Case Study: Increase SQL Server Performance 20x

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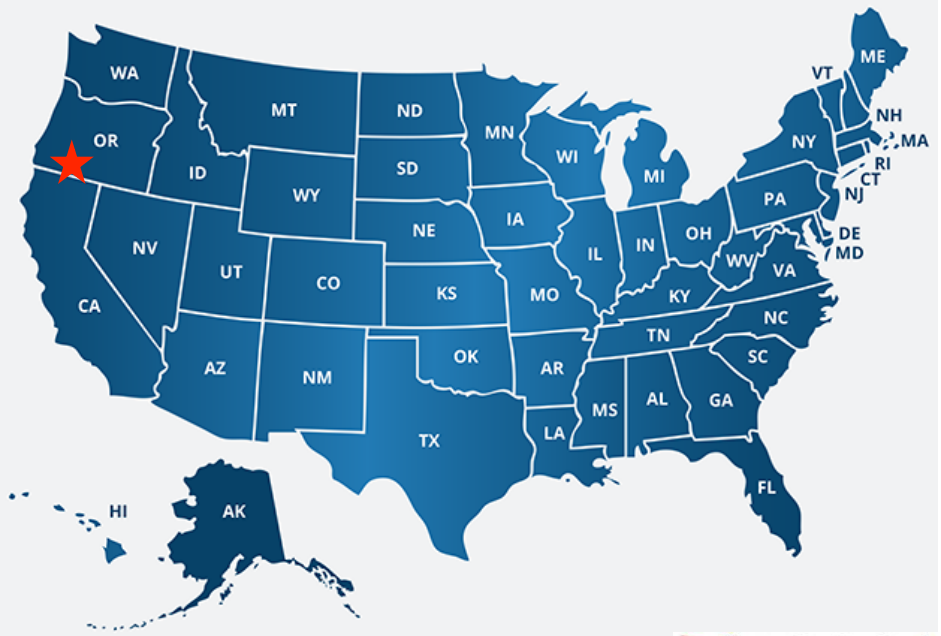
Emergency Communications of Southern Oregon

- Located in Jackson County on the southern Oregon border
- Serves an estimated population of 200K over 2.8K square miles
- Receives over 300K calls per year
- 40 Dispatchers with 12 administrative staff
- Works with 30 agencies covering Fire, Law enforcement and Emergency Medical agencies



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Key Challenge: SQL Server Performance

- Mission-critical application: Call dispatch application built on MS SQL Server
  - Enter 911 call details
  - Query databases to access call and case histories
  - Find the closest unit to send for help using GPS
- Application was unable to keep up with dispatcher
  - The dispatcher would have to wait for queries or commands to finish
- Root cause analysis showed bottleneck was storage
  - Multiple times per day, latencies were 200ms+

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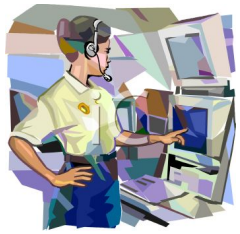
Simplified View of the Dispatch Application

Call Taker inputs call information to database (create to entry)



Microsoft® SQL Server®

Dispatcher receives priors and premise information

Call summary sent to Responders' phone

Call details sent to Responders' laptops

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ECSO Call & Dispatch Goals

- Law Enforcement – Dispatch Benchmarks (Priority E & 1)
  - Processed within 90 seconds, 90% of the time (Creation to enter)
  - Processed within 120 seconds, 95% of the time (Creation to enter)
- Emergency Medical – Dispatch Benchmarks (Priority E & 1)
  - Processed within 90 seconds, 90% of the time (Creation to entry)
  - Dispatched to the appropriate agency(s) within 30 seconds, 90% of the time (Entry to dispatch)
- Fire – Dispatch Benchmarks (Emergency fire incidents)
  - Processed and dispatched within 90 seconds, 90% of the time (creation to dispatch)
    - Create to Entry = 60 seconds
    - Entry to Dispatch = 30 seconds
  - Processed and dispatched within 120 seconds, 95% of the time (creation to dispatch).
    - Create to Entry = 90 seconds
    - Entry to Dispatch = 30 seconds

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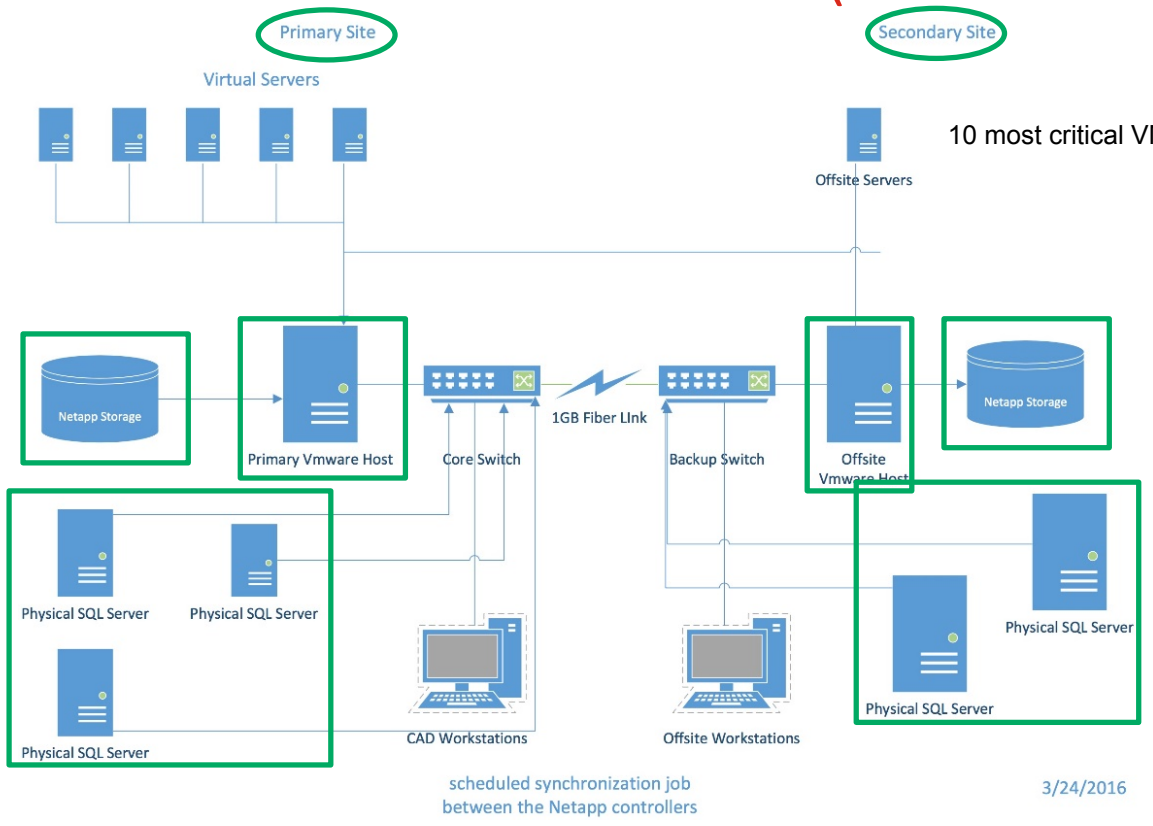
ESCO IT Infrastructure (Previous)

Virtualized Infrastructure
- 1 host each at primary and secondary
- 25 VMs: Standard business applications, Active Directory and Exchange

Physical Servers
- SQL Server was NOT virtualized due to inadequate storage performance
- SQL Server hosts were clustered (DAS)



Storage
- NetApp FAS2240-4 at primary and secondary (24TB each)
- Scheduled synchronization job periodically depending upon the importance of the data
- For critical data, job ran every 15 minutes
- Most data was 12 hours old

Alternatives Considered

Software

- ESXI accelerator software (PernixData, Infinio)
  - Not enough performance; didn't address availability
- VMware vSAN software
  - Expensive; incompatible with existing hardware
- Zerto
  - Didn't address performance

Hardware

- New storage arrays
  - NetApp
  - Pure Storage
  - Nimble Storage
    - Decent performance but not a huge increase

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Testing I/O Performance

- Used Iometer
  - Block sizes: 2K, 4K, 8K, 32K, 64K, 128K, and 256K
  - Options: Random vs sequential / Read vs write
- 28 total runs
  - 2K, Random, Read
  - 2K, Random, Write (and so on)
- Note: Same VM was used in testing, but hardware was different
  - NetApp had separate servers and storage
  - DataCore hyperconverged had combined server and storage
    - Same servers generating I/O load had to handle it

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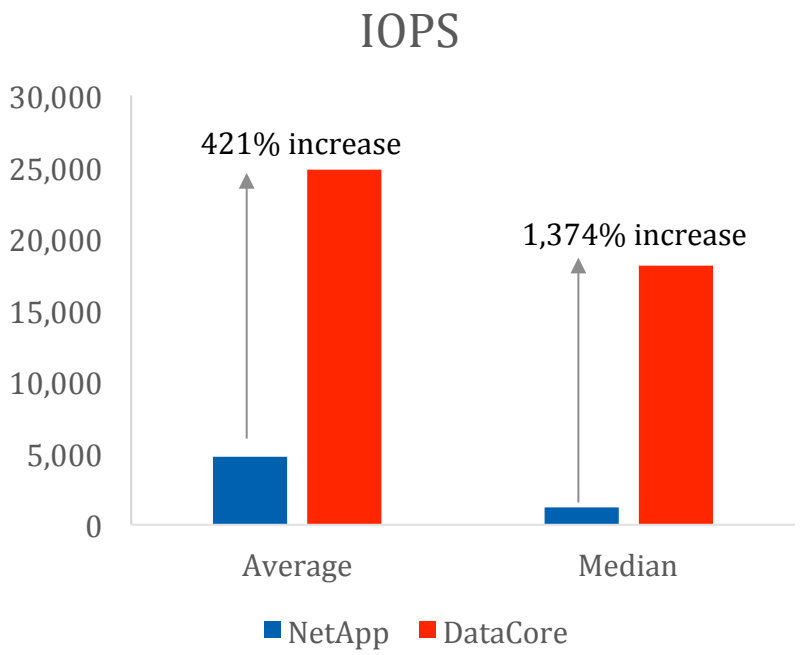
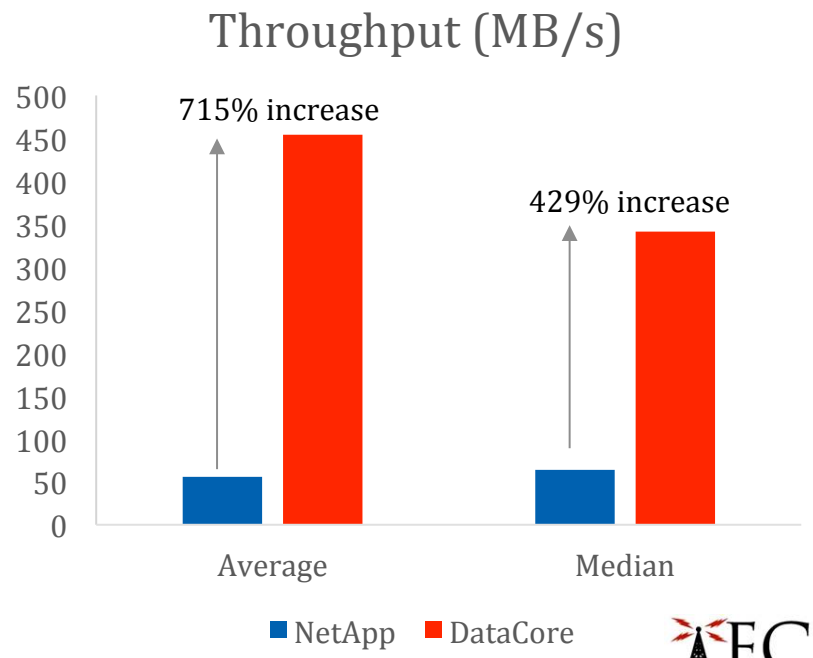
Comparison of I/O Performance





Summary of Performance Improvement

- Numbers
  - In Production: 20x improvement in latency (on average)
    - Previously, peak latency was 200ms and hit multiple times per day
    - Current peak is less than 5ms
  - In Lab: 4x to 14x performance increase
    - In some cases 100X improvement in IOPS and Throughput
- Anecdotes
  - Dispatchers no longer complain about the input lag they were experiencing
  - Able to vMotion virtual machines to secondary site for maintenance and users unaware they are no longer running on primary site

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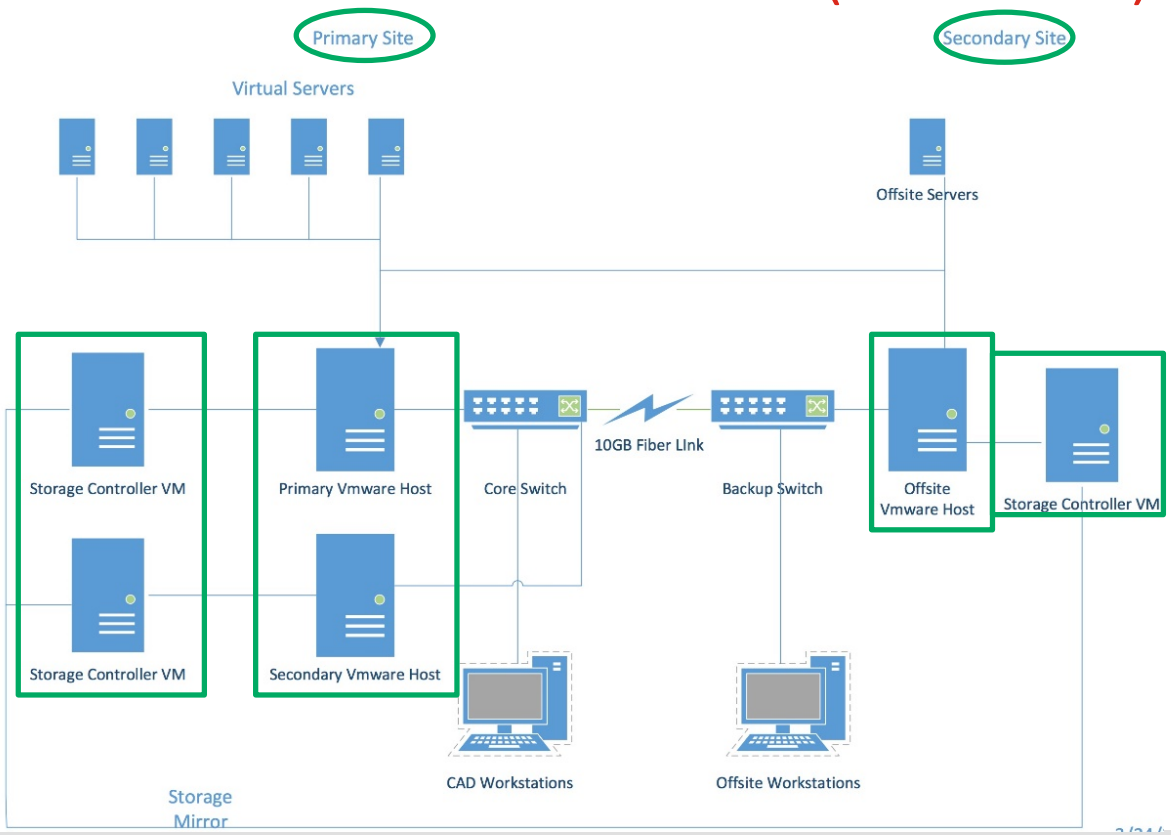
ESCO IT Infrastructure (Current)

Hosts
- SQL Server instances were virtualized
- Went from 5 total servers (2 virtual + 3 physical) down to 2 virtualized hosts

Storage
- DataCore Hyperconverged Virtual SAN (1 per host) with direct-attached storage
- Data is synchronously mirrored to DR site
- 911 calls, radio traffic, and critical SQL Server data are using CDP
- NetApp storage became tier 3 (archive)



Hosts
- Went from 3 total servers (1 virtual + 2 physical) down to 1 virtualized host

Cost Benefits

Lower Costs

- 60%+ less infrastructure
  - Reduced hosts from 8 to 3 and eliminated external storage for production data
  - Save on administration time and PCSE
- Saved ~$100K on SQL Server licenses
  - Change to per core licensing was going to cost ~$120K with physical hosts
    - Each physical host was single processor with 12 cores (5 servers x 12 cores)
  - By virtualizing SQL Server, able to control number of cores
    - 1 VM with 8 vCPUs – Cores and 2 VMs with 4 vCPUs – Cores (total of 16 vCPUs – Cores)
  - Better performance enabled consolidation of instances
    - Went from 5 physical servers to 3 VMs
  - ~$25K in license costs afterwards

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DataCore
Hyperconverged Virtual SAN

I/O Performance determines Use Cases for Hyperconverged

- Hyperconverged has been used primary for VDI and ROBO
  - VDI environments typically require 200K IOPS
- Databases and other Tier 1 workloads require much more I/O performance and low latency
  - 1M IOPS or more are needed
  - Key metric is latency

Sources: IDC

SPC Performance Benchmark: Database I/O Workload

Criteria	SPC Benchmark
Industry Standard	✓
Independently Verified & Audited	✓
Peer Reviewed	✓
Covers different types & generations of technology	✓
Maps to “real world” performance (OLTP databases)	✓
Shows cost for achieving performance level	✓

Enterprise Vendors run SPC Benchmarks

DataCore: First Hyperconverged product to run SPC-1

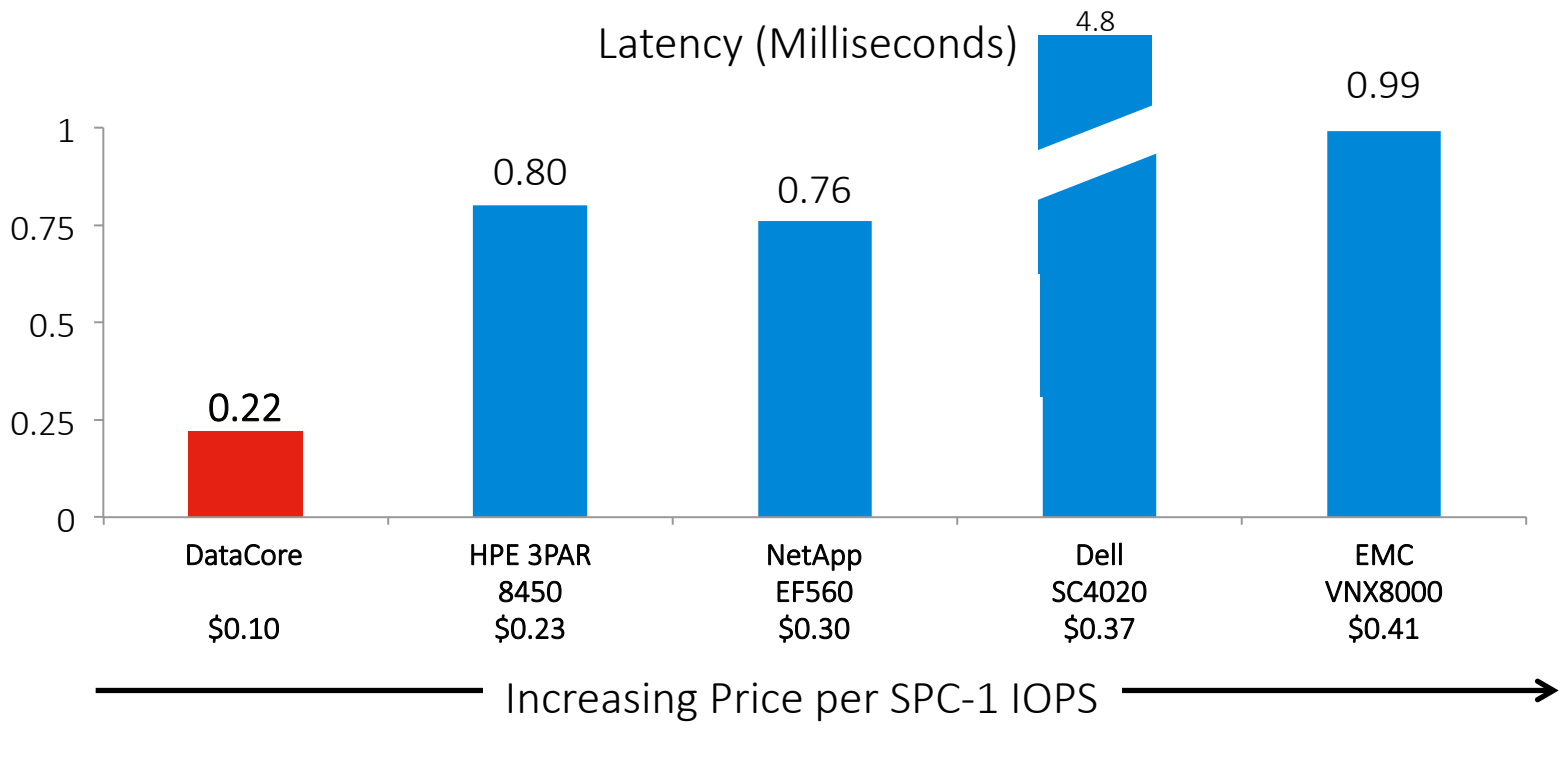
World Record Results!

PERFORMANCE	PRICE-PERFORMANCE	RESPONSE TIME
1.2 million SPC-1 IOPS™	**$0.10 Per SPC-1 IOPS™**	**0.22 milliseconds**
Highest Productivity	Unmatched Economics	Ultra Fast Applications

High-Availability / Multi-Node / Fibre Channel

Source: Storage Performance Council SPC-1 Benchmark as of Nov 3, 2016[1]

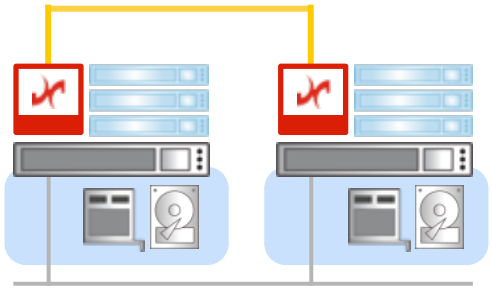
DataCore Hyperconverged is Faster than AFAs



DataCore Ran Both SPC-1 Database Workload + Storage Load at SAME Time!

Hyperconverged SPC-1

All-inclusive Price (HA 2 Nodes)

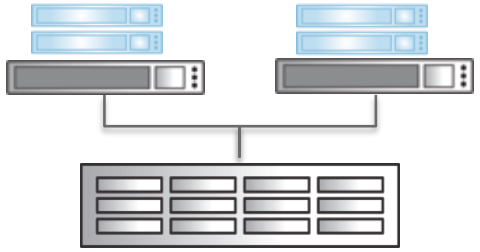


DataCore™ SOFTWARE

1.2M IOPS

$115K

Traditional SPC-1



Servers Not Included in Price

SAN (Only Partial Price)

EMC²

435K IOPS

$177K

1.2M IOPS	>>	435K IOPS
$115K	<<	$177K

Storage Performance Council

Source: Storage Performance Council SPC-1 Benchmark as of Nov 3, 2016[2]

DataCore Benefits

IMPROVE PERFORMANCE

Improved performance by
3X or more

REDUCE DOWNTIME

Reduced storage-related downtime by
50% of more

INCREASE UTILIZATION

Reduced storage-related spending by
25% or more

SAVE MONEY

In the first year,
positive ROI

Research by TechValidate

PROVEN. GLOBALLY.

30,000+ DEPLOYMENTS WORLDWIDE

10,000+ Customers

10th Gen Product

Companies in all Industries & Sizes

Software-defined Storage & Hyperconverged

Technology: Storage Virtualization & Parallel I/O

Main Offices

- Australia
- France
- Germany
- Japan
- UK
- USA

Next Steps

- Try DataCore Hyperconverged Virtual SAN in your environment
  - Speed up critical applications & consolidate your infrastructure
- Schedule a 15-minute live demo with one of our Solution Architects
  http://info.datacore.com/LiveDemo
- Download Free Trial of DataCore™ Hyperconverged Virtual SAN
  http://www.datacore.com/resources/free-hyperconverged-virtual-san

Thank You!

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www.datacore.com

Other Challenges
(aside from storage latency)

Better Availability

- RPO goal of 0 (no data loss)
  - Wanted synchronous replication to DR site
- RTO goal of 30 mins
  - Still long time for emergency communications to be down
  - Wanted vMotion to DR site when needed
- Able to test failover and failback

Lower Costs

- Continue using existing NetApp storage (only a year and half old)
- Needed new hosts with additional compute and memory
- Wanted a single pane of glass for management

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Availability & Flexibility Benefits

Better Availability

- Synchronous replication between hosts so RPO is 0 (no loss of data)
- RTO is time to restart VMs

Increased Flexibility

- Added memory to increase Cache
- Adding NVME to add storage tier
- SQL Servers are now virtualized

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Real-World Availability Situation

- UPS at primary site was to be replaced
- Would knock out power for 6-10 hours to primary site
- All VMs were “vMotioned” to secondary site in 10 minutes
  - Users were able to continue accessing applications
  - No performance degradation (completely transparent to them)
- Once UPS was replaced, all VMs were “vMotioned” back to primary site
  - Started at midnight, back to primary by 9am
- Storage is no longer a single point of failure, with no data loss due to outages

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