Software Defined Storage
The New Storage Platform

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IT Industry Journey - Roadmap

**Standardization**
Standard IT Infrastructure - Volume Economics HW/Syst SW
(Servers, Storage, Networking Devices, System Software (OS, MW & Data Mgmt. SW))

**Integration/Consolidation**
Integrate Physical Infrast./Blades to meet CAPSIMS
Cost, Availability, Performance, Scalability, Inter-operability, Manageability & Security

**Virtualization**
Pools Resources. Provisions, Optimizes, Monitors Shuffles
Resources to optimize Delivery of various Business Services

**Cloudization**
On-Premises > Private Clouds > Public Clouds
DC to Cloud-Aware Infrast. & Apps. Cascade migration to SPs/Public Clouds.

**Automation**
Automatically Maintains Application SLAs
(Self-Configuration, Self-Healing©IMEX, Self-Acctg. Charges etc.)

**Big Data Analytics**
Predictive Analytics - Unstructured Data
From Dashboards Visualization to Prediction Engines using Big Data.

(Welcome to the IT Industry Journey - Roadmap. This roadmap outlines the journey that organizations undertake to optimize their IT infrastructure. The journey is marked by several key stages, each focusing on specific aspects of IT management. These stages include Standardization, Integration/Consolidation, Virtualization, Cloudization, Automation, and Big Data Analytics. Each stage is designed to enhance the IT infrastructure, addressing key areas such as cost, availability, performance, scalability, inter-operability, manageability, and security.)
Data Centers & Cloud Infrastructure

Public CloudCenter®

Enterprise VZ Data Center
On-Premise Cloud

Supplier/Partner

Remote/Branch Office

Wireless

Home Networks

Internet

Core

Optical

Edge

Switches: Layer 4-7, Layer 2, 10GbE, FC Stg

FC/IPSANs

ScaleOut NAS

Database Servers, Middleware, Data Mgmt

Tier-3

Data Base Servers

Tier-2 Apps

Application Servers

HA, File/Print, ERP, SCM, CRM Servers

Tier-1

Edge Apps

Web 2.0

Social Ntwks.

Facebook, Twitter, YouTube...

Cable/DSL...

Middleware Platform

Directory

Security

Policy

Management
RAID – First SW Defined Storage 1988

RAID SW Creates Specific Storage Capabilities (HA, Performance, Cost)

**Sources:**
- Vasudeva, Anil “A Case for Disk Arrays” Presented at LAN Conference, Santa Clara, CA Aug 1988

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Workloads need Infrastructure > Optimized for Cost, Availability, Performance …
Virtualization: Impact on IT Infrastr.

Virtualization led Workload Consolidation provided >20x Savings in RE, Pwr., & Bottlenecks in Physical Servers sharing Memory

Virtualization: TCO Savings

995 Pre-Virtualization (VZ) Servers → 78 VZ Servers

Cost over 3 years

- Provisioning
- Downtime
- Disaster Recovery
- DC Real Estate
- Power & Cooling
- Network
- SAN
- Hardware

VZ SW & Support

Virtualized Server Penetration

50% of all servers in 2011 growing to 85% by 2016

Virtualization: Impact on IT Infrastr.

Worldwide Spending on Servers

Power/Cooling & Data Management

Customer Spending ($B) vs. Installed Servers (Millions)

- Physical Server Installed Base (Millions)
- Logical Server Installed Base (Millions)
- Power & Cooling Expense
- Management Cost
- Server Spending

Virtualization Gap

60 million virtual machines by 2013

Multiple VMs create I/O Blender Effect

Virtualized Server Penetration
NextGen Applications Exploding

Applications Growth 2013-17

- NextGen Cloud: 70% growth
- Traditional: 14% growth

NexGen Cloud

- HDFS / Object Storage
- Eventual Consistency
- Tolerance For Data Loss
- Software-Based Resiliency

Traditional Applications

- Block / File Storage
- Transactional Consistency
- Little Tolerance For Data Loss
- Hardware-Based Resiliency
Application’s SLA dictates the Resources Required to meet specific requirements of Availability, Performance, Cost, Security, Manageability etc.
Next IT Frontier: Big Data Analytics
Next IT Frontier: Object Storage

File

Object

File Name: CATSCANJOE SMITH
Created By: Technician 1
Created On: 01-01-2001
File Type: .DICOM

Object ID: 12345
File Type: .DICOM
Patient Name: John Q. Smith
Patient ID: 555-55-5555
Procedure Date: 01-01-2001
Physician Name: Dr. Organ
Physician Notes: .WAV File
Prior 1: XYZ.DICOM
Modality: XYZ
Manufacturer: XYZ
Diagnosis: XYZ
Description: XYZ
Custom Metadata: XYZ

Source: Dell
ITaaS: Apps leveraging SDDC/SDS

<table>
<thead>
<tr>
<th>Biz Intelligence</th>
<th>Entertainment-Social Networks</th>
<th>HPC &amp; Commercial</th>
<th>Bioinformatics &amp; Healthcare</th>
<th>Productivity/VDI</th>
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<td>Big Data</td>
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Virtualization Opens New Opportunities

Virtualization Platform Has

• Inherent knowledge of Application’s Requirements
• Global View of Infrastructure
• Is Hardware agnostic

Converged Storage Pools

Virtualization Platform
vSphere / Hyper-V / Xen / KVM /…
Need: A New Storage Architecture

1 Key Tenets of Virtualization (VZ)

<table>
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<th>Resources Utilization</th>
<th>Costs</th>
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<tr>
<td>Virtual Servers</td>
<td>63%</td>
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<tr>
<td>Physical Servers</td>
<td>15%</td>
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2 Storage Performance Issues in VZ

The VM I/O Blender – A key Culprit

Storage Underperforms in VM Environments

- Very Random, Write intensive I/Os from some VMs get blended with Sequential, Read Heavy I/Os from other VMs resulting in:
  - Degraded Storage Performance by 30-50%
- Legacy Soln: Larger, more expensive storage configs created to meet needed IOPs
  - Storage Capacity wastage
- Other Effects
  - Poor Thin Provisioning & Snapshots/Cloning
  - Inefficient VM Management

3 Solution: Storage Defined Storage

Improves Perf., Mgmt, Cost/Provisioning, Snaps

- Create a storage abstraction layer
  - Do for Storage like Hypervisor for Compute
    - Virtualizes Storage for Optimum Mgmt.
- Unlock the Performance & Wasted Capacity of Existing Storage by provisioning Storage as fast as VMS can be created
  - Improves storage performance by 10x
  - Improves Thin Provisioning & Snapshots
  - Reduces capacity consumption up to 90%
- Provide a VM-Centric Management paradigm
  - VM-Centric Management
- Integrate Seamlessly into existing Hypervisor

```
VM 1  VM 2  VM 3  VM n
  vDisk  vDisk  vDisk  vDisk

Hypervisor

Storage Hypervisor

Storage Pool
```
Storage Hypervisor: Key to SDS

### Storage Hypervisor Characteristics
Improves Perf., Mgmt, Cost/Provisioning, Snaps

- Software Solution that deploys in each Host
- Improves Storage Performance by up to 10x
- Reduces Capacity Consumption by up to 90%
- Instantly provisions high performance Storage
- Provides VM-Centric Mgmt. for Ease-of-use

### Storage Hypervisor Architecture

- Removes Random Write I/Os to remove storage IO inefficiencies from Hypervisor
- Thin-Provisions vDisks to Outperform VMDKs to cut storage costs in half
- Enable CDP making fast and scalable High Performance Snapshots/Cloning
- Provides Instant Provisioning of High Performance Storage
- Provides transparent VMDK level Mgmt.
- Lowers VDI Costs/desktop by 50%
Storage Hypervisor Overview

• **Automated Storage Management** - Storage Policies per VM derived from App/WorkLoad Requirements
• **Integrated** with Hypervisor & Managed in vCenter
• **SLA** Requirements per VM managed by Intelligent Data Placement
• **Instant Storage Provisioning**
• **Built-In Resiliency/Protection** from HW failures
• **Dynamic Scalability** to Grow from TB to PB

Storage designed for VMs

Dynamic, Fast & Resilient

50% Lower TCO
Software Defined Storage:
Bringing Operational Mode of Compute to Storage

Software-Defined Storage

Policy-Driven Control Plane

App-Centric Data Services

Virtualized Data Plane

Software-Defined Data Center
All infrastructure is virtualized and delivered as a service, and the control of this data center is entirely automated by software.

Software-Defined Storage
Heterogeneous storage resources are abstracted into logical pools, consumed and managed through app-centric policy-based automation.
SDS Drives App-Centric Data Services

VM Storage Policy
- Capacity
- Performance
- Availability

De-Dupe
Replication
Snapshots
Caching
Compression
Encryption
Back Up
Storage Hypervisor (vSAN)

Key Features
- Policy-driven per-VM SLA
- vSphere & vCenter integration
- Scale-out storage
- Built-in resiliency
- SSD caching
- Converged Compute & Storage

Key Components
- Hybrid storage system which leverages Aggregates local SSD’s as a cache and local HDD’s to provide a distributed data store for VM consumption
- Distributed object-based RAIN architecture provides no single point of failure
- Fully integrated with vCenter, HA, DRS, vMotion
- Scale-Out Storage: 3-8 nodes in 1.0, >8 planned for near future
Self-Tuning Dynamic Storage for VMs

Instantly provision VM storage using simple policies.

Each VM maintains its unique policy in the clustered VSAN datastore.

Storage capacity and performance scale dynamically with your cluster.
SDS-Control Plane Automates & Manages

vCloud Automation Center

Control Plane

Data Plane

Block Storage  File Storage  Object Storage

Scale Out NAS Storage  High End Storage  Mid-Range Storage  Open Storage

1. Manages Data Plane... And Arrays Directly
Standardize Management Across Existing & New Architectures

2. Integrates With OpenStack & Hyper-V

Virtualization & Management Of Storage Drives Efficiency
**SDS is a Programmable Platform**

- **vCloud**
  - Infrastructure & Application Software Vendors
  - REST APIs
  - REST APIs

- **Control Plane**
- **Data Plane**
  - Block Storage
  - File Storage
  - Object Storage

- Scale Out NAS Storage
- High End Storage
- Mid-Range Storage
- OpenStack Storage
VM Storage Policies Built in Advance

- Capacity
- Performance
- Availability

VM Storage Policies are built in advance of VM deployment to reflect the requirements of the applications running in the virtual machine.

- The policy is based on the VSAN capabilities.
- Thus the policy comprises of only VSAN capabilities.
- The appropriate policy is selected for the VM at deployment time (based on VM requirements).
vDataStore Capabilities visible to vCenter

1. At the time **vSAN Cluster** is created, the capabilities available in **vSAN Datastores** are read and automatically sent to **vCenter**

2. vCenter looks at these capabilities available in Datastores and sets **VM Storage Policies**

3. **VM Storage Policies** then have the Requirements of the Application running on the VM (Requirements such as Availability, Performance and Provisioning etc.)
New Role of IT: ITaaS

**Virtual Workspace**
Manages Access to Services, Applications and Data for Any Device

**Hybrid Cloud**
Seamlessly Extends Data Center to Public Cloud

**Software-Defined Data Center**
Virtualizes the Entire Data Center

**Automation & Management**
- Storage & Availability
- Compute
- Network & Security
ITaaS - From vCenter to vStores
ITaaS Cloud Model using SDDC
Outlook: Software Defined Storage

SDS - Key to “Next Big Thing in ITaaS”
Built-In strong features for Virtualized Data Centers & Cloud Federation

SDS Features

- Services Based Infrastructure provides Automation, Unifies Control and Efficiency
- Provisioning via Policies and Workload-aware services to match specific requirements of Each App
- Utilizes Open Standards and Interfaces based resilient, commodity Data Storage deployable on any platform of choice
- Covers full spectrum of block, file and object storage
- Cost-effective and Highly Automated
- Highly Scalable (Capacity, Throughput, Performance)
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The New Storage Platform

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