Building Your Cloud:

Scale-Out Compute Demands
Scale-Out Storage

Redefining Storage Economics…

Disrupting a $30+ billion industry

- Ethernet SAN technology: **EtherDrive®**
  - 5-8x price-performance advantage vs legacy storage
  - Radically simplified SAN topology
- Founder – inventor of PIX, LocalDirector
- Coraid was bootstrapped in Linux market starting 2004, built business with 1500+ customers and multi-million run rate
- 45+ Countries
- 100% Channel-driven model

$85m funding, experienced exec team

2-3x Annual Revenue Growth

1,500+ Customers

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Key Core Competencies

EtherDrive™

- CorOS - Distributed Operating System
- AoE – Low Latency Data Transmission
- RAIDShield
- Operating System Drivers
- SAN Virtualization
- Centralized Management

Complete Ethernet SAN Enterprise-class storage solution

SRX-Series

- Price-Performance
- 10 GbE & 1 GbE
- SSD, SAS, SATA

SR-Series

- Cost-per-TB
- 1 GbE
- SATA

STORAGE

HBAs

- End-to-End Solution
- 10 GbE & 1 GbE

COMMUNICATIONS

VSX-Series

- Virtualization appliance

ESM1500

- Centralized Management

MANAGEMENT

Enterprise Experience…

350k users; 167 sites; 6000+ ESX Licenses; 2300+ ESX Hosts; 7000+ VMs

- Reduced Server Count by 65%+
- Reduced Power by 1800+ kWatts
- Reduced HVAC by 2200+ kWatts
- Reduced Data Center space by 11000+ sqft
- Reduced CO_2 emissions by 22 tons
- Reduced Server CAPEX by 15%+
- Reduced Networking CAPEX by 40%+
- Reduced Power/HVAC OPEX by 45%+
- Reduced Server Provisioning by 75%+
- Increased DR posture by 90%+

Increased CAPEX/ OPEX associated with Storage by 155%+

What industry would have you believe…


THE REALITY???

Agenda

- Industry View
- The Legacy (of) Storage
- Building Blocks
- What You Should Be Looking For

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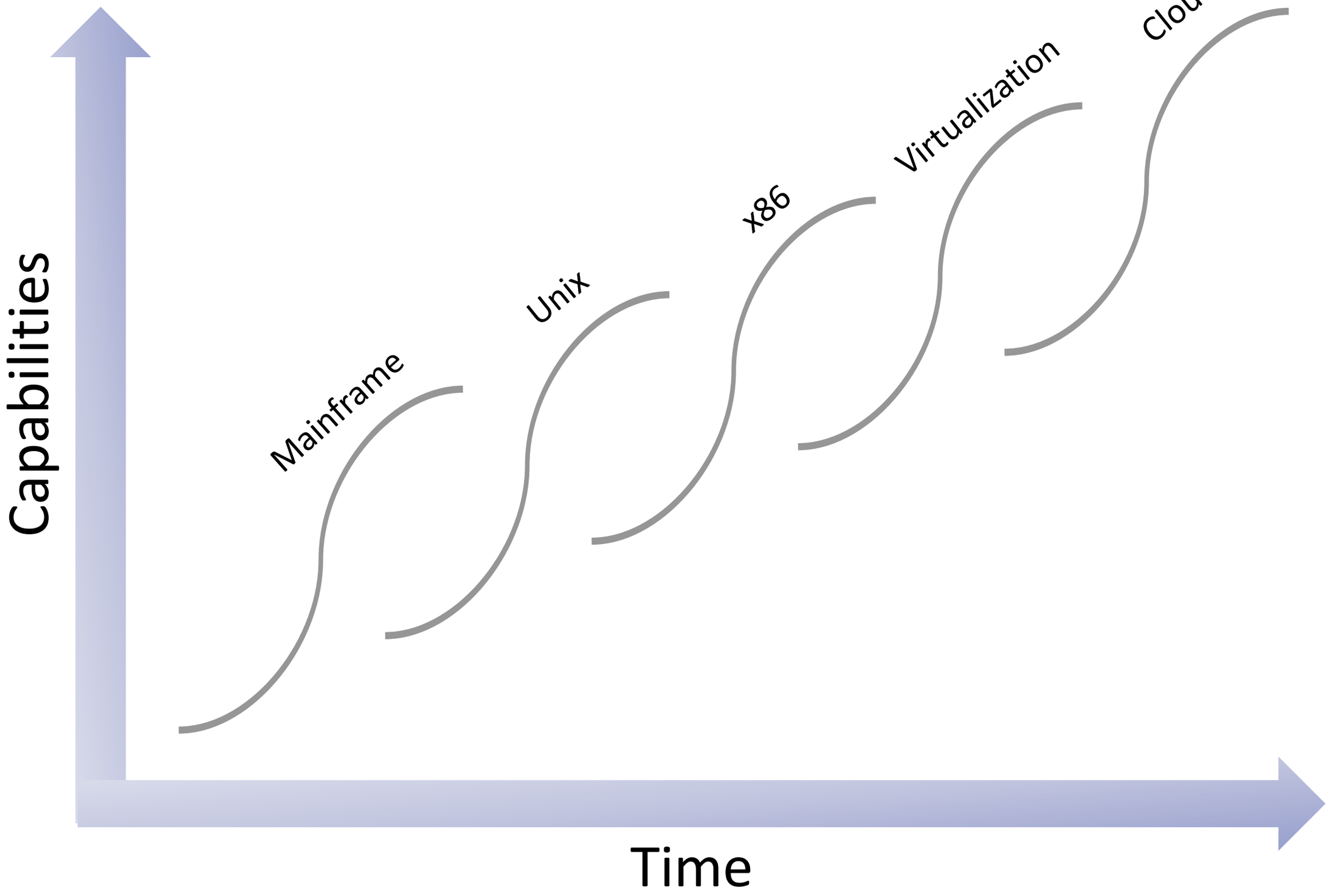
Computing: A Story of Disruption



Cloud Computing: Definition and Key Attributes

A style of computing where scalable and elastic IT-enabled capabilities are delivered as a service to customers using Internet technologies

Public Cloud Service	*Community Cloud Service*	*"Virtual" Private Cloud Service*	*Private Cloud Service*
• Open access • Fully shared	• Limited access	• Open access • Limited sharing	• Closed access

Gartner

Thomas Bittman – Gartner – *Private Cloud Computing: The New Virtualization* 2010

CORAID

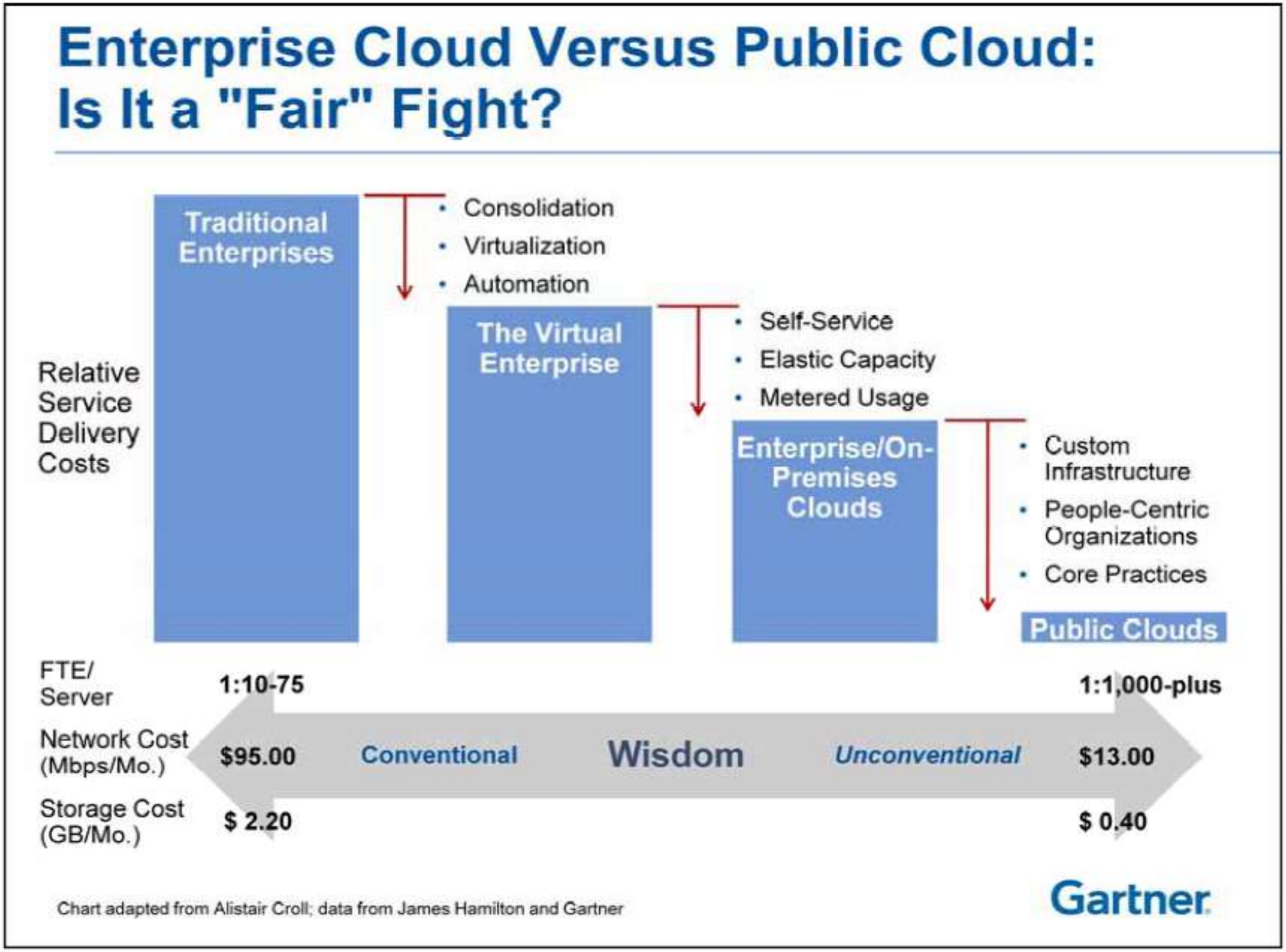
Why Cloud Computing?

- Cloud is immature
  - Security / Segmentation
- Cloud is evolutionary
  - Private / Hybrid / Public
- (Economies of) Scale isn't everything
  - Customer needs must drive solutions
- Cloud isn't always cheap

However…

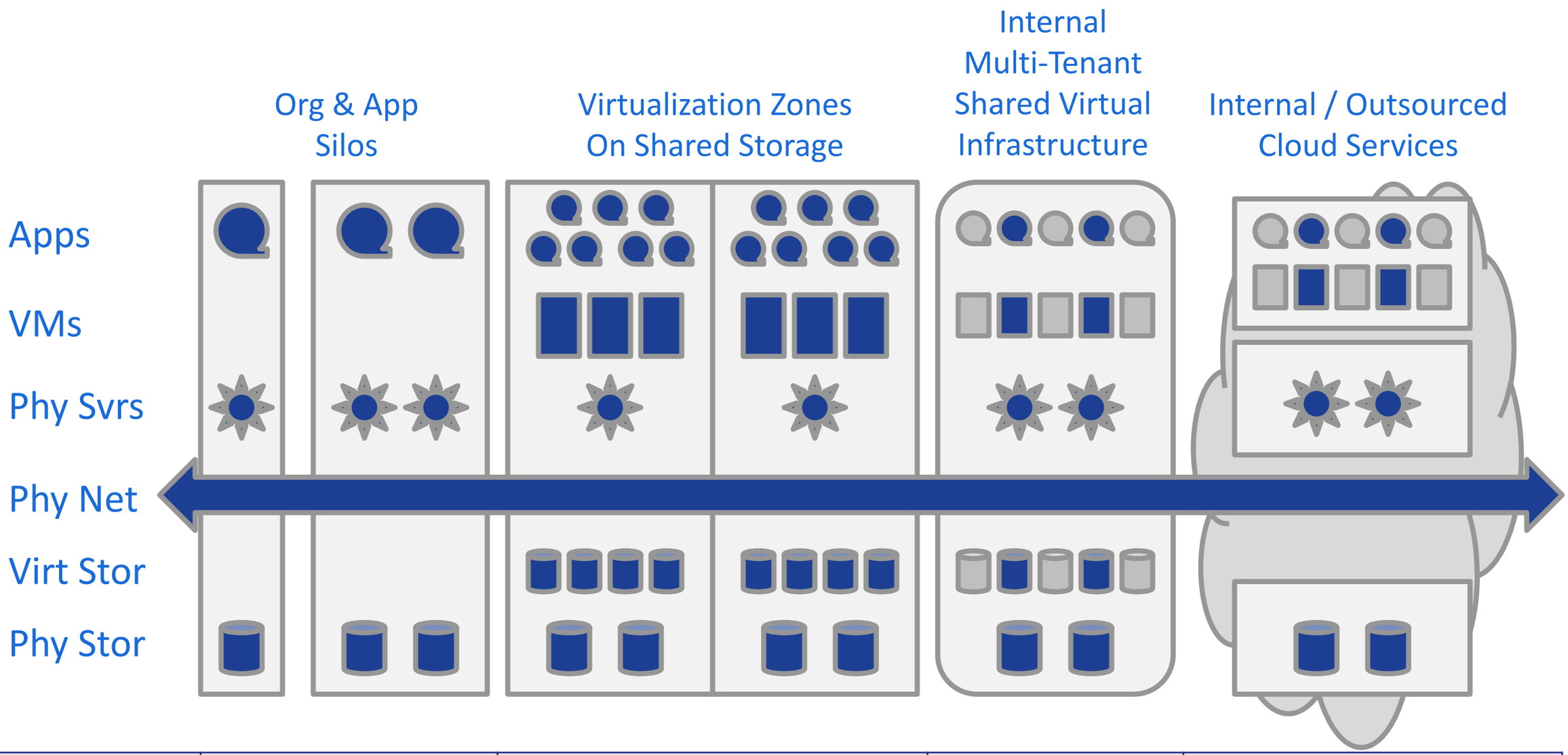
- IaaS vs. PaaS/SaaS
  - Tactical solutions for strategic change
- Private Cloud is hard
  - Processes, automation, funding models, service catalog, culture, politics
- Private Cloud isn't Cheap

Achieving Cloud Computing at Scale



Cameron Haight – Gartner – *Achieving Cloud Computing at Scale* 2010

Physical Silos to Virtual Services



IT Gov	Separate	Separate	Unified	Unified
IT Budgets	Separate	Separate	Combined	Combined
Server Util	Low	High	High	High
Storage Util	Low	Low	High	High
Provisioning	Days/Weeks	Hours	Minutes	Minutes
Costs	Very High	Medium	Low	Lowest
SLAs	Poor	Better	Strong	Strong
Security	Inconsistent	Better	Strong	Strong

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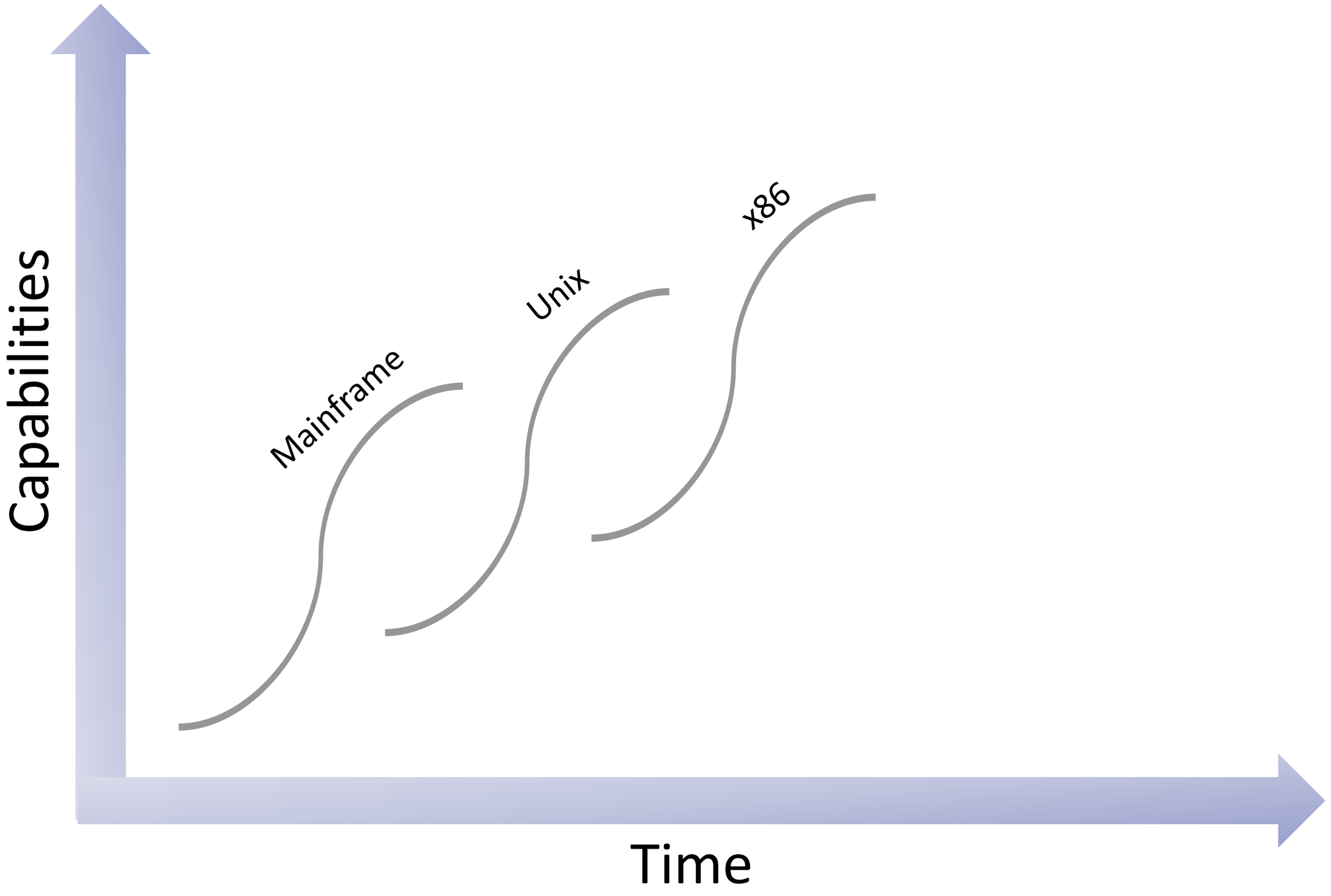


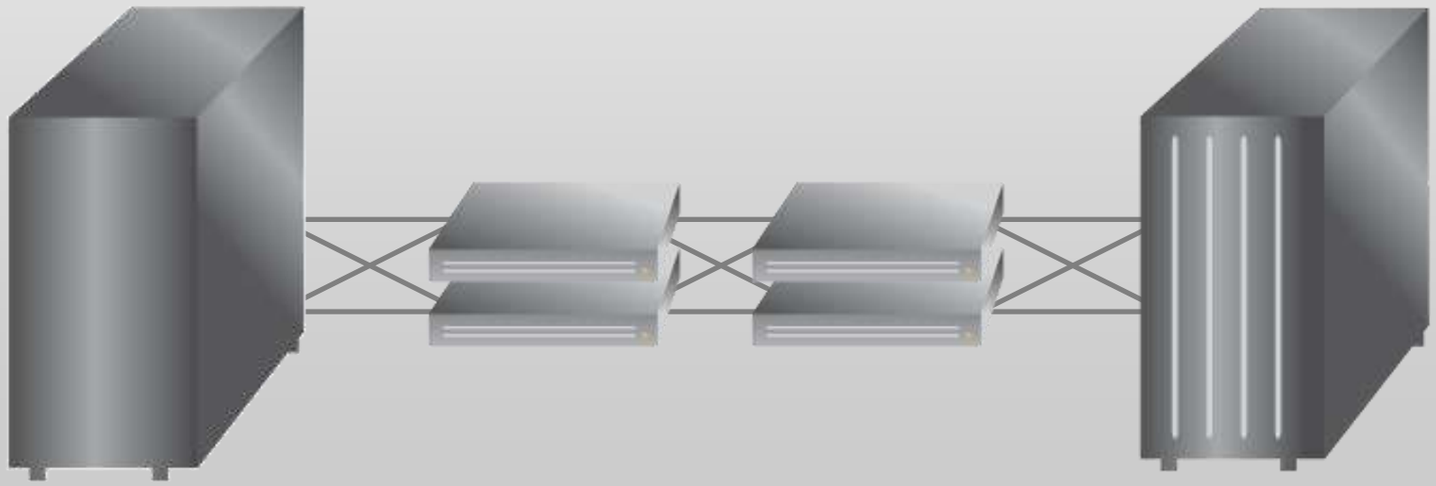
Storage Challenges: Mainframe Era

A **Legacy SAN Topology:** Rigid, Expensive

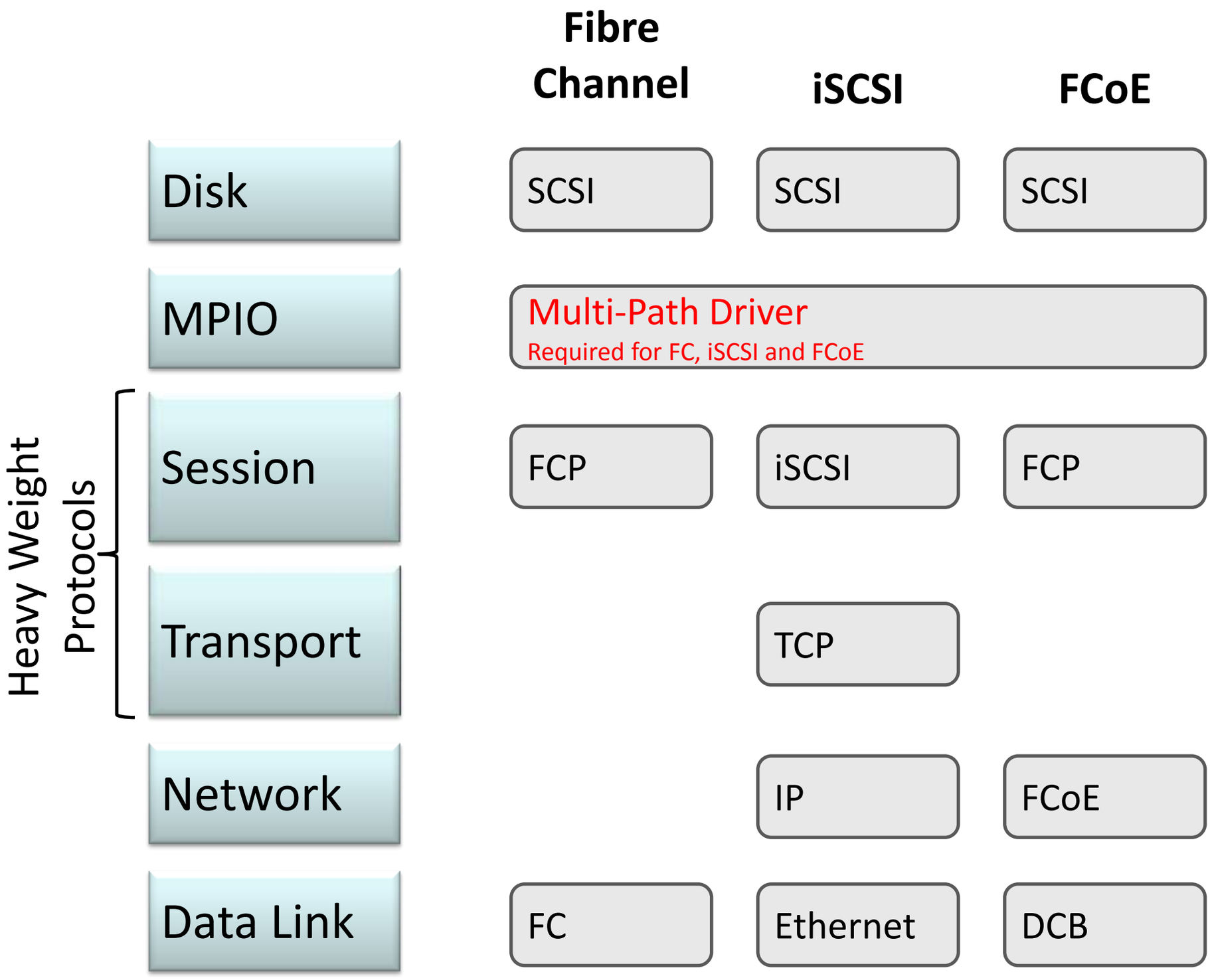
Expensive HBAs, Static Workload

Complex Multipathing

Controlled Data Layout on Drives

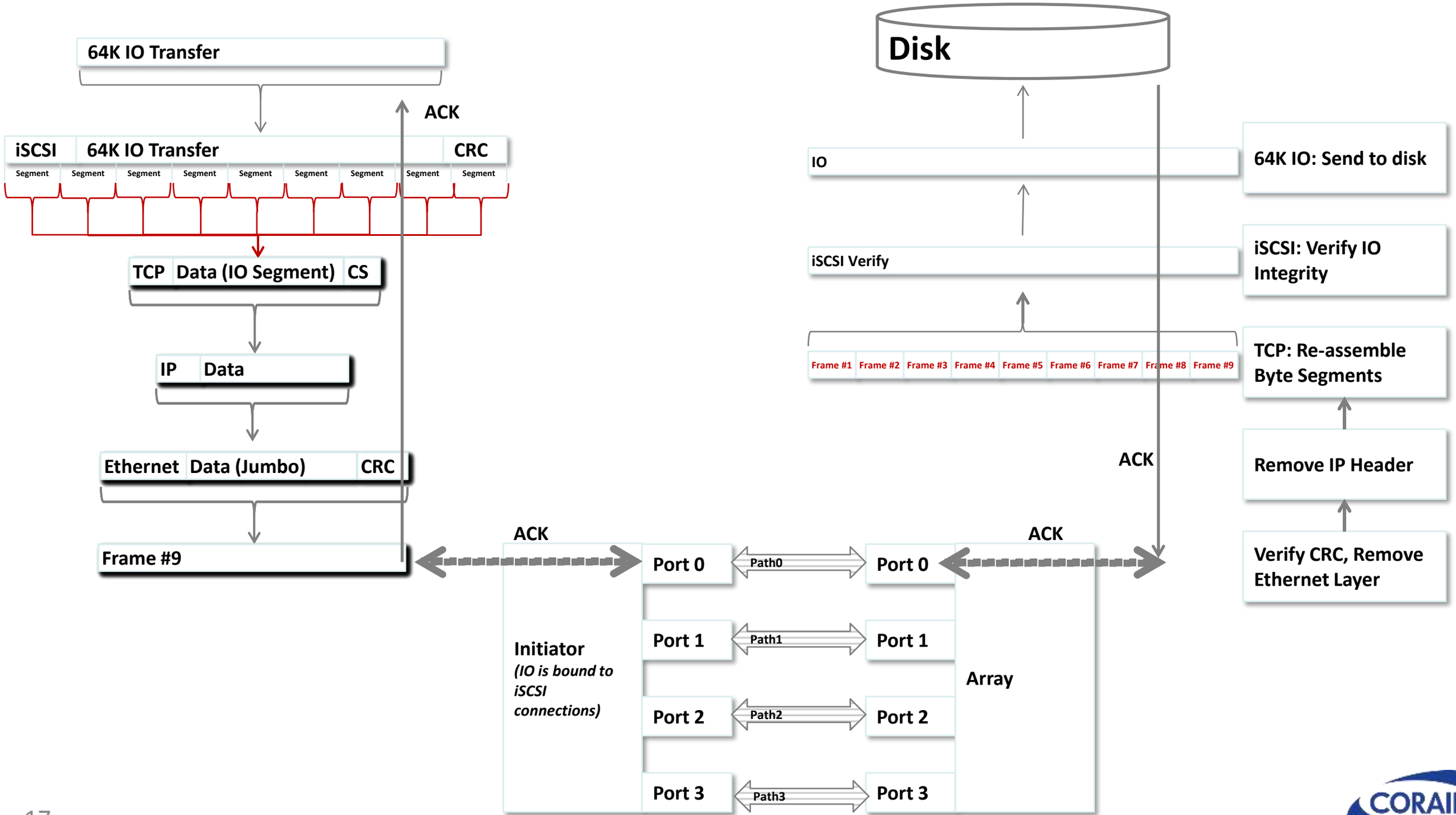


Complex Legacy Protocols

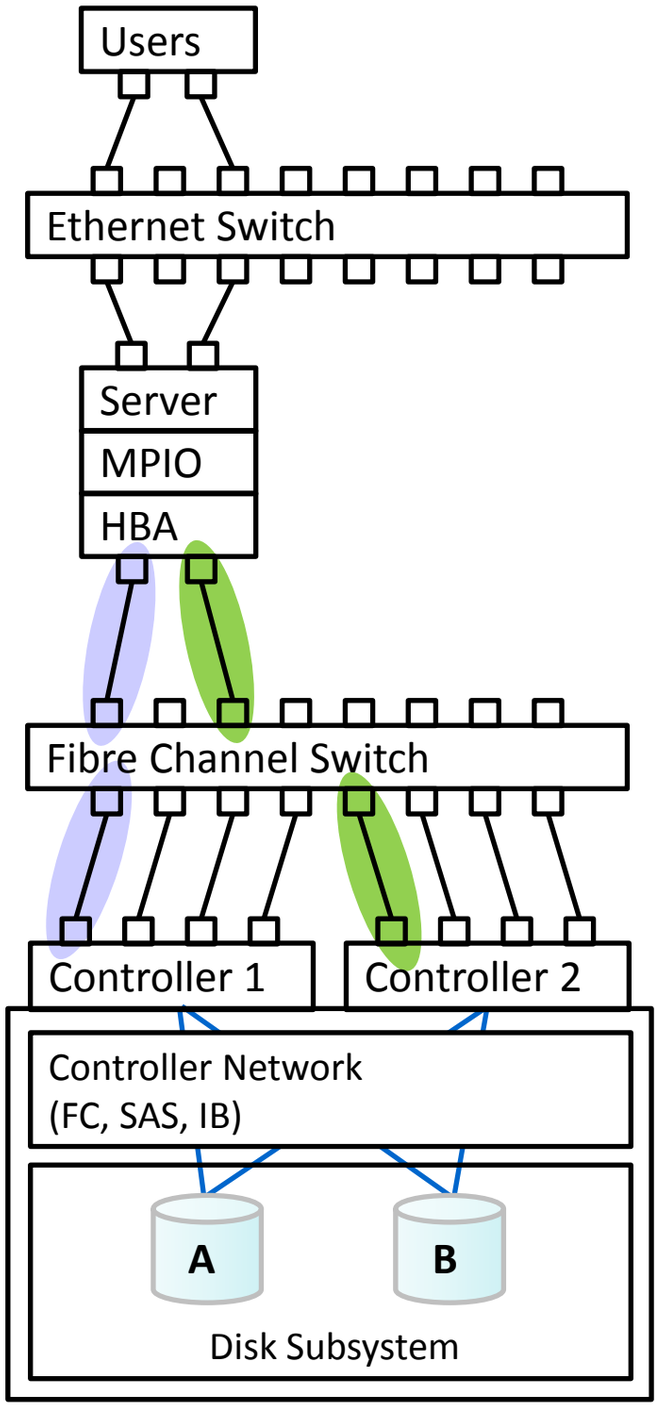


Traditional Storage Data Path

iSCSI (FC, FCoE): Connection-based, serial delivery



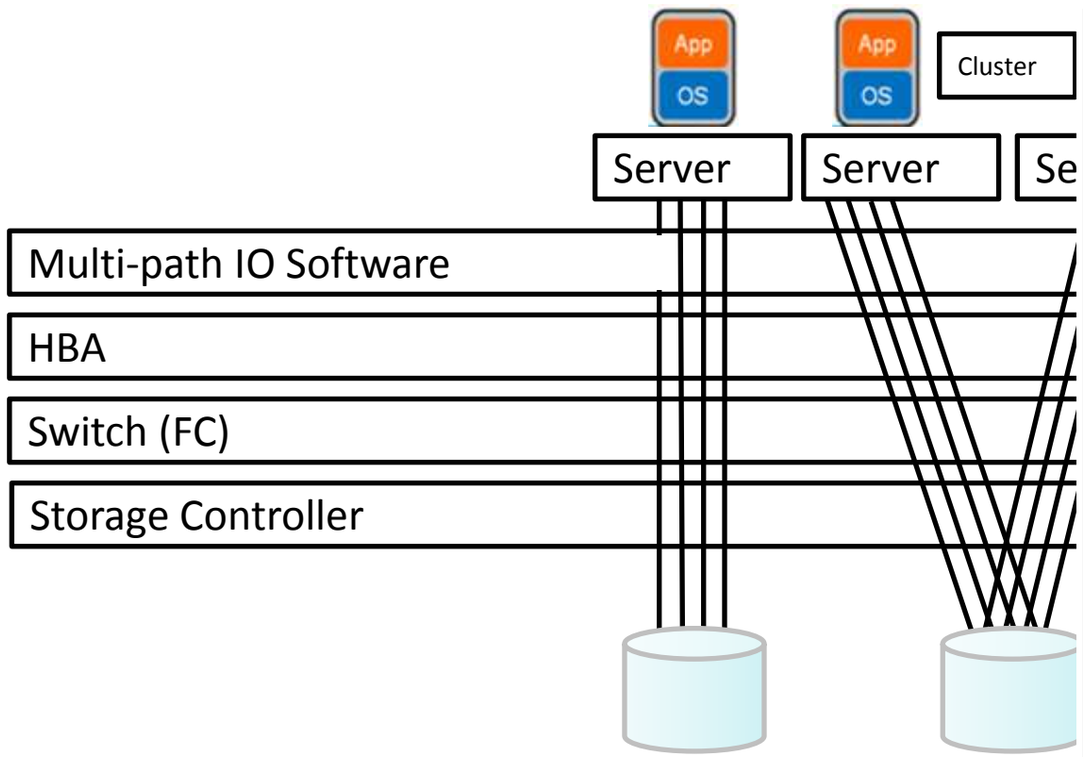
Traditional Storage

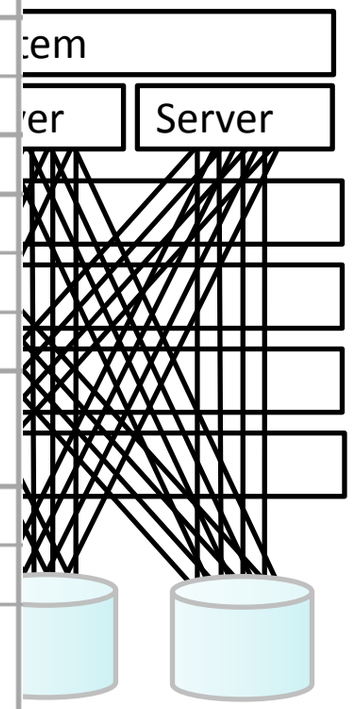


Steps	Fibre Channel
1	Plug in physical HBA
2	Load HBA specific firmware
3	Install MIPO driver
4	Configure storage port connections
5	Capture WWN (will need this later)
6	Perform LUN discovery
7	Log into LUN (requires storage access)
8	Zone HBA to storage port (MPIO requires zone for each path)
9	Configure NPIV (if Vmotion required)
10	Configure storage
11	Mask Initiator (requires WWN)
12	Go to the HBA and perform a LUN discovery
13	Mount disk
	13 steps = Hours

Hours Become Days and Weeks

Traditional Storage Configuration





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- **Difficult to configure**
- **Difficult to Scale**
- **Impossible to manage**
- **Vendor with the best interoperability test matrix wins**

(EMC Matrix: 19,000 pages and counting. http://www.emc.com/collateral/elab/emc-support-matrices.pdf)

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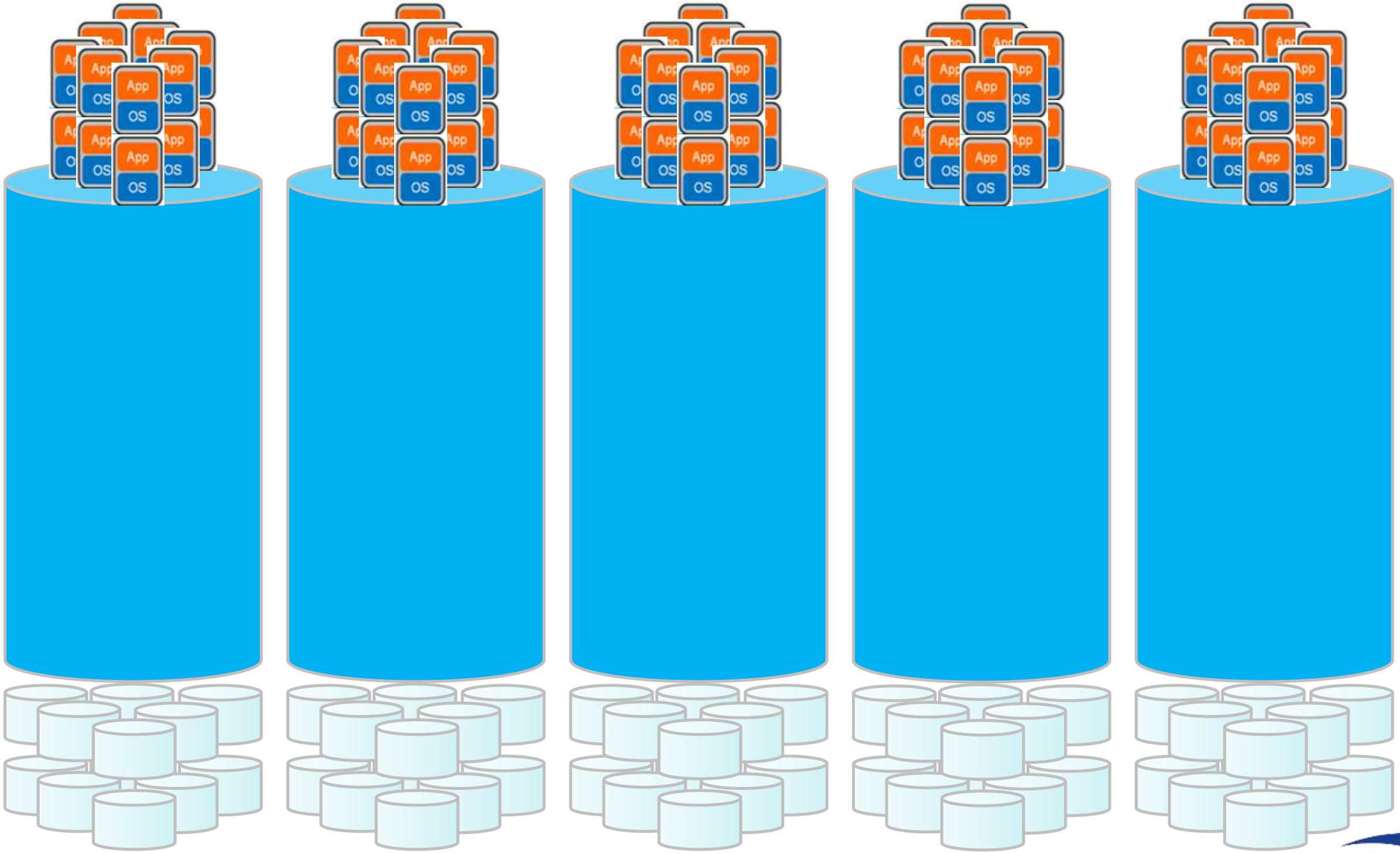
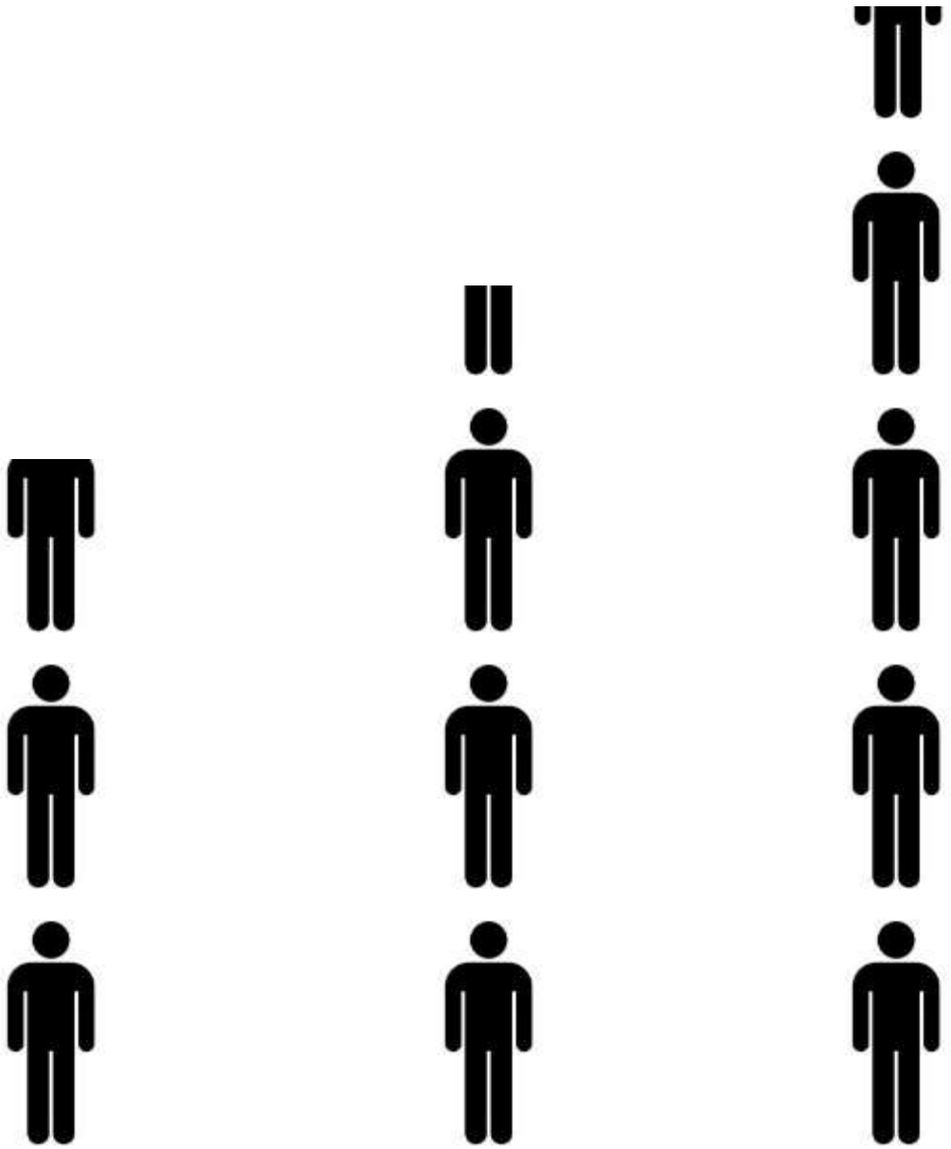
Application view of traditional storage



Efficiency Problems Plague Storage Admins



Average Number of Admins

50 – 249 TB

250TB – 1PB

1PB+

Source: Enterprise Strategy Group, 2010

Storage Under Management

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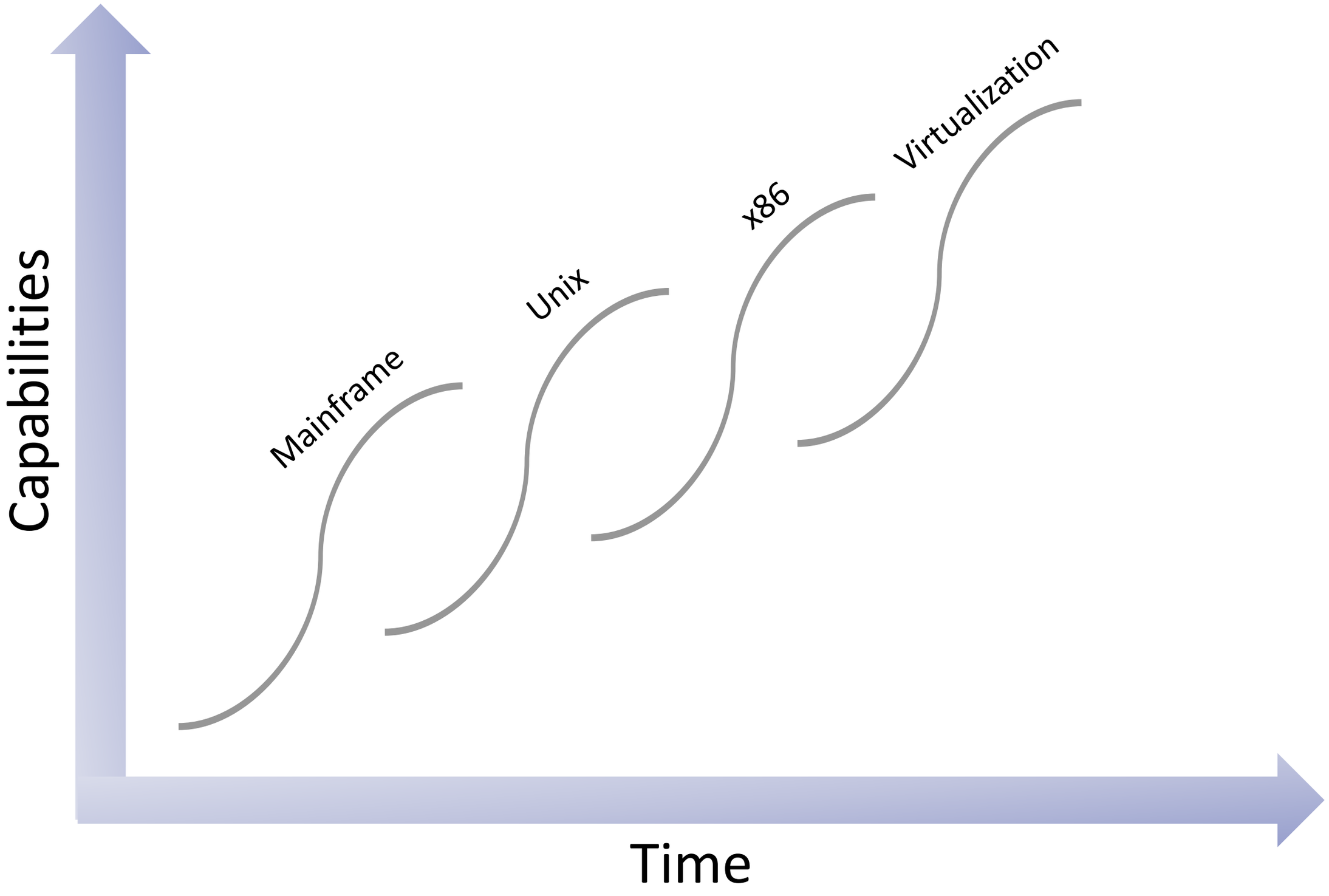


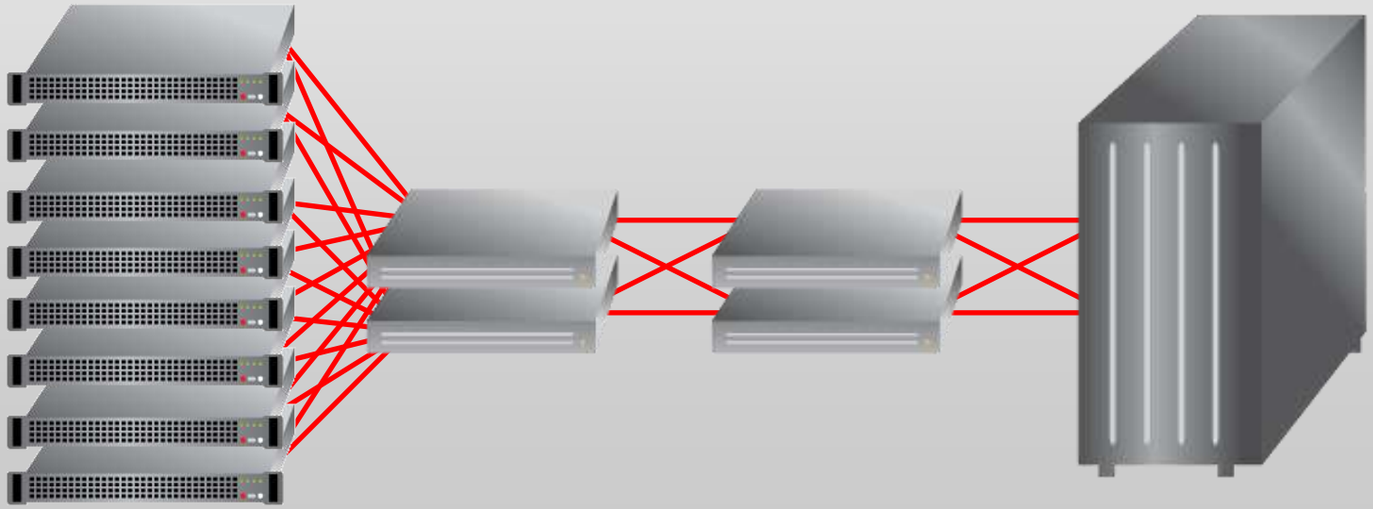
Scale Out Compute Highlights Storage Deficiencies

B **Bottleneck:** Dynamic Virtual Workloads

Server Cluster with VMotion

Extremely Complex SAN Management

Chaotic Data Layout on Drives: Head Contention



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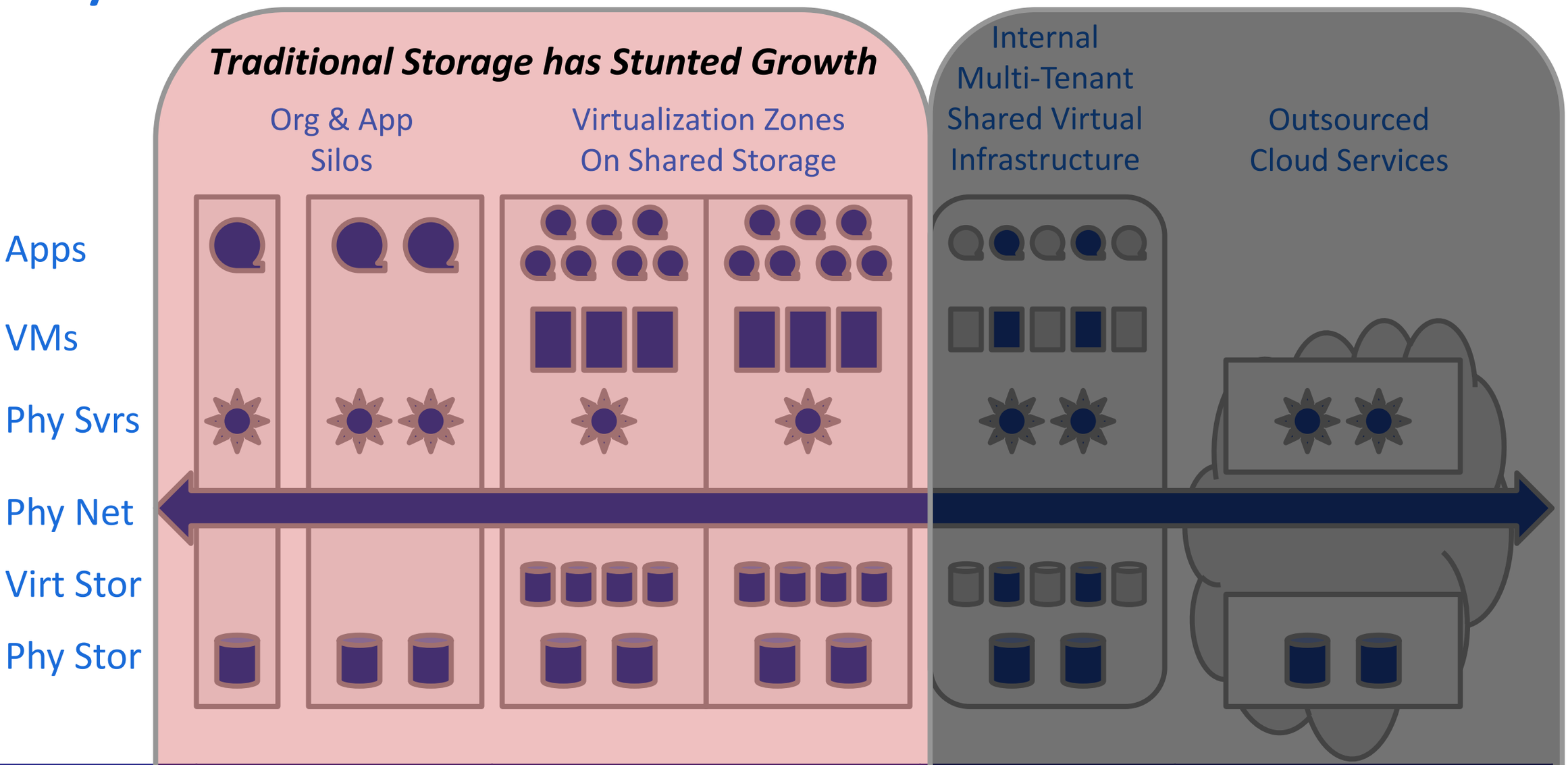
Physical Silos to Virtual Services



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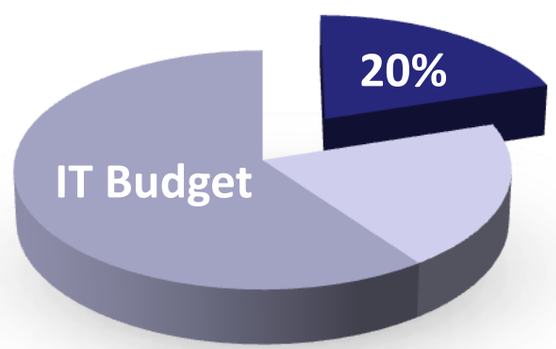
Security	Inconsistent	Better	Strong	Strong

SAN Evolution

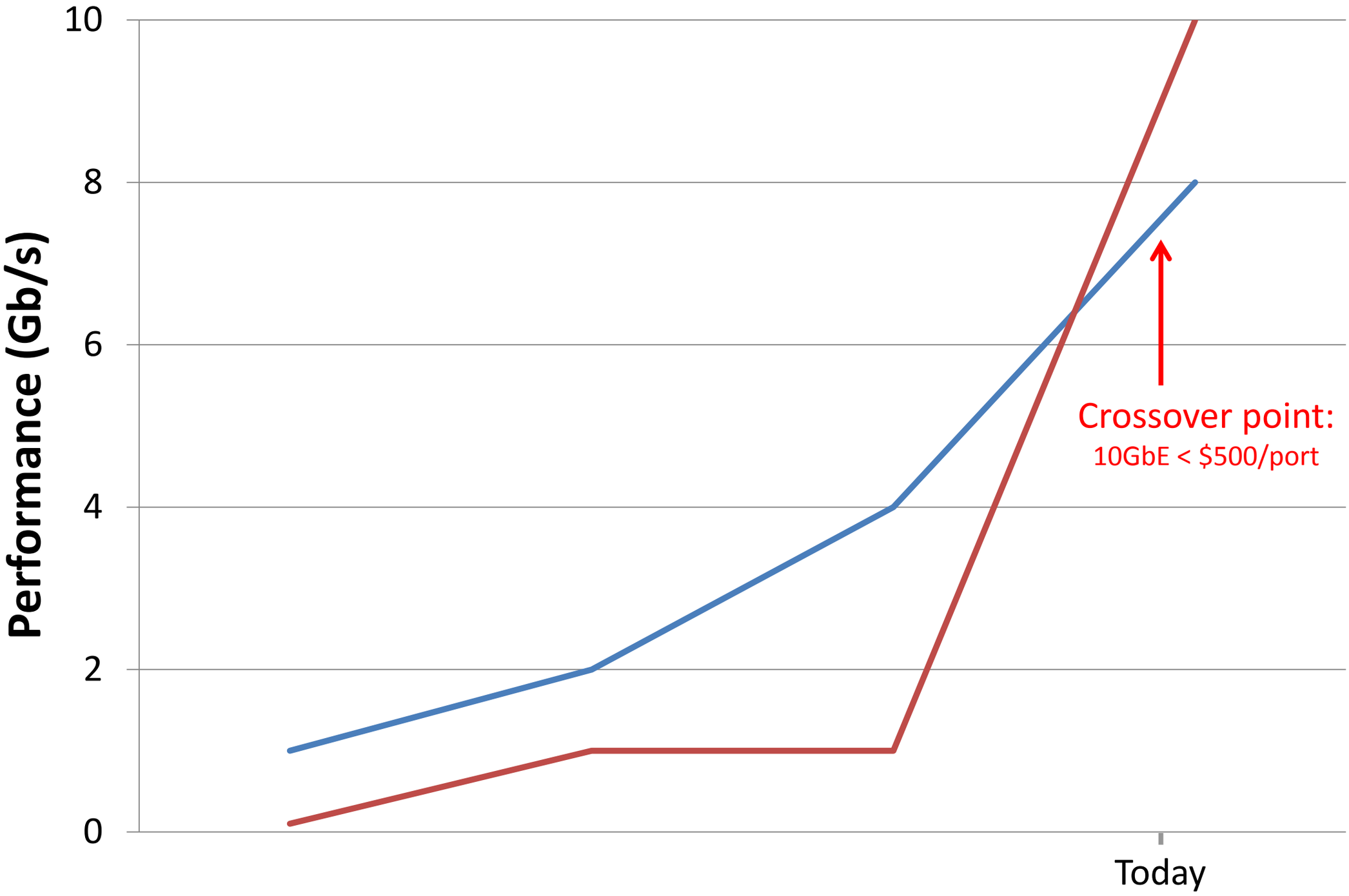
Ethernet SAN Value Proposition

- 2x storage capacity
- Improve performance
- Decrease OPEX
- Move to Ethernet and elastic cloud architecture

Savings potential: 20% of IT Budget



Tectonic Shift: Fibre Channel vs. Ethernet



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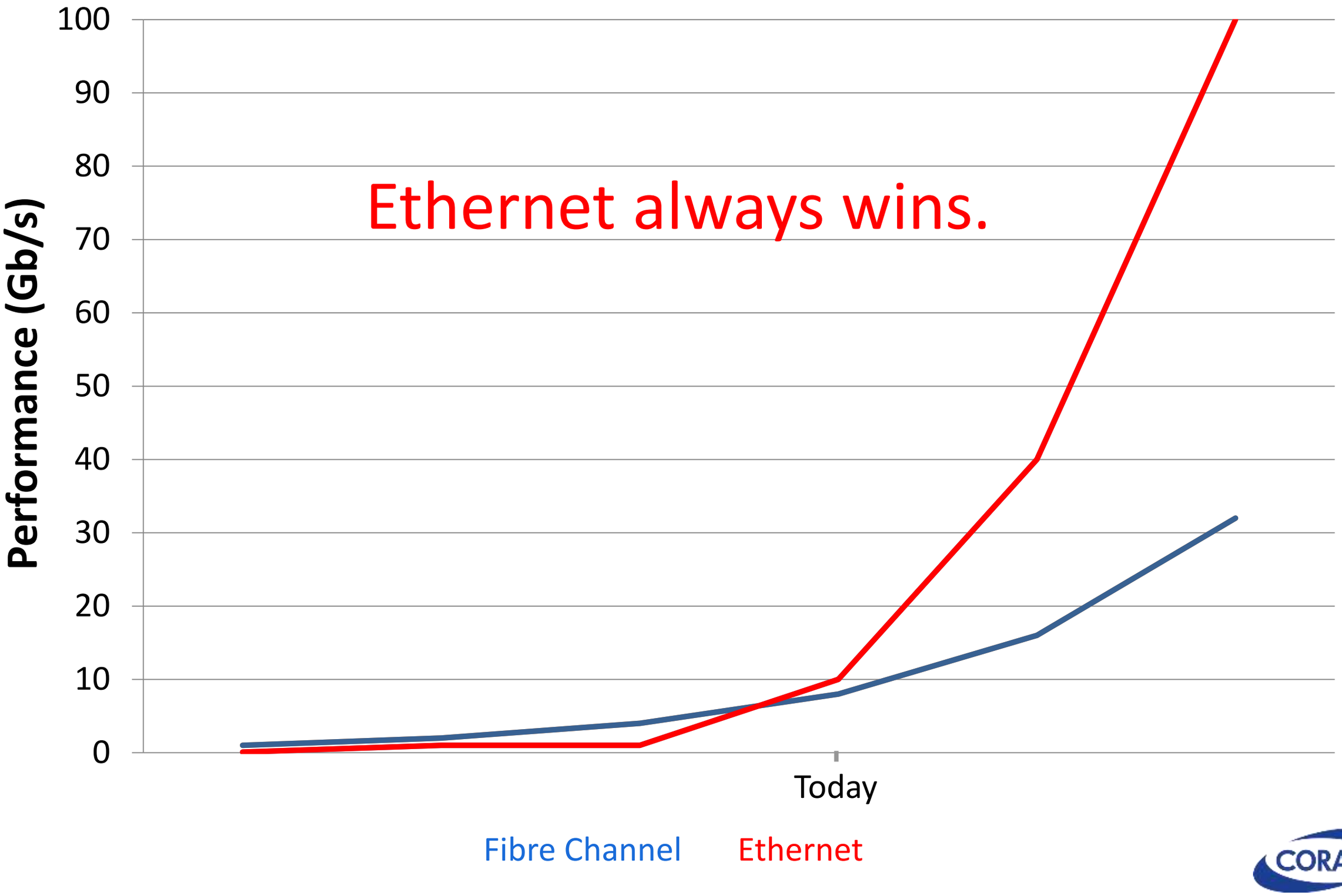

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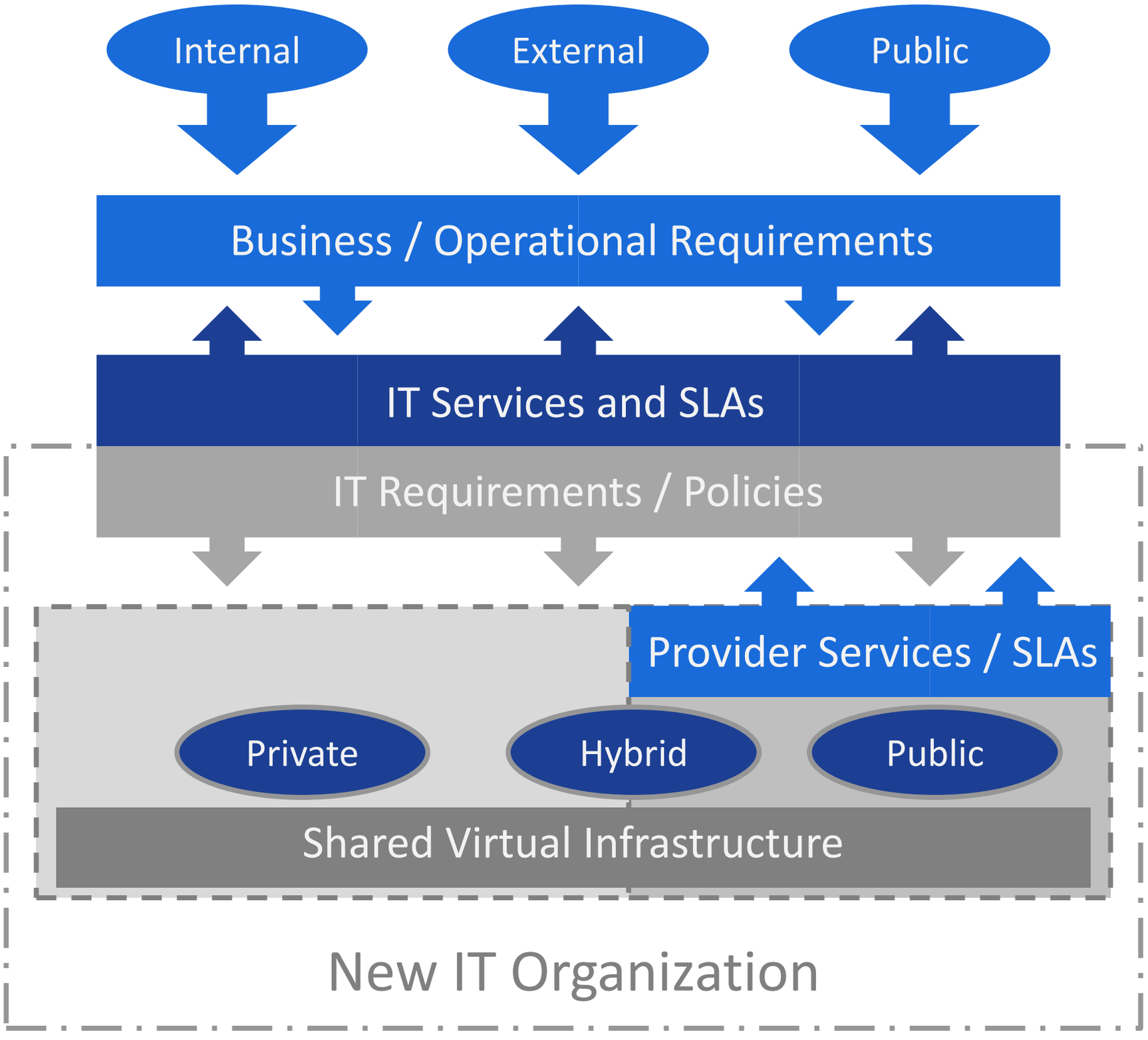
People: Institutional Impact of Cloud Computing



- Lower TCO
  - CapEx / OpEx
  - Consolidate Skills
- Faster to Market
  - New Services Faster
- Lower Risk
  - Data Protection

Benefits…

- Efficient / Effective
- Elastic / Scalable
- Dynamic / Always On

Processes: The Path to Cloud

Centralize IT, Policies, Mgt

Virtualize / Consolidate

Standardize Service Catalogue

Automate

Self-Service / Self-Manage / Chargeback

Assess Tasks Ahead / Determine Use Cases / Estimate ROI

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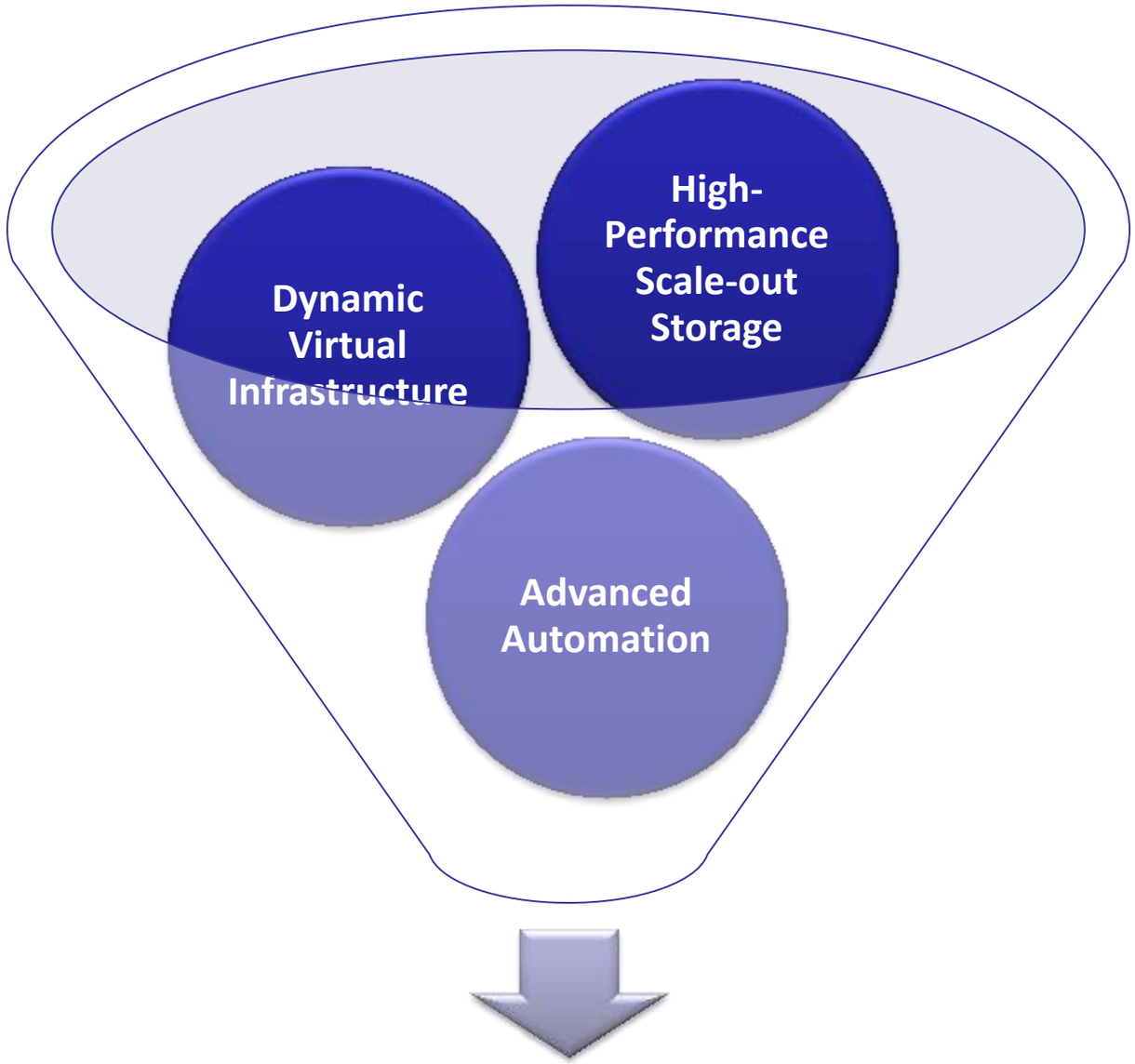
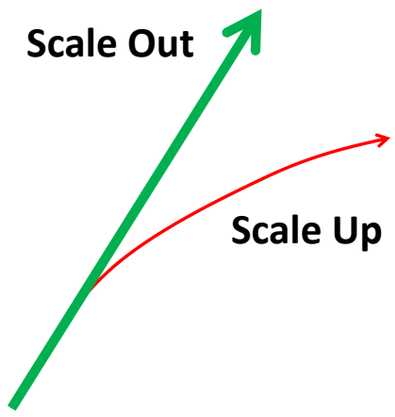
Technology: Critical Components of Cloud



Why Scale-Out Wins: x86 Processors

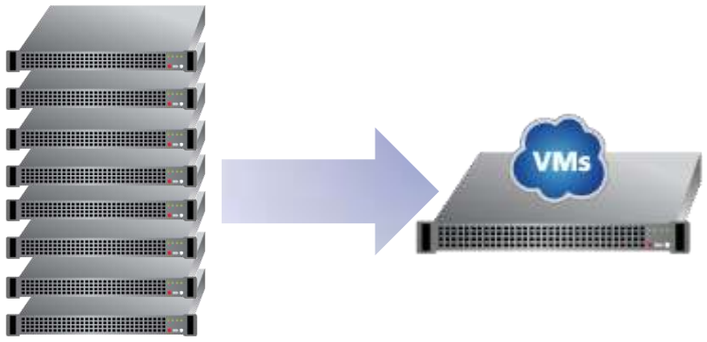
More Efficient: *Price - performance*

Just-in-Time*: Buy what you need*

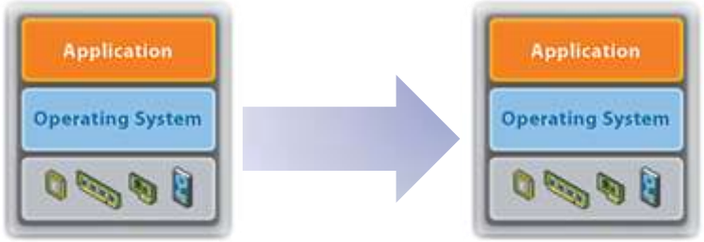


Scalable: *Linear scalability*

Why Scale-Out Wins: Virtual Machines



More Efficient: *Server Consolidation*



Just-in-Time*: Instant Provisioning*

```
class Contact
  include ActiveModel::Validations
  validates_presence_of :email, :sen

  # to deal with form, you must have
  attr_accessor :id, :email, :sender

  def initialize(attributes = {})
    attributes.each do |key, value|
      self.send("#{key}=", value)
    end
```

Scalable: *Programmable Infrastructure*

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Scale-Out Wins: Storage *(Ethernet SAN)*

More Efficient: *5-10x Price-Performance*

Just-in-Time*: 60-second install, self-serve*

Scalable: *Massively Parallel 10GbE*
Multiple Petabytes

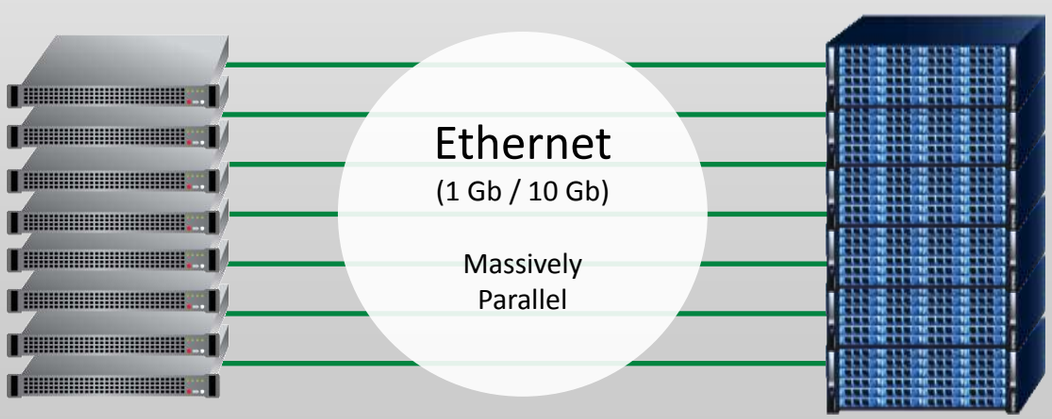
Scale-out Ethernet SAN

Dynamic Virtual Workloads

Server Cluster with vMotion™

AoE

EtherDrive Storage Arrays



Benefits

5-8x Price-Performance Advantage

- "Bare metal performance"
- Off-the-shelf hardware

Operational Simplicity:

- Eliminates complex topologies and multipathing
- Simple recovery – Zero Hour Support

Scale-out

- No controller bottleneck
- Grow in-line with business demand

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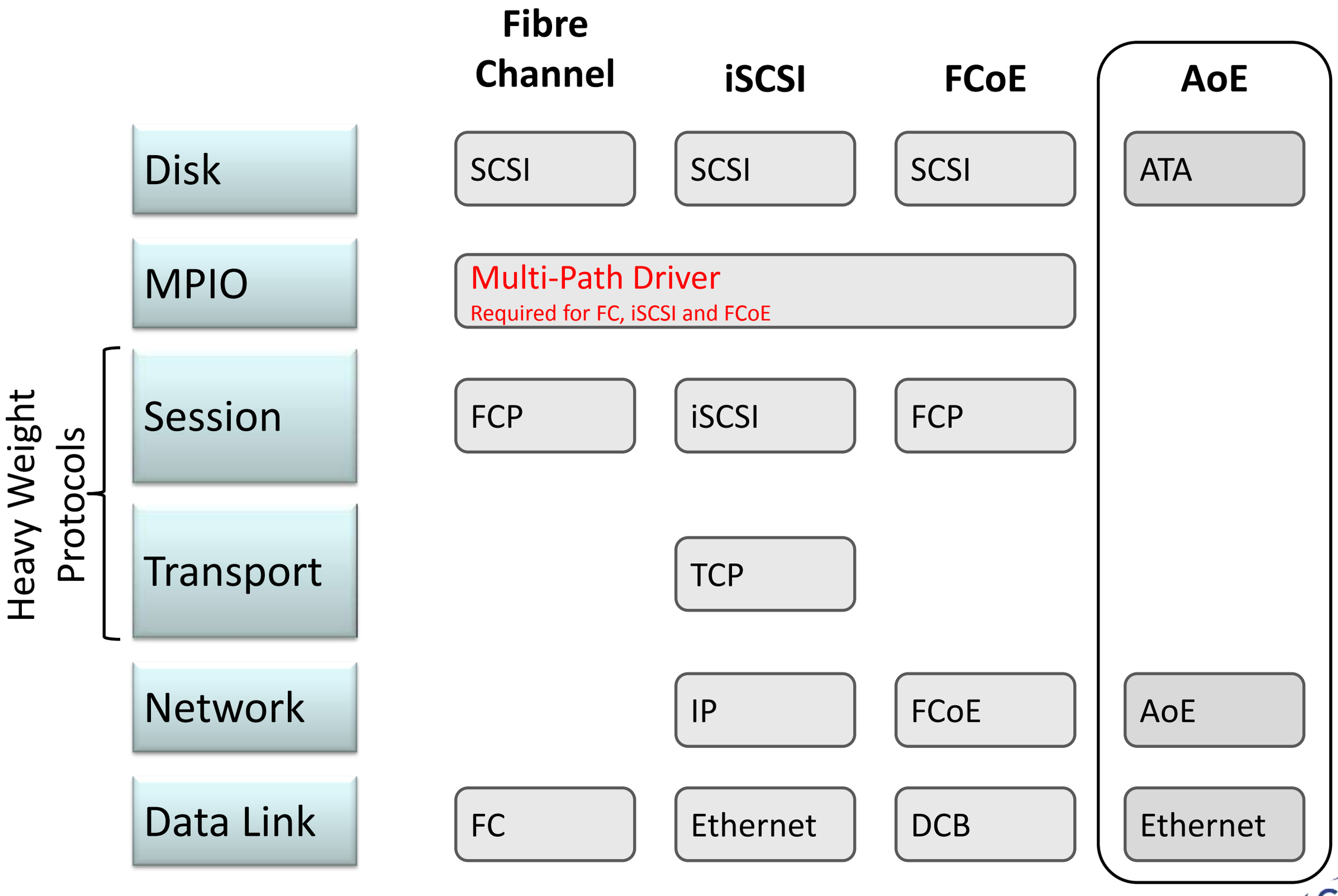
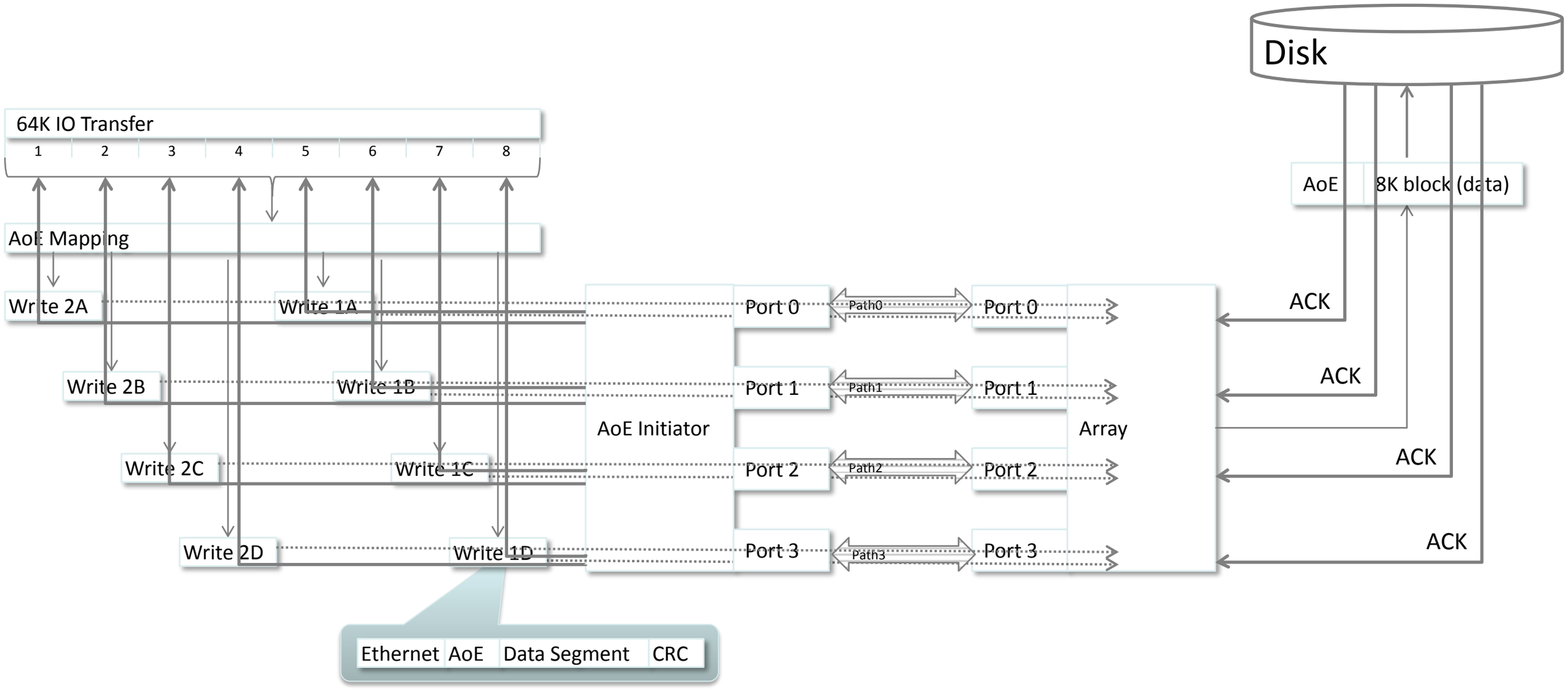
Eliminating Protocol Complexity

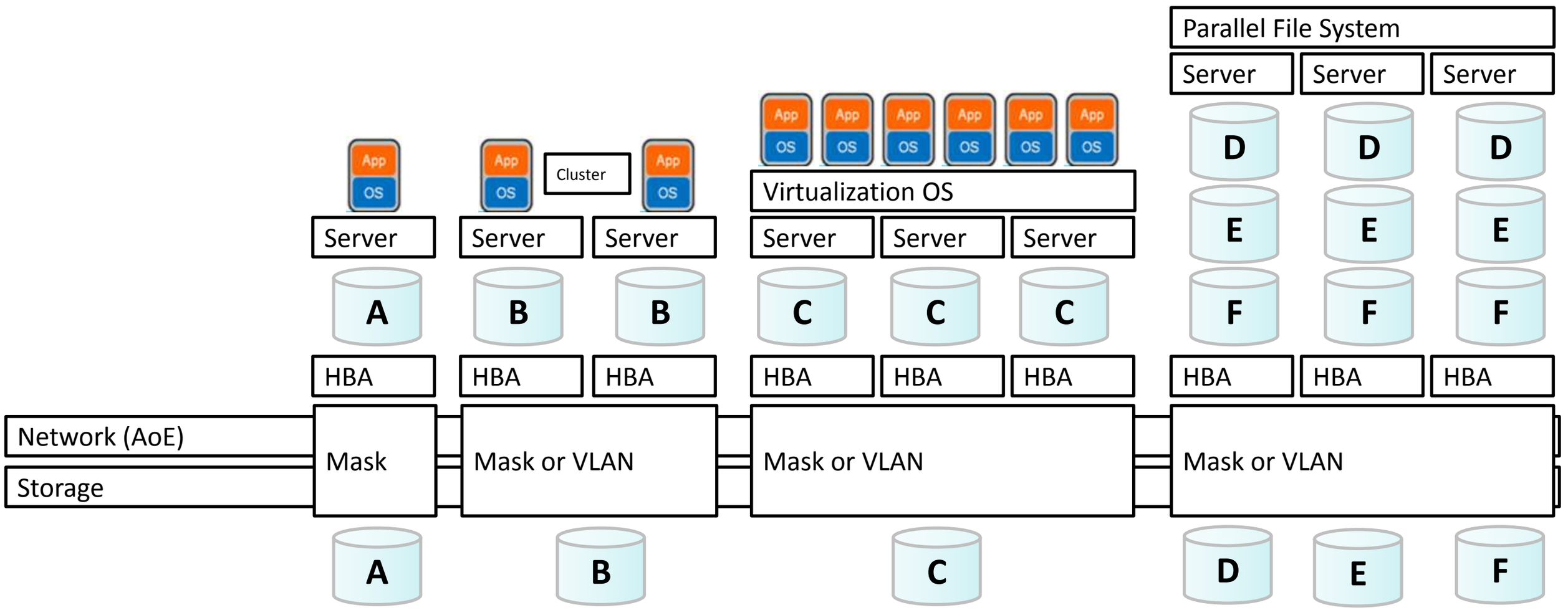


Cloud Storage Data Path

AoE: Connectionless, parallel delivery



Configuring Cloud Storage



- **LUNs automatically appear as locally attached**
- **LUN masking for 1:1 Server/Storage**
- **VLANs for Cluster, Virtual OS, or Parallel File System**

End Users are Looking for a New Model

- On-demand
- No commitment
- Lower Cost

SaaS — salesforce.com

PaaS — Windows Azure

IaaS — amazon web services

Developers
Application Owners
Line of Business (LOB)
End Users

Internal IT: Monopoly on Services

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Cloud is Shaking Up the Market

New Infrastructure Spend

- Traditional IT
  - Private clouds
  - 2011/2012: Design win opportunity
- Resellers / VARs
  - Is reselling hardware and services a dead end?
  - Looking to provide public cloud or managed services
  - How to compete with Amazon?
- Web hosters / outsourcers
  - How to compete with Amazon?
- SaaS Players
  - Rapid innovation

Cloud Requires New Architectures[1]

- On-demand self-service
- Broad network access
- Resources pooling
- Rapid elasticity
- Measured service

Can Legacy Storage do this?

1. Source: National Institute of Standards

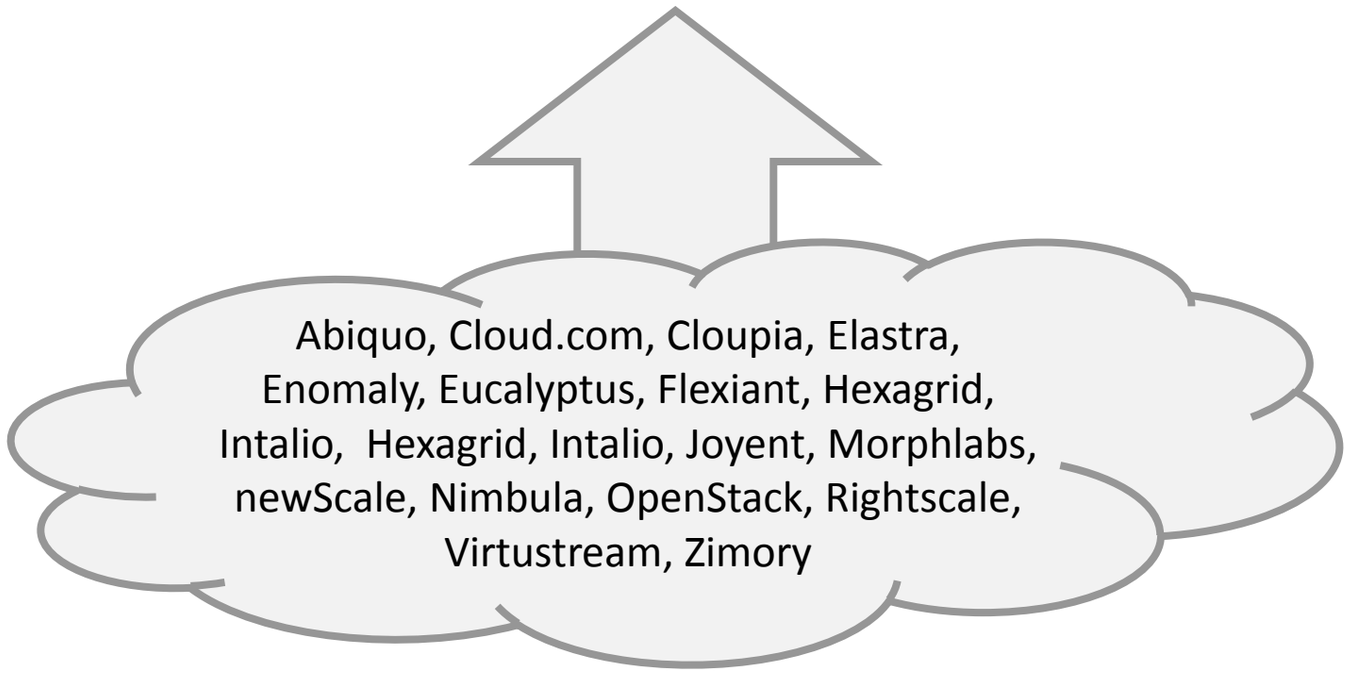
Vendors are Focusing Above the Hypervisor

Cross-Cloud Management

Cloud OS

Hypervisor

Server, Storage, Network



Assumption: Server, Storage, and Network are already provisioned

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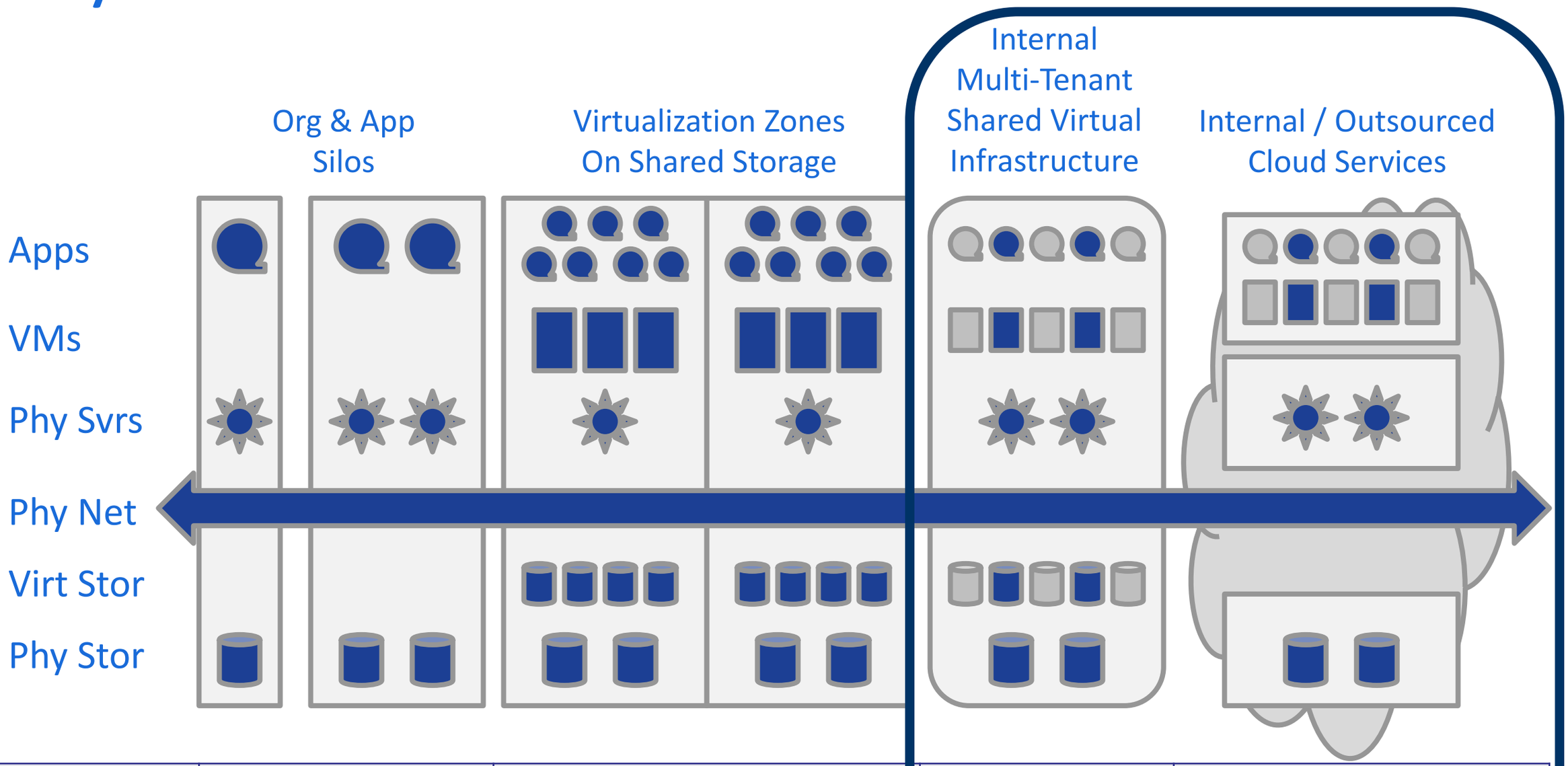

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Transitioning Fixed Infrastructure to Cloud

DELIVERY

ORCHESTRATION

Cloud Infrastructure

Application

Hosted Virtual Desktops

Back Office

Line Of Business

Self-Service Automation and Management

Compute

CIFS / NTFS

Microsoft Windows HyperV

ZFS

Solaris x86

NFS / SAMB

XEN

LINUX

VMFS

VMware ESX

Physical Network

1GbE

10GbE

Storage Virtualization

File System Agnostic

NSPoF

Robust Block Management

Physical Storage

Universal Storage Platforms

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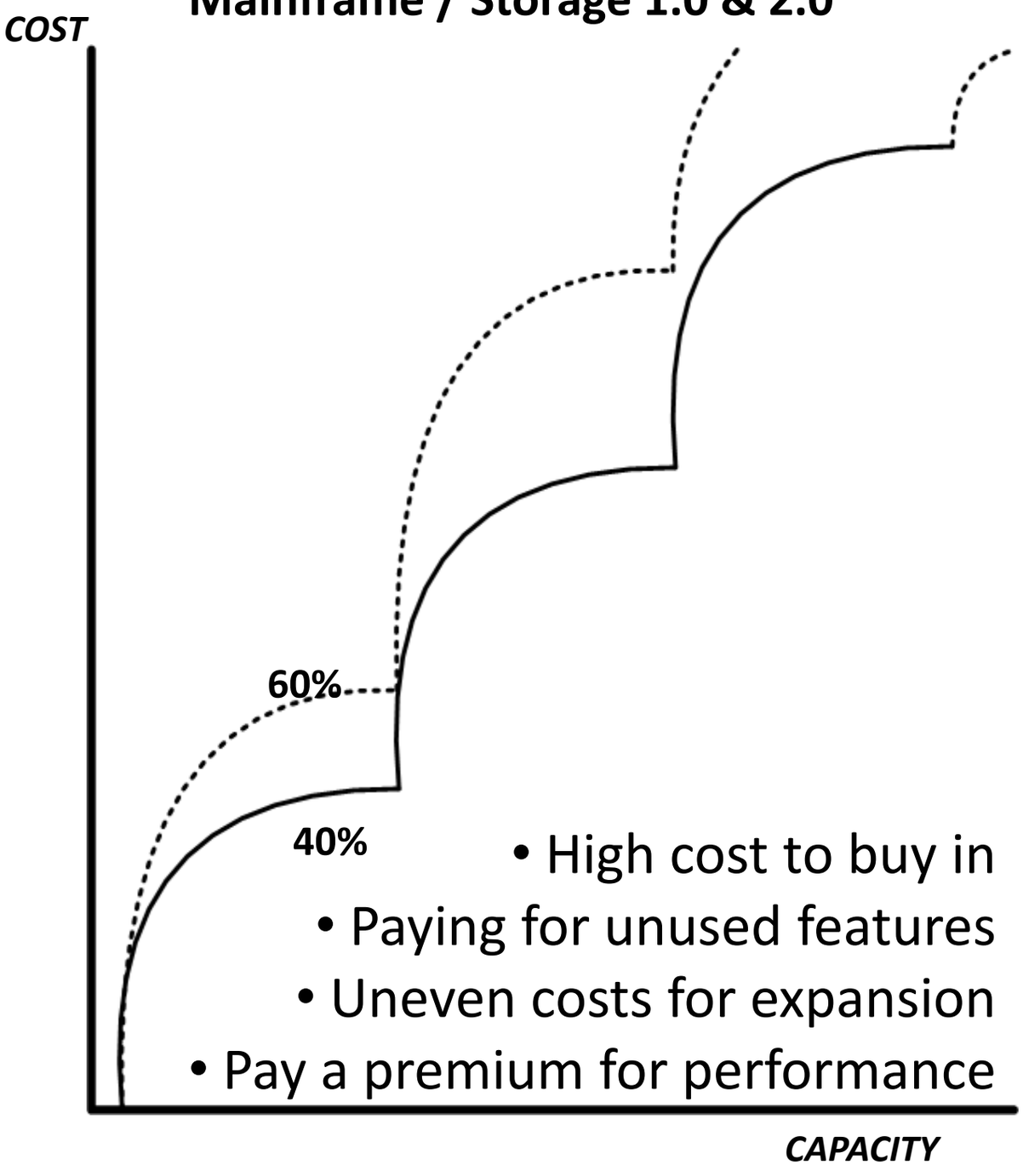
Cost Models

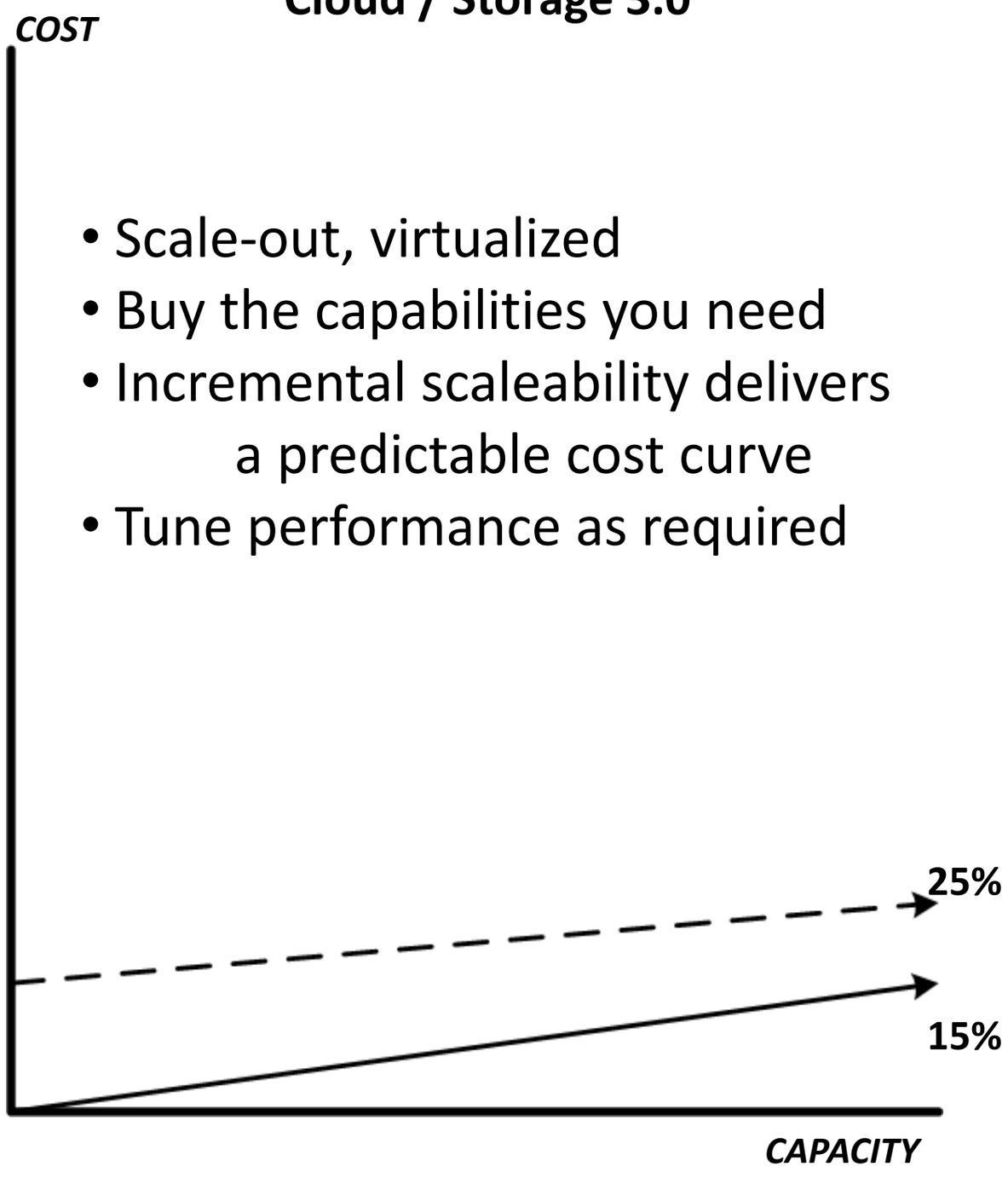
Evolving to Cloud

Mainframe / Storage 1.0 & 2.0



- High cost to buy in
- Paying for unused features
- Uneven costs for expansion
- Pay a premium for performance

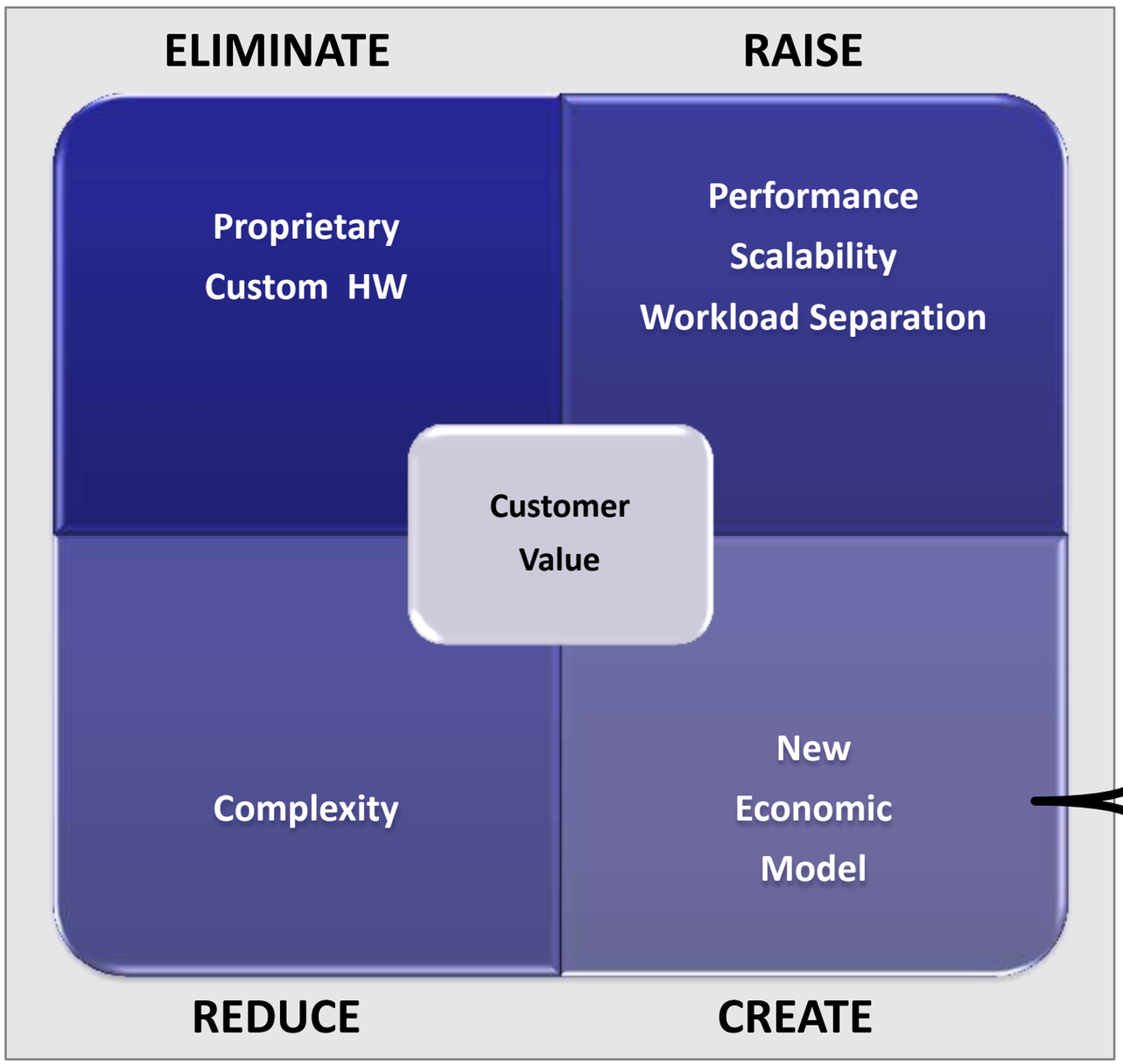
Cloud / Storage 3.0



- Scale-out, virtualized
- Buy the capabilities you need
- Incremental scaleability delivers a predictable cost curve
- Tune performance as required

Cloud Economics for the Consumer

The Future of Cloud Storage…



- Transparent Scalability
  - Industry Standard Hardware
  - Eliminate “noisy neighbors” through distributed controller architectures
- High Performance
  - 1GbE / 10GbE
  - 530MB - 1800MB / sec
- Low Budget Impact per Unit/GB

“Ethernet SANs are the future. Protocols are secondary.”

Enterprise Strategy Group – Jan 2011

Understand the Environment…
Set Realistic Goals & Objectives…
Engineer a Solid Foundational Architecture…
Cost vs. Capability, Agility, Speed, and Innovation…

Keep Your Eye on the Ball…

Some analysts to start with:
Greg Schultz – StorageIO
Mark Bowker - ESG
Cameron Haight – Gartner
Chris Wolfe – Gartner

Questions

Chip Brodhun

Director, Cloud Services & Solutions – Coraid, Inc.

chip.brodhun@coraid.com | 571.277.6398

Speaker

Chip Brodhun, Director of Cloud Services and Solutions, Coraid

chip.brodhun@coraid.com // cell: 571.277.6398

www.linkedin.com/in/cbrodhun

Chip brings over 20 years of experience within the virtualization and storage industry. As Coraid's Director of Cloud Services and Solutions, Chip is tasked with accelerating customer success as they adopt, deploy, and operate virtualization and cloud computing environments.

Prior to Coraid, Chip served in the USMC as the technical director for Enterprise Standards and Technologies within Product Group 10. In this role, Chip was responsible for the identification, evaluation, and introduction of advanced and emerging standards, technologies, and processes to the United States Marine Corps. Specifically, the USMC Enterprise Virtualization initiative – approximately 2300 ESX hosts, nearly 7000 virtual machines deployed, and almost 20,000 hours of deployment engineering and training services delivered across 167 sites globally – set a number of benchmarks for highly distributed, enterprise-scale, virtualization roll-outs. Chip retired from active service with the USMC in May 2010.

ESG Lab Validation Report: March 2011

"ESG Lab has tested nearly every major storage system in the industry, and we found the ease of implementation and management of Coraid EtherDrive storage shockingly simple compared to most Fibre Channel and iSCSI systems. The simplicity of the system is brilliant, and the price-performance is staggering. It's fair to say we were enormously impressed."

– Tony Palmer, Senior Engineer at ESG Lab

Higher performance than Fibre Channel at 20% the cost

Performance: 1800+ MB/sec per shelf

ESG was able to provision EtherDrive in less than 2 minutes from power on

CORAID

Coraid EtherDrive™ Product Line

EtherDrive™

- CorOS - Distributed Operating System
- RAIDShield
- Operating System Drivers
- SAN Virtualization
- Centralized Management

Complete Ethernet SAN
Enterprise-class storage solution

- **SRX-Series**
- **Price-Performance**
- **10 GbE & 1 GbE**
- **SSD, SAS, SATA**
- **16 Drv – SRX2800**
- **24 Drv – SRX3200**
- **24 Drv – SRX3500**
- **36 Drv – SRX4200**

STORAGE

- **HBAs**
- **End-to-End Solution**
- **10 GbE & 1 GbE**
- **PCIe HBA**
- **Blade Mezzanine**

COMMUNICATIONS

- **VSX3500**
- **Virtualization appliance**
- **Large Vol Mgt**
- **Local Synch Mirror**
- **LUN Cloning**
- **Asynch Replication**

- **ESM1500**
- **Visualization**
- **Reporting**
- **Centralized Management**

MANAGEMENT