Data Centre Evolution

The Role of the Network in Data Centre Transformation

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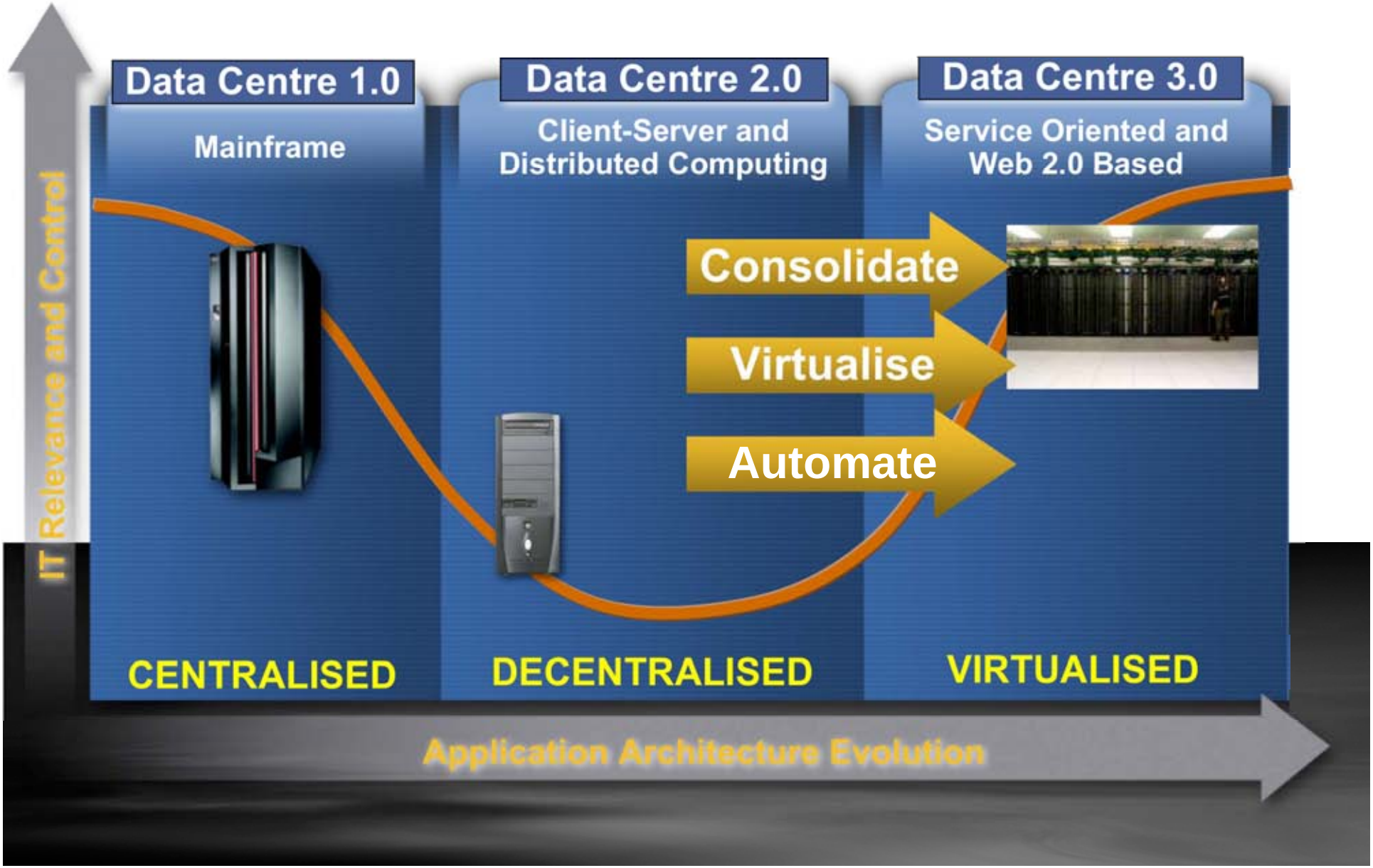
Agenda

- Cisco Data Centre 3.0
- Current DC Technology Trends
- Consolidated I/O – Unified Fabric – Enhancements to Ethernet
- Orchestration
- Summary

Data Centre and Network Evolution



Data Centres are Under Increasing Pressure

Collaboration

Empowered User

SLA Metrics

Global Availability

Reg. Compliance

New Business Pressures

Operational Limitations

Power & Cooling

Asset Utilisation

Provisioning

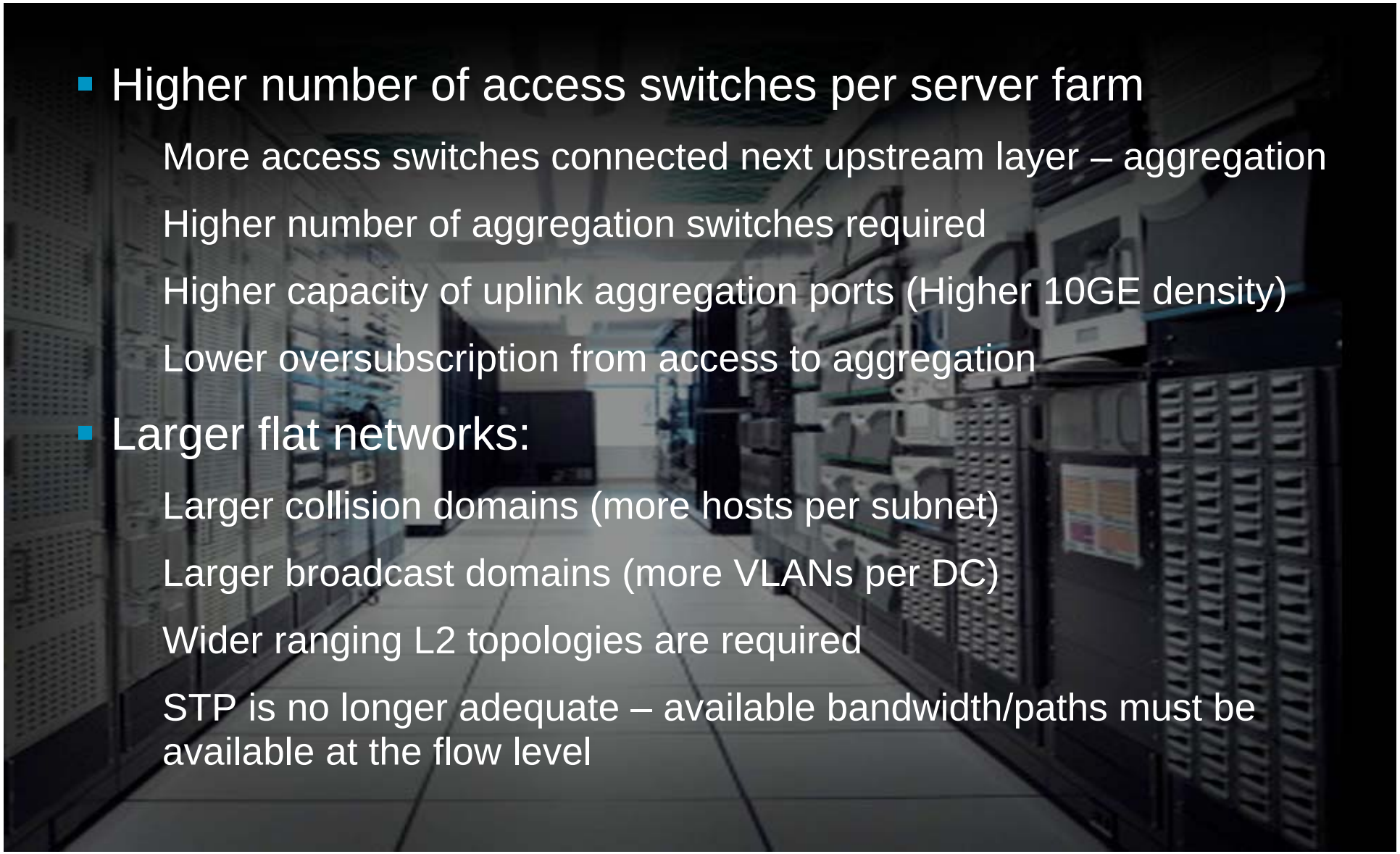
Security Threats

Bus. Continuance

Trends in Data Centre Network Environments

- Broad use of Clustered app and Grid middleware
- Higher performance servers
- Denser server farms
- Oversubscription targets are lower
- Traffic isolation in denser server farms is required
- Adoption of blade and standardisation of 1RU platforms
- Increase use of blade and top of rack switches
- Server multi-homing

Implications on DC Network Architectures



- Higher number of access switches per server farm
  - More access switches connected next upstream layer – aggregation
  - Higher number of aggregation switches required
  - Higher capacity of uplink aggregation ports (Higher 10GE density)
  - Lower oversubscription from access to aggregation
- Larger flat networks:
  - Larger collision domains (more hosts per subnet)
  - Larger broadcast domains (more VLANs per DC)
  - Wider ranging L2 topologies are required
  - STP is no longer adequate – available bandwidth/paths must be available at the flow level

10GbE Drivers in the Data Centre

Servers moving to dense rack chassis*

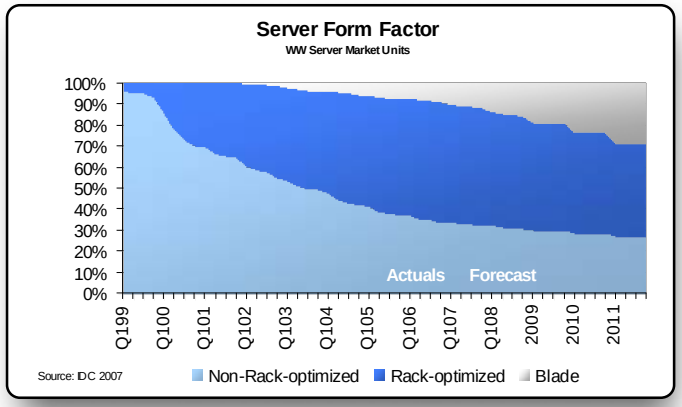
Cable Density/Cable Management

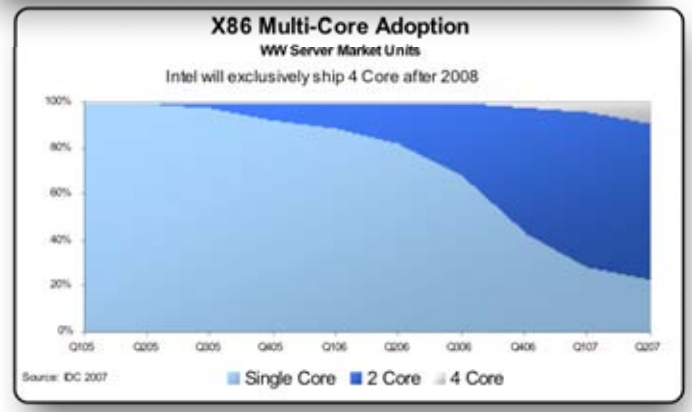
Growth of virtualisation exceeds growth of physical servers*

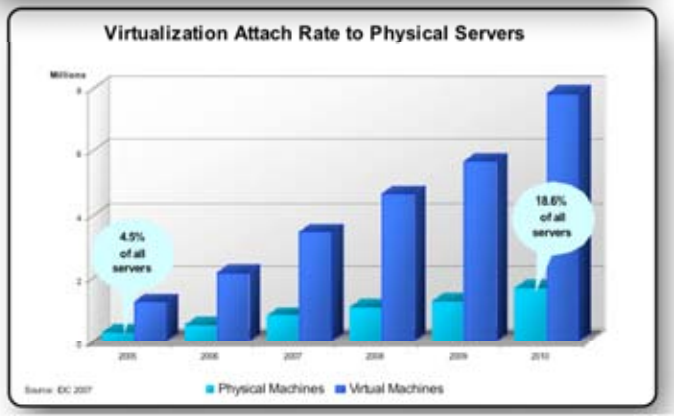
Rapid Adoption of multicore*

- Post 2008 Intel will ship exclusively 4+ cores servers

All drives the need for more storage and network BW



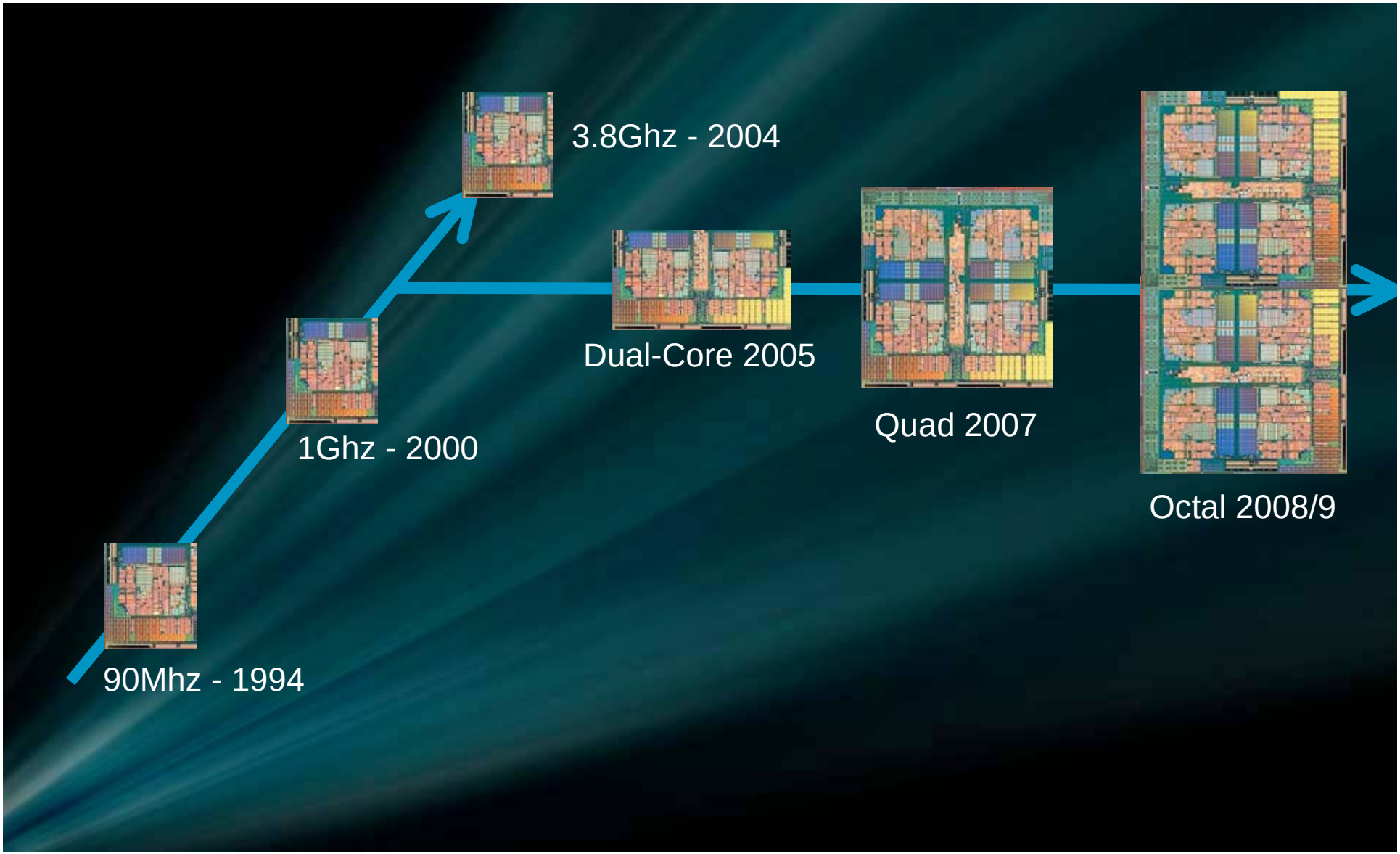




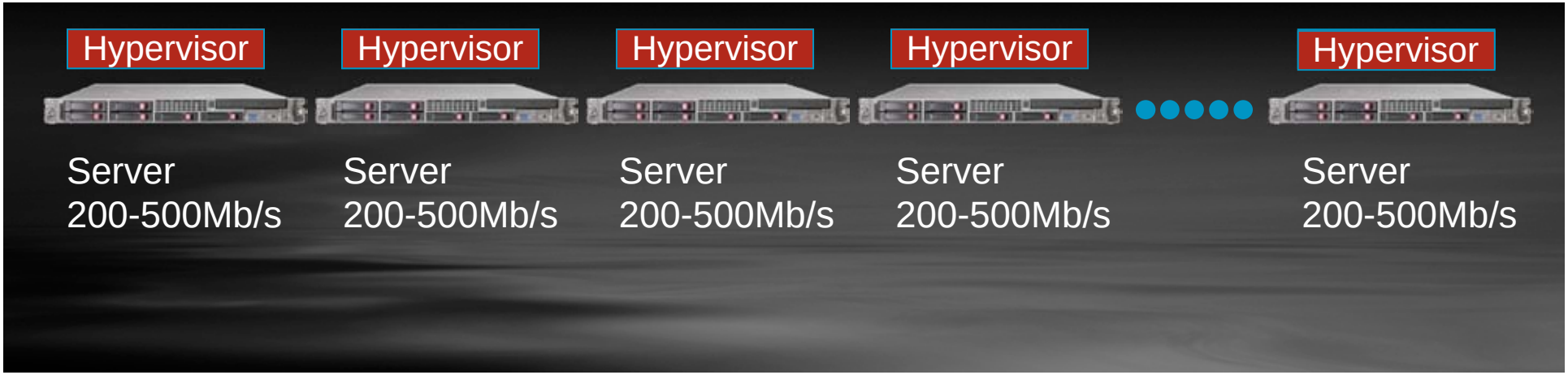
Multi-Core CPUs and Server Virtualisation driving the demand for higher bandwidth network connections

* IDC 2007

Processing Evolution



Virtualisation Drives Network Bandwidth



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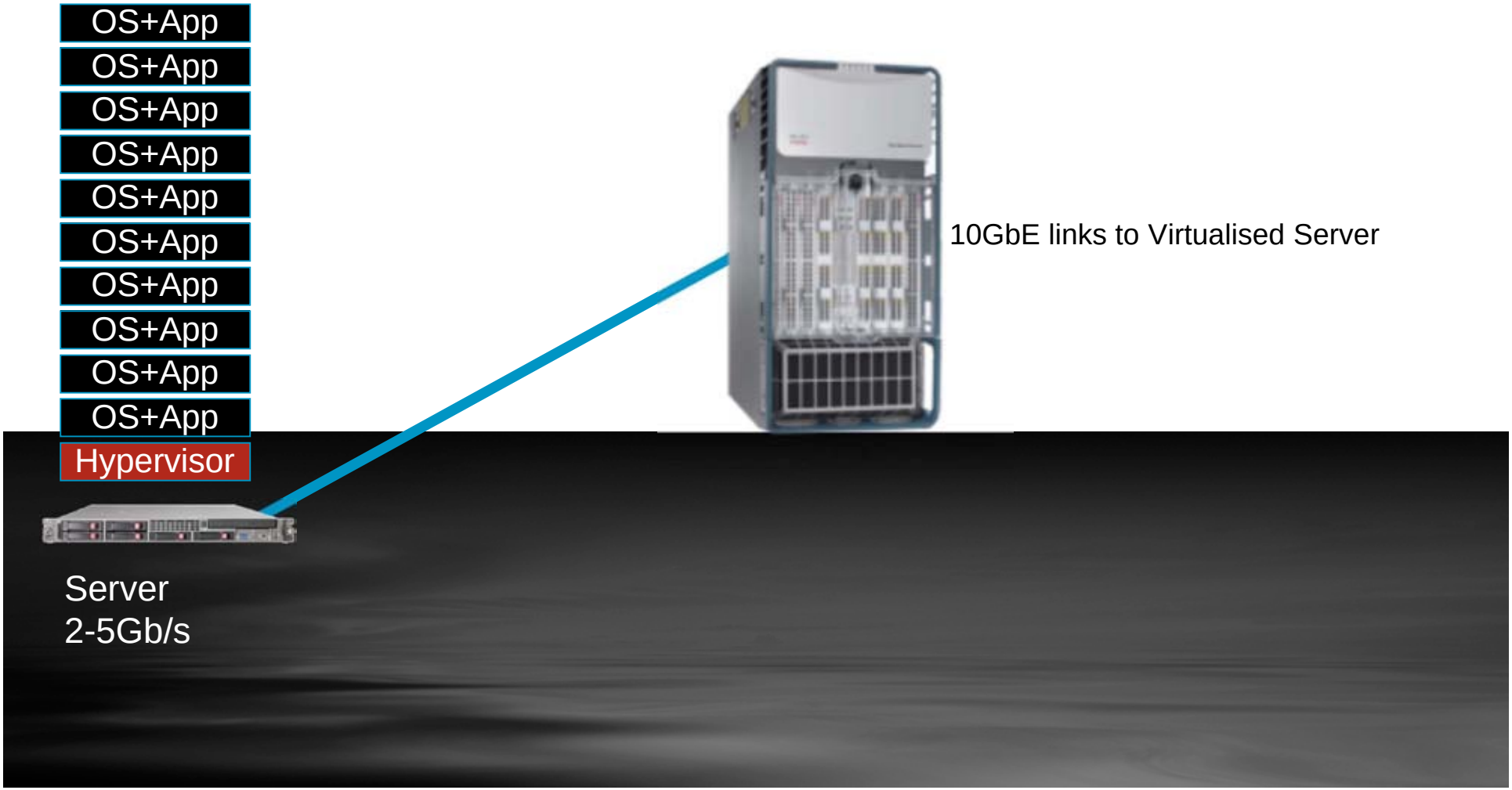
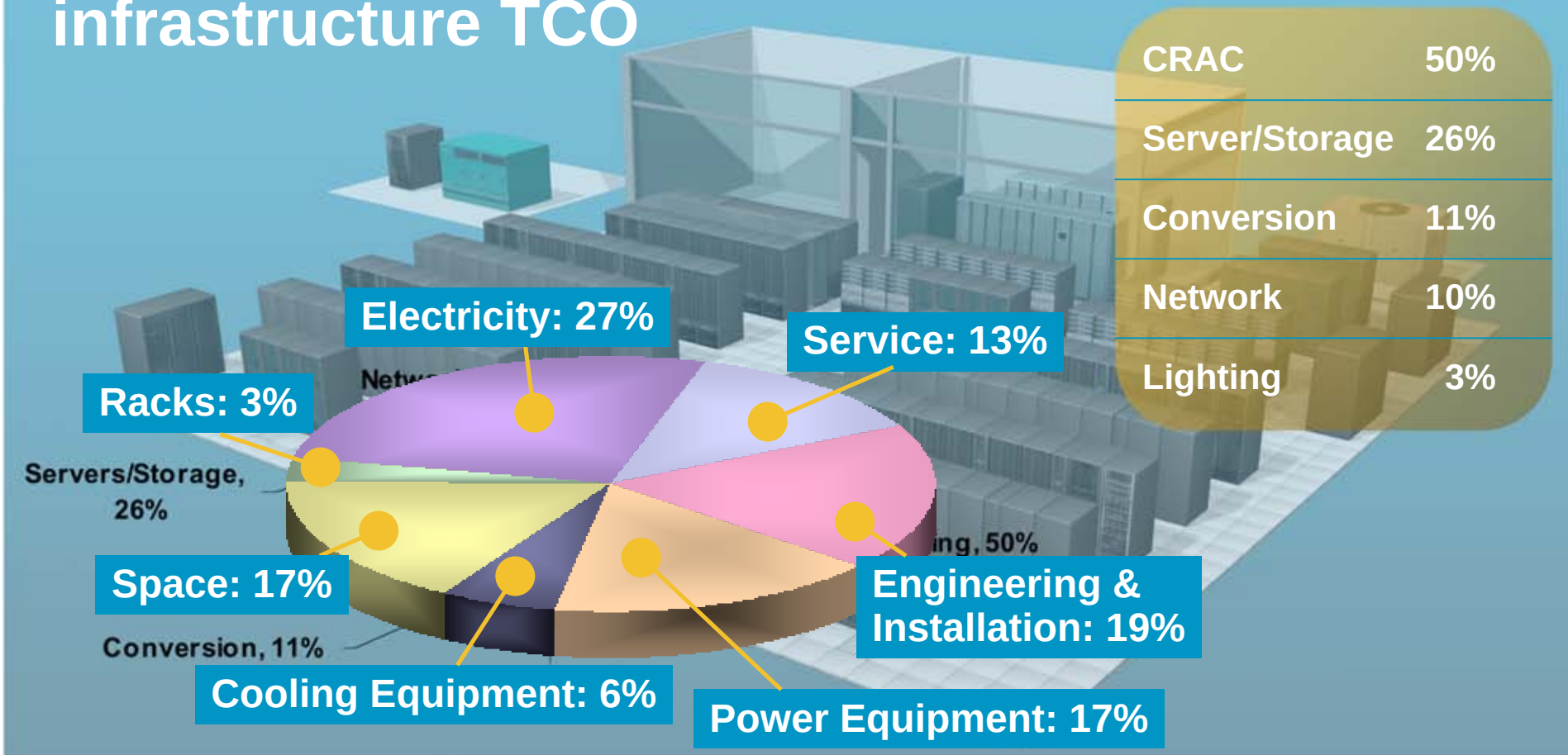


Electricity is the most significant portion of infrastructure TCO



CRAC	50%
Server/Storage	26%
Conversion	11%
Network	10%
Lighting	3%

- Each watt consumed by IT infrastructure carries a “burden factor” of 1.8 to 2.5 for power consumption associated with cooling, conversion/distribution and lighting*

Source: APC

Future Power Requirements

- Building power density of 1500 W/m^2
- Building out to 10000 m^2
- Burden factor of 2
- Requirement – 30 MW
- Many issues with supply in some areas…

An Example of DC Evolution Over Past 2 Years

Evolution of Ethernet Physical Media

Role of Transport in Enabling these Technologies

Mid 1980's	*Mid 1990's*	*Early 2000's*	*Late 2000's*
10Mb	***100Mb***	***1Gb***	***10Gb***
UTP Cat 3	*UTP Cat 5*	*UTP Cat 5* *SFP Fiber*	*X2* *SFP+ Cu (BER better than 10^{-18})* *SFP+ Fiber* *Cat 6/7*

Technology	Cable	Distance	Power (each side)	Transceiver Latency (link)
SFP+ CU Copper	Twinax	10m	~0.1W	~0.1µs
SFP+ USR ultra short reach	MM OM2 MM OM3	10m 100m	1W	~0
SFP+ SR short reach	MM 62.5µm MM 50µm	82m 300m	1W	~0
10GBASE-T	Cat6 Cat6a/7 Cat6a/7	55m 100m 30m	~8W ~8W ~4W	2.5µs 2.5µs 1.5µs

Summary of Future DC Requirements

- Increase in network capacity
  - Server/performance density
  - Lower over subscription
- Drive up Efficiency – network, server and storage resources
  - Utilisation – virtualisation is the enabler
  - Consolidation of I/O and Fabric
- Faster Provisioning of application services/Mobility of applications
  - Orchestration/Re-purposing – again virtualisation is the enabler
  - Larger layer 2 domains

Cisco's vision for Unified I/O in the Data Centre

Key Benefits of Unified Fabric

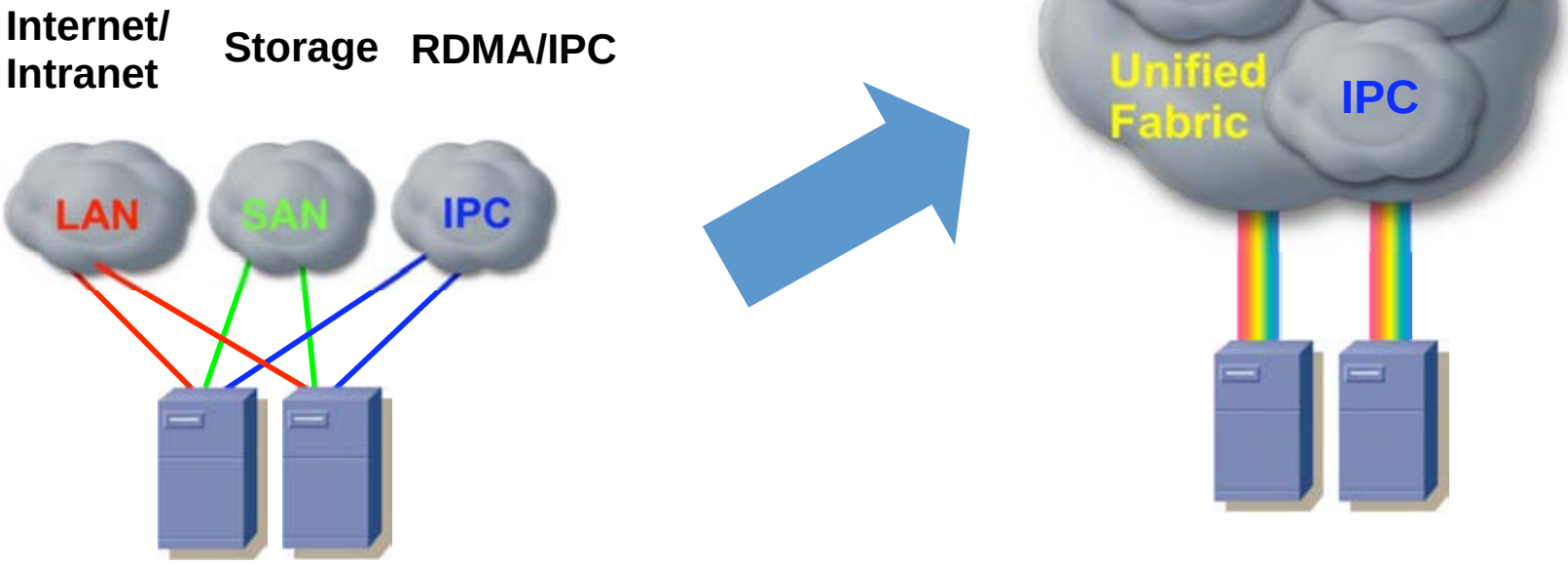
Reduce overall data power consumption.
Extend the lifecycle of current data centre

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.
Drive storage consolidation and improve utilisation.

Rack, Row, and X-Data Centre VM portability become possible.

Data Centre Vision:
Unified Fabric with Cisco DCE



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

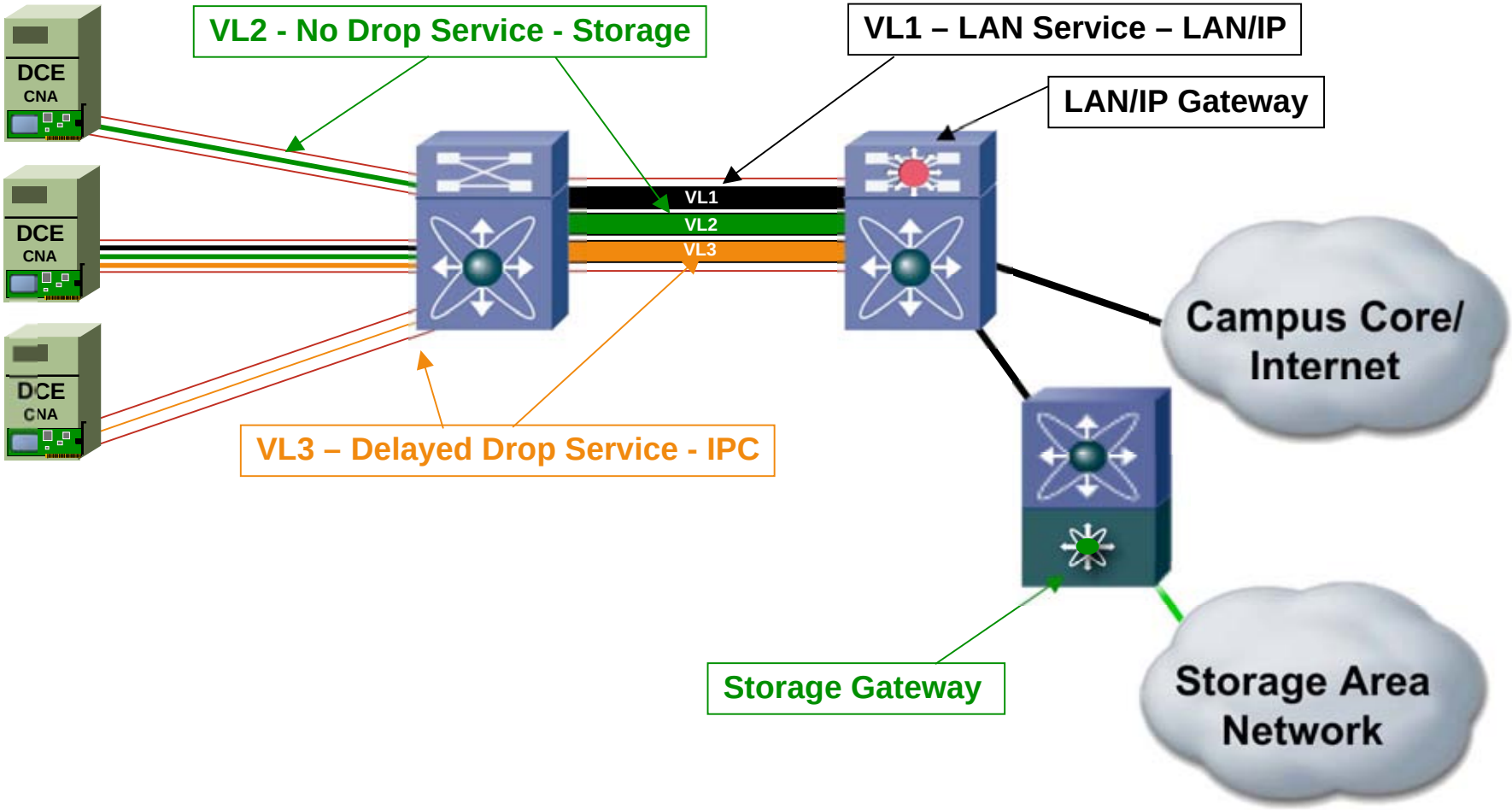
With DCE
- Single L2 Transport
- L2 Multipath
- Unified & Virtualised I/O
- Built-in Interoperability

Data Centre Ethernet Features
Overview

Feature	Benefit
Priority-based Flow Control (PFC)	Provides class of service flow control. Ability to support storage traffic
CoS Based BW Management	Grouping classes of traffic into “Service Lanes” IEEE 802.1Qaz, CoS based Enhanced Transmission
Congestion Notification (BCN/QCN)	End to End Congestion Management for L2 network
Data Centre Bridging Exchange	Auto-negotiation for Enhanced Ethernet capabilities DCBX (Switch to NIC)
L2 Multi-path for Unicast & Multicast	Eliminate Spanning Tree for L2 topologies Utilise full Bi-Sectional bandwidth with ECMP
Lossless Service	Provides ability to transport various traffic types (e.g. Storage, RDMA)

Virtual Lanes
An example

Up to 8 VL's per physical link
Ability to support QoS queues within the lanes



What is Fibre Channel over Ethernet?

- From a Fibre Channel standpoint it's

  FC connectivity over a new type of cable called… an Ethernet cloud

- From an Ethernet standpoints it's

  Just another ULP (Upper Layer Protocol) to be transported, but… a challenging one!

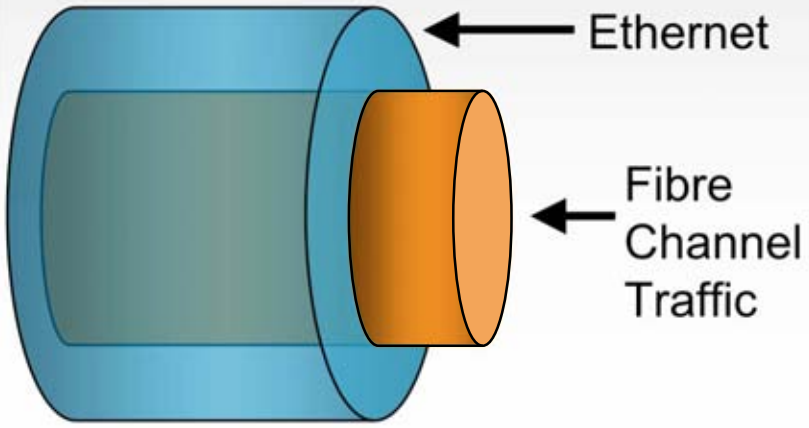
- And technically…

FCoE is an extension of Fibre Channel onto a Lossless Ethernet fabric

FC over Ethernet (FCoE)

FCoE

- Mapping of FC Frames over Ethernet
- Enables FC to Run on a Lossless Ethernet Network

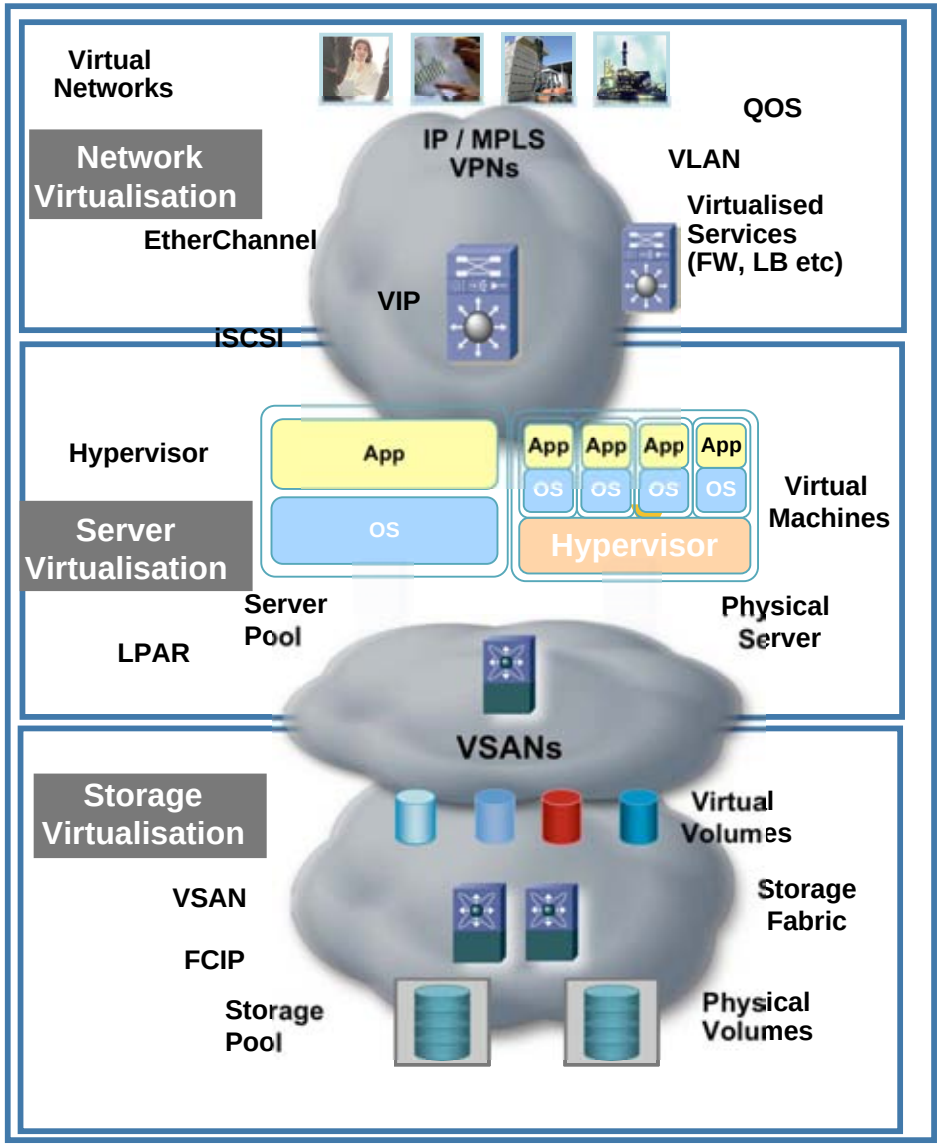


Benefits

- 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

Virtualisation and Service Orchestration

Data Centre Virtualisation



Network Virtualisation

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

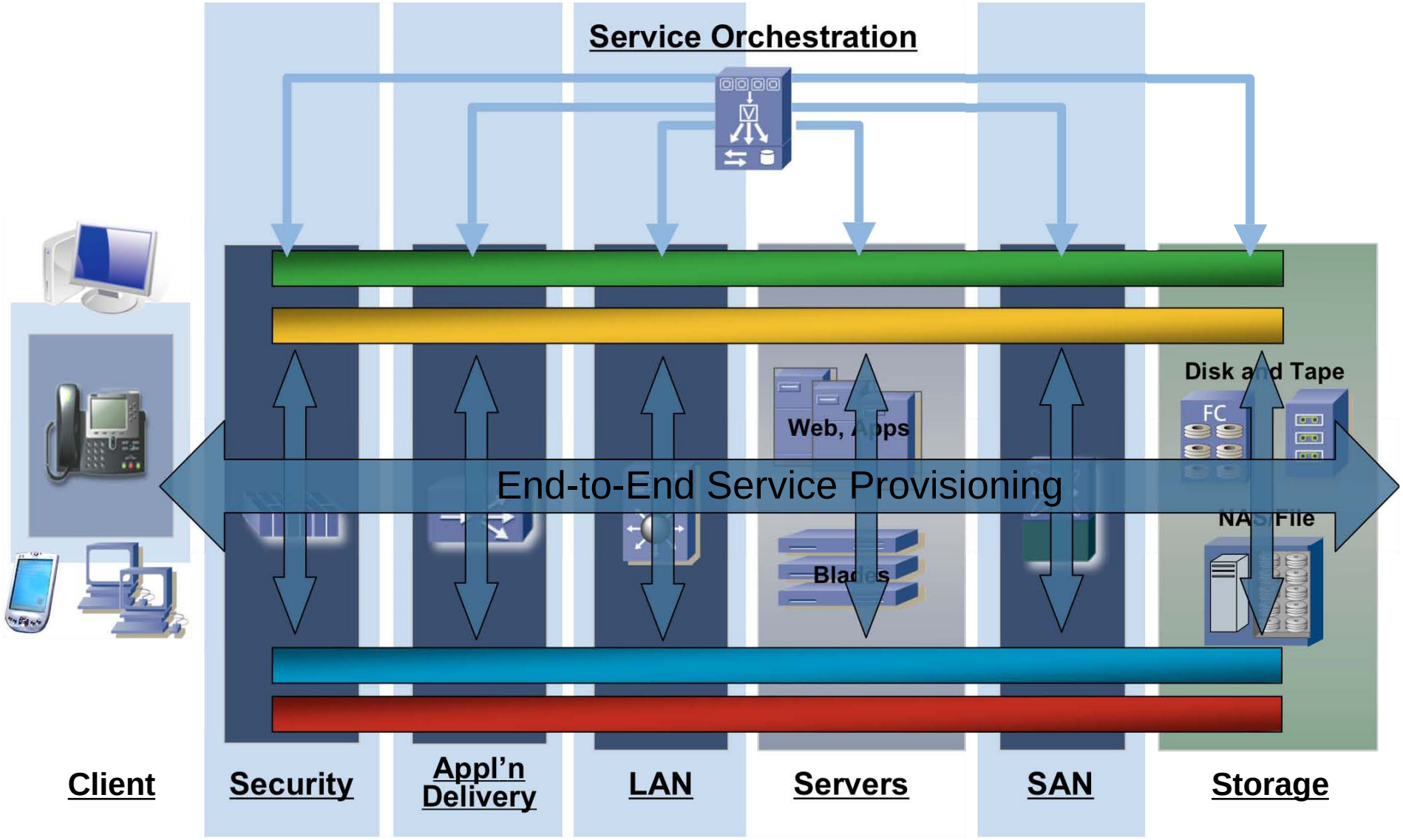
Server Virtualisation

- 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

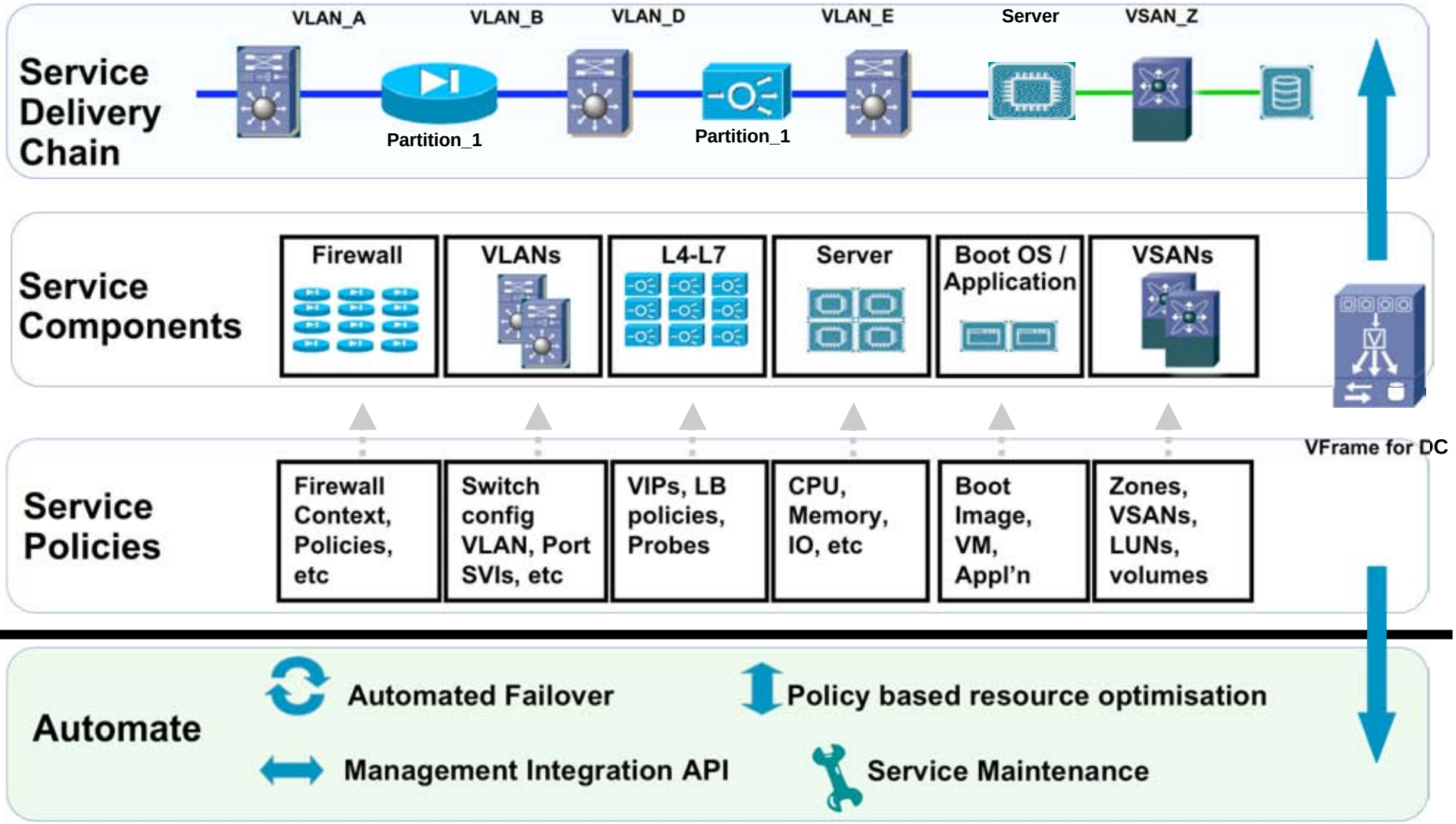
Storage Virtualisation

- 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

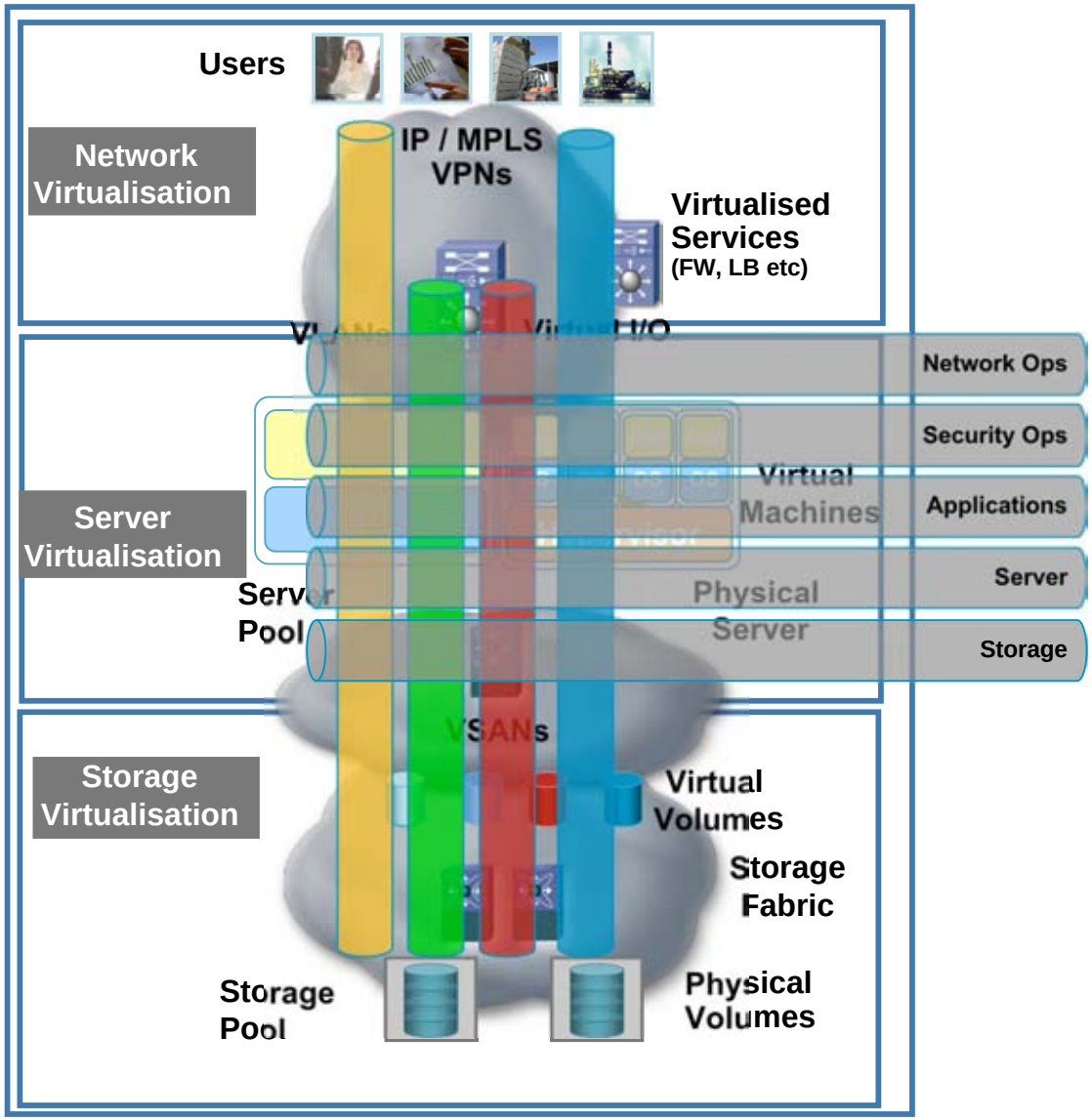
Data Centre Virtualisation via the Network



Application Service Provisioning
Design, Orchestration & Deployment



Cisco Data Centre 3.0
Transforming the Data Centre



- Virtualisation is a key enabler for Service Centric Data Centre
- Product Development is Focused on Progressive Delivery of DC 3.0
- Automation requires *co-ordination* of resources in accordance with *Business Policies* to deliver *Application services*
- Existing systems & Utility environments can co-exist on the same fabric

Data Centre Product Evolution in 2008

- 10Gbps Ethernet, high density (40/100 Gbps capable)
- Consolidated I/O Enabled
- Ultra high performance modular and top of rack (Nexus family)
- DC focussed, ultra high availability hardware and operating system
- 10Gbps, virtualised integrated blade switches
- Layer 2 multipath support (STP elimination)