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
“There is a big difference between mostly dead and all dead”
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
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**
- **Serial Attached SCSI to SSDs**
- **Internal to Storage System**
- **3D XPoint for caching**
- **PCIe Extended Connections**
- **Internal connection of storage system**
- **Minimize latency – connect as memory devices**
- **Flash Controllers**
- **Flash Modules**
New Hierarchy of Storage with Solid State

- DRAM
- In-Server Non-Volatile 3D XPoint
- High Performance 3D XPoint and Flash
- Consolidated Workloads Low-Cost Flash
- Online Archive Use Long-life Flash >15 years
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
OH WOW! PARADIGM SHIFT!
IT’s Domain & Management

Traditional IT Environments

- Independent Departments
- SMB Environments
- Remote Offices
- Hyperconverged & Converged

Cloud Systems with Open Storage Platforms

- Private / Hybrid Cloud
- Specific Usage Solutions
- Build it Yourself or Integrated Systems
- Public Service Provider

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Hyperconverged Study, Joint Study, 2016

- Infrastructure Consolidation
- Server Virtualization
- Virtual Desktop
- Backup / Data Protection
- Private Cloud Infrastructure
- General Business
- Database Applications
- Test and Dev / Dev Ops
- Big Data and Analytics
- File and Print
- Departmental Computing
- Remote Office
- Other
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

Application owner / admin triggers backup

Storage system sends changed blocks to backup storage system

Backup Storage System creates full image
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 than 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