Cisco Expo 2009

Data Center

Arkitektur & Tendenser

Ib Hansen, Systems Engineer, Cisco

Agenda

- Drivers & Trends
- Benefits & Challenges
- Server Virtualization Developments
- Network & Security Virtualization Developments
- Storage Virtualization
- Summary

Data Centers under Increasing Pressure

New Business Pressures

Collab

red U

SLA

Reg. Compliance

Operational Li

Power & Cooling

Asset Utilization

Provisioning

Threat Prevention

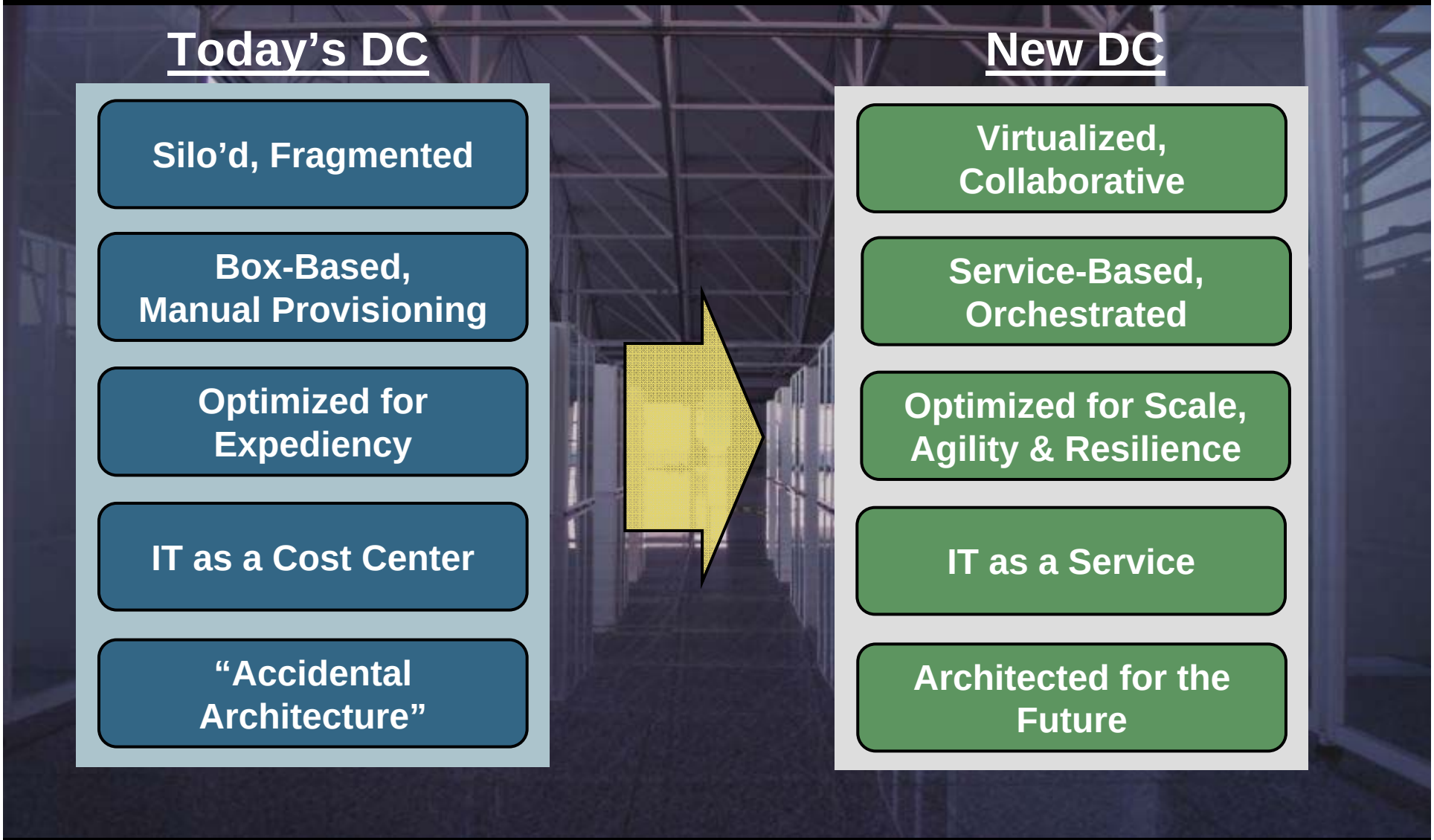
Bus. Continuance

CIO Imperatives

Business Relevance	**Align IT with business needs** **Measure and communicate IT Value**
Business Agility	**React to market needs—in real time** **Deliver process efficiency**
Total Cost of Ownership	**Strategic management of IT finances** **Achieve ROI on investments**
Risk Management	**Ensure compliance with regulations** **Ensure business continuity**
Customer Experience and Satisfaction	**Add new customers** **Drive customer loyalty**

DC Virtualization addresses these issues

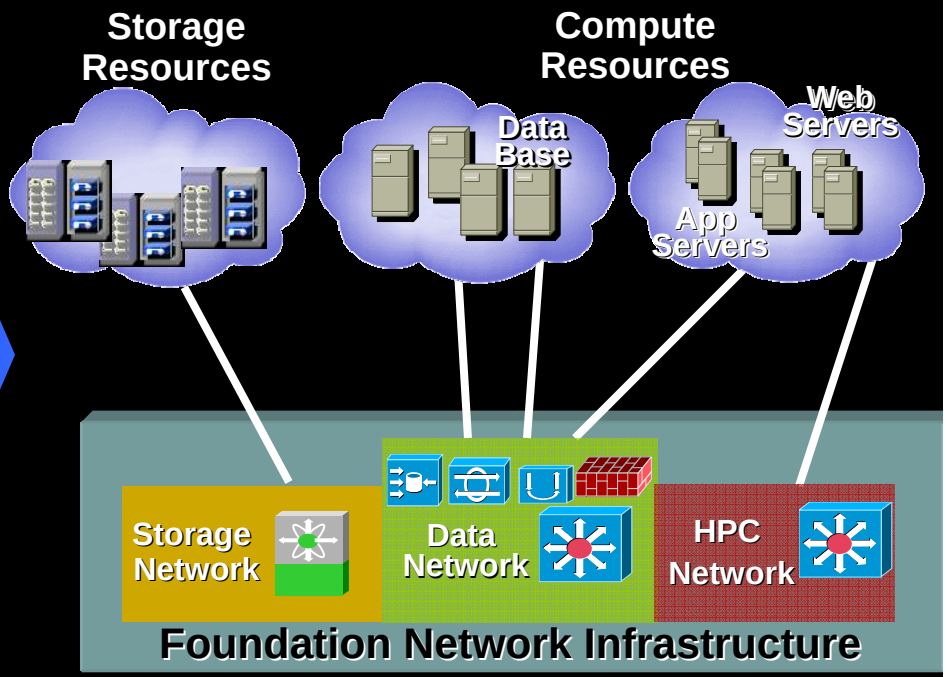
DC Infrastructure Needs to Evolve



Moving to Consolidated Architecture

"Silos to Pools"

Pools of compute, storage and network resources; virtualization



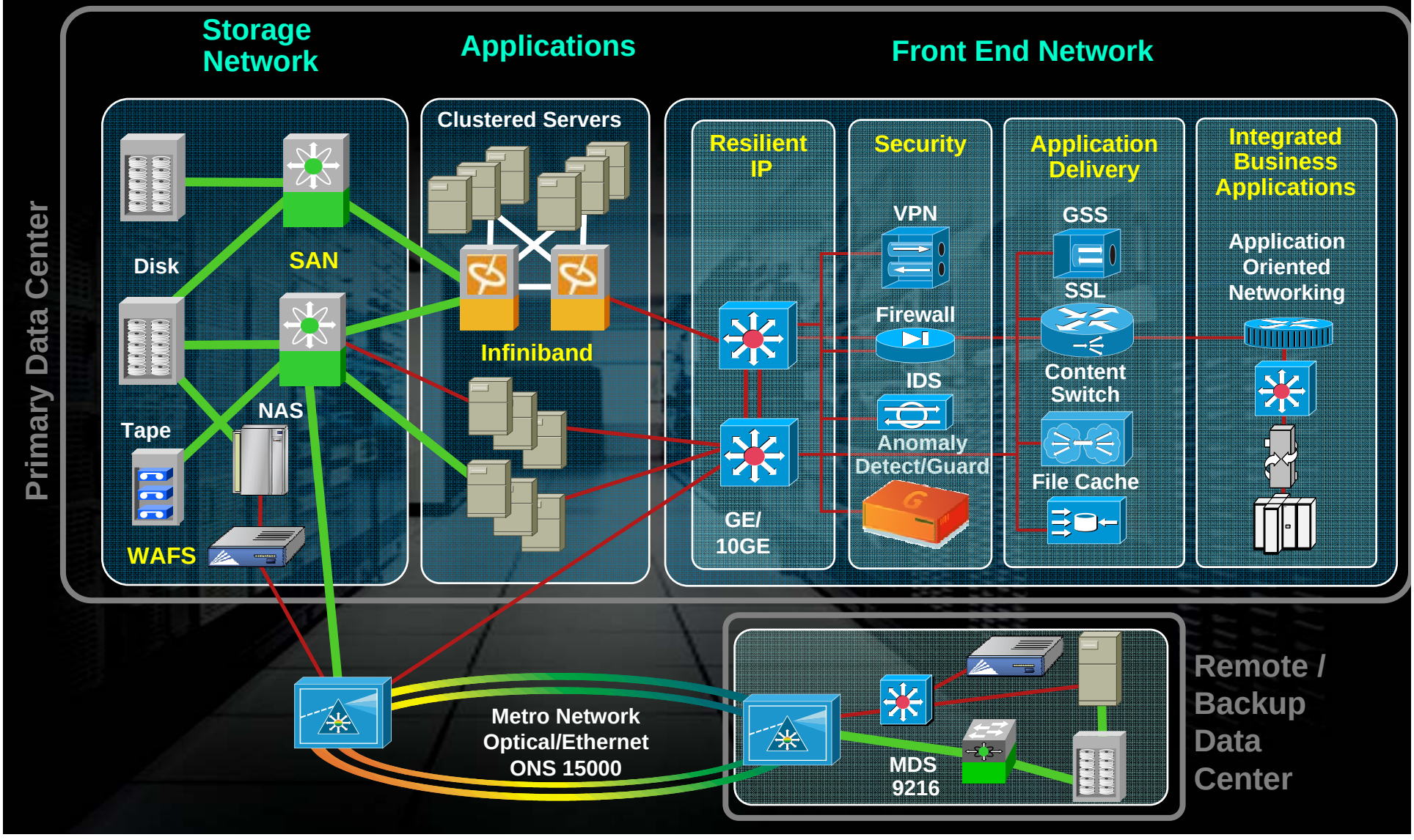
Pooling and virtualization of resources:

- reduces complexity
- reduces sustaining burden
- increases resource utilization
- enables automation

What is Virtualization to our customers?

- Most customers associate “Virtualization” with SERVER Virtualization.
- Many CIO’s see Server Virtualization (e.g. VMware) as one of the most important IT innovations in 20 years
- Cisco has invented and innovated lots of ***virtualization*** that delivers similar benefits & efficiencies, delivered over 20 years (not 3-5 years)
  - Within the Data Centre Cisco features & functionality are just as important as VMware features & functionality – Complimentary Capabilities
  - DC “infrastructure” is a lot more than server platform – it’s everything in the DC
  - “End to End” infrastructure is the entire IT estate from user interface to data archive

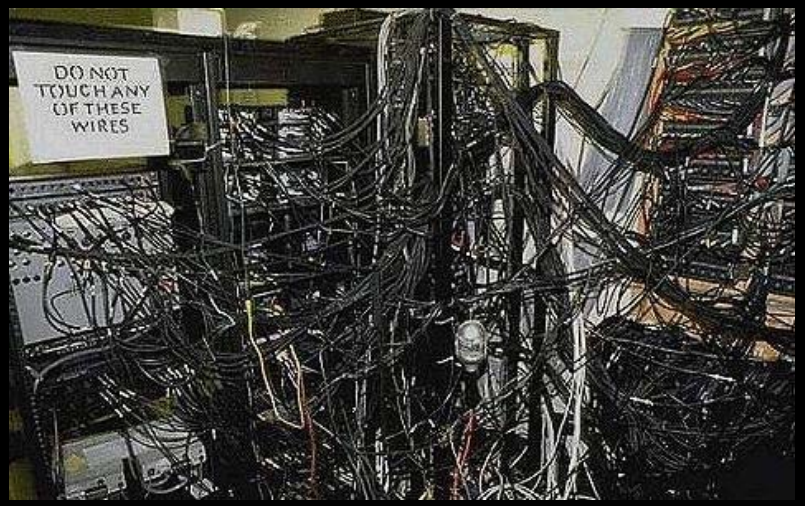
The Cisco Data Center Network



Benefits & Challenges

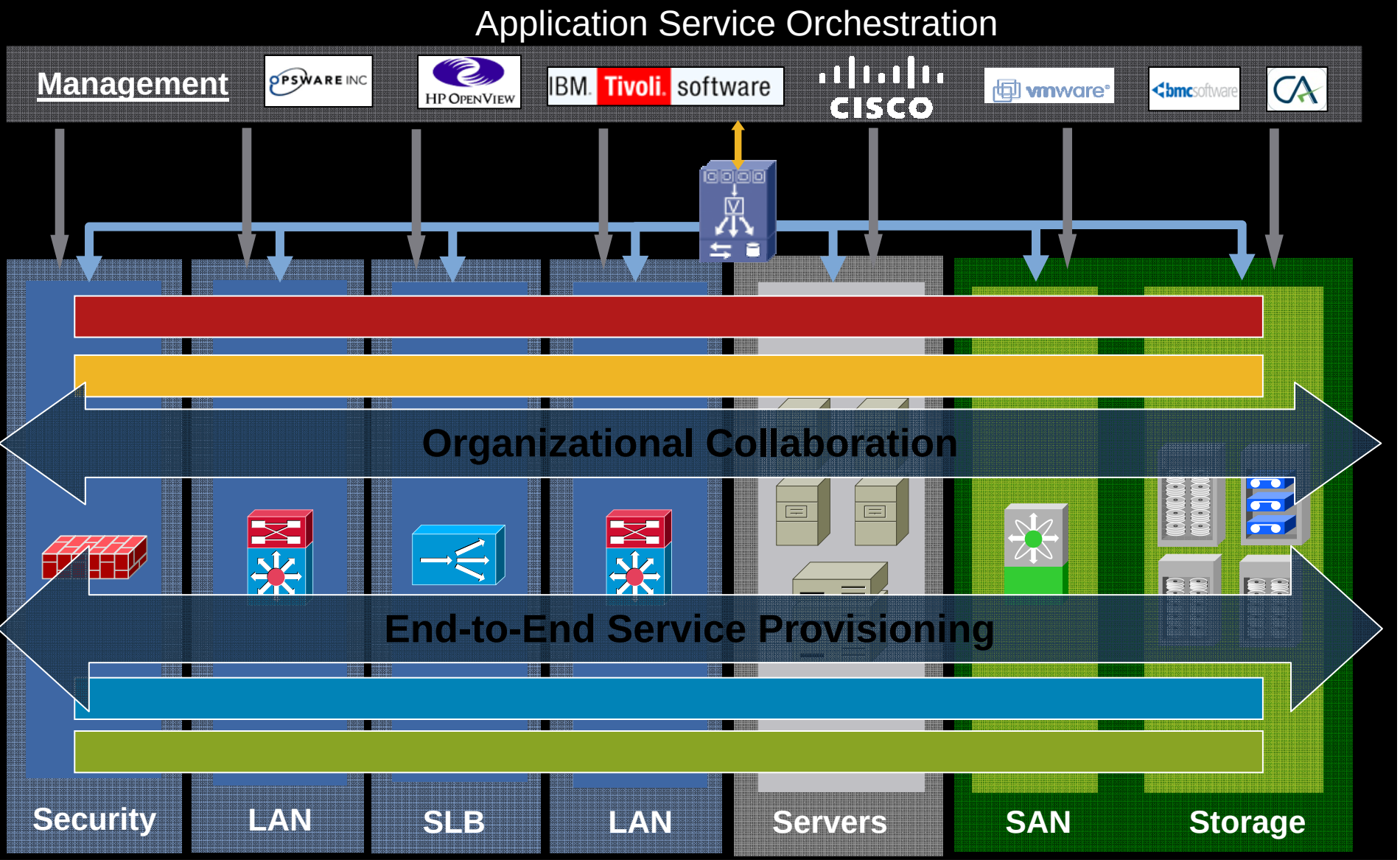
Virtualization changes everything….
So why Virtualize?

- Improved Resource Utilization
- Service Velocity
- Extends the life of the DC
- Greener IT
- Better Business Continuance
- Improved & Faster ROI
- Reduced Costs
- Higher Availability
- Staff Productivity
- Simpler Management
- Increased Security



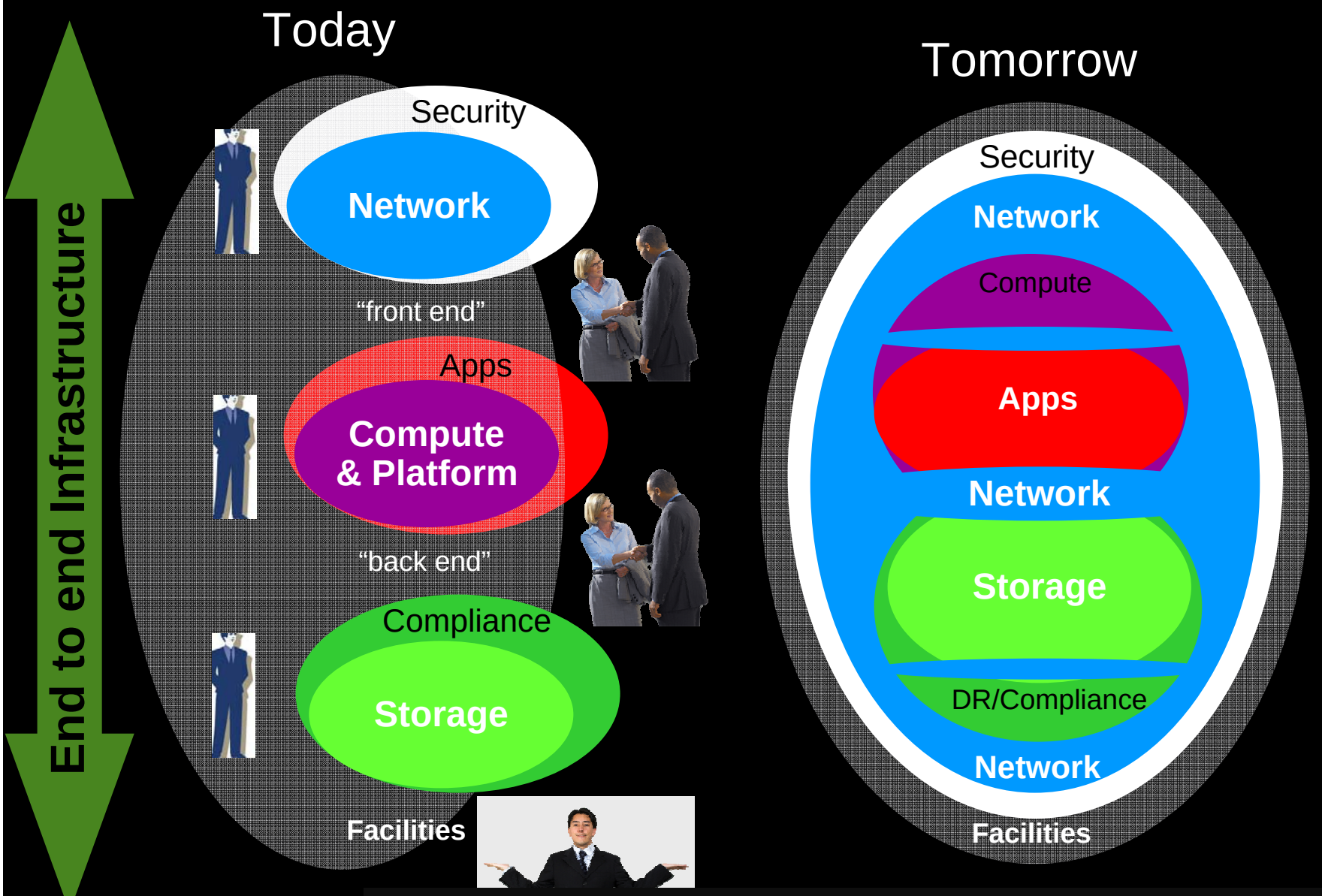
Virtualization Provides the Opportunity to Transform the IT Infrastructure for Operational improvement.

Evolution of Virtualization; Automation



The network is the GLUE holding the DC together. The Network is the Platform

Data Center Terminology & Stakeholders

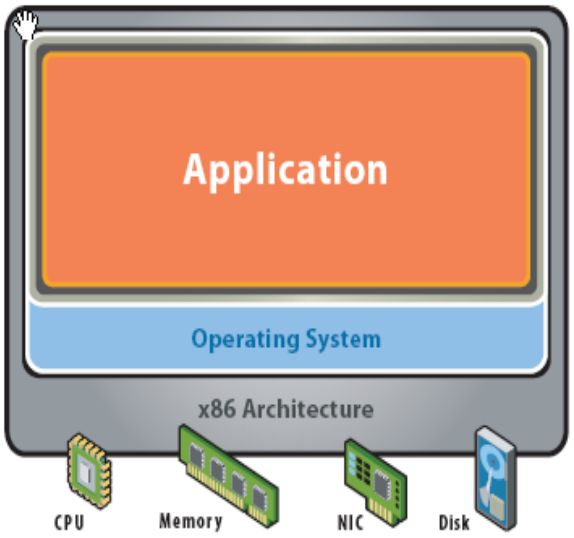


How do you get organisational collaboration & synchronisation?

Server Virtualization Developments

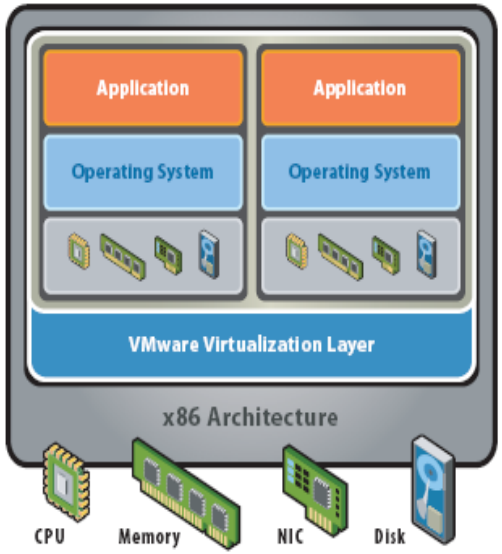
Server Virtualization 101

One Application per Server → Many Applications per Server → DC Server Consolidation



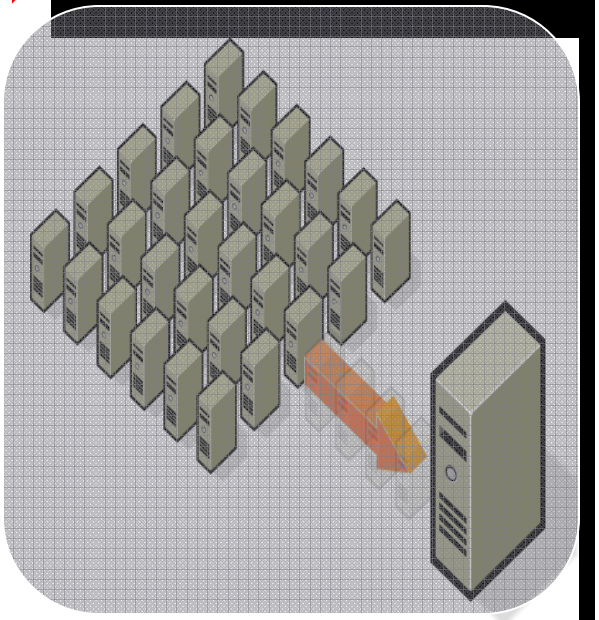
Before Virtualization:

- Single OS image per machine
- Software and hardware tightly coupled
- Running multiple applications on same machine often creates conflict
- Underutilized resources
- Inflexible and costly infrastructure



After Virtualization:

- Hardware-independence of operating system and applications
- Virtual machines can be provisioned to any system
- Can manage OS and application as a single unit by encapsulating them into virtual machines



Value Proposition

- Reduced Power & Cooling
- Reduced Management
- Rapid Deployment & Agility
- Increased Availability
- Reduced Rack space
- Reduced CAPEX
- Reduced OPEX

Gartner; Virtualization “2.0”

- Advances in Virtualization technologies will continue in 2008.
- Virtualization technologies can improve IT resource utilization and increase the flexibility needed to adapt to changing requirements and workloads.
- Virtualization technologies are enablers that help encourage broader improvements in infrastructure cost reduction, flexibility and resiliency.
- With the addition of automation technologies – with service-level, policy-based active management – resource efficiency can improve dramatically, flexibility can become automatic based on requirements, and services can be managed holistically, ensuring high levels of resiliency.

http://www.gartner.com/it/page.jsp?id=530109

Virtualization with the addition of Mobility (like **VMotion**) takes the entire value proposition to a new level. The surrounding network infrastructure must be supportive of *Virtualization 2.0* to enable the benefits of mobility and automation.

A Virtualized Data Center is a Dynamic Data Center

VMware Operational Benefits
The Agile & Resilient Data Center

Distributed Resource Scheduling (DRS)

- Balance workloads
- Right-size hardware
- Optimize real time

High Availability (HA)

- Restart immediately when H/W or OS fail
- Protect all apps

On-demand Capacity

- Scale without disruption
- Reconfigure on the fly
- Provision new server

10 Gb Data Center Ethernet

- High bandwidth
- Highly available
- Cost-effective

Unified Fabric

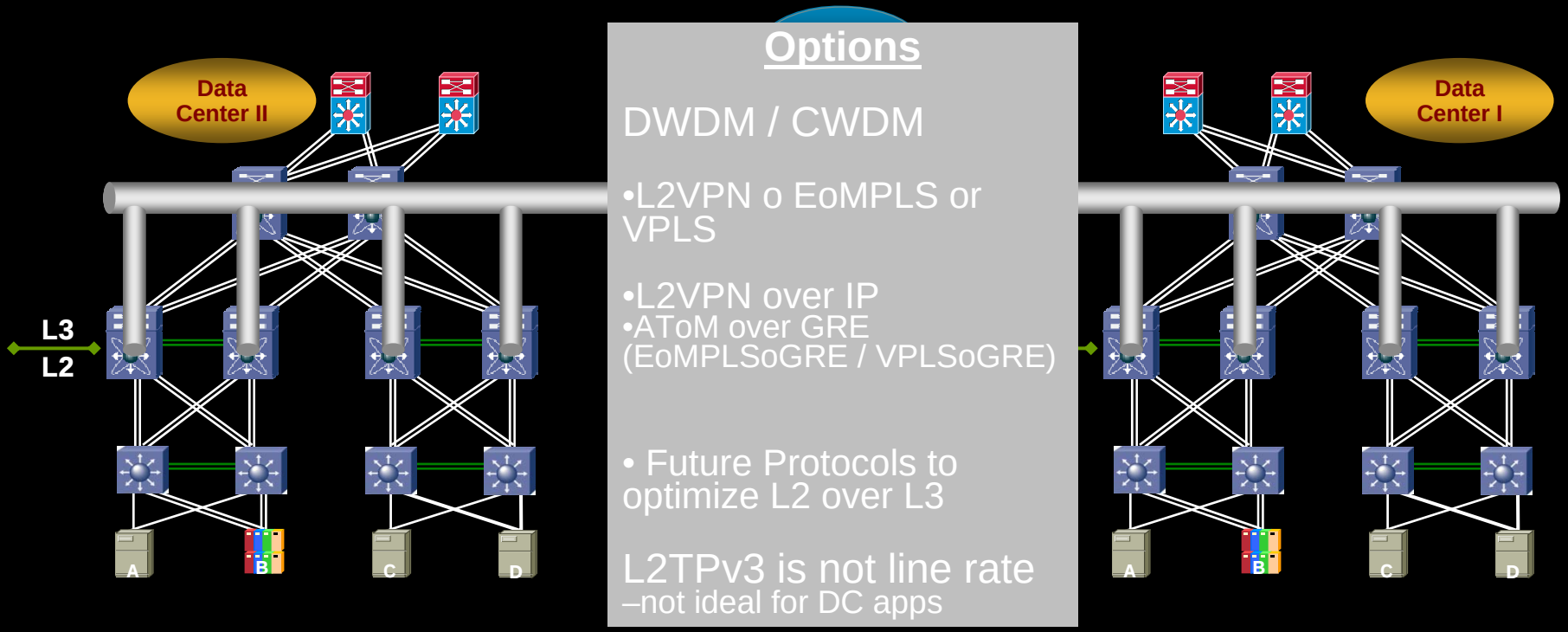
- Support DC wide portability
- Consistent, ubiquitous services

VM-aware Network

- Network services move with VM
- Provision in seconds

creates a MAC address space explosion!

Virtual Data Center
LAN extensions: Inter/intra Data Center



Options

DWDM / CWDM

•L2VPN o EoMPLS or VPLS

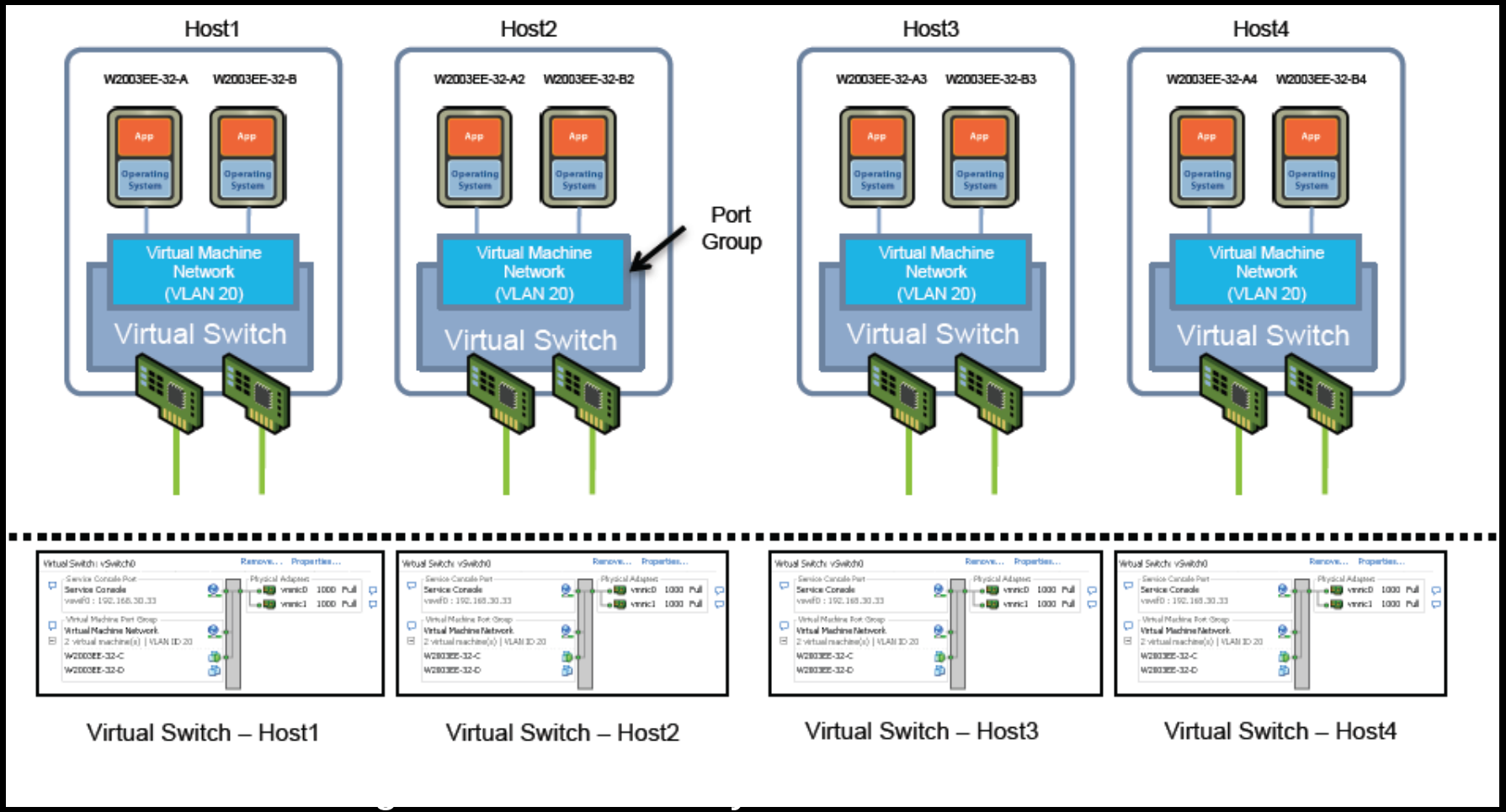
•L2VPN over IP
•AToM over GRE (EoMPLSoGRE / VPLSoGRE)

• Future Protocols to optimize L2 over L3

L2TPv3 is not line rate
–not ideal for DC apps

- Certain Applications require L2 connectivity among peers
  - Clusters (Veritas, MSFT)
  - vMotion
  - Home-brewed apps
- Server migrations
- Disaster recovery and resiliency
- High rate encryption may require an L2 transport between sites

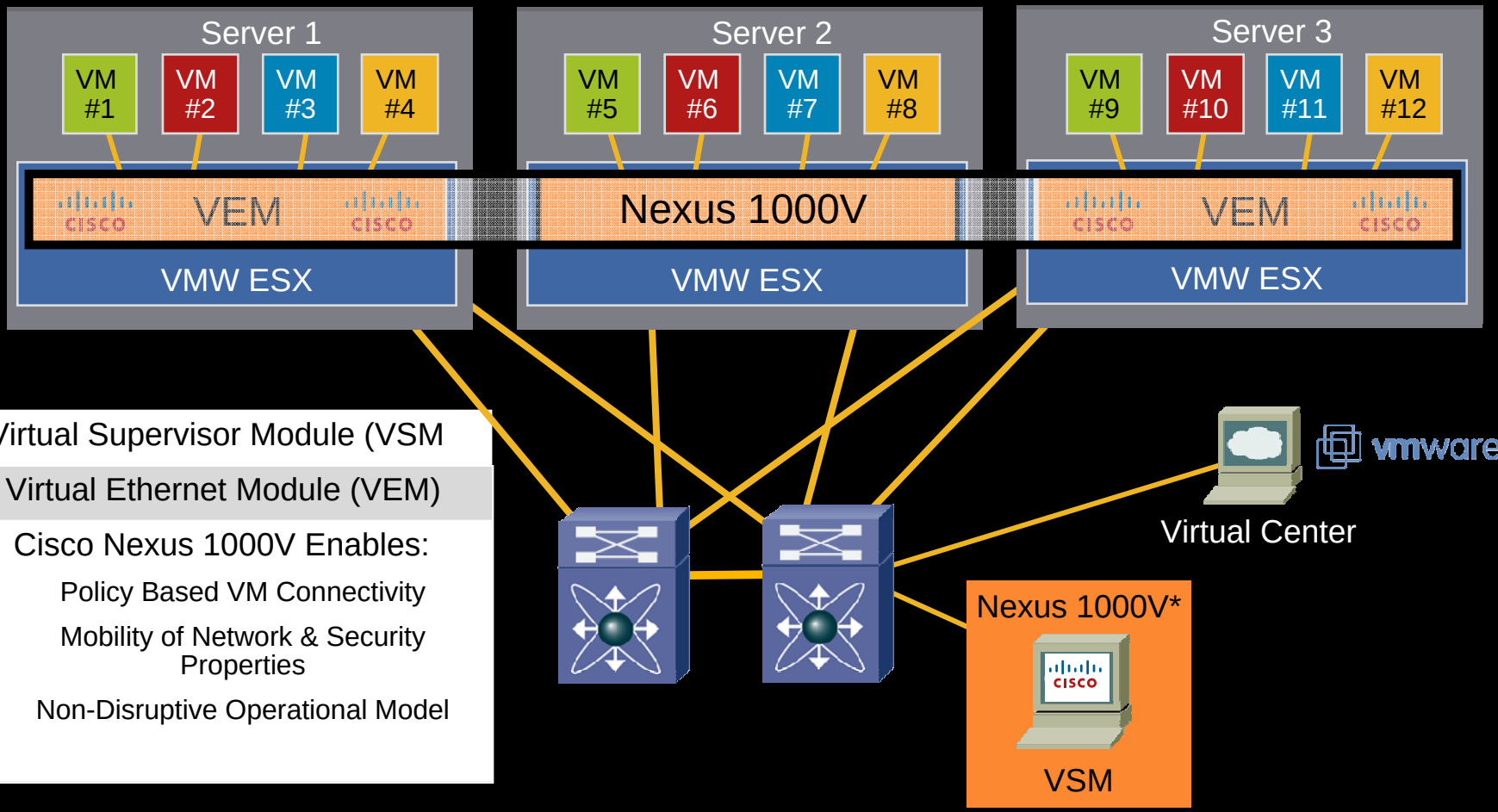
VI 3.5 Network Configuration



- Scaling management & "touch points"
- Frequent Manual intervention with server mobility or changes
- Inconsistent Policies
- Overlooked Security
- Best Practice is disputed or disregarded
- Benefits of automation are challenged

Consolidation of VM networking

***using Nexus 1000v available for future VMware ESX version**

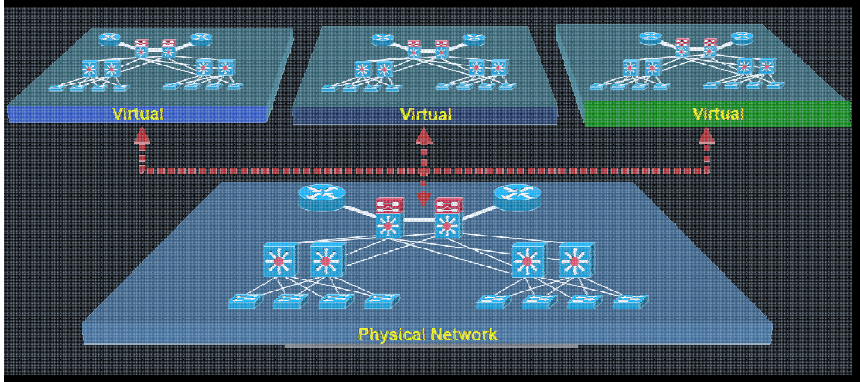


Hypervisor advancements such as Cisco Nexus 1000v will remove barriers to adoption, accelerate deployments and eliminate “turf war” challenges.

The network becomes as portable as the VM

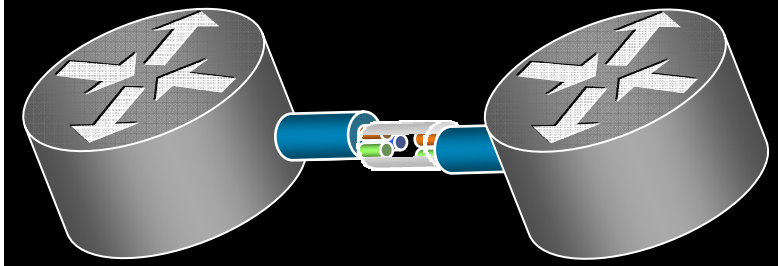
Network & Security Virtualization Developments

Enterprise Network Virtualization
The Building Blocks



Device Partitioning

- One to Many device
- Primary use case is infrastructure reduction
- Increases service agility & flexibility
- Improves asset utilisation
- Examples; VLAN, VSAN, VDC, Firewall Context



Virtualized Interconnect

- Multiple “wires” within a wire
- Primary use case is link consolidation
- Reduces circuit OPEX costs and cable plant
- Examples; VPN, MPLS, Unified IO, FCoE

Device Pooling

- Many to One device
- Primary use case is maximum availability & density
- Reduces Management plane
- Examples; Cisco VSS, Virtual Blade Switch, GLSB, HSRP

Network Virtualization Landscape

Drivers	Solutions	Technologies
Security Zones	Segmentation	VNET, vSAN, MPLS
Max utilization & flexibility	Storage Virtualization	vSAN, NPV Flexattach, Invista
Flexible Server Deployment	Intelligent L2 domains	vPC, DCE, TRILL
Fault Isolation	Device Partitioning	VDC, SDR, Contexts: FW, ACE
Site Flexibility	LAN/SAN Extensions	FCIP, WAAS
Pwr/Cooling, Process	Fabric Consolidation	DCE, FCoE, Priority Groups
I/O Proliferation	I/O Consolidation	FCoE, CNA
VM Proliferation	VM-aware Networking	VN-Link, VN-Tag, NPIV

Operational Complexity

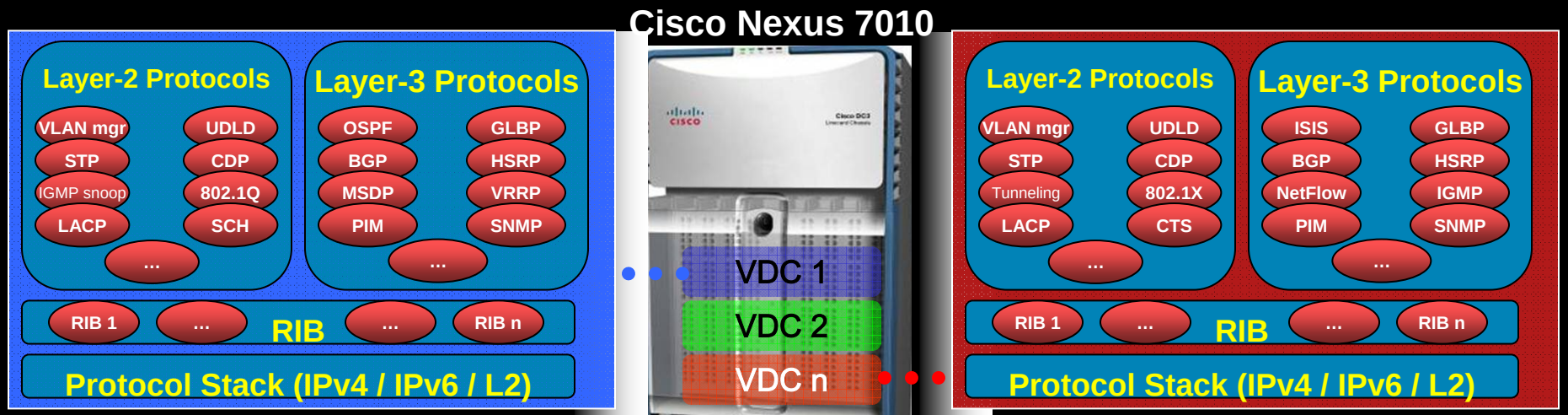
Centralized Management

DCNM, FM, LMS

Example; Virtualize the network

Virtual Device Context (VDC)

Virtualization is key to maximizing resource utilization while providing strong security and software fault-isolation



Software Separation:

- Software fault isolation domains
- Addressing domains
- Service differentiation domains
- Management domains
- Resource allocation
- Security domains

Shared resources:

- Software Infrastructure
- Kernel
- Power Supplies
- Fans
- Chassis

Hardware Separation:

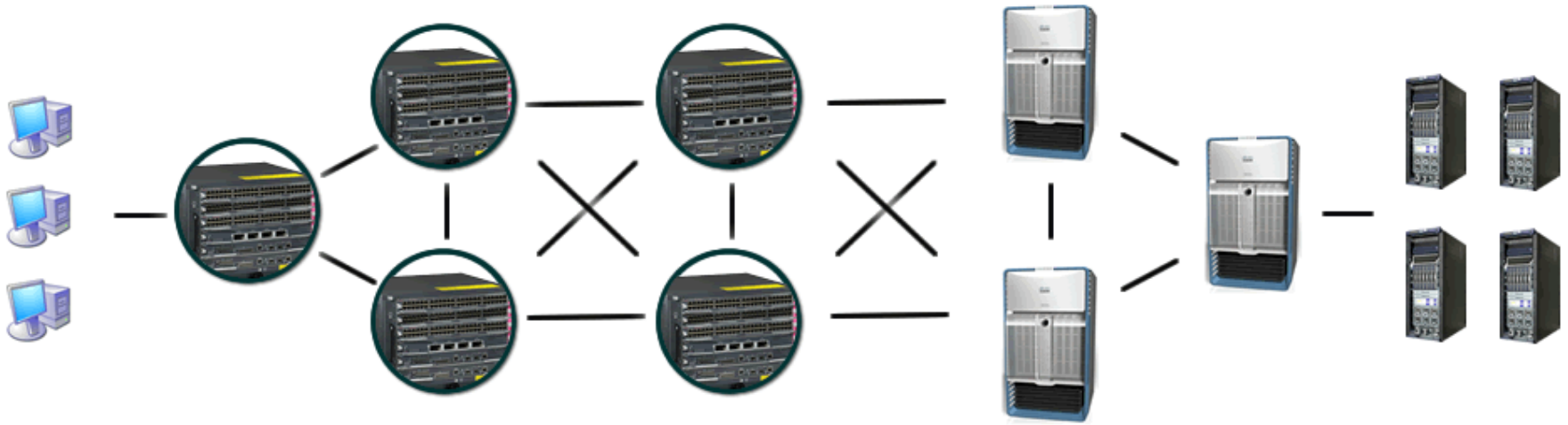
- Individual Physical Ports
  - Layer 2
  - Layer 3
- Port Channels
- Entire Linecards

Example; Virtualized Security

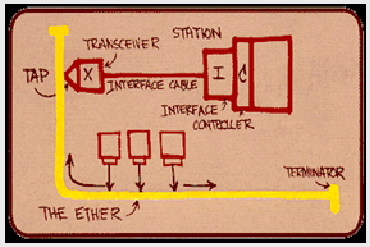
Cisco TrustSec on Nexus Series

Part of a multi-phase, rich policy-based services for admission & access control; providing confidential communications integrated into the network fabric that preserves existing network service. Encompasses 4 major areas…

1. Network Device Admission Control
2. Endpoint Admission Control
3. Packet Confidentiality & Integrity
4. Security Group Access Control Lists (SGACLs)



Ethernet Evolution



May 22, 1973
Robert Metcalfe circulated a memo titled "Alto Ethernet"

~~Token Ring~~

~~FDDI~~

~~100VG Anylan~~

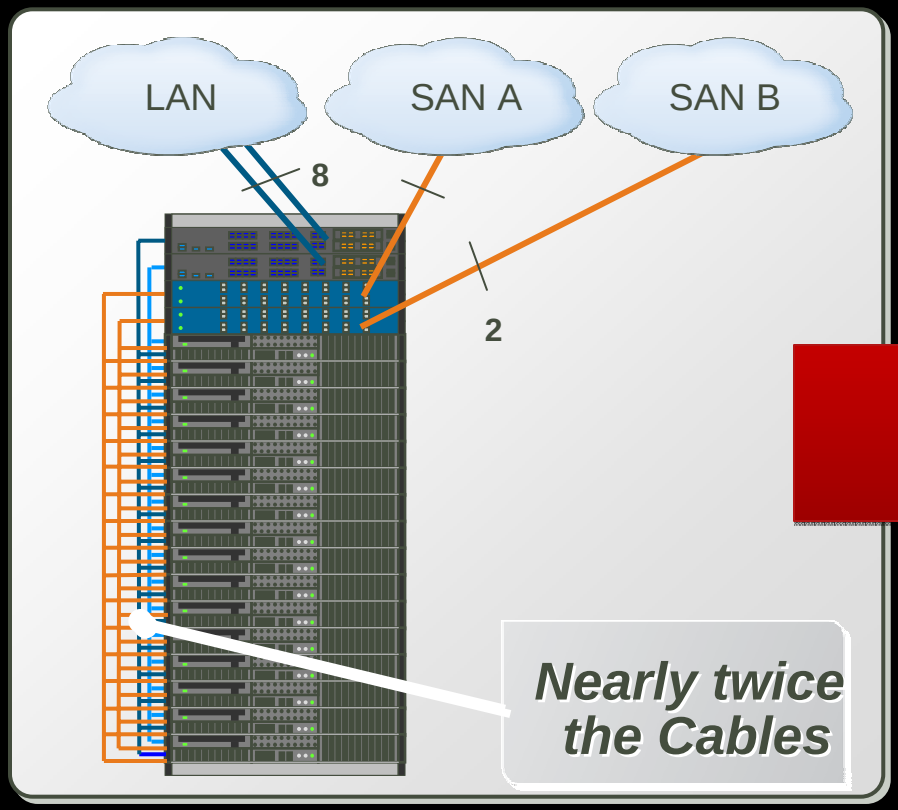
~~Campus ATM~~

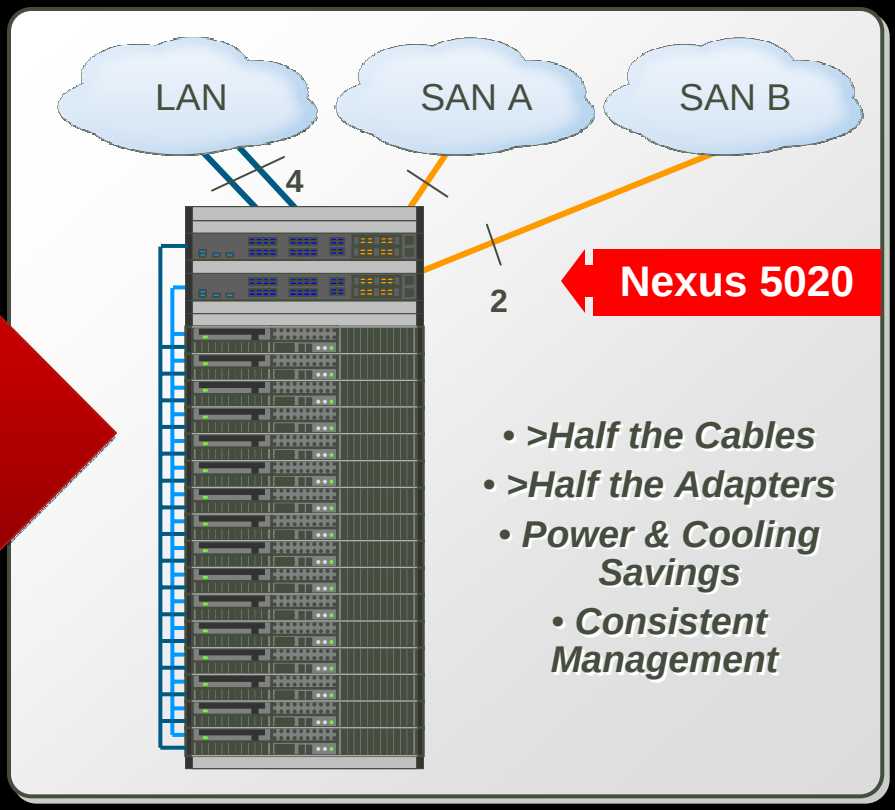
~~Enterprise Infiniband~~

1973		Ethernet Invented
1983	802.3	Ethernet (10 Mbps) Thick Coax
1986	802.3a	Ethernet Thin Coax
1991	802.3i	Ethernet Twisted Pair
1995	802.3u	Fast Ethernet (100 Mbps) Fiber, TP
1998	802.3z	Gigabit Ethernet (1 Gbps) Fiber
1999	802.3ab	Gigabit Ethernet Twisted Pair
2003	802.3ae	10G Ethernet (10 Gbps) Fiber
2003	802.3af	PoE, Power over Ethernet 4 / 7 / 15,4 watts
2006	802.3an	10G Ethernet Twisted Pair
2006	802.3ap	Backplane Ethernet (Blade servers and communications equipment)
2007	TRILL WG	Solve L2 STP forwarding limitations, with a link state protocol
2007	802.1aq	Shortest Path Bridging (Optimal Bridging) in L2 Ethernet topologies
2007	802.1Qau	Congestion Management (per virtual link)
2007	802.3ar	Enhancements for rate limiting (per physical link)
2008	ePoE	ePoE, Enhanced Power over Ethernet ~30 watts
2009	FCoE	Fibre Channel over Ethernet
2009	DCE	Data Center Ethernet / Data Center Bridging / CEE
		✓ Lossless Ethernet [Pause, Per Priority Pause]
		✓ Ethernet Congestion Management [ECN / (aka BCN)
		✓ IEEE 802.1Qau, Priority Groups
		✓ IEEE support for (baby) giant frames
		✓ Layer 2 Multipath [Cisco DCE, TRILL]
2009	802.3at	PoE Plus, Power over Ethernet Plus ~60 watts
2010	802.3ba	40Gbps = server /storage, applications, 100Gbps = aggregation
2011	802.3az	Energy Efficient Ethernet

I/O Consolidation

- Virtualizing Server Access





16 Servers	Enet	FC	Total
Adapters	20+	20	40*
Switches	2	2	4
Cables	40	40	80
Mgmt Pts	2	2	4

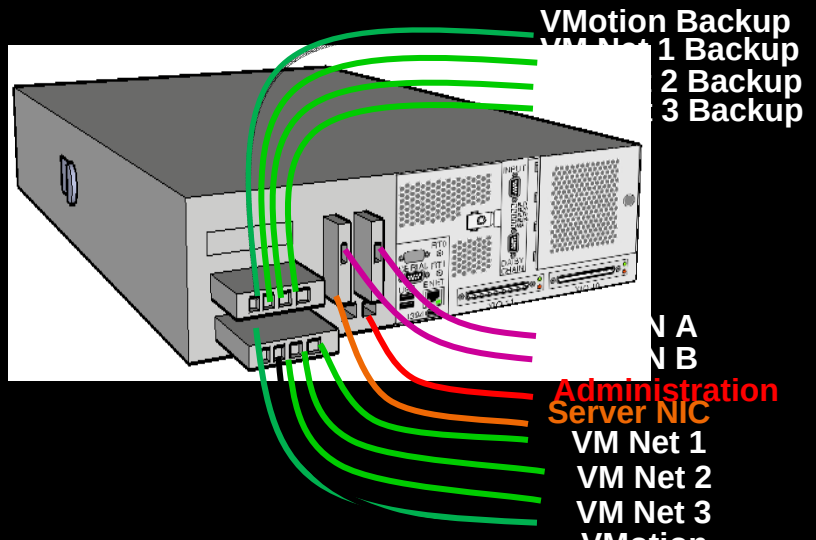
16 Servers	Enet	FC	Total
Adapters	20	0	20
Switches	2	0	2
Cables	40	0	40
Mgmt Pts	2	0	2

Storage Access Virtualization

- FCoE for Converged Networks

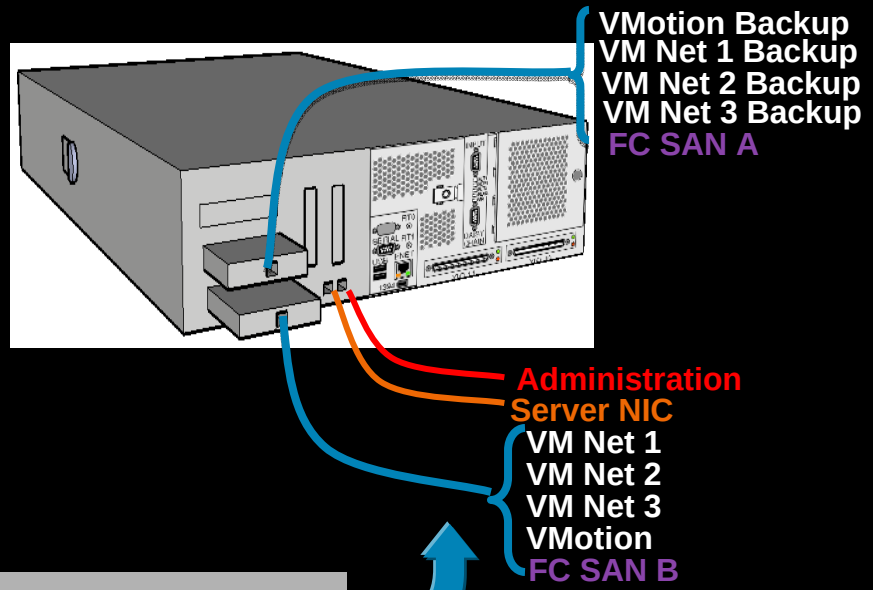
Today's Model

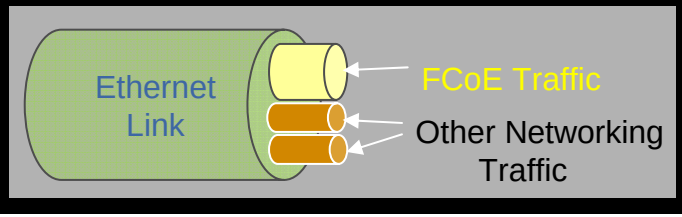
- Two Server LOM Ethernet Ports
- Two 1G Quad-Port NICs
- Two 4G Single Port HBAs



Converged Networks Using FCoE:

- Two Server LOM Ethernet Ports
- Two 10G Single Port Converged Network Adapters (CNA)

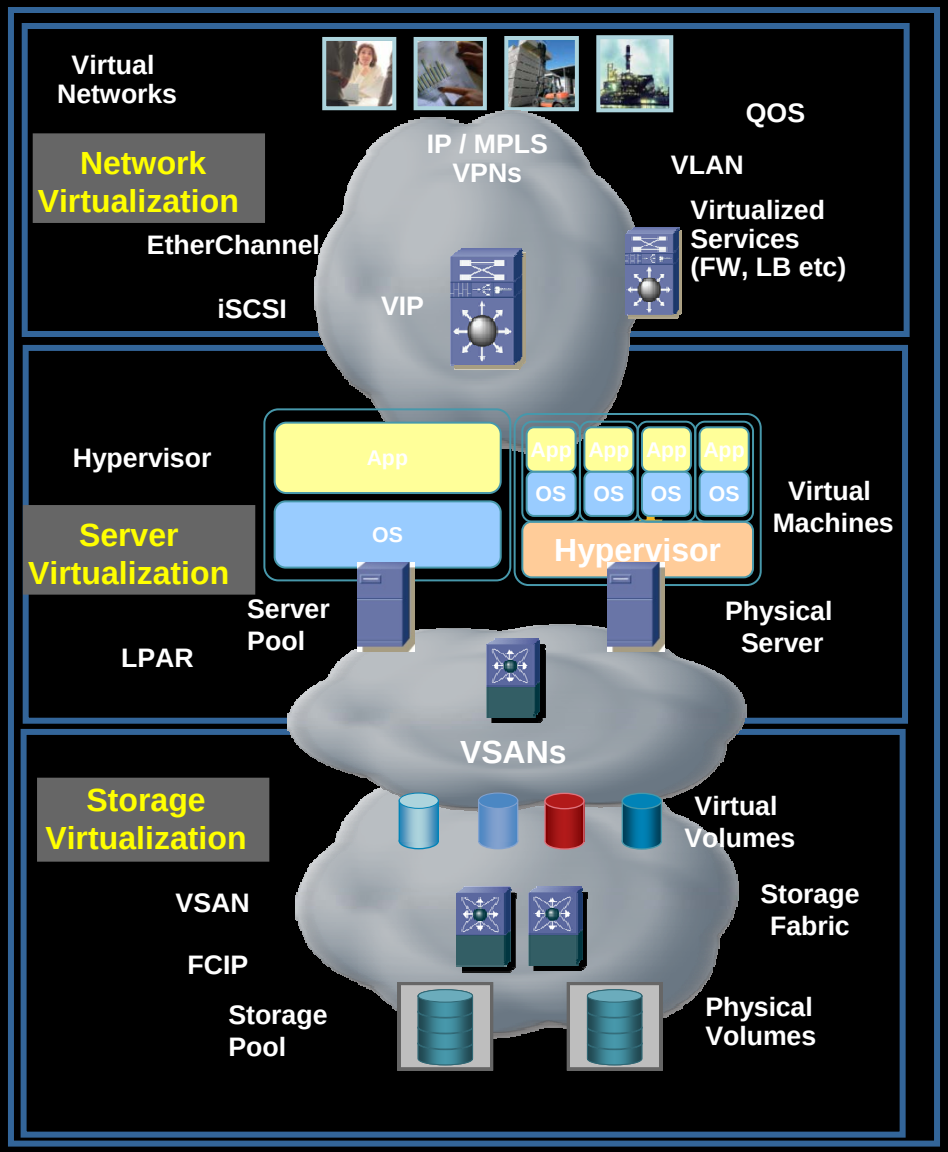




Lossless Ethernet, prioritization and guaranteed delivery are important characteristics

Summary

Data Centre Virtualization



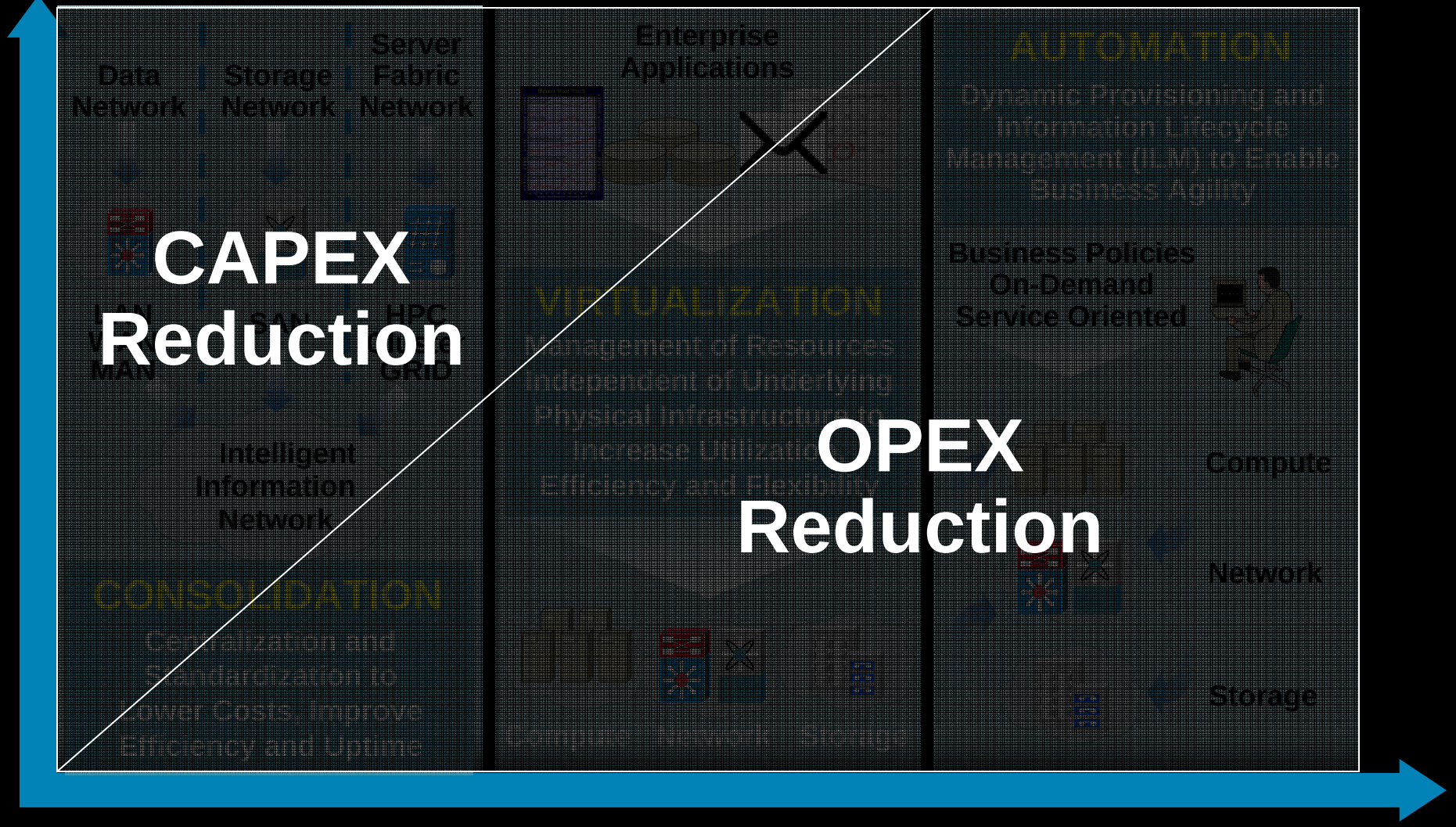
- Creates isolated, secure application environments
- Network-hosted services enhance performance, availability, security and flexibility
- Enables greater efficiency, agility & lower power consumption

- Enables consolidation of *physical* servers that reduces management, power and cooling, etc
- Virtual Machine mobility allows enhance performance, availability and flexibility
- Rapidly deploy or redeploy servers to support existing or new applications

- Network-hosted services enhance scalability, availability and transparency
- Improved data management, security & compliance
- Non-disruptive provisioning & migration of production data
- Enables greater efficiency, flexibility & power consumption

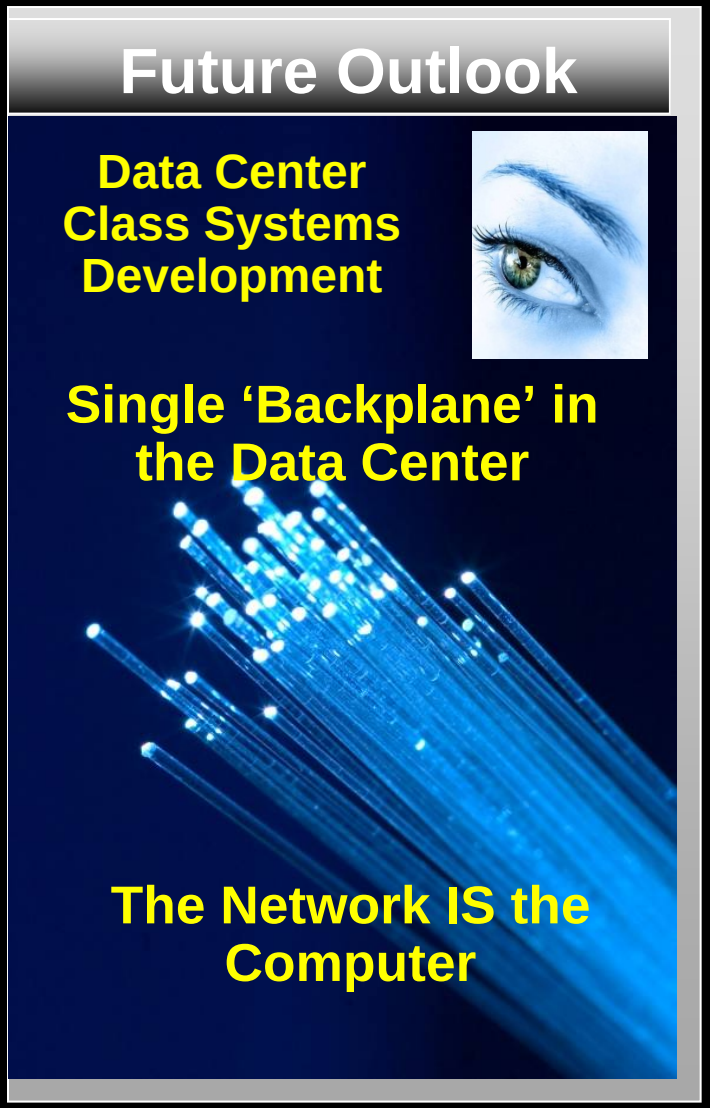
Evolution of the Data Center Infrastructure

Cisco Data Center 3.0 Strategy & Vision



Why is Cisco DC 3.0 important?

- The Network Is **Virtualized**
- The Network Is **Pervasive**
- The Network Is **Transparent**
- Promotes **Standards**
- Provides **Scale**
- Preserves **Investments**
- Enables **Dynamic Provisioning**



Summary

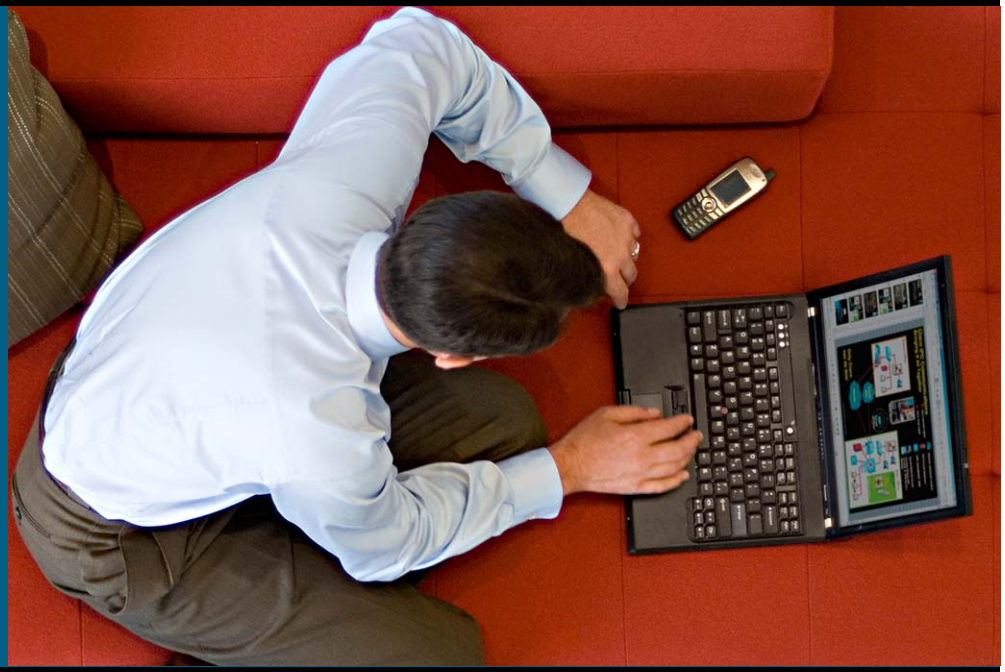
Virtualization solves many of the challenges facing DC managers today; power, space, weight, scaling, SLA, complexity, green, agility, CAPEX & OPEX

The Virtualized Data Center is changing rapidly and it is important to keep aware of new developments

Cisco continues to innovate in the Data Center to create to new compute models and respond to new compute models; blade, VM, mobility, cluster, etc

Cisco DC 3.0 Strategy defines the architecture , services & functionality of next generation Dynamic Data Centers

Q and A




CISCO