



# FlexPod<sup>®</sup>

NetApp Spotlight on Technologies

FlexPod Advantage: Performance, Agility, Economics

## Abstract

With a five-year history in providing FlexPod<sup>®</sup> solutions to over 7,000 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

Cisco and NetApp have teamed for over five years in developing the FlexPod converged infrastructure solution portfolio. This portfolio includes components that combine NetApp® storage systems, Cisco Unified Computing System servers, and Cisco Nexus fabric switches into a validated architecture that provides a highly efficient operational model for workload deployments. The FlexPod platform has proven to be an ideal solution for many leading workloads, including Microsoft SQL Server, Oracle, virtual desktop infrastructure solutions, and shared workloads. The recently announced FlexPod Advantage program highlights three compelling characteristics of FlexPod when deployed in enterprise database and virtual environments: performance, agility, and economics. In this paper, we offer evidence of each of these characteristics with validated proof points that provide further substantiation.

## FlexPod 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 best-in-class capabilities across components to customize a solution that relieves performance-inhibiting bottlenecks. All Flash FAS systems deliver a new performance standard for enterprise data centers with the ability to deliver up to 4 million IOPS with 1ms latencies. 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, provides an additional layer of assurance that data will perform when it is needed most. Cisco UCS servers have over 100 world record benchmarks, 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 over and 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.

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<sup>1</sup> <https://www.netapp.com/us/media/tr-4403.pdf>.

## 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.

## 100+ World Record Benchmarks

- During the period of Cisco and NetApp FlexPod partnership, over 100 world record<sup>4</sup> benchmarks have been recorded, including the first-ever posting of the TPC's 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 for 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 (ACI) reduces TCO, automates IT tasks, and accelerates data center application deployments. The combination of validated designs with high-performance infrastructure delivers 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 ACI

- UK cloud service provider Pulsant deployed Cisco's ACI as the basis for the Pulsant Cloud Fabric, connecting two data centers used to deliver hybrid cloud services. Pulsant simplified provisioning and sped up delivery of its cloud services through policy, orchestration, and automation enabled by Cisco

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<sup>2</sup> [http://resources.idgenterprise.com/original/AST-0146931\\_Technical\\_WP\\_FlexPod\\_Iforium\\_Load\\_Test\\_4.15\\_Final.pdf](http://resources.idgenterprise.com/original/AST-0146931_Technical_WP_FlexPod_Iforium_Load_Test_4.15_Final.pdf).

<sup>3</sup> <http://www.scalabilityexperts.com/scalability-experts/news/scalability-experts-recognized-as-winner-for-2015-microsoft-data-platt/>.

<sup>4</sup> [http://www.cisco.com/c/dam/en/us/products/collateral/servers-unified-computing/le\\_32801\\_pb\\_ucs\\_worldrecords.pdf](http://www.cisco.com/c/dam/en/us/products/collateral/servers-unified-computing/le_32801_pb_ucs_worldrecords.pdf).

<sup>5</sup> [http://www.tpc.org/tpcx-hs/results/tpcxhs\\_result\\_detail.asp?id=115102301](http://www.tpc.org/tpcx-hs/results/tpcxhs_result_detail.asp?id=115102301).

<sup>6</sup> [http://www.cisco.com/c/en/us/td/docs/unified\\_computing/ucs/UCS\\_CVDs/flexpod\\_hadoop\\_cloudera.pdf](http://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/UCS_CVDs/flexpod_hadoop_cloudera.pdf).

ACI. With an average delivery time of 7 to 14 days for custom cloud services, Pulsant now needs only 2 to 3 days and 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 provide a predesigned, 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 did not feel its current lab infrastructure had the necessary horsepower to power 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 for tests to complete 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 VMs and supply an entirely self-service private cloud infrastructure to over 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 reclaimed 37,000 weeks, or 70%, of engineering time that can now focus on customer satisfaction issues rather than provisioning lab environments.<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, giving 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 drive the consolidation of data center space. Additional savings may also be realized from reduced power consumption with flash memory. All Flash FAS can reduce storage by 5x to 10x with data-reduction technologies. Continuing improvements in flash module longevity can enable more time between replacement cycles. Investment

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<sup>7</sup> <https://www.cisco.com/c/dam/en/us/solutions/collateral/data-center-virtualization/application-centric-infrastructure/idc-pulsant.pdf>.

<sup>8</sup> [http://www.cisco.com/c/en/us/td/docs/unified\\_computing/ucs/UCS\\_CVDs/flexpod\\_esxi55u2\\_n9k\\_aci\\_aff8040\\_design.html](http://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/UCS_CVDs/flexpod_esxi55u2_n9k_aci_aff8040_design.html).

<sup>9</sup> <http://www.netapp.com/us/media/cs-citrix.pdf>.

<sup>10</sup> <http://www.netapp.com/us/media/na-206-1214.pdf>.

protection not only is guaranteed with the ability to reuse existing components in a FlexPod deployment, but also is backed by a free storage controller upgrade program.

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

- Forrester Consulting recently 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 three-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. While 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 within 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 are supporting 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-intense

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<sup>11</sup> <http://www.netapp.com/us/forms/gatedassetonnetappcom-forrester.aspx> (registration required).

<sup>12</sup> <http://www.netapp.com/us/company/news/press-releases/news-rel-20150924-682390.aspx>.

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 within FlexPod systems have no such challenge, having 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 provide agility with low risk.

NetApp and Cisco have a five-year history of 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.

Refer to the [Interoperability Matrix Tool \(IMT\)](#) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

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