



# FlexPod Advantage: Performance, Agility, Economics

## Abstract

With more than 8 years of partnership in providing FlexPod® solutions to more than 9,000 customers, Cisco and NetApp have set the standard for flexible, converged infrastructure solutions that deliver prevalidated storage, networking, and server technologies. This paper examines the key attributes that set FlexPod apart from other full stack IT solutions.

## Introduction

The FlexPod portfolio includes components that combine current and new workloads with NetApp® storage systems, Cisco Unified Computing System™ servers, and Cisco Nexus® fabric switches into a validated architecture that is a highly efficient operational model for workload deployments. FlexPod is built on a NetApp and Cisco partnership that spans 20 years. Cisco and NetApp have teamed for more than 9 years in developing the diverse and comprehensive FlexPod converged infrastructure solution portfolio. Through these large, long-term investments by Cisco and NetApp, FlexPod makes your innovations easier to deploy in today's enterprise data centers. FlexPod consistently updates current workloads (SQL Server, Oracle, SAP, and more) and adds new technologies and verticals (VDI, EPIC, AI and ML) to its vast solution portfolio. These two key FlexPod ingredients (technology and simplification) give FlexPod based enterprises a huge advantage in delivering new services and applications for their customers.

## FlexPod Embraces Private and Hybrid Clouds with Confidence

FlexPod supports multicloud strategies by providing a converged infrastructure that readily extends to the cloud, allowing customers to embrace hybrid cloud with unmatched versatility, and it powers modern applications with the latest platform innovations and world-class performance.



The latest FlexPod technologies include:

- Cisco Nexus, built for scale, industry-leading automation, ACI Anywhere programmability, and real-time visibility
- Cisco Unified Computing System, delivering the next-generation fabric with support for 100GbE, 32GB Fibre Channel and NVMe over fabric, and a purpose-built server for deep learning
- NetApp ONTAP® AFF A800 storage arrays; support for 100GbE and 32GB FC; and end-to-end NVMe over Fibre Channel

FlexPod versatility and next-generation technologies enable customers to embrace the cloud with confidence. With FlexPod, NetApp storage arrays, and Cisco CloudCenter™, customers can leverage the NetApp Data Fabric to easily manage from edge to core to cloud to support demanding data and compute requirements. The Cisco Nexus fabric offers application agility through a policy-driven automated framework that delivers consistent capabilities across customers' on-premises and public cloud environments. FlexPod also enables interoperability with a growing list of public clouds, including Google Cloud, AWS, Azure, and IBM. FlexPod customers can modernize on their premises and off with cloud-connected flash, building clouds to deliver new services or inspiring innovation in any cloud. Customers can start anywhere with confidence, knowing that FlexPod will satisfy their unique business requirements and multicloud strategy.

FlexPod integrates advanced cloud services with the only hybrid, multicloud converged infrastructure stack that leverages the NetApp Data Fabric, an architecture and set of data services that provide consistent capabilities across a choice of endpoints, spanning on-premises and multiple cloud environments. The Data Fabric simplifies and integrates data management across the cloud and on the premises to accelerate digital transformation. It delivers consistent and integrated hybrid cloud data services for data visibility and insights, data access and control, and data protection and security. In addition, FlexPod customers can use Cisco CloudCenter to securely deploy and manage applications in multiple data center, private cloud, and public cloud environments. This software solution helps you modernize and automate your data center or add public cloud application deployments to your service offering.

By embracing the cloud and new workloads, customers can be assured that there is a FlexPod design that can meet their application and workload requirements and protect their application and infrastructure investment. The FlexPod platform is trusted worldwide—and its future is even brighter than its past.

### **Spotlight on Technology**

This Spotlight on Technology paper highlights three compelling characteristics of FlexPod when deployed in enterprise database and virtual environments: performance, agility, and economics. This paper offers evidence of each of these characteristics with validated proof points.

### **Performance**

The high performance of a FlexPod solution results in the ability to confidently deploy multitenant architectures with applications that are responsive to the demands of administrators and end users alike. A single validated platform delivers industry-leading capabilities across components to customize a solution that relieves

performance-inhibiting bottlenecks. NetApp AFF storage systems offer a new performance standard for enterprise data centers, with the ability to deliver up to 11.4 million IOPS at 1ms latency in a cluster with a truly unified scale-out architecture, allowing nondisruptive integration of new technologies such as NVMe<sup>1</sup> Unified SAN and NAS delivery means that this high performance can be shared over database and enterprise applications on a single platform. Built-in data protection with integration for leading application vendors, including Microsoft, Oracle, and SAP, offers an additional layer of assurance that data will perform when it's needed most. Cisco UCS<sup>®</sup> servers have more than 150 world-record benchmarks<sup>14</sup> offering multiple blade and rack server options to relieve performance bottlenecks. Low-latency fabric and interfaces with bandwidths of up to 100Gbps deliver high-speed connectivity in FlexPod solutions.

### **20x Reduction in Latency over Traditional Disk**

To demonstrate performance variances between legacy HDD-based storage arrays and modern SSD-based arrays, NetApp recently performed comparison tests<sup>1</sup> using SQL Server 2014 and the publicly available HammerDB workload generator to simulate an OLTP environment, driven simultaneously from each of 10 database servers. Initially, the SQL Server workload was directed to a legacy storage array containing 144 450GB 15K HDDs, and the database load was increased until consistent read latencies of 20ms were observed. After this baseline performance of the legacy storage system was captured, identical database and HammerDB configurations were directed to a NetApp AFF8080 EX configured with 48 400GB SSDs. The results were striking: 20x reduction in I/O latencies, 4x improvement in storage IOPS, and 4x improvement in SQL Server CPU utilization. In addition, performance

headroom remaining on the AFF8080 EX would enable it to deliver further performance increases above what was observed in the comparison tests. This test validated the fact that a FlexPod configuration equipped with NetApp all-flash storage could be configured with fewer servers, fewer storage devices, and fewer network connection points while still delivering superior database performance.

### **208% Faster SQL Server Response Time**

Scalability Experts, a triple Gold Microsoft Partner, performed SQL Server 2014 load tests<sup>2</sup> using a real-world workload from Iforium, one of the UK's leading online gaming companies, and a FlexPod solution consisting of Cisco UCS blade servers, Cisco Nexus unified fabric switches, and a NetApp FAS8020 hybrid storage array configured with 48 600GB SAS HDDs and 1TB of Flash Cache™. The testing took place over several weeks as simulations of up to 50,000 concurrent Iforium users were performed and evaluated. The test results<sup>3</sup> confirmed 208% faster SQL Server transaction response times, 250% faster page response times, and very sequential linear scalability, with overall 3x performance with FlexPod compared to Scalability Experts' SQL Server testing norms and Iforium's prior workload experience. These tests confirmed that FlexPod configured with a relatively small amount of storage flash could contribute a significant amount of performance boost.

### **150+ World Record Benchmarks**

During the Cisco and NetApp FlexPod partnership, more than 150 world-record<sup>14</sup> benchmarks have been recorded, including the first-ever posting of the TPCx-HS Hadoop sort 100TB benchmark. This benchmark stresses both hardware and software and includes Hadoop runtime, Hadoop file system API-compatible systems, and MapReduce layers. Using 32 Cisco UCS servers, 21.99 HSph at 100TB was posted,<sup>5</sup> a

measurement of the time required to sort 1 trillion Hadoop records. The fact that Cisco UCS servers were employed in this first-ever attempt at a large-scale big data benchmark is testament to a commitment to performance excellence. When big data calls for big performance, FlexPod validated designs for Hadoop<sup>6</sup> mean that businesses can meet tight SLAs around data performance while reducing the risk of deploying new applications.

### **FlexPod Agility**

FlexPod keeps IT teams responsive to the demands of end users with the ability to accelerate the deployments of infrastructure and applications. The simplification and automation of tasks increase productivity and time to service for IT customers. The reduction of error-prone processes and guesswork reduces risk and increases confidence in the rapid deployment of new services. Cisco Application Centric Infrastructure (Cisco ACI<sup>®</sup>) reduces TCO, automates IT tasks, and accelerates data center application deployments. The combination of validated designs with high-performance infrastructure offers a platform for rapid application test and delivery. Validated designs with management and automation tools mean that more resources can be applied to new services and innovation for the business.

### **83% Faster Provisioning with Cisco ACI**

UK cloud service provider Pulsant deployed Cisco ACI as the basis for the Pulsant Cloud Fabric, connecting two data centers that deliver hybrid cloud services. Pulsant simplified provisioning and sped up delivery of its cloud services through policy, orchestration, and automation enabled by Cisco ACI. With a previous average delivery time of 7 to 14 days for custom cloud services, Pulsant now needs only 2 to 3 days. They also reduced the time needed for network uplink provisioning from 1 hour to 10 minutes, or 83% less time.<sup>7</sup> FlexPod, the first converged infrastructure solution to

support Cisco ACI, has several validated designs<sup>8</sup> that offer a pre-designed, best practice data center architecture that incorporates Cisco ACI.

### **20% to 30% Reduction in Application Testing Time**

Citrix wanted to increase its DevOps focus to enable faster test/dev cycles on multiple simultaneous releases of its XenApp and XenDesktop applications, but the company felt that its current lab infrastructure did not have the necessary power for the intense compute and I/O resources needed for this workload.

After considering several options, Citrix deployed a completely flash-based FlexPod configuration<sup>9</sup> and immediately noticed a significant improvement. Storage latency improved by 4x to 10x, reducing the required time to complete tests by 20% to 30%. The team can now run up to 125 tests in parallel, and with increased frequency. Testing at scale is consistent, fast, and reliable, and tests no longer need to be extended or repeated. According to a Citrix product development manager, "With NetApp and FlexPod, we can scale up or out as needed and maintain low latencies even as we increase the number of concurrent tests."

### **70% of Engineering Time Reclaimed**

Symantec's goal for its Granite Labs project was immense: to replace hundreds of labs in 25 locations around the world with a completely software-defined data center that could host tens of thousands of virtual machines and supply an entirely self-service private cloud infrastructure to more than 3,000 employees. Over a period of 15 months, with the help of VMware, Cisco, and NetApp and the implementation of a complete VSphere and FlexPod environment, Granite Labs became a reality: a single, shared pool of networking, storage, and compute resources. With an average lab provisioning time of 17 minutes, Symantec estimates that Granite Labs has

eliminated 37,000 weeks, or about 70%, of engineering time, that would previously have been spent on manually provisioning lab environments. That time can now be spent focusing on customer satisfaction issues.<sup>10</sup> Agility factors cited by Symantec were (1) the FlexPod environment acts as one seamless system within a single VMware vCloud instance and uses the NFS protocol, providing the flexibility to meet changing requirements; and (2) FlexPod allows scaling the private cloud as needed by using dense, easily deployed building blocks.

### **Economics**

FlexPod solutions deliver real savings for both capex and opex. With flash memory approaching the cost of disk, it is no longer reserved for only high-performance workloads. Several flash benefits can be realized for all workloads. The reduced footprint of solid state drives can help consolidate data center space. Additional savings may also be realized from reduced power consumption with flash memory. NetApp AFF can reduce storage by 5x to 10x with data-reduction technologies. Continuing improvements in flash module longevity can mean more time between replacement cycles. Investment protection is guaranteed with the ability to reuse existing components in a FlexPod deployment, and it's backed by a free storage controller upgrade program.

### **76% ROI in Just 17 Months**

Forrester Consulting examined the return on investment (ROI) that enterprises could realize by adopting the FlexPod platform. In this study,<sup>11</sup> Forrester calculated the costs and savings of a FlexPod system deployed over a 3-year period at a large entertainment company with a variety of related businesses, including hotels, casinos, restaurants, and retail shops. Results of this study confirmed a risk-adjusted ROI of 76% with a 17-month payback. Total costs amounted to \$1,137,060, and total benefits were

\$1,995,742, a net present value (NPV) of \$858,682. Financial verbiage aside, several key technologies allowed the company to achieve this high level of ROI. First, 45 physical legacy servers residing in 8 locations were replaced with 45 virtualized servers residing on the single FlexPod configuration. Next, several storage efficiency technologies, specifically deduplication, virtual cloning, and thin provisioning, allowed the company to reduce storage costs by 60% to 70%. Finally, the unified, embedded management of FlexPod components allowed the company to manage dozens of resources with less operational overhead, returning the equivalent costs of one server administrator and one storage administrator per year.

### **Free Storage Controller Upgrade**

NetApp recently announced a program<sup>12</sup> that allows FlexPod all-flash storage controllers to be upgraded to newer and faster controllers for free. Although free is always a nice thing, with obvious benefits to the bottom line, upgrades of storage controllers are potentially the most disruptive event that can occur for enterprise applications, because storage controllers are often taken offline for extended periods during controller replacement and associated data migration. Fortunately, NetApp storage controllers contained in FlexPod systems are grouped into high-availability (HA) pairs. During the controller upgrade process, storage devices connected to the downed controller are logically reassigned to an alternative controller for the duration of the upgrade. The data stays intact on its original storage because network I/O requests are serviced by the alternative controller. After the upgrade is complete, all storage devices are reassigned back to their original path. In this manner, FlexPod users can reduce costs and take advantage of the latest technology without disruption to business.

## Performance of Flash at the Price of Disk

For years, people have been predicting the demise of rotating disk in favor of silicon-based storage devices. The recent release of the 3.8TB SSD is a big step in reducing the cost/capacity price gap. Higher capacity SSDs, available on FlexPod systems, can now take the place of legions of short-stroked, high-performance HDDs at price parity. Other than FlexPod, very few storage arrays support this new class of high-capacity SSD devices. Most of these arrays contain inline deduplication and data compression, which generate significant metadata and require CPU-intensive real-time space reduction. As SSD capacities rise, these vendors are being challenged in maintaining throughput while also performing dynamic space storage efficiency techniques. The NetApp storage arrays contained in FlexPod systems have no such challenge; they've been built from the ground up to support massive scale-up and scale-out architectures.

## Summary

With enterprise organizations processing billions of I/O instructions each day, every microsecond counts. FlexPod converged infrastructure solutions represent the latest generation of high-performance servers, networking switches, and storage arrays, bringing the sustained and consistent performance required by business applications.

Enterprise application owners are extremely risk averse. Who can blame them, when the fate of an entire company rests on their shoulders? FlexPod unified management and validated designs leverage proven platform architectures that offer agility with low risk.

NetApp and Cisco have more than 9 years of partnership in providing FlexPod with industry-leading investment protection. Customers can be confident that their investments in FlexPod today will enable their businesses to succeed and

evolve with the changing business and IT landscape. The FlexPod Advantage program helps customers understand the performance, agility, and economic benefits of FlexPod.

## About NetApp

NetApp is the data authority for hybrid cloud. We provide a full range of hybrid cloud data services that simplify management of applications and data across cloud and on-premises environments to accelerate digital transformation. Together with our partners, we empower global organizations to unleash the full potential of their data to expand customer touchpoints, foster greater innovation, and optimize their operations. For more information, visit [www.netapp.com](http://www.netapp.com). #DataDriven

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