Data Center Networking

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Outline for Today's Discussion

- Cisco IT Data Center Background
- Current Data Center Network Architecture
- Data Center Network Evolution

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Cisco IT Data Center Background

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Cisco Production Data Centers

Data Centers	Production Data Center	Development Data Center

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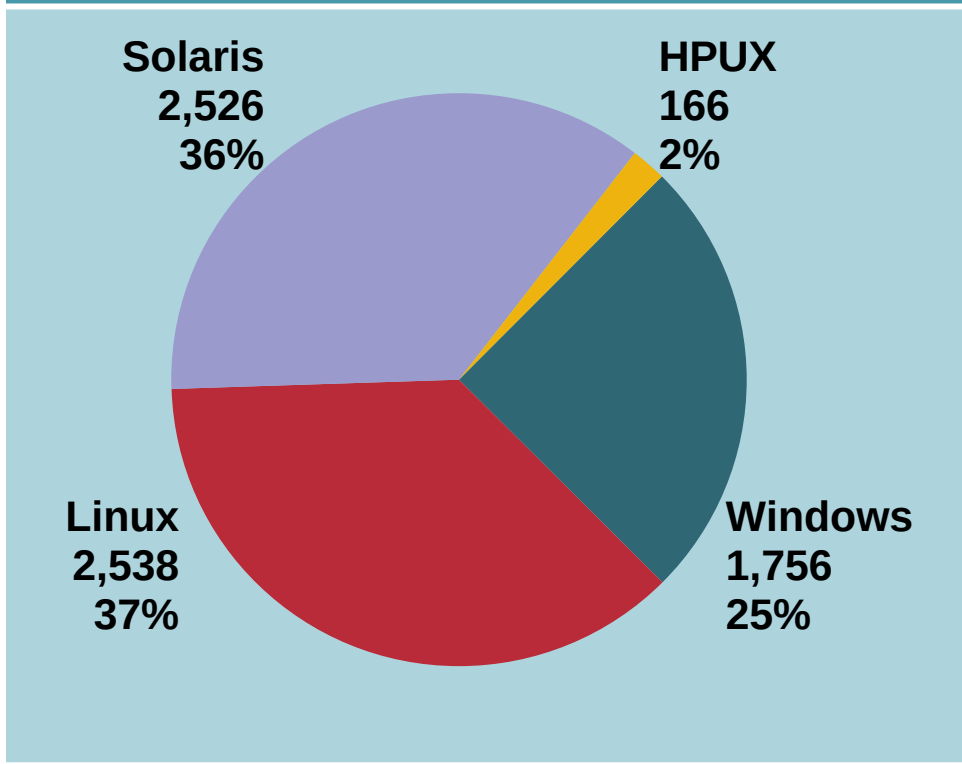
Cisco Data Center Landscape

- Overall population of 7,000 servers
- Cisco currently has one SA for every 80 servers
- Server environment and ratio will continue to grow
- Heterogeneous environment with multiple hardware vendors
- Multiple OS environments



Source: Cisco IT, October 2005

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Cisco Data Center Goals

- **Optimize TCO**
  - Consolidate data centers
  - Life cycle management
  - Data center standards
- **Business agility**
  - On-demand utility
  - Rapid delivery of services
  - Enabler of business goals
- **Business continuance**
  - Security
  - Active-active architecture
  - Virtual OS and application layers






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Utility Data Center: Foundation for ISM

Three Major Integrated Service Management Components

Client Services

Centralized MACS

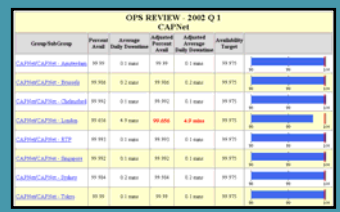
CC
Cell
Pagers
Home Access
VPN
Softoken/DES
ORYX
OnRamp

Services

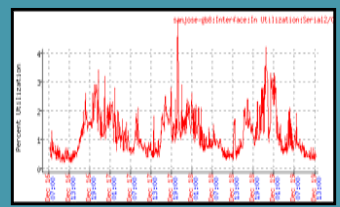
Billing and Financial Reporting

Management Services

Enterprise Monitoring



Executive Metrics



Historical Trending

Chg Mgt/SLA/DR/Dependencies

Infrastructure Services

AM/DNS/DHCP

Epage

ACS (LEAP)

Cisco Unity™

Microsoft Exchange 2000

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Cisco IT Data Center Network Architecture

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Today's Data Center Network in Cisco IT

- **Production data center network is a standard L2-based, core-distribution-access architecture on Cisco Catalyst® 6500 platforms**
- **IP network services (load balancing, SSL off-load, firewall) supported using service switch model**
- **OOB access provided by serial consoles via Cisco 2600/3600 or Ethernet lights-out management via Cisco Catalyst® 3750 switches in separate infrastructure**
- **Most servers are connected at 100 Mbps; new deployments are deploying copper Gigabit Ethernet ports**
- **Distributed Director providing global load balancing services**

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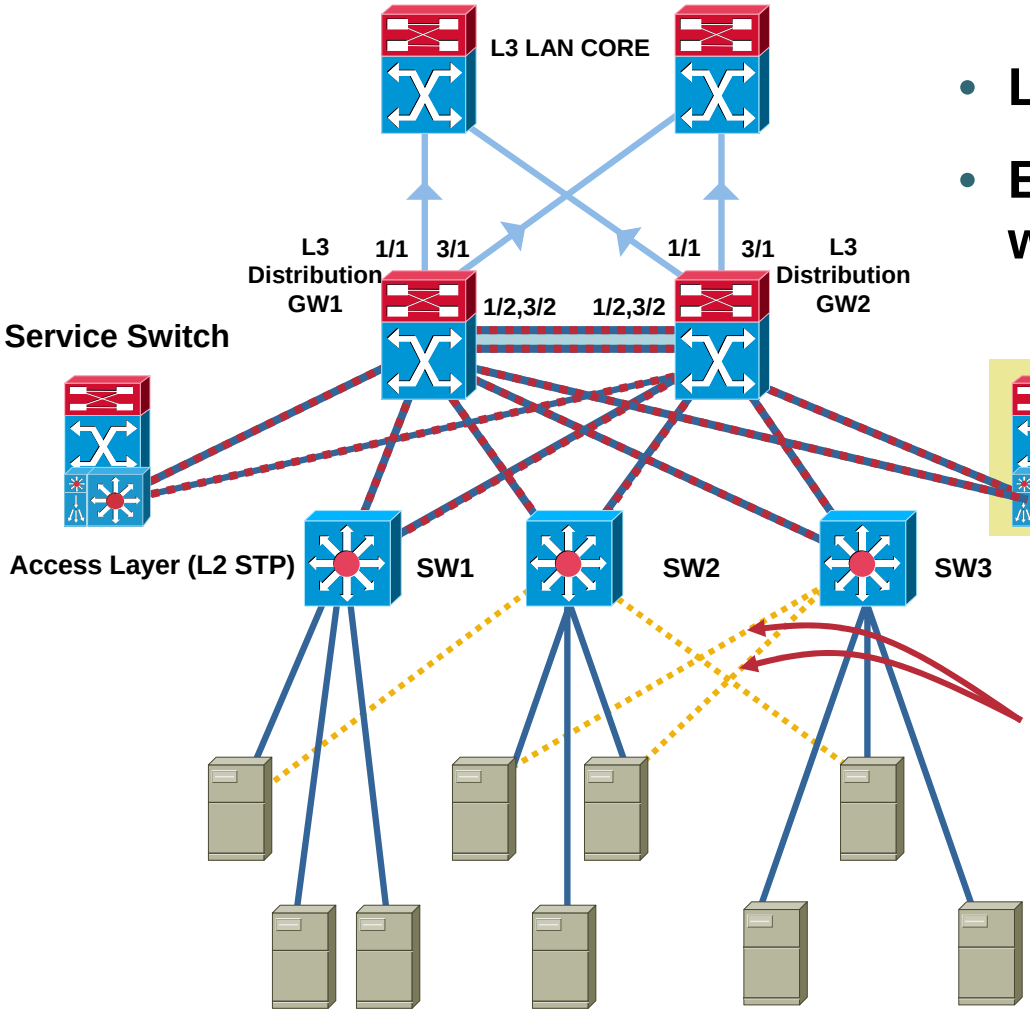
Cisco IT Data Center Network Layout



- **Layer 2 domain**
- **Enables L4–L7 deployments with full redundancy**

Service Switch (L2)
Content Switching
SSL Offload
Security Services

Standby Link for Redundant Interface

Hosts Requiring Redundant NIC

Host Not Requiring Redundant NIC

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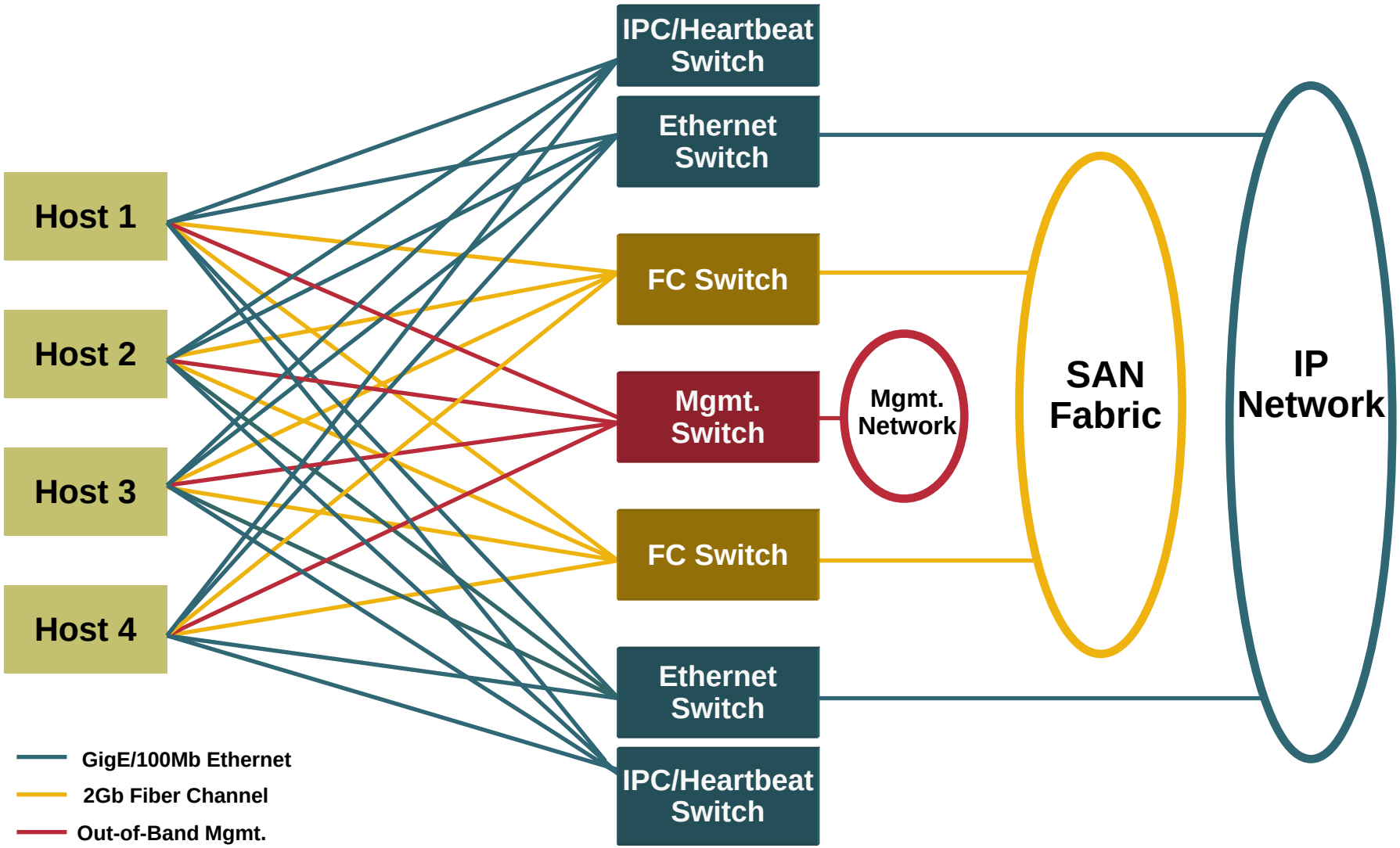
Operating System Architecture
Existing Server Environment



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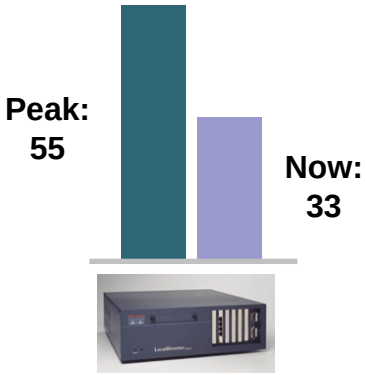
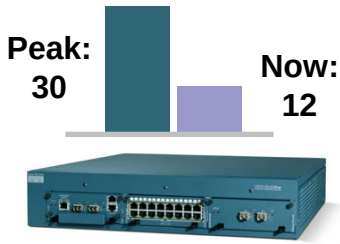
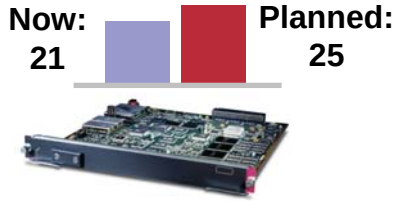
IT Content Switching Services



LD Pairs



CSS Pairs



CSM Pairs
In 13 Service Switches

- **600+ virtual servers on CSM infrastructure**
- **Applications on CSM**
  - **CCO, a.k.a. www.cisco.com: 50M+ L7 decisions per day**
  - **Sametime: 20k+ simultaneous connections**
  - **Oracle 11i**
  - **CCX/CCI (external and internal Java 2 Platform, Enterprise Edition)**
  - **Exchange front-end (SMTP, POP3, IMAP4, HTTP)**

Cisco Systems Lotus software ORACLE Java Microsoft Office Outlook Web Access

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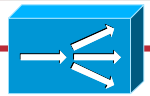
Content Networking Product Evolution

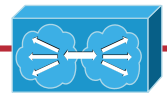
LocalDirector 430

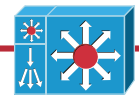
Large-scale distributed deployment
LD pair per server (VLAN)
Still used for DNS, DHCP, ACS, etc.
LD430 EOS'ed in 2002

Content Switching Module (CSM)

Preferred Platform
L2-3 Network integration
L4-7 capabilities
Integrated Cisco IOS®







Time

Content Service Switch (CSS 11503)

Limited adoption of CSS
L4-7 capabilities

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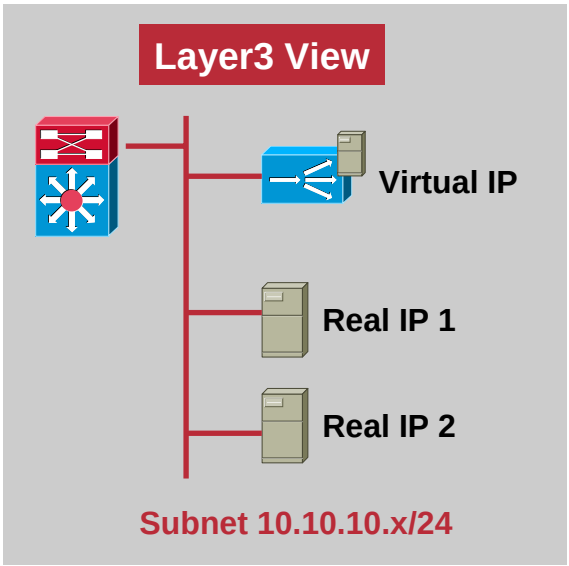
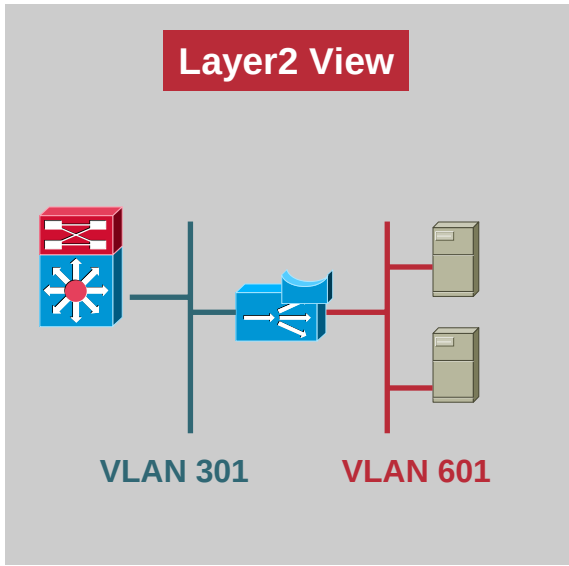
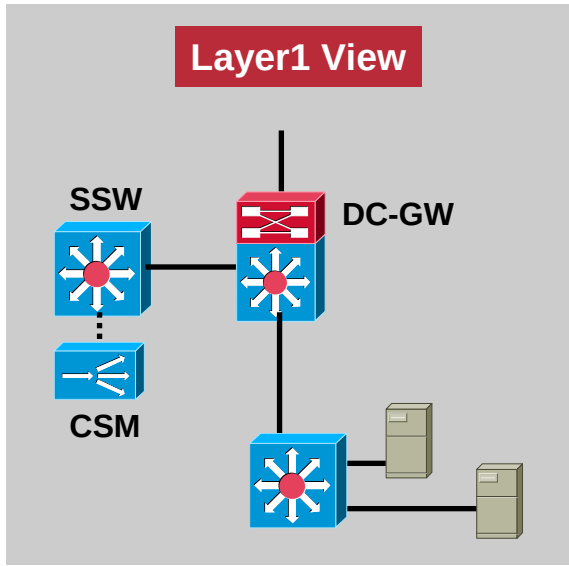
Content Switching: Bridged Mode

- CSM deployed in bridged mode
- Multiple routable/non-routable VLAN pairs
- Active/standby with stateful failover (“replicate”)

Pro	Con
No L3 Changes	All Server Traffic Through CSM
VLAN Segregation	Spanning Tree Loop Risk
No Changes to Server	Complex Troubleshooting
Source IP Preserved	







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Cisco IT

Future Data Center Network Evolution

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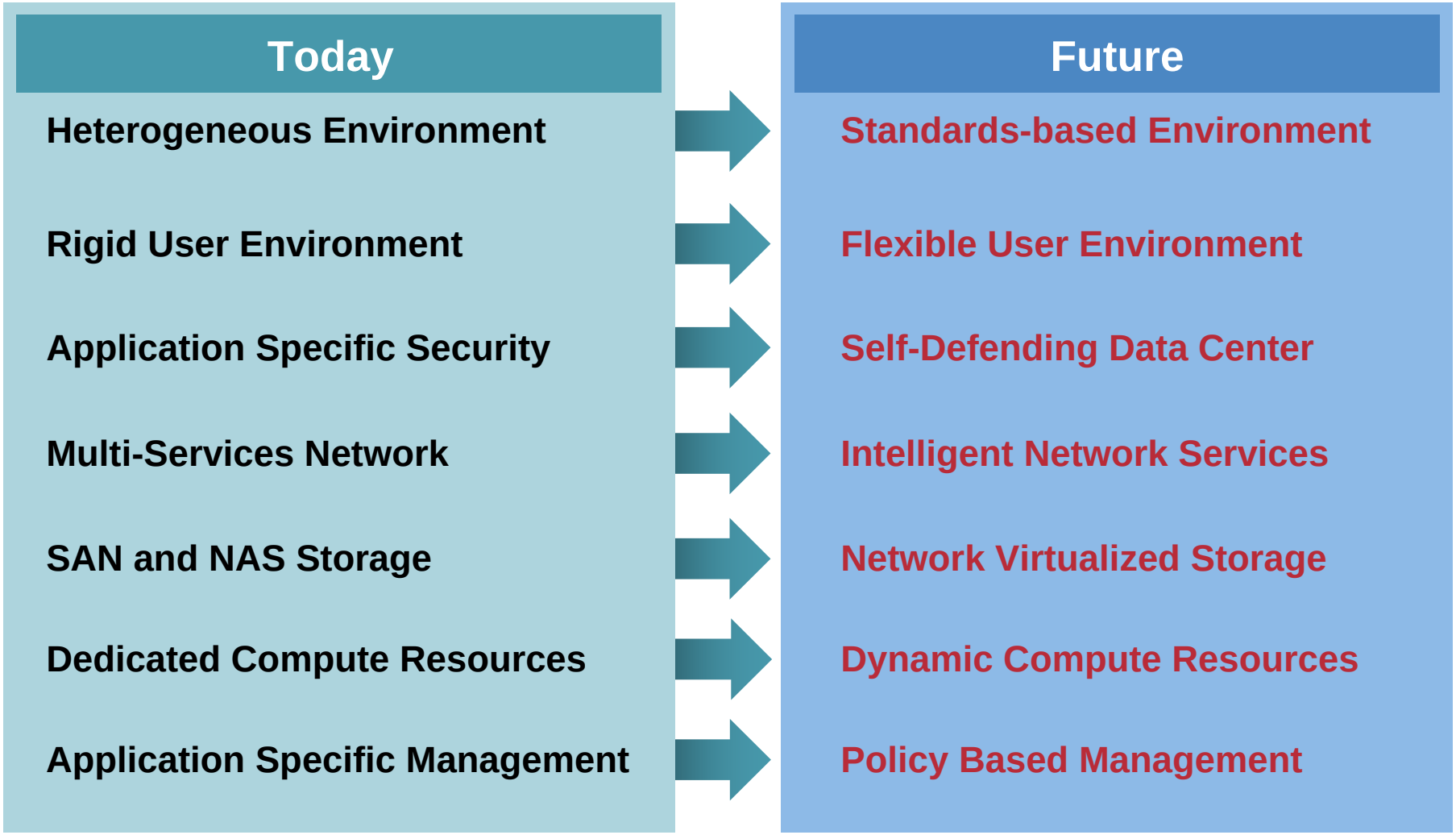
Cisco Data Center Trends



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Data Center Consolidation

Data Center Consolidation

Collapsing many data centers to few

- Higher number of servers
- Larger network infrastructure

Server/App Consolidation

Concentrating servers and apps

- Standard high performance servers
- Fewer application architectures

Storage and SAN Consolidation

Centralizing storage/SAN resources

- Improve effective storage utilization
- Fewer isolated SANs

What the Network Needs

Flexibility

Seamless deployment of new application environments

Scalability

Higher density, better aggregate performance, service scaling ability

High Availability

More predictability, higher redundancy

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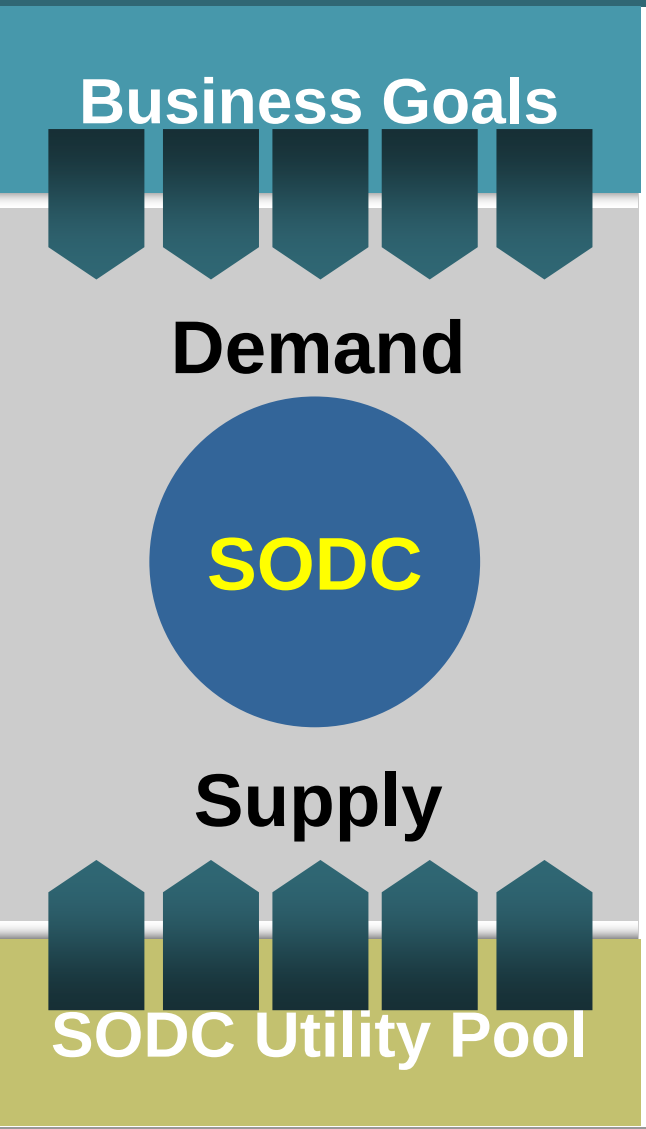
Service-Oriented Data Center Model



SODC Intelligent Management Fabric
(IME/VFrame 4.0)

SODC Vision

- Highly Automated Virtual Environment

Main Objectives

- Drive Productivity
- Enable Cisco Business
- Optimize TCO
- Show case Cisco

Main Requirements

- Availability
- Scalability
- Flexibility
- Business Continuance
- Security

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Service-Oriented Data Center Roadmap

Legacy Data Center	Current Data Center	Virtual Data Center	Service-Oriented Data Center
• Infrastructure aligned to BU • Storage silos • Manual patches • Heterogeneous OS • Low utilization • Element management • Distributed DC	• Infrastructure consolidation • SAN virtualization • Centralized resources • OS • Improve utilization • Centralize DC	• Infrastructure aligned to application • Active SAN/NAS virtualization • Virtual • Common OS • Automated purposing • Fabric management	• Infrastructure aligned to Service • Automated application • Policy-based • Utility model • Policy-based management • Self purposing • Optimized TCO

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Data Center Network Drivers

Integrate Roles-Based Access to Critical Areas of the Network

Authenticate All Access

Protect Critical Cisco Assets

Integrate Storage Transport into DC IP Network

Consolidates Infrastructure

Reduces TCO via Utility Computing

Automate Infrastructure Service Provisioning and Delivery

Reduce Defects

Increase Availability

Deploy Intelligent Capabilities to Optimize Applications

(e.g., WAFS, AONS)

Improves User Experience and Satisfaction

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Network Segmentation

Three Primary Functions for Network Segmentation

Separation of Access
(Path Isolation)

Adapt to a Changing Acquisition Model

Limit Access (Coarse-grained) for Vendors and Contractors

Extend "Specialty Networks" Such as Guest Access/DMZ in the Infrastructure

Protection of Critical Data Center Assets
(Access Control)

Protect Corporate Financial Data, HR data, and Source Code

Assists in Sarbanes-Oxley Compliance

Quarantine Unhealthy and Untrusted Systems
(Policy Enforcement)

Limit Damage Potential From Untrusted and/or Unhealthy Systems

Provide a Self-service Platform for Remediation

Support Network Edge Authentication and NAC

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Data Center Network Architecture Impacts

- Continuing Bandwidth Growth with Convergence of Storage onto IP Network
- Required Alignment of Architecture Resiliency Characteristics Among the Network, Computing Resources, and Applications
- Scaling Switching Architecture to Support High Density Utility Computing Environment
- Enhancing Service Delivery Automation for Application Deployment or Movement Among Compute Resources
- Enhancement of QoS Architecture to Support Storage Traffic Over IP Network
- Continued Focus on Security

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Data Center Network Design Considerations

- Jumbo Frames
- Spanning Tree Scalability
- High Availability
- Data Center Space Considerations
- Number of Network Devices to Manage
- Cabling: Rack-to-Rack and SDF-to-Rack
- Network Component Lifetime vs. Server Components
- Granular Incremental Deployment

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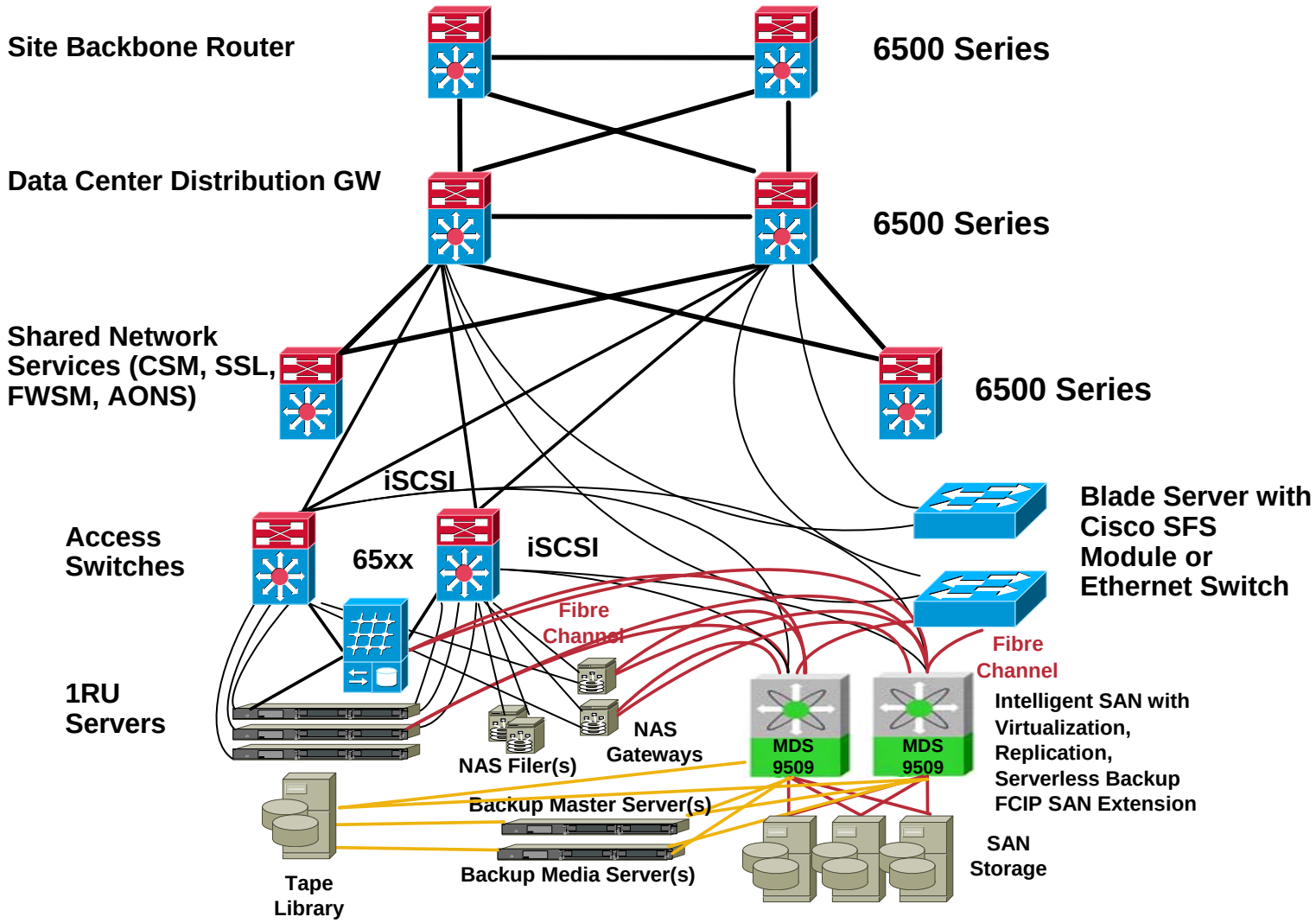
Physical SODC Architecture



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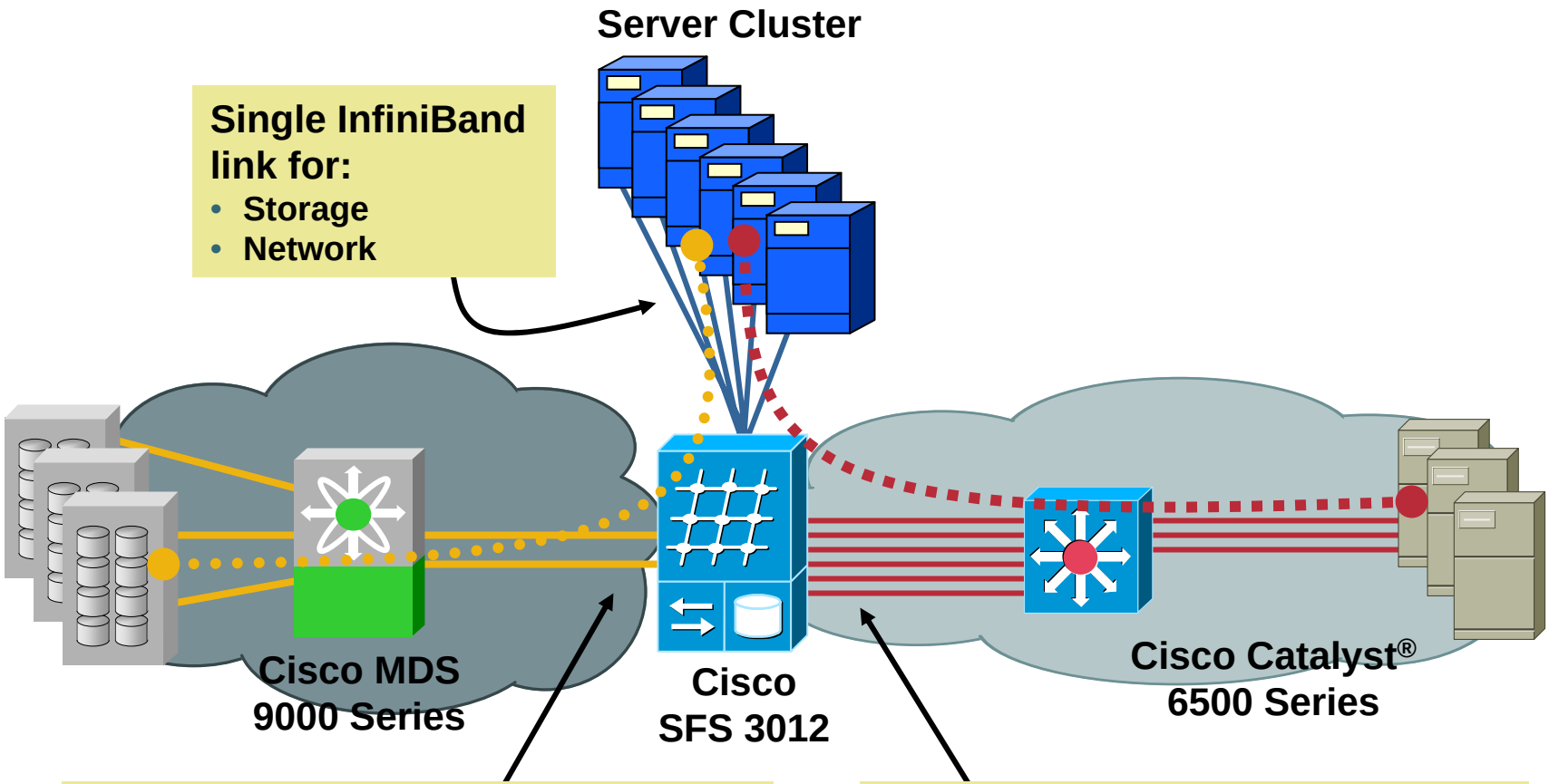
Cisco SFS for I/O Consolidation and Clustering



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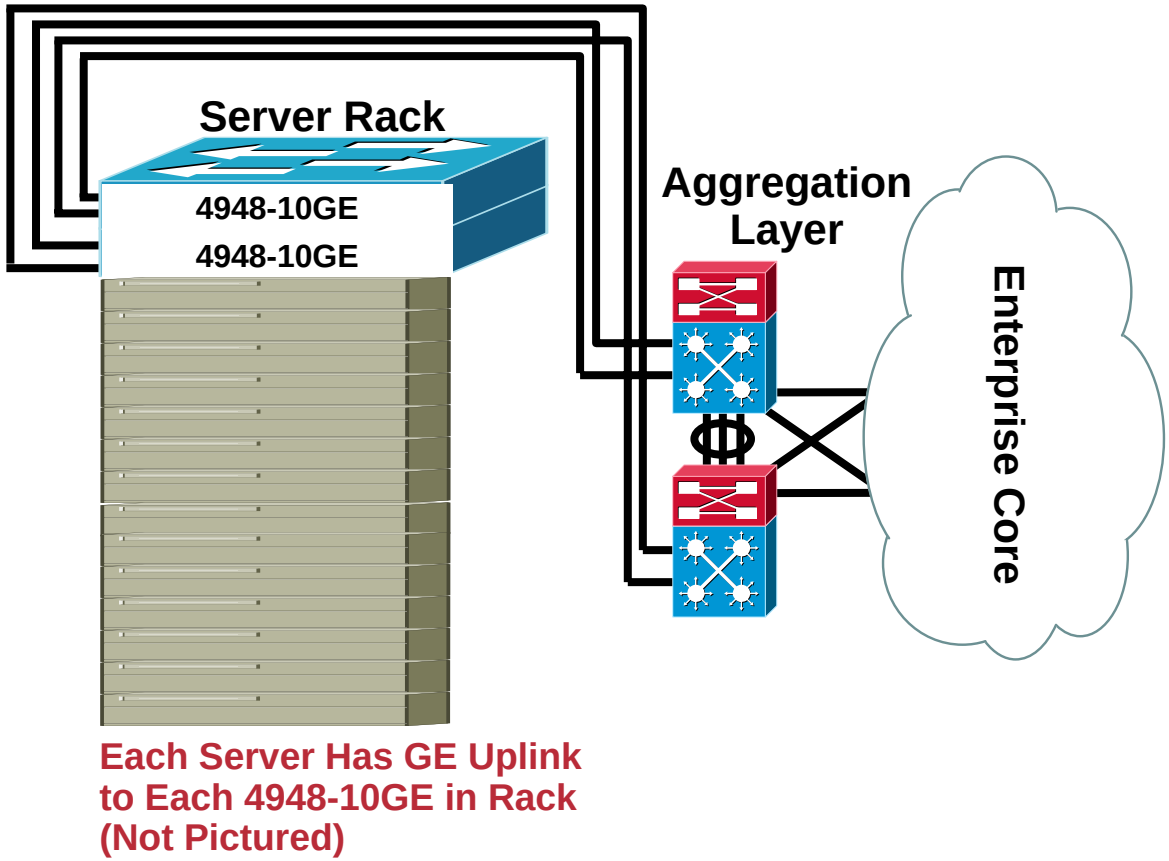
High-Density Attachment to the DC Network



— 10 Gig Ethernet

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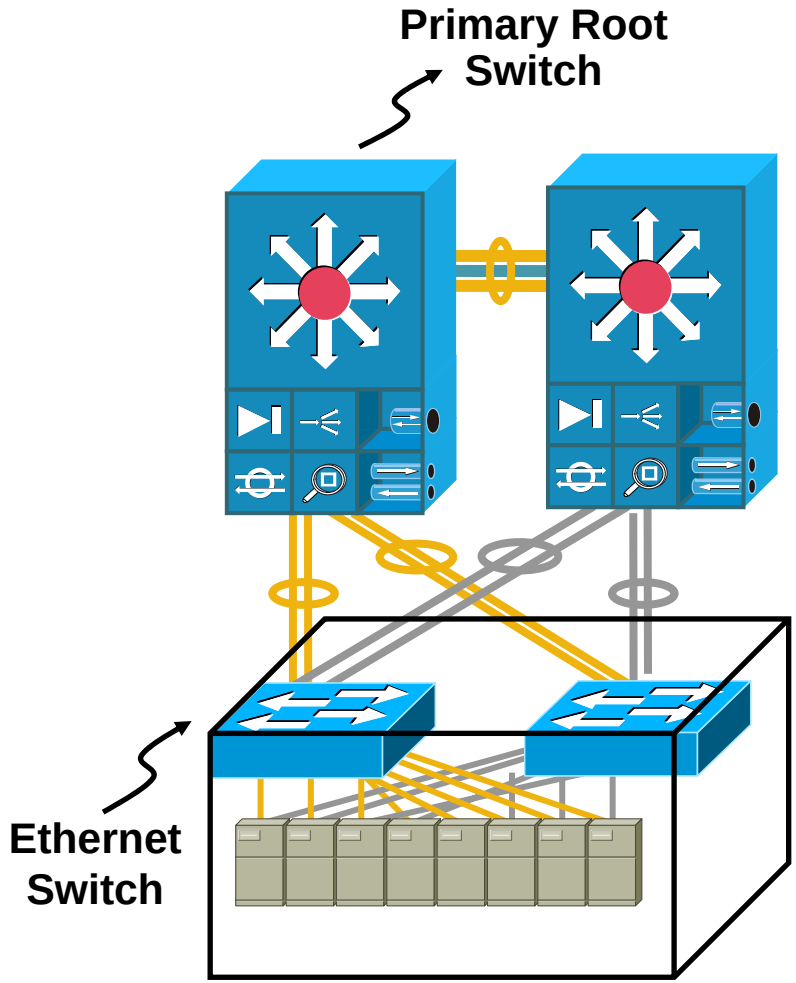
Blade Server High Availability Using Integrated Switches

- Systematic approach
- Redundant devices and links in the network create no single point of failure
- L2/L3 features such as HSRP, VRRP, RPVST+
  - Fast convergence
  - Predictable behavior
- Load balancers to support applications
- Blade server HA enhanced via NIC teaming



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Q and A

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More Data Center Resources

Case Studies (Coming Soon); Please Check:

http://www.cisco.com/en/US/about/ciscoitatwork/case_studies.html

Operational Practices and Design Guides

http://www.cisco.com/en/US/about/ciscoitatwork/data_center_op.html

http://www.cisco.com/en/US/netsol/ns340/ns394/ns165/ns391/networking_solutions_design_guidances_list.html

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