Next Generation Data Centers
Networks Consolidation and Virtualization

Samuel TAYLOR

Directeur Technique Channel - WCA
samtaylo@cisco.com

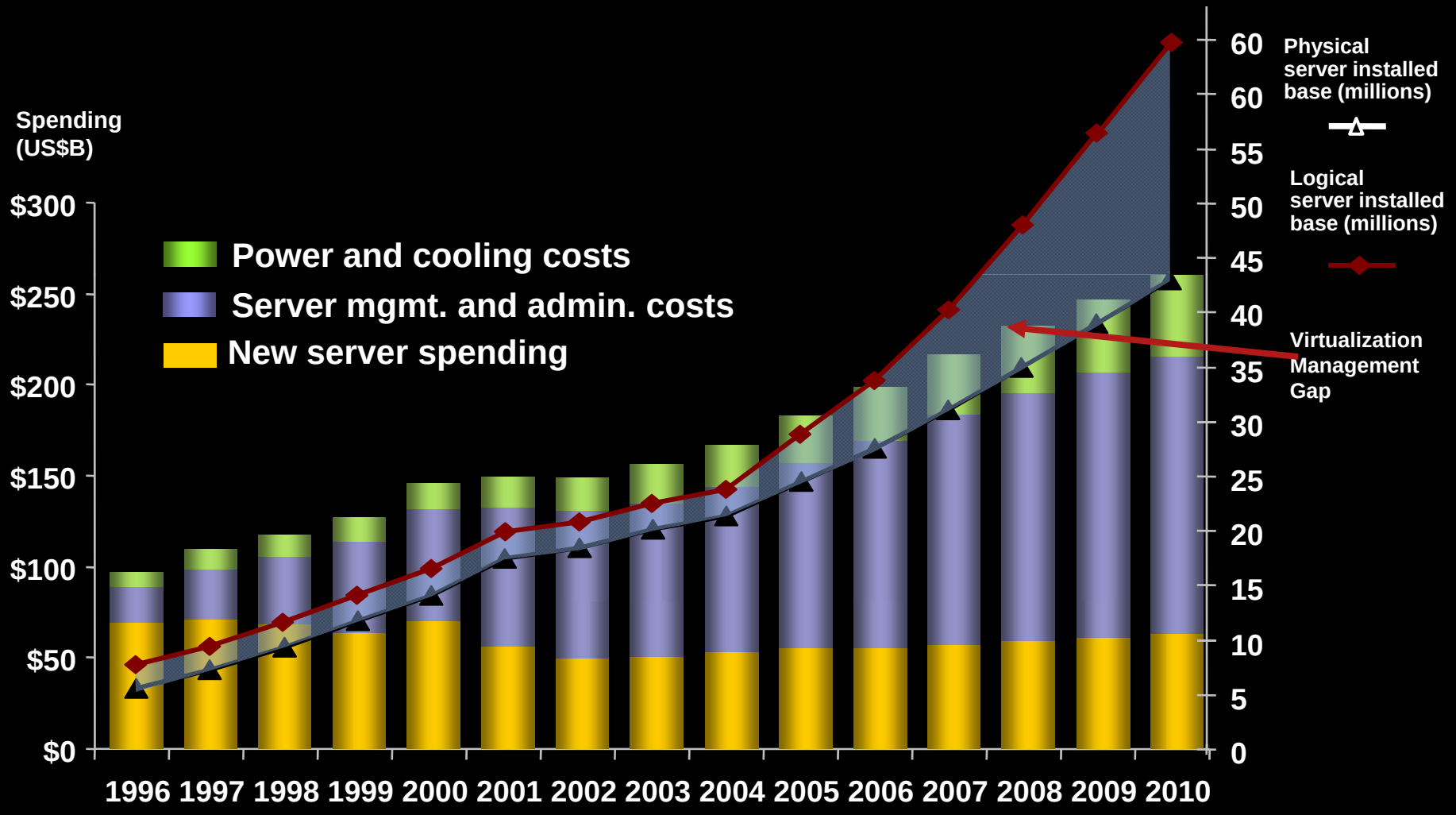
70%

. . . of CIOs would increase spending on virtualization even if they had to cut back on IT spending.'

- Merrill Lynch, June '08

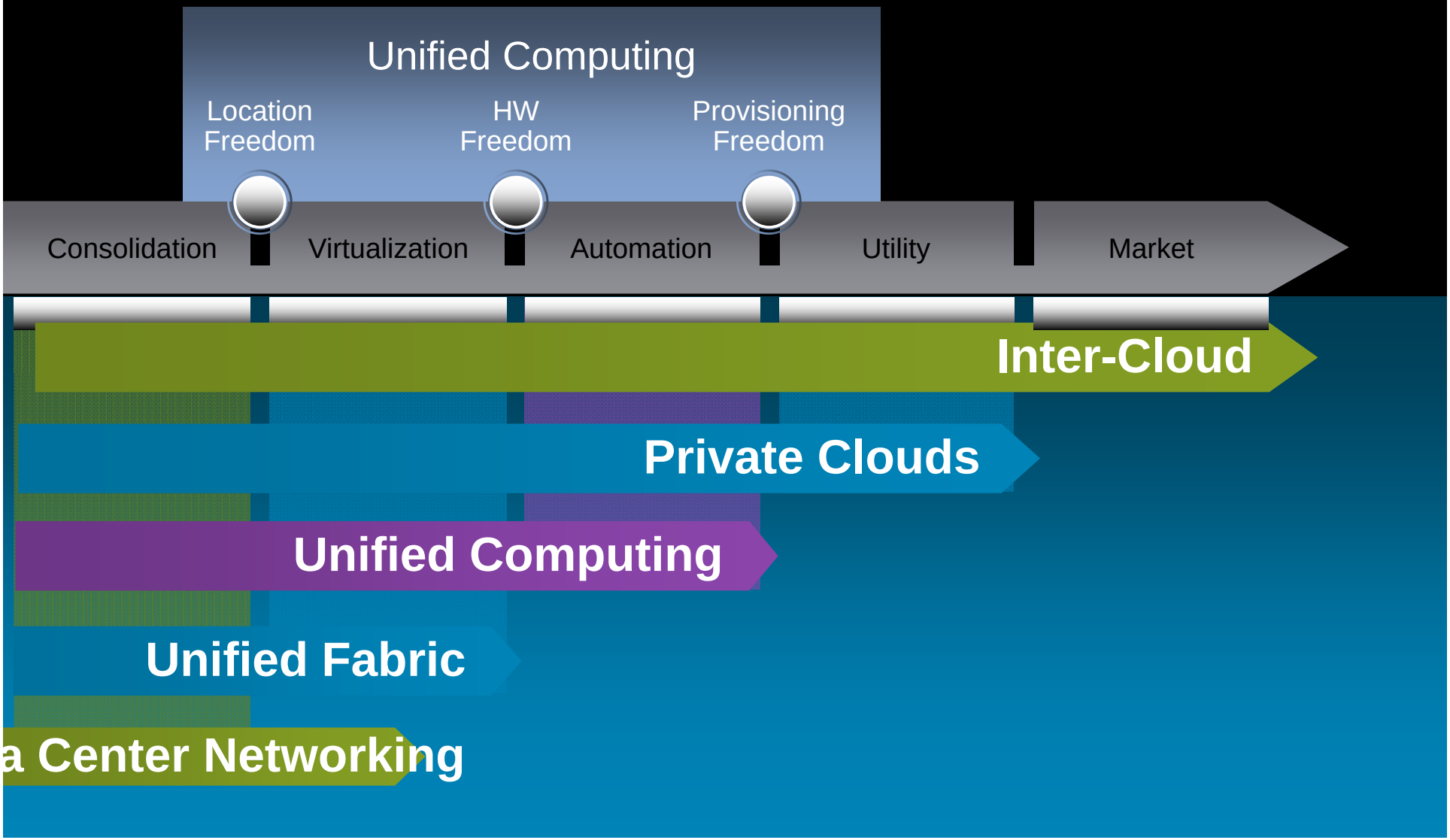
Data Center Economics Forcing an Architectural Reckoning

Ops & maintenance now ~80% of IT budgets—and growing

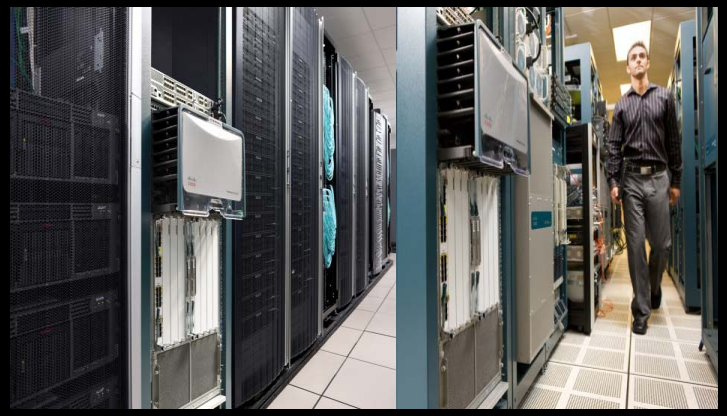


Virtualization Flattens Cap-Ex But Heightens Crisis of Complexity

Data Center 3.0 Evolution Path



Data Center Solutions Portfolio



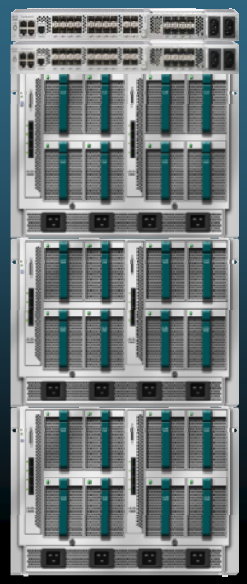
DC Interconnect Solutions

Nexus and Catalyst Switching Solutions

Catalyst

Nexus Family

Unified Computing Solutions



DC Services Solutions

ASA and ACE Families

DC Storage Solutions

MDS 9000 Family

Expanding Role of Server Virtualisation

Server Consolidation And Virtualisation Are #1 And #2 Spending Priorities

Source: Goldman Sachs CIO Survey

10% of server workloads virtualised in 2008; forecast to be 50%-60% in next 5 years

Source: Industry analyst reports

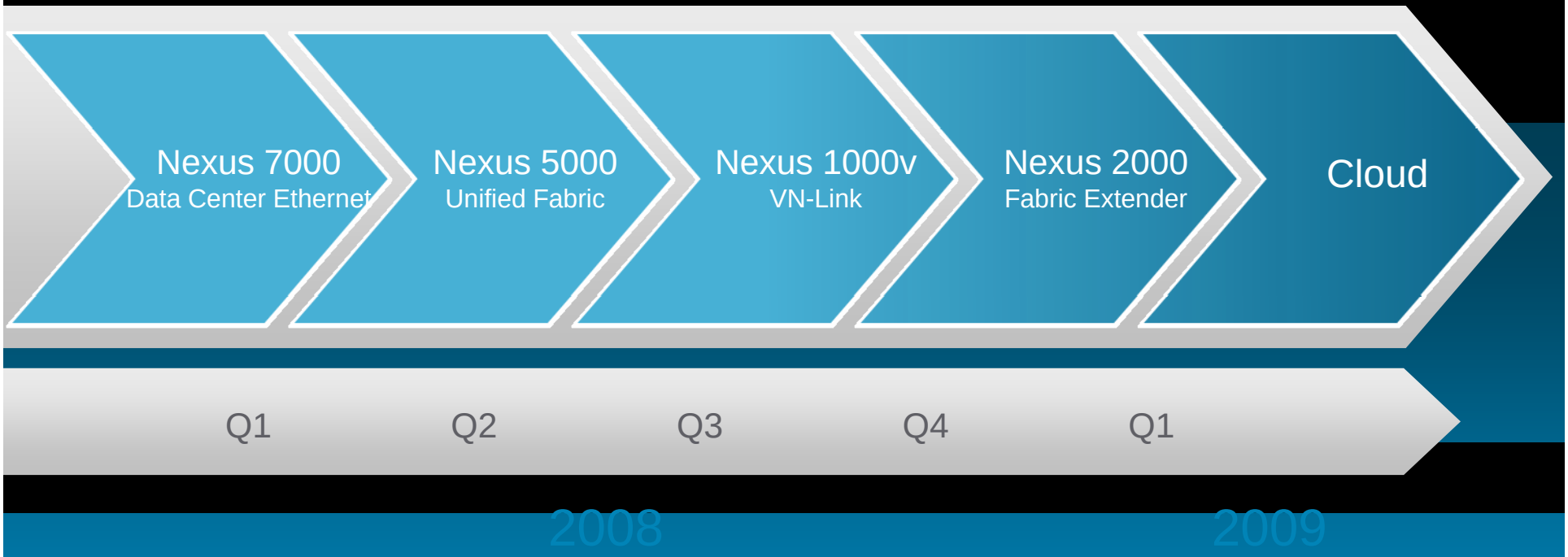
Increasing Use of VMotion and DRS resulting in Multiplicative Increase in Complexity

Source: Cisco

Desktop Virtualisation Gaining Traction as Tool to Address Desktop Manageability, Security and Cost

Source: Goldman Sachs IT Spending Survey

Technology Introduction Timeline

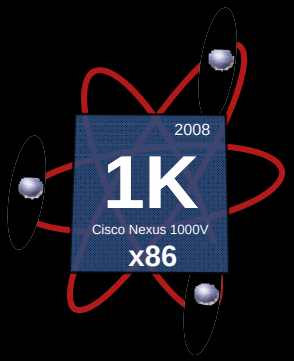


Nexus: An Unmatched Rate of Innovation

Platform

Cisco Nexus 7000
Raised the bar for availability and performance

Cisco Nexus 5000
Delivered DCE and FCoE



Cisco Nexus 1000V
Revolutionized virtual machine networking

2008 **Jan** **Sep** **2009**

Technology

NX-OS
Unified OS for the data center

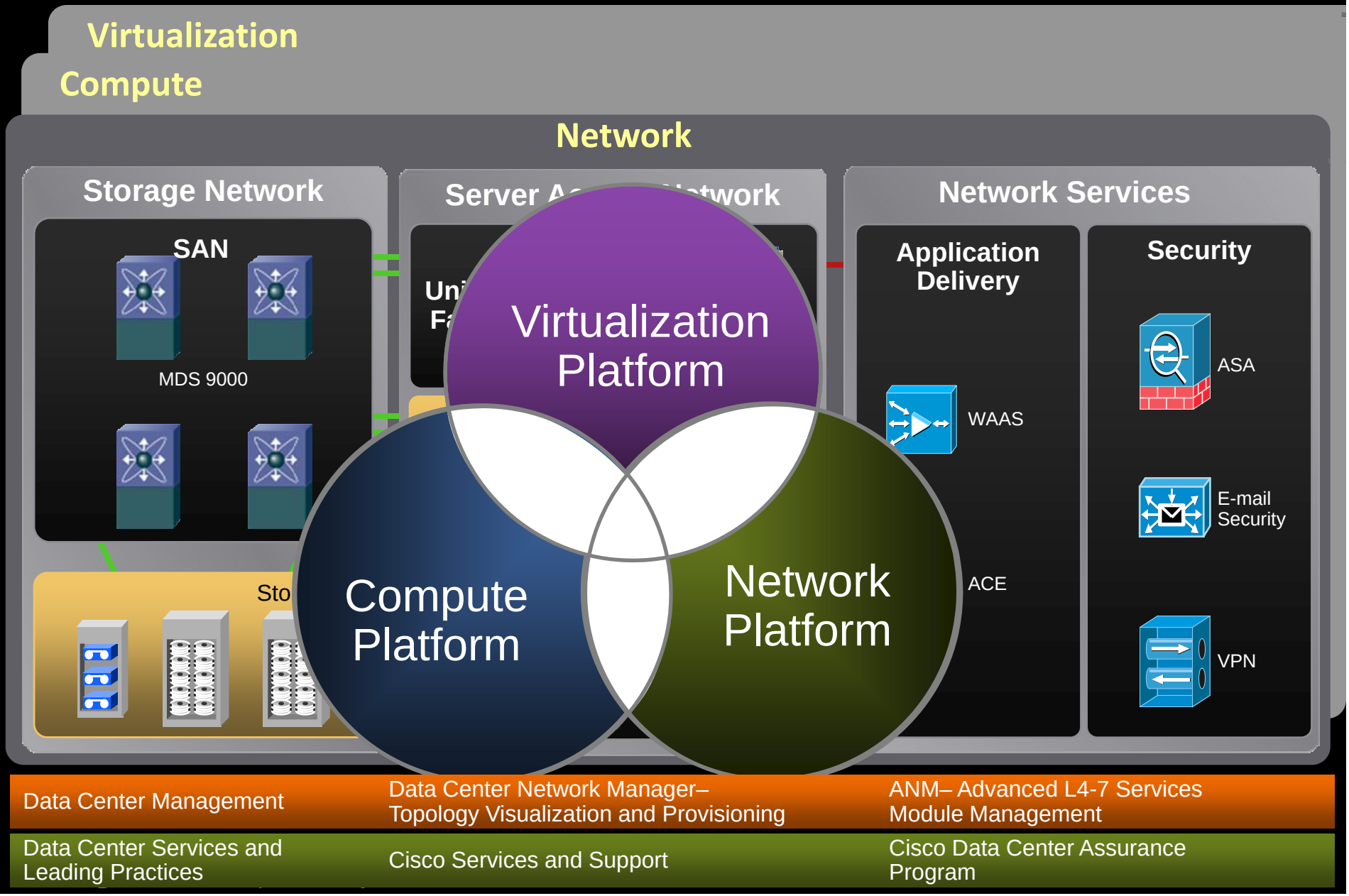
Data Center Ethernet
Lossless 10Gb transport

Fibre Channel over Ethernet
Unified transport for LAN and FC

VN-Link
Virtual Machine Aware Network , Storage and Unified Fabric

- ⇨ **Portfolio Enhancement**
- ⇨ **Portfolio Expansion**
- ⇨ **Network Services Strategies**

Cisco Data Center 3.0 Portfolio



Cisco Data Center 3.0 Ecosystem

Data Center Virtualization Solution

Storage Network	Server Access Network	Network Services
Storage Partners EMC² hp invent Xiotech NetApp® Sun microsystems IBM NSP Network Storage Platform Hitachi Data Systems	**Virtualization and Unified Fabric Partners** vmware™ Microsoft redhat intel QLOGIC EMULEX NetApp® EMC²	**Application Partners** Microsoft ORACLE PARTNERNETWORK SAP Certified Integration vmware™

Data Center Management	Data Center Network Manager– Topology Visualization and Provisioning	ANM– Advanced L4-7 Services Module Management
Data Center Best Practices and Services	Cisco Services and Support	Cisco Data Center Assurance Program

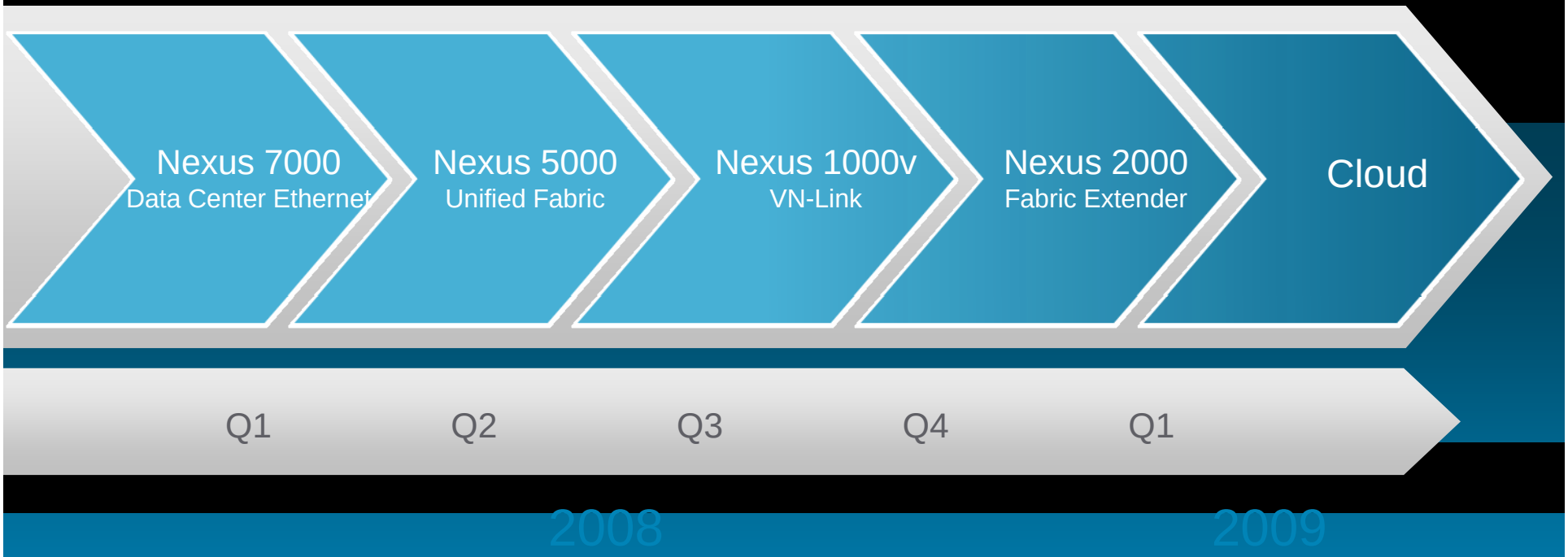
Data Center Networking Environment

- Multi-Core CPU architectures and server virtualization is driving the need for more bandwidth per server
- Higher dependency of Application performance on network performance
  - Bandwidth and Latency matter
- Packet “drop” affects most traffic types
- Flat Networks are common in the Data Center

Server Virtualization is Changing the Game

- Virtual networks growing faster and larger than physical
  - Network admins are getting involved in virtual interface deployments
  - Network access layer needs to evolve to support consolidation and mobility
- Multi-core Computing driving Virtualization & new networking needs
  - Driving SAN attach rates higher (10%➔40%➔Growing)
  - Driving users to plan now for 10GE server interfaces
- Network Virtualization enables CPU & I/O Intensive Workloads to be Virtualized
  - Enable broader adoption of x86 class servers

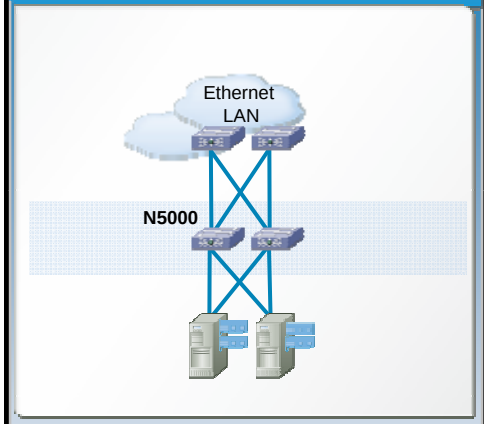
Technology Introduction Timeline



10G FCoE Unified Fabric

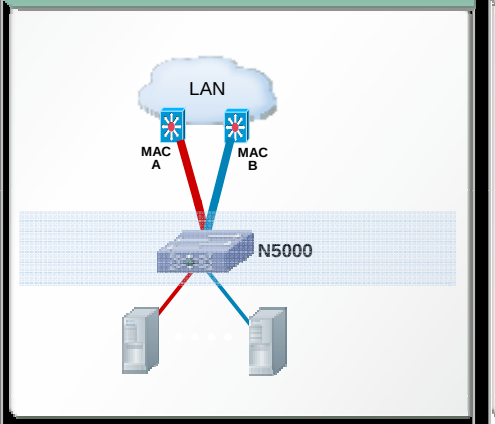
Standards

Wire speed 10GE



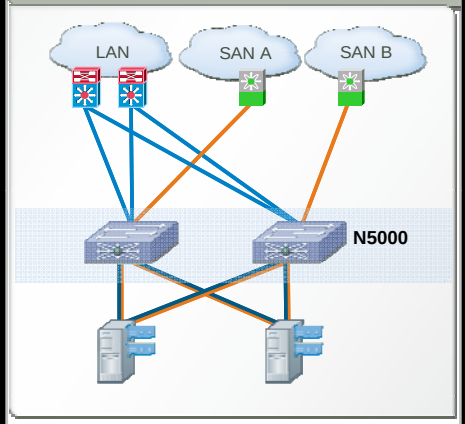
10GE L2 non-blocking, lossless, low latency switch

Data Center Ethernet

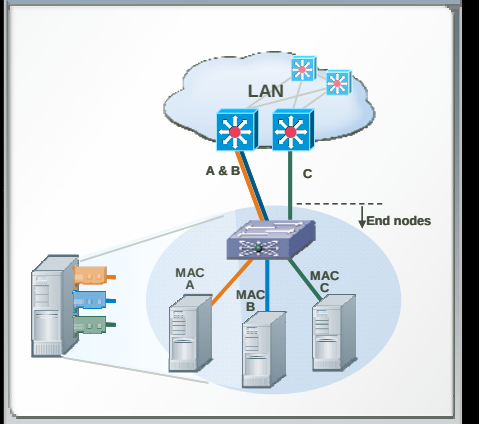


Standards based Ethernet extensions

FCoE



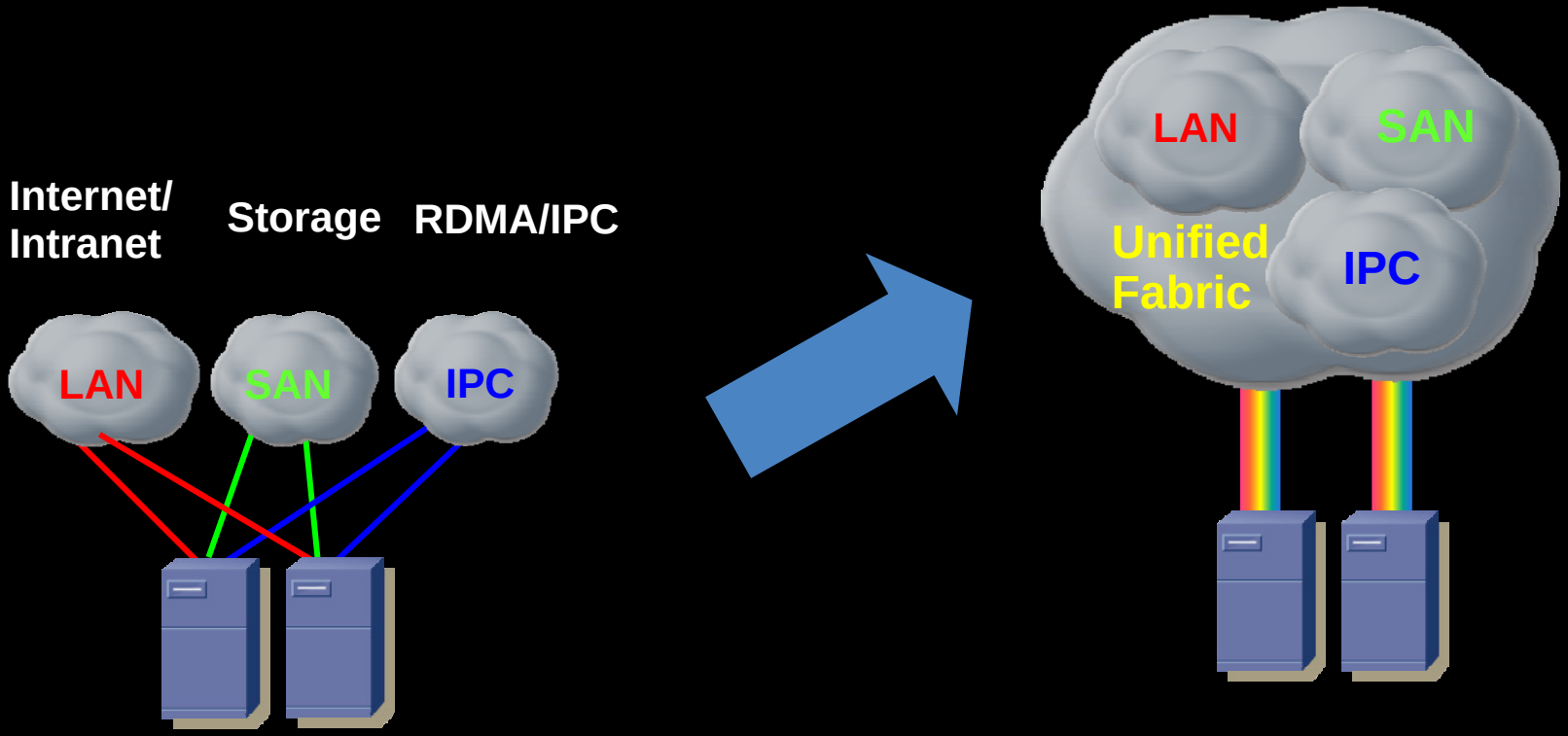
Virtualization



VM-optimized networking

Ecosystem Partners

Data Center Vision:
A *Unified Fabric with Cisco DCE*

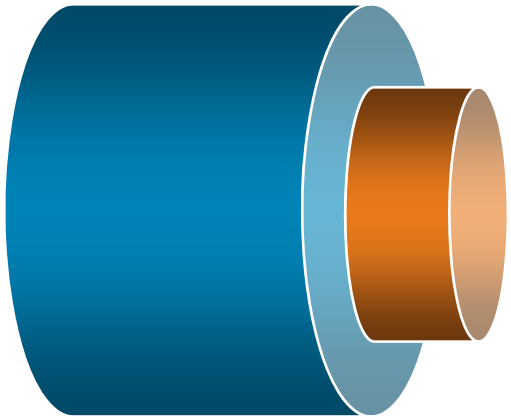


Today
- Multiple I/O
- Higher Capex
- Higher Opex
- Multiple Mgmt mechanisms

With DCE
- Single L2 Transport
- L2 Multipathing
- Unified & Virtualized I/O
- Built-in Interoperability

FC over Ethernet (FCoE)

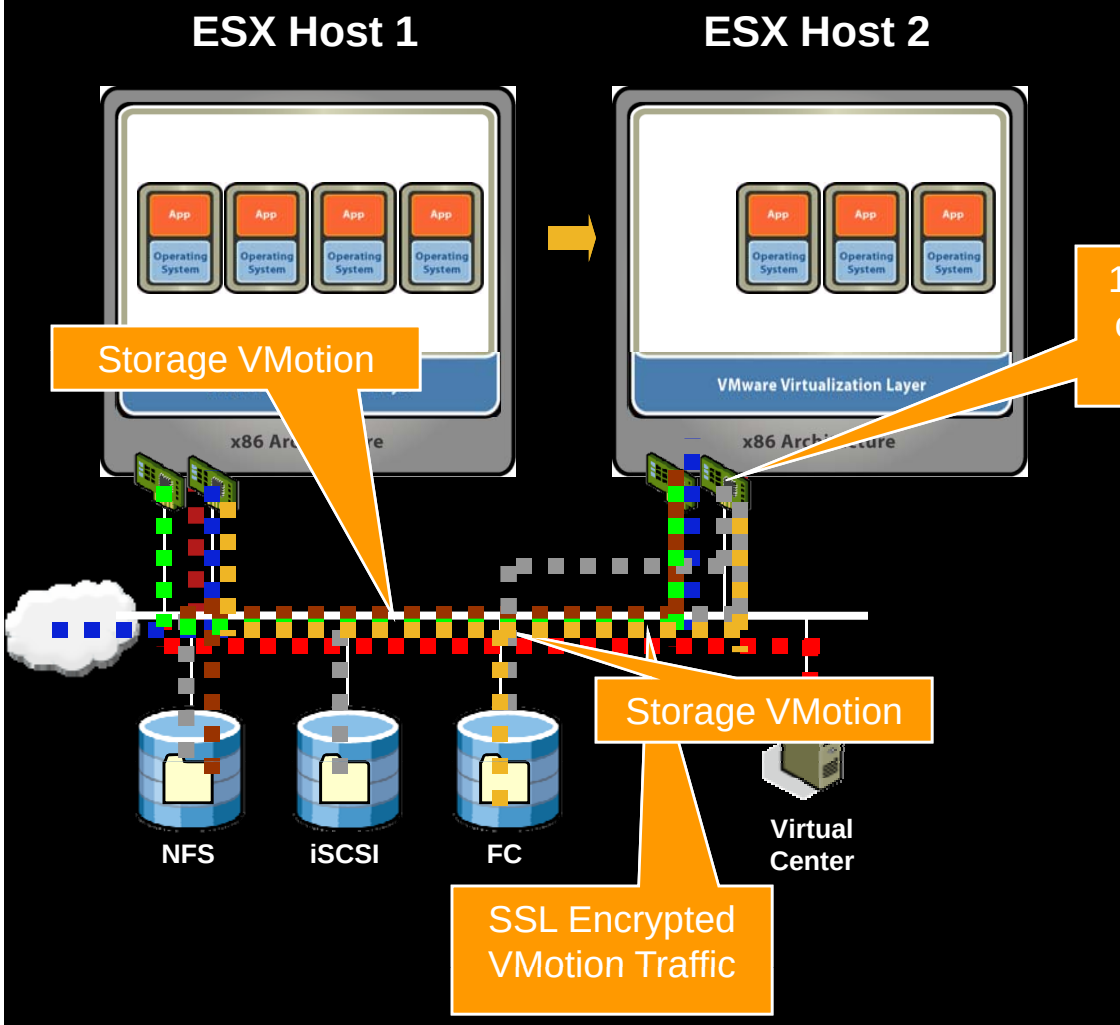
FCoE



Benefits

- Fewer Cables
  - Both block I/O & Ethernet traffic co-exist on same cable
- Fewer adapters needed
- Overall less power
- Interoperates with existing SAN's
- No Gateway – Stateless – end to end Fibre Channel session

Consolidated I/O around 10GE



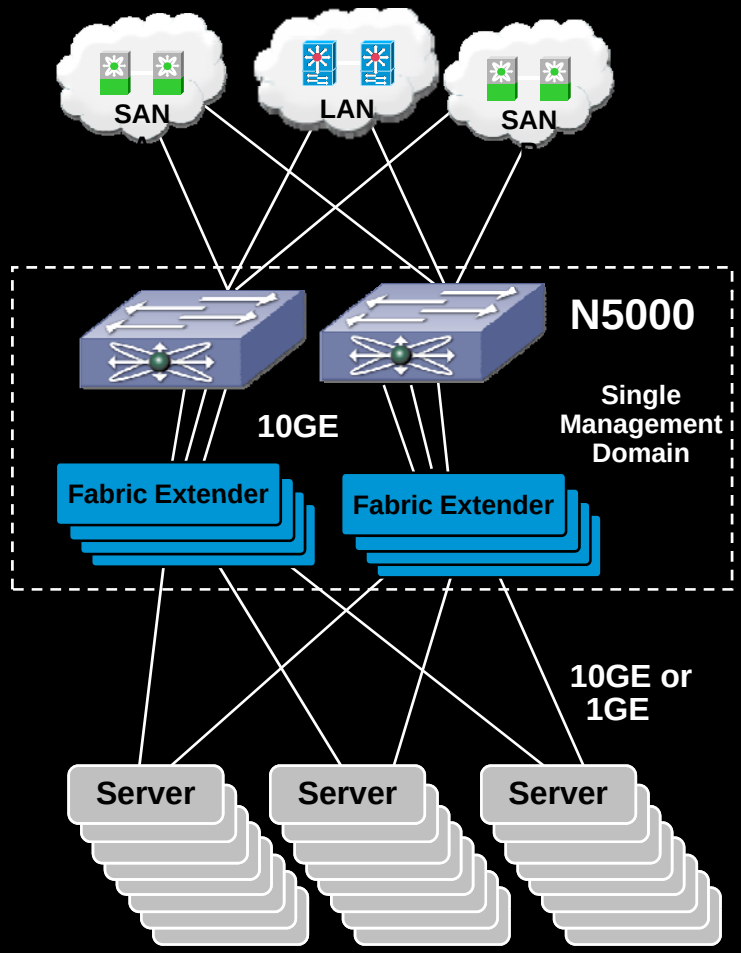
- Traffic Types
  - VMotion Traffic
  - Management
  - HA Heartbeats
  - VM Traffic
  - NFS / iSCSI
  - FCoE
  - Storage VMotion
  - Availability*

- VI supports over 7 different traffic types today
- More traffic types are just around the corner
- VI I/O infrastructure must be performance optimized for all types

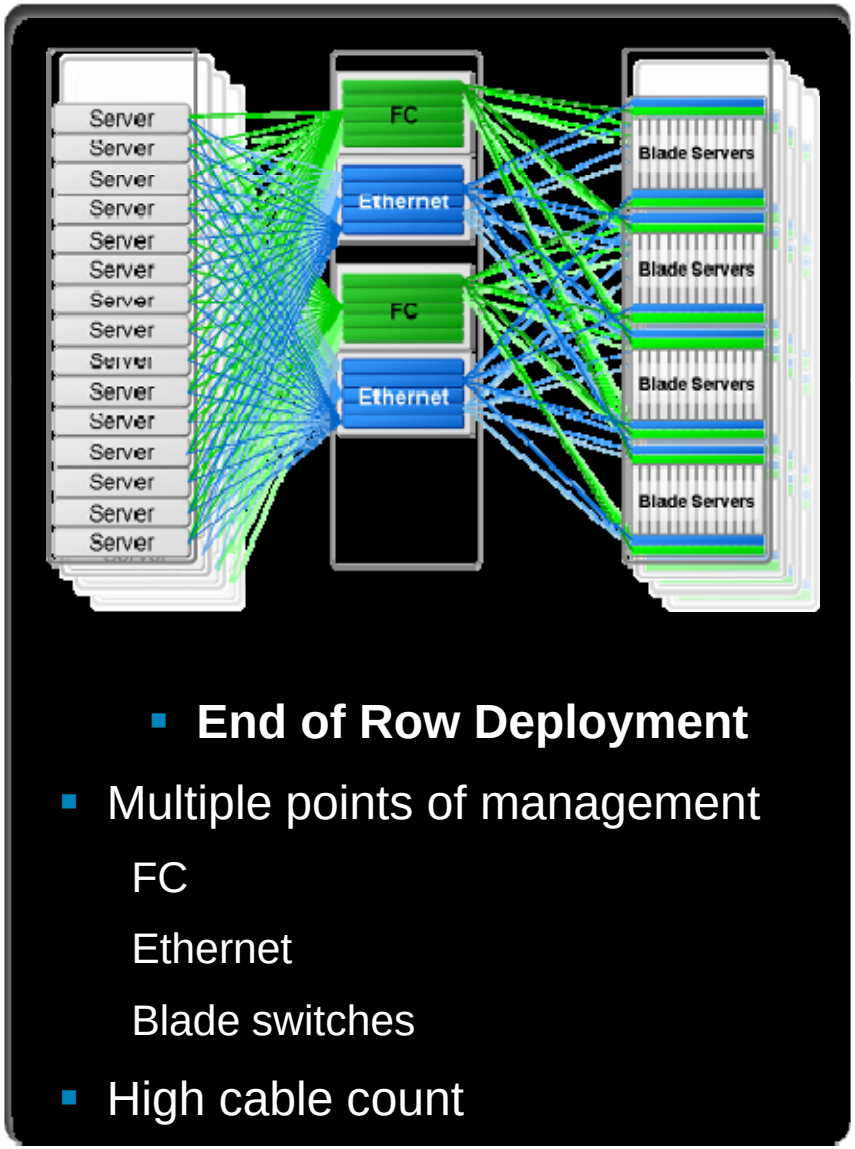
Nexus 5000 Top of Rack Fabric Extender

N5000 Fabric Extender

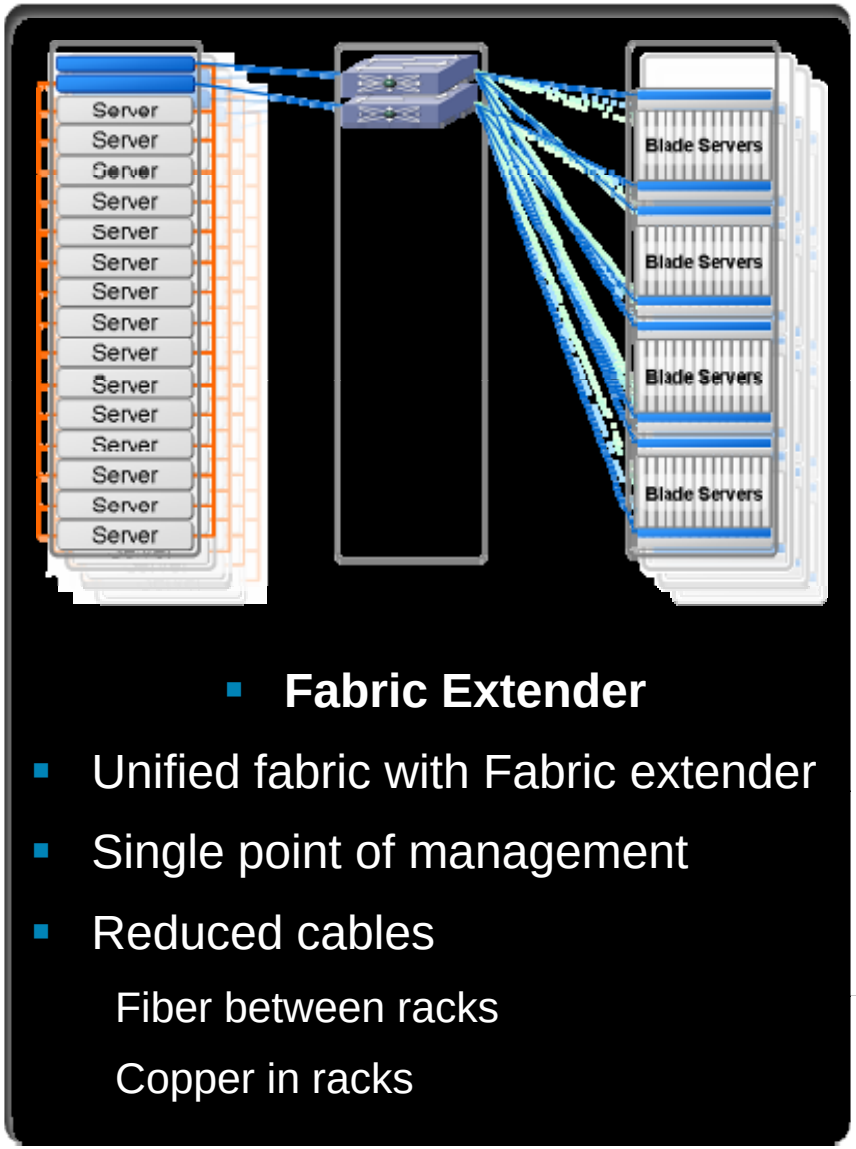
- *Cost effective Scalable 1GE and 10GE version*
- *RJ-45 connectivity for 1GE, SFP+ for 10GE*
- *Feature consistency with Nexus 5000*
- *High density server aggregation*
- *LAN, SAN and HPC/IPC support*
- *Low Latency*
- *Combines pass thru & switch benefits*
- *Fewer management points*
- *1 RU, no local switching*



Unified Fabric with Fabric Extender
(Remote "Line Card")

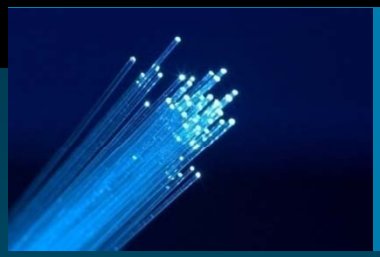


- **End of Row Deployment**
- Multiple points of management
  - FC
  - Ethernet
  - Blade switches
- High cable count



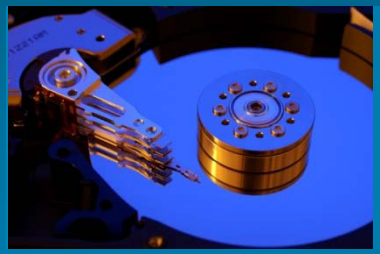
- **Fabric Extender**
- Unified fabric with Fabric extender
- Single point of management
- Reduced cables
  - Fiber between racks
  - Copper in racks

Key Benefits of Unified Fabric

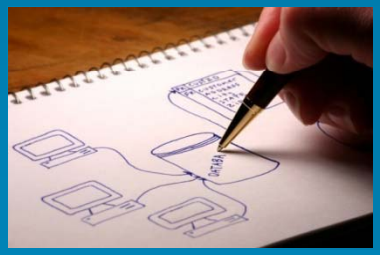


Reduces overall data power consumption
Extends the lifecycle of current data center

Wire hosts once to connect to any network - SAN, LAN, HPC. Faster rollout of new apps and services.

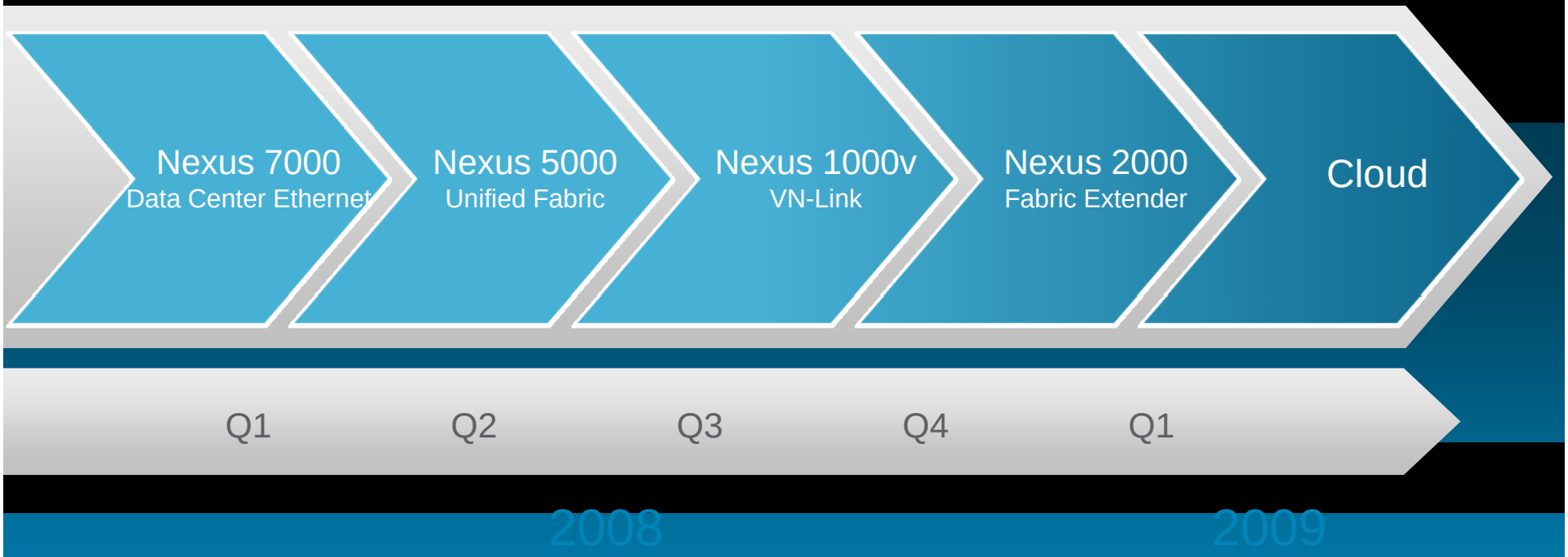


Every host will be able to mount any storage target. Drives storage consolidation and improves overall utilization.



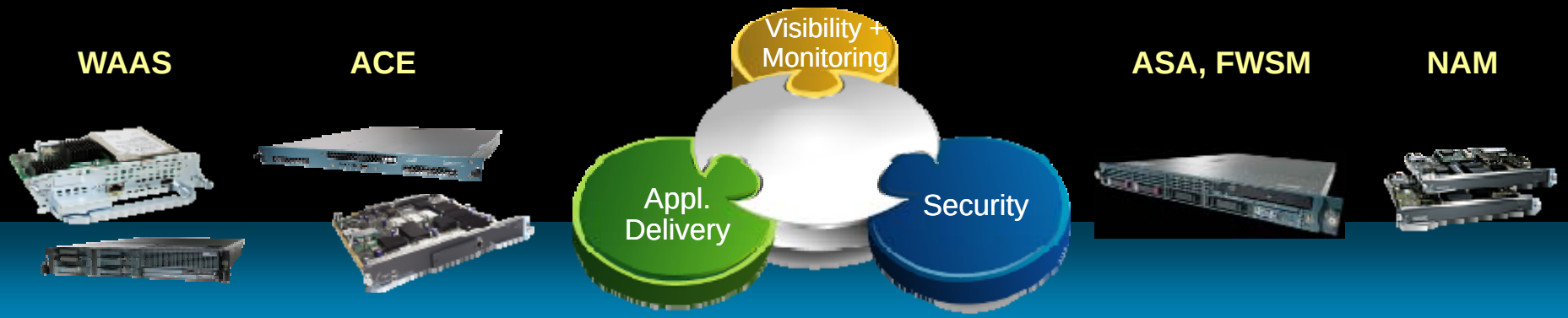
Data Center VM portability becomes easier.

Technology Introduction Timeline



Linking Network Services to Infrastructure

- Scale with Demand
  Virtual appliances, appliances, integrated data planes
- Execute in the best place to support workload - mobile workloads
- Converge to a common O/S and programming model
- Efficient implementation



Networking Challenges to Scaling Server Virtualisation

Security and Policy Enforcement

Applied at physical server—not the individual VM

Impossible to enforce policy for VMs in motion

Operations and Management

Lack of VM visibility, accountability, and consistency

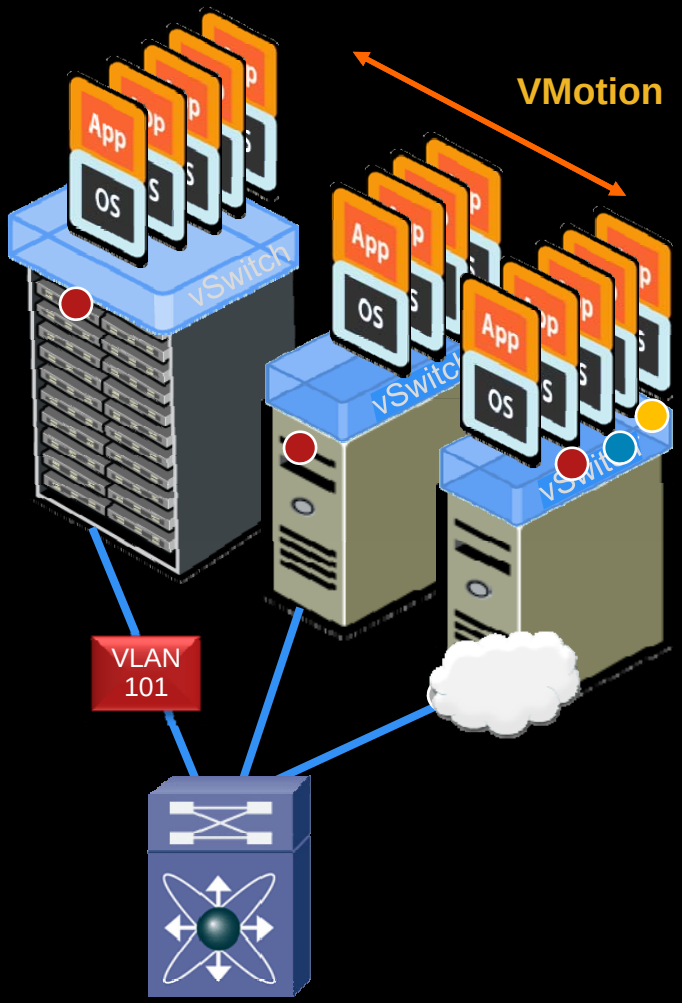
Inefficient management model and inability to effectively troubleshoot

Organizational Structure

Muddled ownership as server admin must configure virtual network

Organizational redundancy creates compliance challenges

What Problems Need to be Addressed?



Problems:

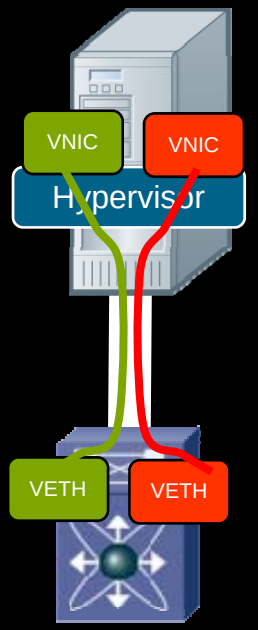
- VMotion may move VMs across physical ports—policy must follow
- Impossible to view or apply policy to locally switched traffic
- Cannot correlate traffic on physical links—from multiple VMs

Virtual Network Link (VN-Link):

- Extends network to the VM
- Consistent services
- Coordinated, coherent management
- Continuum of deployment options

VN-Link…in very simple terms

- Virtual Network Link (VN-Link) is about:
  - VM-level network granularity
  - Mobility of network and security properties (follow the VM)
  - Policy-based configuration of VM interfaces (Port Profiles)
- VN-Link with Nexus 1000V
  - Hypervisor switch with Cisco modular switch (software)
- VN-Link with Nexus 5000
  - Uses Network Interfaces Virtualization

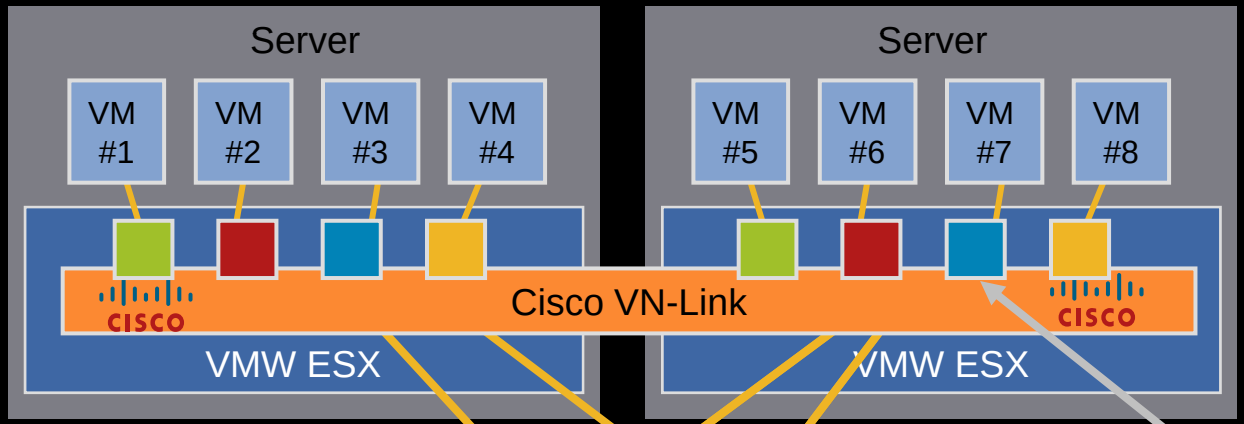


VN-Link Capabilities

Faster VM Deployment

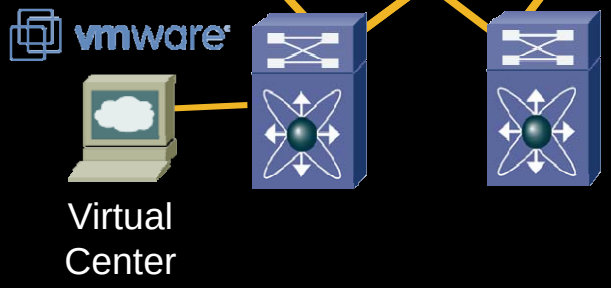
Cisco VN-Link—Virtual Network Link

Policy-Based VM Connectivity	Mobility of Network & Security Properties	Non-Disruptive Operational Model



Defined Policies

- WEB Apps
- HR
- DB
- Compliance



VM Connection Policy

- Defined in the network
- Applied in Virtual Center
- Linked to VM UUID

Policy Based Connectivity:

Virtualization Admin Benefits

- Accelerate & Simplify deployment of new ESX hosts

  Network Admin provisions physical switch trunks & ESX host PNICs in a uniform and consistent way (takes care of both sides of physical connection)

  Virtualization Admin 1) plugs in a new ESX host, 2) assigns PNICs to Cisco vNetwork Distributed Switch in vCenter, 3) ESX PNIC configuration (including vMotion & Console) automatically assigned and enabled, 4) ESX host ready for VMs

- Ensure proper connectivity & networking safeguards are in place

  Virtualization Admin leverages existing workflow (vCenter & Port Groups) to assign VNIC policy.

  Network Admin responsible for ensuring Port Groups provide proper VLAN access & DC network security policy

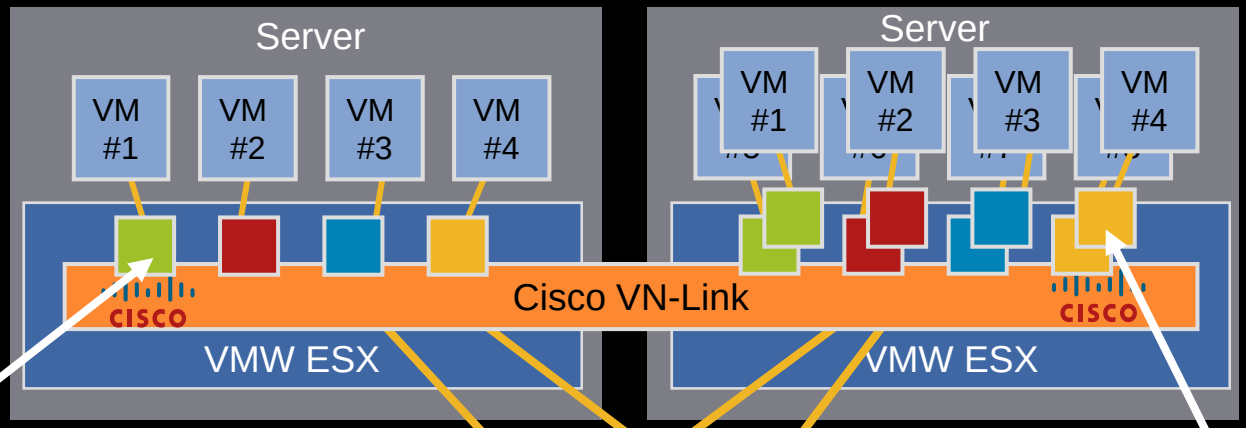
  Cisco Nexus 1000V extends VM networking to include IP/Port security rules, multi-host PVLAN, Flow Statistics, Quality of Service.

VN-Link Capabilities

Richer Network Services

VN-Link: Virtualizing the Network Domain

Policy-Based VM Connectivity	Mobility of Network & Security Properties	Non-Disruptive Operational Model



VMs Need to Move

- VMotion
- DRS
- SW Upgrade/Patch
- Hardware Failure

VN-Link Property Mobility

- VMotion for the network
- Ensures VM security
- Maintains connection state

Mobility of Network & Security Properties
Virtualization Admin Benefits

- Prevent ESX host/network config discrepancies from impacting vMotion

  vMotion domains can be configured once and the vSwitch parameters across the cluster will always be consistent with the physical network

- Gain consistent visibility into VM-level I/O

  Virtual applications can be diagnosed using the same tools and method NOCs currently use in the physical environment. 1 consistent operations model provides faster MTTR of virtual applications

- Secure I/O to VMs located in the DMZ

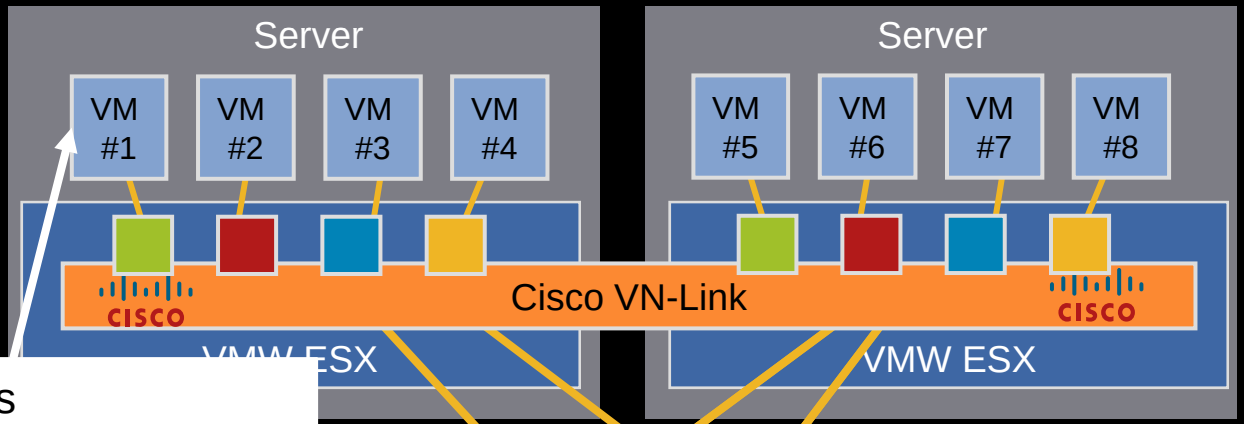
  The use of IP/Port security rules (also know as Access Control Lists) can lock down traffic to/from a particular VM. For instance, a Web server in a DMZ can have traffic limited only to Port 80 to support a Web Server. This rule set is applied to the VM VNIC and moves with the VM during vMotion

VN-Link Capabilities

Increase Operational Efficiency

VN-Link: Virtualizing the Network Domain

Policy-Based VM Connectivity	Mobility of Network & Security Properties	Non-Disruptive Operational Model



Server Benefits

- Maintains existing VM mgmt
- Reduces deployment time
- Improves scalability
- Reduces operational workload
- Enables VM-level visibility

Center

Network Benefits

- Unifies network mgmt and ops
- Improves operational security
- Enhances VM network features
- Ensures policy persistence
- Enables VM-level visibility

Non-Disruptive Operational Model
Virtualization Admin Benefits

- VM workflow doesn't change

  Virtualization administrator continues to leverage vCenter for VM creation, maintenance, monitoring

- ESX vSwitch configuration & management responsibility offloaded

  vSwitch and Port Groups now provisioned along with the physical network infrastructure ensuring consistency, virtualization administrator subscribes VMs to available Port Groups and vSwitch is dynamically provisioned

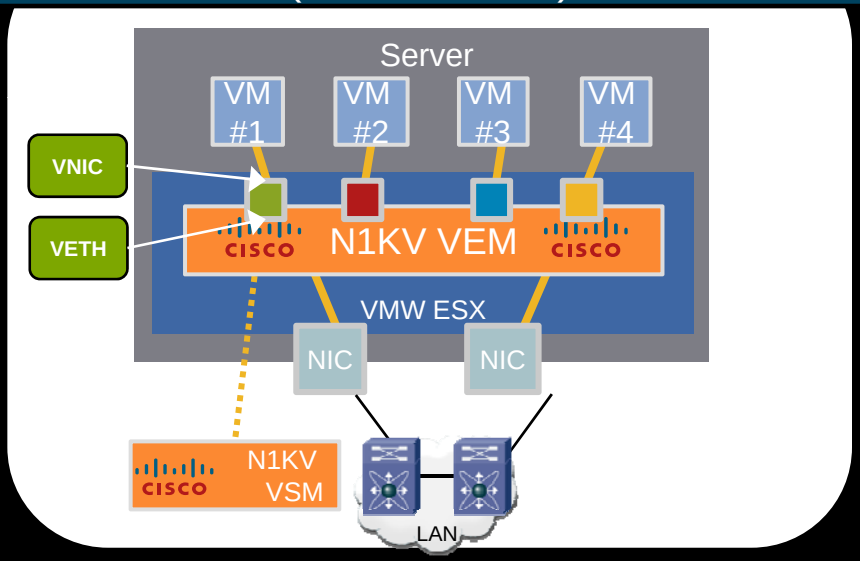
- Equip Data Center operations teams to respond to applications issues

  By extending the data center network operations model and troubleshooting toolkit down to the virtualization infrastructure, customers can leverage physical world tools and diagnostic procedures for their VM-based applications – 1 consistent model for the whole data center

VN-Link Solutions

Software VN-Link

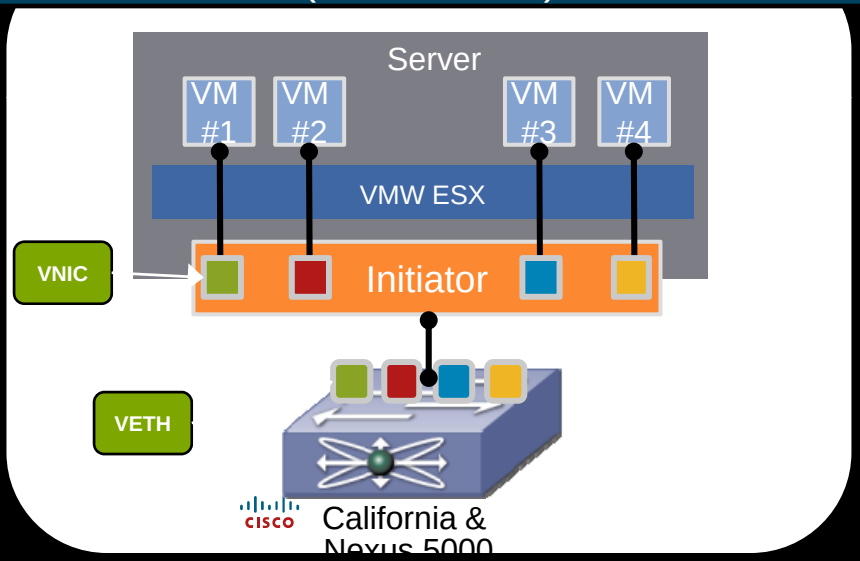
(Nexus 1000V)



May 2009 FCS

Hardware VN-Link

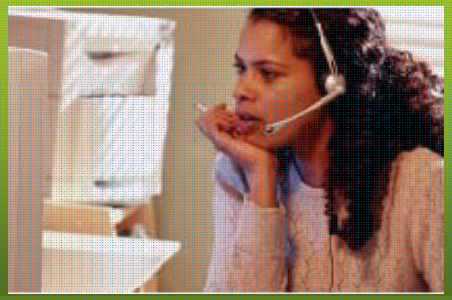
(Nexus 5000)



N5K: Q1 2010 Availability (Target)

Cisco Nexus 1000V

Three New Features that Make a Difference



Encapsulated Remote SPAN (ERSPAN)

- Mirror VM interface traffic to a remote sniffer
- Identify root cause for connectivity issues
- No host-based sniffer virtual appliance to maintain
- Follows your VM with VMotion or DRS

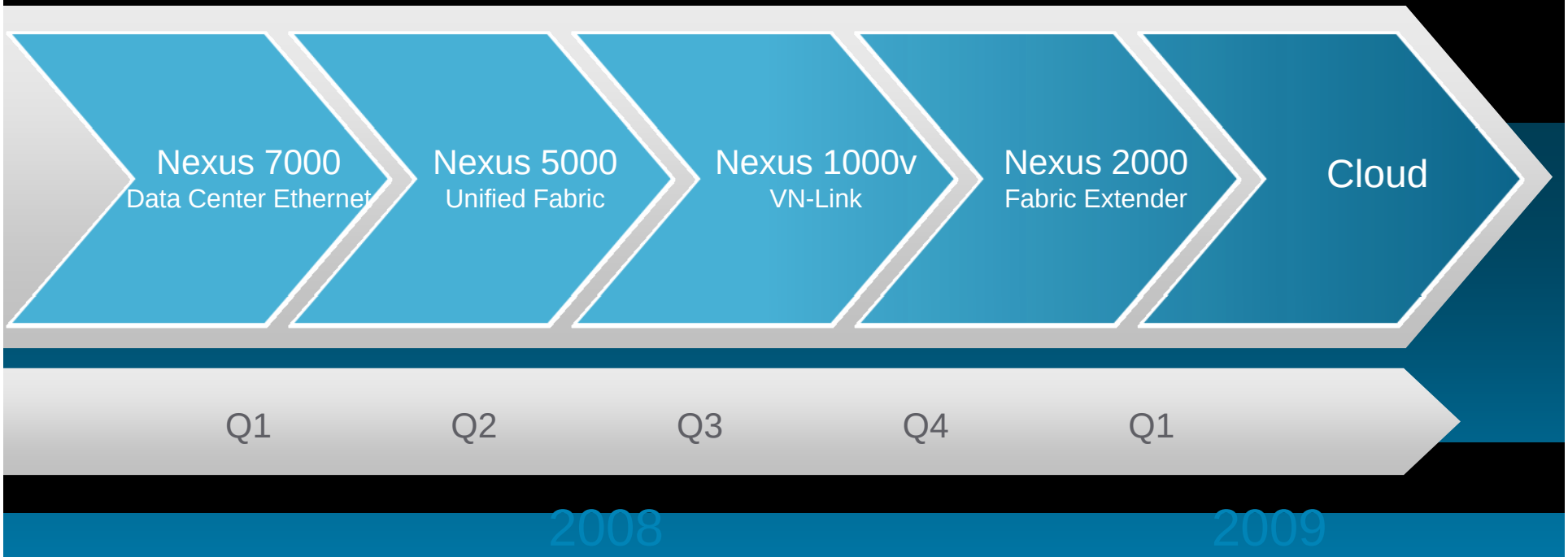
NetFlow v.9 with Data Export

- View flow-based stats for individual VMs
- Captures multi-tiered app traffic inside a single ESX host
- Export aggregate stats to dedicated collector for DC-wide VM view
- Follows your VM with VMotion or DRS

Private VLANs (PVLANs)

- Great for mixed use ESX clusters
- Segment VMs w/o burning IP addresses
- Supports isolated, community and promiscuous trunk ports
- Follows your VM with VMotion or DRS

Technology Introduction Timeline

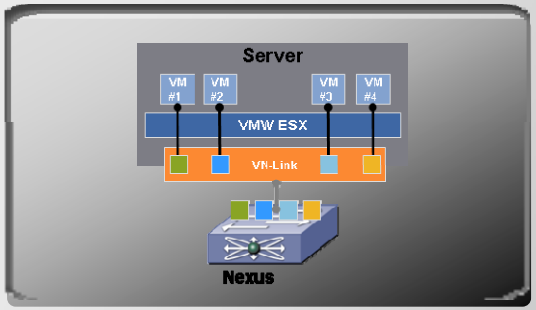


Cisco Systems Data Center 3.0 Technology Roadmap

Unified Fabric

Nexus 5K, 2K-FEX

- ToR server access
- Wire once infrastructure
- Low-latency lossless
- Virtualization aware
- Standards-based



Server Virtualization

- VN-Link, Nexus 1K

- Virtualization aware access layer
- Compatible with switching platforms
- Combine VM and physical network ops
- Standards-based