SNIA DSI '16 DATA STORAGE INNOVATION CONFERENCE
Innovation in Storage Products, Services, and Solutions
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Enterprise Architectures
The Pace Accelerates

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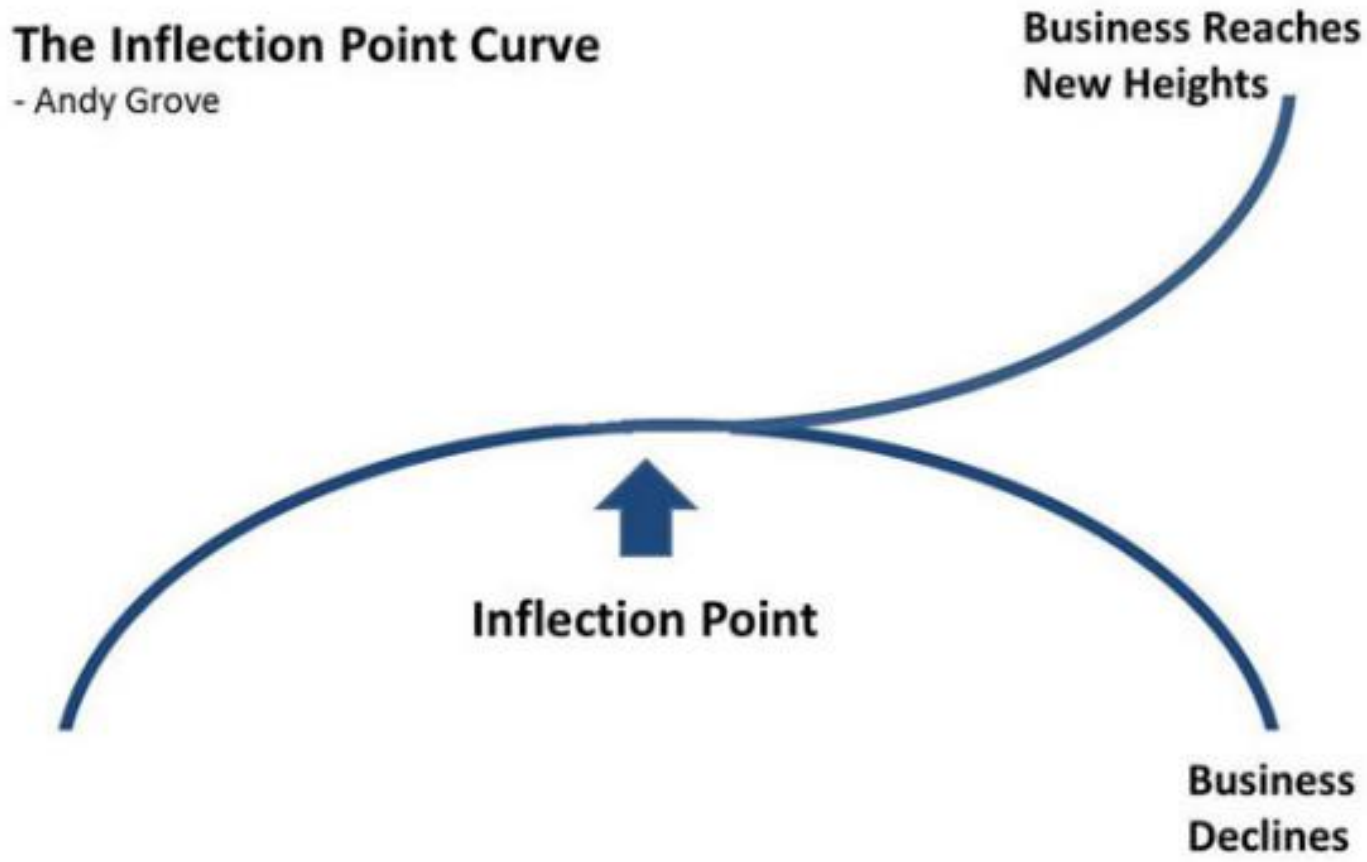
Change is constant in IT

….But some changes alter forever the way we do things

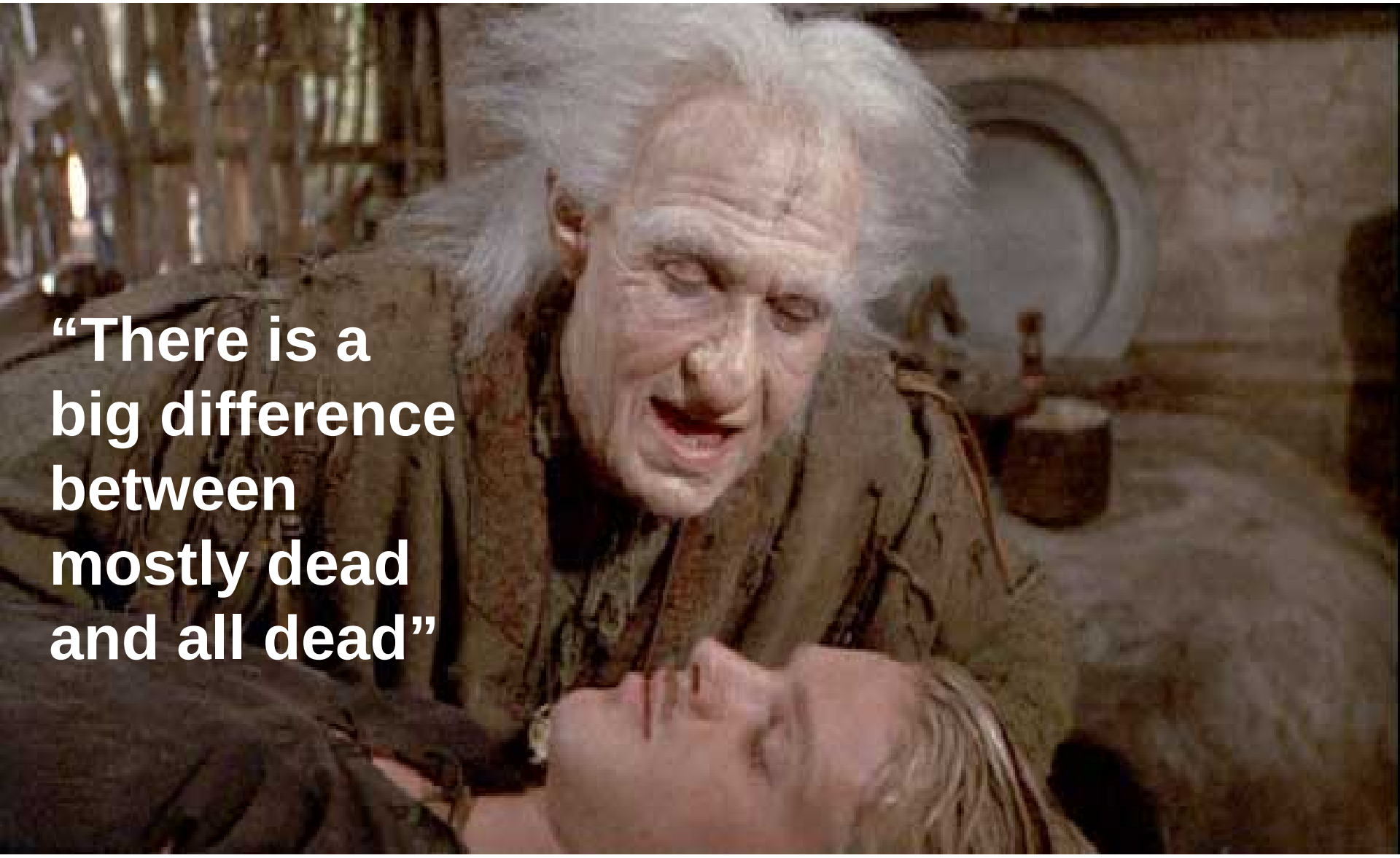


Inflections & Architectures

- Solid State
- Service Delivery & “Cloud”
- Data Protection

Solid State Transitions

- Flash – Today and Tomorrow
  - Continue to get less expensive – greater density, though improved manufacturing process & capacity
  - Different classes of flash will be available
    - Based on longevity, number of writes
  - Economics move towards use in long-term storage - >15 years
- Product Differentiation
  - SSD form factor vs custom
  - Interface and protocol differences – disk-based vs. non-volatile memory based
  - Data reduction – where and how implemented
  - Data Services



All Primary Storage Moving to All Solid State

- Multiple Islands vs Single Solution
- Scale up vs Scale out to match performance vs capacity needs
- Traditional arrays / systems repurposed for non-primary storage
  - Larger capacity disks & lower access demand
- Enterprise-class all solid state systems
  - Availability and feature sets expected
  - Move away from SSDs that emulate disk drives – PCIe and NVMe

Primary Storage

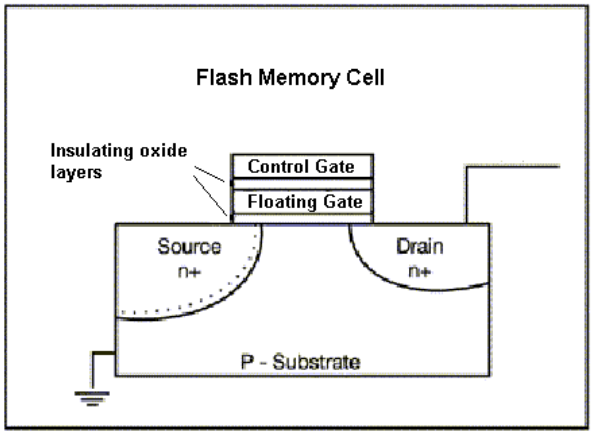
Performance critical apps All Flash

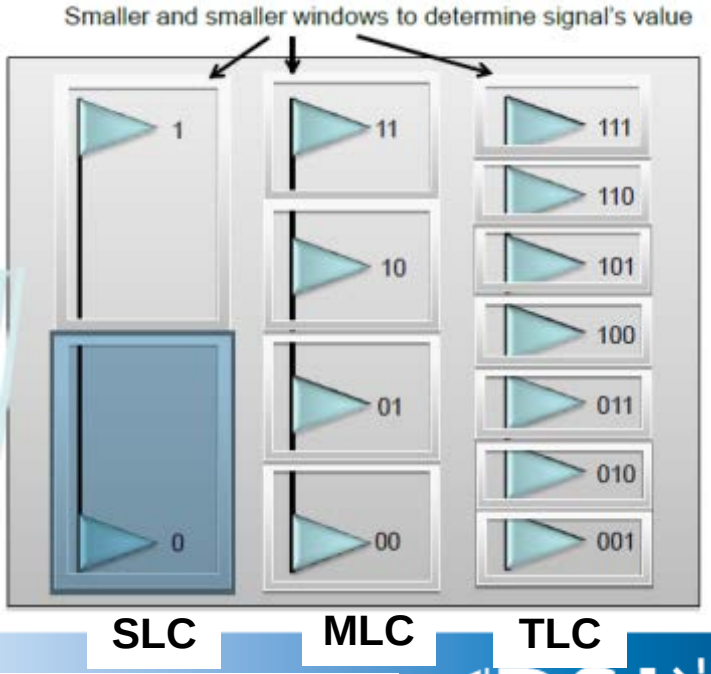
Secondary Storage

Other Application Storage: Traditional Storage with Flash Added

Where we are now – Flash Storage

- NAND Flash technology
  - Continued advances in technology
  - 3D NAND Flash – stacked
    - Greater endurance
    - Greater density and lower cost
- Now in the storage systems
  - Larger capacity – lower cost
  - Factor in expanding workloads
  - Reliability of Flash – changing the TCO





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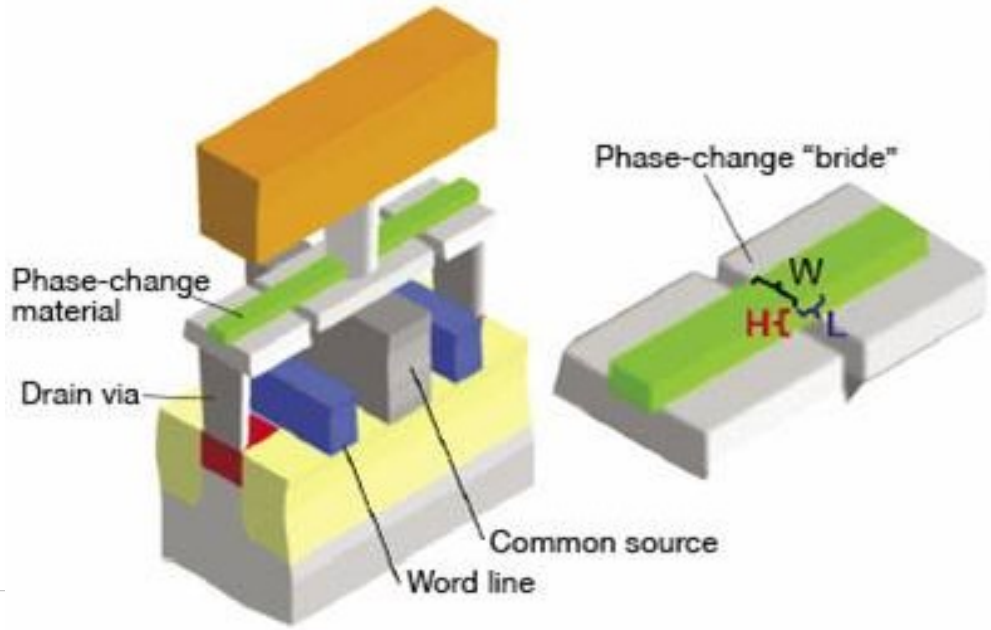
Solid State Storage Devices

- Non-volatile memory technology
  - Data is persistent even with loss of power
  - Length of time data is retained can vary based on technology
  - Technology evolving
    - NAND flash
    - MRAM
    - Memristor
    - Resistive RAM
    - PCM
    - 3D XPoint



Transitions in Flash Deployments

Controller Node

Internal to Storage System

3D XPoint for caching

Serial Attached SCSI to SSDs

PCIe Extended Connections

Internal connection of storage system Minimize latency – connect as memory devices

Flash Controllers

Flash Modules

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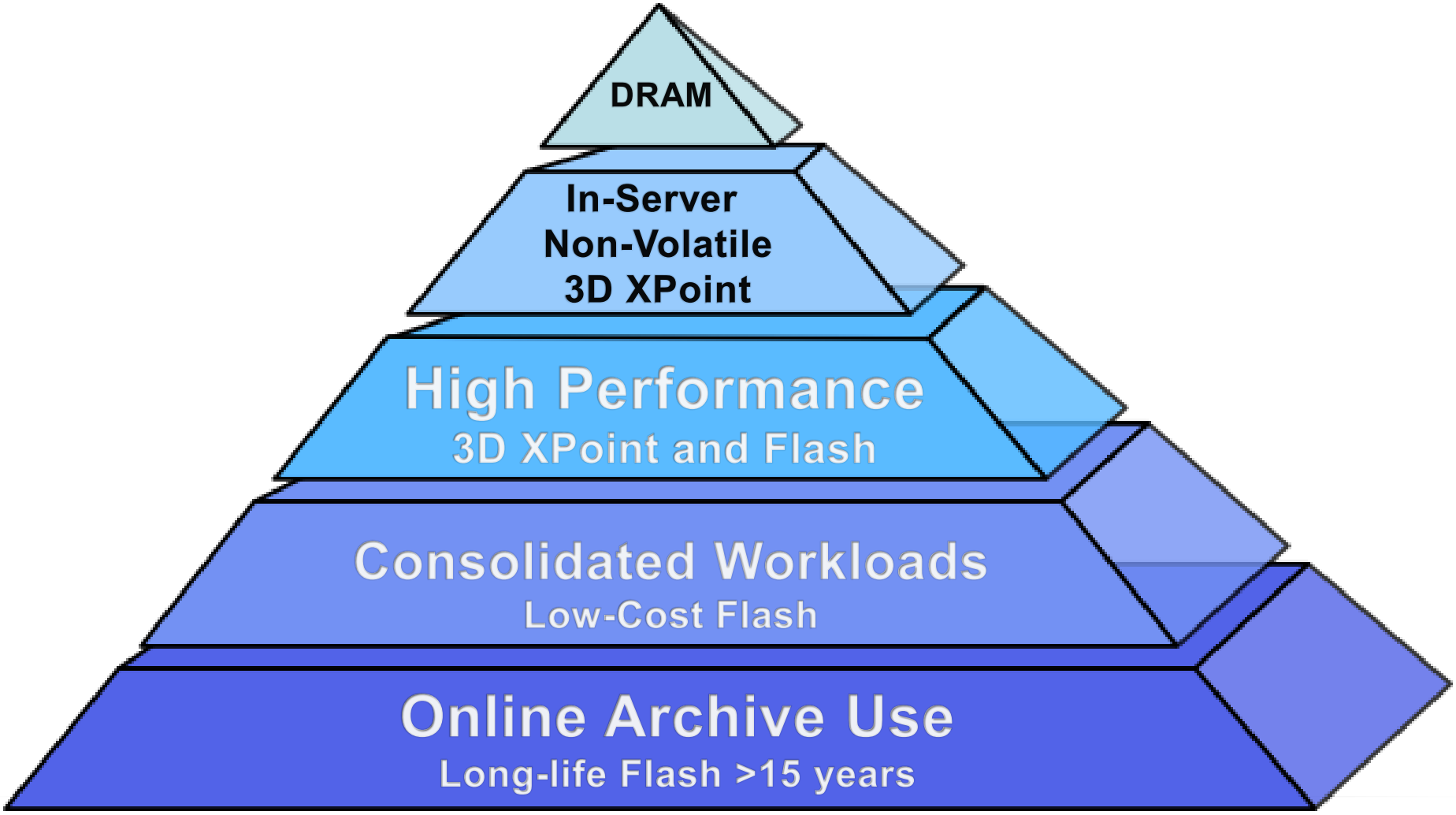
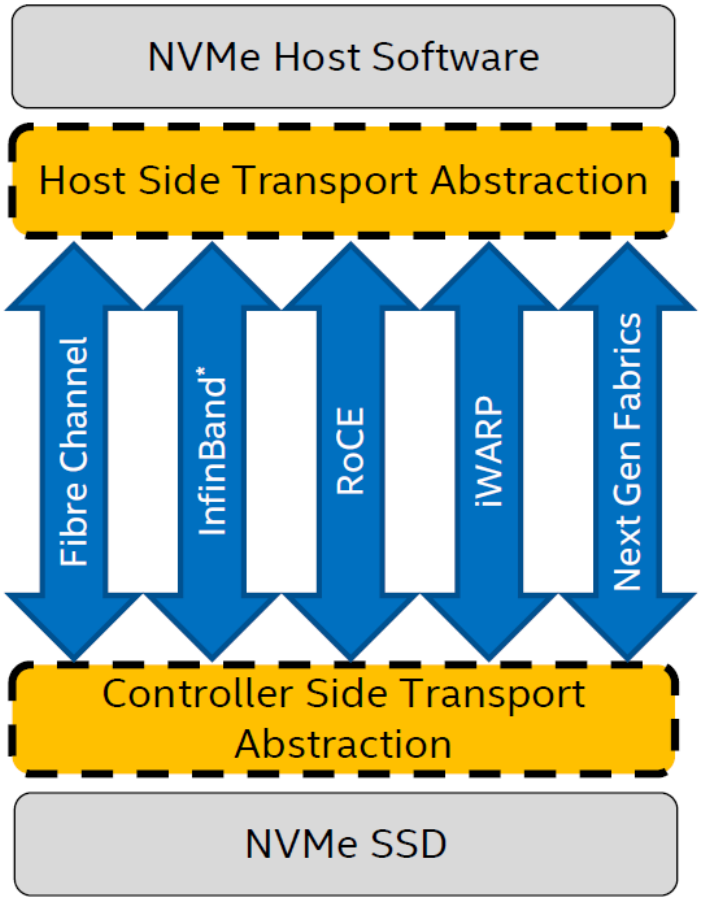
New Hierarchy of Storage with Solid State



Interfaces & Storage Network - Evolution

- Storage device connections – PCIe to controller
  - More offering by mid-year
  - Competitive by year end
- Storage system connection to server
  - Initially direct connect for PCIe
  - 2-3 years for battleground to settle – RDMA over Fabric
- Continuation of storage vs general purpose network



iWARP (internet Wide Area RDMA Protocol)
RoCE – RDMA over Converged Ethernet
NextGen - PCIe

New App, New Use, New Architectures

- Performance lends itself to new approaches for current and new applications
- Longevity changes the economics of access and management
- Still absolute need for shared storage

Service Delivery & Cloud

We've been here before

IT Shift

Efficiency

Cost Management
SLA
Operations

Service Delivery

Competitive Edge
New Business
Models
New Services

The Tipping Point for Service Delivery / Cloud Architectures

- More than half expect to devote 50% or more of their IT budgets to cloud
  - Hardware, software, and professional services for “build-your-own” private cloud
  - Operational costs for public cloud subscriptions
- Workloads cross all categories
  - Finance and Accounting systems
  - Customer Relationship Management
  - Proprietary Applications
  - Mobile, Social and Analytics inclusion

Public Cloud Adoption & Leaders

85-90% adoption rate among enterprises

Leaders:

- AWS
- MS Azure
- Google Cloud
- IBM SoftLayer

Private Cloud Adoption & Leaders

Adoption rate of 70-75% and growing

"Cloud" Software Players

- VMware vSphere
- OpenStack
- VMware vCloud Suite
- Bare Metal Cloud

Google as Hyper-scale Model

- Lights out data centers in different regions/countries
- Job types
  - Services (25% of workload) - Usually user facing and latency sensitive
  - Batch (75% of workload) - Never user facing and throughput sensitive
    - Hadoop and Big Table
  - Both run on the same physical infrastructure
- 60% CPU utilization, 50% memory utilization.
- Failure mode: A 2000 machine service sees ten crashes per day but there is no outage from the perspective of the user
  - Replaces broken things periodically
- What's hard here?
  - Building, deploying, and versioning software over time (apps, tools, automation layers)
  - Replicating system deployments to the greatest extent possible
  - Both are labor intensive

Two Modes of the Data Center

Efficiency

Traditional IT

- ❑ Server
- ❑ Network
- ❑ Storage
- ❑ IT Managed
- ❑ Self Contained
- ❑ Primarily ScaleUp

Service Delivery

New Architectures

- ❑ Self Service / Client Managed
- ❑ On - Off Premise
- ❑ Cloud Native App Tools
- ❑ Scale Out Elasticity
- ❑ Resource Pooling
- ❑ Software Based
- ❑ Ability to manage failures

Private Cloud – Presumed Outcomes

- Lower the cost of VM environment, on and off premise
- Build in-house AWS-like capability to lure business user groups back to central IT
- Improved business agility and productivity
- Infrastructure cost savings
- Improved security and compliance
- 5-10% time savings for IT management and support

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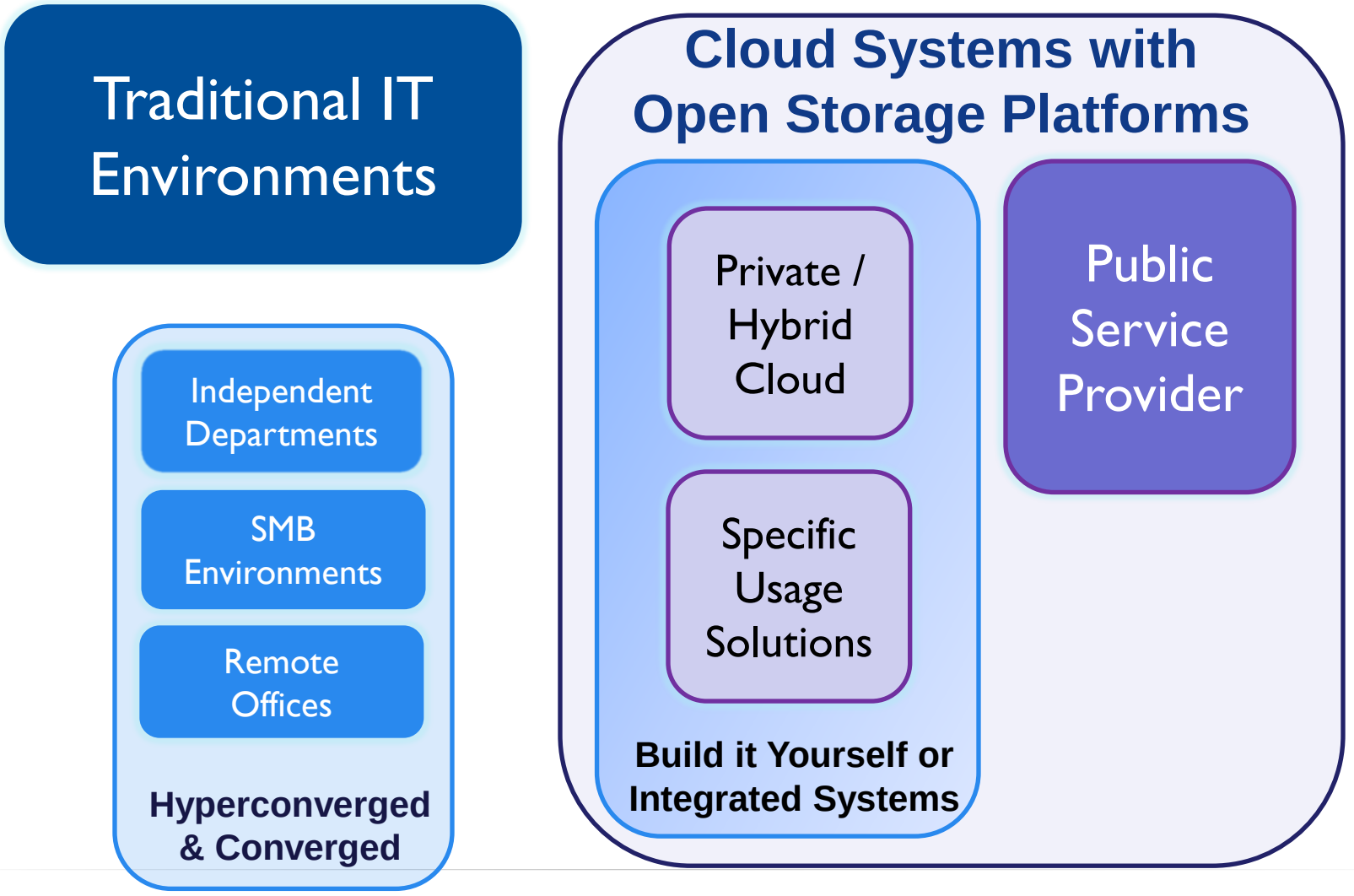
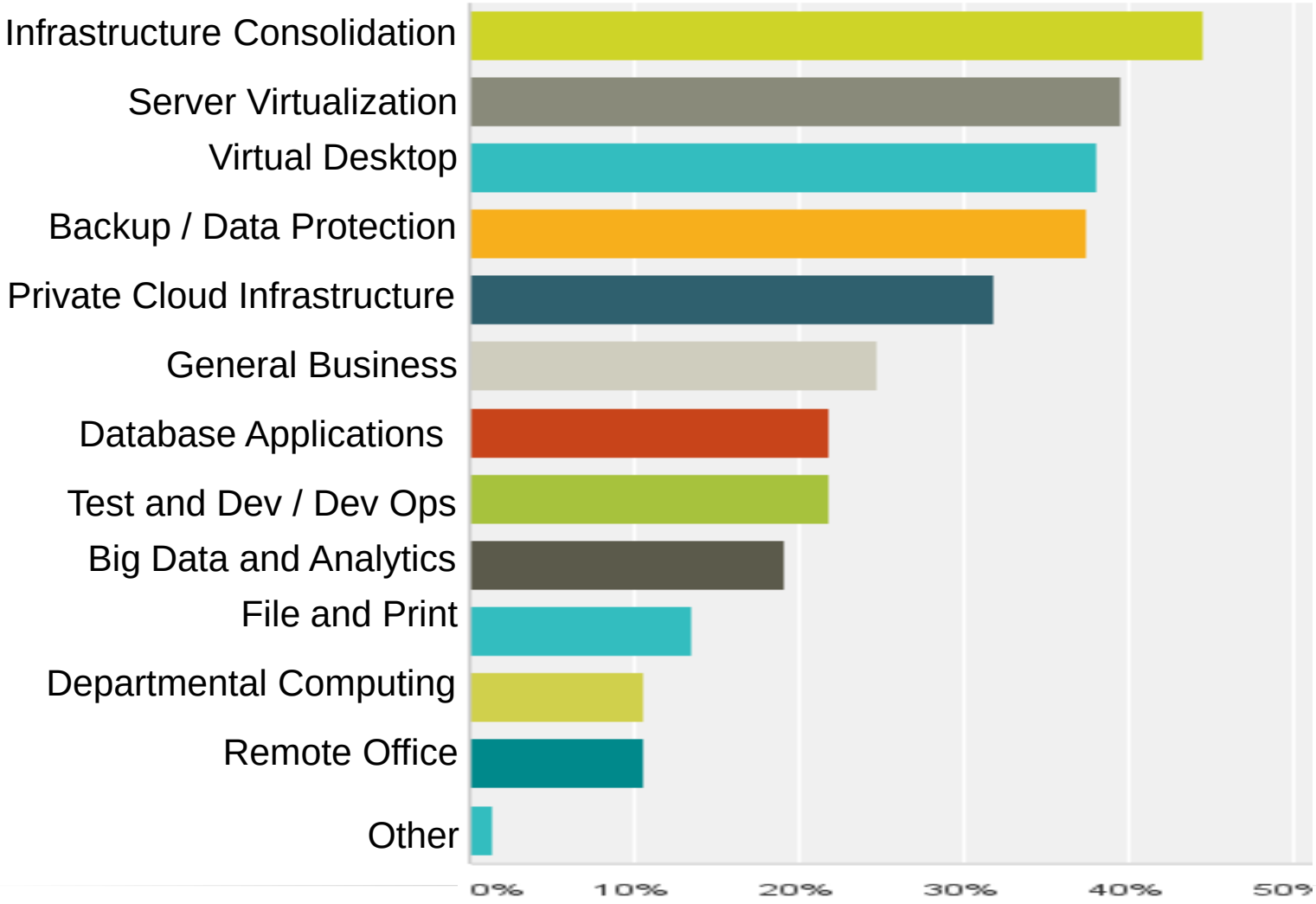
IT's Domain & Management



Hyperconverged Study, Joint Study, 2016



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Private Cloud Choices, Options & Risks

- External Private Managed Cloud
  - Contract
  - Locations
- Open Source, OpenStack
  - People costs
  - Management
  - Risk
- Hyperconverged
  - Scale?
  - Lock in
- Converged
  - Cost and lock in
- Vendor Supported Software Defined
  - People Costs
  - Risks

On and Off Premise Cloud Challenges

- Interoperability/integration challenges
- Cost of changing from current system
- OpenSource or Not?
- Which cloud model (public/private/hybrid) fits best for the business use case or application? – leads to multi cloud but creates complexity
- Security at the CSP and within the interconnecting network
- Differences in CSP business models; cloud products, services, support, and security practices
- Understanding that you can't outsource risk i.e risk of data loss/downtime/failure *always* rests with the enterprise
- Fear of "lock-in" when the wrong choice is made or business needs change
- Cost of cloud services
- Performance limitations
- Network bandwidth limitations

Data Protection

Expansion of Data Protection

- Greater capacity – mostly with unstructured data
  - With current practices:
    - More target systems / infrastructure / cost
    - More operations staff / processes / cost
    - More time spent on protection
  - Differences in value of data
    - Impacted with more data and defined values
    - Typically, only business owner can define or understand
  - Differences in activity of data

Expansion of Data Protection

- Includes maintaining integrity of data
  - Assurances
- Often includes security
  - Control of access
  - Log of access
- Access Availability

Changes in Protection Technology – Self Protecting

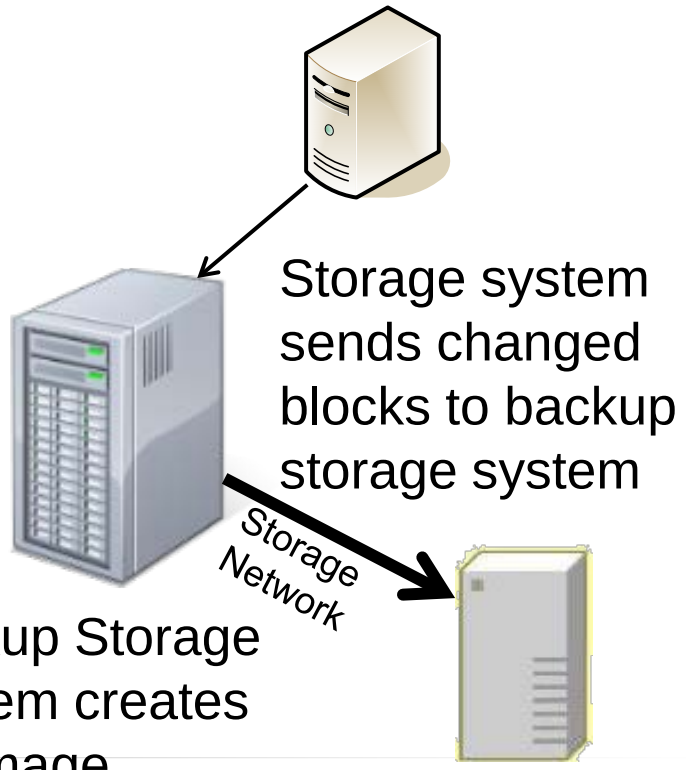
- Beyond the ability to make a snapshot or clone copy
- Storage system makes protected copies
  - Directed from application
- Replicated copies with versioning
  - Generally seen in object storage systems
  - Matter of scale

Changes in Protection Technology Integrity

- Embedded integrity checks with data
- Continuous background verification with correction

Changes: Direct Backup from Storage

- Application directed data protection
  - Agent on application server invokes backup (and restore)
  - Communication to storage system
  - Storage system moves data - changed blocks from last full backup – to backup to disk system (restore from backup to disk)
  - Backup to disk system reconstitutes full image
- Backup software not the data mover
  - Managing the catalog becomes major value
  - Snapshots / changed blocks on storage network
- Control/responsibility moved to application owner



Changes for Self-Protecting Storage

- Systems with incorporated backup software
  - Makes snapshots or clone copies on remote systems
    - Policy controls
    - Coalesced snapshots – similar to synthetic fulls
  - Examples today include some hyper-converged appliances with built-in backup software

Changes in Self-Tiering Storage

- Systems with incorporated file migration software
  - Majority are file or object based
  - Criteria established and data automatically moved
  - Recalls on access – transparently
- Some block storage systems with ability to move data to object storage (on premises or cloud)
  - Internal to system – may have internal gateway

Summary

- All sectors of IT are changing
- Efficiency and Service Delivery Drive Decisions
- Changes in technology are moving Faster then we have ever seen….

- New Skills
- New Operations
- New Risks

Thank you

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Service Delivery - Shifts

- Brings new, competitive capabilities to the enterprise
- Changes technology and the role of IT
- New opportunities for IT personnel