

Solution Overview  
February 2017



# Cisco HyperFlex Systems

Cisco HyperFlex™ Systems  
with Intel® Xeon® Processors



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## Highlights

### Complete End-to-End Solution

- Cisco HyperFlex™ Systems, powered by Intel® Xeon® processors, deliver a new generation of hyperconverged solutions that are flexible, scalable, and enterprise class. They combine the software-defined networking and software-defined computing of the Cisco Unified Computing System™ (Cisco UCS®) with Cisco HyperFlex HX Data Platform software to provide a single distributed, multilayer, object-based data store with enterprise storage features.

### Agile

- Our end-to-end solution helps you work faster and more quickly achieve your business's digital transformation.

### Efficient

- Our solution keeps your data optimized and your infrastructure aligned with application requirements.

### Adaptable

- We help make you ready for an expanding range of applications and operating models.

## The Challenge: Limitations of First-Generation Hyperconverged Systems

The first generation of hyperconverged systems arose from the need to more easily deploy a virtualization cluster without the complexity of enterprise shared storage systems. These systems combined generic x86-architecture servers with software-defined storage to create a simplified, distributed computing platform. But to achieve simplicity and to get to market quickly, vendors made design trade-offs and took many architectural shortcuts. As a result, these first attempts at hyperconvergence fell short of full success:

- **Networking is manual, not automated.** First-generation hyperconverged systems treat networking as an afterthought. They do not include an integrated network fabric with consistent, low latency and high bandwidth between nodes, nor do they attempt to integrate microsegmentation through software-defined networking. Network resources cannot be configured provisioned, or scaled automatically using profiles and templates, limiting the simplicity of deployment and system expansion.
- **Scaling is inflexible.** Most hyperconverged products are based on white-box appliances that scale both computing and storage at fixed ratios. These resource ratios may or may not be appropriate for your applications and may cause you to overprovision components you don't need. In the real world, every set of applications has a unique set of requirements, and first-generation products fail to let you independently scale computing, storage, and network resources.
- **Performance requires trade-offs.** The data platforms are implemented using off-the-shelf file systems that weren't built specifically for hyperconvergence. They lack some or all essential features, including local and remote replication, snapshots, data encryption, and integration with enterprise shared storage and enterprise backup strategies. Their deduplication and compression may require performance trade-offs.
- **New silos are created.** First-generation infrastructure simplifies the deployment and operation of cluster nodes, but they add new GUIs for storage management while still requiring separate tools to manage server hardware. They don't

## What's New

### All-Flash Nodes

- Now you can choose even higher-performance and lower-latency all-flash nodes for your Cisco HyperFlex cluster.

### Independent Scaling with Variety of Cisco UCS Servers

- Use variety of Cisco UCS servers as computing-only nodes to achieve the right balance of processing power and storage capacity for your workloads.

### Securely Encrypted Storage

- A self-encrypting drive option encrypts data in all storage tiers of your Cisco HyperFlex cluster.

### Native Replication

- Replicate your virtual machines to local or remote sites for backup or disaster recovery.

### Enhanced Management

- Monitor and manage your Cisco HyperFlex cluster from any device with an advanced role-based HTML 5 interface.

### Integrated Networking

- Integrated networking is even faster with low-latency, lossless 40-Gbps connectivity with Cisco UCS 6300 Series Fabric Interconnects.

### Data Protection Ecosystem Enhancement

- Native data protection APIs integrate with leading enterprise backup systems, enabling a single backup approach across your entire data center.

### Integrated Third-Party Storage

- Connect third-party enterprise storage directly to your cluster through Fibre Channel and IP network connectivity.

integrate the network or provide support for software-defined networking (SDN). They lack a unified control plane and open API to allow integration into higher-level management, orchestration, backup, and disaster-recovery tools. As a result, these environments have spawned new islands of infrastructure and require administrators to learn a new set of management tools. To be most effective, hyperconvergence must integrate with the data center you have today—including balancing workloads across hybrid clouds.

## The Solution: Cisco HyperFlex Systems

Cisco HyperFlex™ Systems, powered by Intel® Xeon® processors, deliver a new generation of more flexible, more scalable, enterprise-class hyperconverged solutions. We deliver a complete solution based on a next-generation data platform—one that smoothly integrates into the data center you have today. In contrast to first-generation products, our solution includes an integrated network fabric and powerful data optimization capabilities that unlock the full potential of hyperconvergence for a wider range of workloads and use cases. Our solution is faster to deploy, simpler to manage, easier to scale, and ready to provide a unified pool of resources to power applications as your business needs dictate. You harness these resources with simplified, centralized management that is integrated, not isolated. Cisco HyperFlex Systems integrate into the data center you have today without creating an island. You can deploy our solution wherever you need it, from central data center environments to remote locations and edge-computing environments (Figure 1).

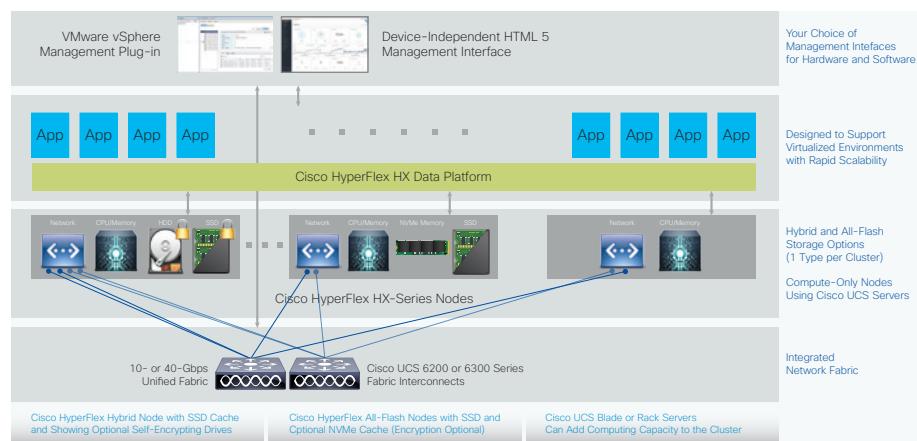


Figure 1 Only Cisco HyperFlex Systems Can Deliver This Combination of Essential Features in a Single Solution

## Complete End-to-End Solution

We offer the first hyperconverged platform that is designed as an end-to-end software-defined infrastructure that eliminates the compromises found in first-generation products. We designed Cisco HyperFlex Systems to support a broader range of applications and workloads in the data center, remote locations, and edge-computing environments. This new generation extends the ease of hyperconverged system deployment, management, and support beyond your central data center.

Cisco HyperFlex Systems combine software-defined computing in the form of Cisco Unified Computing System™ (Cisco UCS®) servers with Intel Xeon processors, software-defined storage with the powerful Cisco HyperFlex HX Data Platform software, and software-defined networking with Cisco UCS fabric that integrates smoothly with Cisco® Application Centric Infrastructure (Cisco ACI™). Together, these elements comprise an adaptive infrastructure that lets you integrate your existing infrastructure. The result is a cluster comes up and configures itself in an hour or less and that scales resources independently to closely match your application resource needs.

#### **Engineered on Cisco UCS Technology**

Cisco UCS provides a single point of connectivity and hardware management that integrates Cisco HyperFlex nodes into a single unified cluster. The system is built to be self-aware and self-integrating so that when the system's fabric interconnects notice a new component attached, that component is automatically incorporated into the cluster.

This capability automates your infrastructure. Rather than requiring you to configure each element in the system manually through a variety of element managers, Cisco UCS was built so that every aspect of server personality, configuration, and connectivity can be set through software. Cisco HyperFlex Systems can be configured in minutes with no risk of configuration creep or noncompliant settings. Cisco UCS service profiles are preconfigured so that the system's installation wizard can get you up and running in less than an hour.

When you make the move to automated infrastructure, you also reap the benefits of the unified Cisco UCS management API. Cisco UCS Director can implement end-to-end application lifecycle orchestration and automation. Cisco ONE™ Enterprise Cloud Suite can turn your cluster into an on-premises cloud service with smooth migration of workloads to and from public cloud facilities.

You can independently scale the computing power of your cluster by configuring Cisco UCS servers as computing-only nodes. This feature lets you adjust the balance of CPU and storage capacity, optimizing your total cost of ownership (TCO). Incremental scalability allows you to start small and scale as your needs grow,

#### **Powered by Next-Generation Data Technology**

The HX Data Platform combines the cluster's storage devices into a single distributed, multilayer, object-based data store. Performance scales linearly as you scale the cluster because all components contribute processing and storage capacity to the cluster. The data platform optimizes storage tiers for an excellent balance between price and performance. For example, hybrid nodes use solid-state disk (SSD) drives for caching and hard-disk drives (HDDs) for capacity; all-flash nodes use fast SSD drives or Nonvolatile Memory (NVM) Express (NVMe) storage for caching and SSDs for capacity.

A full set of enterprise-class data management features are built in: for example, snapshots, thin provisioning, replication, data encryption, integration with third-party backup tools, and instant and space-efficient cloning. Our networking secures your data through its lifecycle, with security and compliance controls for protection when you distribute, migrate, and replicate data across storage environments. New

security features help you comply with industry and governmental standards. The platform delivers high availability through parallel data distribution and replication, accelerated by the low latency and high bandwidth of the Cisco unified fabric. Data is continuously optimized with real-time, always-on deduplication, compression, and optional encryption, helping reduce your storage costs without affecting performance. Dynamic data placement in server memory, caching, and capacity tiers increases application performance and reduces performance bottlenecks.

## Agile, Efficient, and Adaptable Solution

Bringing benefits to your IT organization and to your business, Cisco HyperFlex Systems overcome the limitations of first-generation products, delivering real solutions that are agile, efficient, and adaptable. Our solution is well suited for hosting environments such as virtual desktops, server virtualization deployments, and test and development environments.

### More Agile

Cisco HyperFlex Systems are more agile because they perform, scale, and interoperate better:

- **Deployment is fast and easy.** Your cluster ships with the hypervisor and data platform preinstalled and ready to launch through the installation wizard.
- **Integrated networking brings high performance.** Your cluster is interconnected with low, consistent latency, and with 10- and 40-Gbps network bandwidth.
- **Scaling is fast and simple.** The system automatically discovers new hardware when it is installed. Then adding it to the cluster takes only a few mouse clicks.
- **Interoperability is straightforward.** Management capabilities enable you to install and operate your Cisco HyperFlex System in the data center you have today, with high-level management tools that support operations across your hyperconverged and your traditional infrastructure.

### More Efficient

Our solution was designed from the beginning with a purpose-built, highly efficient data platform that combines the cluster's scale-out storage resources into a single, distributed, multitier, object-based data store. Features you expect of enterprise storage systems are built into Cisco HyperFlex Systems:

- **Buy only the storage you need.** Continuous inline data deduplication and compression, fast, space-efficient clones, and thin provisioning contribute to lowering the cost of your storage.
- **Data protection is built in.** You can use native HX Data Platform capabilities or use the same data protection solutions you use in your data center because Cisco HyperFlex Systems interoperate with leading backup tools.
- **Your data is secure.** You don't need to take extra steps to secure your data at rest when using self-encrypting drives. Cisco HyperFlex Systems help you save time and ensure compliance.
- **Save on storage administration.** You don't need to install a complex storage network or worry about logical unit numbers (LUNs). If you already have enterprise shared storage, you can connect it directly to your cluster to run virtual

machines from it, migrate the storage to your cluster, or use the storage for backup operations.

### More Adaptable

Your business needs and your workloads are constantly changing. Your infrastructure needs to quickly adapt to support your workloads and your business.

- **Easy resource expansion and contraction.** You can scale resources up and out without having to adjust your software or networking capabilities.
- **Nondisruptive scaling.** Your infrastructure can easily scale out without the need to take down your cluster to add a node.
- **Pay as you grow.** You can grow in small increments that won't break your budget, and you can independently scale your computing and capacity resources so they adapt to fit your specific application needs.

## Solution Architecture

Cisco HyperFlex Systems combine Cisco UCS networking and computing technology, powerful Intel Xeon processors, and the HX Data Platform to deliver a complete, preintegrated solution. After you run the configuration wizard, your cluster is ready to work for you. You get a uniform pool of computing, networking, and storage resources that is designed to power your applications.

Logically, a cluster of three or more Cisco HyperFlex HX-Series nodes provide computing and storage resources to a hyperconvergence layer that supports applications with a full-featured data platform. The data platform is implemented using an HX Data Platform controller that runs on each node. This approach creates a uniform pool of resources that supports applications across the cluster. When you need to provision computing or storage capacity, that capacity is drawn from the entire pool. No longer do you have to worry about creating LUNs and configuring Fibre Channel switches. You simply serve virtual machine storage needs from the pool of resources.

Physically, the system is delivered as a cluster of three or more HX-Series nodes. These are integrated to form a single system by a pair of Cisco UCS 6200 or 6300 Series Fabric Interconnects with 10- or 40-Gbps connectivity (Figure 2). Up to an equal number of Cisco UCS servers can act as computing-only nodes, participating in the data platform but contributing only computing power to the cluster.

### Complete Hyperconvergence with Cisco Networking

Networking in most hyperconverged environments is an afterthought. We give you complete hyperconvergence with networking as an integral and essential part of the system. Using Cisco UCS fabric interconnects, you have a single point of connectivity and management that incorporates HX-Series nodes and Cisco UCS servers: a feature that no other hyperconverged vendor can offer. After you deploy a cluster, you can scale it to its maximum size without needing to redesign the network. The solution is designed for easy, smooth scaling. Hyperconverged systems need massive amounts of east-west traffic bandwidth and low latency, and we deliver both with your choice of fabric interconnects supporting either 10- or 40-Gbps networking.

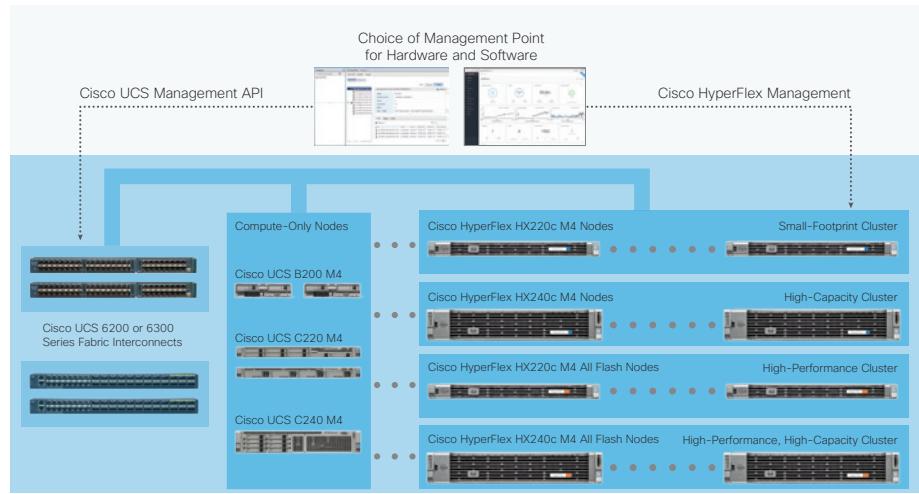


Figure 2 Cisco HyperFlex Systems Product Family

Networking is important in hyperconverged systems because the storage platform performance depends on it. With Cisco UCS fabric interconnects, you get high-bandwidth, low-latency unified fabric connectivity that carries all production IP traffic, hyperconvergence-layer traffic, and management traffic over a single set of cables. Every connection in the cluster is treated as its own microsegment, with the same level of security as if it were supported with a separate physical link, making the integrated network more secure than when commodity approaches are used.

The system is designed so that all traffic, even from different blade server chassis, reaches any other node in the cluster with only a single network hop. No other vendor can achieve this result because every other vendor builds switching into the blade chassis—switching that adds latency. Our latency is deterministic, so you get consistent network performance for the data platform, and you don't have to worry about network constraints on workload placement. This single-hop architecture accelerates east-west traffic, enhancing cluster performance.

#### Integration with Cisco Application Centric Infrastructure

As your environment grows and begins to span your enterprise, you can use Cisco ACI to implement a software-defined network. Cisco ACI provides automated, policy-based network deployment that secures your applications within secure, isolated containers. The network can attach directly to virtual machines and physical servers with increased security, real-time monitoring and telemetry, and automated performance optimization. You get consistency at scale because you can use Cisco ACI to interconnect your entire data center network, integrating your hyperconverged cluster into your existing infrastructure.

#### Cisco HyperFlex HX Data Platform

The HX Data Platform is a purpose-built, high-performance, scale-out file system with a wide array of enterprise-class data management services. The data platform's innovations redefine distributed storage technology, giving you complete hyperconvergence with enterprise storage features:

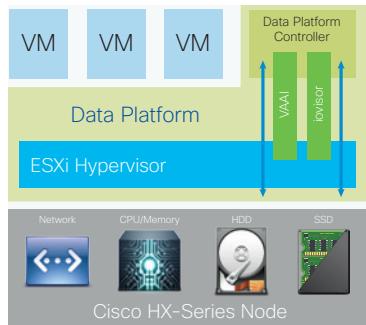
- **Enterprise-class data management features** required for complete lifecycle management and enhanced data protection in distributed storage environments are provided. Features include deduplication, compression, thin provisioning, fast space-efficient clones, snapshots, native replication, and integration with backup solutions from leading vendors.
- **Continuous data optimization** with inline data deduplication and compression increases resource utilization with more headroom for data scaling.
- **Securely encrypted storage** optionally encrypts both the caching and persistent layers of the data platform. Integrated with enterprise key management software or with passphrase-protected keys, encryption of data at rest helps you comply with industry and government regulations. The platform itself is hardened to Federal Information Processing Standard (FIPS) 140-1, and the encrypted drives with key management comply with the FIPS 140-2 standard.
- **Dynamic data placement** optimizes performance and resilience by enabling all cluster resources to participate in I/O responsiveness. Hybrid nodes use a combination of SSD drives for caching and HDDs for the capacity layer; All-flash nodes use SSD drives or NVME storage for the caching layer and SSDs for the capacity layer.
- **Clusterwide parallel data distribution** implements clusterwide data replication for high availability and performance, accelerated by the low latency and high bandwidth of the Cisco UCS network fabric.
- **Linear and incremental scaling** provides faster, easier scalability compared to enterprise shared-storage systems, in which controller resources become a bottleneck and necessitate a complete upgrade of the storage system. Instead, whenever you add an increment of storage in Cisco HyperFlex Systems, you also increment the data platform processing capacity.
- **API-based data platform** architecture provides data virtualization flexibility to support existing and new cloud-native data types. An API for data protection allows enterprise backup solutions to create snapshot-based backups of virtual machines.
- **A simplified approach** eliminates the need to configure LUNs or to require a storage administrator to configure SANs. Storage and data services are managed completely through hypervisor tools such as VMware vCenter.

#### [Cisco HyperFlex HX Data Platform Administration Plug-in](#)

The HX Data Platform can be administered through a VMware vSphere web client plug-in. Through this centralized point of control for the cluster, administrators can create volumes, monitor the data platform health, and manage resource use. Administrators can also use this data to predict when the cluster will need to be scaled.

#### [Cisco HyperFlex HTML 5 Management Interface](#)

Your cluster can also be administered through the HTML 5 management interface, which allows you to accomplish important daily tasks using a fast and intuitive interface that can be accessed from both desktop and mobile devices.



**Figure 3** Cisco HyperFlex Data Platform Controller Plugs into the Hypervisor in Each Node

### Cisco HyperFlex HX Data Platform Controller

An HX Data Platform controller resides on each node and implements the distributed file system (Figure 3). The controller runs in user space within a virtual machine and intercepts and handles all I/O from guest virtual machines. When nodes are configured with self-encrypting drives, the controller negotiates with Cisco UCS Manager to receive the encryption keys that enable the drives to encrypt and decrypt data that flows to and from the various storage layers.

In a VMware environment, the controller occupies a virtual machine with a dedicated number of Intel Xeon processor cores and memory, allowing it to deliver consistent performance and not affect the performance of the other virtual machines in the cluster. The controller can access all storage through the VMware VM\_DIRECT\_PATH feature. It uses the node's memory and SSD drives or NVMe storage as part of a distributed caching layer, and it uses the node's HDDs for distributed storage. The controller manages the self-encrypting drives in concert with the fabric interconnects that interface with enterprise key management software. The controller integrates the data platform into VMware software through the use of two preinstalled VMware ESXi vSphere Installation Bundles (VIBs):

- **IO Visor:** This VIB provides a network file system (NFS) mount point so that the ESXi hypervisor can access the virtual disk drives that are attached to individual virtual machines. From the hypervisor's perspective, it is simply attached to a network file system.
- **VMware API for Array Integration (VAAI):** This storage offload API allows vSphere to request advanced file system operations such as snapshots and cloning. The controller implements these operations through manipulation of metadata rather than actual data copying, providing rapid response, and thus rapid deployment of new application environments.

### Data Distribution

The HX Data Platform controller handles all read and write requests for volumes that the hypervisor accesses and thus intermediates all I/O from the virtual machines. Recognizing the importance of data distribution, the HX Data Platform is designed to exploit low network latencies and parallelism, in contrast to other approaches that emphasize data affinity.

With data distribution, the data platform stripes data evenly across all nodes, with the number of data replicas determined by the policies you set (Figure 4). This approach helps prevent both network and storage hot spots and makes I/O performance the same regardless of virtual machine location. This feature gives you more flexibility in workload placement and contrasts with other architectures in which a locality approach does not fully utilize all available networking and I/O resources.

- **Data write operations:** For write operations, data is written to the local SSD or NVMe cache, and the replicas are written to remote caches in parallel before the write operation is acknowledged.
- **Data read operations:** For read operations, data that is local will usually be read directly from the local SSD drive. If the data is not local, the data is retrieved from an SSD drive on the remote node. This approach allows the platform to use all

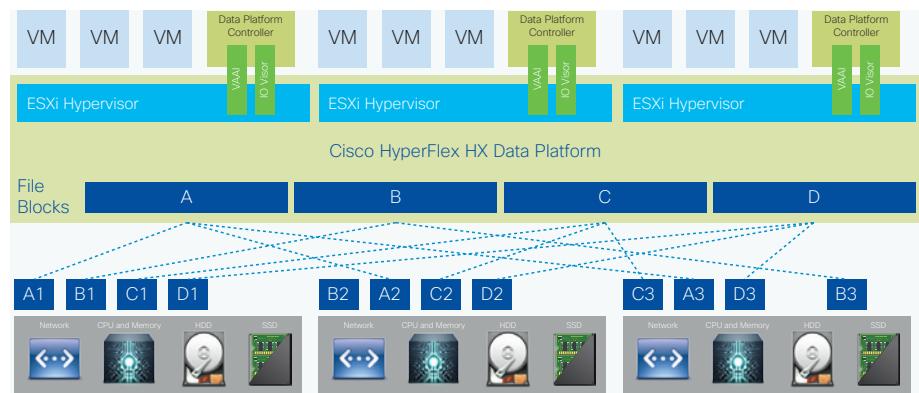


Figure 4 Data Blocks Are Replicated Across the Cluster

SSD drives for read operations, eliminating bottlenecks and delivering superior performance. All-flash nodes do not use a read buffer, and read operations take data directly from the SSD drives in the capacity layer.

In addition, when moving a virtual machine to a new location such as through VMware Dynamic Resource Scheduling (DRS), the data platform does not require data movement, and moving virtual machines has no performance impact or cost.

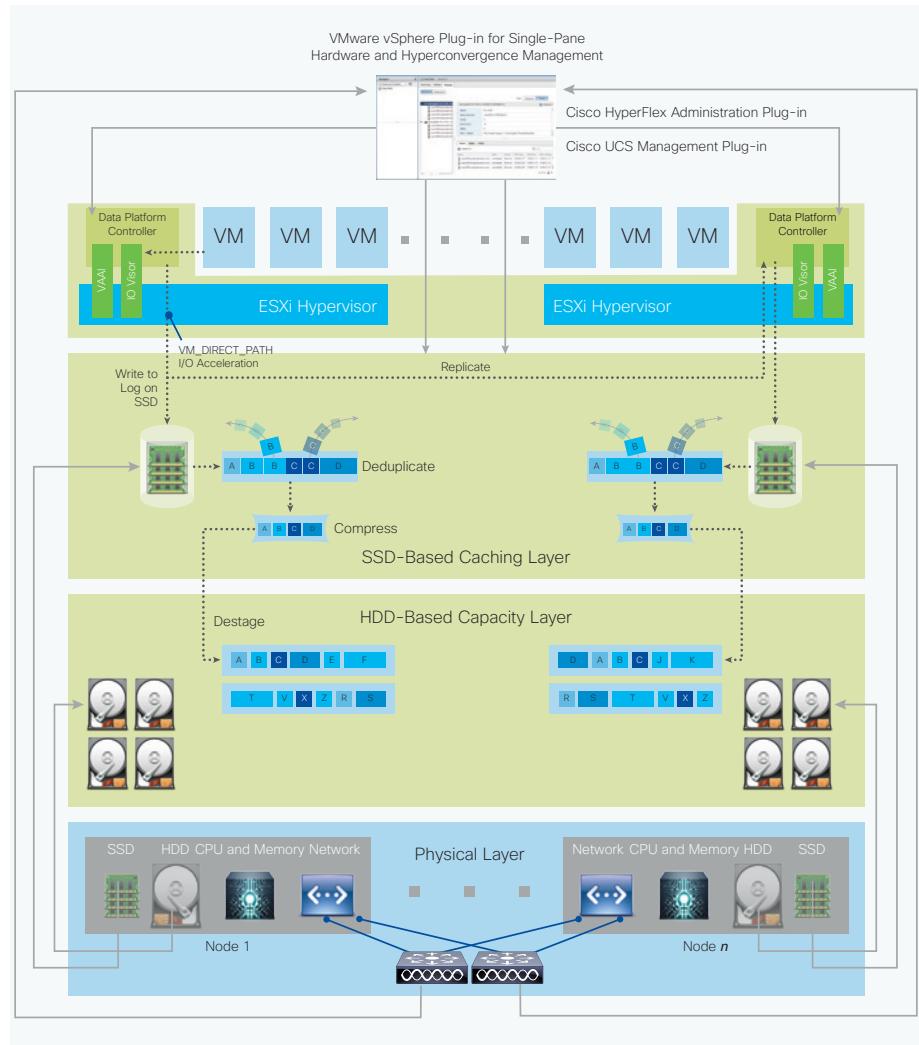
### Data Operations

The data platform implements a log-structured file system that uses a caching layer to accelerate read requests and write responses, and it implements a capacity layer for persistent storage.

Incoming data is striped across the number of nodes that you define to meet your data availability requirements. The log-structured file system assembles blocks to be written to a configurable cache until the buffer is full or workload conditions dictate that it be destaged to a spinning disk. When existing data is (logically) overwritten, the log-structured approach simply appends a new block and updates the metadata, requiring little use of the server's Intel Xeon processors. When data is destaged, the write operation consists of a single seek operation with a large amount of data written. This approach improves performance significantly compared to the traditional read-modify-write model, which is characterized by numerous seek operations and small amounts of data written at a time.

When data is destaged to disk in each node, the data is deduplicated and compressed. This process occurs after the write operation is acknowledged, so there is no performance penalty for these operations. A small deduplication block size helps increase the deduplication rate. Compression further reduces the data footprint. Data is then moved to the capacity tier as cache segments become free (Figure 5).

Read operations in hybrid nodes cache data on the SSD drives and in main memory for high performance. In all-flash nodes they read directly from SSD drives. Having the most frequently used data stored in the caching layer helps make Cisco HyperFlex Systems with Intel Xeon processors perform well for virtualized applications. When virtual machines modify data, the original block is likely read from the cache, so there is often no need to read and then expand the data on a spinning



**Figure 5** Data Write Flow Through the Cisco HyperFlex HX Data Platform

disk. The data platform decouples the caching tier from the capacity tier and allows independent scaling of I/O performance and storage capacity.

### Enterprise-Class Storage Features

The data platform has all the features that you would expect of an enterprise shared storage system, eliminating the need to configure and maintain complex Fibre Channel storage networks and devices. The platform simplifies operations and helps ensure data availability. Enterprise-class storage features include the following:

- **Replication** stripes and replicates data across the cluster so that data availability is not affected if single or multiple components fail (depending on the replication factor configured).
- **Native replication** transfers cluster data to local or remote clusters for backup or disaster-recovery purposes.

- **Deduplication** is always on, helping reduce storage requirements in virtualization clusters in which multiple operating system instances in client virtual machines result in large amounts of replicated data.
- **Compression** further reduces storage requirements, reducing costs, and the log-structured file system is designed to store variable-sized blocks, reducing internal fragmentation.
- **Encryption** protects your data at rest with self-encrypting drives combined with enterprise key management software.
- **Thin provisioning** allows large data volumes to be created without requiring storage to support them until the need arises, simplifying data volume growth and making storage a “pay as you grow” proposition.
- **Fast, space-efficient clones** rapidly replicate storage volumes so that virtual machines can be replicated simply through metadata operations, with actual data copied only for write operations.
- **Data protection API** enables enterprise backup tools to access data volumes for consistent, per-virtual-machine backup operations.

## Engineered on Cisco UCS Technology

Cisco UCS, the foundation for Cisco HyperFlex Systems, is built with a single point of management and connectivity for the entire system. The system is designed as a single virtual blade server chassis that can span multiple chassis and racks of blade and rack server-based nodes. Cisco thus is in the unique position of being able to deliver a hyperconverged solution that can incorporate blade and rack systems in its architecture, offering greater flexibility than any other solution. You can optimize your system with the amount of computing and storage capacity that you need by changing the ratio of Intel Xeon processor-intensive Cisco UCS blade and rack servers to storage-intensive Cisco HyperFlex capacity nodes.

### Cisco HyperFlex HX-Series Nodes

A cluster requires a minimum of three homogeneous nodes (with disk storage). Data is replicated across at least two of these nodes, and a third node is required for continuous operation in the event of a single-node failure. Each node is equipped with at least one high-performance SSD drive for data caching and rapid acknowledgment of write requests. Hybrid nodes use SSD drives for caching and HDDs for the capacity layer. All-flash nodes use SSD drives or NVMe storage for caching, and SSD drives for the capacity layer.

### Scaling with Cisco UCS Servers

If you need more computing power than a cluster of HX-Series nodes provides, you can add Cisco UCS servers to your cluster to increase the ratio of computing power to storage. These servers become computing-only nodes that participate in the data platform layer but with no local cache or storage. You need to have a minimum of three HX-Series nodes in your cluster, and you can add Cisco UCS servers up to the point where you have one Cisco UCS server for each HX-Series node in the cluster. Supported servers include the Cisco UCS B200 M4 Blade Server and the Cisco UCS C220 and C240 Rack Servers.

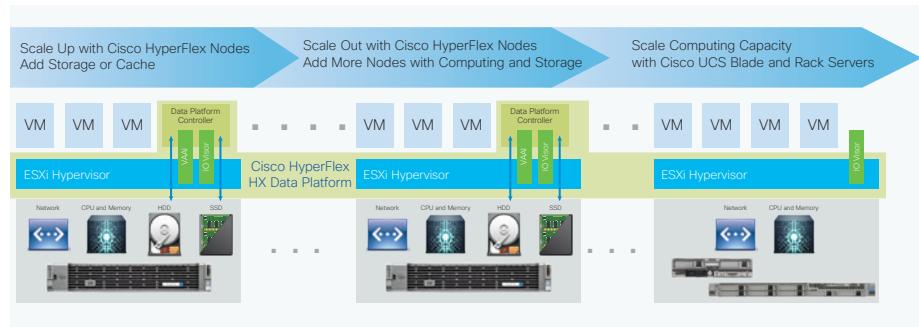


Figure 6 Scale Computing Capacity with Cisco UCS Blade and Rack Servers



### Cluster Configuration Options

A good starting point is either a small-footprint cluster or a capacity-intensive cluster. You can scale up specific nodes to increase memory, caching, and disk capacity (Figure 6). You can scale out with Cisco UCS servers if you need additional computing capacity. Or you can scale out with more of the same nodes if you need additional storage capacity. Each cluster has an all-flash drive option, and each cluster can be equipped with self-encrypting drives. All nodes ship with the ESXi hypervisor preinstalled to reduce deployment time.

- **Small-footprint cluster** with Cisco HyperFlex HX220c M4 Nodes: This starting configuration contains a minimum of three nodes. Each node includes two Cisco Flexible Flash (FlexFlash) Secure Digital (SD) cards for booting, a single 120- or 240-GB SSD data-logging drive, a single 400-GB SSD write log drive, and up to six 1.2-terabyte (TB) SAS HDDs or up to six 3.8-TB or 960-GB SATA SSD drives, for a contribution of up to 22.8 TB of storage capacity to the cluster.
- **Capacity-intensive cluster** with Cisco HyperFlex HX240c M4 Nodes: This configuration contains a minimum of three nodes. Each node includes two FlexFlash SD cards, a single 120- or 240-GB SSD data-logging drive, a single 1.6-TB SSD write log drive, and up to 23 3.8-TB SAS HDDs or 960-GB SATA SSD drives, for a contribution of up to 87.4 TB of storage capacity to the cluster.

### Encrypting Data at Rest

The self-encrypting drive option uses self-encrypting SSDs and HDDs and is available for both hybrid and all-flash nodes. Cisco UCS Manager interfaces with third-party key management systems to keep disk encryption keys safe.

### Connect to External Shared Storage

Many organizations use external shared storage in existing environments. Your Cisco HyperFlex Systems can connect to that shared storage directly through the fabric interconnects. You can connect through 8-Gbps Fibre Channel or up to 40-Gbps Small Computer System Interface over IP (iSCSI). With this capability you can:

- Boot and run virtual machines stored on the shared storage system
- Migrate virtual machines to your more scalable hyperconverged cluster
- Use shared storage for backing up your existing environment

Fibre Channel storage can be connected directly to each hypervisor with separate Fibre Channel interfaces that are configured through software on the Cisco UCS virtual interface cards (VICs) in each node. These interfaces allow the cluster to be configured to follow the hypervisor vendor's recommended best practices for traffic separation by creating separate network interfaces for each type of traffic, configured through software.

#### Powered by Intel Xeon Processors

Each node offered in these three packages is powered by two Intel Xeon processor E5-2600 v4 series CPUs. This Intel Xeon product series is at the core of an agile, efficient data center. It delivers significantly greater performance and power efficiency than the previous generation of Intel Xeon processors. The series provides more cores with more threads, more processor cache space, faster main memory, and reduced power consumption by intelligently matching core, memory, cache, and I/O power to system demand. Each HX-Series node includes a range of processor choices, with up to 16 cores, clock rates of up to 2.6 GHz, and 128 to 768 GB of main memory.



#### Cisco UCS Management

Bringing you complete infrastructure automation, Cisco UCS management detects any component plugged into the system, making it self-aware and self-integrating. With the system itself able to adapt to changes in hardware configuration, you need only a few mouse clicks to incorporate new servers into a cluster. With Cisco UCS service profiles, every aspect of a node's identity, configuration, and connectivity is set through software, increasing efficiency and security and reducing deployment time.

Cisco HyperFlex Systems integrate easily into existing environments and operation processes. Cisco UCS management's API enables integration into higher-level management tools from Cisco and more than a dozen independent software vendors (ISVs). Tools include monitoring and analysis tools such as VMware vRealize Operations Manager and vCenter, other deployment and configuration tools, and service orchestration tools such as VMware vRealize Orchestrator. Cisco UCS management is also integrated into Cisco UCS Performance Manager for monitoring and analysis. When Cisco HyperFlex Systems are managed with Cisco UCS Director or Cisco ONE Enterprise Cloud Suite, they can be managed as infrastructure as a service (IaaS) or even as part of a hybrid cloud along with other Cisco and third-party hardware.

#### Conclusion

With Cisco HyperFlex Systems and Intel Xeon processors, we deliver a complete, next-generation hyperconverged solution that you can use anywhere: from your enterprise data center to your remote locations. We unlock the full potential of hyperconvergence so that you can use a common platform to support more of your applications and use cases, including virtual desktops, server virtualization deployments, and test and development environments. Cisco HyperFlex Systems deliver the operational requirements for agility, scalability, and pay-as-you-grow economics of the cloud—but with the benefits of on-premises infrastructure.

### Part of Our Broad Data Center Strategy

As part of our overall data center vision, integration with Cisco ACI and Enterprise Cloud Suite will put you on the road to a hybrid cloud environment (Figure 7). Cisco UCS Director enables you to use your Cisco HyperFlex Systems to deliver IaaS and create a hybrid cloud. Your customers and clients can use the integrated service catalog to order customized application infrastructure. And when you need to augment capacity to handle periodic peaks, Enterprise Cloud Suite will help you use a policy-based approach for engaging public cloud services. When you choose Cisco HyperFlex Systems and Intel Xeon processors, you take your organization beyond a point-product solution, putting your business on a path to a more agile, adaptable, and efficient future.

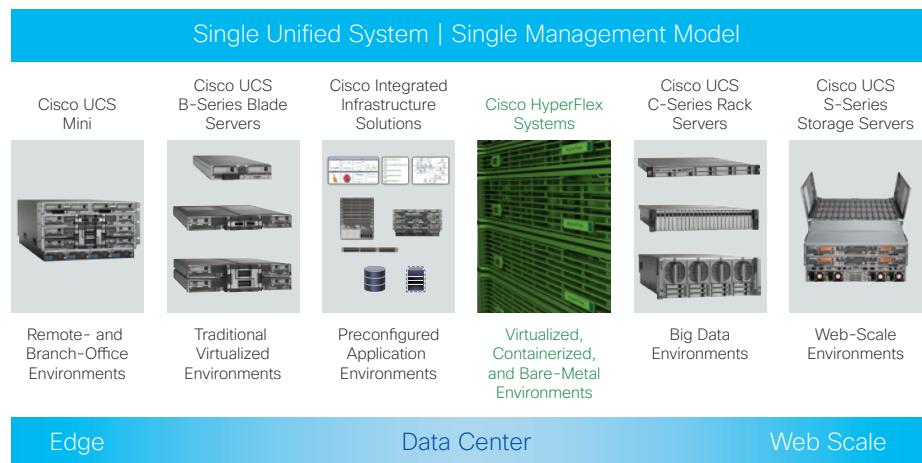


Figure 7 A Single Management Model Supports the Entire Cisco Product Portfolio

### Cisco HyperFlex Services

Cisco Hyperflex services offers expertise that can help you rapidly migrate to Cisco Hyperflex systems and gain faster time to value. Cisco Hyperflex services can help you identify workloads, applications, and storage to migrate as well as verify I/O profiles and availability requirements of your applications.

### For More Information

For more information about Cisco HyperFlex Systems, visit <http://www.cisco.com/go/hyperflex>.

For more information about Cisco HyperFlex services, visit <https://www.cisco.com/c/dam/en/us/solutions/collateral/data-center-virtualization/services-hyperflex-aag.pdf>.



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