

Pivot3 Surveillance Technology Overview



John Gormally
Area Executive
Pivot 3, Inc



Agenda



Pivot3 Company Overview

Surveillance Infrastructure Options

Pivot3 Solutions

OEM Program Overview

Q & A

Pivot3 Overview



Company

- Founded in 2003 by storage industry veterans from Compaq, Adaptec, VMware
- Inventors of Software Defined Storage
- 20 Key Technology Patents
- #1 Surveillance Market Share in IP SAN Storage
- Global Sales and Partnership Presence
- Over 1,600 Customers and 220PB Deployed

Purpose-Built Hyper-Converged Infrastructure

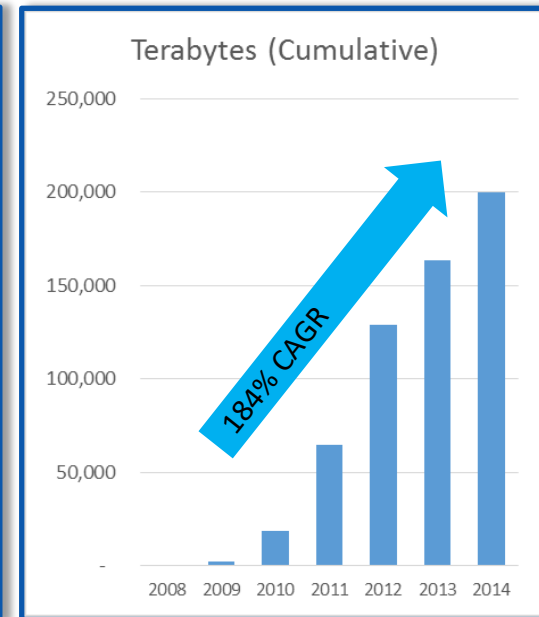
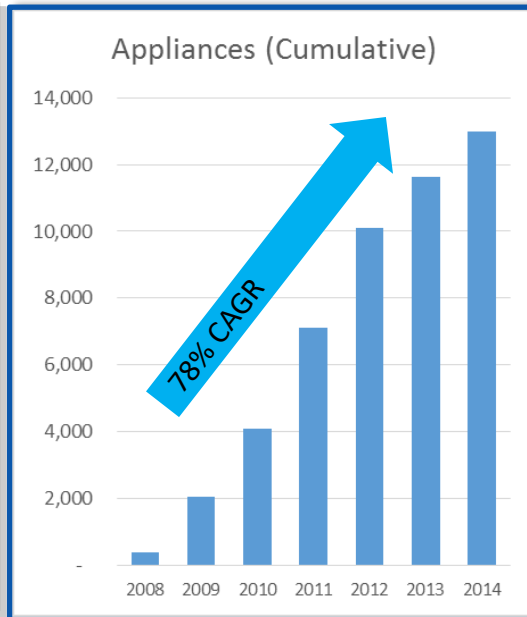
SAN Storage
Compute
Virtualization
Mobility



Video Surveillance
Virtual Desktop
Backup and Disaster Recovery



First in Hyper-Converged Infrastructure



Proven Experience



Gaming

CASINO ARIZONA

HAUTE PALACE CASINO

GULFSTREAM PARK

THE 101 CASINO

TREASURE ISLAND Las Vegas

MGM GRAND

Chumash Casino RESORT

planet hollywood RESORT & CASINO • LAS VEGAS

CHOCTAW CASINO | HOTEL

CREEK NATION Casino

Chinook Winds CASINO RESORT

MAGIC CITY CASINO

TWIN RIVER CASINO

CALDER CASINO & RACE COURSE

RIVER SPIRIT Casino

Commercial / Enterprise

SAFeway

BEST BUY

Kroger

Bank of America

kaneka

Apple

NAVISTAR

NOVARTIS

NVIDIA

Nintendo

PPG

verizon

FedEx Ground

GIANT

Rhodes PHARMACEUTICALS

PURDUE

Transportation

Toronto Pearson

Tampa International Airport

Green Airport

M metro

Metra

The way to really fly.

OMA

Port of Seattle

INTERCONTINENTAL 40 YEARS OF FLIGHT BUSHIAN

Massachusetts Bay Transportation Authority

Nashville MTA

Government

PORTLAND HOUSING AUTHORITY

CLACKAMAS COUNTY

U.S. Department of Justice Drug Enforcement Agency

REGISTERED POLICE DEPT

U.S. ARMY

U.S. DEPARTMENT OF HOMELAND SECURITY

IRS Department of the Treasury Internal Revenue Service

UNITED STATES COAST GUARD 1990

WEST VIRGINIA POLICE

CITY OF CHICAGO POLICE DEPARTMENT INCORPORATED 4th MARCH 1837

NEW YORK STATE POLICE

CITY OF PHILADELPHIA

LOS ANGELES POLICE DEPARTMENT FOUNDED 1911

BOSTON HOUSING AUTHORITY

TORONTO

Higher Education

FORDHAM UNIVERSITY THE JESUIT UNIVERSITY OF NEW YORK

HARVARD

MICHIGAN STATE UNIVERSITY

NOVA SOUTHEASTERN UNIVERSITY

THE UNIVERSITY OF TEXAS AT AUSTIN

SMITHSONIAN COLLEGE

INDIANA UNIVERSITY

NICHOLS COLLEGE

ADDELPHI UNIVERSITY

Tulane University

Healthcare

FAIRVIEW

Parkland

Texas Children's Hospital

LEGACY HEALTH

THE Portland Clinic

KAISER PERMANENTE

Hospira

Franciscan Health System



Large Global Deployments



Choctaw Nation

- 6.6 PB storage
- 500+ appliances
- Genetec VMS



Chicago Metra

- 7.5 PB storage
- 312 appliances
- Genetec VMS



Correctional Svcs Canada

- 7+ PB storage
- 15 facilities
- Genetec VMS



WMATA

- 5+ PB storage
- 140 appliances
- Verint VMS



MBTA

- 3 PB storage
- 130 appliances
- Genetec + Geutebruk



FedEx Ground

- 600+ facilities
- 1000+ appliances
- Genetec VMS



Majid Al Futtain

- 5 PB storage
- 11 sites
- Milestone VMS



Isla Maria Prison

- 3.4 PB storage
- 100 appliances
- Genetec VMS



NVIDIA

- 2 PB storage
- Multiple locations
- ONSSI VMS



Casino Sentosa

- 3 PB storage
- Avigilon VMS



Souq Waqif

- 2.4 PB storage
- 70 appliances
- ONSSI VMS



Dallas Love Field

- 2 PB storage + VSS
- 48 appliances
- Avigilon VMS



Madinat Jumeirah

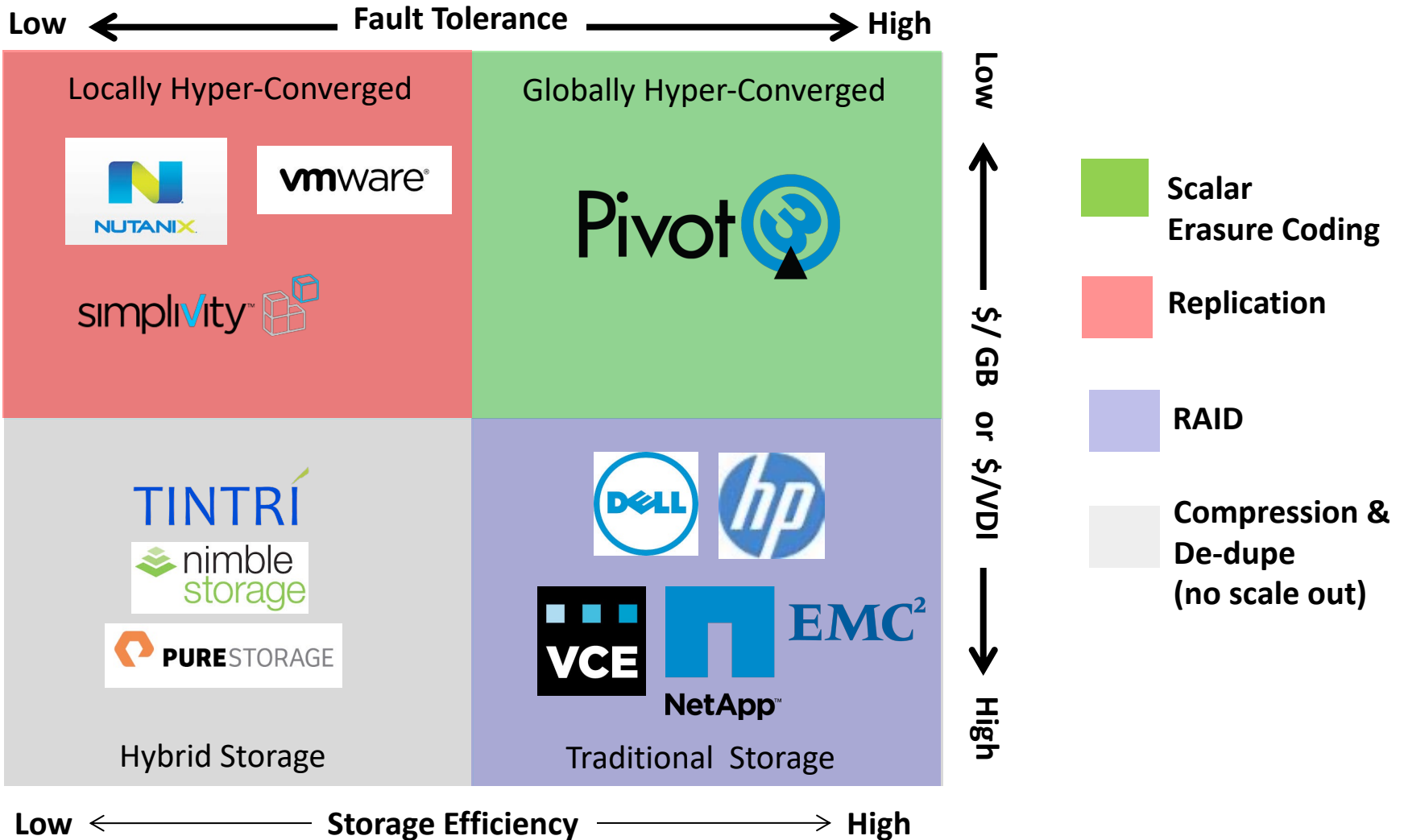
- 1 PB storage
- 44 appliances
- Milestone VMS



Tampa Airport

- 1.4 PB storage
- Genetec VMS

Competitive Positioning, based on Technology



Hyper-Convergence Overview



Current Fragmented Data Centers



Storage



Processing



Networking



Security



Analytics

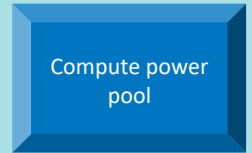
Purpose-built Platforms and Servers



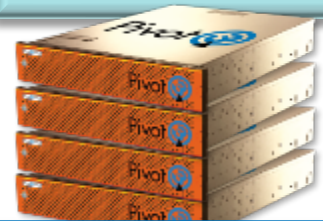
Hyper-Converged Infrastructure



Storage pool



Compute power pool



Arrays of Hyper-Converged Appliances

Consolidation through Hyper-Converged Infrastructure

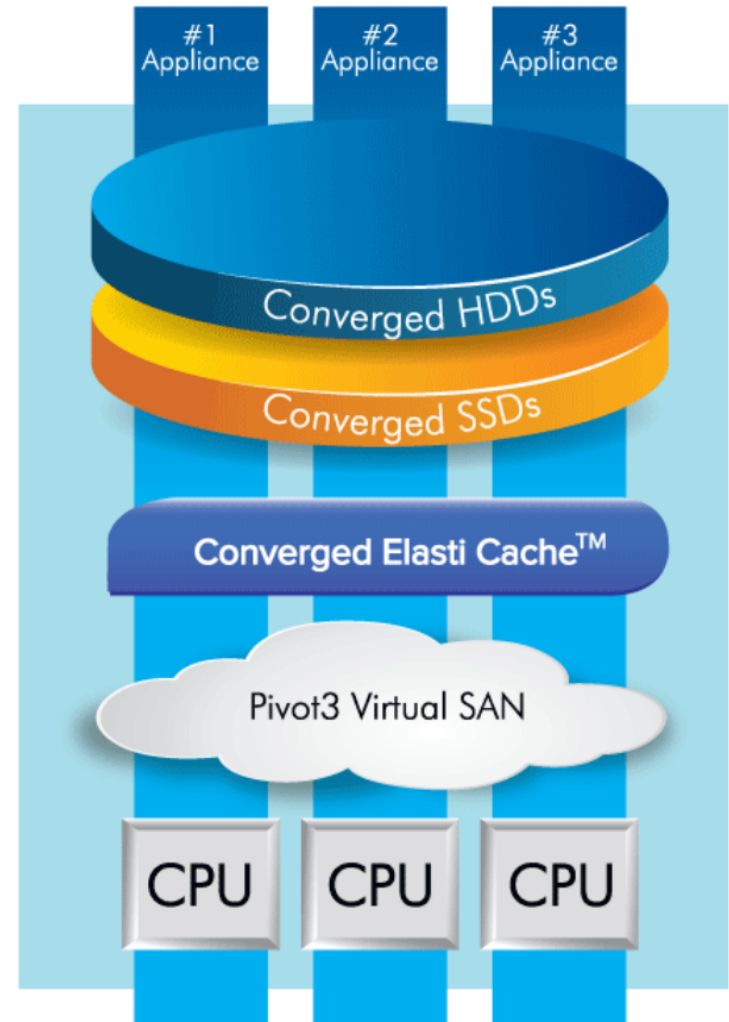
Pivot3 appliances create homogeneous, reliable, scalable and economical pools of storage and compute power to be used by any application.

Global Hyper-Convergence



Pivot3 implements patented *Scalar Erasure Coding* to:

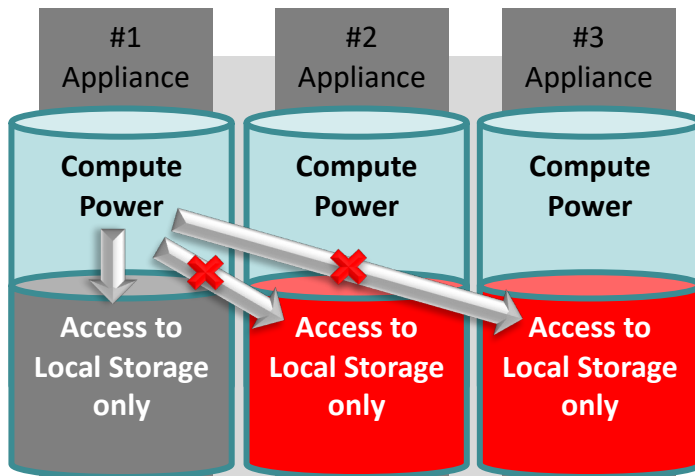
- Create merged pools of RAM cache, SSD storage, HDD storage, and IOPs, not just within each appliance but also across appliances.
- ***Pivot3 Hyper-Converged Infrastructure is truly global***
- Other architectures only create resource pools within each appliance, and are therefore only *locally* hyper-converged
- High fault tolerance in hyper-converged appliances which also results in extraordinary storage efficiency for significant cost savings.



Why Global HCI Matters – No Hot Spots



Hot Spots!



Compute and Storage Mismatches

➤ WARNING!

➤ May require manual Re-Balancing<

Example:

What if I run out of compute power before running out of local storage, or visa-versa?

“Local hyper-converged” players force customers to align compute and storage in a delicate balance to extract full load/storage value. Re-distributing load requires manual adjustments that adds to administrative complexity and increases TCO.

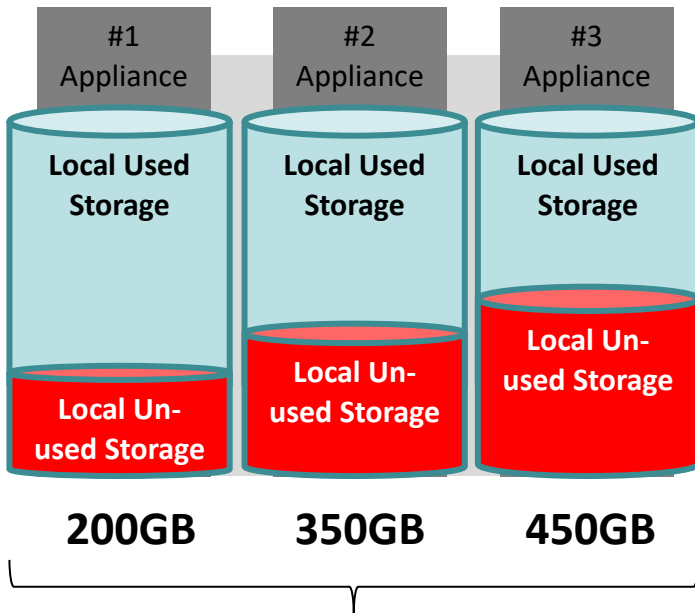


Our “globally hyper-converged” cluster of appliances automatically load balances. No hot spots. No stranded “local only” storage.

Why Global HCI Matters - Fragments



Storage Space Fragments



Example:

What if the user need 1TB of space?

Locally hyper-converged" players – can't unify the fragments.

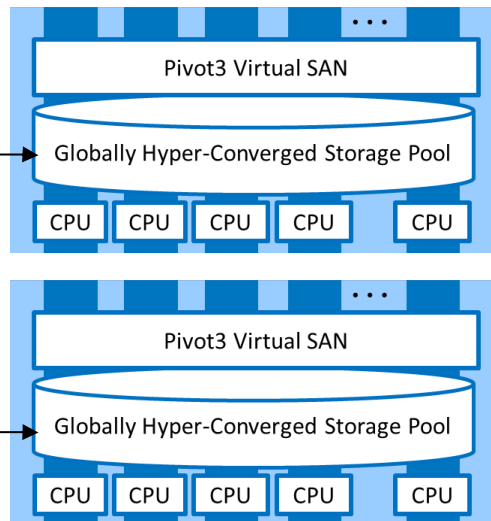
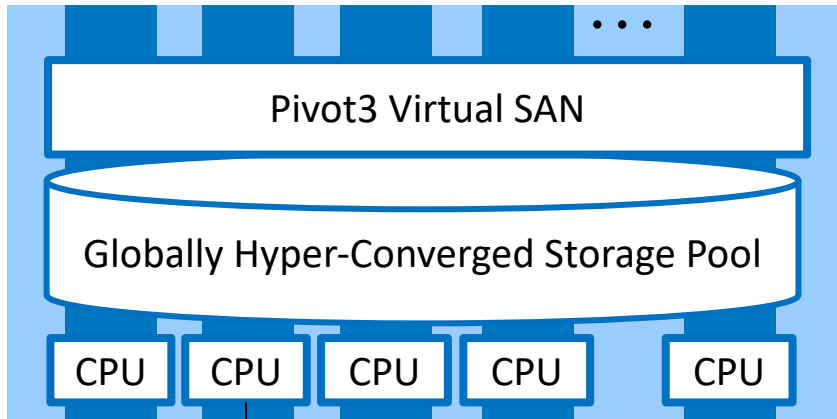
**Stranded Capacity
'islands'**

> Increase with node quantity <



Unifies storage across the nodes.
We aggregate the available space.

Scale-Up with Multiple Pivot3 Clusters



iSCSI LUN mapping enables scale-up... just like adding another SAN

Pivot 3 Cluster n

Pivot 3 Cluster 2

Pivot 3 Cluster 1

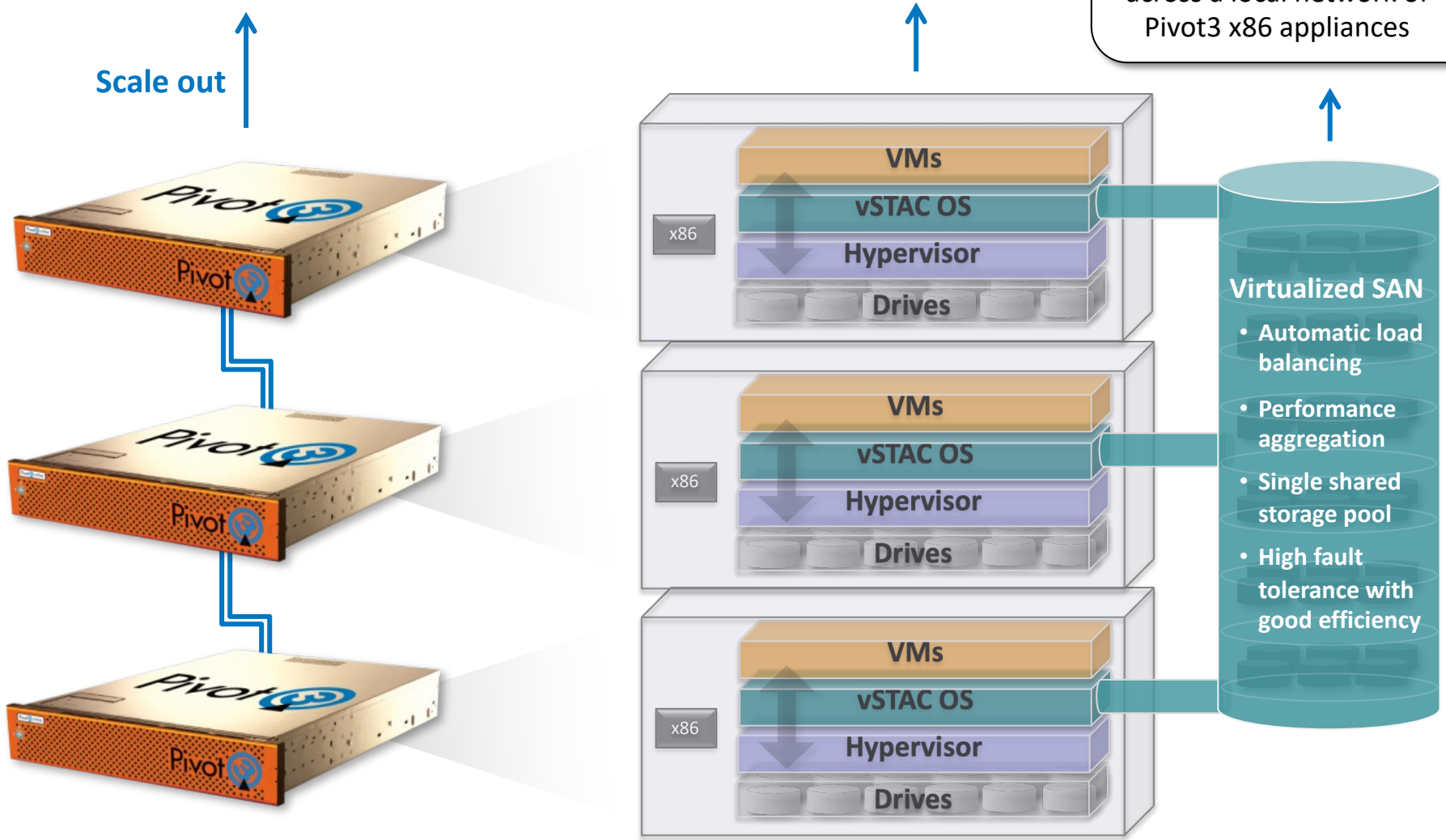
Leverage multiple clusters to achieve the best combination of cluster performance and capacity.

Scale-up to petabytes!

All unified through the Pivot3 Management Console

Pivot3 vSTAC Dynamic Scale Out

vSTAC OS seamlessly creates a virtual SAN with distributed RAID protection across a local network of Pivot3 x86 appliances



Erasure Coding



Storage



- ✓ Distributes data and parity across Pivot3 appliances with Erasure Coding
- ✓ Data is efficiently protected against component & appliance failures
- ✓ Creates a Scalable iSCSI SAN with Appliance Fault Protection

Erasure Coding-Based Storage Efficiency



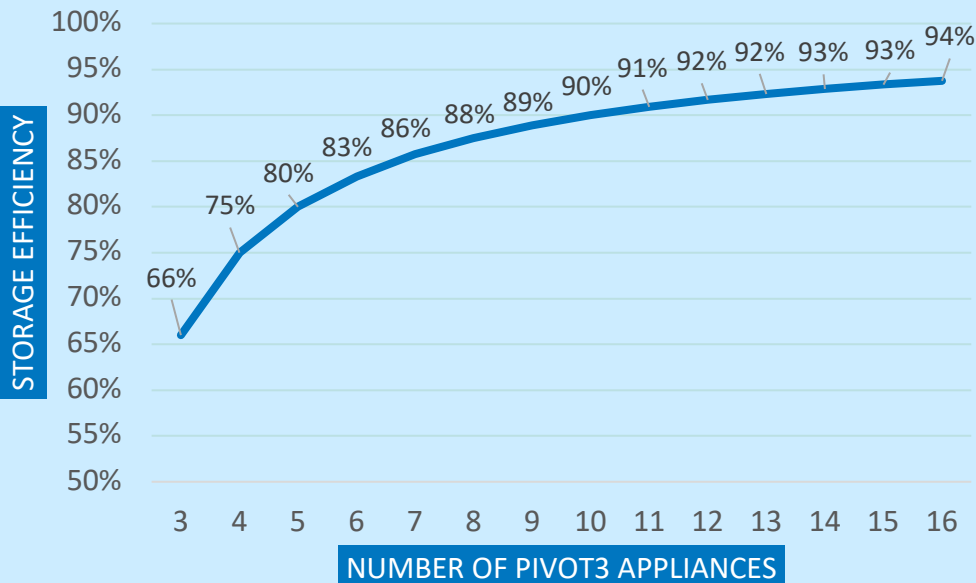
High Storage Efficiency That Increases With Scale

- Patented matrixed erasure coding methodology to ensure high-availability.
- Storage efficiency as appliances are added.
- Supports five drive failures - or- an appliance and two drive failures.

Patented

<- Replication-Based Appliances ->

- Storage efficiency of data replication schemes is poor.
- Storage efficiency does not improve with scale.
- Storage efficiency is drastically reduced as data protection is increased.
- Poor storage efficiency results in very high storage costs.



Efficiency

Replication offers a maximum of 50% useable capacity.

50% Single Drive Protection

33% Two Drive Protection

16% Five Drive Protection

Scale

Predictive Drive Sparing



Pro-active Drive Replacement

- Drives often times do not fail completely. Performance degrades over time, slowing down the entire system.
- Pivot3 technology allows for predictive drive sparing...

Step 1

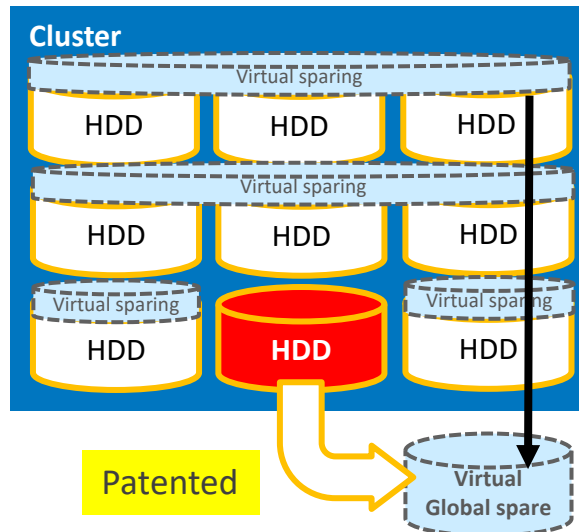
Detect the response time degradation of a specific physical drive



Drive Response time		
Drive 1	Drive 2	Drive n
→	↘	→

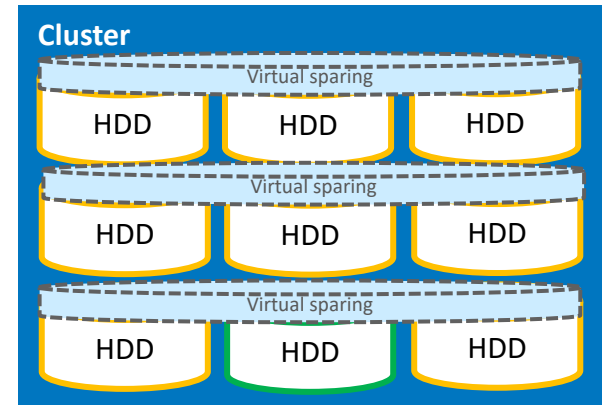
Step 2

Rebuild the failing drive within the Global Spare. Pro-actively fail the drive and remove it.



Step 3

Replace the physical drive without interruption of regular operations.



Global Virtual Drive Sparing



Pivot3 Virtual Global Sparing

- Instead of dedicating an entire drive per appliance, Pivot3 creates a virtual spare drive across the cluster of appliances.
- Pivot3 clusters need to set aside only the equivalent of one drive per cluster.
- In case of drive failure, full protection & performance are restored w/o human intervention.

Appliance #1

Patented



Appliance #2



Appliance #n



Conventional sparing system

Appliance #1



Appliance #2



Appliance #n



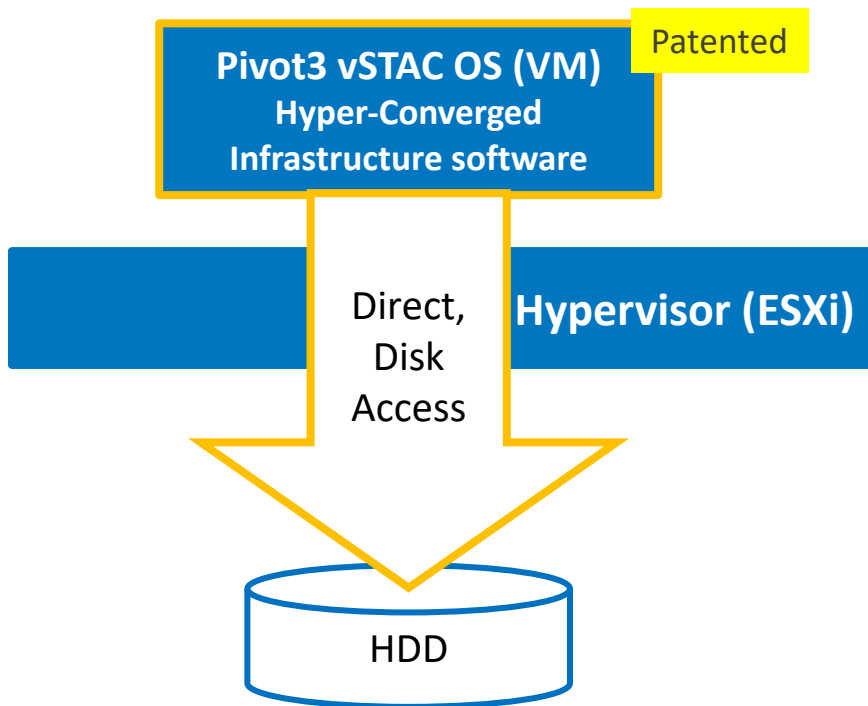
- Conventional sparing sets aside a single drive in each appliance to protect against drive failure.

Direct Channel to Disks



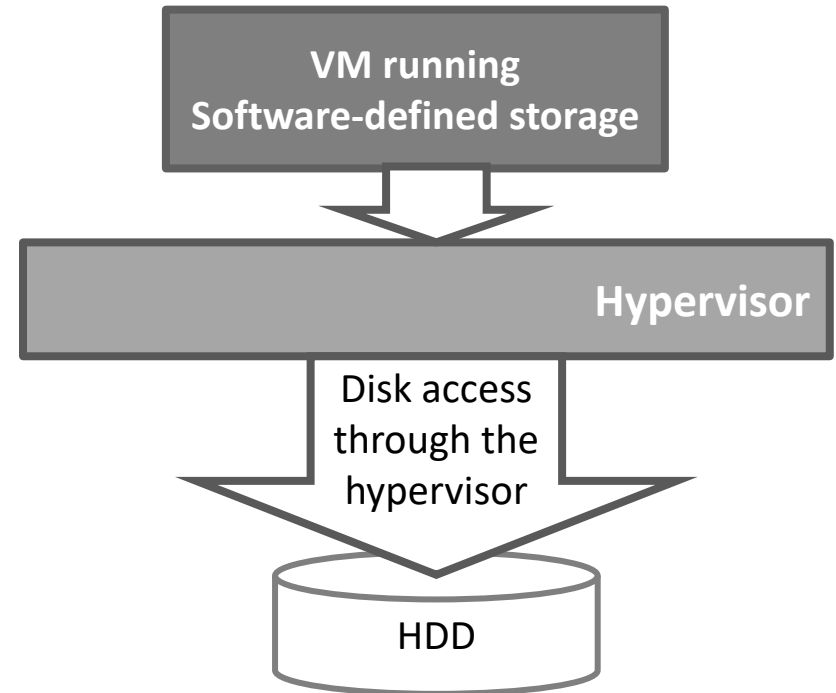
Pivot3 Close-to-the-metal methodology

- Disk access is direct, without going through the hypervisor, resulting in a 30-40% increase in storage performance.
- Results in significantly increased performance.

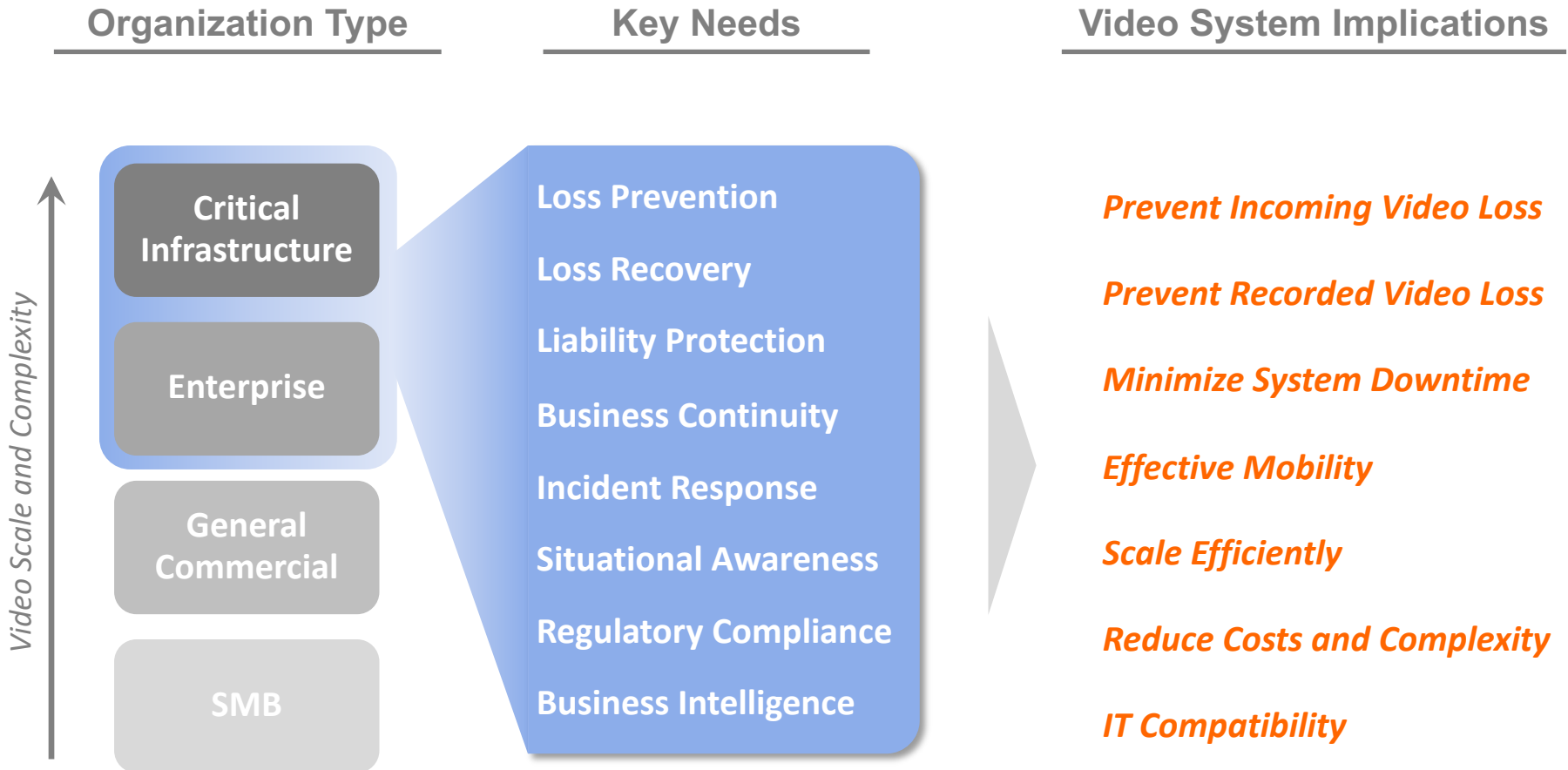


Disk Access through the Hypervisor

- Accessing storage through the hypervisor can cause a drop in performance.
- Hypervisor is effective at virtualizing the CPU, but not at virtualizing IO.

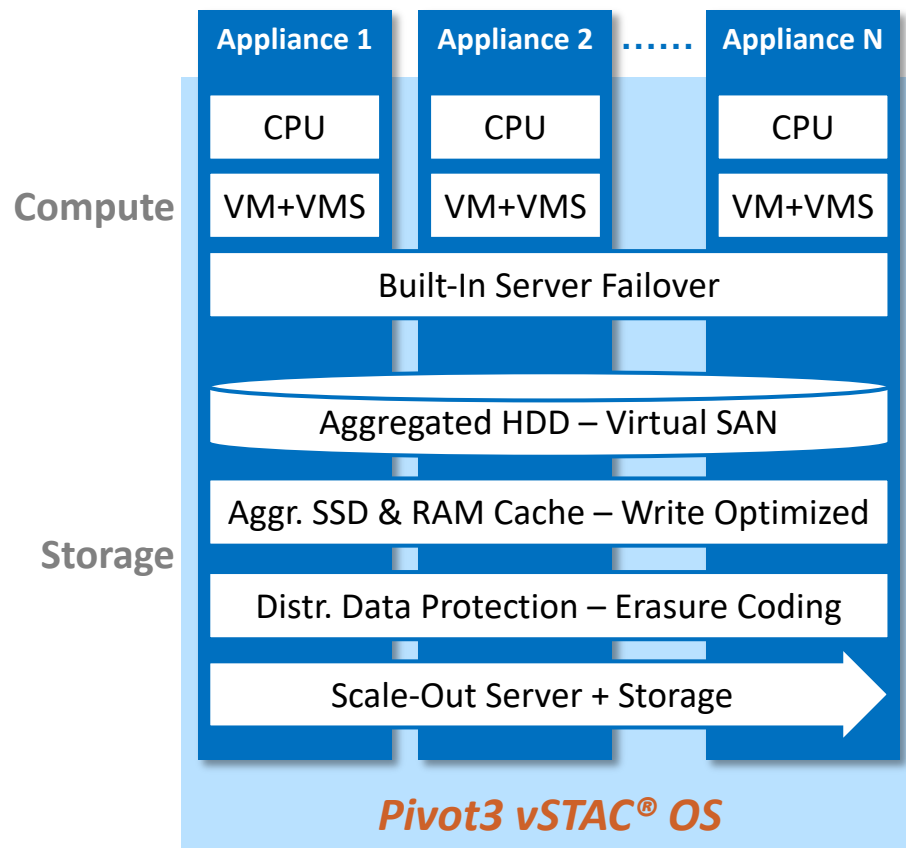


Critical Video Surveillance



Pivot3 Hyper-Converged Infrastructure

Converged Servers and Shared Storage



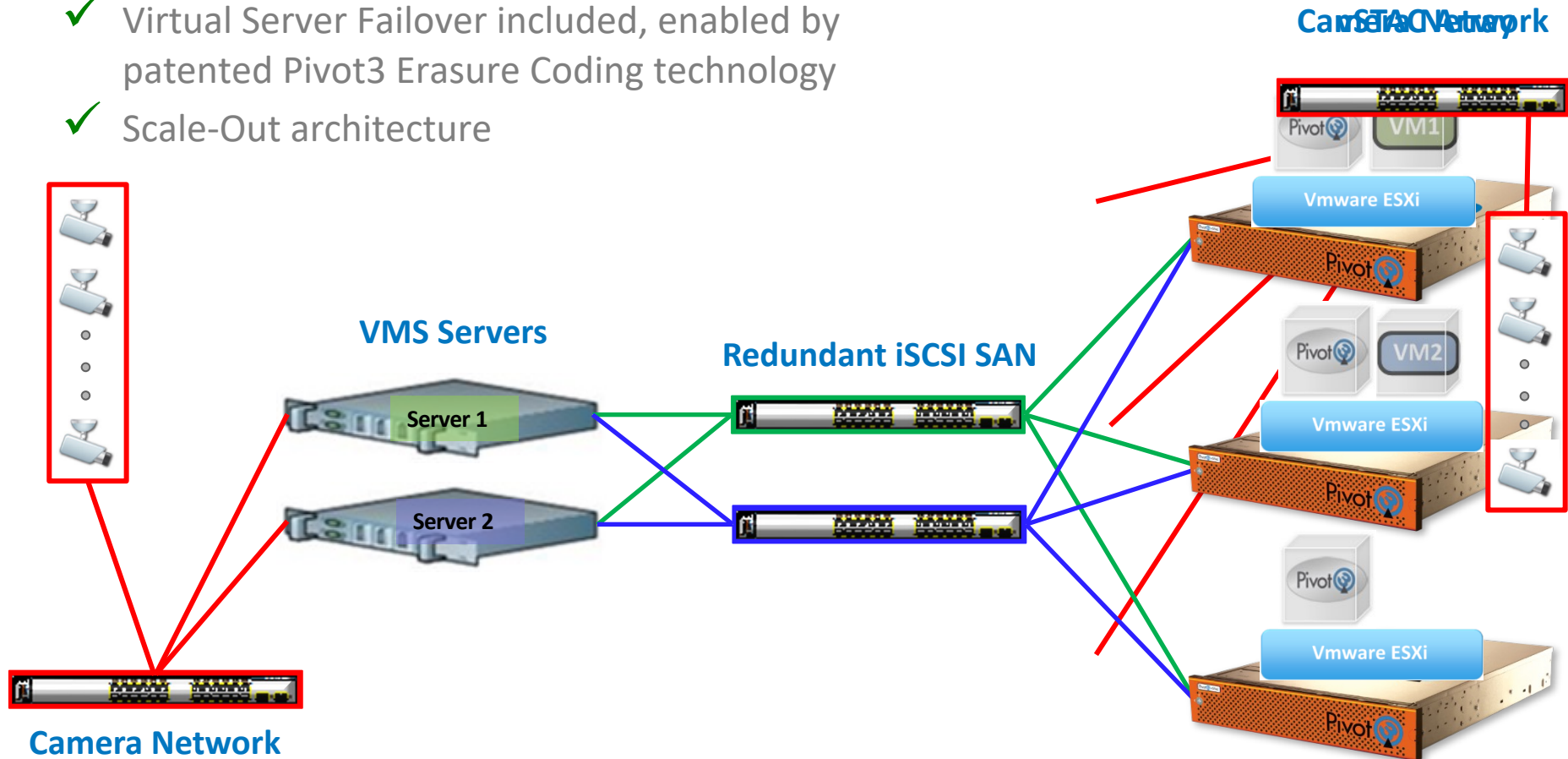
- ✓ Robust enterprise solution without the cost or complexity
- ✓ Improves storage efficiency
- ✓ Eliminates need for separate servers
- ✓ Eliminates single points of failure and stranded video
- ✓ Prevents dropped video
- ✓ Protects recorded video better
- ✓ Reduces system downtime
- ✓ Scales linearly without disruption

High Availability

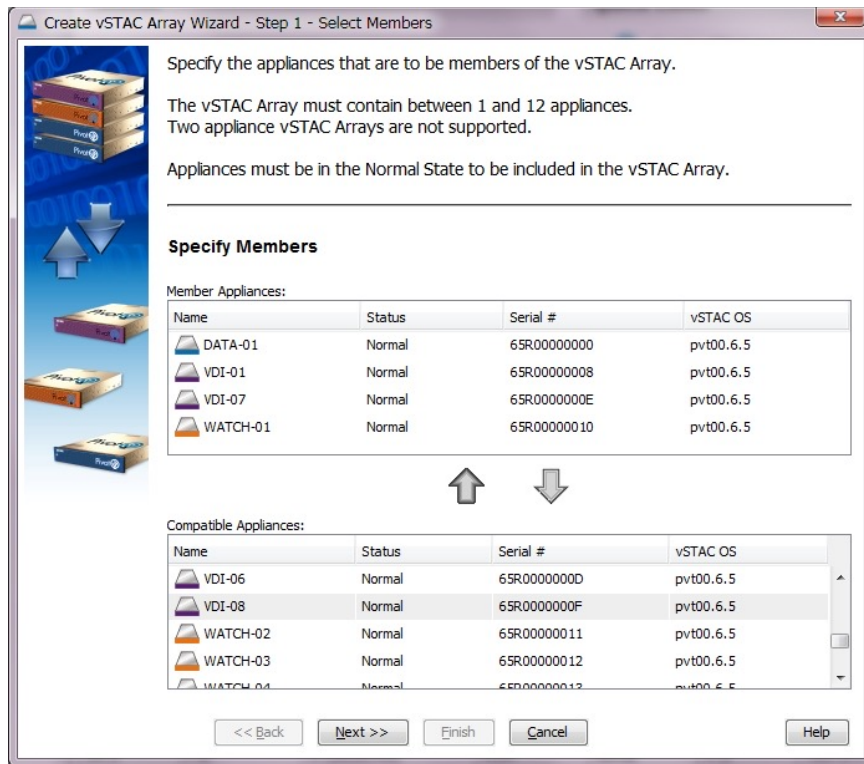


Stackable Compute & Storage Appliance

- ✓ Hyper-Converged Virtual Server and Storage platform
- ✓ Virtual Server Failover included, enabled by patented Pivot3 Erasure Coding technology
- ✓ Scale-Out architecture



Ease of Use



- **Ultra-simple administration**
 - Point-and-click to add an appliance to an array
 - Complexities automatically managed in the background
- **Designed for non-expert simplicity**
 - Wizard-driven setup and changes
 - Hover-over tool tips
- **Fast failure recovery**
 - Point-and-click restores a node to production
 - All rebuild processes occur without any additional administrative steps
- **Non-disruptive in-place upgrades**
 - Wizard guides customers through software updates
 - Systems remain online throughout update process

vSTAC Surveillance Product Family



vSTAC Watch – Compute + Storage (12/24/48/72 TB Options)

- VMS Application/Recorders
- Access Control

vSTAC Edge – Compute + Storage (4/8/12/16 TB Options)

- Ideal for distributed sites

vSTAC Trend – Intense Compute + Storage

- Video Analytics
- Back Office

vSTAC Data – Storage Only (12/24/48/72 TB Options)

- Extend storage capacity to an array

vSTAC Virtual Security Server – Compute + Storage + Mobility

- Centralized Video Monitoring
- Secure Remote Access

vSTAC Surveillance Solutions



Watch/Edge/Trend

*Application Server +
iSCSI vSAN Storage*



Data

*iSCSI vSAN Storage
Expansion*



VSS

*Remote Security
Operations Center*

Virtual Security Server (VSS)



Pivot3 Watch Servers
Host VMS Servers and
Video Storage

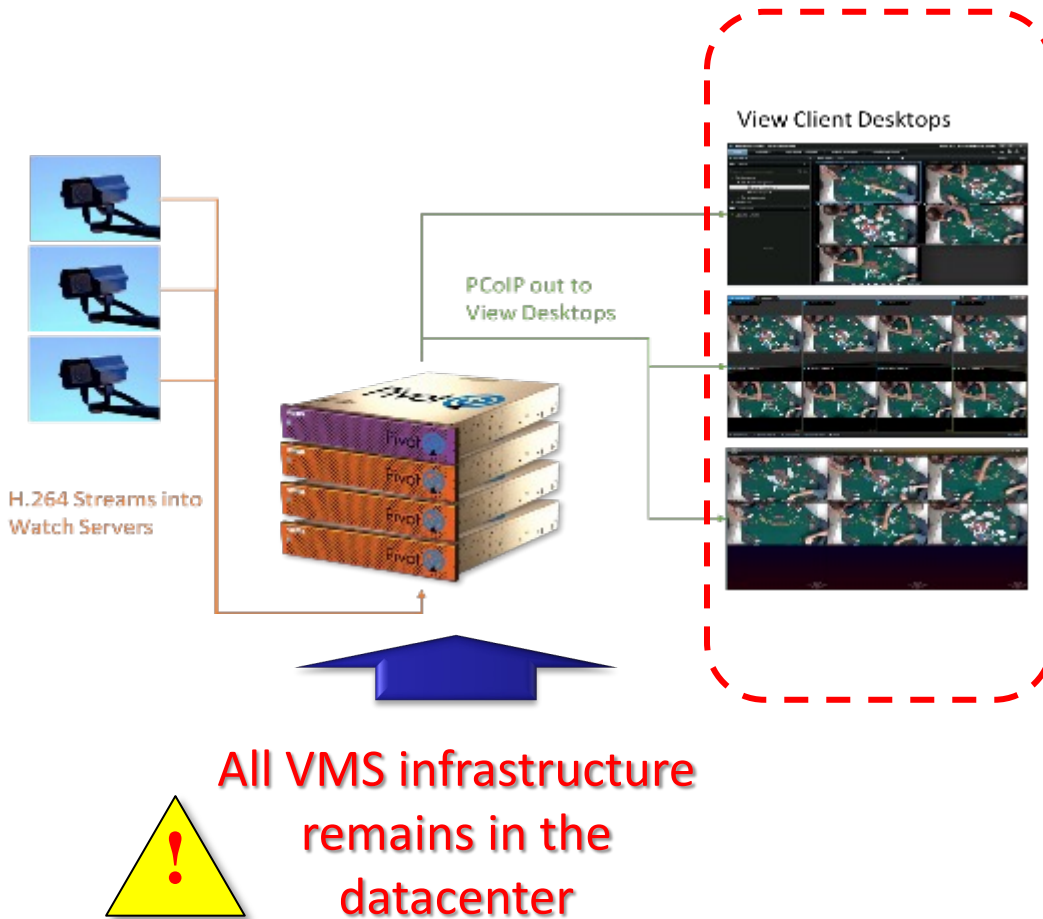


Pivot3 Virtual Security
Servers (VSS) Hosts VMS
Client Applications



- Servers host VMS clients for virtual viewing by remotely connected clients.
- VSS contains optimization hardware for handling graphics (GPU) and accelerating the PCoIP remoting protocol (off-load card)

VSS Benefits



- Remote viewing locations
- No data leaves the datacenter
- More bandwidth and processor efficient
- Flexible choice of client devices
- Lower cost end point devices
- Centrally managed application software

Virtual Security Server (VSS)



Data Center

Virtual Security Server



vSTAC Storage & Servers



Security Operations Center



Video Wall



Zero Clients



Digital Signage



Workstations



LAN/WAN



Mobile Devices



Zero Clients



Workstations

Remote Locations

Secure remote monitoring and control of all SOC applications

- Access any time, any place on any device
- Eliminates the need for costly dedicated workstations
- Reduced bandwidth and processing vs native mobile and rich client apps
- Data remains secure inside the datacenter

The Pivot3 Advantage



Better Value

The benefits of enterprise servers and shared storage w/out the cost

Performance

Optimized to prevent loss of critical video data

High Availability

Prevents downtime and ensures access to recorded video

Fault Tolerance

Protects critical video data better than RAID and replication

Mobility

Access critical apps anytime, anywhere, on any device

Scalability

Scales linearly, cost effectively and without disruption

Ease of Use

Simplified administration eliminates complexity

Expertise

Proven video surveillance and storage expertise and services

*The Optimal Solution for Critical Video Surveillance
Server and Storage Infrastructure*

Partnership Benefits



Pivot3's differentiated technology and position within the market offer a number of unique benefits to program partners:



Hyper-Converged Infrastructure is recognized by IT datacenters as the preferred solution for new infrastructure and Pivot3 is the only HCI solution for video



Improves ability to win server/storage revenue with differentiation of off-the-shelf options against internal IT dept. procurement routes and HW brand preferences



Technology optimized for mid-tier and multi-petabyte enterprise installations and do not conflict or compete with Honeywell's existing smaller scale offerings



Built in HW failover elevates competitive advantage over other VMS SW only failover solutions



VSS provides a clear differentiator against other VMS solutions for SOC and mobile display options that can be integrated into the video storage array

Partner Program Options



Marketing

Co-Marketing Option

- CO-Marketing and promotion campaigns
- Pivot3 bezel

Co-Branding Option

- Co-Marketing and promotion campaigns
- Advantech bezel “powered by Pivot3”

OEM Options

Appliance OEM

- Pre-configured appliance procurement & delivery
- Advantech bezel

SW Hybrid OEM

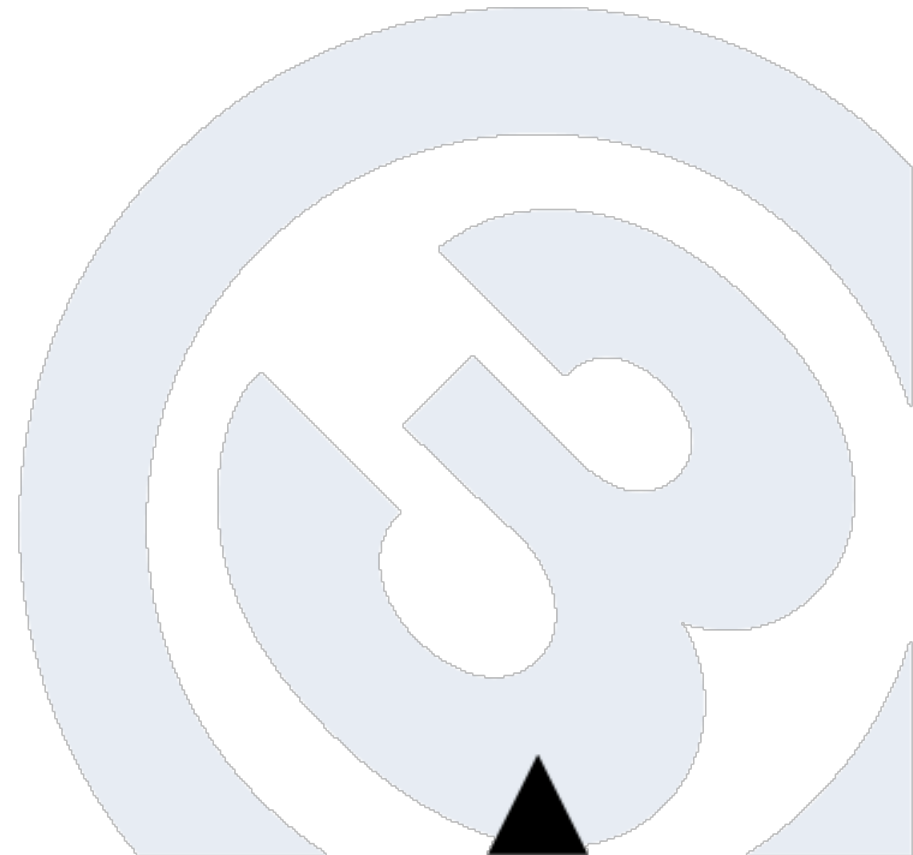
- Advantech procurement, Pivot3 integration & delivery
- Advantech bezel

SW Only OEM

- SW procurement, Advantech HW integration
- Advantech bezel

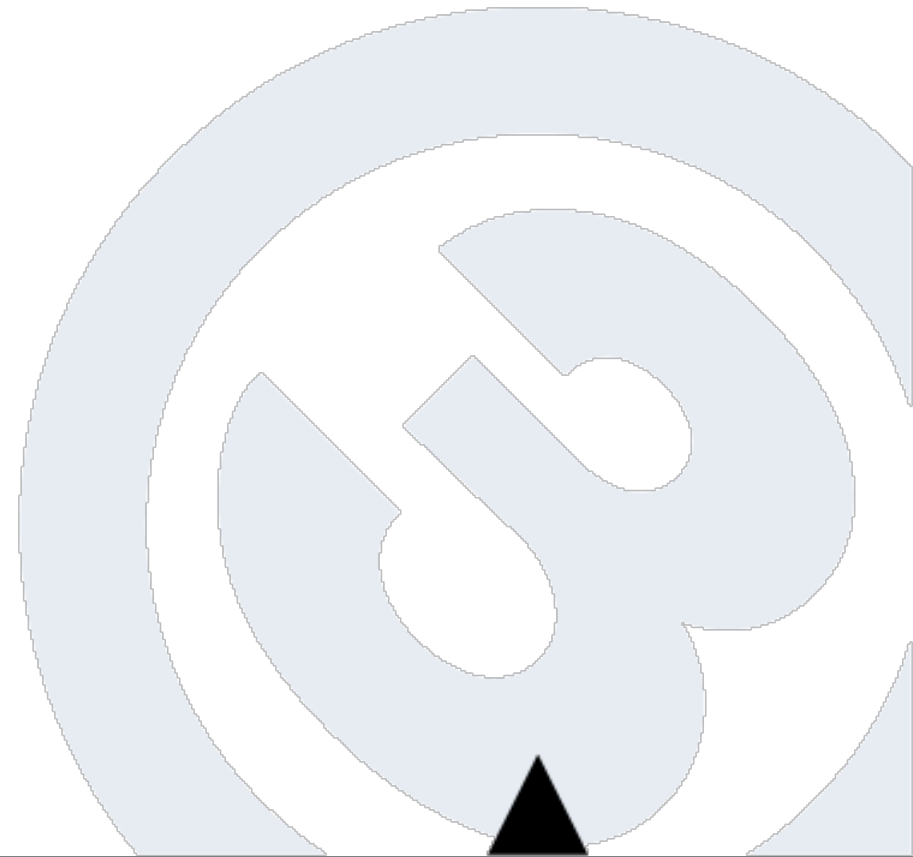


Questions?





Features Overview



vSTAC OS Features Primer



Key Storage Features

- ✓ Hyper Converged Infrastructure
- ✓ Virtual SAN
- ✓ ElastiCache - Flash Acceleration
- ✓ Direct Disk Access
- ✓ Allocate-on-write
- ✓ Optimized for Write Workloads
- ✓ Predictable Degraded Performance
- ✓ Virtual Global Sparing
- ✓ Fast Parallel Rebuilds
- ✓ Predictive Sparing
- ✓ Continuous Background Verification
- ✓ SNMP Support
- ✓ Phone Home Diagnostics

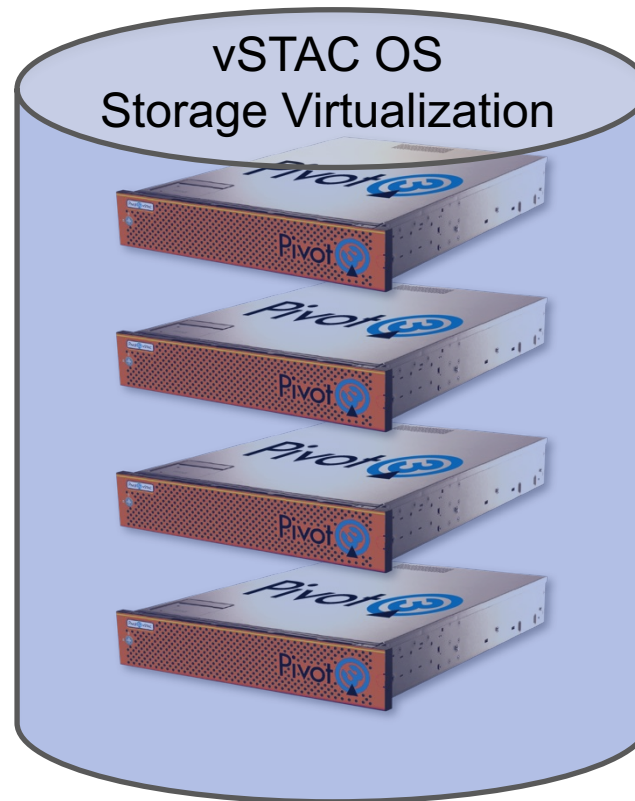
Clustered Storage Features

- ✓ Dynamic Scaling
- ✓ True Storage Pool
- ✓ Automatic Load Balancing
- ✓ Storage Aggregation
- ✓ High Availability
- ✓ High Fault Tolerance
- ✓ Disk Groups

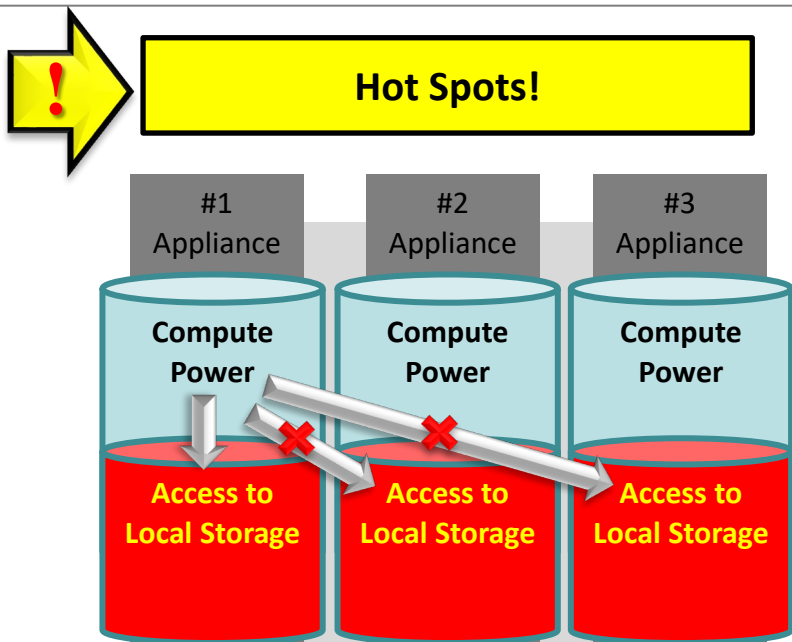
Virtual SAN



- ✓ Using Industry Standard Server platforms to create scalable solutions
- ✓ Using Ethernet connectivity for simple configuration & management



Performance Acceleration




Compute and Storage Mismatches
> **WARNING! May require manual Re-Balancing** <

Example:

What if I run out of compute power before running out of local storage, or visa-versa?

“Local hyper-converged” players force customers to align compute and storage in a delicate balance to extract full load/storage value. Re-distributing load requires manual adjustments that adds to administrative complexity and increases TCO (tweak, tweak, tweak!).

Pivot  Our “globally hyper-converged” system **automatically load balances**. Self-adjusts! No hot spots! No stranded “local only” storage!

Predictive Drive Sparing



Pro-active Drive Replacement

- Drives often times do not fail completely. Performance degrades over time, slowing down the entire system.
- Pivot3 technology allows for predictive drive sparing...

Step 1

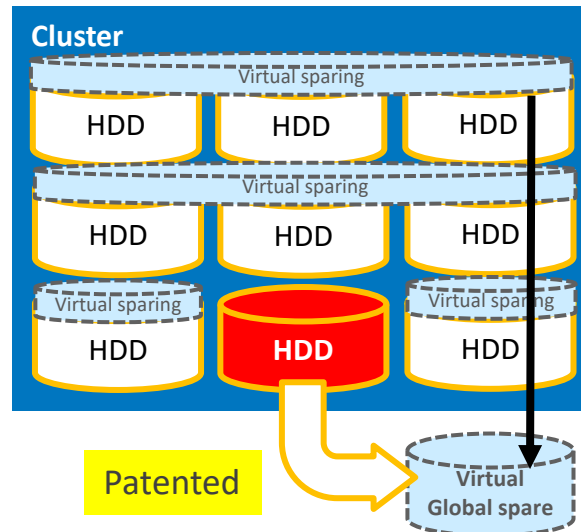
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Drive Response time		
Drive 1	Drive 2	Drive n
→	↘	→

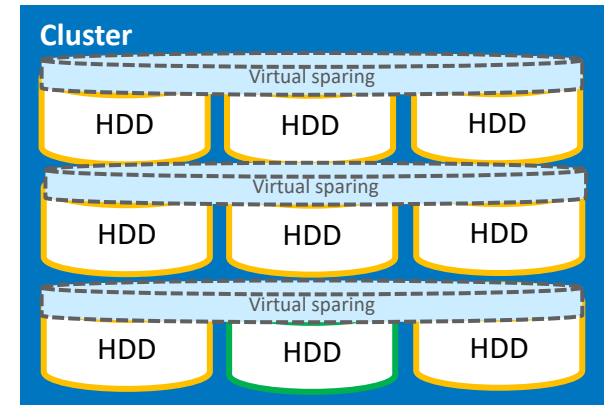
Step 2

Rebuild the failing drive within the Global Spare. Pro-actively fail the drive and remove it.



Step 3

Replace the physical drive without interruption of regular operations.



Global Virtual Drive Sparing



Pivot3 Virtual Global Sparing

- Instead of dedicating an entire drive per appliance, Pivot3 creates a virtual spare drive across the cluster of appliances.
- Pivot3 clusters need to set aside only the equivalent of one drive per cluster.
- In case of drive failure, full protection & performance are restored w/o human intervention.

Appliance #1

Patented



Appliance #2



Appliance #n



Conventional sparing system

Appliance #1



Appliance #2



Appliance #n



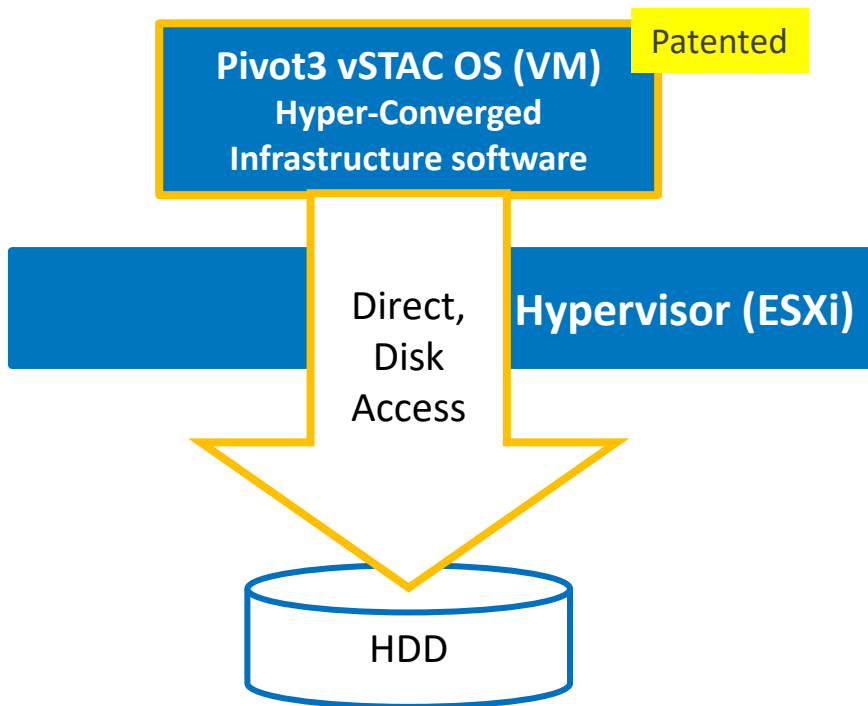
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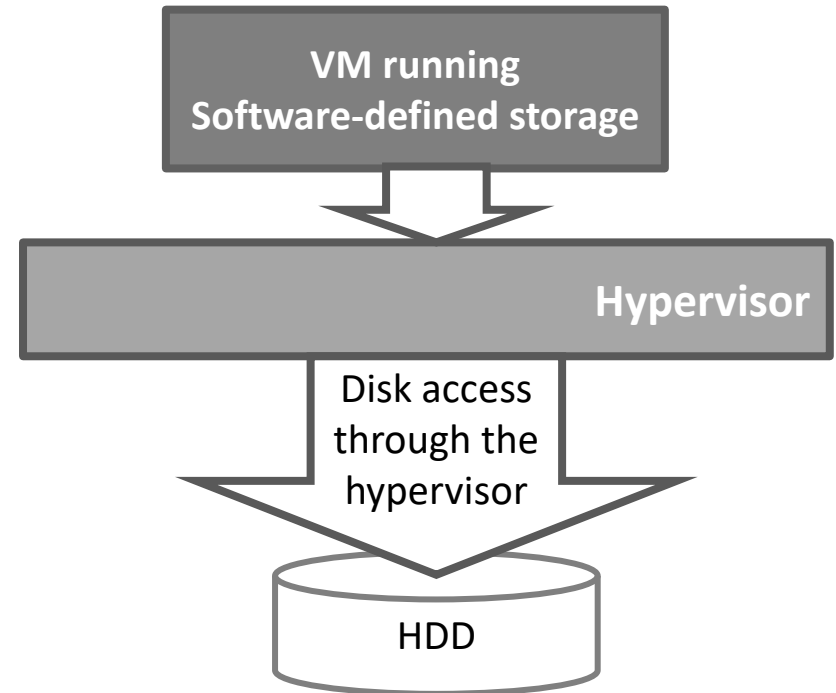
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- Results in significantly increased performance.



Disk Access through the Hypervisor

- Accessing storage through the hypervisor can cause a drop in performance.
- Hypervisor is effective at virtualizing the CPU, but not at virtualizing IO.



Full-time Active/Active



Pivot3 Global Active/Active

- Pivot3 appliances access all controllers in the cluster.
- Bandwidth is additive. Bandwidth expands linearly with each added appliance.
- True, optimized Global Active / Active.

Appliance #1



Controller

Appliance #2



Controller

Appliance #n



Controller

Global Active / Active =>

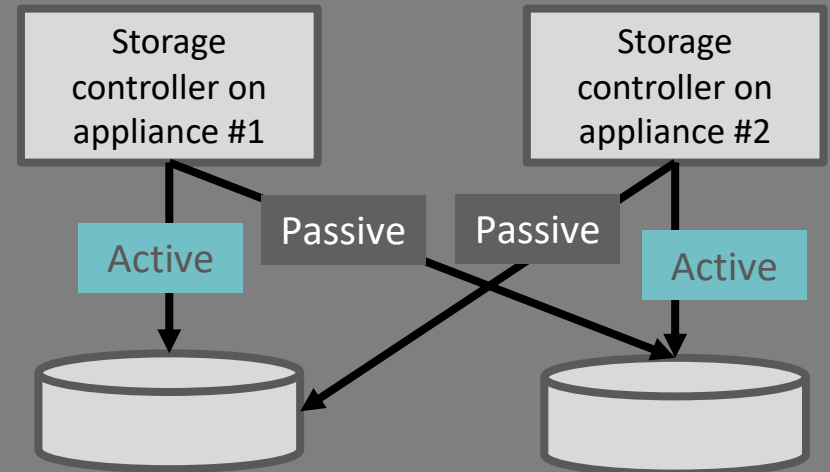
Σ (IOPs)

Patented

Conventional SAN: Active / Passive

- Larger SANs have two controllers for redundancy.
- One controller is active on one set of drives while the other is passive on the same set, to ensure continuous operation in case of controller failure
- Bandwidth is fixed and limited to the performance of each individual controller.

Active / Passive Redundant Controllers



Erasure Coding



Storage



- ✓ Distributes data and parity across Pivot3 appliances with Erasure Coding
- ✓ Data is efficiently protected against component & appliance failures
- ✓ Creates a Scalable iSCSI SAN with Appliance Fault Protection

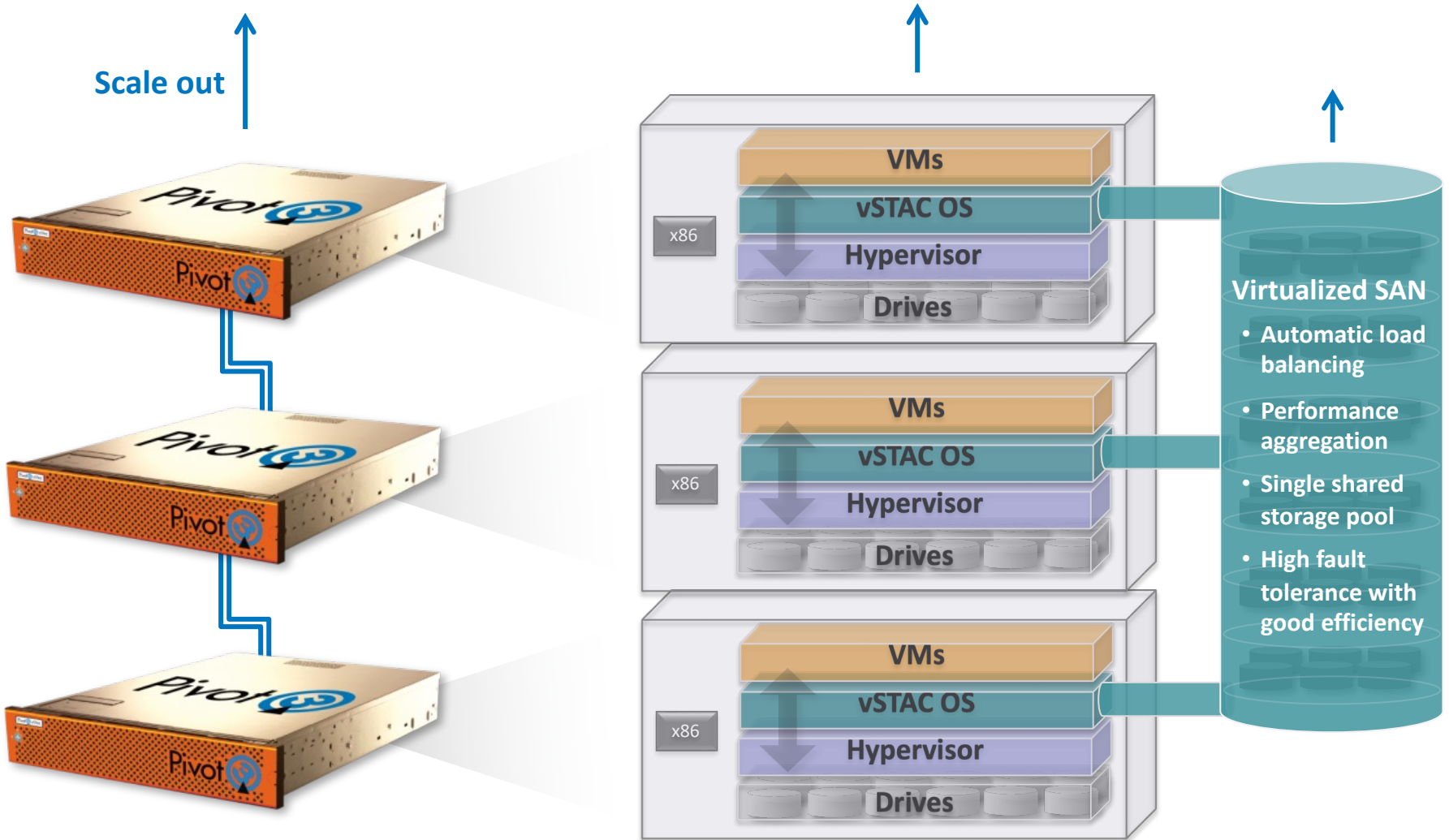
Fault Tolerance Options



Pivot3 Level (Proprietary Architecture)	Data / System Protection
RAID 1	1 disk failure
RAID 5	1 disk failure
RAID 6	2 simultaneous disk failures
RAID 1E	1 disk or 1 appliance failure
RAID 1P	<ul style="list-style-type: none">• 3 simultaneous disk failures or• 1 disk + 1 appliance failure
RAID 6P	<ul style="list-style-type: none">• 3 simultaneous disk failures or• 1 disk + 1 appliance failure
RAID 5E	1 disk or 1 appliance failure
RAID 6P	<ul style="list-style-type: none">• 3 simultaneous disk failures or• 1 disk + 1 appliance failure
RAID 6E	<ul style="list-style-type: none">• 3 simultaneous disk failures or• 1 disk + 1 appliance failure
RAID 6X	<ul style="list-style-type: none">• 5 simultaneous disk failures or• 2 disk + 1 appliance failure

} Applicable to single appliances, only

Scalability



Proactive Diagnostics (Phone Home)



Pivot3 offers a new *Proactive Diagnostic* service to help keep vSTAC storage infrastructure running smoothly and effectively.

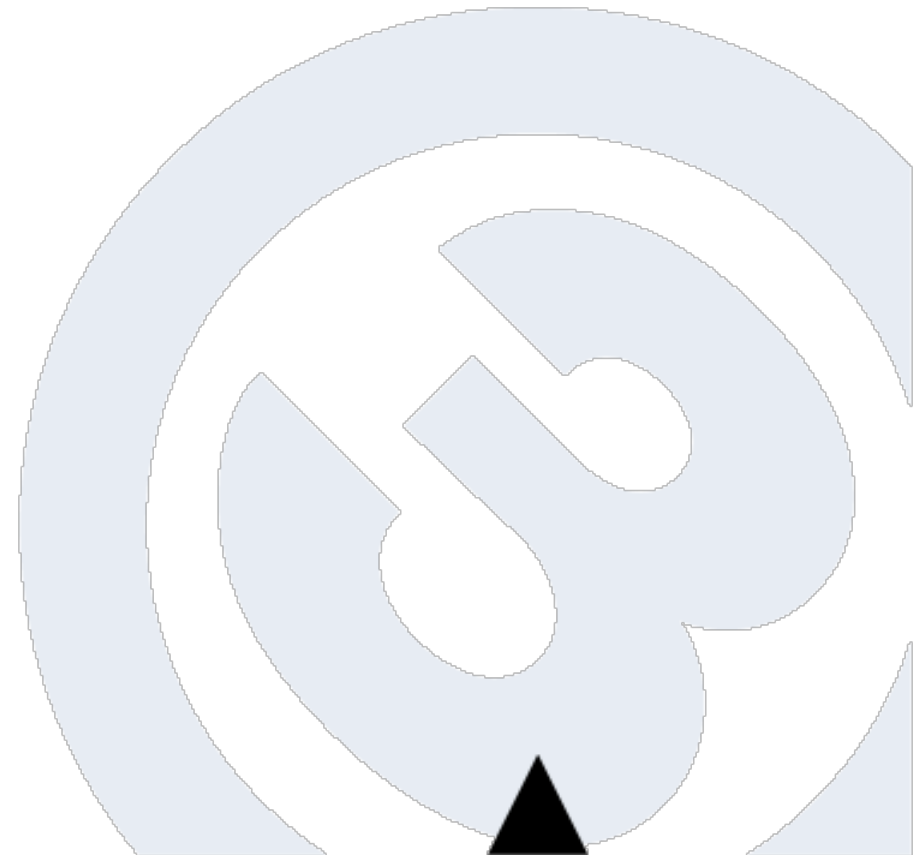
- Provided by Pivot3 Support based on Premium level or better active Hardware Warranty and Software Support.
- Customer must be upgraded to 6.5 and enable the feature through vSTAC Manager Suite.

This service provides:

- Next business day notification to the customer and/or the registered integrator that an event has occurred.
 - Response and corrective measures by Pivot3 Support.
 - Monitoring of access to the Management Station with 48-hour notification that the Management Station is unable to reach Pivot3 Support Services.
-
- ✓ **Configuration reporting:** Licensing, P3 Failover, Software Versions
 - ✓ **Device Health reporting:** Drives, NICs, CPUs, Memory, PS, Temp
 - ✓ **Logical State reporting:** Arrays, Volumes



Product Family Overview



vSTAC Watch R2



Ideal for Storage Heavy

Pivot3 vSTAC OS 6.5

- *Scale Out storage*
- *Protected storage*
- *Load Balanced storage*
- *Superior upgrade experience*

Enterprise Server

- *Dell 720xd*
- *Intel E5-2630v2*
- *16GB RAM base*
- *4 x 1 GigE iSCSI*
- *2 x 10 GigE iSCSI*



Enterprise Storage

- *12x 1/2/4/6TB SATA*
- *50GB SLC Flash Cache*
- *Distributed RAID controller*

Redundant Components

- *Hot-swap power supplies, fans*
- *Front-loading disk drives*

Multiported iSCSI

- *Load-balanced*
- *Multipath support*
- *Scale-out*

vSTAC Edge R2



Ideal for distributed sites

Pivot3 vSTAC OS 6.5

- *Scale Out storage*
- *Protected storage*
- *Load Balanced storage*
- *Superior upgrade experience*

Redundant Components

- *Hot-swap power supplies, fans*
- *Front-loading disk drives*



Enterprise Server

- *Dell 320 1U*
- *Intel E5-2400v2*
- *16GB RAM base*
- *4 x 1 GigE iSCSI*
- *2 x 10 GigE iSCSI*

Enterprise Storage

- *4x 1/2/4TB SATA*
- *Distributed RAID controller*

Multiported iSCSI

- *Load-balanced*
- *Multipath support*
- *Scale-out*

vSTAC Trend R2



Analytics Workloads

Pivot3 vSTAC OS 6.5

- *Scale Out storage*
- *Protected storage*
- *Load Balanced storage*
- *Superior upgrade experience*

Enterprise Server

- *Dell 720xd*
- *Dual Intel E5-2680v2*
- *64GB RAM base*
- *4 x 1 GigE iSCSI*
- *2 x 10 GigE iSCSI*



Enterprise Storage

- *12x 1/2/4/6TB SATA*
- *50GB SLC Flash Cache*
- *Distributed RAID controller*

Redundant Components

- *Hot-swap power supplies, fans*
- *Front-loading disk drives*

Multiported iSCSI

- *Load-balanced*
- *Multipath support*
- *Scale-out*

Virtual Security Server



Pivot3 vSTAC OS 6.5

- *Scale-out Storage*
- *Protected Storage*
- *Load-balanced Storage*

Supports viewing of 40 HD Streams
For 4 to 10 Viewing Stations



Teradici APEX 2800 Card

Hi-
Performance
Graphics



NVIDIA K1/K2 Cards

Enterprise Server

- *Dell 720xd*
- *Dual 8-core 2680v2*
- *64GB RAM base*
- *4 x 1 GigE iSCSI*
- *2 x 10 GigE iSCSI*



Redundant Components

- *Hot-swap power supplies, fans*
- *Front-loading disk drives*

Enterprise Storage

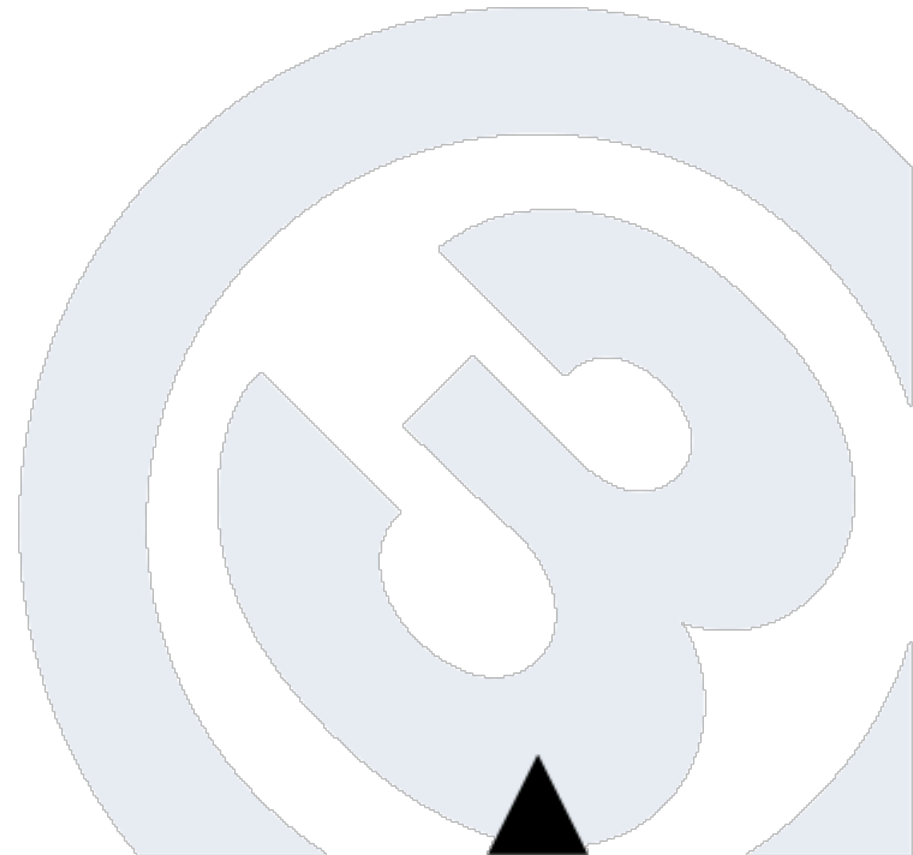
- *12x 1/2/4/6TB SATA*
- *50GB SLC Flash Cache*
- *Distributed RAID controller*

Multiported iSCSI

- *Load-balanced*
- *Multipath support*
- *Scale-out*



Virtual Security Server



VSS Value For GSOC



Security

- Maintain centralized control of video surveillance data
- Deliver video securely to remote monitoring/viewing stations

Mobility

- Speed event-driven response
 - Engage remote staff quickly
 - Support any device (thin clients, phone, tablets, retired PCs)
- Tap best available security judgment
 - Securely review events anytime / anywhere
 - Simple access means more review

Add disaster recovery for critical video

- Dual stream cameras to two sites
- Secondary clients available on incident

Virtual Security Server Elevator Pitch



Pivot3 Virtual Security Server allows flexible SOC capabilities any time, any place

- Access through multiple device types
- Deliver equivalent physical security console capabilities anywhere, any time
- Increase security operations deployment options, on premise or remote
- Save money on expensive workstation PCs

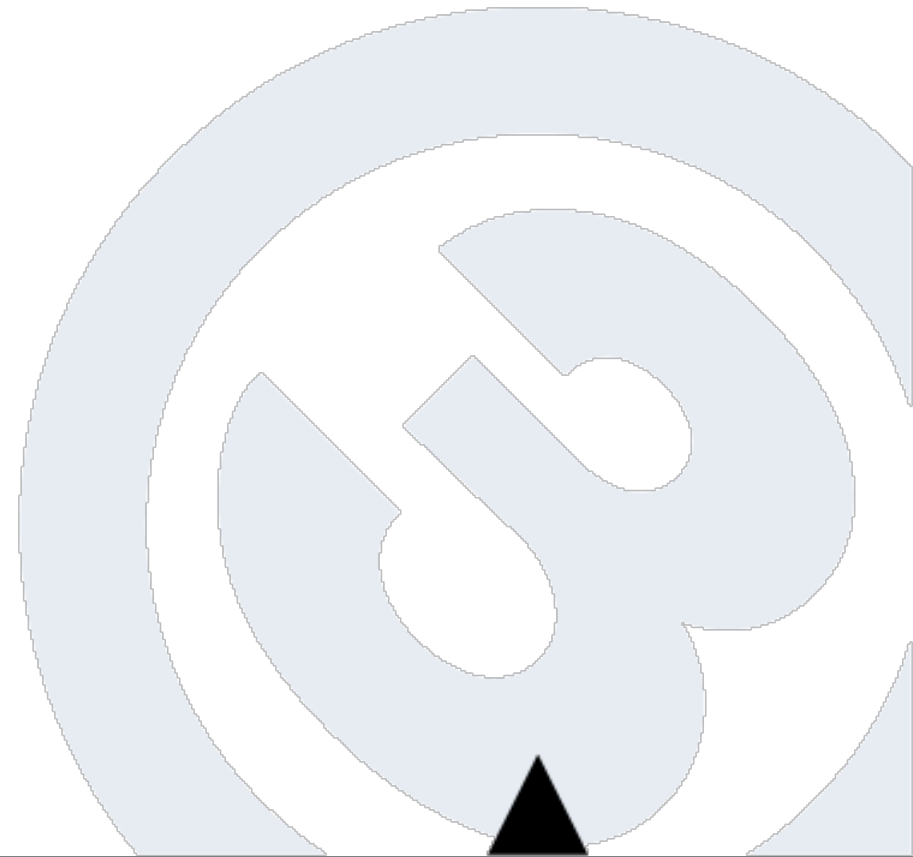
The technology



- A special engine installed in the central server captures and compresses just the screen pixel layer of HD images before transmitting them to a remote viewing station (e.g., thin client).
- The VMS client application operates as usual, but it resides on the VSS server. **The VMS software hasn't been re-written, nor will customers load the VMS software on the end point devices. A VMware View client acts like a browser to view the VMS application hosted on the server.**
- The refresh rate of the image is high enough to deliver a viewing experience comparable to viewing the image directly rendered on the central workstation/server.



Competitive Comparisons













vSTAC® Watch vs DAS Summary



	Pivot3 vSTAC® Watch	Direct Attached Storage
PERFORMANCE	<ul style="list-style-type: none"> • Prevents video loss due to bottlenecks • Automatically adapts to changing conditions to maintain performance 	<ul style="list-style-type: none"> • Prone to performance bottlenecks which can lead to video loss • Typically no cache for write acceleration
AVAILABILITY AND FAULT TOLERANCE	<ul style="list-style-type: none"> • No single point of failure • Recorded video always accessible after hardware or software failover • No special equipment, software or skills required for full data protection • Less hardware, rack space, cooling, power and licensing required 	<ul style="list-style-type: none"> • Single point of failure at every server • Recorded video inaccessible for hours or days after hardware or software failover • Risk of total loss of stored video • VMS hot standby failover + redundant servers, licensing, real estate required to match Pivot3 value
SCALABILITY	<ul style="list-style-type: none"> • Scales easily w/out downtime or video loss as needs and budgets change • Maximizes storage and resource utilization to prevent over-purchasing 	<ul style="list-style-type: none"> • Forces over-purchase of equipment and inefficient resource utilization • Does not easily or cost effectively scale to meet business needs
COST AND COMPLEXITY	<ul style="list-style-type: none"> • No need to purchase separate equipment and software for system failover • Maximizes storage and resource utilization to prevent over-purchasing • Simple administration of entire storage system; No special IT skills or resources needed 	<ul style="list-style-type: none"> • Must purchase redundant hardware, software and licensing to implement VMS software failover • Purchased storage utilized inefficiently; leads to overprovisioning and stranded capacity • Complex administration required for each server independently



















vSTAC® Watch vs DAS (1 of 3)



	Pivot3 vSTAC® Watch	Direct Attached Storage
SYSTEM PERFORMANCE	<i>The System's ability to ingest and manage large amounts of high definition video without risk of data loss or system interruption</i>	
<i>Throughput</i>	 Bandwidth pooled across all ports and appliances so entire pipe (up to 240Gbps) available to all cams	 Bandwidth is limited to individual server capacity, causing bottlenecks during heavy traffic
<i>Configurable, Aggregated Cache</i>	 Aggregated across appliances to accelerate disk performance; auto reallocates write vs read to optimize throughput; Combo RAM and SSD up to 64GB	 Generally not available, or RAM cache is limited in size and optimized primarily for read operations
<i>Auto Load Balancing</i>	 Automatically balance storage, bandwidth and cache across appliances to prevent bottlenecks	 Not available → Servers must be overprovisioned to accommodate heavy workloads or risk data loss
<i>Direct Disk Access</i>	 Disk writes bypass virtual machine hypervisor to improve performance by 30%+ vs traditional VM	 Not available
<i>Predictive Disk Sparing</i>	 Proactively detect underperforming disks and auto spare (replace) to prevent performance impact	 Not available













vSTAC[®] Watch vs DAS (2 of 3)



	Pivot3 vSTAC [®] Watch	Direct Attached Storage
AVAILABILITY AND FAULT TOLERANCE	<i>The System's ability to protect against loss of live and recorded video and automatically repair itself in the event of a server or disk failure</i>	
<i>Single Point of Failure</i>	 Automatically and immediately fails over and balances loads to avoid video disruption or loss	 Recording halts, access to live and recorded video unavailable until hardware fully restored
<i>Simultaneous Disk Failure Protection</i>	 Up to 5 disks in any part of the array, or 1 appliance + 2 disks simultaneously	 Up to 2 disks simultaneously * Requires hardware RAID implementation
<i>Server Failover</i>	 Yes – Server and applications automatically restart on new VM in event of hardware or VM failure	 No – Separate physical servers required, plus clustering, backup servers, licensing, etc.
<i>Simultaneous Server + Disk Failure</i>	 Yes – 1 appliance + 2 disks may fail simultaneously	 Not Available
<i>Recorded Video Access on Failure</i>	 Yes – Immediately and automatically with no user intervention, even during VMS or OS failure	 No – Video stranded until original server is manually rebuilt and configured → hours or days
<i>Risk of Recorded Video Loss</i>	 No – Data striped across disks AND appliances; accessible during hardware, OS or VMS failure	 Yes – May lose recorded video during multi-disk (more than 2), RAID controller or OS failure
<i>Non-Disruptive Updates</i>	 Yes – Application automatically restarts on new VM to prevent disruption during array updates	 No – Recording and access to live and recorded video stops while servers are updated
<i>Failed Disk Recovery (Sparing)</i>	 Virtual Global Sparing pools all array resources for drive rebuilds; reduces rebuild time, performance impact and redundant hardware requirements	 Drive sparing limited to dedicated disks w/in same RAID group, requiring significant excess capacity
<i>Proactive Maintenance</i>	 Predictive Disk Sparing and background verification detect and repair problems proactively to prevent failures	 Not Available

vSTAC[®] Watch vs DAS (3 of 3)



	Pivot3 vSTAC [®] Watch	Direct Attached Storage
SCALABILITY	<i>The ability to meet changing needs (new cameras, increased resolution or retention) and changing environments (increased motion activity, changing network conditions) without significant interruption, cost or complexity</i>	
<i>Scale-Out Architecture</i>	 Add a single appliance to scale storage, bandwidth and compute linearly to all cameras	 Add a recording server to provide capacity only for cameras directed at that server
<i>Auto Provisioning</i>	 Added resources auto-provisioned with no user intervention, no recording downtime or loss of recorded video	 Each new server that is added must be provisioned and configured manually
<i>Auto Load Balancing</i>	 Traffic auto-balanced across appliances without user intervention, system downtime or complexity	 Not available
COST IMPLICATIONS	<i>The costs and skills required to acquire, install, maintain and scale all system components to ensure reliable recording and availability of critical video data</i>	
<i>VMS Servers Included</i>	 Virtual servers included in vSTAC appliance, no need to add separate VMS servers	 Separate VMS servers, rack space, cooling and power required
<i>Server Failover Included</i>	 Included – No separate equipment or licensing required	 Separate equipment, software, licensing and management required
<i>Storage Efficiency</i>	 Storage pooled across disks and appliances so entire array available to all cameras – up to 94% efficiency	 Storage dedicated to each server, requiring overprovisioning to achieve desired retention















vSTAC® Watch vs SAN Summary



	Pivot3 vSTAC® Watch	Storage Area Networks
PERFORMANCE	<ul style="list-style-type: none"> • Optimized for uninterrupted handling of write-intensive large-scale IP video • Prevents frame drops and video loss due to bottlenecks & failed hardware • Automatically adapts to changing conditions to maintain performance 	<ul style="list-style-type: none"> • Optimized for general read-intensive IT applications (ie database, reporting) • Prone to performance bottlenecks which can lead to frame drops and video loss
AVAILABILITY AND FAULT TOLERANCE	<ul style="list-style-type: none"> • Storage, VMS servers and failover included in hyper-converged appliance • Extensive disk and appliance fault protection & preventive maintenance • Recorded video always accessible after hardware or software failover 	<ul style="list-style-type: none"> • Separate servers, software and licensing required for VMS hosting and failover • Risk of total loss or inaccessible recorded video after hardware failure • Snapshots, backup and replication impractical for write-intensive IP video
SCALABILITY	<ul style="list-style-type: none"> • Scales linearly and cost effectively without downtime or video loss as needs change • Storage and performance scaled simultaneously and automatically 	<ul style="list-style-type: none"> • Complex and expensive to scale • Only retention is scaled – additional servers and software required to add cameras or change record parameters
COST AND COMPLEXITY	<ul style="list-style-type: none"> • Up to 40% savings: less hardware, software, rack space, cooling, power • Maximizes storage and resource utilization to prevent over-purchasing • No special IT skills or resources needed 	<ul style="list-style-type: none"> • Forces over-purchase of equipment and inefficient resource utilization • Requires separate hardware and software for SAN, servers and failover • Advanced IT skills and multiple resources

vSTAC[®] Watch vs SAN (1 of 2)



	Pivot3 vSTAC [®] Watch	Storage Area Networks
PERFORMANCE	<i>Throughput</i>	 Bandwidth pooled across all ports and appliances so entire pipe (up to 240Gbps) is available to all cameras  Bandwidth pooled at storage nodes, but bottlenecked at VMS servers
	<i>Cache</i>	 Aggregated across appliances to accelerate disk performance; auto reallocates write vs read to optimize throughput; Combo RAM and SSD up to 64GB  Aggregated across nodes; optimized for read transactions, not configurable read vs write
	<i>Auto Load Balancing</i>	 Automatically balance storage, bandwidth and cache across appliances to prevent bottlenecks  Traffic balanced across storage nodes, but incoming traffic to VMS is not balanced, resulting in performance degradation and dropped video
	<i>Direct Disk Access</i>	 Disk writes bypass virtual machine hypervisor to improve performance by 30%+ vs traditional VM  Not available
	<i>Predictive Disk Sparing</i>	 Proactively detect underperforming disks and auto spare (replace) to prevent performance impact  Proactively detect underperforming disks and auto spare (replace) to prevent performance impact
SCALABILITY	<i>Scale-Out Architecture</i>	 Add a single appliance to scale storage, bandwidth and compute linearly to all cameras  Add a node to scale storage capacity and SAN bandwidth, but additional equipment required to scale VMS server bandwidth and compute capacity
	<i>Auto Configuration and Load Balancing</i>	 Added resources automatically configured and load balanced with no user intervention, no recording downtime or loss of recorded video  Added storage and server resources require manual intervention and configuration

vSTAC® Watch vs SAN (2 of 2)



	Pivot3 vSTAC® Watch	Storage Area Networks	
AVAILABILITY AND FAULT TOLERANCE	<i>Single Point of Failure</i>	Automatically and immediately fails over and balances loads to avoid video disruption or loss	Single points of failure at separate VMS servers; failover requires additional software and hardware
	<i>Disk Failure Protection</i>	Up to 5 disks in any part of the array, or 1 appliance + 2 disks simultaneously	Typically use replication and snapshots for data resiliency – inefficient for video surveillance
	<i>Server Failure Protection</i>	Yes – Server and applications automatically restart on new VM in event of hardware or VM failure	Not available
	<i>Simultaneous Server + Disk Failure</i>	Yes – 1 appliance + 2 disks may fail simultaneously	Not available
	<i>Recorded Video Access on Failure</i>	Yes – Immediately and automatically with no user intervention, even during VMS or OS failure	Yes after disk failure No after RAID controller failure
	<i>Risk of Recorded Video Loss</i>	No – Data striped across disks AND appliances; accessible during hardware, OS or VMS failure	No – Data is striped across disks and SAN nodes
	<i>Non-Disruptive Updates</i>	Yes – Application automatically restarts on new VM to prevent disruption during array updates	Yes
	<i>Failed Disk Recovery (Sparing)</i>	Virtual Global Sparing pools all array resources for drive rebuilds; reduces rebuild time, performance impact and redundant hardware requirements	System borrows from free drive space to create virtual hot spare
	<i>Proactive Maintenance</i>	Predictive Disk Sparing and background verification detect and repair problems proactively	Proactively remove any drive that reaches a threshold of defined errors
COST IMPLICATIONS	<i>Separate VMS Servers Needed</i>	No – Virtual servers included in vSTAC appliance, no need to add separate VMS servers	Yes – Separate VMS servers, rack space, cooling and power required
	<i>Server Failover Included</i>	Yes – VMS server and application automatically restarts on hardware failure; no separate equipment or licensing required	No – separate equipment, software, licensing and management required
	<i>Storage Efficiency</i>	Storage is pooled across all appliances so entire array is available to all cams – up to 90% efficiency	Storage is pooled across nodes, efficiency varies depending on data protection scheme
	<i>Storage Management Complexity</i>	Simple management of storage array, volumes and virtual machines through single interface	Highly complex management requires specific expertise

