



The FlexPod Advantage

Introduction

- [Why refresh IT infrastructure now?](#)
- [What's new with FlexPod](#)
- [The FlexPod advantage](#)



What's new with FlexPod

Refreshing your IT infrastructure with FlexPod gives you access to a trusted platform with unmatched versatility that unlocks the value of your critical data. FlexPod provides:

- Higher CPU performance to support more virtual machines and applications in less rack space
- Intel® Optane™ DC persistent memory to allow large memory capacities at an affordable price
- Accelerated storage and application performance
- An order of magnitude improvement in latencies to shorten time to results
- Higher network throughput and greater network security to speed and protect application layers



Standing still isn't an option

Updating to the latest FlexPod advancements helps fuel IT innovation and application and business performance.

Applications drive IT infrastructure refresh cycles

Everywhere you look there is more data to process. Although the nature of applications continues to change and expand, a lot of data remains untapped. As more users and applications try to tap in and gain insight in real time, the need to quickly ingest, collect, store, and process data continues at a rapid pace—a pace that most aging infrastructure and even systems that are only two to three years old simply cannot handle.

A multitude of examples

Consider a few examples. Cloud solutions offer a way to extend IT infrastructure, but may not be the right fit for your organization. For example, it may be inappropriate or risky to store sensitive data in a public cloud, yet the cost of storing and processing that data locally may break an organization's IT budget. Sophisticated artificial intelligence (AI), machine learning (ML), and deep learning (DL) tools allow your teams to extract value from your data, but the processing power and high-speed transfers needed may force you to overhaul your systems. Enterprise applications continue to evolve in several-year cycles to push the boundaries of data mining, and developers need a better, faster, streamlined DevOps lifecycle to deliver capabilities in less time.

FlexPod continues to be the solution to IT needs

Moving to FlexPod systems—or refreshing your existing FlexPod deployments with the latest advancements—can mean the difference between success and failure. This field-proven platform is trusted worldwide to deliver the innovation and flexibility needed to respond to dynamically changing conditions.

FlexPod is a converged infrastructure (CI) platform that lets you unleash the potential of your data. This versatile platform consists of the best technologies from Cisco and NetApp so that you can fuel your deployments with the latest technological innovations. Deployment is fast, scaling is easy, and performance is unmatched with a solution that is tailored to meet application and workload demands, whether they reside on premises or in the cloud.

FlexPod solutions are tested and documented through Cisco Validated Designs, which help reduce risk and guesswork by giving your architects and administrators guidebooks for implementation. Validated designs are available for more than 170 deployment scenarios and delivery models. By following these guidelines, you can create a foundation that helps protect against compromise while delivering a simplified, standardized, and trusted approach for the use and management of your IT resources.

Business advantages and benefits

Refreshing your data center with FlexPod offers many benefits, from improved efficiency and performance to dramatic cost savings.

Performance, efficiency, and cost savings

Your infrastructure should work with you, not against you.

FlexPod solutions can help you:

- **Deploy IT infrastructure faster:** FlexPod takes the guesswork out of making IT components work together and perform. With our integrated solution, your IT staff can deploy systems faster and focus on strategic business objectives.
- **Get more work done with the same or fewer resources:** FlexPod allows your IT staff to consolidate

more workloads onto fewer servers so there are fewer components to buy and manage.

- **Scale and adapt to support demand:** With FlexPod, you can scale and repurpose systems without having to adjust your software or your networking capabilities or interrupt operations. You can purchase the systems you need today and scale up your integrated infrastructure for greater performance and capacity (adding or upgrading computing, network, or storage resources), or scale out if you need multiple consistent deployments (adding integrated systems).

- **Increase productivity:** Built-in automation, orchestration, and lifecycle management capabilities simplify deployment and make it easy for your IT staff to operationally integrate your bare-metal and virtual infrastructure resources to address complex, time-consuming, manual, and compartmentalized processes.
- **Save:** Components with low power-consumption, simplified connectivity mechanisms, and an efficient cabinet design result in a unique architecture that reduces cabling, power, and cooling requirements.



43%
fewer staff
needed to manage



32%
faster software
installation and
management



65%
more time spent
on innovation and
new projects



23%
savings on
cloud computing



34%
reduction in data
center floor space



28%
savings on
services,
outsourcing,
and consulting



29%
less time spent
on monitoring,
troubleshooting,
and remediation



24%
CapEx reduction
for both hardware
and software



23%
savings on annual
maintenance fees



29%
savings on
power and cooling

FlexPod architecture

- Overview
- Cisco UCS servers
- NetApp storage
- Cisco UCS networking
- Unified management

“We completely recouped our initial investment in just nine months and saved more than \$1M in the first year.”

Ayako Wilson
Senior General Manager, AWNC

[Read the story](#)

Innovation runs deep in the FlexPod architecture

Our trusted, end-to-end solution unleashes the potential of your data and accelerates application delivery.

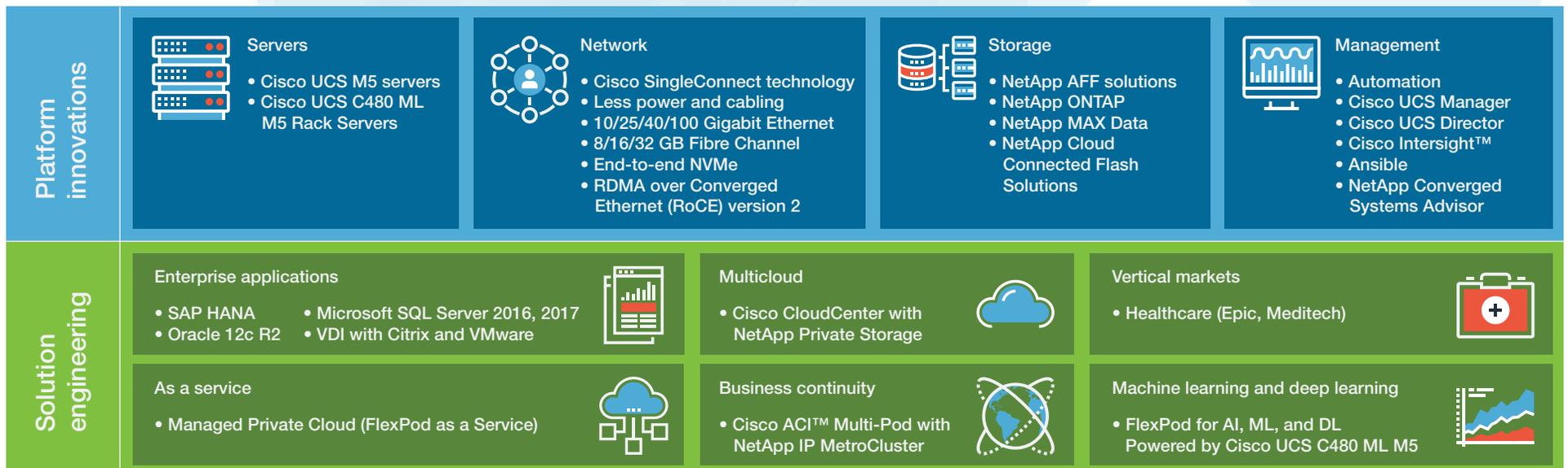
FlexPod is an adaptable platform that combines Cisco Unified Computing System™ (Cisco UCS®) servers, Cisco Nexus® switches, next-generation NetApp storage systems, and virtualization software into a single solution. It lets you move from technology silos to a cloud model that transforms your data center infrastructure into pools of resources that can be easily allocated and repurposed. Your applications can run more efficiently within, between, and beyond your data center boundaries—and your IT organization can evolve to IT as a service (ITaaS) to increase IT and business agility.

■ **Modernize:** FlexPod makes it easy to transform your data center. Using the latest technologies from Cisco and NetApp,

you can take advantage of cloud and multicloud environments with an efficient, infrastructure as a service (IaaS) platform.

- **Automate:** Built-in tools simplify and automate infrastructure and policy management. Using a single pane of management, your IT staff can increase operation efficiency and achieve 2.3 times lower TCO of existing FlexPod deployments.¹
- **Secure:** Storage-based data protection and recovery and advanced risk protection deliver continuous operations and help eliminate both planned and unplanned downtime.

1. The Enterprise Strategy Group, Inc: Quantifying the Value of FlexPod Converged Infrastructure with Cisco M4 Servers and NetApp All-Flash FAS (AFF) Storage Arrays, 2017.



Cisco UCS M5 servers

Designed to provide your computing infrastructure now and into the future, Cisco UCS M5 servers give you the benefits of the latest processors:

- More cores to accelerate parallelized virtualized and bare-metal workloads
- Larger memory capacity for better performance and larger in-memory databases
- Higher memory bandwidth to accelerate the flow of information to and from the CPU
- Up to 8 GPU accelerators for the most demanding machine learning workloads, or a smooth user experience in virtual desktop environments



Groundbreaking performance powers applications

Cisco UCS servers deliver more memory, CPU, and GPU resources to accelerate workloads and deliver results.

FlexPod can take advantage of the broad Cisco UCS server product line, making the process of matching servers to workloads straightforward. A choice of servers allows you to achieve the best balance of CPU, memory, I/O, internal disk, and external storage-access resources using the blade or rack server form factor that best meets your local storage and GPU acceleration requirements.

Powered by Intel Xeon Scalable processors

Cisco UCS servers are powered by Intel® Xeon® Scalable processors to deliver highly robust capabilities with outstanding performance, security, and agility. They offer up to 28 cores in 2- and 4-socket configurations for excellent performance and scalability. The CPUs provide excellent memory channel performance and include three Intel UltraPath Interconnect (Intel UPI) links across the sockets for scalability and intercore data flow. The processors also offer hardware-assisted security advancements that lower the performance overhead for data encryption and decryption, lowering the cost of securing data. These features further enhance the value of IT infrastructure in your enterprise.

GPU acceleration

Cisco UCS rack servers incorporate GPU accelerators to power virtual desktop infrastructure (VDI) environments and

lightweight artificial intelligence (AI) and machine learning (ML) workloads such as inferencing. Purpose-built AI/ML servers use these GPU resources to support heavyweight model training.

Memory acceleration

Cisco UCS servers use Intel Optane DC persistent memory to accelerate data transfer and processing. High memory density, nonvolatile data persistence, and near-DRAM speeds support large memory capacities at a low cost per TB. These memory enhancements allow you to:

- Consolidate databases and landscapes onto fewer servers
- Accelerate access to very large data volumes
- Perform deep data analysis on more data and do it faster

Memory-accelerated data

A new feature in FlexPod—memory acceleration powered by MAX Data—works with Intel Optane memory to further accelerate applications. This new technology integrates NetApp storage into the server's memory, presenting a file system interface to applications. This tiered file system provides a persistent storage layer that uses persistent server memory and an all-flash storage tier to store, protect, and accelerate access to information.

NetApp AFF A-Series

- Offer 100% NVMe storage solutions that accelerate data access, deliver consistent and predictable low latency, and reduce storage requirements by up to 7:1 with inline data reduction
- Accelerate workloads with the fastest unified scale-out all-flash array, with up to 7 million I/O operations per second (IOPS) and latency of less than a millisecond
- Manage and protect data to increase usable capacity and reduce costs

NetApp FAS Hybrid Flash

- Provides consolidated SAN and NAS storage
- Supports enterprise applications, virtualization, Microsoft solutions, and backup and recovery deployments



More storage for more data and insight

NetApp all-flash and NVMe storage systems scale up and out to store and manage growing volumes of data.

FlexPod allows you to take advantage of storage improvements to accelerate applications and reduce the burden on your IT staff and budgets. With NetApp AFF and hybrid-flash FAS storage systems, you can use different types of storage media for different workloads, all within a unified platform that is designed with data protection and security in mind. You can even deploy end-to-end NVMe solutions to further accelerate data access and keep applications working to deliver results in less time.

With NetApp ONTAP software, you can cluster your ONTAP storage resources—including all-flash and hybrid-flash systems from different generations—and use it on premises or tier it to a private or public cloud. This powerful data management software includes inline data compression, deduplication, and compaction, and works with other NetApp solutions to snapshot, replicate, and clone data for increased protection.

NetApp AFF series	Workloads and storage characteristics	Max nodes	Max SSDs	Effective capacity (PB)	Form factor
AFF A800	■ Demanding workloads, ultra-low latency	■ 24	■ 2880	■ 316.3	■ 4U
AFF A700	■ Performance-driven workloads, small footprint	■ 24	■ 2592	■ 316.3	■ 4U
AFF A700s	■ Performance-driven workloads, maximum expandability	■ 24	■ 5760	■ 702.7	■ 8U
AFF A400	■ Balance of performance and cost	■ 24	■ 5760	■ 702.7	■ 4U
AFF A300	■ Enterprise applications, performance, and scalability	■ 24	■ 4608	■ 562.2	■ 3U
AFF A220	■ Mid-sized businesses, balance of performance and cost	■ 24	■ 1728	■ 193.3	■ 2U
AFF 80X0	■ NAS scale-out deployments	■ 24	■ 5760	■ 366.6	■ 6U
	■ SAN scale-out deployments	■ 8	■ 1920	■ 26.2	■ 6U
NetApp FAS series	Workloads and storage characteristics	Max drives	Max raw capacity (TB)	Form factor	
FAS2650	■ Virtual server consolidation, high performance	■ 144	■ 1243	■ 2U/24 drives	
FAS2620	■ Remote offices, secondary workloads, backup targets, larger capacity deployments	■ 144	■ 1440	■ 2U/12 drives	

Cisco Application Centric Infrastructure

As your environment grows, you can use Cisco Application Centric Infrastructure (Cisco ACI) to implement a software-defined network and deliver consistency at scale. You can link your data centers and support multipod and metrocluster solutions to connect your networks, systems, applications, and users wherever they reside. Hybrid multicloud capabilities abstract cloud-native APIs to support physical, virtual, and containerized workloads across on-premises infrastructure and public clouds.

Cisco ACI provides automated, policy-based network deployment that secures your applications within isolated containers. The network can attach directly to virtual machines and physical servers with increased security, real-time monitoring and telemetry, and performance optimization.



Networking is simple, but powerful

The FlexPod architecture lets you wire once, walk away, and manage networks and bandwidth through software.

Simplicity with a unified fabric

With FlexPod, you can wire once, walk away, and then manage features and bandwidth through software. This zero-touch I/O configuration is policy based, not cable based. It converges the three networks required by traditional systems (LAN, SAN, and management) into one unified network that can match bandwidth resources to specific application needs.

The unified fabric in FlexPod radically simplifies server I/O configuration, cabling, and upstream switching. The low-latency, high-bandwidth fabric supports easy access to NetApp storage using file-based (NFS) and block-based (Fibre Channel or iSCSI) protocols depending on your application.

Fast, highly available interconnects

Within FlexPod, the unified fabric is created by Cisco UCS fabric interconnects. Deployed as an active/active pair, the interconnects integrate all components into a single, highly available management domain. All I/O is managed efficiently and securely at a single point, resulting in deterministic I/O latency regardless of a server or virtual machine's location in the system.

Cisco® fabric interconnects support low-latency, line-rate, lossless Ethernet and Fibre Channel over Ethernet (FCoE) connectivity. The Cisco UCS 6300 Series Fabric Interconnects supports 10- and 40-Gbps connectivity, and the Cisco UCS 6454 supports 10 and 25 Gbps connectivity.

Accelerated storage networking

The Cisco MDS 9000 family of storage networking solutions provides flexibility, a proven operating system, and a central management platform to deliver efficient storage networking and seamless connectivity to fabric interconnects within FlexPod. With multiprotocol support, the Cisco MDS 9000 family delivers a single network that supports virtually any storage communication protocol. These intelligent switches and network directors offer:

- **Performance** that delivers more than three times the bandwidth of any director in the industry
- **Comprehensive end-to-end virtualization** with unique features such as Virtual SANs (VSANs), built-in Inter-VSAN Routing (IVR), N-Port ID Virtualization (NPIV), and fabric-port (F-port) trunking that support end-to-end virtual environments
- **Operational efficiency** with robust instrumentation, advanced management applications, standards-based interfaces, and a customizable dashboard that provides enhanced visibility and automated fabric provisioning of dynamic data centers
- **Integrated telemetry** with path visualization, troubleshooting, and performance monitoring from the virtual machine all the way to the storage port
- **Ultimate reliability** through fully redundant components and a fault-tolerant architectural design
- **Investment protection** with storage connectivity options for mission-critical applications, massive amounts of data, solid-state drives, and cloud-based environments

Workload protection

Cisco Tetration™ can help you identify security incidents, contain lateral movement, and reduce your attack surface with a zero-trust model using segmentation. You get a composite security score for workloads based on various parameters. You can:

- Use real-time telemetry data from application components and behavior-analysis algorithms to view the connections between data and applications
- Track behavior changes to keep policies up to date and minimize exposure to malware-style attacks
- Enforce a consistent whitelist policy across on-premises data centers and public clouds
- Continuously monitor for and identify compliance deviations
- Detect software vulnerabilities

Unified management delivers simplicity

A self-aware system and built-in automation make it easy to deploy, monitor, and manage IT and support your business.

Easy deployment

FlexPod is a self-aware, self-integrating system that takes the guesswork out of deployment. Every aspect of server identity, personality, and connectivity is abstracted and can be applied through software. Your IT staff defines profiles and the solution automatically configures the infrastructure as needed. By automating layers of repeatable and error-prone manual configuration that your IT staff likely performs today, you can consistently deliver the data center resources that your applications need in less time and with end-to-end security.

Simplified automation and management

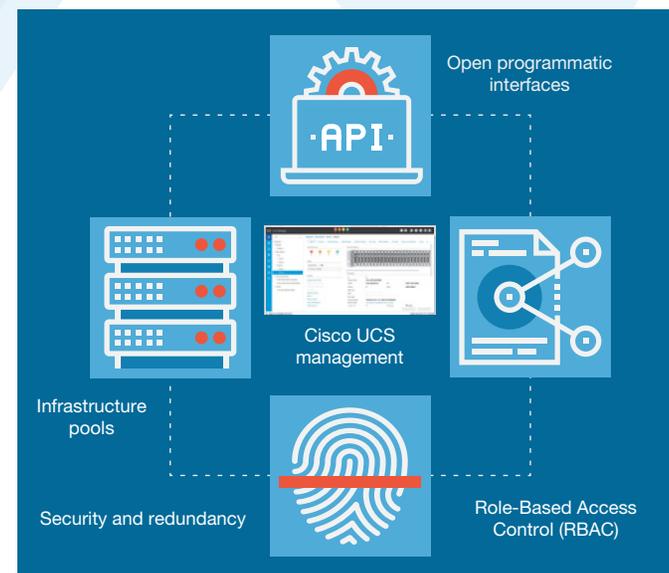
Cisco UCS Director abstracts the complexity from individual devices, hypervisors, and virtual machines and automates FlexPod management processes. You can deliver on-premises private cloud capabilities, rapidly and consistently deploy resources in local and remote locations, automate IT workflows, and provide a foundation for hybrid IT.

Workload optimization

Cisco Workload Optimization Manager is a real-time decision engine that drives continuous health in your FlexPod deployment. The intelligent software continuously analyzes workload consumption, costs, and compliance constraints and automatically allocates resources in real time. You can determine when, where, and how to move and resize workloads, maximize elasticity with Amazon Web Services (AWS) and Microsoft Azure public cloud resources, and quickly model infrastructure and workload growth scenarios to determine how much infrastructure you will need and when you will need it.

Performance management

Our smart approach to performance management allows you to connect application performance and user experiences to business outcomes. With AppDynamics® you can actively monitor, analyze, and optimize complex application environments at scale, and correlate and act on performance data in real time. By tapping into automated, cross-stack intelligence, you can gain visibility across servers, networks, and containers whether on premises or in the cloud, pinpoint and fix application issues, and understand the impact of code on user experience and application performance. You can even visualize revenue paths for better business insight.





Use cases

🔗 [AI/ML](#)

🔗 [Business continuity](#)

🔗 [Healthcare](#)

🔗 [Hybrid and multicloud](#)

🔗 [Microsoft SQL Server](#)

🔗 [Oracle Database](#)

🔗 [SAP HANA](#)

🔗 [VDI](#)

🔗 [VSI and cloud](#)

Customer successes

- Cambridge Consultants help clients create new data-driven services to meet real needs.
- Shanghai PPDAL uses AI to serve the financially underserved.

Did you know?

FlexPod Datacenter for AI is ready to train models for faster insight.

- Accelerates AI/ML initiatives with a validated solution that demystifies deployment
- Scales to more than 20 PB in a single namespace to support very large learning data sets with ONTAP FlexGroups
- Processes data quickly with a scalable approach to massive computing power with Cisco UCS servers
- Reduces data storage capacity requirements up to 10 times with deduplication and compression techniques
- Supports development, testing, training, and inferencing environments

Use case: Artificial intelligence and machine learning

Tap into data, gain more insight, and make better decisions.

The promise of artificial intelligence (AI)

Whether you need to make discoveries, analyze patterns, detect fraud, improve customer relationships, optimize supply chains, or automate processes, deep learning (DL) and machine learning (ML) techniques can help you use digital information for business advantage. These complex tasks require unprecedented levels of computing power and large amounts of scalable storage, and models can take days or weeks to train. Computing nodes, storage systems, and networks often are unable to handle the data volume, velocity, and variability of AI, ML, and DL applications at scale—and achieving predictable and scalable performance is hard.

Look at your data in new ways

If your AI and ML solutions are failing to keep pace—or if you have not implemented AI or ML solutions yet—deploying the FlexPod Datacenter for AI solution with Cisco UCS C480 ML M5 Rack Servers can open the door to better insight. This is especially true when data gravity, security, and regulatory requirements dictate that model training be performed on the premises, where your data lives.

The FlexPod Datacenter for AI solution is fully equipped to power your AI and ML workloads and databases. By deploying this highly scalable computing platform, your organization can take advantage of built-in technology advancements and a unified approach to management to achieve many IT and business benefits. The solution integrates with Kubeflow Pipelines to foster collaboration across multiple private and public cloud platforms and provide broad access to AI capabilities.

Easy access to existing data sets

In traditional infrastructure deployments, accessing and copying large volumes of data is slow and results in poorly used storage systems. The ONTAP software included in the FlexPod Datacenter for AI solution provides fast access to existing data sets, without the need to copy large volumes of data onto the hard-disk drives (HDDs) of newly deployed FlexPod platforms.

Extreme performance

Delivering better results in less time requires speed at every layer of infrastructure. The extreme low latency performance of NetApp All Flash storage systems and fast networking interconnects supports the accelerated movement of data from where it resides to where it is processed. After its arrival, high performance servers like the Cisco UCS C480 ML M5 with multiple GPUs help ensure that your data is processed quickly, accessing up to 1 petaflop of processing capability per server.

Artificial intelligence

Perform basic chores faster than a human.



Machine learning

Use AI techniques to parse data, learn from it, and make decisions.



Deep learning

Engage neural networks to sort through vast amounts of data and make distinctions.



FlexPod Datacenter for AI solution

Optimized for analytic workloads, the solution includes massively scalable Cisco UCS blade and rack servers, Cisco Nexus 9000 Series switches, Cisco UCS 6000 Series Fabric Interconnects, and NetApp AFF A800 flash storage arrays with NetApp ONTAP. NVIDIA Tesla V100-32GB Tensor Core GPUs further enhance processing power.

In the solution, Cisco UCS C480 ML M5 computing engines place massive GPU acceleration close to the data stored on your FlexPod infrastructure. These computing engines are connected through the system's fabric interconnects, just like the other Cisco UCS blade and rack servers in your FlexPod deployment. Your AI and ML models and applications run on the server, with the NetApp Data Fabric in your FlexPod infrastructure moving data from its collection point or storage location to the computing engines at high speed.

Create a data lake

The ONTAP software makes it easy to create a seamless data lake that spans your distributed data sources. Your data lake can stream data from the all-flash arrays into your training environment at high speed and with low latency, supporting many I/O streams in parallel. The system can move data across storage tiers based on policies you set, and analytics can be run on the right data tier with the optimal quality of service.

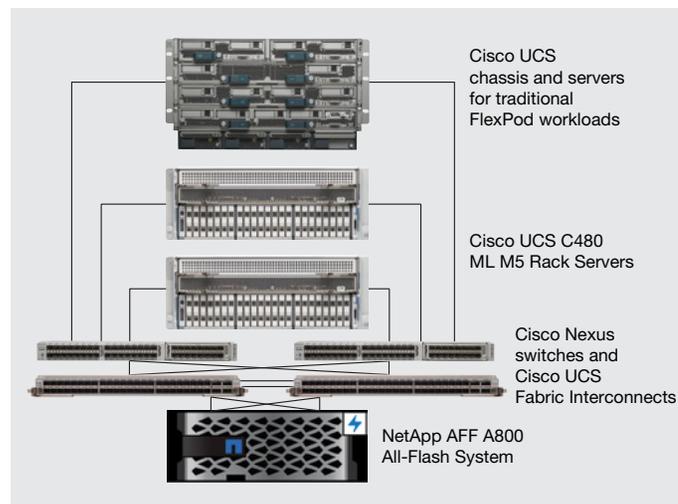
The FlexPod Datacenter for AI solution with Cisco UCS C480 ML M5 Rack Servers stands ready to train your models for faster insight.

Support continuous integration and development

The FlexClone® capability built into your FlexPod infrastructure makes it easy for your staff to create development and test environments for sandboxes and configuration testing or copies of data sets. Traditional copies can take many minutes or hours to make. With FlexClone technology, even the largest volumes can be cloned in a matter of seconds, enabling you to rapidly improve model accuracy and development velocity as your developers and test engineers spend less time waiting for access to data sets and more time doing productive work.

Scale storage capacity

With the massive scalability created with Cisco Nexus 9000 Series Switches and ONTAP software, you can deploy environments that scale to 20 PB and beyond in a single namespace to support very large data sets, resulting in better data models. The FlexGroup capability in ONTAP creates scale-out NAS volumes consisting of multiple storage components that automatically and transparently share the traffic. Combined with automatic load distribution, FlexGroups make it easy to use infrastructure resources to serve workloads that require massive scalability, high throughput, and low latency, without complicating storage management.



Related Cisco Validated Designs

- [FlexPod Datacenter for AI/ML with Cisco UCS 480 ML for Deep Learning](#)

Cisco UCS C480 ML M5 Rack Server

Designed for AI/ML workloads, the Cisco UCS C480 ML M5 Rack Server complements your FlexPod deployments and offers:

- Fast computing with two Intel Xeon Scalable processors
- Fast GPU acceleration with eight NVIDIA Tesla V100-32GB Tensor Core GPUs in a 4-rack-unit (4RU) form factor
- NVIDIA NVLink technology for high bandwidth and massive scalability in multi-GPU configurations
- Flexible options for network, storage, memory, OS, and AI/ML frameworks

Customer success

- Government of Rotterdam cut server provisioning from days to hours and saves four man-hours per week, thanks to the ability to restart servers simultaneously.
- Teva Czech Industries achieves fast and reliable online data protection and has had stable data operation over several years.

Did you know?

FlexPod with Cisco ACI integrates with VMware software to provide a single point of policy management for your physical and virtual environments. Your IT staff can:

- Accelerate application deployment
- Transparently instantiate applications in VMware vSphere virtual machines
- Gain visibility into the health of applications through the holistic aggregation of information across physical and virtual environments
- Extend Cisco ACI across on-premises and multicloud instances for consistent policy, security, and visibility

Use case: Business continuity

Tie multiple data centers together to improve availability.

The metropolitan advantage

Placing data centers across metropolitan areas is a popular approach for supporting business continuity and avoiding disasters. Sites are generally chosen based on locality, environmental or weather considerations, available floor space, and cost constraints. Accessing and optimizing these data centers, and keeping them running, requires a solution that makes it easy to interconnect and centrally manage geographically dispersed data centers.

One logical data center

FlexPod Datacenter running Cisco ACI Multi-Pod and NetApp MetroCluster™ IP software provides a multiple-data-center solution that elevates business and data continuity. Cisco ACI Multi-Pod provides seamless network connectivity across the sites, called pods. The result is a logical grouping of physically separated pods that function as a single fabric. As a result, your IT staff can balance workloads between two data centers, non-disruptively move workloads, and migrate services among sites with little or no downtime.

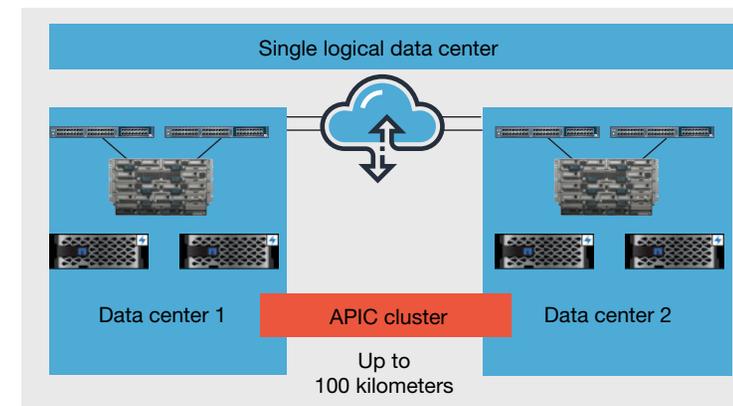
Data efficiency and availability

Built-in data reduction technologies, including deduplication and compression, help save space across the data centers. All data is duplicated on a transaction-by-transaction basis, with synchronous replication performed across sites. Together, these capabilities help provide uninterrupted access to applications and data, reduce the likelihood of data loss, and eliminate the complexities associated with host-based clustering solutions.

Disaster avoidance and recovery

With the FlexPod solution, you don't have to wait a long time for applications to be up and running after a disruption. To help shorten recovery time, the solution contains redundancy at every layer in the infrastructure stack so that data continues to be served even if one or more components fail. In the event of an impending natural disaster or planned upgrade, your IT staff can seamlessly migrate all workloads to the "safe" site. The endangered site can then be shut down safely and brought online at a later time.

The solution features a stretched cluster environment that can span distances. During a regional power outage or natural disaster, control can be switched to the surviving site and applications can continue to run with minimal downtime. Data services are restored at the secondary site in a matter of seconds using an automated single command, with no complex failover scripts or restart procedures.



Solution architecture

Based on the FlexPod Datacenter platform, the solution interconnects two geographically dispersed data centers at the network layer using a multicast-enabled IP-based network. In this approach, a Cisco Application Policy Infrastructure Controller (APIC) cluster manages all pods, whether they reside on different floors or buildings within a campus or in a local metropolitan region. Each pod is a localized fault domain. Using the Virtual Extensible LAN (VXLAN) forwarding features in Cisco ACI, the compute infrastructure in both data centers is connected such that hosts and storage at one site can reach the hosts and storage at the other site without the need to configure any Layer 3 routing.

Tap into one logical virtual infrastructure

To enable a single logical virtualized architecture across two physical data centers, each VMware vSphere ESXi host in the cluster is configured with the same virtual LANs (VLANs) and subnets. Storage controllers at both data centers are also configured using the same VLANs and IP subnets. The Cisco ACI Multi-Pod configuration allows virtual machine kernel (VMkernel) interfaces on the compute nodes in each data center to communicate with the logical interfaces for storage systems as if they resided on the same LAN segment. And adding the

VMware vSphere ESXi hosts across the two sites to the same VMware High Availability (HA) cluster supports additional high availability features across the two sites.

Gain consistency with a single point of management

Integration of Cisco ACI with VMware software provides a single point of policy management for your physical and virtual environments. With these management capabilities, your IT staff can accelerate application deployment, transparently instantiate applications in VMware vSphere virtual machines, and seamlessly move workloads across overlay networks. All controller and data paths are decoupled, helping ensure that network traffic is not affected due to the loss of a controller. In addition, your IT staff gains visibility into the health of the application through the holistic aggregation of information across physical and virtual environments.

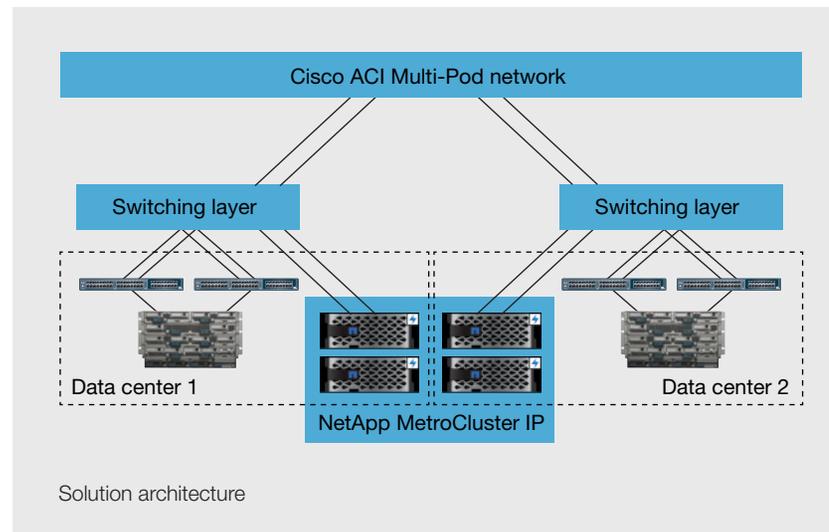
Keep your business running

FlexPod Datacenter with Cisco ACI Multi-Pod, NetApp MetroCluster IP, and VMware vSphere 6.7 can help you tie your data center sites together to achieve new levels of availability. With the capability to interconnect and centrally manage two or more fabrics deployed in separate, geographically dispersed data centers, you can safeguard your IT infrastructure against site failures and keep your business running.

“The failover was 100% transparent and proved that we can run applications from both sites at the same speed and keep our users happy.”

Yiannakis Vakis
IT infrastructure manager,
Bank of Cyprus

[Read the story](#)



Related Cisco Validated Designs

- [FlexPod Datacenter with Cisco ACI Multi-Pod with NetApp MetroCluster IP and VMware vSphere 6.7](#)

Products

- [FlexPod Datacenter platform](#)
- [Cisco UCS B200 M5 Blade Servers and Cisco UCS C-Series Rack Servers](#)
- [Cisco Nexus 9000 Series Switches](#)
- [Next-generation NetApp AFF storage systems](#)
- [VMware vSphere 6.7 software](#)
- [Cisco ACI software](#)

Resources

- [Extending ACI to Multiple Sites: Dual Site Deployment Deep Dive](#)
- [Cisco ACI for Data Centers](#)

Customer successes

- **Aossia** accelerated access to images stored on its picture archiving and communication systems.
- **Mercy** digitized all patient records and handled 50 percent more servers through improved productivity.
- **Tucson Medical Center** virtualized 98% of its healthcare applications and can now spin up a development environment in 20 minutes.
- **UMC New Orleans** reduced Epic software deployment time by 80% and reduced the time needed to copy its production database from 8–16 hours to less than 20 minutes.

Did you know?

Cisco UCS and NetApp AFF systems received the Epic High Comfort Level rating, providing Epic users with the performance and responsiveness they expect from Epic operations.

Use case: Healthcare

Simplify IT for better clinician access.

Infrastructure supports patient care

Healthcare organizations of all types and sizes—from ambulatory clinics and small hospitals to large healthcare systems—rely on electronic health records (EHR) to deliver patient care. Running these time-sensitive systems on aging or legacy platforms poses many risks. Ineffective resource usage, poor scalability, and slow response are just a few of the factors that limit the capability for clinicians to access data and make informed medical decisions.

FlexPod solutions for healthcare

Whether your organization uses Epic, MEDITECH, Cerner, Agfa HealthCare, GE Healthcare, Merge, or other solutions, FlexPod platforms can help you respond faster. These FlexPod solutions allow you to consolidate a wide range of applications onto a single system, including EHR, picture archiving and communication systems (PACS), virtual desktops, and department-specific applications, for greater IT efficiency and accelerated response.

Simple and fast server refresh cycles

One way to improve the performance of healthcare applications is to upgrade your FlexPod deployment to the latest Cisco UCS servers. Your IT staff can use Cisco UCS service profiles to create and replicate server configurations and experience a rapid transition to a new server platform. The server refresh operation is as simple as applying a Cisco UCS service profile and rebooting to launch the new server. By preparing service profiles in advance, your

administrators can prestage server configurations and attach mappings to components and save even more time.

IT and user efficiency

Upgrading your IT infrastructure can have a powerful effect on healthcare applications. With a FlexPod foundation, you can:

- **Share resources** with a multitenant architecture that supports the demands of secure, virtualized environments and delivers a high quality of service
- **Increase uptime and responsiveness** with new servers that provide more processing power and can be quickly provisioned to support initiatives such as health management, onboarding of new applications, and supporting more workloads and users
- **Protect, consolidate, and migrate hospital data** based on policies to reduce your storage data footprint, while delivering transparent data access to applications and clinicians
- **Improve scalability** with standardized configurations that scale from entry-level designs for hundreds of users up to high-performance big data workloads for thousands of users
- **Increase clinician and staff productivity** with fast logins, accelerated system and application response times, and a smoother user experience
- **Lower CapEx and OpEx** with space-saving storage systems, built-in automation, and a platform with less network, cabling, and power requirements

FlexPod Datacenter for Healthcare

FlexPod healthcare solutions consist of Cisco UCS servers that are virtualized with VMware ESXi. Data is stored on NetApp FAS and AFF storage. This radically simplified architecture packs more computing power into less space while allowing your IT staff to choose from a portfolio of servers and storage systems to deliver massive computing density and scalability. Your healthcare workloads can be sized to meet user needs and moved to larger systems as demand grows.

Consolidate healthcare applications and workloads

FlexPod lets you meet ever-increasing guest operating system memory footprint demands on fewer physical servers. The system's high density, high-performance design increases consolidation ratios for 2-socket servers, saving the capital, operating, physical space, and licensing costs of running virtualization software on larger, 4-socket servers. With support for large capacities of high-speed memory in a 2-socket server, you can host more healthcare applications without sacrificing performance.

Access patient information faster

NetApp all-flash and hybrid storage systems deliver the low-latency read and write response times and I/O operations per second (IOPS) that healthcare workloads require. Using both types of storage systems, you can optimize data placement

to accelerate access to vital patient information. In fact, the extreme low-latency performance of NetApp All Flash storage systems and fast fabric interconnects in the platform support the accelerated movement of data from where it resides to where it is processed, presented, and analyzed.

Simplify your storage infrastructure

With FlexPod, you can deploy different types of storage in a single platform and simplify management operations. For example, you can use NetApp SAN storage arrays for healthcare applications that need high IOPS or environments that need to maximize storage density. NetApp FAS8000 Series storage arrays can also be deployed to meet extreme performance demands. Whether you deploy SAN or NAS solutions or both, storage resources are administered from a single pane of management for greater consistency and control.

Comply with data retention requirements

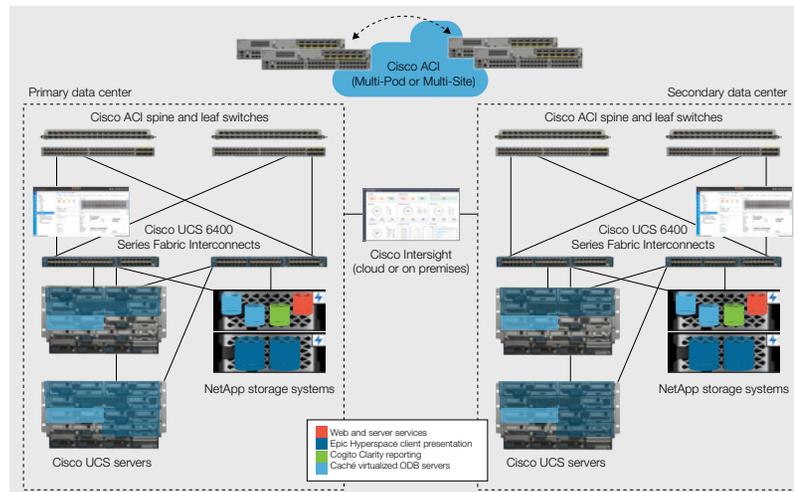
FlexPod solutions can help you comply with local, state, federal, or international requirements to protect patient records and images, and meet disaster recovery, security, and data retention requirements. You can:

- Take advantage of robust authorization, access control, and logging capabilities
- Rely on industry-leading, data-at-rest encryption and immutability capabilities

“We believe in simplicity, and this is why a FlexPod solution is at the heart of our infrastructure.”

Ivaylo Petrov
CEO, Aossia S.A.

[Read the story](#)



Related Resources

- [Accelerate Time to Value with Streamlined FlexPod Deployment for Clinical Systems](#)
- [FlexPod Datacenter for Epic EHR Infrastructure](#)
- [FlexPod Datacenter for MEDITECH EHR Infrastructure](#)

“Healthcare has been sitting on a mountain of data for decades, and we really haven’t used it to its fullest until lately. Mercy now has ways to get that data to physicians and nurses instantaneously to make decisions that can save lives.”

Gil Hoffman

Senior vice president and chief information officer, Mercy Technology Services

[Read the story](#)

Customer successes

- Kaufman Hall improved performance by 100% compared to its previous solution.
- Logicalis increased security and automation and created a multicloud environment.
- neteffect technologies scales performance and capacity and meets demands of internal users and cloud customers in less time.
- TechnologyOne achieved a seven-figure reduction in storage costs.
- TierPoint simplifies infrastructure management and scales seamlessly.
- Zajil Telecom shortened time to market and expanded its public cloud footprint.

Did you know?

Using NetApp SnapMirror, you can replicate data between your private storage and on-premises storage. Data can be available in the cloud for application bursting or in the FlexPod private data center for application repatriation.

Use case: hybrid and multicloud deployments

Implement all types of clouds for better business agility.

Multicloud is becoming ubiquitous

IT managers recognize the value of digital transformation—and the challenges it presents to data center management. Traditional, monolithic applications such as Microsoft, SAP, and Oracle continue to be important assets. Modern applications use highly distributed microservices and interact with users through many different devices, both mobile and stationary, that operate in managed, on-premises, and off-premises cloud environments. As a result, your IT staff must support private and public clouds while maintaining availability, performance, and security across the entire environment.

FlexPod Datacenter for Multicloud

The FlexPod solution makes it easy to implement a cloud strategy and reap the benefits of unprecedented levels of IT agility. With the right balance of on-premises and off-premises clouds, your IT staff and users can tap into computing and data storage resources in a way that aligns with your needs, including data location, security, compliance, cost, and flexibility—and you retain sovereignty over your traditional and cloud-native applications and data for enhanced business success.

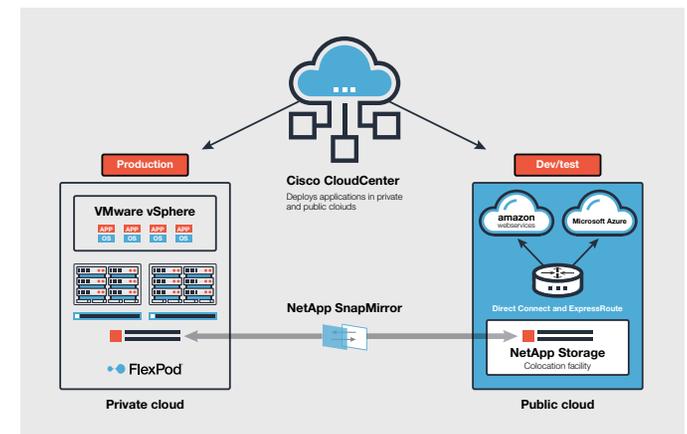
With this FlexPod solution, you can:

- Burst into the public cloud and maintain access to and control over your data
- Identify the most effective cloud environment for workloads
- Secure your data in movement and at rest
- Control communication to, from, and between application tiers

Simplify multicloud management

Within the solution, Cisco CloudCenter™ securely provisions infrastructure resources and deploys applications to data center, private cloud, and public cloud environments easily and consistently. This application-centric approach allows you to quickly and easily build a cloud-independent application profile that defines the deployment and management requirements of an entire application stack.

With a single click, you can deploy the application profile and related components and data to any data center or cloud environment. Management is easy. You can apply a wide range of application lifecycle actions, including setting policies to enable in-place scaling; supporting cross-environment bursting, high availability, and disaster recovery; and deleting the deployment (at end of life).



Solution architecture

Our approach makes it easy to deploy IT resources and applications in a multicloud environment. The solution builds on the FlexPod Datacenter platform, adding Cisco Container Platform, Cisco ACI, Cisco CloudCenter, and NetApp Private Storage to deliver a simplified, secure, and cohesive approach to managing multicloud deployments.

Fast, consistent, and secure deployment

FlexPod makes it easy for you to deploy workloads in any location and any cloud, based on business benefits and not technology limitations. With Cisco Cloud ACI, you get a comprehensive solution for automated network connectivity, consistent policy management, and simplified operations for multicloud environments. The solution captures business and user intents and translates them into native policy constructs for applications deployed across various cloud environments for greater security, consistency, and control.

Storage capacity anywhere you need it

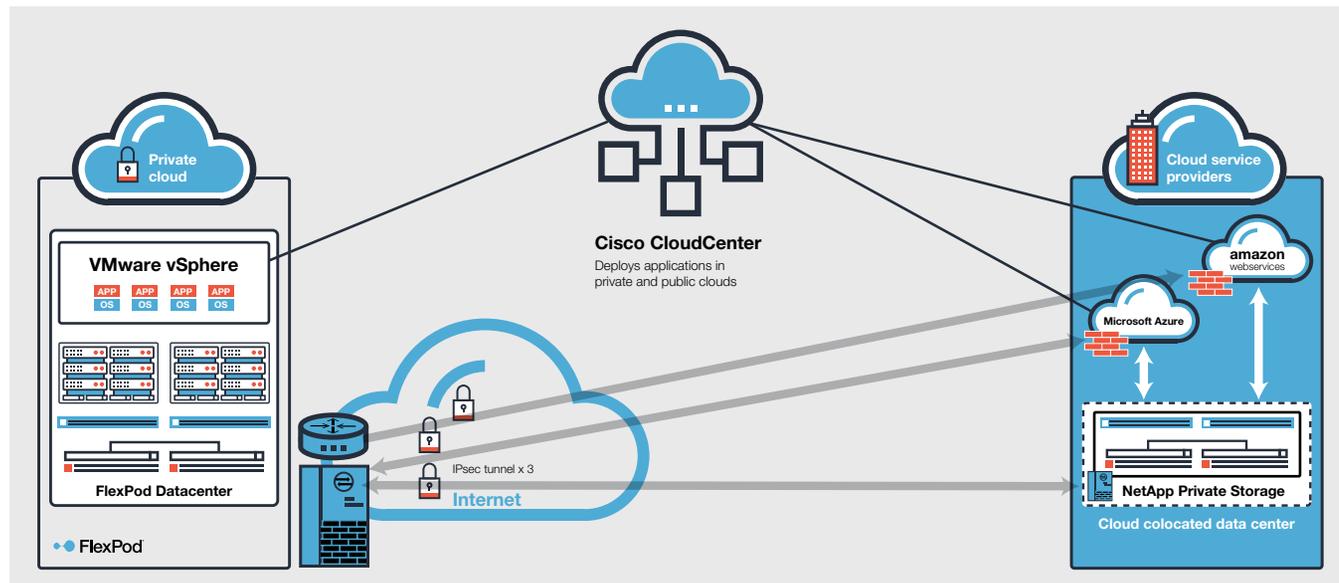
NetApp Private Storage (NPS) for Cloud is a key component of the data fabric within the solution. It provides secure storage that you “own” in a colocation facility, and seamlessly provides

high-performance data access from your on-premises data center to the off-premises cloud. NPS is used by leading cloud providers to enable you to easily burst to the cloud. If you prefer, you can configure the NPS to retain control of your critical data and then delete NPS volumes for data protection and security.

Secure connection to public clouds

The solution architecture is built as an extension of the FlexPod private cloud to the Amazon AWS and Microsoft Azure public clouds. The FlexPod-based private cloud is connected to the Internet using a Cisco Adaptive Security Appliance (ASA) as a firewall. The appliance allows users to establish site-to-site virtual private network (VPN) connections for secure connectivity between the private cloud and the public cloud(s) so that application virtual machines can communicate with virtual machines hosted in the public cloud(s).

It also provides secure connectivity from the private cloud to NPS for communication between the storage controllers in NPS and the storage controllers in FlexPod. This connection supports SnapMirror operations. The VPN link can also be used to access the management interface(s) of the remote storage controllers.



Related Cisco Validated Designs

- [FlexPod Datacenter for Multicloud with Cisco CloudCenter and NetApp Data Fabric](#)

Multiple Configurations

The Cisco Validated Design for this multicloud solution outlines how to:

- Create a base configuration with Cisco CloudCenter
- Add a FlexPod private cloud
- Configure the Amazon AWS public cloud in Cisco CloudCenter
- Add a Microsoft Azure Resource Manager cloud to Cisco CloudCenter
- Create secure storage with NPS
- Enforce governance rules

Customer successes

- **Avago Technologies** accelerated long-running batch processes by 30-40% and decreased operational costs by 40%, all while adding a third data center.
- **BankIslami** eased capacity planning, reduced power costs by US\$70,000 per year, and cut operational costs at their production and disaster recovery site by 50%.
- **Cherokee Nation** achieved nearly 300% storage efficiency and manages double the workload with no additional staff.
- **Cyta Hellas** realized an analysis-proven TCO advantage with up to 35% cost savings compared to legacy storage infrastructure.
- **Electricity Authority of Cyprus** shortened SAP reporting time, decreased operating expenses by 40%, and consolidated more than 200 file servers.
- **INC Research** reduced its data center footprint by more than 75%, reduced associated costs by 50% to 65%, and reduced operational costs by US\$250,000 annually.

Use case: Oracle Database

Deliver highly available Oracle deployments.

More data requires more availability

Data powers most operations in modern enterprises, from keeping the supply chain operating efficiently to managing relationships with customers. As more applications and data sources are deployed, your IT staff must find ways to quickly deliver services. Relational databases for online transaction processing (OLTP) and online analytics (OLAP) power it all. Keeping database environments running at peak efficiency—and moving applications quickly from development to production—require systems that are reliable, available, secure, and perform.

FlexPod Datacenter for Oracle

Sustaining high availability for database deployments is not an easy task. The FlexPod solution simplifies the approach, delivering a platform for highly available, high-performance Oracle database and application services. With a combination of high-performance servers, industry-leading storage systems, unprecedented scalability, continuous data access, and automated data management, your organization can take advantage of fast responses to improve business outcomes.

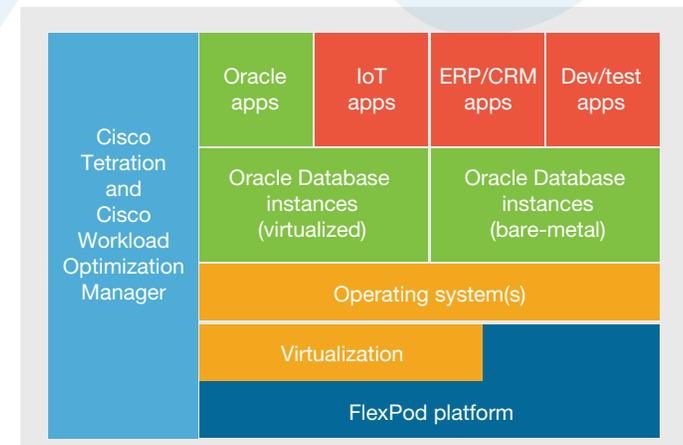
With this solution, you can:

- Accelerate database operations
- Keep your applications running at optimal levels
- Improve IT agility
- Identify potential bottlenecks
- Automate management
- Eliminate costly and disruptive downtime

Simplify, availability, security, and compliance

Without visibility into your IT infrastructure, your administrators probably spend too much time trying to analyze application and database availability and performance and meet policy requirements. The FlexPod solution includes powerful management software that lets you:

- Give your Oracle Database, Oracle RAC, application, and IT teams the skills and knowledge needed to deliver visibility across your network, data center, security, and applications
- Gain insight into every transaction to help ensure that every part of the application ecosystem—infrastructure, individual services, and business outcomes—is optimized for performance, cost efficiency, and quality of service
- Monitor, manage, and automate policy-based security across data centers to protect your enterprise



Solution architecture

The solution makes it easy to deploy an end-to-end architecture that supports transaction and analytic workloads and applications. Our approach builds on the FlexPod Datacenter platform and uses NetApp All Flash AFF A700 storage systems and Oracle Real Application Clusters (RAC) to deliver a highly available database platform that helps reduce TCO.

Optimization for greater efficiency

Within the solution, NetApp AFF systems support solid-state drives (SSDs). Built-in multistream write technology and advanced SSD partitioning help maximize storage capacity. Capabilities such as thin provisioning, deduplication, compression, compaction, and snapshots further enhance space savings without affecting performance. With the right amount of effective storage capacity, you can significantly reduce your storage-related costs for any workload.

In addition, compression capabilities built into Oracle Database help increase performance and optimize the use of storage. All types of data can be compressed, including Oracle Database tables, files, indexes, redo and backup data, and more.

Balanced performance with database partitioning

Your databases can be partitioned to take advantage of different types of storage and optimize data placement. Your IT staff can subdivide tables, indexes, and index-organized tables into smaller, more manageable pieces and put them on the storage media that supports initiatives. With less data to scan in each table and index, read and write times are accelerated. These capabilities combine with high-performance servers, low-latency storage systems, and high-bandwidth connectivity to give users faster access to raw and processed information.

Massive storage scalability

The use of ONTAP data management software and NetApp AFF8000 series of storage controllers allows your system to start as a small single-instance Oracle database to a large-scale Oracle RAC deployment. Controllers can be mixed within the cluster to support capacity and performance requirements. In SAN-only environments or mixed SAN and NAS environments, an ONTAP cluster scales to eight nodes or four HA pairs, supporting up to 23 petabytes (PB) of data. In NAS-only environments, an ONTAP cluster scales up to 24 nodes or 12 HA pairs, supporting up to 69 PB of data capacity.

“We have a very large Oracle environment using both Oracle Database and RAC and the entire Oracle E-Business Suite. It is one of the biggest in the world, running on over 1200 Cisco UCS blade servers. The combination of Tetration, Cisco Workload Optimization Manager, and AppDynamics running on Cisco UCS helps us make our Oracle environment the best it can possibly be. These tools are better together.”

Sidney Morgan
Distinguished Engineer, Cisco IT

Related Cisco Validated Designs

- [FlexPod Datacenter with Oracle RAC Databases on Cisco UCS and NetApp AFF A-Series](#)
- [FlexPod Data Center with Oracle RAC on Oracle Linux](#)

“Although we’re reducing the footprint by more than 75 percent, the power and performance of Cisco UCS and the FlexPod environment will increase available computing and storage capacity by 50 percent.”

Jonathan E. Shough
Chief Information Officer,
INC Research

[Read the story](#)

Customer successes

- Centerity monitors its business-critical big data applications on FlexPod
- TasNetworks consolidated and scaled services by augmenting the compute, storage, and network capacity within a pod.

Did you know?

FlexPod provides foundational technology for your entire SAP landscape. These platforms are the foundation for an intent-based data center that automates, simplifies, and protects your digital future—and it is the basis for all of our SAP solutions. These solutions are the result of a massive engineering effort and deep involvement in SAP initiatives, including SAP HANA, S/4 HANA, and SAP Data Hub.

Our validated designs can help you:

- Run multiple SAP HANA production systems in one FlexPod solution
- Run SAP application servers and the SAP HANA database on the same infrastructure
- Reduce risk with an SAP HANA backup strategy

Use case: SAP HANA

Accelerate data access and applications for faster insight.

Enterprise applications need agile infrastructure

As you seek to adopt new business models and build on your digital investments—including your SAP landscapes—a simplified IT infrastructure that can scale and adapt to meet the needs of applications is critical. This infrastructure can't require endless maintenance, and must quickly and easily deliver your SAP applications with outstanding control, speed, and scale.

FlexPod Datacenter for SAP

Whether you need to deploy a traditional SAP HANA deployment or SAP HANA as a service, FlexPod solutions can help. Our solutions provide an excellent foundational infrastructure for your SAP HANA system and applications. They ease SAP lifecycle management with replication, provisioning, cloning, and refresh processes and make the deployment of test and development systems fast and repeatable. These innovative solutions can help you accelerate every application in your SAP landscape without disruption, dramatically improve data center economics, and prepare your infrastructure for the future with confidence.

Support massive data volumes

Our solutions accelerate your SAP environment with the fastest unified scale-out all-flash array. The NetApp AFF A320 NVMe solution provides industry-leading performance with up to 11.4 million I/O operations per second (IOPS), latency as low as 100 microseconds and 300 gigabytes per second throughput. The NetApp AFF A320 NVMe array can scale to an effective capacity of 35 petabytes (PB) of efficient flash storage.

Gain visibility

With FlexPod, your SAP environments gain pervasive visibility and high-performance connectivity with built-in Cisco Tetration, giving your IT staff visibility into your data center resources in real time. It uses behavior-based application insight and machine learning to build dynamic policy models and automate security enforcement. Cisco ACI Anywhere links your data center networks to where your data lies—locally, at remote data centers, or in the cloud—with policy-based security and automation.

Speed database backups

With FlexPod, you can accelerate projects, simplify operations, and future proof your IT investments. NetApp storage systems in FlexPod enable end-to-end solutions that integrate tightly with standard SAP applications for seamless operations. NetApp SnapCenter provides centralized control and oversight, allowing you to use a single tool to manage backup, restore, and clone operations for databases such as SAP HANA. For full automation of SAP development and test-system provisioning, NetApp ONTAP data management software is tightly integrated into the SAP Landscape Management (SAP LaMa) tool, providing space-efficient copies of storage volumes with NetApp ONTAP FlexClone technology.

Solution architecture

FlexPod solutions for SAP unite Cisco UCS servers and NetApp All-Flash FAS (AFF) storage systems, integrated with Cisco Nexus switches. Combined with the parameters established with SAP HANA Tailored Datacenter Integration (TDI), these designs deliver modern infrastructure for SAP landscapes.

Fast processing

A portfolio of Cisco UCS blade and rack servers deliver enterprise-class performance, reliability, and expandability to your SAP landscape. These servers harness the power of the Intel Xeon Scalable processor family and support a wide range of enterprise workloads, including virtualization, collaboration, and bare-metal applications.

The servers use Intel Optane Data Center Persistent Memory Modules to accelerate data transfer and processing. High memory density, nonvolatile data persistence, and near-DRAM speeds support large memory capacities at a low cost per TB. As a result, you can:

- Consolidate SAP databases and landscapes onto fewer servers
- Accelerate access to very large data volumes
- Perform deep data analysis on more data and do it faster

“FlexPod has transformed our performance and efficiency, so we can focus on applications and end-user services.”

Liam Cole

IT Commercial Operations
Team Leader, TasNetworks

[Read the story](#)

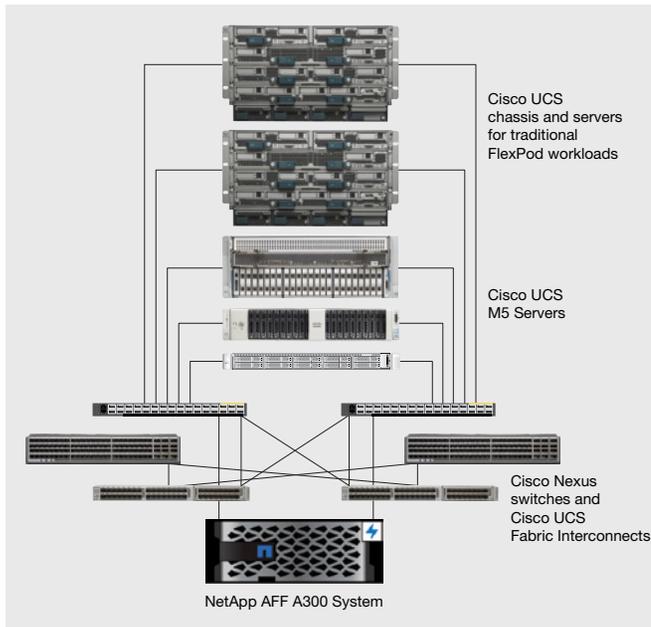
Fast and flexible deployment options

This solution architecture allows you to run all your enterprise applications in a single management domain connected to the same unified fabric. This feature gives you high-speed, low-latency, deterministic networking to accelerate the flow of intelligence to business applications and to meet SAP’s networking requirements.

Integrated with a pair of fabric interconnects with 10- or 40-Gbps unified fabric connectivity, the system uses a single set of cables to connect your IP, storage, and management networks to speed the flow of data between SAP HANA and your landscape applications. With Cisco UCS management, you can define your SAP landscape using policies that automatically configure servers to comply with SAP’s certifications.

Recover faster

Your users don’t have time to waste waiting for access to data and applications. Within Cisco UCS servers, Intel Optane DC persistent memory maintains large SAP HANA databases across reboots. This can speed recovery from errors by as much as 12x so that your users can get back to work quickly.



Related Cisco Validated Designs

- [Flexpod Datacenter for SAP Applications with Cisco ACI and Vnomic Policy-Driven Automation](#)
- [FlexPod Datacenter for SAP Solution with Cisco ACI on Cisco UCS M5 Servers with SLES 12 SP3 and RHEL 7.4](#)
- [FlexPod Datacenter for SAP Solution with Cisco Nexus 9000 Series Switches and NetApp AFF A-Series and IP-Based Storage](#)
- [FlexPod Datacenter for SAP Solution with IP-Based Storage using NetApp AFF A-Series and Cisco UCS Manager 3.2](#)
- [Virtualized SAP HANA on FlexPod Datacenter: Design Considerations and Best Practices](#)

Customer successes

- [Denver Broncos](#) deployed infrastructure that can scale from 50 terabytes to 1 petabyte and reduced storage requirements by 25%.

Did you know?

Memory-accelerated FlexPod raises the performance bar. It offers a unique combination of NetApp MAX Data software and Intel Optane hardware that together enable a fast path to business performance and enable services for business applications requiring low latency and the ability to work with large data sets in memory.

Memory-accelerated FlexPod leverages NetApp MAX Data software in a seamless, plug-and-play server software solution. It works with existing applications to make use of Intel Optane DC persistent memory without the application being modified or rewritten.

Use case: Microsoft SQL Server

Keep your business applications available.

Modernize Microsoft SQL Server deployments

If you're thinking about upgrading your Microsoft SQL Server deployment, you're not alone. Modernizing your databases lets you tap into advancements that help accelerate access to business insight and keep your business running. Running the latest database software advancements on outdated hardware offers minimal benefit and may keep you from taking advantage of all the software has to offer.

FlexPod Datacenter for Microsoft

If your Microsoft SQL Server deployments are siloed, sprawling, or running on outdated systems, it's time to modernize. Deploying FlexPod Datacenter running Microsoft SQL Server AlwaysOn software—or refreshing your existing FlexPod infrastructure—can help ensure that your online transaction processing (OLTP) and other business applications continue to deliver data and insight.

Reduce TCO

FlexPod is cost-effective infrastructure right out of the box. These solutions can help you deploy or upgrade to a robust and redundant data center that gets more work done with the same or fewer resources. Your IT staff can run more database workloads and business applications on fewer servers so there are fewer components to buy and manage. These solutions can also reduce cabling, power, and cooling requirements and automate routine tasks to increase productivity.

Manage smarter

Your IT staff doesn't have time to waste. FlexPod Datacenter solutions for Microsoft use Cisco UCS Director to deliver end-to-end automation of your IT processes. With this powerful software, your IT staff can:

- Trust an automated infrastructure discovery process that maps the physical and logical relationships of each component layer within FlexPod
- Quickly assemble, configure, validate, and manage workflows for FlexPod before they go into production
- Obtain detailed status, usage, and consumption reports to make better decisions about capacity planning

A host of benefits

The combination of FlexPod Datacenter and Microsoft SQL Server:

- Accelerates database application performance by up to 20x (based on NetApp testing using HammerDB)
- Reduces application deployment times from months to weeks
- Maintains the performance and flexibility of best-of-class components from Cisco, NetApp, and Microsoft

Solution architecture

This innovative FlexPod solution uses Cisco UCS blade servers, Cisco Nexus 9000 Series Switches, next-generation NetApp SAN storage, NetApp FAS8000 Series storage systems, Microsoft virtualization solutions, and Microsoft SQL Server AlwaysOn software to deliver a highly available platform that supports near-site disaster recovery.

Built-in reliability

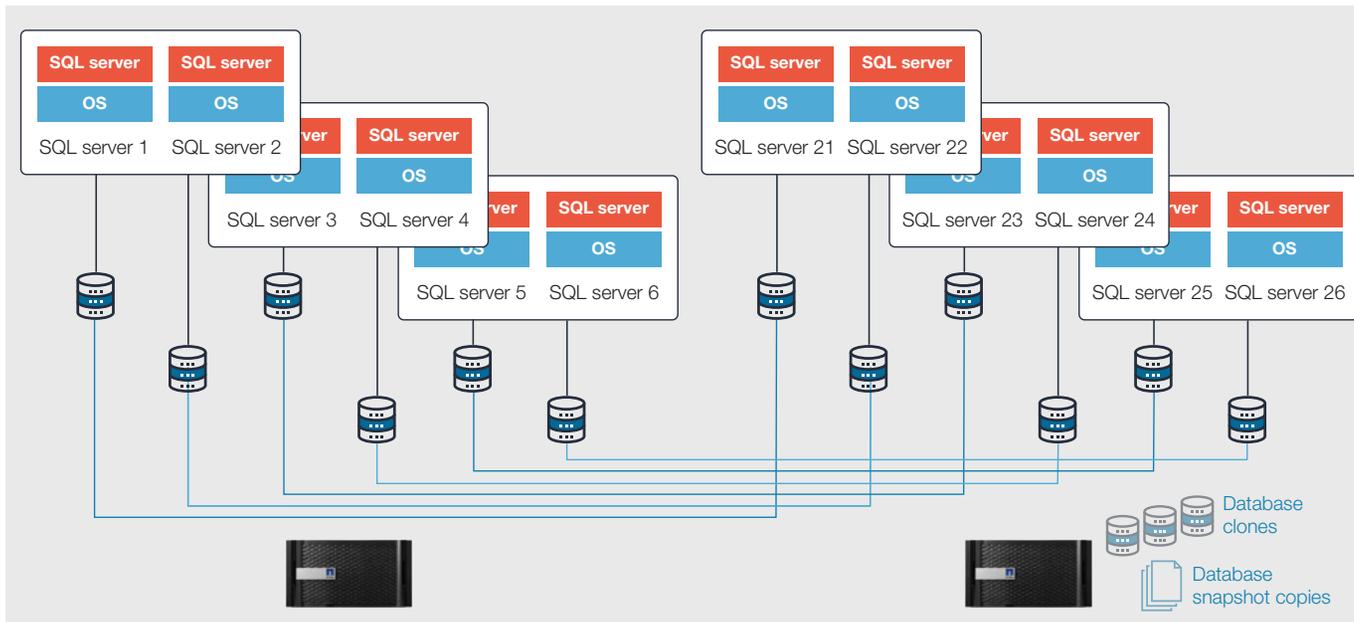
Within the solution, clustering technology and integrated data protection software help enable fast recovery from system, site, and regional outages. Microsoft SQL Server AlwaysOn software, NetApp SnapMirror technologies, and Cisco UCS management tools work together to automate the monitoring of IT infrastructure. The system can replicate data to a secondary site to protect against service disruption.

The underlying infrastructure is redundant. All hardware and software components, including network switches and physical and virtual PortChannels, can be failed over. This capability helps ensure that data traffic continues to flow if a networking component fails or becomes inaccessible.

Data accessibility and performance

The FlexPod approach gives you the flexibility to use the right storage in the right place to balance capacity and performance requirements. For example, you can use NetApp SAN storage arrays for applications that need high IOPS or environments that need to maximize storage density. NetApp FAS8000 Series storage arrays can also be deployed to meet extreme performance demands. Whether you deploy SAN or NAS solutions or both, storage resources are configured to optimize Microsoft SQL Server database server performance.

- Data compaction reduces “wasted” space inside storage blocks for small-block data types, and aggregate-level deduplication significantly increases effective capacity by deduplicating blocks across every volume in the aggregate.
- Granular QoS controls allow your IT staff to regulate performance for critical applications.
- Cold data can be tiered to several public and private cloud storage options including Amazon AWS, Microsoft Azure, and NetApp StorageGrid, allowing you to reclaim storage capacity and consolidate more SQL workloads on systems.



Related Cisco Validated Designs

- [FlexPod Datacenter with Microsoft SQL Server 2016 and VMware vSphere 6.5](#)
- [FlexPod Datacenter with Microsoft SQL Server 2017 on Linux Virtual Machine Running on VMware and Hyper-V Design Guide](#)

Why refresh?

FlexPod can handle the most demanding database workloads and significantly improve database response times by taking advantage of FlexPod’s AFF A-Series All Flash Arrays. Deployment times are reduced, and applications run faster with All Flash FAS (Fabric Attached Storage) and the high performance of Cisco UCS M5 servers. And Cisco ACI enables software-defined, policy-based, automated deployment of enterprise applications.

Customer successes

- **Best Best & Krieger LLP** achieved 100% payback on its infrastructure investment, avoided a US\$200,000 purchase of encryption software, and reclaimed 60% of its storage capacity.
- **ICON** reduced capital and operational expenses and saved approximately US\$100,000 by reclaiming unused storage capacity.
- **Meander Medisch Centrum** accelerated the deployment of new services by 400%, increased application performance by 200%, and improved server utilization by 40%.
- **Metro Health** reduced capital expenses by 30% and improved graphics acceleration rates by more than 300%.
- **University of Tennessee** allows students and faculty to learn and teach anytime, anywhere, on any device.
- **Westdeutsche Genossenschafts-Zentralbank (WGZ Bank)** improved application performance, with login times cut by more than 90%.

Use case: Virtual desktop infrastructure

Accelerate the deployment, operation, and management of your desktop and application virtualization environments.

Change requires agility

Change in the work environment continues to redefine and complicate desktop management and makes security goals difficult to balance against user needs. Laptops, tablets, and smartphones give users the flexibility to work in alternate locations. Upgrades to operating systems and applications often require the replacement of outdated desktop hardware. Disaster-recovery measures and operation changes such as mergers, acquisitions, and the use of off-shore facilities require highly available infrastructure that can quickly adapt.

FlexPod solutions for virtual desktop infrastructure

Whether your organization is contemplating a shift to virtual desktop infrastructure (VDI) or needs to upgrade existing deployments, FlexPod solutions can help. Combining VDI software from partners like Citrix and VMware, our solutions let you host desktop images on FlexPod as virtual machines, which can be accessed from laptops, thin clients, tablets, smartphones, or other devices. You can balance your users' need to work at any time, from any location, on any device with your IT staff's need for manageability, increased security and compliance, and lower costs.

Deliver a rich user experience

VDI deployments built with FlexPod solutions deliver efficiency with a rich mobile experience. On-demand access to desktops, applications, and data allows users to work and collaborate in a familiar environment. Users can quickly and easily access newly

provisioned or existing applications, services, and data from any device with consistent high-definition performance that supports even the most demanding 3D applications.

Simplify IT operation

With FlexPod solutions for VDI, your IT staff can eliminate the distributed computing environments that keep your IT infrastructure stagnant and hold your workers back. With a platform designed to support changes in technology, your IT staff can quickly and efficiently support new versions of server operating environments, client operating systems, and new devices and applications to deliver the resources users need to work the way they want and be successful.

“We mapped the I/O load of the VDI onto the large memory of the Cisco UCS blades, so we have very good scalability and CPU performance for the virtual desktops.”

Paul Bauwens

Information and Communications Technology Architect, Meander Medisch Centrum

[Read the story](#)

Solution architecture

FlexPod solutions for VDI deliver conveniently packaged infrastructure that modularizes data center components into easily consumable building blocks that can be added for scalability. Each unit of infrastructure offers self-contained computing, storage, and network fabric resources coupled with virtualization software to simplify and accelerate your virtual desktop deployments. Everything is connected together so that users can securely access their desktops, applications, data, and company services from any device.

Choice of deployment configurations

FlexPod solutions for VDI allow you to deploy platforms in the way that best meets the access and performance needs of your users. You can:

- Distribute components among a large number of servers, or provide greater scalability and failover by increasing the number of controllers in your site. Management consoles can be installed on separate computers to manage the deployment remotely.
- Use multiple regional sites. User connections can be directed to the most appropriate site for desktop and application delivery. The use of multiple sites reduces the amount of unnecessary WAN traffic, improving performance.

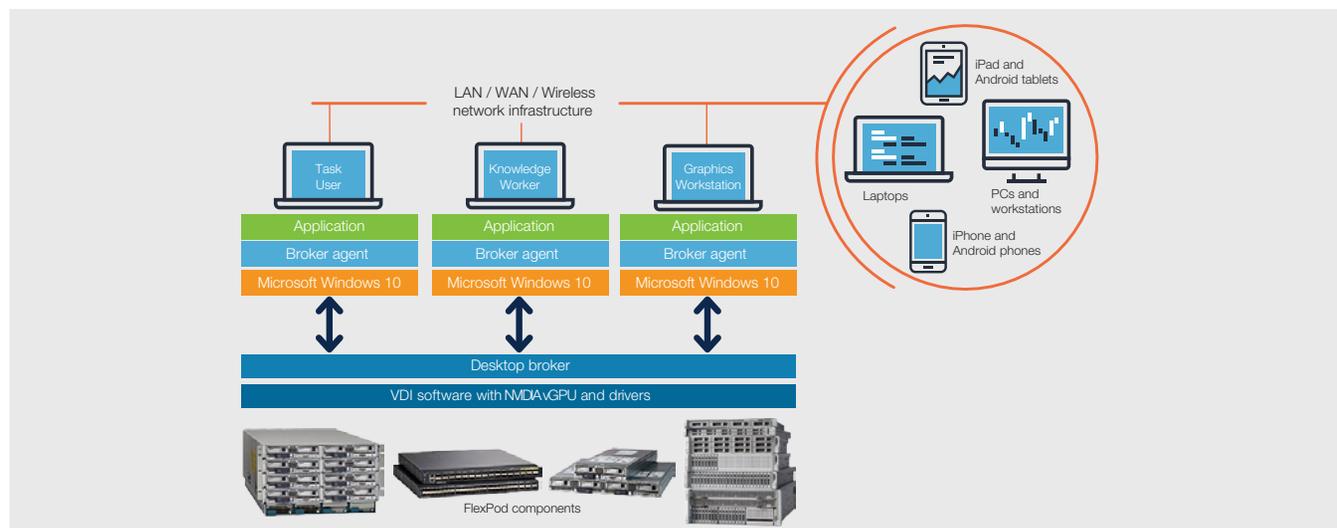
Choice of software

To promote configuration flexibility, FlexPod solutions support:

- Multiple hypervisors, including Citrix Hypervisor, Microsoft Hyper-V, and VMware vSphere. You can accommodate the needs of your business units, capitalize on the hypervisor skill sets of your IT staff, and avoid vendor lock-in.
- Multiple software options, including Citrix Virtual Apps and Desktops, and VMware Horizon View. You can deliver applications or full virtual workstations for high-end graphics users. Your deployments can run on your premises or at cloud scale with a desktop-as-a-service (DaaS) approach.

Protection for your intellectual property

With FlexPod solutions, you can deliver, manage, and protect data by keeping your servers, applications, storage resources, and intellectual property in your data center, yet allow users to securely access that information any time they need it without loss of control by your IT staff. Encrypted data is tunneled through a secure network and firewall, allowing your IT staff to restrict access and use. Centrally managed desktops simplify conformance to corporate, industry, and government regulations and policies, and extensive role-based access control (RBAC) and the capability to isolate virtual desktop workgroups help protect applications and data.



Related Cisco Validated Designs

- [FlexPod Datacenter with Citrix XenDesktop/XenApp 7.15 and VMware vSphere 6.5 Update 1 for 6000 Seats](#)
- [FlexPod Datacenter with VMware Horizon View 7.3 and VMware vSphere 6.5 Update 1 with Cisco UCS Manager 3.2 for 5000 Seats](#)

“Employees can login from any workstation and access all the applications assigned to them. Desktops are managed with one golden image, making it quick and simple to complete software upgrades.”

Jens Becker-Mühlenbrock
Authorized Representative,
Organization and Operation
of IT Systems, WGZ Bank

Customer successes

- [AWNC](#) recouped its investment in nine months and saved more than USD\$1M in the first year.
- [Central New York Regional Information Center](#) improved infrastructure standardization, scalability, and management.
- [City of Fremantle](#) reduced administration overhead by 33%.
- [City of Houston](#) cut costs, streamlined workflows, and consolidated data centers.
- [First Riding Technology](#) reduced construction time and raised productivity.
- [Fraport](#) shortened server deployment timelines from weeks to minutes.
- [Logicalis](#) built a completely automated private cloud.
- [NaviSite](#) consolidated its Oracle application stack, simplified management, and reduced costs.
- [Swinburne University](#) increased access to high-performance digital resources.
- [Telindus](#) doubled year-on-year revenues and halved the number of physical servers in their deployment.

Use case: Virtual server infrastructure and cloud

Deploy, scale, manage, and monitor IT resources with ease.

Modern virtual and cloud infrastructure

As the pace of change continues to accelerate, lagging IT infrastructure poses a threat to businesses. Unfortunately, aging systems often fail to support workloads, leaving users with lackluster performance. Modernizing IT resources and updating or moving to a virtual or cloud model offers both technical and operational benefits, from increasing reliability and scalability to supporting business innovation and user experiences.

The solution

FlexPod Datacenter with VMware vSphere and Cisco UCS Director make it easy to deploy virtual servers and infrastructure as a service (IaaS). You can transition from silos of technology to a cloud model and deliver access to pools of resources that can be easily allocated and repurposed. Individual devices, hypervisors, and virtual machines are abstracted, creating a simplified model of IT infrastructure that is easy to deploy, use, change, manage, and integrate with your automated processes.

Deploy and access IT resources with ease

Your users can't always wait for IT to provision resources. With the FlexPod solution, your users interact with an easy-to-use, secure, self-service portal to make resource requests. The system automatically provisions the underlying computing, storage, and network resources. Every layer of the platform is synchronized and optimized to help ensure that resources are available at a moment's notice.

Scale up and out to meet demand

You can easily expand your virtual infrastructure and private cloud to support more workloads and users. You can purchase the IT resources you need today and scale up (by adding more resources to the FlexPod system) or scale out (by adding more FlexPod instances to your deployment) as demand grows.

Monitor, manage, and charge

Within the solution, Cisco UCS Director helps you securely separate tenants and monitor and manage applications. In addition, resource consumption reports allow your team to charge appropriately for IT infrastructure use. With at-a-glance status panels, resource usage tracking, and predefined reports, your IT staff can monitor infrastructure status, show IT resource charges, and charge users only for the resources they use.

“By combining NetApp storage with Cisco UCS servers, we can achieve enormous densities on our cloud platform. That means we can run more services on the same amount of hardware with a whole lot more performance.”

John Campbell

CTO, neteffect technologies

[Read the story](#)

Solution architecture

The FlexPod solutions combine Cisco UCS servers, Cisco Nexus switches, Cisco MDS storage networking, next-generation NetApp storage systems, and VMware vSphere software. These designs can be deployed within one data center rack or according to your data center design.

Flexible configurations

Extensive port density allows the networking components to accommodate multiple configuration options. For example, you can connect Cisco UCS blade servers and Cisco UCS fabric interconnects with 10- or 40-Gigabit Ethernet connections, use 25 Gigabit Ethernet to connect to rack servers, and deploy high-speed 100 Gigabit Ethernet to connect switches and storage arrays. You can add Cisco MDS switches to provide hosts with block-level access to shared storage. As additional storage is added to the architecture, no re-cabling is required from the hosts to the fabric interconnect.

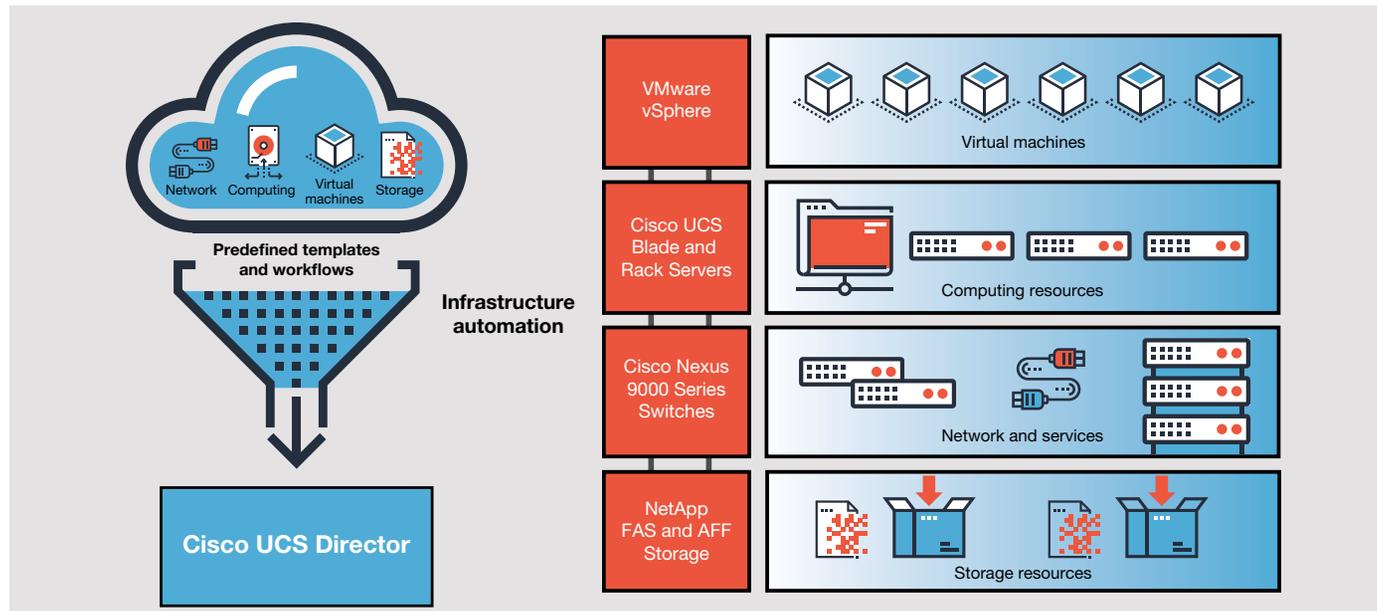
Secure sharing of IT resources

Within the architecture, user resources remain separate and are protected from unauthorized access. The system

uses security and isolation models to contain and protect everything needed for a workload. These physical and virtual resources are reserved and set apart from other workspaces to help ensure that optimum resources are available for your business and application teams.

Automation

Cisco UCS Director securely provisions the requested resources. Using predefined application requirements and descriptions (policy profiles) that you create, the system automatically provisions the network, application services, security policies, and tenant subnets your applications require, and places the workload in an isolated container. Complete security isolation between applications and tenants lets you pool resources and safely cohost services so that you can make secure, cost-effective use of your capital investments—and it helps ensure that unauthorized users and rogue processes cannot adversely impact the operation of applications or gain access to data.



Related Cisco Validated Designs

- [FlexPod Datacenter with IBM Private Cloud](#)
- [FlexPod Datacenter with Cisco ACI 3.0 and Microsoft Hyper-V Windows Server 2016 Design Guide](#)
- [FlexPod Datacenter with Docker Enterprise Edition for Container Management](#)
- [FlexPod Datacenter with Microsoft Private Cloud Fast Track 4.0 and Cisco Nexus 9000 Series Switches](#)
- [FlexPod Datacenter with Red Hat Enterprise Linux OpenStack Platform](#)
- [FlexPod Datacenter with VMware vSphere, Cisco UCS Director, Cisco Nexus 9000 Series Switches, and Cisco Application Centric Infrastructure](#)
- [FlexPod Datacenter with VMware 6.5 Update1 and Cisco ACI 3.1](#)
- [FlexPod Datacenter with VMware vSphere 6.7 U1, Cisco UCS 4th Generation, and NetApp AFF A-Series](#)

Get started

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-  [Resources](#)

Learn more

- flexpod.com
- cisco.com/go/flexpod
- netapp.com/flexpod

Discover the technology

- [Cisco UCS servers](#)
- [Cisco UCS management](#)
- [Cisco networking](#)
- [NetApp storage](#)

Read the analyses

- [Four Reasons to Refresh Your FlexPod Infrastructure](#)
- [How FlexPod Drives Data Center Modernization \(IDC\)](#)
- [Top Ten Benefits of Switching to FlexPod](#)

See what customers say

- [Customer stories \(Cisco\)](#)
- [Customer stories \(NetApp\)](#)
- [FlexPod reviews](#)

Get started with FlexPod

Learn more, do more, and achieve more.

Trusted worldwide

The FlexPod platform is trusted worldwide to help organizations like yours deliver a better user experience. We do this by simplifying your support experience with full stack support from a single vendor. We enable you to continually optimize your operations with intelligent and actionable insights from Cisco Intersight software and NetApp Active IQ. And you can streamline your IT administration by delivering a simple, cloudlike experience for both your users and admins. That's why FlexPod is the top selling converged infrastructure in the world.

Service offerings

You can accelerate your data center modernization initiatives with Cisco and NetApp service providers. Our experts and certified partners offer a broad range of cloud transformation, consulting, and systems integration services to address your end-to-end application and cloud lifecycle requirements.

- **Advisory services** use detailed analysis, assessment, planning, and design activities to help you identify ways we can help meet your business objectives.
- **Implementation services** experts help you develop and implement detailed test plans, develop implementation plans, and install, configure, and integrate your solution in your environment while reducing the risk associated with migration.
- **Training services** help reduce risk and enhance the quality of service by improving the skills of your engineering and operations staff.

- **Optimization services** help lower costs and prevent outages by optimizing the solution and your operations while we work with you to secure your applications and data.
- **Managed services** experts can manage and optimize the performance, availability, and security of your infrastructure: computing, network, storage, virtualization, and operating systems. We help you adopt new technology quickly and reduce operating costs and downtime, freeing you to focus on achieving business outcomes.

Cooperative support model

Cisco and NetApp offer a cooperative support model that takes advantage of the combined experience, resources, and technical support expertise of Cisco and NetApp experts, as well as our technology partners (Citrix, Microsoft, Red Hat, and VMware). You have access to a simplified process for identifying and resolving FlexPod problems, regardless of where a problem resides. Your IT staff simply call one of the vendors based on your problem assessment. FlexPod engineers share information, tap into knowledge gained through joint training, and use a formal escalation process to accelerate problem resolution.

Financing

Available in more than 100 countries, Cisco Capital® financing can help you acquire the technology you need to achieve your objectives. You can reduce capital expenditures (CapEx), accelerate growth, and optimize investments—and get flexibility in acquiring hardware, software, services, and complementary third-party equipment—with one predictable payment.

