Next-Generation Data Center for Government and Education

Cisco Data Center Solutions

Cisco Data Center 3.0 accelerates virtualization and enables automation to extend the lifecycle of mission-critical resources, and forms the architectural foundation for next-generation cloud computing architectures to support evolving government needs.

By bringing network, compute/storage, and virtualization platforms closer together, Cisco Data Center 3.0 Unified Fabric optimizes the delivery of critical government processes, while enabling the next wave of operational efficiency and capital expense optimization.
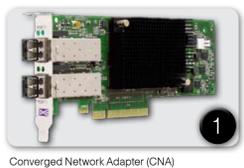
Based on tested and proven designs, innovative technologies, industry-leading partnerships, and professional services, Cisco Data Center 3.0 enables low-risk, incremental evolution to a secure, stable, and resilient next-generation infrastructure.
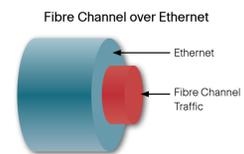
www.cisco.com/go/datacenter

PHYSICAL

The 10 Gigabit Ethernet age is here—especially in the data center. As you look to transition to 10 Gigabit, you must consider technical value, economics, and longevity within your data center. While cabling costs and optics have deterred adoption for some time, Cisco is pleased to introduce data center solutions that can deliver technical advantages as well as cost efficiency.

Cisco's unified fabric technology reduces cost by consolidating networks through Cisco Data Center Ethernet. This eliminates the need for multiple sets of adapters, cables, and switches for LANs, SANs, and high-performance computing networks. The unified fabric is a low-latency, lossless 10 Gigabit foundation that enables a "wire-once" deployment model in which changing I/O configurations no longer means installing adapters and re-cabling racks and switches.

Converged Network Adapter (CNA) — 1

Fibre Channel over Ethernet
- Ethernet
- Fibre Channel Traffic

Data center 10 Gigabit costs become significantly lower through an innovative solution that integrates SFP+ compatible connectors with Twinax cables into an energy-efficient, low-cost, and low-latency solution. Small Form-Factor Pluggable Plus (SFP+) direct-attach 10 Gigabit copper cables use only 0.1 watt of power per connection and introduce only approximately 0.25 microsecond of latency per link. This solution, available in lengths up to 10 meters, enables both lower capital and operating expenses for in-rack cabling.

SFP+10 Gigabit Twinax Cables — 2

Copper vs. Fiber: what is the best option for you? Today, the transition to 10 Gigabit will depend on the strategic combination of copper and fiber within the data center. As Cat-6a is the only viable copper option today, the distance limitation of 100m and power requirements (infrastructure) creates a need for fiber. With current fiber technologies, a single investment can lead you to 10 Gigabit, 40 Gigabit, and eventually 100 Gigabit without replacing the fiber cable plant.

It is clear the need for copper in certain deployments will still remain. Thus, it becomes critical to define top of rack, end of row, and aggregation strategies using the appropriate blend of fiber, copper, and SFP+ Twinax cables to meet both technology and economic needs.

Copper vs. Fiber

UNIFIED FABRIC

The Cisco Nexus 7000 enables high-speed, non-stop operation of the core routing of the network by leveraging advanced features such as ISSU, software modularity, and a highly resilient hardware and software architecture. The Cisco Nexus 7000 provides a scalable platform for high-density 10 Gigabit Ethernet aggregation. Coupling this with the ability to provide Data Center Ethernet (DCE) transport and Multi-Chassis Etherchannel (MEC) enables the unified data center fabric to reduce cost and improve flexibility.

Virtual Device Contexts (VDCs) provide the ability to virtualize the Cisco Nexus 7000 into multiple logical switches on a common physical platform enabling network device consolidation. VDCs also allow additional scalability of the hardware resources in the Cisco Nexus 7000.

Cisco Nexus 7000 Series Switches — 3

The Cisco Nexus 5000 enables you to provide the foundation for wire-speed 10 Gigabit connectivity in the access layer in a top of rack form factor. Additionally, the Cisco Nexus 5000 empowers you to leverage technologies such as DCE and Fibre Channel over Ethernet (FCoE) to build unified data center fabrics. Unified fabrics provide a vehicle for reduction in the number of cables needed for connectivity while still leveraging existing tools and process for provisioning, support, and maintenance.

Cisco Nexus 5000 Series Switches — 4

The Cisco Nexus 2000 Series Fabric Extenders comprise a new category of data center products that provide a highly scalable and flexible server-access layer networking solution. The Cisco Nexus 2000 Series is designed to meet the server-access networking requirements of the virtualized data center. It works in conjunction with Cisco Nexus 5000 Series Switches to provide high-density, low-cost Gigabit connectivity for servers. The Cisco Nexus 2000 Series Fabric Extenders are designed to simplify data center architecture and operations by meeting the business and application needs of a data center.

Cisco Nexus 2148T Fabric Extender — 5

The Cisco MDS fibre channel switches provide a feature-rich platform that is a foundation for consolidation, virtualization and fabric-enabled services. With unparalleled investment protection providing a platform for 1, 2, 4, 8, and 10Gbps fibre channel, embedded fabric services such as SANTap, fibre channel write acceleration (FCWA), tape acceleration, and virtualization enable you to limit data center appliance sprawl and provide simplified cabling designs. Additionally, providing support for DCB empowers you to reap the benefits of Cisco Unified Fabrics.
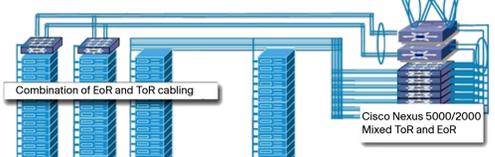
Cisco MDS 9500 Series Multilayer Directors — 6

The Cisco Catalyst 6500 can deliver virtualized services such as firewall, load balancing, IDS/IPS, NAM, and SSL offload to applications in the access layers of the network.

The Cisco Catalyst 6500 with the Virtual Switch Services (VSS) capability enables you to achieve resilient loop-free data center networks. The flexibility to support non-rack mountable systems in the data center with network connectivity and services in a rich number of configurations allows you to build the architecture that meets your needs for every aspect of the data center.

Cisco Catalyst 6500 Series Switches — 7
VSL — 8

A combined Top of Rack (ToR) and End of Row (EoR) access layer design can help you deliver solutions for every scenario. A mixed design provides the flexibility to deliver one Gigabit and 10 Gigabit Ethernet ports to servers and blade centers.

Combination of EoR and ToR cabling
Cisco Nexus 5000/2000 Mixed ToR and EoR

Unified Computing Technology Partners
- bladelogic
- bmcsoftware
- EMC² where information lives
- EMULEX
- intel
- Microsoft
- N
- NetApp
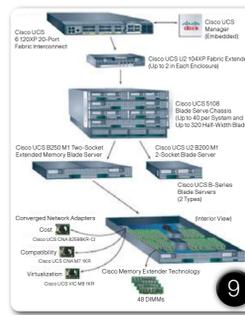- ORACLE
- QLOGIC
- redhat
- vmware

VIRTUALIZATION

The Cisco Unified Computing System is a next-generation data center platform that unites compute, network, storage access, and virtualization into a cohesive system designed to reduce total cost of ownership (TCO) and increase business agility. The system integrates a low-latency, lossless 10 Gigabit Ethernet unified network fabric with enterprise-class, x86-architecture servers. The system is an integrated, scalable, multichassis platform in which all resources participate in a unified management domain.

The Cisco Unified Computing System is designed to deliver:
- Reduced TCO at the platform, site, and organizational levels
- Increased IT staff productivity and business agility through just-in-time provisioning and mobility support for both virtualized and nonvirtualized environments
- A cohesive, integrated system that is managed, serviced, and tested as a whole
- Scalability through a design for up to 320 discrete servers and thousands of virtual machines, and the capability to scale I/O bandwidth to match demand
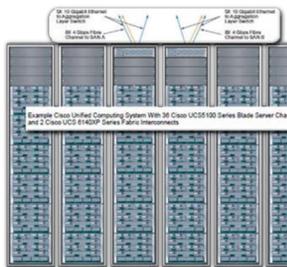- Industry standards supported by a partner ecosystem of industry leaders

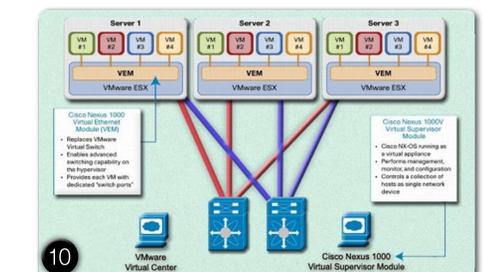**Cisco Unified Computing System Architecture** — 9

Cisco UCS5100 Series Blade Server Chassis

The unified fabric is extended to up to 40 blade chassis via up to two Cisco UCS 2100 Series Fabric Extenders per blade chassis, each supporting up to four unified fabric connections. Each chassis must have at least one connection to a parent Cisco UCS 6100 Series Fabric Interconnect.

Up to eight Cisco UCS B-Series Blade Servers can be installed in a Cisco UCS 5100 Series Blade Server Chassis. The chassis supports half-width and full-width blades. Cisco UCS B-Series Blade Servers use Intel Xeon 5500 Series processors that deliver intelligent performance, automated energy efficiency, and flexible virtualization.

When server virtualization is deployed in the data center, virtual servers typically are not managed the same way as physical servers. Server virtualization is treated as a special deployment, leading to longer deployment time with a greater degree of coordination among server, network, storage, and security administrators. But with the Cisco Nexus 1000V Series Switch, you can have a consistent networking feature set and provisioning process all the way from the virtual machine (VM) to the access, aggregation, and core switches. Your virtual servers can use the same network configuration, security policy, tools, and operational models as physical servers. Virtualization administrators can leverage predefined network policy that follows the nomadic VM and focus on VM administration. This comprehensive set of capabilities will help you deploy server virtualization faster and realize its benefits sooner.
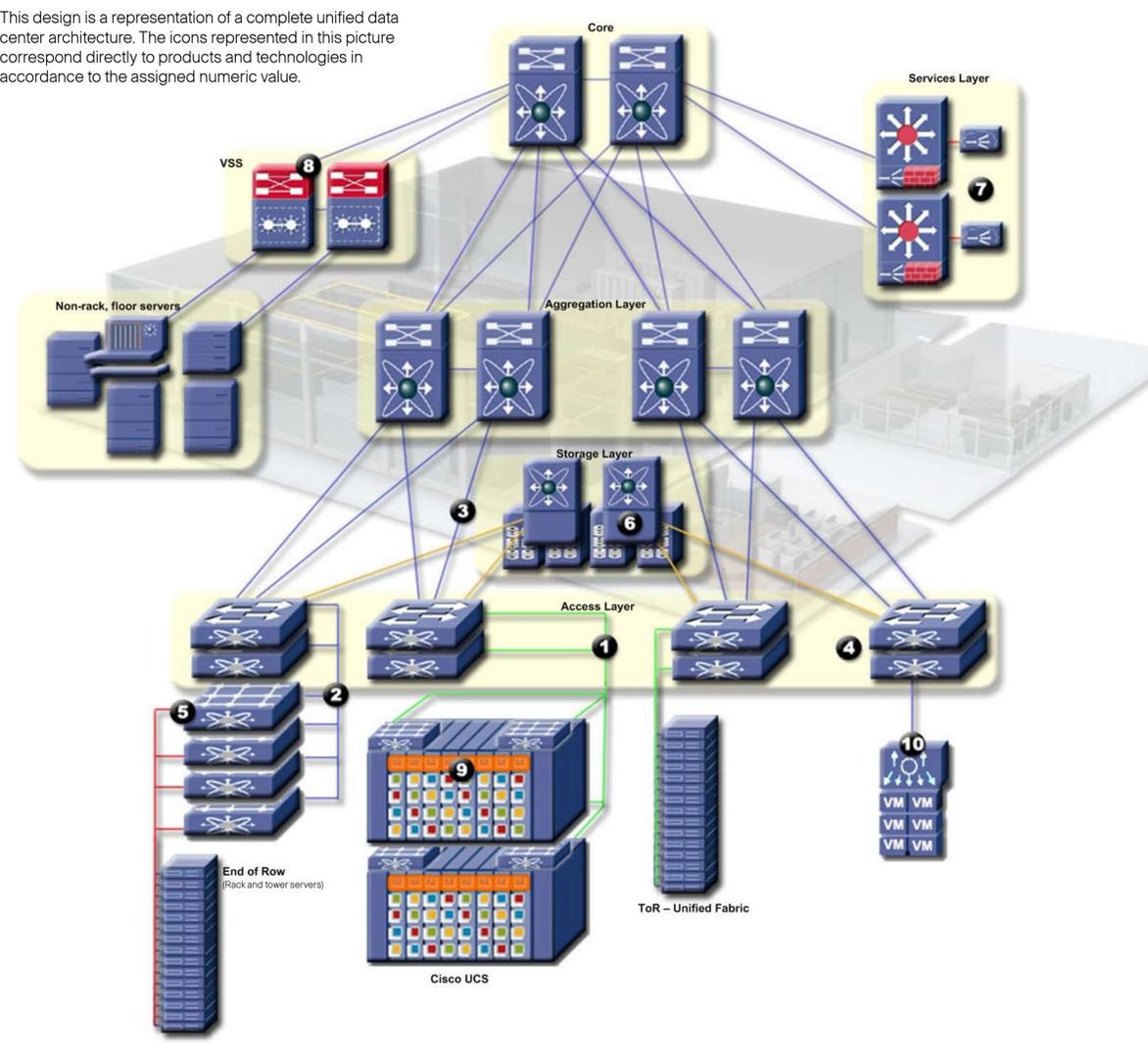
Developed in close collaboration with VMware, the Cisco Nexus 1000V Series Switch is fully integrated with VMware Virtual Infrastructure, including VMware Virtual Center, VMware ESX, and ESXi. You can use the Cisco Nexus 1000V Series Switch to manage VM connectivity with confidence in the integrity of the server virtualization infrastructure.

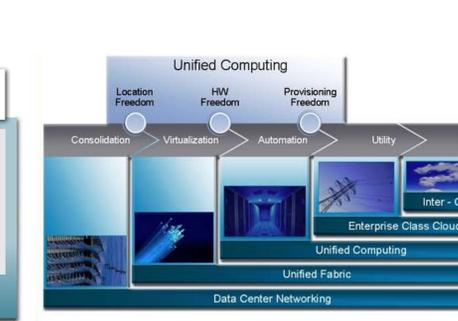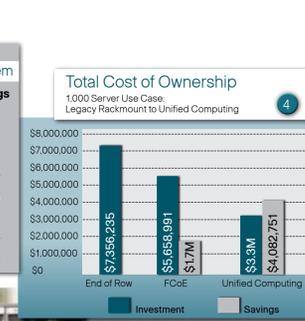**Cisco Nexus 1000V Series Switches** — 10

PHYSICAL —— UNIFIED FABRIC —— VIRTUALIZATION

This design is a representation of a complete unified data center architecture. The icons represented in this picture correspond directly to products and technologies in accordance with the assigned numeric value.

- Core
- Services Layer — 7
- VSS — 8
- Non-rack, floor servers
- Aggregation Layer
- Storage Layer
- Access Layer
- End of Row (Rack and tower servers)
- ToR – Unified Fabric
- Cisco UCS

Business Benefits—Cisco Unified Computing System

Sample Case Study — Large Enterprise — 3

Legacy System	Cisco Unified Computing System	Savings
· 320 Servers	· 320 Servers	
· Time to provision new applications: days to weeks	· Time to provision new applications: minutes	
· $21M spent on CapEx	· $12M spent on CapEx	43%
· $800K spent on power and cooling (3 year)	· $650K spent on power and cooling (3 year)	19%
· 3,520 cables	· 480 cables	86%
· 31 racks	· 12 racks	61%

Total Cost of Ownership
1,000 Server Use Case:
Legacy Rackmount to Unified Computing — 4

- $8,000,000
- $7,000,000
- $6,000,000
- $5,000,000
- $4,000,000
- $3,000,000
- $2,000,000
- $1,000,000
- $0

End of Row: $7,356,235 / FCoE: $5,658,991 / Unified Computing: $1.7M / $3.3M / $4,082,751

Investment — Savings

Unified Computing
- Location Freedom
- HW Freedom
- Provisioning Freedom
- Consolidation > Virtualization > Automation > Utility > Cloud
- Inter - Cloud
- Enterprise Class Clouds
- Unified Computing
- Unified Fabric
- Data Center Networking

Cisco Unified Computing System Legend
1. Server and cabling before Cisco Unified Computing System deployment
2. With Cisco Unified Computing System (same applications as retired servers)
3. Cisco Unified Computing System cost savings example
4. Cisco Unified Computing System TCO example

CISCO