



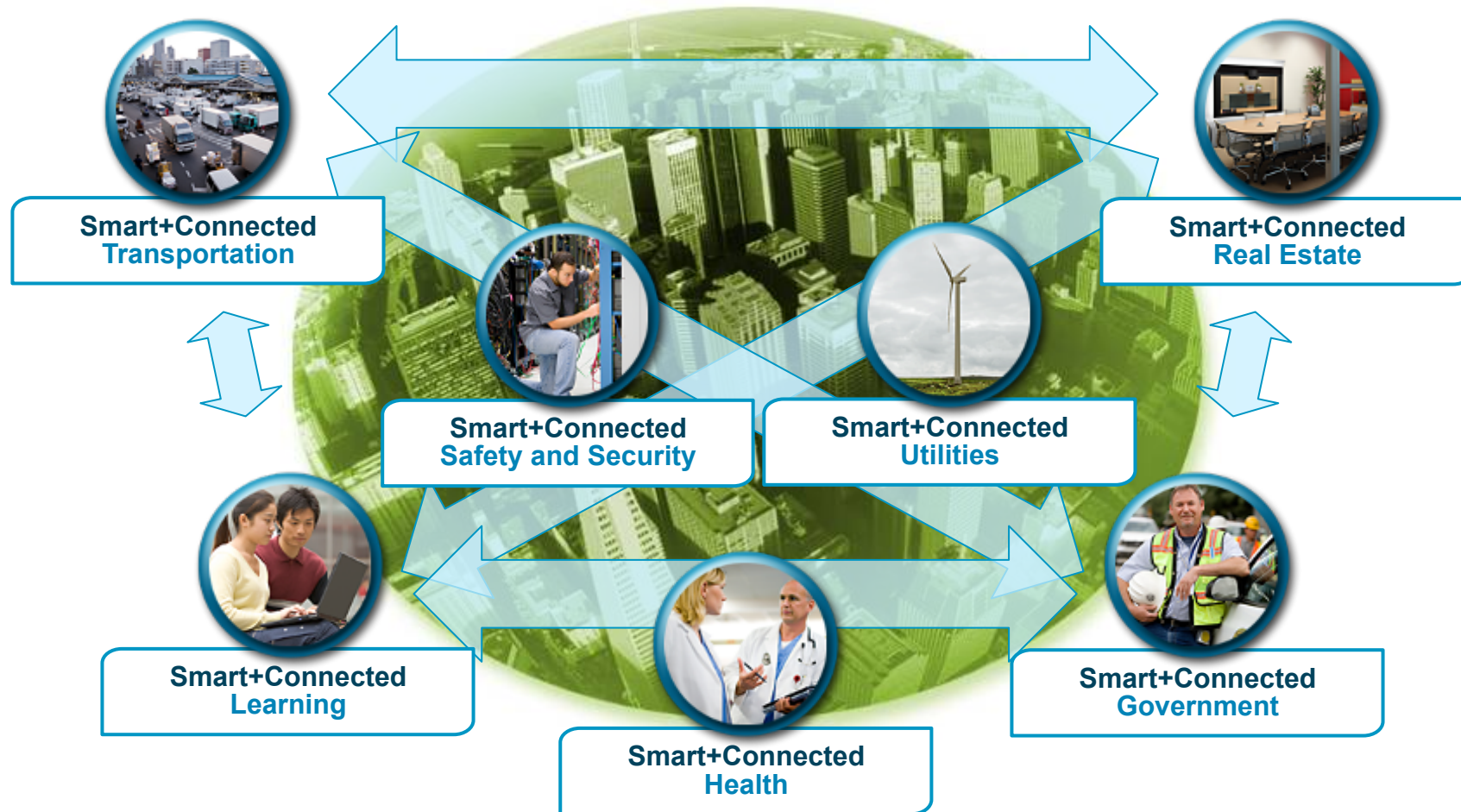
Data Center Solutions for Higher Education

Juan Antonio Castilleja
Systems Engineer



Smart+Connected Communities

Connecting Governments, Businesses, and Citizens



Connect, involve, and empower businesses and citizens to improve communication and provide better access to government and the community.

Inspiring New Connections

Students are changing, and we are becoming one global economy.
The education we deliver, therefore, must necessarily change.



Different Roles, Different Styles of Interaction



Provost, Chancellor

“Call my admin,
email me”

IT, Administration

“Find me,
follow me”

Researcher, Student

“Contact me
online”

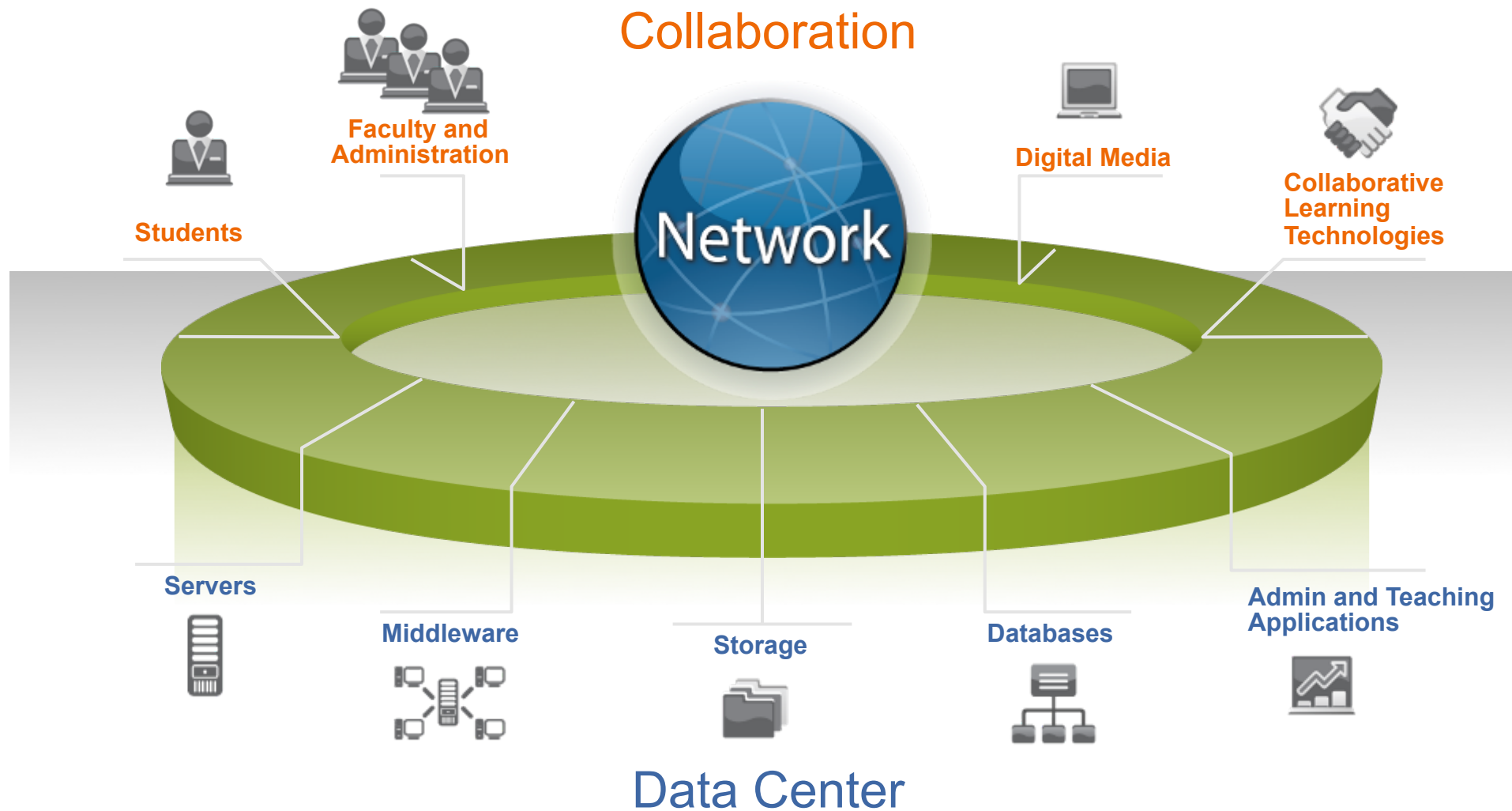
Higher-Order Collaboration— More Than Email



“Raising the productivity of people whose jobs cannot be automated is the next great performance challenge.”

The Connected Learning Environment

Uses the Network as a Platform



The data center is the heart of the system for consolidation, virtualization, managing, sharing and securing resources and information

Data Center Challenges for Higher Education

Creating Connected Learning
Environments



Data Center Challenges for Higher Education



- Accommodate more data center users, applications, and data—and escalating user expectations
- Simplify management and reduce TCO—computing, energy, and maintenance costs
- Maintain the university's reputation for leading-edge computing to attract students, faculty, and research.
- Seamlessly integrate applications, network, and computing to ensure the highest availability and ease of use.
- IT has been the foundation of university operations—IT is increasingly critical to connected learning, safety and security, and energy management.

Data Centers for Higher Education:

Maximize IT Resources and Improve Processes

Converge



- Converge multiple, disparate voice, video, and data systems onto one unified, robust IP network
- Increase performance, scalability, and manageability by centrally managing all applications and devices

Consolidate



- Consolidate and embed services and applications into the network
- Consolidate servers, applications, and data centers to free up valuable IT resources and save money.

Virtualize



- Virtualize servers, applications, and desktops across the IP network
- Automatically update and standardize operating systems and applications.
- Reduce management and maintenance costs.
- Increase ability to scale and respond to growth needs.
- Extend life of existing equipment

How Cisco has Helped in the Data Center

University of Wyoming

▶ Before

“Students don’t restrict their hours from 8:00 a.m. to 5:00 p.m. In fact, we experience some of our heaviest loads late in the evening, so availability, reliability, and ease of maintenance are crucial. For students, network connectivity is as important as electricity.”

Brad Thomas – Network Specialist

▶ After

“As far as we know, our data center is the most advanced in the state of Wyoming and one of the most advanced in United States higher education institutions.”

Brad Thomas – Network Specialist

How Cisco has Helped in the Data Center

East Carolina University

▶ Before

“We realized that we didn’t want to take any chances with downtime in our distance learning program whether it was for maintenance or for an unplanned downtime, and decided that it was time to build out the SAN to include a secondary fabric for our critical applications and backups.”

Colleen Rhodes, Systems Analyst of Storage Technology

▶ After

“We estimate the SAN environment made available through our MDS directors is saving us over US\$2 million. Had we purchased stand-alone boxes for that entire infrastructure and had to power up several devices, it would have cost us approximately \$2 million more than what we spent for our current SAN environment.”

Colleen Rhodes, Systems Analyst of Storage Technology

How Cisco has Helped in the Data Center

Hong Kong Institute of Education



Before

"Hong Kong Institute of Education strives to inculcate an appreciation and familiarity of multimedia technology in the area of education. We encourage the frequent constructive use of rich media and Web 2.0 applications in the context of education."

Victor Cheng – Director of Information Technology Services



After

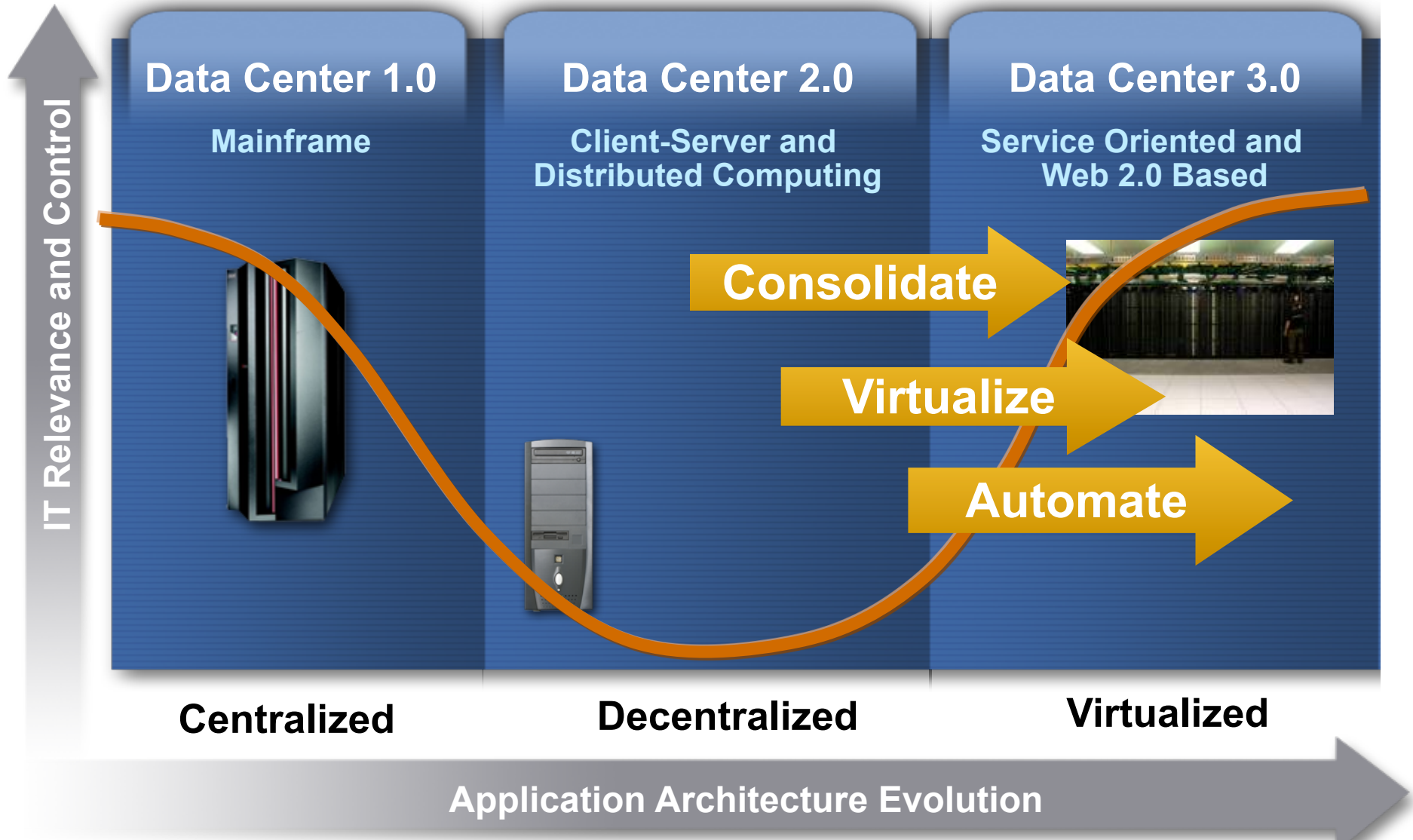
"With this solution, Cisco has effectively brought our institute to the forefront of education in Hong Kong."

Victor Cheng – Director of Information Technology Services

Overview of Data Center Solutions



Data Center and Network Evolution



Data Center Benefits for the Higher Education

Consolidation

- Reduce the number of devices to decrease cost, environmental impact and improve management
- The foundation to improve services, agility, scalability, and productivity
- Open, secure and resilient
- Enable shared services

Virtualization

- Merge multiple applications to increase server virtualization
- Decreasing the number of equipment and appliances
- Decrease the cost of maintaining old equipment and reduce management

Unified Fabric/ Automation

- The solutions to improve service velocity, productivity, and communications
- Automate routine tasks
- Streamline management and operations

Unified Computing

- A common infrastructure for sharing new and innovative services
- Allows migration of existing applications to the shared infrastructure

Cloud Computing

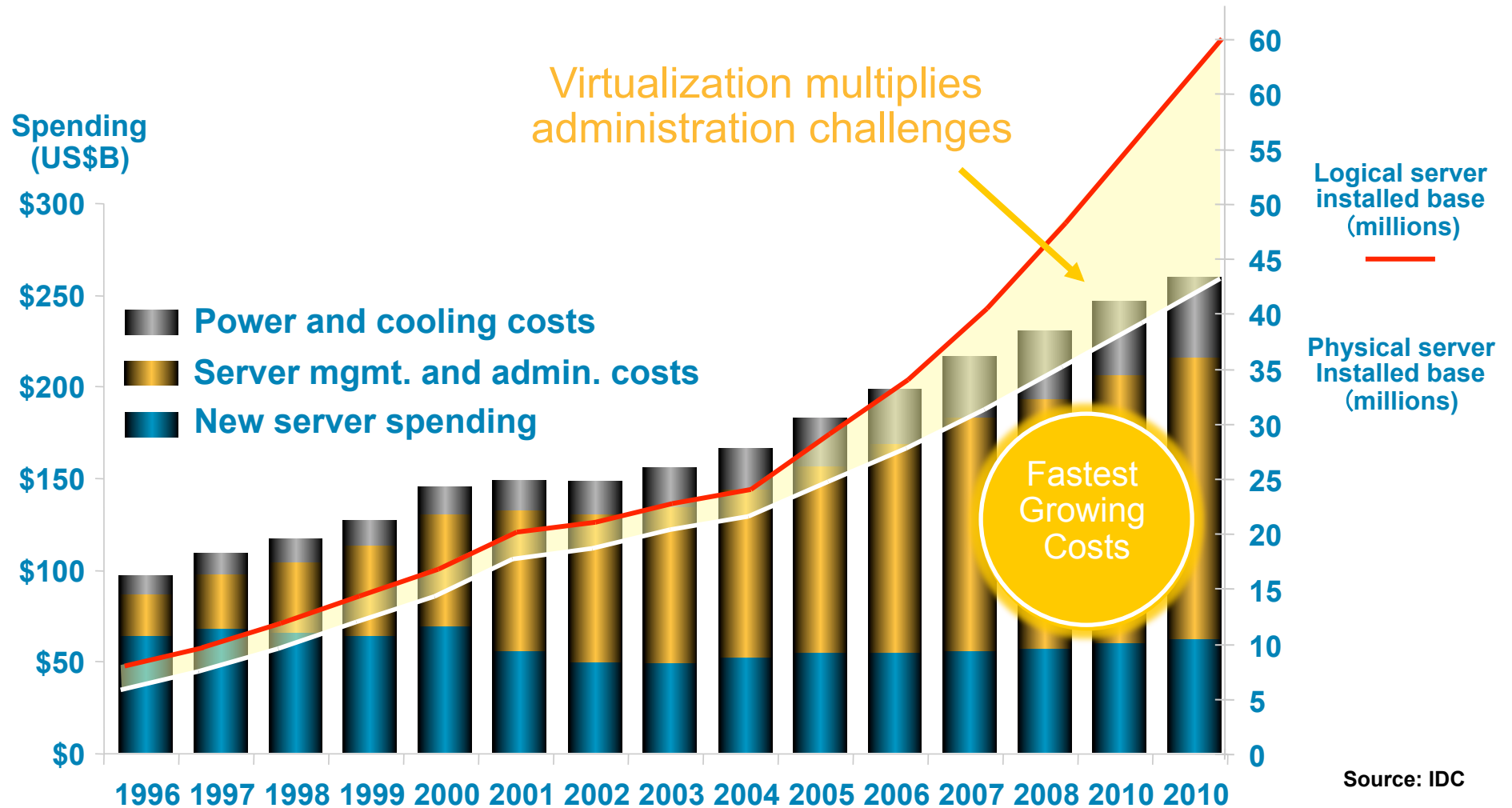
- IT resources and services provided on-demand, at scale in a multi-tenant environment
- Allows for software as a service, platform as a service, infrastructure as a service

Security

The Network is the Platform

Data Center Infrastructure

Operations and maintenance now 80% of IT budgets and growing



Source: IDC 2010

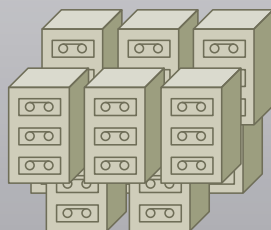
Data Center and Network Evolution in Education

Consolidation and Virtualization: Server

Reducing and optimizing servers will decrease costs of management, power, cooling, and physical challenges while enabling the sharing of servers and applications across different user groups.

Consolidation

Data Center



Virtualization

Main Campus



Satellite Campuses



Remote Learners and Faculty



Data Center and Network Evolution in Education

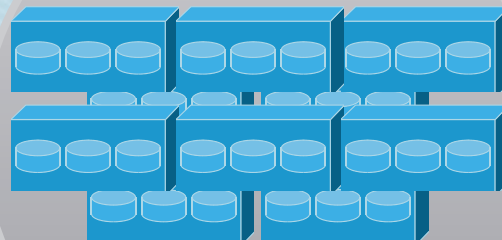
Consolidation and Virtualization: Storage

Merging separate storage environments will decrease many costs while allowing the sharing of equipment and information

In addition to VMware and EMC, Cisco also works with NetApp, Microsoft, and other partners.

Consolidation

Data Center



Virtualization

Main Campus



Satellite Campuses



Remote Learners and Faculty



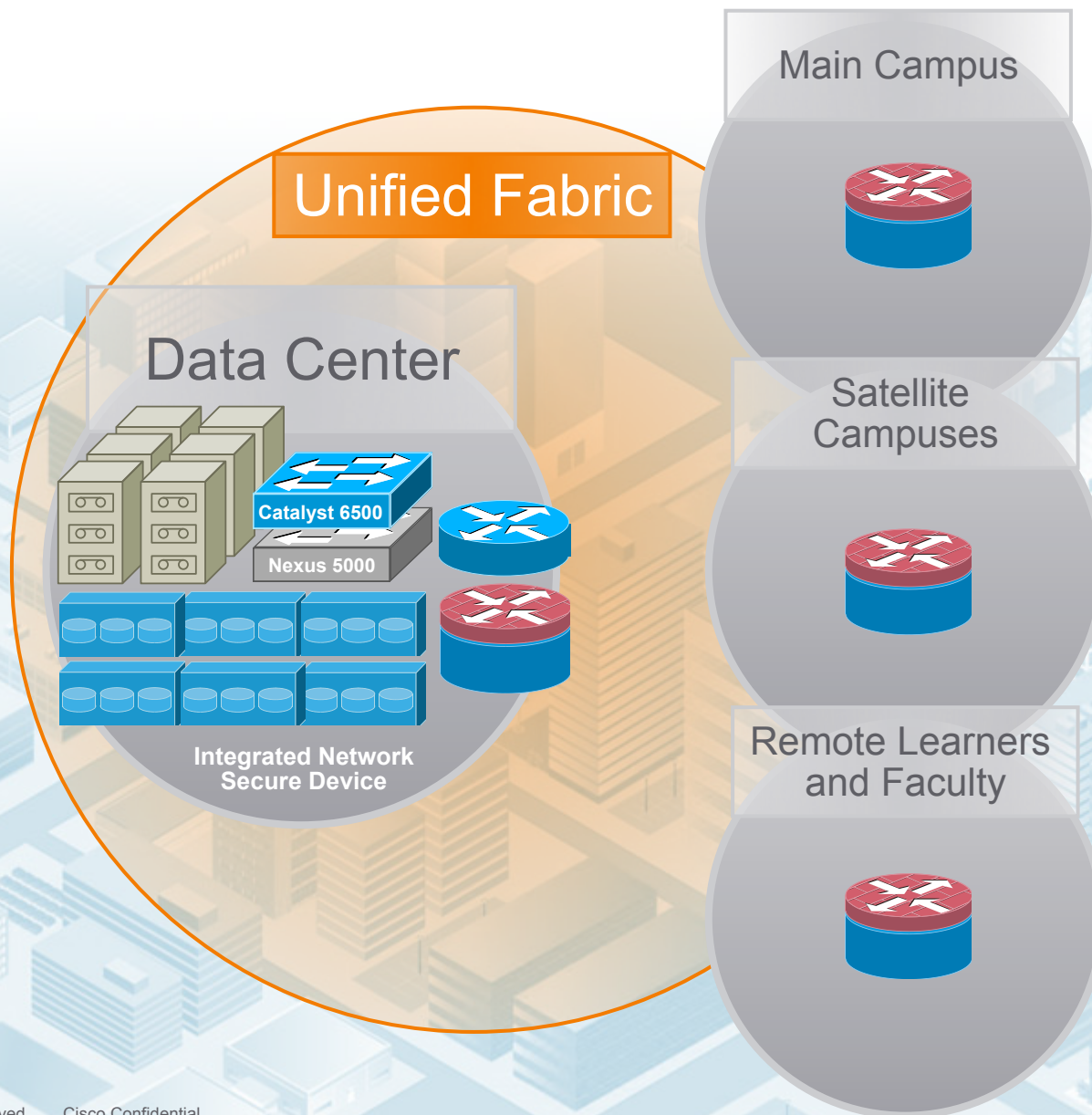
Data Center



Data Center and Network Evolution in Education

Unified Fabric

Server, storage, and network operations unified on a single, Unified Fabric enables an efficient, secure and versatile communications platform which does more, saves money and is prepared for the future



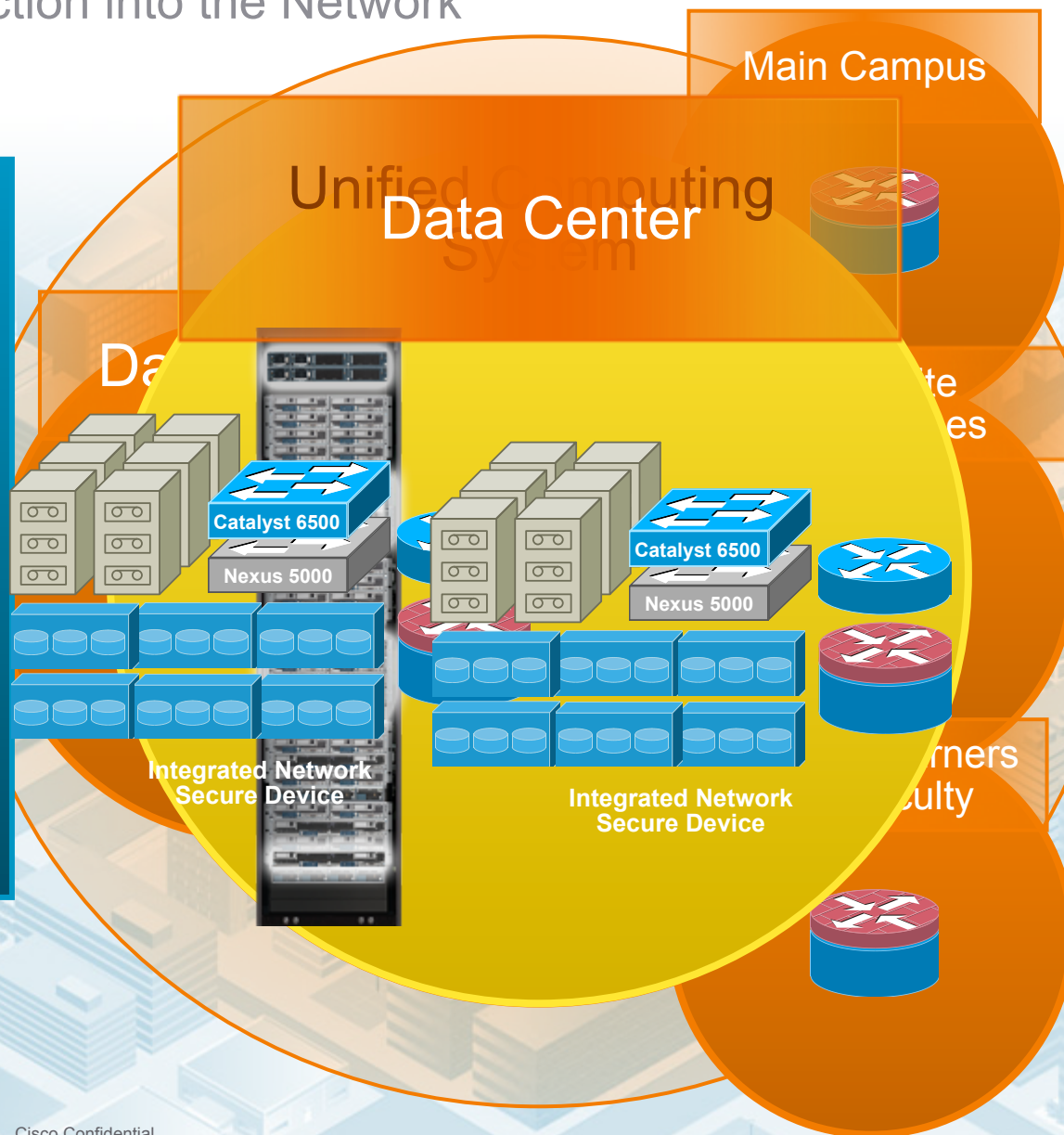
Data Center and Network Evolution in Education

Optimized for Interaction into the Network

Cisco Unified Computing System: Optimized for Interaction into the Network

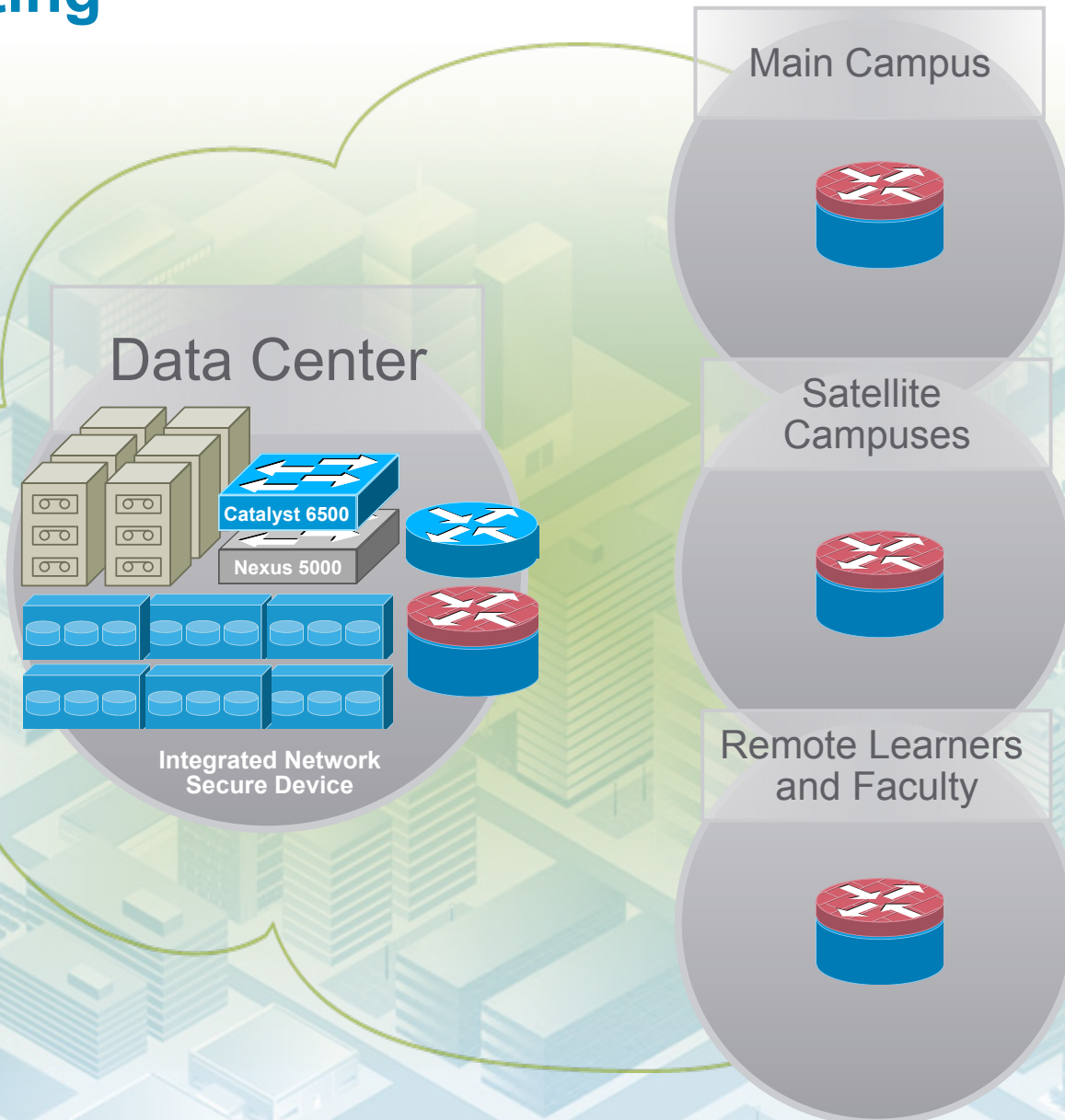
- Industry Standard Servers
- Unified Fabric
- Virtualization Optimization
- Automated Provisioning

Designed to dramatically reduce datacenter total cost of ownership while simultaneously increasing IT agility and responsiveness.



Cloud Computing

- Move from physical to virtual servers
- Unify and standardize architecture across campuses
- Maximize existing devices and resources
- Simplify DC, network, and application operations
- Meet increasing demands for access and availability
- Enable faster scalability
- Save on capital, maintenance, and energy costs



Customer Examples

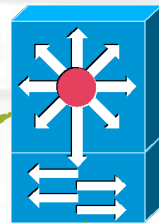


University of Wyoming

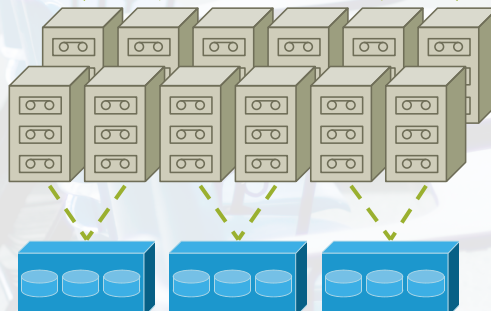
**Distributed users,
students and staff**
On and off-campus

1 Gig Connections

Catalyst 6500



1 Gig Connections



Current cabling inadequate
for future growth and
throughput requirements

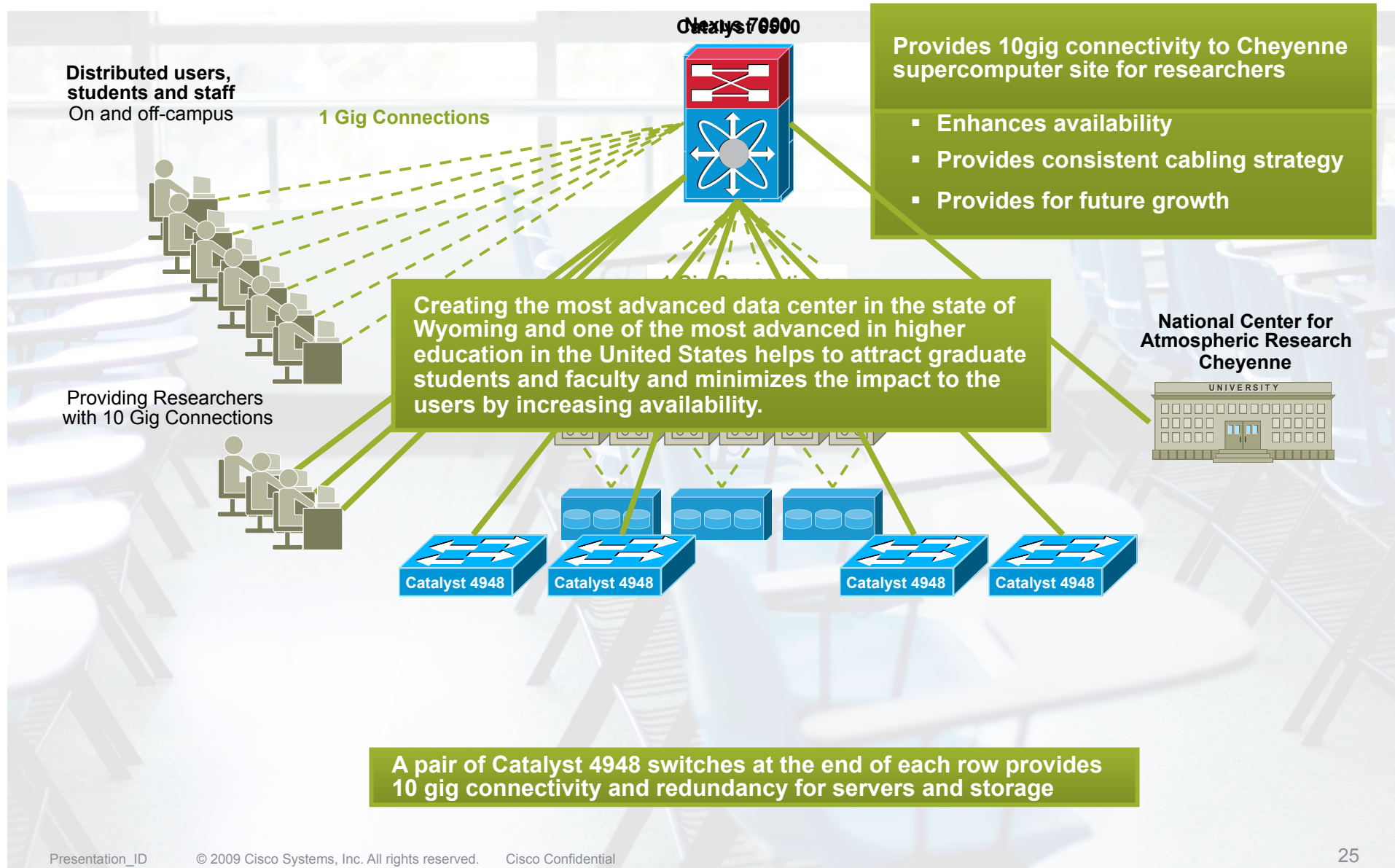
Limited Port Density left no
room for growth

Downtime requirements for
maintenance impacted
users

Migration to Blade Servers
required higher bandwidth

iSCSI and Fiber Channel SAN
required 10 gig connections

University of Wyoming



University of North Carolina, Charlotte

Transitioned an outdated campus computing facility into a service-oriented data center

Challenge

Expecting 10,000 more students by 2015, they engaged Cisco to help them design a new data center to:

- Meet the needs of more students, faculty, and data
- Accelerate introduction of new business services
- Help ensure business continuity

Solution

Data center design and proof of concept lab testing

Multilayer Director Switches, Application Control Engine modules, Adaptive Security Appliance, Catalyst Switches, and Bladeswitch

Benefit

Increased data center scalability and availability

Strengthened business continuity

Reduced total cost of ownership

UNC-C

“Our Cisco data center consultant has become part of the team, conducting a couple of half-day sessions monthly. We regard him as a trusted advisor for all aspects of data center design, not just the Cisco solutions.”

Tom Lamb, Chief Technology Officer, University of North Carolina at Charlotte



Harvard Chemistry & Chemical Biology Dept.

Ivy league university innovates IT architecture

Challenge

- Create a high-performance server fabric with shared pools of I/O and storage resources offering high throughput for research cluster computing
- Support advanced computational methods
- Increase price-performance and provide compatibility for scientific computing applications

Solution

A unified high-performance computing fabric with Cisco® Catalyst®, Cisco InfiniBand, and Cisco MDS Multilayer SAN Switches to support cluster computing, share storage, and highly available access

Benefit

- Improved cluster performance as much as 50 percent faster than a fiber channel architecture
- An infrastructure suited to the computational workload demands of the department
- HPC solution meets current needs and serves as a template for future computing

Harvard University

The new infrastructure is suited to the computational workload demands of the department, and the bandwidth and capacity challenges previously experienced are virtually nonexistent since upgrading the file system.



East Carolina University

Director-class switches create a new, scalable SAN

Challenge

Establish a SAN with a high-performance, scalable, director-class storage switching infrastructure to accommodate the technology demands of the university's data infrastructure

Create a second SAN fabric to maintain high availability and uptime

Solution

Cisco MDS 9509 Multilayer Directors

Cisco MDS 9513 Multilayer Directors

Cisco MDS 9134 Multilayer Fabric Switches

Cisco MDS 9124-24 Port Multilayer Fabric Switches

Benefit

Allowed implementation of solutions leading to savings of over US \$2 million in equipment and power

Saved approximately 900 megawatts each year through MDS director technologies

Provided a reliable and high-performing storage switching infrastructure

East Carolina University

“We estimate the SAN environment made available through our MDS directors is saving us over US \$2 million. Had we purchased stand-alone boxes for that entire infrastructure and had to power up several devices, it would have cost us approximately \$2 million more than what we spent for our current SAN environment.”

Colleen Rhodes, Systems Analyst of Storage Technology, East Carolina University



University of Arizona

Converged data and storage networks save 50% of infrastructure costs

Challenge

- Increase administrative efficiency
- Reduce costs
- Replace all enterprise applications and accelerate the adoption of virtualization
- Support server virtualization and latency-sensitive applications

Solution

- 10 Gigabit Ethernet environment with a unified fabric for the LAN and SAN
- Cisco Nexus 5010 Switches that support Fiber Channel over Ethernet
- Cisco Nexus 7010 Switches to connect to the IP network and Cisco MDS 9509 Multilayer Director to connect to the SAN

Benefit

- Capital cost savings and investment protection
- Simplified cable management and more convenient maintenance
- Reduced power consumption and cooling efficiency
- Support for high-bandwidth and latency-sensitive applications

University of Arizona

“Our old data center fabric architecture was a shortcoming that we repeatedly had to design around. With users as tech-savvy as ours, the demands on our data center constantly grow and shift. The Cisco Nexus architecture is an enabler, empowering our department to focus on our primary mission, which is to provide the richest user experience possible.”

Derek Masseth, Senior Director
for Infrastructure Services,
University of Arizona



Honk Kong Institute of Education

Cisco provides bright future for Hong Kong education

Challenge

- Facilitate application delivery for 150 application servers
- Increase network bandwidth to accommodate media-rich applications, mobile and remote access
- Simplify and prepare network to support new academic structure with mobile learning and multimedia applications

Solution

- Cisco Virtual Switching Supervisor 1440
- Cisco Application Control Engine modules
- 10 Gigabit Ethernet SFP line cards

Benefit

- High bandwidth
- Reduced system downtime
- Simplified network structure
- Improved access to services and applications

HKIED

"HKIED strives to inculcate an appreciation and familiarity of multimedia technology in the area of education. We encourage the frequent constructive use of rich media and Web 2.0 applications in the context of education. With this solution, Cisco has effectively brought our institute to the forefront of education in Hong Kong."

Victor Cheng, Director of Information Technology Services, HKIED



University of Salerno

Next-generation data center improves education services

Challenge

Meet the demand for more and better computer services and applications
Increase access to educational resources without increasing risk to system security

Solution

Cisco Data Center 3.0
Cisco routing and switching
Cisco Catalyst 6500 Series Firewall Services Module
Cisco MDS 9500 Series Multilayer Directors

Benefit

Increased education application performance by 30 percent
Improved access to educational resources without compromising security
Simplified and reduced the cost of data center operations
Reduced data center carbon footprint

University of Salerno

“Cisco’s data center vision and its networking technology are playing a critical role in enabling the University to deliver better, faster and more efficient services that further enhance education.”

Salvatore Ferrandino, IT Manager,
University of Salerno



University of Naples

Bringing R&D to market faster with high-performance computing

Challenge

- Maintain a reputation as a leading scientific research and development center
- Increase the potential to attract new funding and investment in innovation
- Use existing computing resources more effectively

Solution

- Cisco SFS 7000 Series InfiniBand Server Switches
- Cisco SFS 3012 Multifabric Server Switch
- CiscoMDS 9500 Series Multilayer Directors
- CiscoMDS 9100 Series Multilayer Fabric Switches

Benefit

- Creates a world-class, high-performance computing environment for faster, more efficient research
- Able to bring new research and development to market faster
- Allows the university to take on more research and development projects
- Helps attract more inward investment and increases new research funding

University of Naples

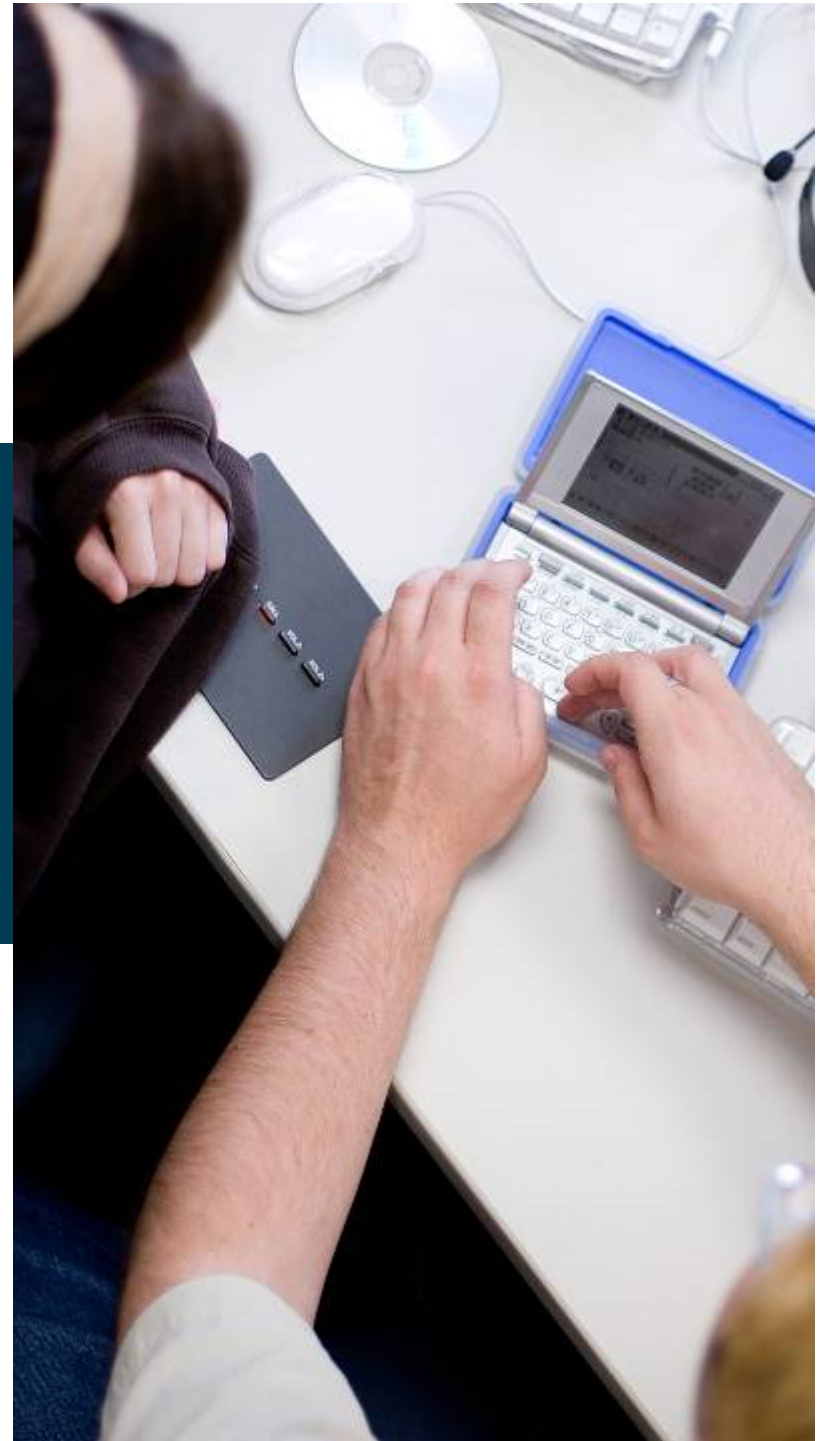
“We feel that Cisco’s vision and attitude toward research is compelling and that the SCoPE networking solution will deliver real value to the University because it is enabling us to tackle business pressures—like securing funding and bringing research to market faster—by consolidating, virtualizing, and automating our computing resources to make them more efficient and cost effective.”

Francesco Palmieri,
Telecommunication Systems
Director, Federico II University of
Naples



Summary

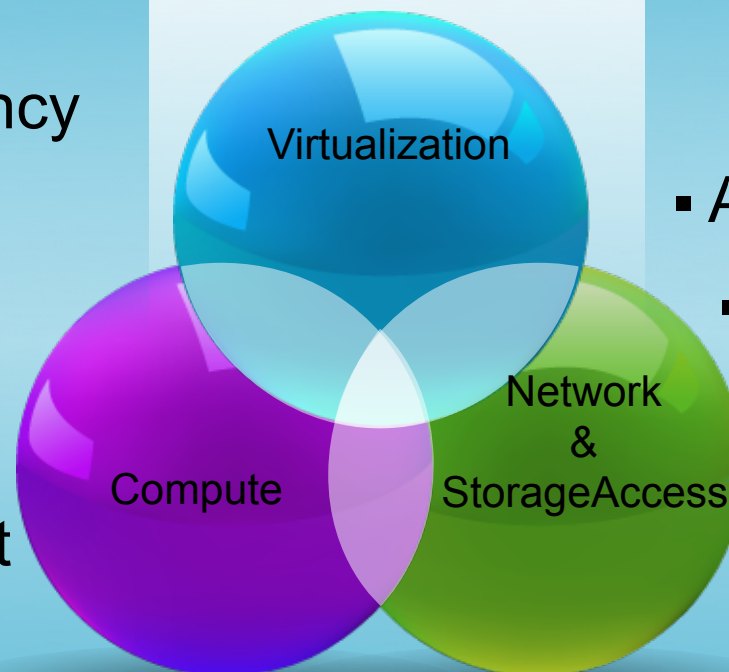
Evolution to Data Center 3.0



The Data Center is at a Market Transition

Transformation

- Technology Advances
- Energy Efficiency
- Economic Efficiency
- Dynamic Business Environment

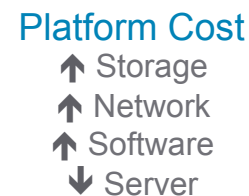
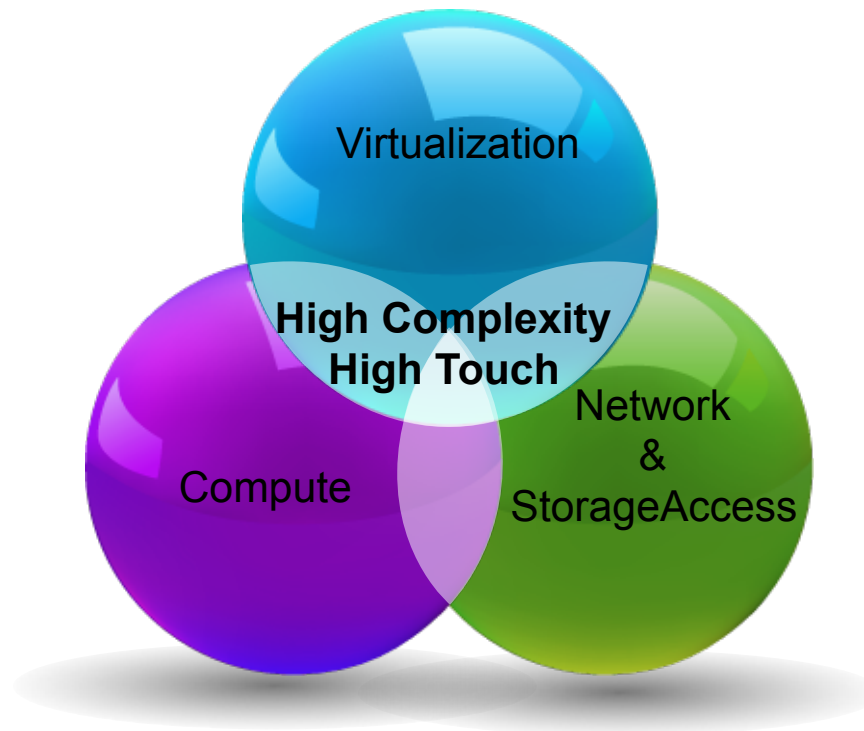


Challenges

- Scalability
- Management Integration
- Application Migration
- Coherent Policies and Security

IT Organizations Must Weave Together Complex Network, Compute, Virtualization and Management

Virtualization Has Been Promised As the Answer. However, Virtualization Solutions to Date May Only Address Part of the Problem, but Has Done So by Increasing Operational Expenses, Infrastructure Complexity, and Risk.



Architectural Flexibility



Accidental Architecture

Silo'd, long-term inhibitor
to innovation



Architecture by Design

Repeatable,
scalable innovation

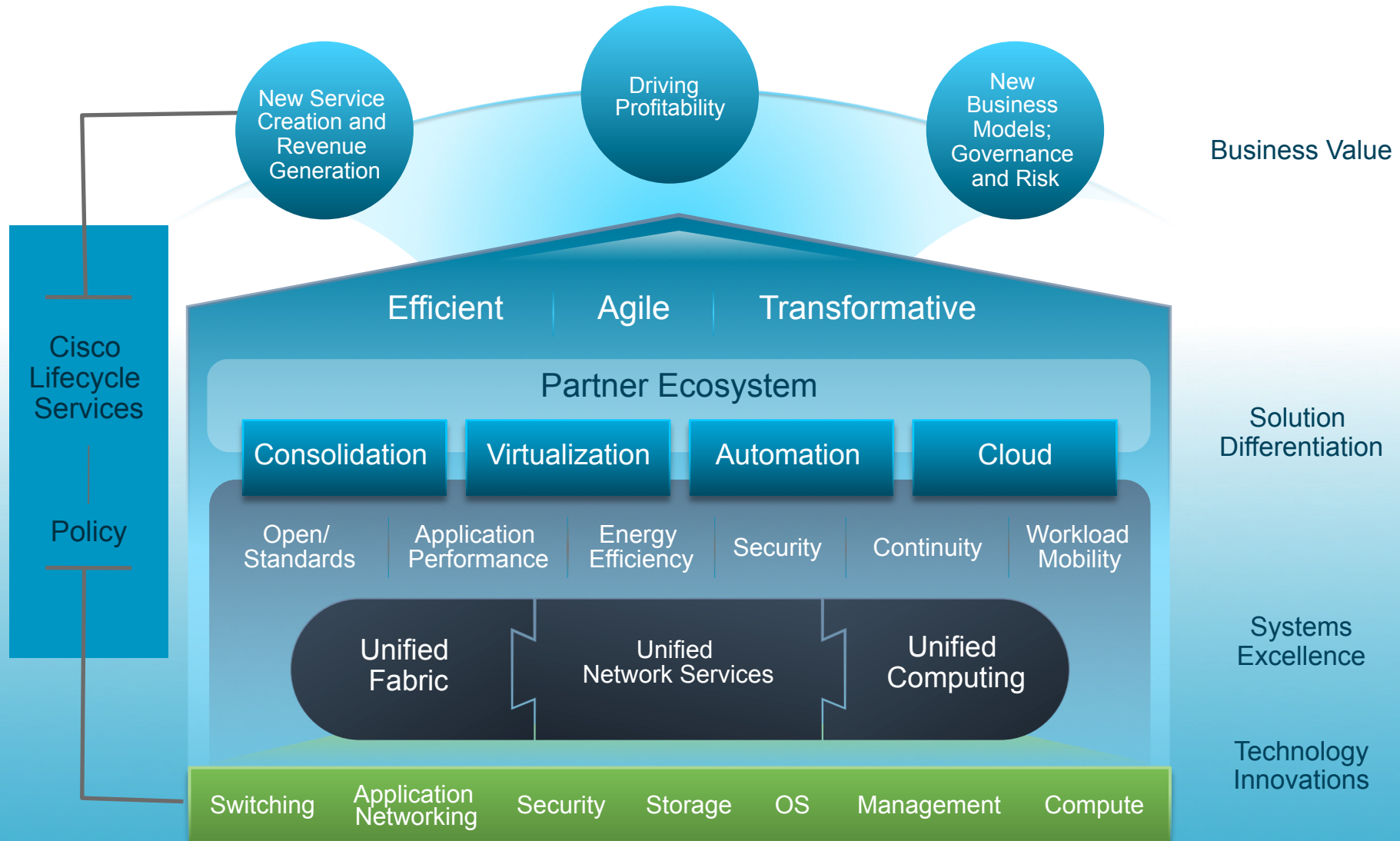
“Data center architectures create opportunities for new competitive dynamics due to blurring distinctions among network, compute and storage...”

Sanford Bernstein- NGN data centers

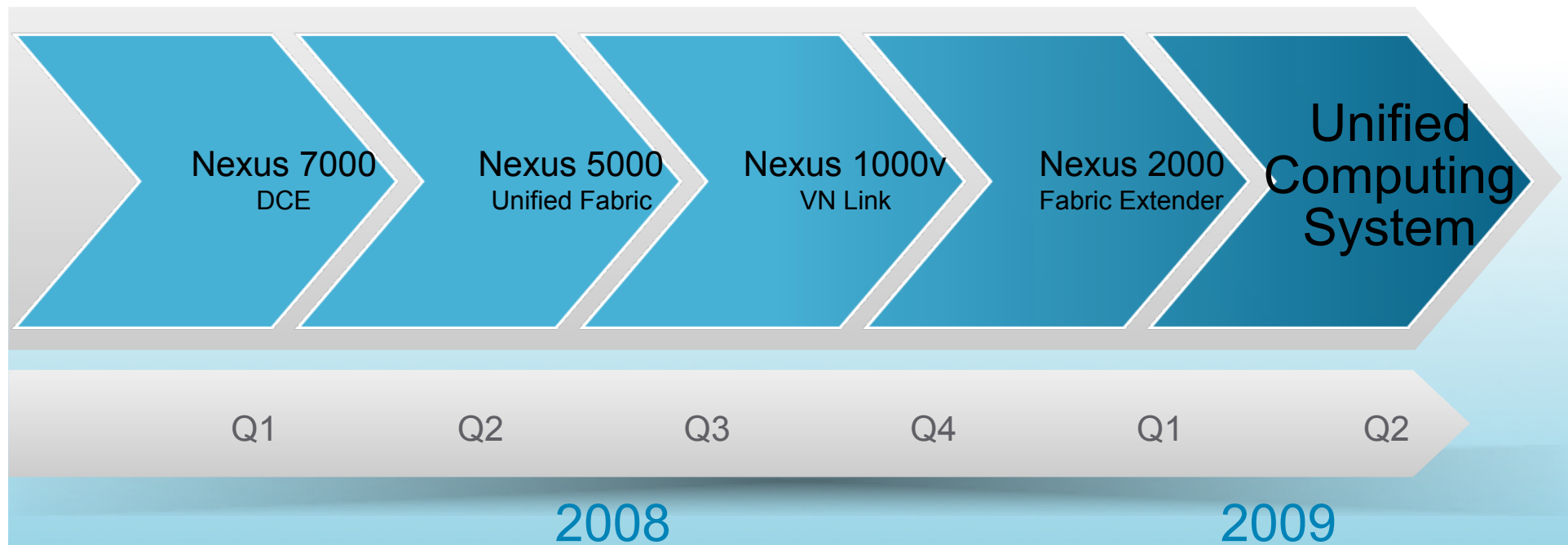
Architectural tenets: unified, extensible, and flexible

Data Center Architecture

At the Heart of Innovation



Technology Introduction Timeline



Unified Computing System



A single system that unifies

- Compute: Industry standard x86
 - Network: Unified fabric
- Virtualization: Control, scale, performance
- Storage Access: Wire once for SAN, NAS

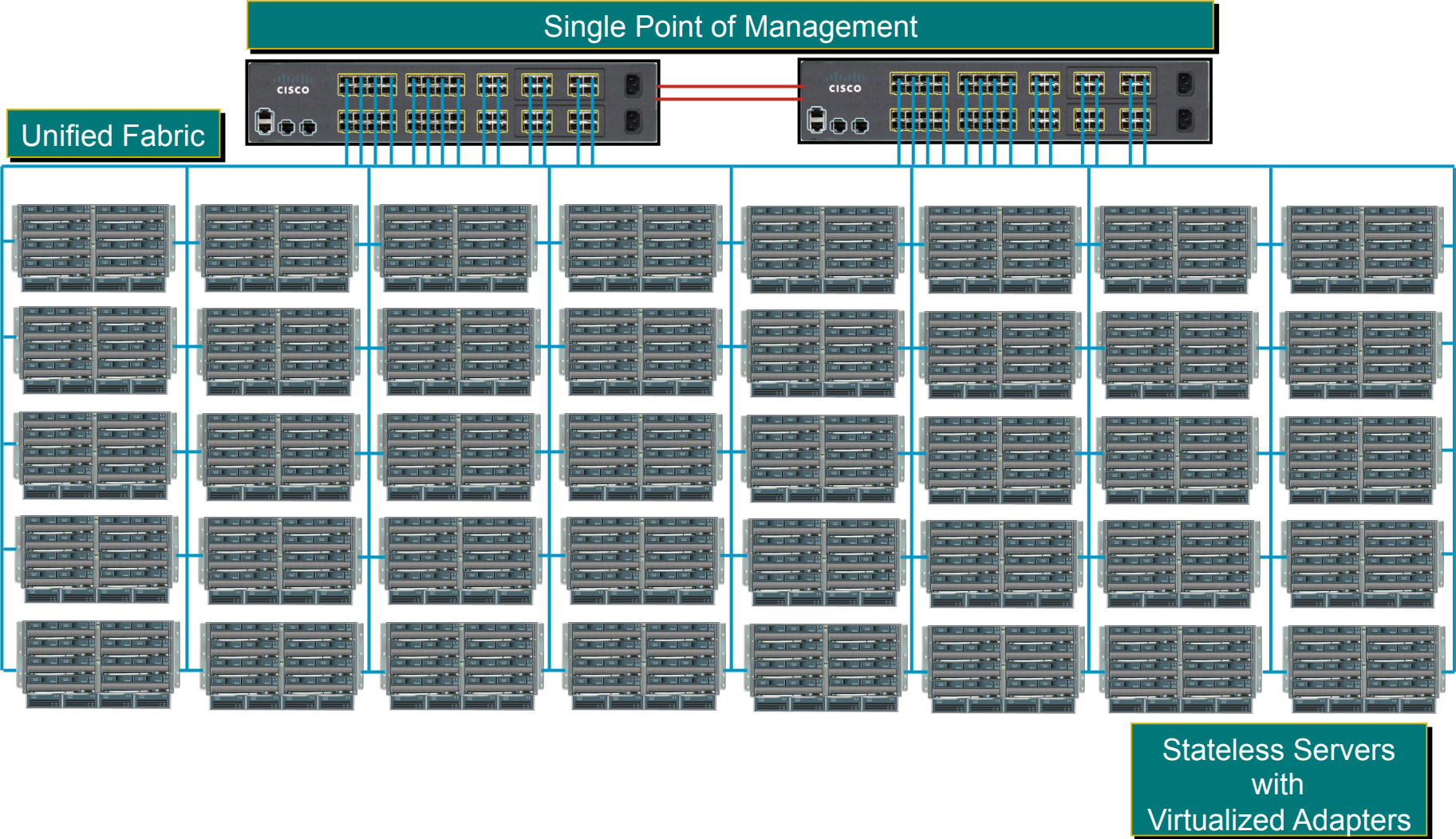
Embedded management

- Increase scalability without added complexity
 - Dynamic resource provisioning
- Ability to integrate with broad partner ecosystem

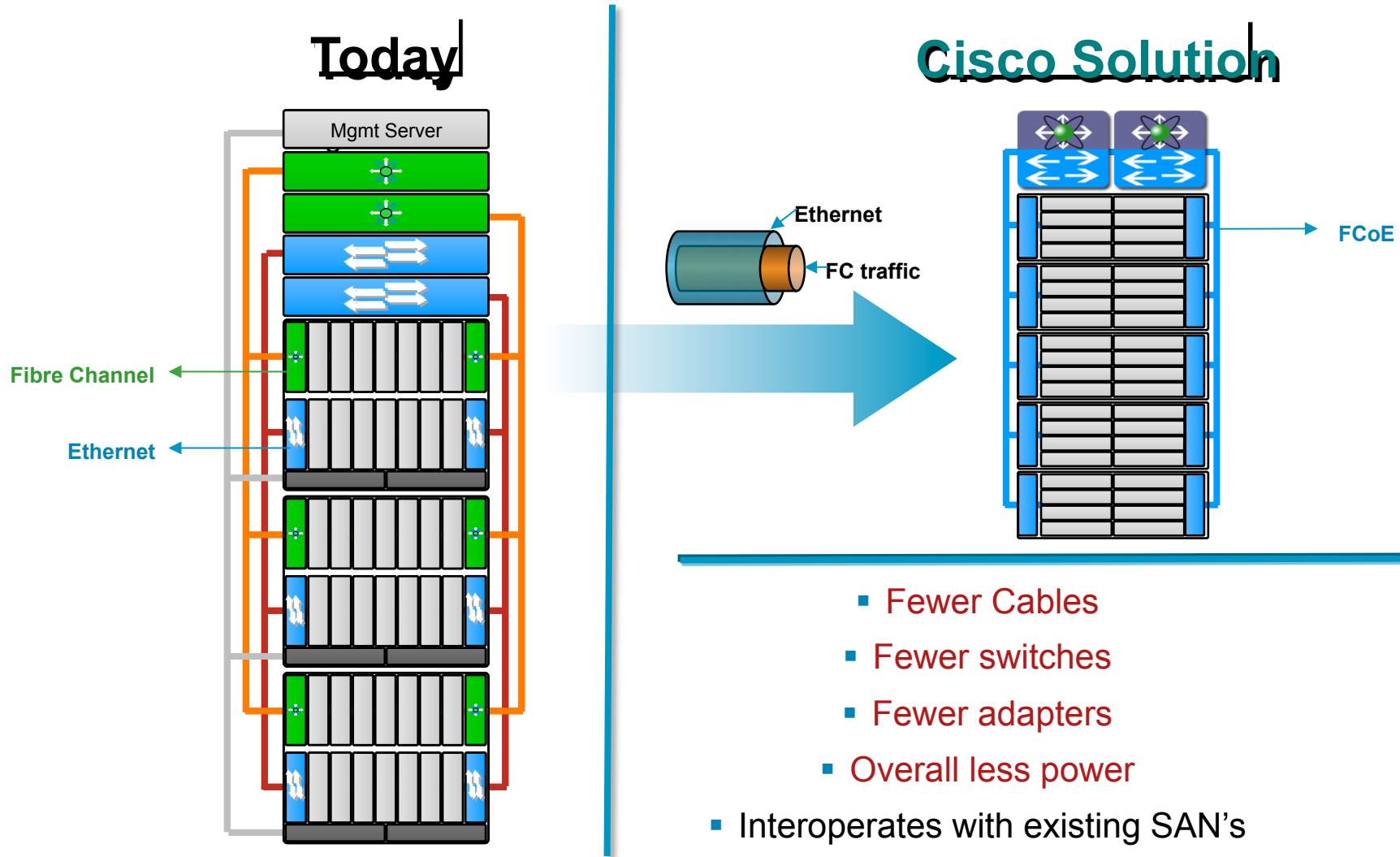
Energy efficient

- Fewer servers, switches, adapters, cables
 - Lower power and cooling requirements
- Increase compute efficiency by removing I/O and memory bottlenecks

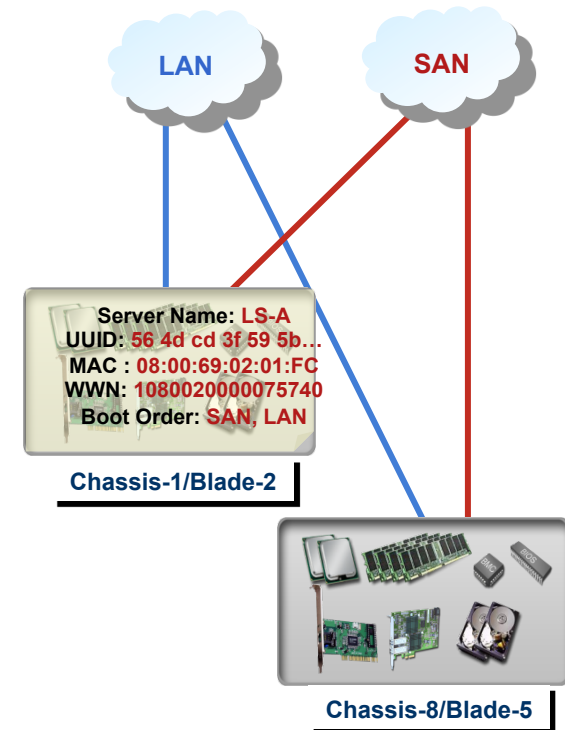
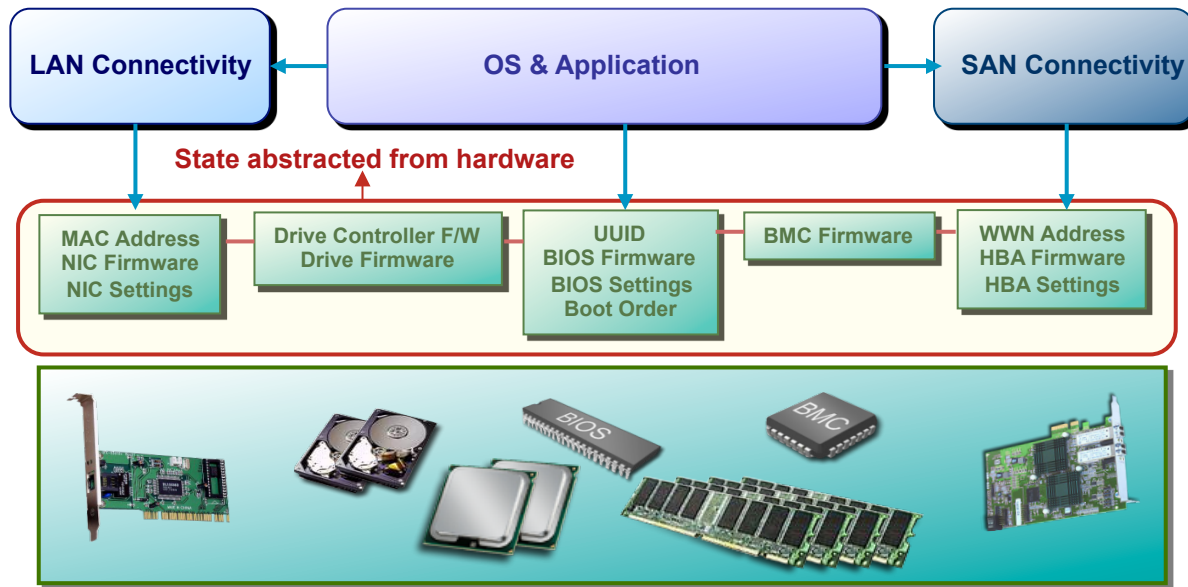
Unified Computing System (UCS)



Unified Fabric: FCoE

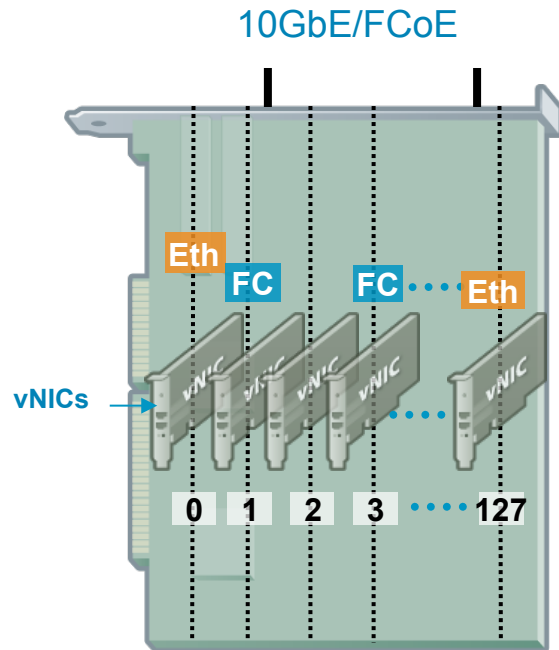


Hardware “State” Abstraction



- Separate firmware, addresses, and parameter settings from server hardware
- Physical servers become interchangeable hardware components
- Easy to move OS & applications across server hardware

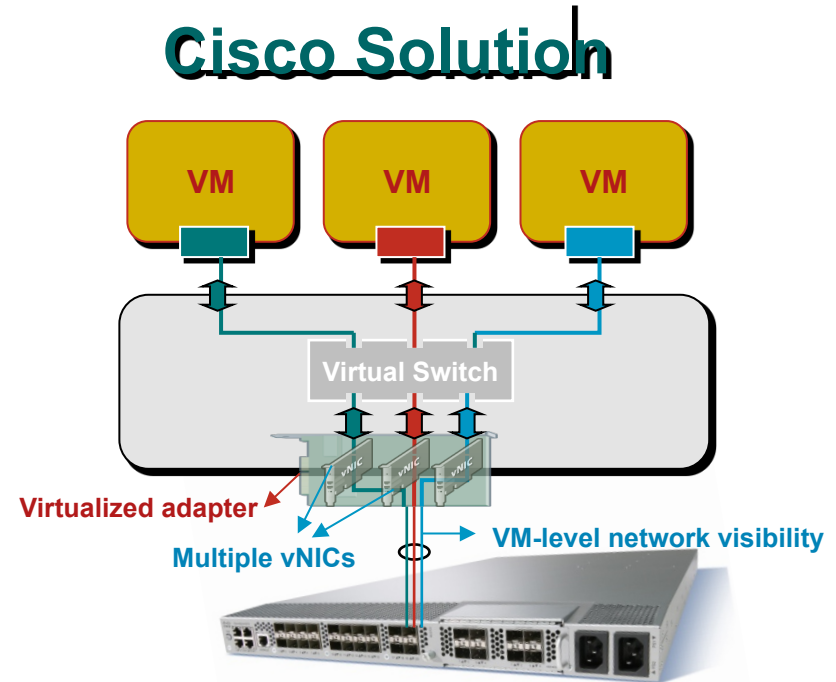
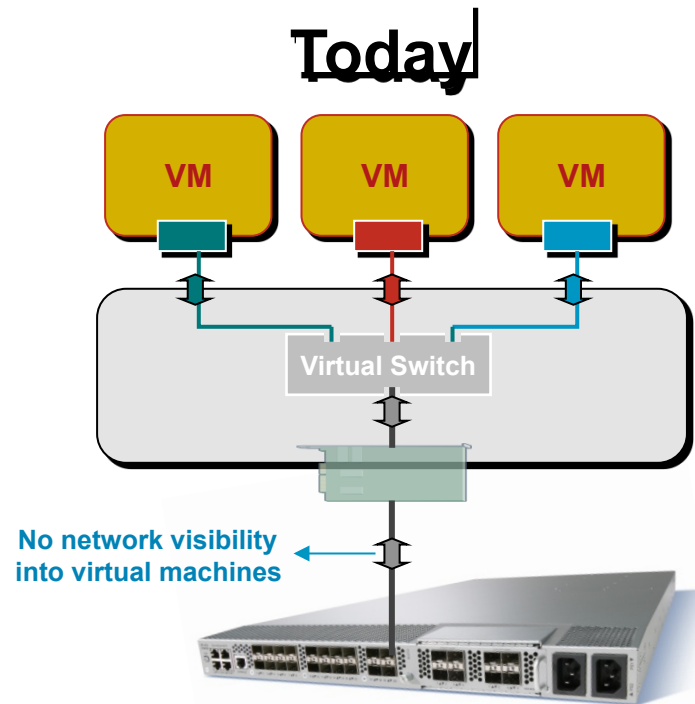
Virtualized Adapter



- Multiple virtual adapters per physical adapter
Ethernet & FC
Up to 128 virtual adapters (vNICs)
- PCIe standards compliant
- Supports single-OS & VM-based deployments
- High Performance
2x 10Gb
500K IOPS

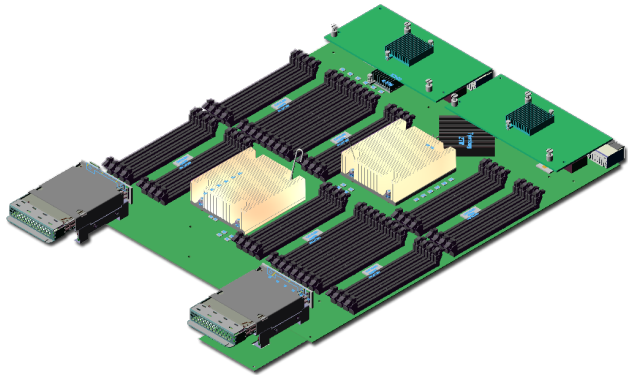
- **Dynamic server provisioning – reduce purchases by time-sharing servers**
 - Re-purpose servers by changing number & type of vNICs in server profiles
 - **Enhanced server availability – purchase fewer servers for HA**
- Use same pool of standby servers for multiple server types – simply apply profile with appropriate vNICs

Virtualized Adapter in VMware Environment



- **VM isolation – secure virtualization environment**
 - Apply network policies for individual VMs
- **Network visibility into individual VMs – improved troubleshooting**
 - Complete visibility into traffic from each VM

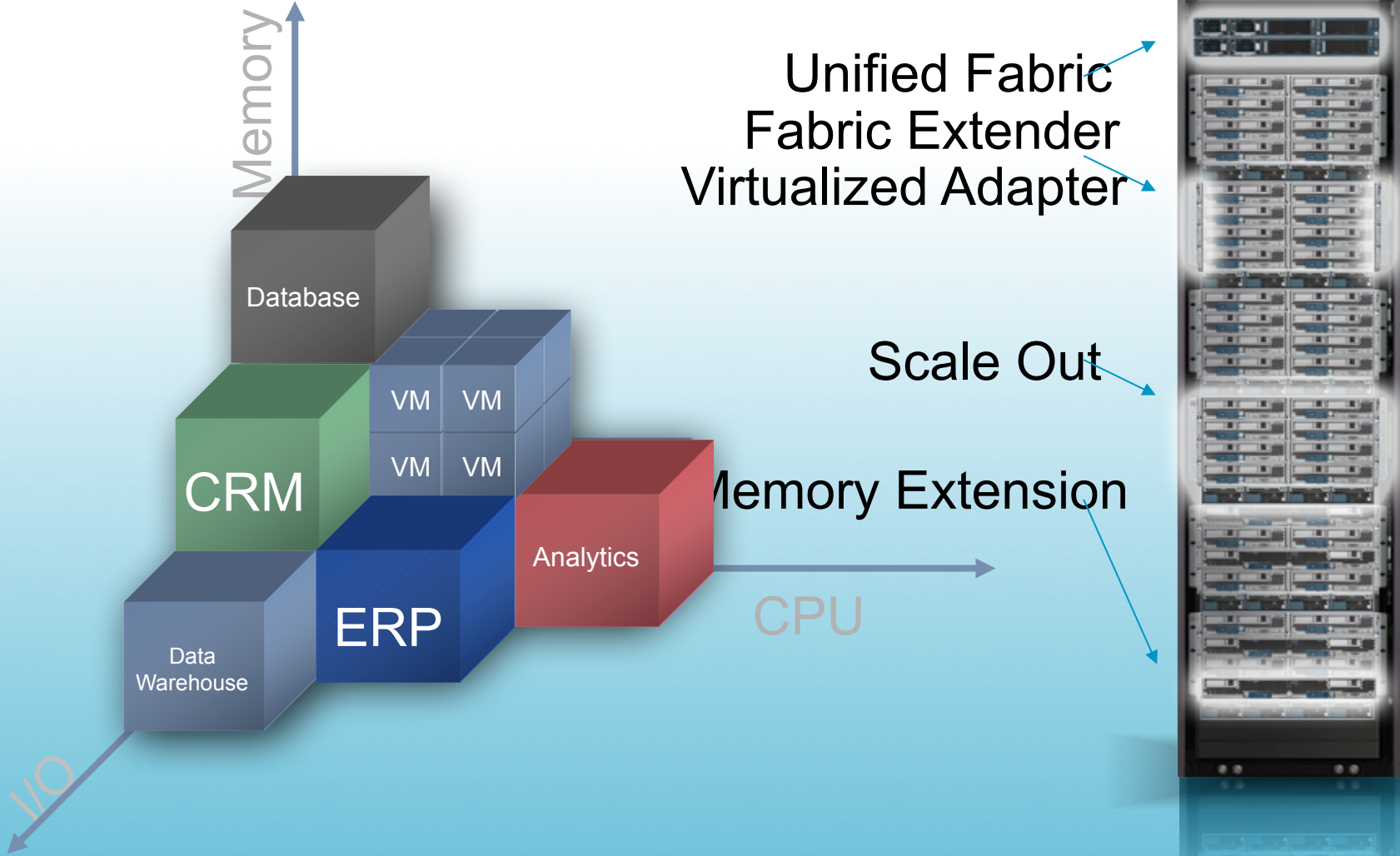
Extended Memory Blade



- 48 DIMM slots in a 2 socket Nehalem-EP blade
 - Standard 2 socket Nehalem-EP only supports 12 slots
- Industry standard DDR3 DIMMs
- Up to 384GB per 2 socket blade
- Transparent to OS and applications

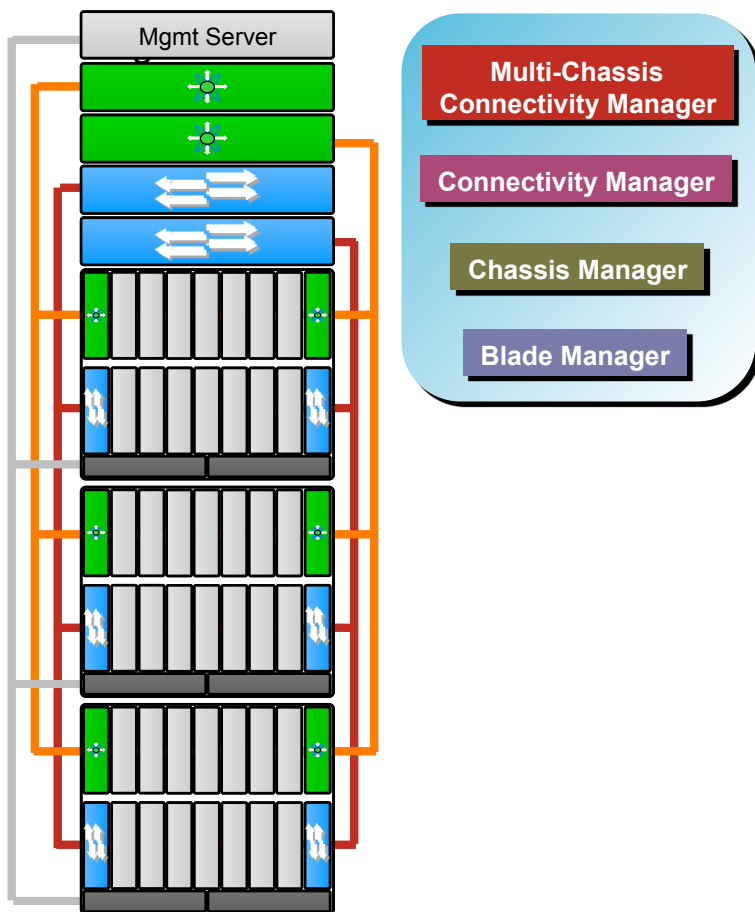
- **Reduced server costs**
 - Purchase fewer servers for memory-bound applications
- **Reduced power and cooling costs**
- **Reduced software costs**
 - Most software is licensed on a per-socket basis

Unified Computing System

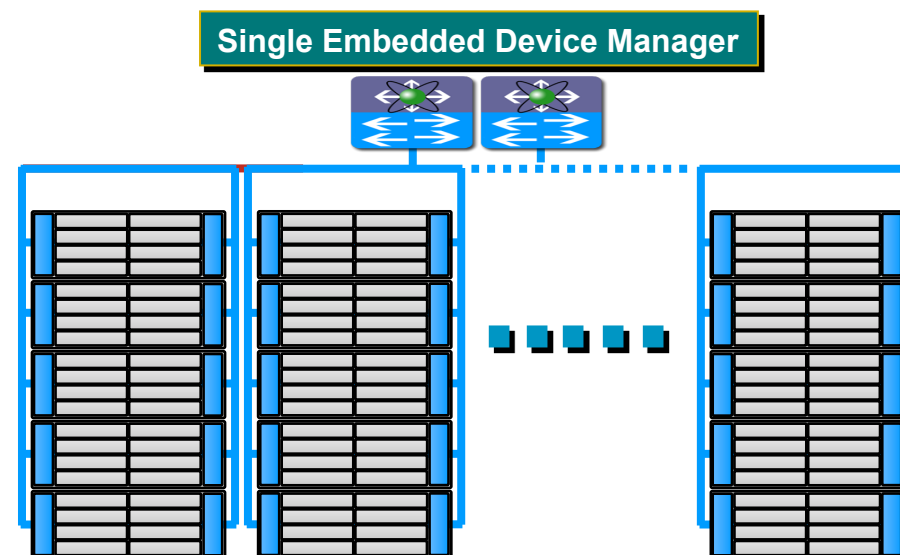


Consolidated Management

Today



Cisco Solution



- Reduced management costs
- Easier to integrate with existing frameworks
 - Single consistent API for all managed objects



CISCO