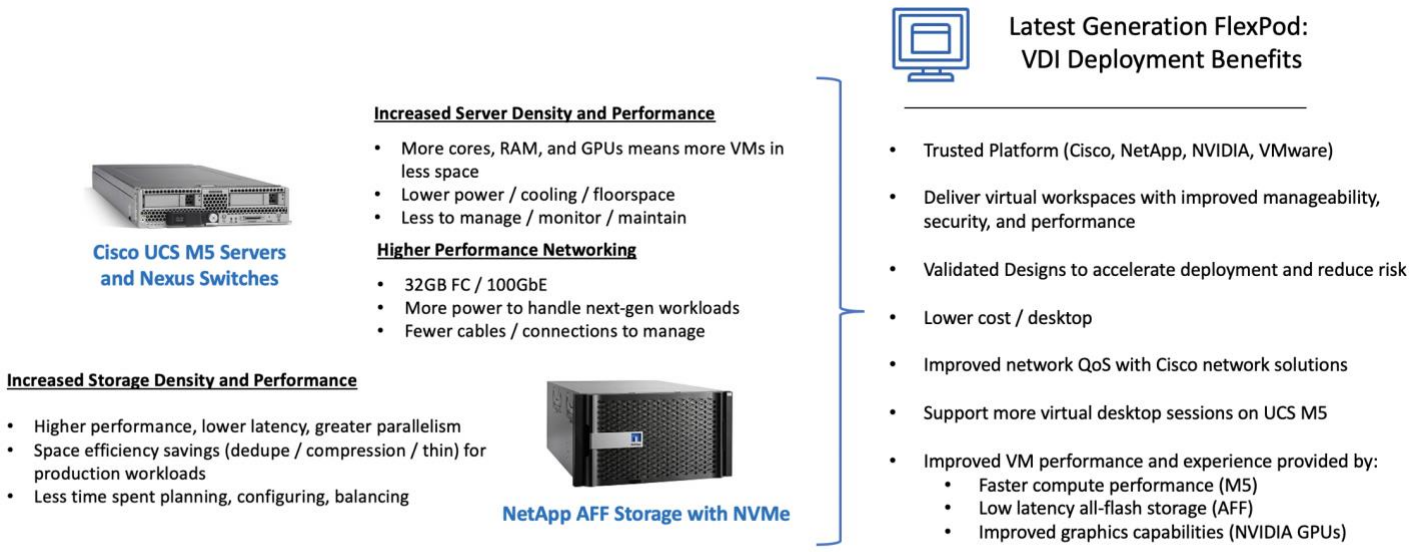
FlexPod deployments are a trusted platform that is perfect for VDI deployments and deliver virtual workspaces with improved manageability, security, and performance. In addition to the improved density and performance improvements provided by the latest generation UCS M5 compute and AFF storage, NVIDIA GPUs can offload graphics while bypassing the hypervisor (UCS M3 compute blades did not support GPUs). GPU accelerated desktops can be provided to users with shared GPUs (for an improved end-user experience with Windows 10 for example) or with dedicated GPUs for each desktop for graphics-intensive applications (such as 3D design or medical diagnostics). Figure 3 summarizes some of the benefits of FlexPod for use in VDI deployments.

Why This Matters

Organizations have realized years of significant operational savings as a result of first deploying their FlexPods, but there may be significant economic benefits to now upgrading these systems to the latest generation offerings.

It is important to perform a TCO analysis to see when a FlexPod refresh makes economic sense. ESG's analysis shows that, for those running UCS M3 servers with spinning disk FAS systems, now is a great time to consider a refresh!

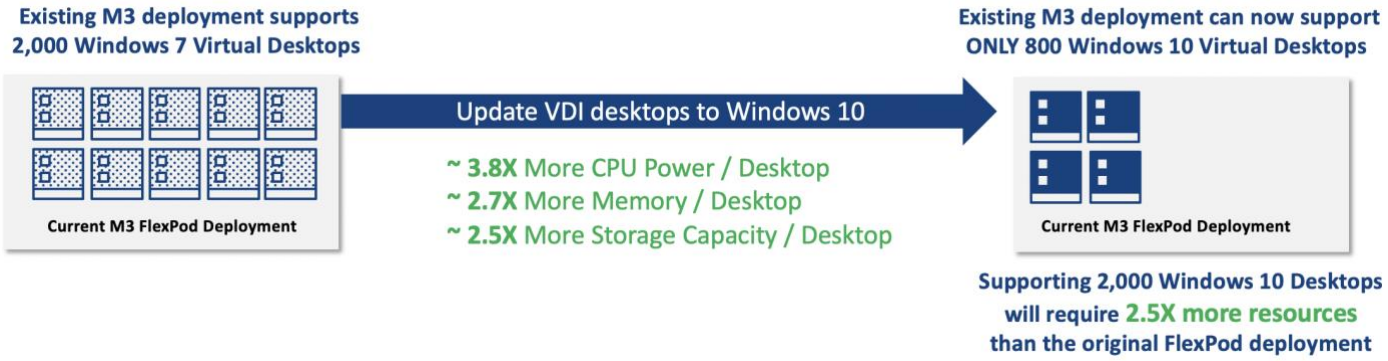
Figure 3. Benefit Summary of Latest Generation FlexPod Components in VDI Deployments



Source: Enterprise Strategy Group

ESG assumed that the modeled organization had made the decision to upgrade its VDI deployment from Windows 7 to Windows 10. ESG assumed that the increased demand placed on the existing hardware to provide a positive user experience on Windows 10 would mean that the existing solution when upgraded would no longer be capable of handling 2,000 virtual desktops. Based on discussions with engineers and customers, we estimated that this configuration would now be able to provide 800 Windows 10 Desktops based on the increased demand for CPU and memory per desktop. In addition, the organization would need to expand its usable storage capacity by 104 TB to provide a total of about 130 GB for each Windows 10 desktop.

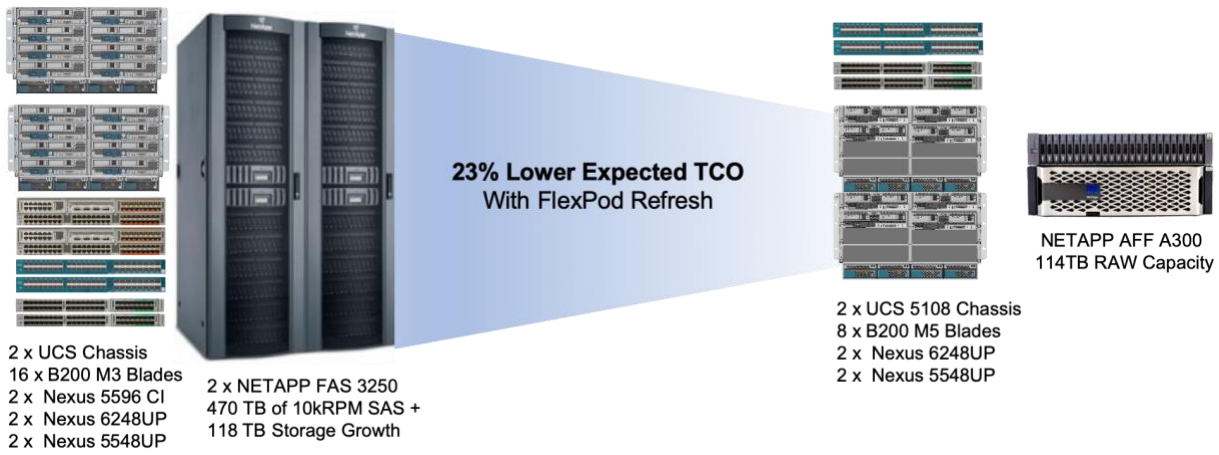
Figure 4. Windows 10 Desktops Require Roughly 2.5x More Physical Resources than Windows 7 Desktops



Source: Enterprise Strategy Group

ESG then worked with Cisco and NetApp engineers to size a latest generation FlexPod solution that could handle the same 800 Windows 10 virtual desktops. The refreshed configuration also contained two 5108 UCS Server Chassis for redundancy but required only half as many UCS B200M5 server blades (a total of 8 blades). Each blade contained two Intel E6230 20-core processors and 768 GB of memory. 522 TB of effective storage capacity was provided by a single AFF A300 all-flash storage array with 114 TB of flash storage capacity (assuming a conservative 5:1 data reduction ratio). The existing and proposed refreshed solutions are shown in Figure 5.

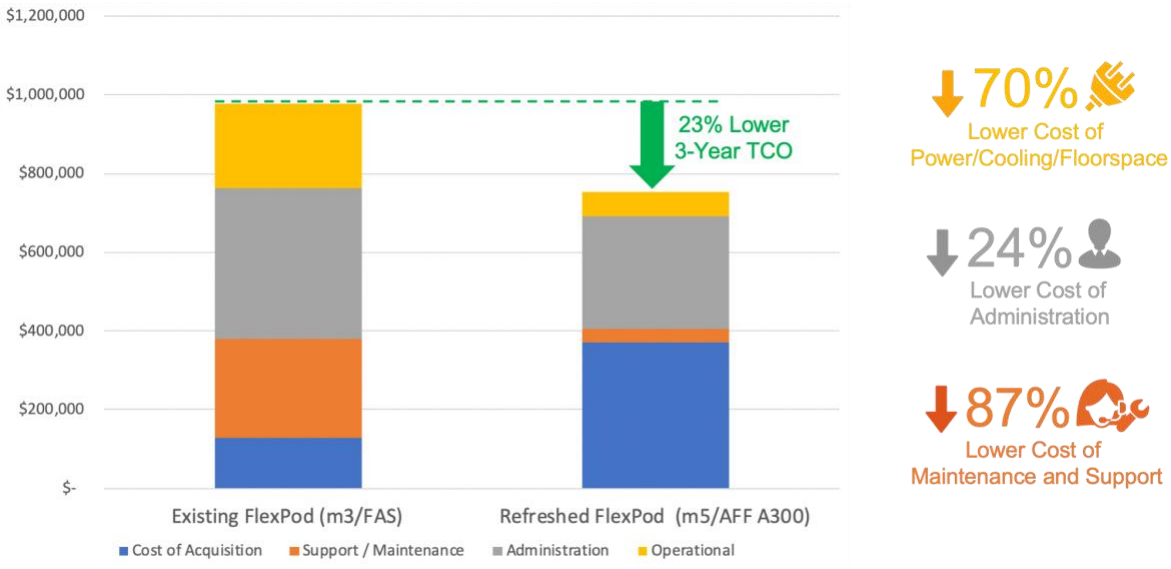
Figure 5. Existing and Proposed Refreshed FlexPod Solution Used in Modeled Scenario



Source: Enterprise Strategy Group

The model calculated and reported the expected costs that would be incurred for the two configurations, including cost of acquisition, power/cooling/floor space, support/maintenance, and administration over a three-year period. The model predicted that providing the 800 Windows 10 Desktops after refreshing the VDI solution with the latest generation FlexPod would provide an expected total cost of ownership that is 23% lower than if the organization expanded the storage capacity and continued to operate the existing FlexPod solution deployed in 2014. The results of the TCO analysis are shown in Figure 6.

Figure 6. Expected Three-year Total Cost of Ownership to Provide 800 Windows 10 Desktops



Source: Enterprise Strategy Group

Although the expected cost of refreshing the solution was nearly three times the cost of expanding the storage capacity of the existing solution, the operational savings and advantages provided by the refreshed solution prove that the refresh is a sound investment. By greatly reducing the storage footprint of the solution by nearly ten times, eliminating the need for cluster interconnect switches, and providing a denser compute platform that requires half of the number of blade servers, the expected cost of power, cooling, and floorspace is lowered by 70% (an expected annual savings of over $50K). The costs for support contracts purchased or included with the new purchase are far lower than for the extended maintenance contracts typically paid for when the original solution was purchased five years ago (ESG assumed a cost of 15% of the original purchase price annually). In addition, the refreshed solution has fewer components to maintain, especially in the storage systems. The result is an expected support and maintenance cost that is 87% lower, or an annual savings of roughly $73K. Finally, ESG modeled the expected administration costs around deploying, migrating data, monitoring and balancing, updating and patching, and other daily administration of the system. While both the original system and refreshed systems provide simplified management compared to traditional solutions, the fact that there are fewer systems and components to manage in the refreshed solution, along with the latest management, integration, automation, orchestration, and support capabilities means even greater administrative savings for the refreshed solution. ESG's model predicted a cost of administration that is 24% lower, providing savings of $31K annually.

By greatly reducing the storage footprint of the solution by nearly ten times, eliminating the need for cluster interconnect switches, and providing a denser compute platform that requires half of the number of blade servers, the expected cost of power, cooling, and floorspace is lowered by 70%.

It should be noted that the data and conclusions presented in this report reflect the output of ESG's economic analysis based on the specific use cases and assumptions modeled for this report. ESG acknowledges that changes to these assumptions will lead to a different set of results, and therefore advises IT professionals to use this report as one validation point in a comprehensive financial analysis prior to making a purchase decision. The model as described in this paper does not consider partial system replacement, which in some cases can result in greater savings.

Pricing assumptions for FlexPod products were provided by Cisco, NetApp, and/or partners. Other IT equipment and labor cost assumptions were obtained from publicly available sources such as IT vendor websites and published price lists. ESG

acknowledges that list prices, configuration details, or other data used as inputs may vary depending on information sources.

The Bigger Truth

As organizations look to modernize their data center and applications, consolidating silos of servers, networking components, and storage into converged systems makes great sense. The business justification for consolidation into a converged architecture, such as FlexPod, that is simple to deploy, manage, maintain, refresh, repurpose, and grow is a relatively easy case to make. ESG validated the many benefits that customers have seen as a result of consolidating siloed systems onto FlexPod in a 2017 report.[2] A converged system provides a faster time to value and helps to lower operational costs such as administration, maintenance, power, cooling, and floorspace. Even better, the latest generation FlexPods provide cloud enabling technologies like the data fabric powered by NetApp to provide a consistent set of data management and data services across all endpoints (on-premise, edge, and multiple clouds), and Cisco Cloud Center software to securely deploy and manage applications across private, hybrid, and multi-cloud environments.

But like any technology, organizations should consider refreshing converged systems from time to time as denser and higher performing components are made available. While refreshing siloed components from multiple vendors and release dates on their own can be risky from an interoperability standpoint, refreshing a FlexPod is simple and safe. Components can be upgraded or refreshed individually with certified components or the system as a whole can be refreshed to take advantage of the latest technologies and capabilities. Refreshing individual components historically has posed a problem since moving data and workloads can have a major impact on applications. With FlexPod, migration is made quick and easy through virtualization automation and the clustering ability of NetApp storage arrays with far less risk or impact to operations. Existing compute, network, and storage resources in a refreshed FlexPod can be integrated into the new solution, easily repurposed as a complete unit, or split into individual components to be used for other important tasks (for example, as a backup or DR target for the new FlexPod). So, it is clear that converged systems should be periodically refreshed, but when is the right time to refresh?

Understanding when technology offers significant technological advantages or functionality that can help to lower operational expenses and positively affect the bottom line of the business is important. A credible total cost of ownership (TCO) analysis provides a solid understanding of the costs that will be incurred by continuing to operate your environment versus the costs that will be incurred if you choose to make a capital investment to consolidate the environment to more powerful FlexPods.

ESG created a modeled analysis for an organization currently running a five-year-old FlexPod that consisted of B200 M3 servers and 10krpm SAS storage arrays. The organization was looking to upgrade its 2,000 virtual desktop deployment from Windows 7 to Windows 10 Desktops, resulting in an increased need for modern hardware. ESG's analysis showed that a refresh to the latest generation FlexPod leveraging Cisco UCS B200 M5 Servers and AFF storage from NetApp would result in an expected total cost of ownership that was 23% lower over the next three years than continuing to operate the existing FlexPod. The operational savings were provided by:

- Lower infrastructure-related costs as a result of greatly reducing the footprint of the solution.
- Lower support and maintenance costs as a result of eliminating expensive extended maintenance contracts.
- Lower administrative costs as a result of managing a single, denser system through a single pane of glass.

[2] Source: ESG Economic Value Validation, *Quantifying the Value of FlexPod Converged Infrastructure with Cisco M4 Servers and NetApp All-Flash FAS (AFF) Storage Arrays*, January 2017.

While ESG's models are built in good faith upon conservative, credible, and validated assumptions, no single modeled scenario will ever represent every potential environment. ESG recommends that you perform your own TCO analysis and consult with your Cisco and NetApp representative to see if it's time for you to consider refreshing all or a portion of your FlexPod deployment with the latest generation UCS servers and AFF storage with NVMe from NetApp. Besides making great economic sense, a refreshed FlexPod would not only better meet the needs of today's workloads, but also provide a scalable modern platform capable of handling workloads in the future.