Hyper Converged and Converged Storage Platforms for ERP

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Agenda

- Introduction
- ERP systems @ Honeywell
- Storage @ Honeywell
- New Data Center Transformation (SAN Free) – Private Cloud
  - Hyper Converged Platform
  - Converged Platform
- Conclusion
Honeywell Overview

Unmatched Scope of Offerings
- Mechanical, Cockpit, and Software Offerings From Nose to Tail
- Apps, Services, Maintenance, Subscriptions
- End-to-End Connectivity Solutions From Hardware to Airtime
- Turbochargers for Fuel Efficiency

Connecting Homes and Buildings
- Security and Fire
- Connecting Homes With Lyric™
- Open Software Connecting “Internet Of Things” in Buildings

Winning Technology
- Refining and Petrochemical Catalysts
- Gas Processing Modular Offerings
- Solstice® LGWP Materials
- SmartLine Transmitters
- Asset Optimization Software

Connecting Workers
- Wireless, Voice, Mobility, Data Analytic Solutions for Workers
- Warehouse Automation
- Keeping Workers Safe

Aerospace
$14.8B Sales
Home and Building Technologies
$10.7B Sales
Performance Materials and Technologies
$9.3B Sales
Safety and Productivity Solutions
$4.6B Sales

Reflects 2016 Full Year Results

NYSE: HON | ~1,300 sites | ~131,000 employees | Morris Plains, N.J. headquarters | Fortune 100
Honeywell is building a smarter, safer, and more sustainable world.

THAT'S THE POWER OF CONNECTED.
THAT'S THE POWER OF HONEYWELL.

Connected Aircraft | Connected Automobile | Connected Home | Connected Building
Connected Plant | Connected Supply Chain | Connected Worker

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The forward-looking statements included in this release are also subject to a number of material risks and uncertainties, including but not limited to economic, competitive, governmental, and technological factors affecting our operations, markets, products, services and prices. Such forward-looking statements are not guarantees of future performance and actual results, developments and business decisions may differ from those envisaged by such forward-looking statements. We identify the principal risks and uncertainties that affect our performance in our Form 10-K and other filings with the Securities and Exchange Commission.
Honeywell Spin Offs

We lead the development of innovative and differentiated solutions which empower the transportation industry to redefine and further advance motion.

- Turbochargers
- Electric Boosting
- Automotive Software
ERP systems at Honeywell

- Primary ERP: SAP
  - 180 systems.
  - Global Users.
  - Very Large Storage Footprint. Few databases in 40~60 TB range.
- Other ERP:
  - Oracle
  - People Soft
SAP on SAN Storage - Hitachi

Use: Mission Critical – Core
Virtualized: Yes
Thin Provisioned: No
Performance: Highest
Availability: Highest
Replication: Local & Remote
Snapshots: 6 Rolling Copies Taken Every 4 Hours

Legend:
- Virtualization Logical Connection
- Async or Point-in-Time Copy
- Full Copy
- Space Efficient Copy
- Virtual Volume

NetApp 3160
SAP DR Replication Architecture - Hitachi

Honeywell Replication Infrastructure
Hitachi Universal Replicator (HUR)
11/1/2010

DCW
USP-V

Cisco 9513

OC-48
2Gbps

Cisco 6509

FC

FCIP

Cisco 6509

FC

FCIP

Cisco 6509

OC-48
2Gbps

Cisco 9513

DCE
USP-V

Cisco 9513
SAP on Preconfigured Platform - VCE

VBLOCK = Cisco UCS Compute + Cisco Network + EMC Storage + VMware

Primary - Production
VMware – 528 cores x 14336 GB RAM
Physical – 120 cores x 6 TB RAM
Storage – 178 TB

Secondary – Dev/QA/DR
VMware – 468 cores x 12288 GB RAM
Physical – 120 cores x 4 TB RAM
Storage – 263 TB

Disaster Recovery
Performance Characteristics

- **Metrics**
  - db file sequential read
  - log file sync
  - IOPS

- **Factors**
  - Batch Jobs
  - Data Warehouse ETL
  - End Users
  - 1 GB Network
New Data Center Transformation

- Primary Data Center is 25 years old
- Majority physical servers with SAN storage
- 1 GB Network connectivity (with few exceptions)
- Secondary Data Center is less than 10 years old but was modeled after the primary data center
- New Data Center: Designed for a private cloud with technology modernization in the areas of network (40 GB to 100 GB backbone), storage and scalable infrastructure.
- Similar design in both primary and secondary locations.
Hydro Converged Platform

More Software-Defined
(Toward Commodity Compute, Storage, Network)

- Hyperconverged
  Software-Defined
  Integrated System

- EVO:RAIL,
  Nutanix, SimpliVity

- Oracle Exadata
  (ZFS)

More Monolithic

- HP Converged System
- VCE Vblocks
- Hitachi, Fujitsu, Unisys,
  Others

- Hardware-Led
  System Integration

More Hardware-Defined

- HP Moonshot
  Future (Dell,
  Others)

- FBC (Hardware-Led
  Convergence With
  Disaggregation)

More Modular

Source: Gartner (May 2015)
Hyper Converged Platform

- Flash Nodes – Dell Nutanix XC630
  - CPU: 2 x 14 cores
  - Memory: 1.5 TB
  - SSD: 10 x 1.6 TB
- Hybrid Nodes – Dell Nutanix XC730XD
  - CPU: 2 x 14 cores
  - Memory: 1.5 TB
  - SSD: 4 x 1.6 TB
  - Hard Drive: 20 x 2 TB
Hyper Converged Platform - Overview

VMWARE

CPU/MEMORY

Virtual Storage

CPU VM CPU VM CPU VM CPU VM CPU VM

MEM STOR MEM STOR MEM STOR MEM STOR MEM STOR

NODE NODE NODE NODE NODE NODE
Hyper Converged Platform - Network

Spine

2 x 10 GB

40 GB

Leaf

2 x 10 GB

2 x 10 GB

2 x 10 GB

2 x 10 GB

2 x 10 GB

2 x 10 GB
Hyper Converged Platform1 - Capacity

**DR**
- PROD Nutanix Platform (Flash)
  - 168 cores
  - 9TB of RAM
  - 48TB of SSD

**Primary**
- PROD Nutanix Platform (6 Nodes - Flash)
  - 168 cores
  - 9TB of RAM
  - 48TB of SSD

- Non-PROD Nutanix Platform (16 Nodes - Hybrid)
  - 448 cores
  - 24TB of RAM
  - 300TB of Disk

**Recover Point for VMs (RP4VM)**
Hyper Converged Platform2 - Capacity

Primary

- PROD Nutanix Platform
  - (6 Nodes - Hybrid)
  - 168 cores
  - 9TB of RAM
  - 48TB of SSD

DR

- PROD Nutanix Platform
  - (6 Nodes - Hybrid)
  - 168 cores
  - 9TB of RAM
  - 48TB of SSD

Recover Point for VMs (RP4VM)
Hyper Converged Platform - Benefits

- Performance for work loads that fit a single node (<16TB for nodes with SSD).
- Compression at the storage level (good for databases).
- Deduplication at the storage level (good for application servers).
- Free Acropolis hypervisor (no need to use VMWare) that is fully supported by SAP.
- Replication for DR possible without additional software or tools.
- Proactive detection of h/w failures.
Hyper Converged Platform - Limitations

- Compute and Memory limitations due to having only 2 CPUs.
- Performance bottlenecks if the work load requires storage that doesn’t fit a single node.
- Adding storage or compute or memory requires adding a node with all three components (storage only nodes have been introduced recently).
Converged Platform - Storage

- Flash Nodes – Dell ScaleIO Ready Node R640
  - CPU: 2 x 12 cores
  - Memory: 96 GB
  - SSD: 10 x 1.92 TB

- Hybrid Nodes – Dell ScaleIO Ready Node R740XD
  - CPU: 1 x 12 cores
  - Memory: 192 GB
  - SSD: 2 x 1.92 TB
  - Hard Drive: 22 x 2.4 TB
Converged Platform - Compute

- Dell R940
  - CPU: 4 x 24 cores
  - Memory: 3 TB
Converged Platform - Overview

VMWARE

CPU/MEMORY

Virtual Storage

MDM
Converged Platform - Network

Leaf

Spine

100 GB

2 x 40 GB

2 x 40 GB

2 x 40 GB

2 x 40 GB
Converged Platform 1 - Capacity

**DR**
- Dell-EMC Compute
  - 576 cores
  - 18 TB of RAM
- Dell-EMC Storage
  - 411TB of SSD (53 Nodes)
  - 144TB of Hybrid (8 Nodes)

**Primary**
- Dell-EMC Compute
  - 1024 cores
  - 36 TB of RAM
- Dell-EMC Storage
  - 361TB of SSD (46 Nodes)
  - 612TB of Hybrid (32 Nodes)

Recover Point for VMs (RP4VM)
Converged Platform2 - Capacity

Primary

- Dell-EMC Compute
  - 576 cores
  - 24 TB of RAM
- Dell-EMC Storage
  - 234TB of SSD (30 Nodes)
  - 162TB of Hybrid (9 Nodes)

DR

- Dell-EMC Compute
  - 384 cores
  - 12 TB of RAM
- Dell-EMC Storage
  - 234 TB of SSD (30 Nodes)

Recover Point for VMs (RP4VM)
Converged Platform - Benefits

- Independently scalable Compute and Storage.
- Performance is also scalable by addition of nodes.
- Dynamically add and remove nodes.
- Automatic rebalance when nodes are added or removed.
Converged Platform - Limitations

- Compression and deduplication features not available yet.
- Additional features offered by the platform not available through VMWare hypervisor (storage snapshots for example).
- Single storage pool has a limit of 512 volumes.
Conclusion

- Smaller work-loads benefit from Hyper Converged Platforms
- Larger work-loads require Converged Platform to manage the performance characteristics.
- Cost comparison between the two: Depends on workload size.