



Setting the Standard for Automation™

Soluções Virtualizadas para Sistemas de Automação

Standards
Certification
Education & Training
Publishing
Conferences & Exhibits

II Simpósio ISA São Paulo de Automação em Sistemas de Água e de Esgoto, 23 de novembro de 2015, Sabesp Ponte Pequena



Setting the Standard for Automation™

What is Virtualization?

Standards
Certification
Education & Training
Publishing
Conferences & Exhibits

Why Virtualization?



- Build extra lanes
- Cars need to be individually maintained
- Inefficient (fuel and time)



- Efficient use of space
- Less maintenance
- Reduces fuel consumption and frees up time

But it doesn't have to be a bus....



- A bus may not be necessary if there are just 3-4 passengers – in that case, a car may be sufficient
- The point is: plants are not required to utilize big machines and make costly hardware purchases in order to run virtualization
- With Virtualization, it all depends on how many “people” you need to carry along with your desired reliability and features.





Setting the Standard for Automation™

Platform Virtualization Benefits and Value

Standards

Certification

Education & Training

Publishing

Conferences & Exhibits

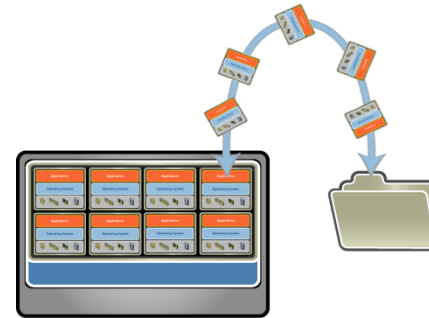
Key Platform Virtualization Benefits



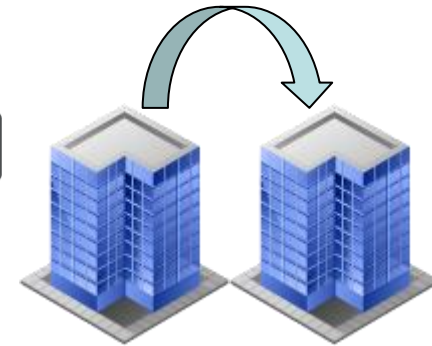
Reduce PC
Hardware
Requirements



Reduce the Impact
and Frequency of
OS and hardware
change

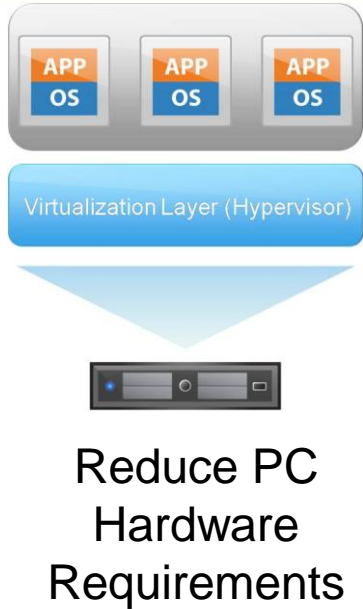


Simplify overall system
management



Improve
availability,
reliability and
disaster recovery

Reduce PC Hardware Requirements



- Run multiple operating systems and application stacks on one physical machine
- For each PC removed, there is a reduction in....



Reduce Impact and Frequency of Change

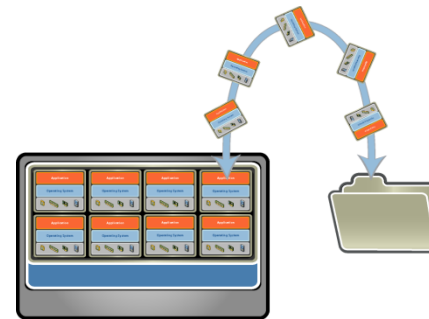


Reduce the Impact
and Frequency of
OS and hardware
change

- Improved OS support for current generation hardware.
- Maintain existing hardware for as long as it meets VM performance requirements
- Impact when a hardware change is required is reduced
- Avoid having to test OS/Application stack against physical hardware

Simplify System Management

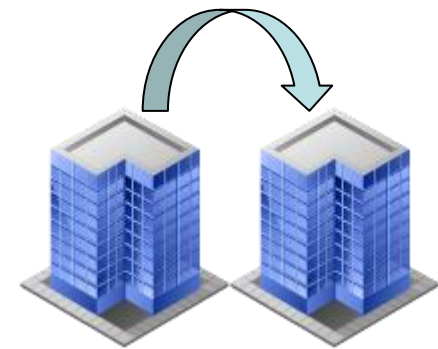
- Provisioning
 - Deploy new machines in minutes rather than hours
- Visibility
 - Centrally administer all virtual machines
- Flexibility
 - Improved hardware choice
- Troubleshooting
 - See the performance of all nodes and receive alerts



Simplify overall system management

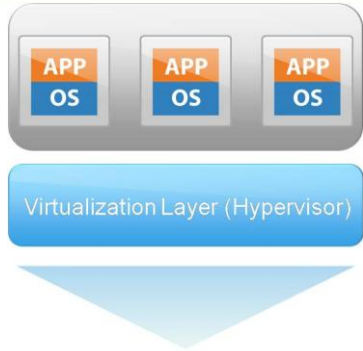
Improve Availability and Reliability

- Improved Application Protection
 - Roll back to known good points using snapshots
 - Simplified disaster recovery
 - Improved application availability
 - Improved driver stability
- Improved Site Protection
 - Honeywell Backup Control Center solution which provides complete site level protection.



Improve
availability,
reliability and
disaster recovery

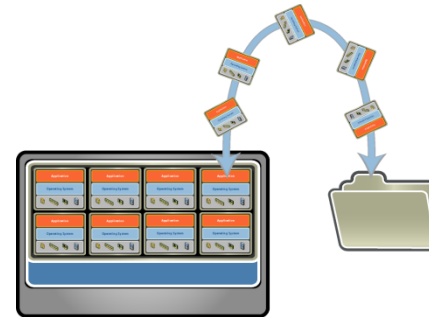
Key Platform Virtualization Benefits



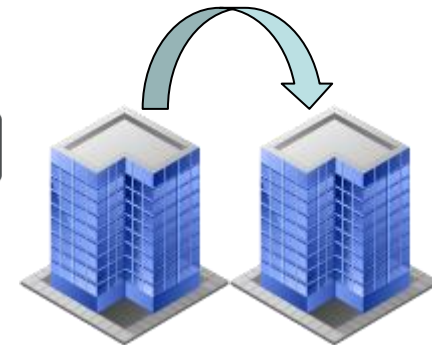
Reduce PC
Hardware
Requirements



Reduce the Impact
and Frequency of
OS and hardware
change

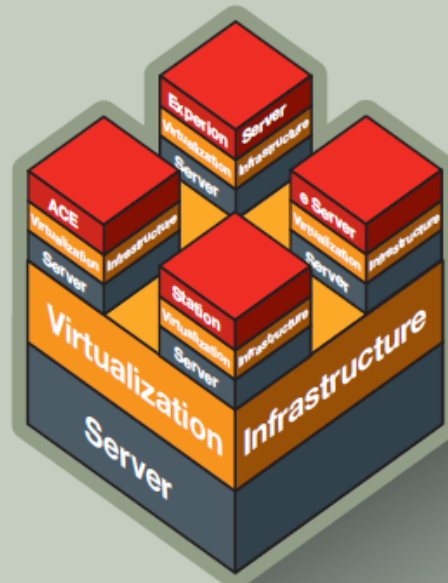


Simplify overall system
management



Improve
availability,
reliability and
disaster recovery

Value of Virtualization



- Fewer PCs
- Reduced PC Infrastructure Change
- Simplified System Management
- Improved Reliability

Reduce Lifecycle Management Costs by 30%!

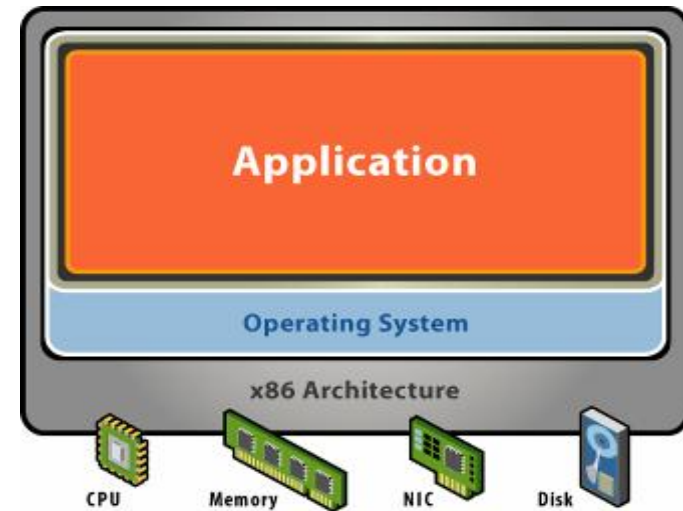
Types of Virtualization and benefits

Platform Virtualization



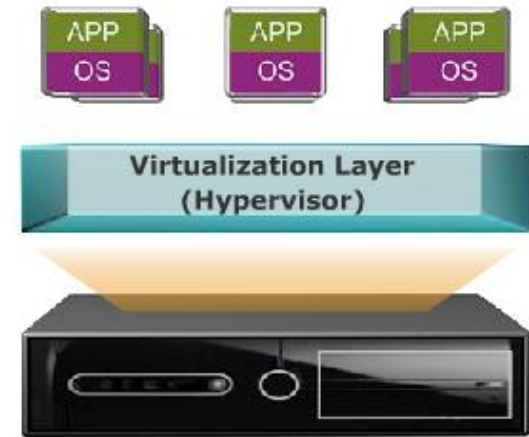
Experience Without Platform Virtualization

- Running multiple applications within an OS can cause conflicts
- Mitigated through having dedicated machines for each major app.
- Therefore Resources are underutilized
- Results in additional cost and expense
- Difficult to source hardware for older operating systems
- Operating systems are tightly coupled with underlying hardware.



What is Platform Virtualization?

- Platform Virtualization is the **separation of the operating system from the hardware**
- It places a thin software layer called the Hypervisor between the operating system and the hardware
- This Hypervisor presents a complete x86 platform to one or more operating systems - these are called Virtual Machines.



Virtual Infrastructure

- Virtual Infrastructure is the software and hardware required to run virtual machines.
- Honeywell supplies the industry-leading virtualization software for use with our products – VMware's vSphere
- End to End Supply
 - Application stack down to the server and storage layer
 - Detailed documentation and best practices capturing installation, configuration and maintenance

Virtual Infrastructure

Hypervisor

Networking

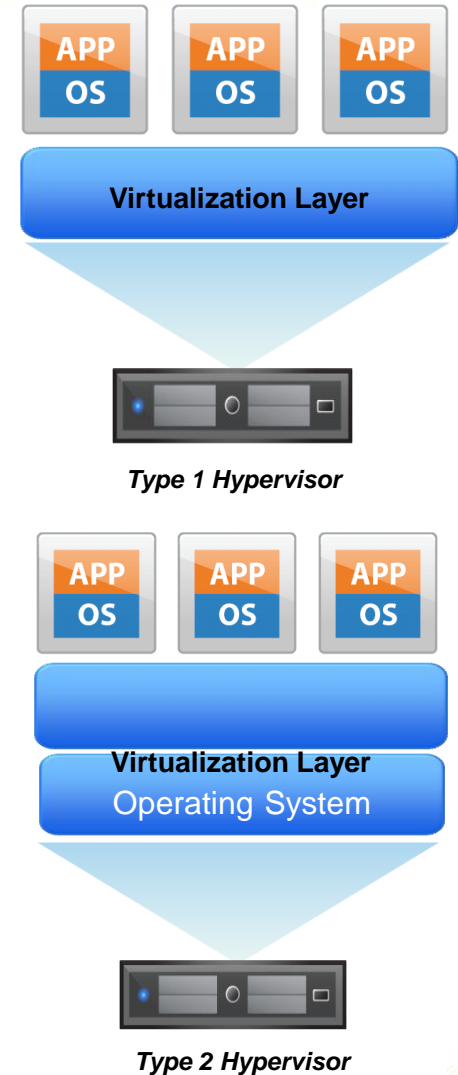
Compute

Storage

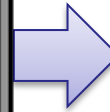
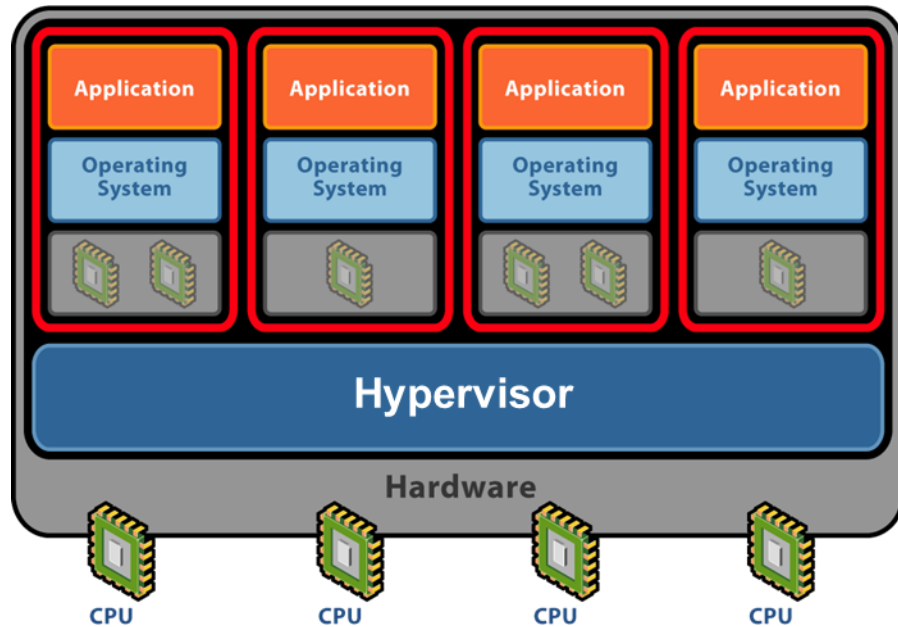


Virtualization Alternatives

- Two main types of Platform Virtualization
 - Type 1 Hypervisor – Native, Bare-Metal
 - Hypervisor runs direction on the Host hardware
 - Typically 90% to 98% of native
 - Only Hypervisor type that we recommend for production
 - Examples: VMware vSphere
 - Type 2 Hypervisor
 - Virtualization software that runs on top of an OS
 - Typically 80-85% of native
 - Examples: VMware Workstation



What is Virtual Hardware?

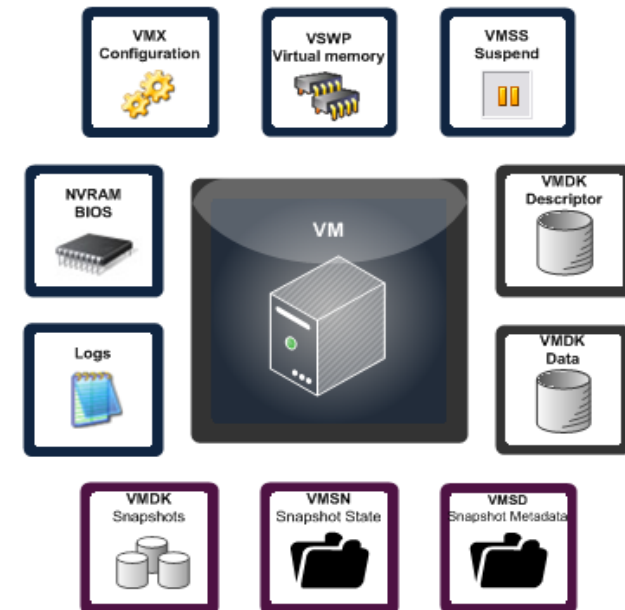


Virtual Hardware

- Virtual Hardware is the component of the Hypervisor that presents the emulated x86
- Has all of the same components that a regular PC does
- Virtual Hardware has a release train that is totally separate from the Hypervisor. This allows for the Virtual Hardware to remain stable regardless of changes to the Hypervisor or Physical Hardware.

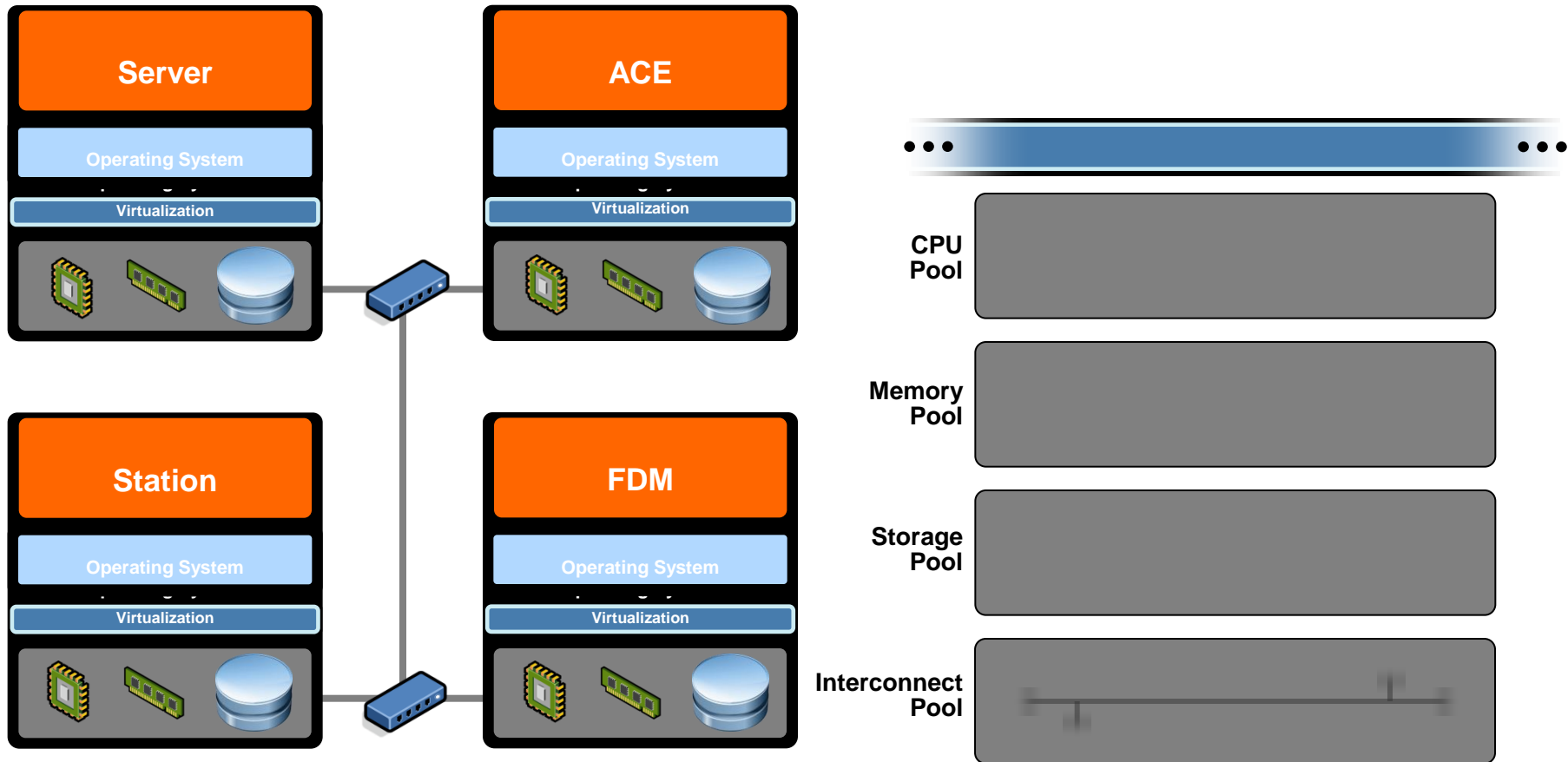
What makes up a virtual machine?

- VM is comprised of a number of files located in its home directory
- Each VM contains things like the Virtual Disk, BIOS, Configuration files etc.
- Most of the files start with the actual name of the VM and have different file extensions based on their type

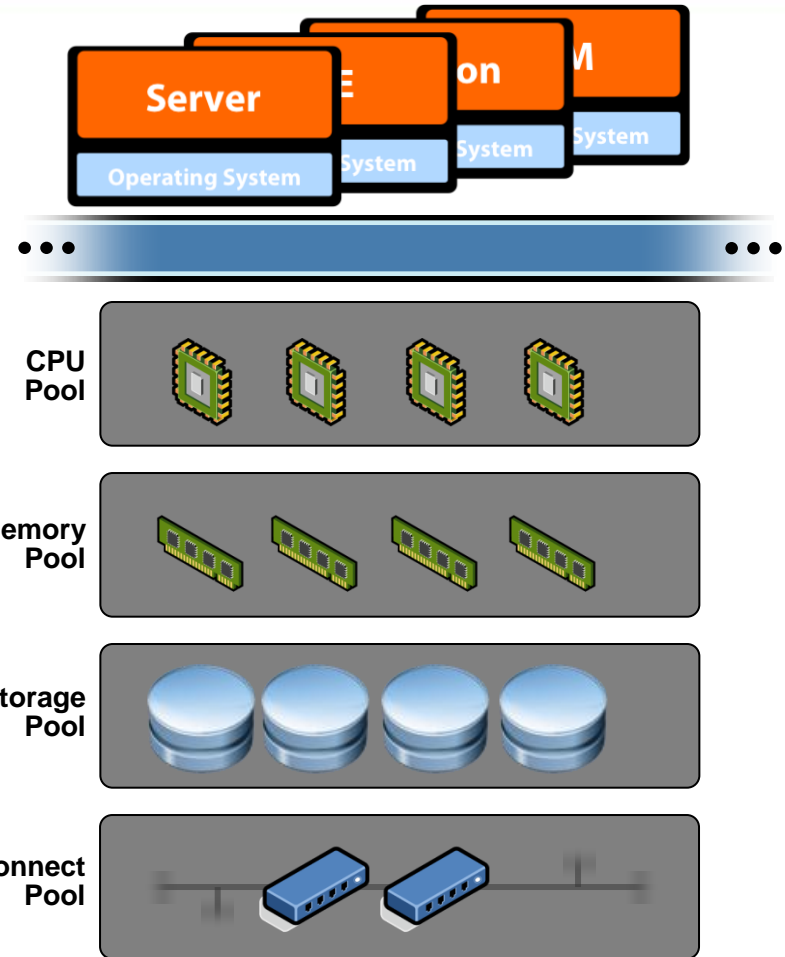


The Traditional way of deploying DCS IT Infrastructure

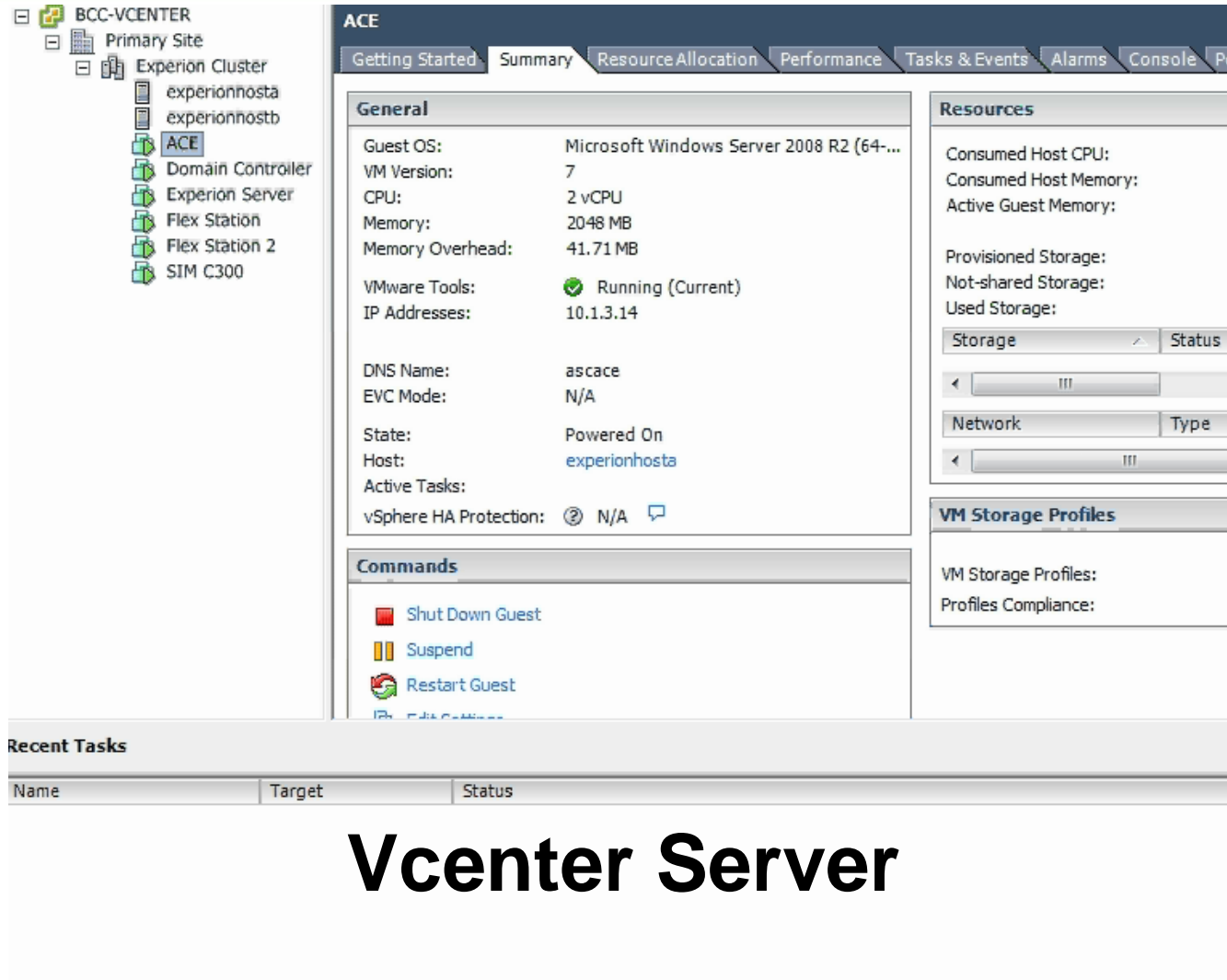
DCS IT on Virtual Infrastructure



The new way of deploying DCS IT



Basic DCS Cluster



BCC-VCENTER


- Primary Site
 - Experion Cluster
 - experionhosta
 - experionhostb
 - ACE**
 - Domain Controller
 - Experion Server
 - Flex Station
 - Flex Station 2
 - SIM C300

ACE

Getting Started | **Summary** | Resource Allocation | Performance | Tasks & Events | Alarms | Console | Pe



General

Guest OS: Microsoft Windows Server 2008 R2 (64-...
 VM Version: 7
 CPU: 2 vCPU
 Memory: 2048 MB
 Memory Overhead: 41.71 MB

VMware Tools:  Running (Current)
 IP Addresses: 10.1.3.14

DNS Name: asace
 EVC Mode: N/A


State: Powered On
 Host: experionhosta
 Active Tasks:


vSphere HA Protection:  N/A 

Resources

Consumed Host CPU:
 Consumed Host Memory:
 Active Guest Memory:

Provisioned Storage:
 Not-shared Storage:
 Used Storage:





Storage  Status

Network  Type

VM Storage Profiles

VM Storage Profiles:
 Profiles Compliance:

Commands

-  Shut Down Guest
-  Suspend
-  Restart Guest
-  Edit Settings

Recent Tasks

Name	Target	Status


Vcenter Server

System Management Benefits

- [-] BCC-VCENTER
 - [-] Primary Site
 - [-] Experion Cluster
 - [-] experionhosta
 - [-] experionhostb
 - [-] ACE
 - [-] Domain Controller
 - [-] **Experion Server**
 - [-] Flex Station
 - [-] Flex Station 2
 - [-] SIM C300


Experion Server
Getting Started | Summary | Resource Allocation | Performance | Tasks & Events | Alarms | Console | Permissions | Maps | Storage Views

Experion PKS



Process Knowledge System

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 Experion® Release 410.1



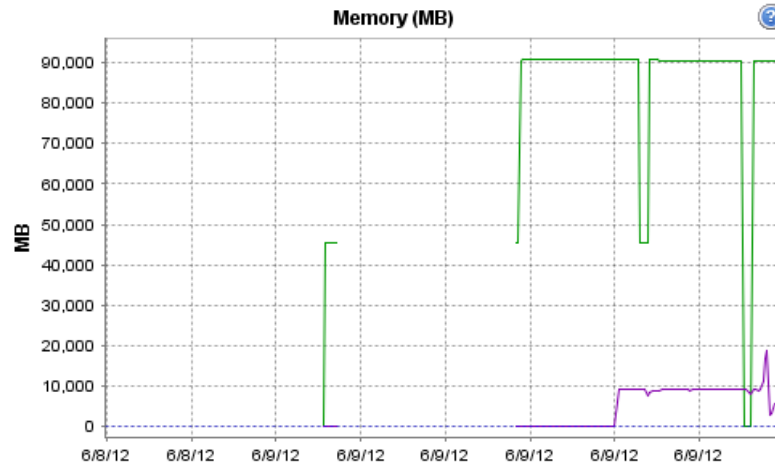
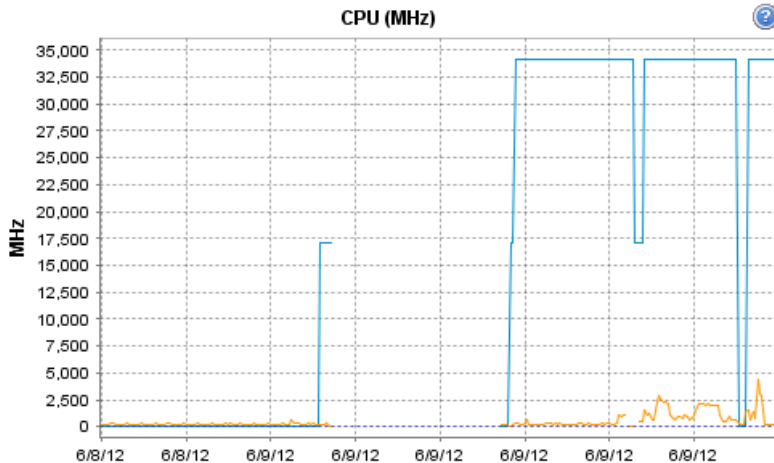
Access the desktop of any virtual machine from a single screen

System Management Benefits

Name	State	Status	Host	Provisioned Space	Used Space	Host CPU - MHz	Host Mem - MB	Guest Mem - %
Flex Station 2	Powered On	✓ Normal	experionhosta	35.00 GB	35.00 GB	47	2111	19
Flex Station	Powered On	✓ Normal	experionhosta	72.03 GB	41.17 GB	71	2150	14
Domain Controller	Powered On	✓ Normal	experionhosta	15.00 GB	15.00 GB	23	1075	5
ACE	Powered On	✓ Normal	experionhosta	35.00 GB	35.00 GB	47	1765	54
SIM C300	Powered On	✓ Normal	experionhosta	35.00 GB	35.00 GB	47	1817	8
Experion Server	Powered On	✓ Normal	experionhosta	129.91 GB	78.91 GB	1292	4154	44

View: Home | Time Range: 1 Day

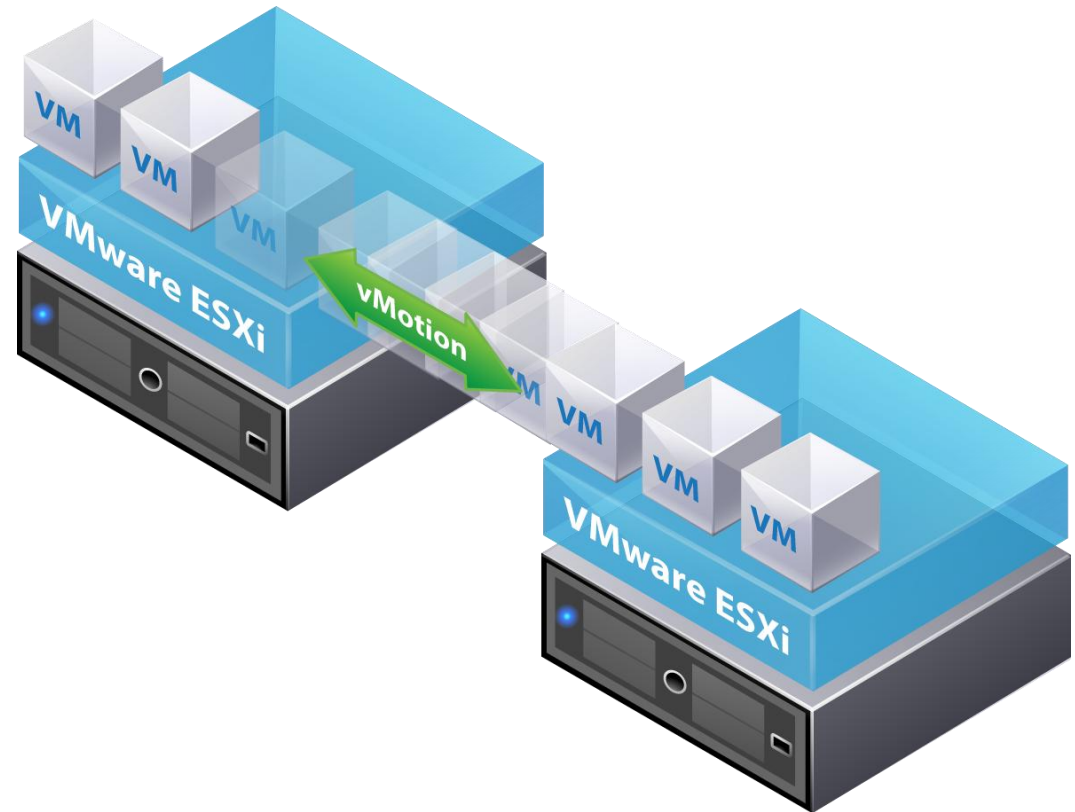
1 Day Summary for Experion Cluster



See the status and performance of all VMs from one window.

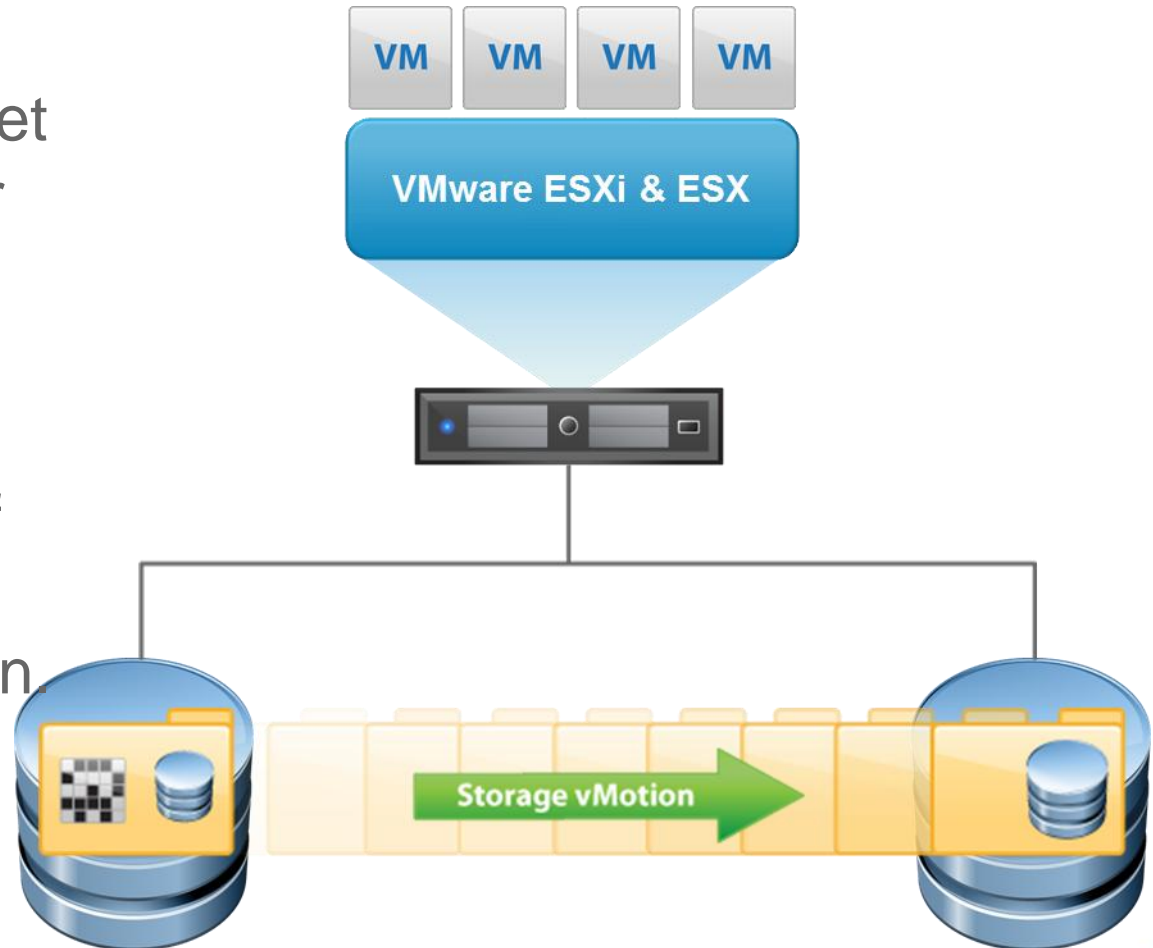
VMotion

- Makes it possible to move virtual machines from one physical host to another without interrupting the applications running inside.



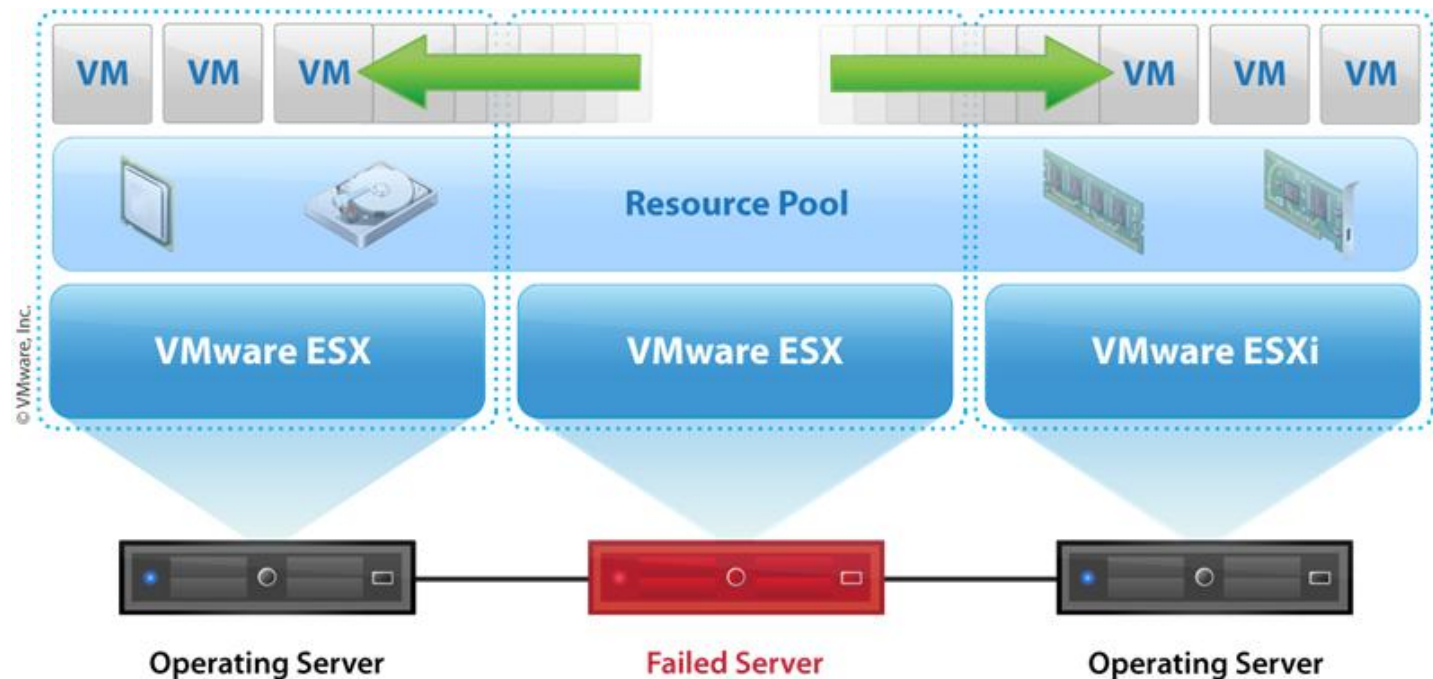
Storage vMotion

- Allows virtual machines to be moved from one set of disks to another while they are running
- Allows for the upgrade/repairs of an array without having to shutdown



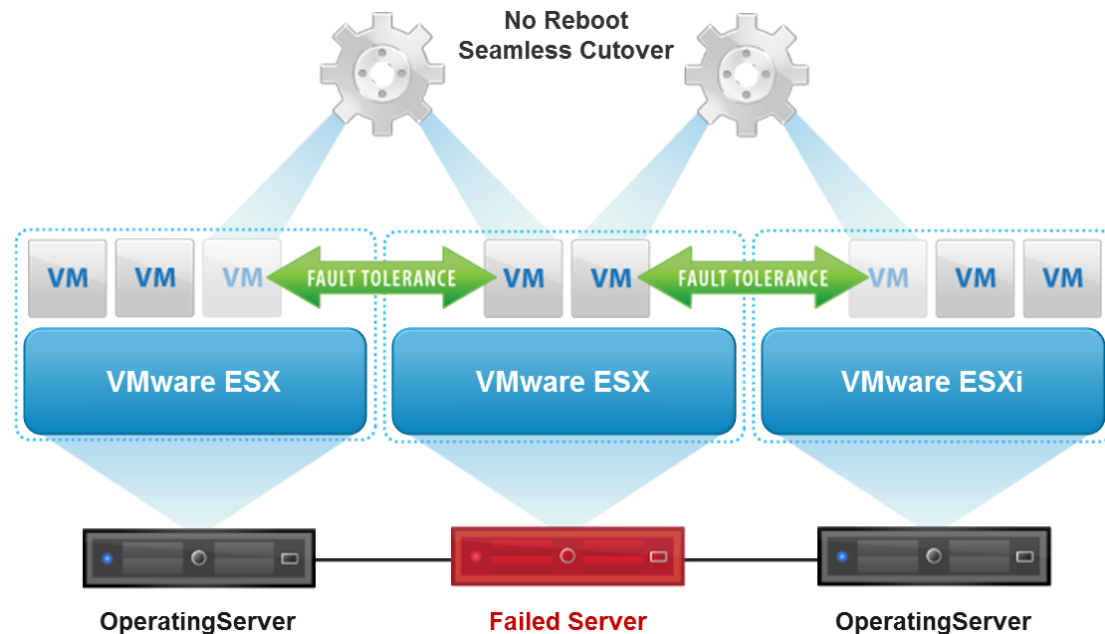
High Availability

- Protects DCS applications against component and complete system failure
- Only one click to configure!



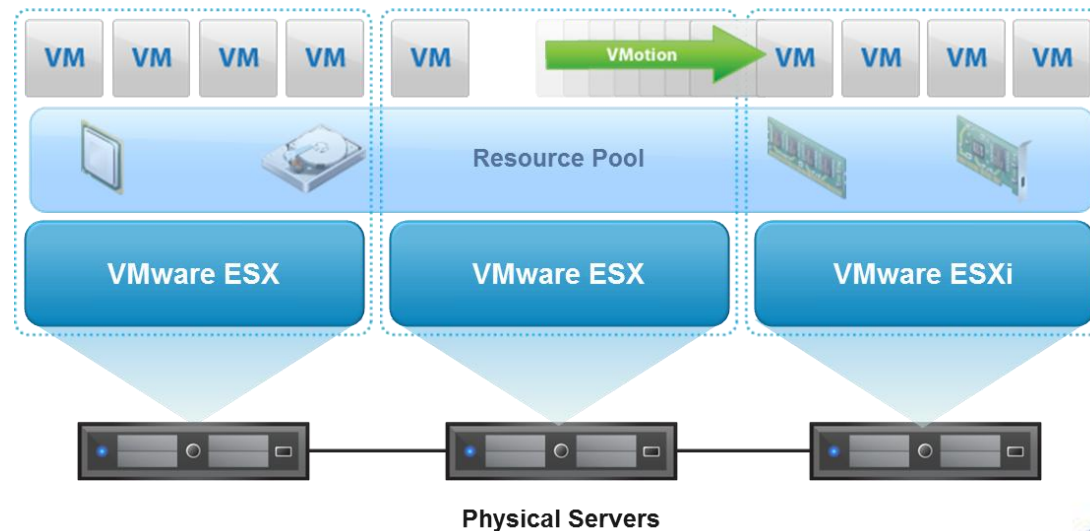
Fault Tolerance

- Allows protected virtual machines that are running on a host to be transparently switched over to another in the event of a host failure.
- Provides for transparent protection of virtual machines if a host should fail.



DRS

- Allows virtual machines to be dynamically allocated between hosts
- If a host needs to be shutdown, virtual machines will be automatically moved to other hosts.



Virtual and Traditional Physical Options

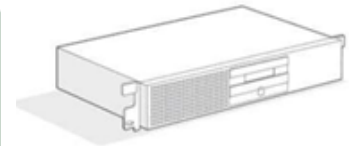


- Cost effective
- Simple

Physical Platform

**Essentia
Is
Platform**

- Cost effective
- Good consolidation
- Improved Lifecycle Experience
- Facility Savings



Virtual



- Highest Density
- High Availability
- Transparent upgrades
- Ultimate Lifecycle Experience

**Premiu
m
Platform**

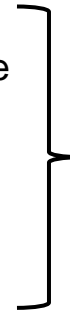
Virtual Infrastructure- Essentials Platform

Management Host

- Dedicated Separate host for Managing Virtual Infrastructure

Standard Production Host

- Production Host for Standard Consolidation Ratio (up 5:1)
- Single CPU based



Dell R320 Power Edge

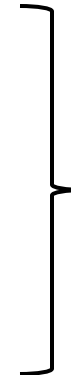


Performance A Production Host

- Production Host for Medium Consolidation Ratio (form 3:1 to 8:1)
- Single CPU based

Performance B Production Host

- Production Host for High Consolidation Ratio (form 8:1 to 12:1)
- Dual CPU based



Dell R720 Power Edge



Virtual Infrastructure- Hardware Peripherals

Thin Client

- Used to display the desktop of virtual machines
- Onboard Video, Ethernet and USB ports to connect I/O peripherals in the Control room
- Supports Single or Dual monitors
- Based on Dell Wyse Z90
- Redundant Port Protector option to support network redundancy



Network Switches

- Dedicated L 2.5 Management Switch based on Cisco C3560X
- Used for vCenter, HA, vMotion and backup management traffic
- L2 Gigabit production switch based on the Cisco C2960x



Network Attached Storage (NAS)

- Cost effective and reliable option for storing virtual machine backups
- Available in Tower and Rack form factors
- Based on LenovoEMC px4-400



Virtual Infrastructure- Premium Platform

Blade Chassis

- 7U Rack Enclosure
- Accommodates up to six Blades
- Onboard storage and dual RAID controllers
- Quad Power Supplies



Blade Server

- Performance A Single CPU based Blade Server
- Performance B Dual CPU based Blade Server
- Designed for Medium (3:1 to 8:1) and High (8:1 to 12:1) Consolidation ratio respectively
- With Pre-loaded Windows Server Datacenter OS

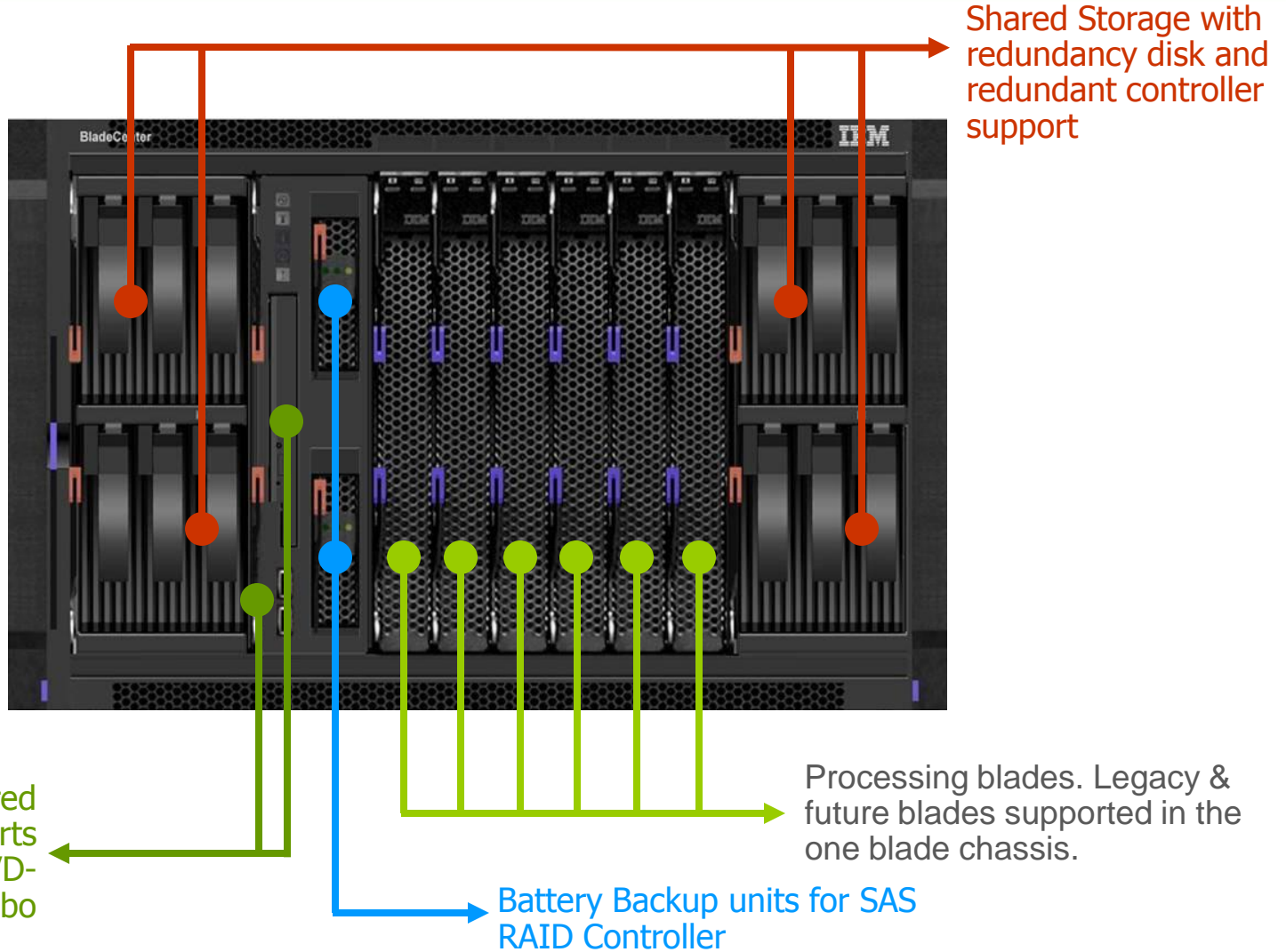


Mounting Rack for Blade

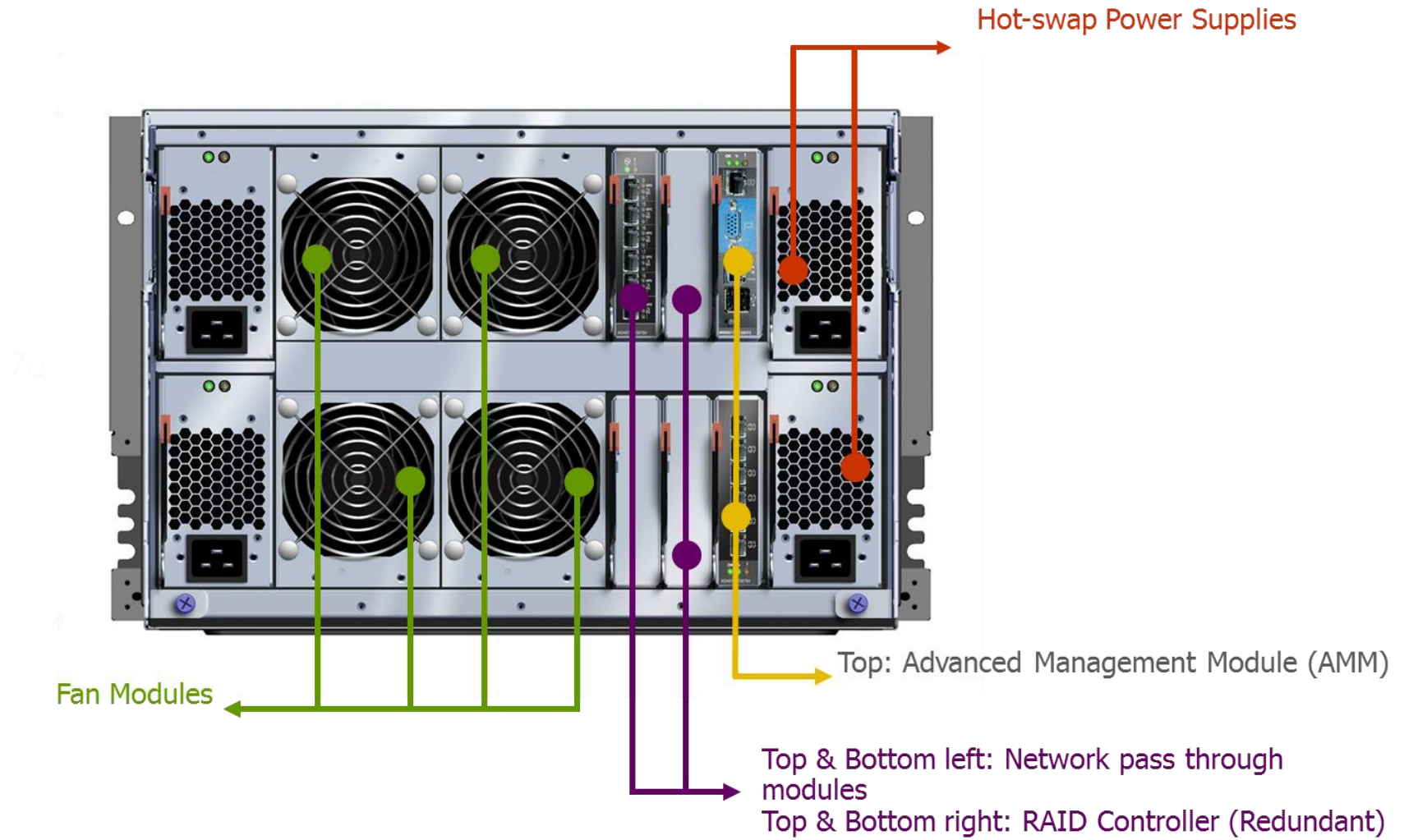
- Ready 42U Rack solution with PDUs and Custom power cords
- Supports up to 3 Blade Chassis per Rack



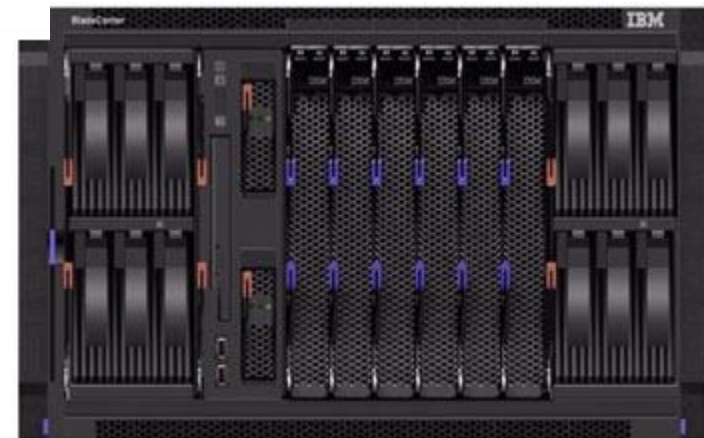
Experion Premium Virt Hardware



Experion Premium Virt Hardware



Experion Premium Virt Hardware



Compact

Supportable



Simple &
Scalable

Reliable

DCS in a Box!

Virtualization and the Blade Server



It's just simpler. Here are some stats on the next best alternative, Dell virtual.

**50% More
Density**

**58% Less
Power**

**60% Longer
Life**

**75% Reduction
in Weight**

**50% Less
Cooling**

So what does it do?



Servers

Networking
All come together in
a single package
management

Storage

**50% More
Density**

Compact

**60% Longer
Life**

Supportable



**74% less
Hard Drives**

Simple &
Scalable

**Zero impact
maintenance**

Reduce Change

The Trade

- **Extend System Life**
- **Improved stability throughout that life**

Traditional


3 Years



Virtualization

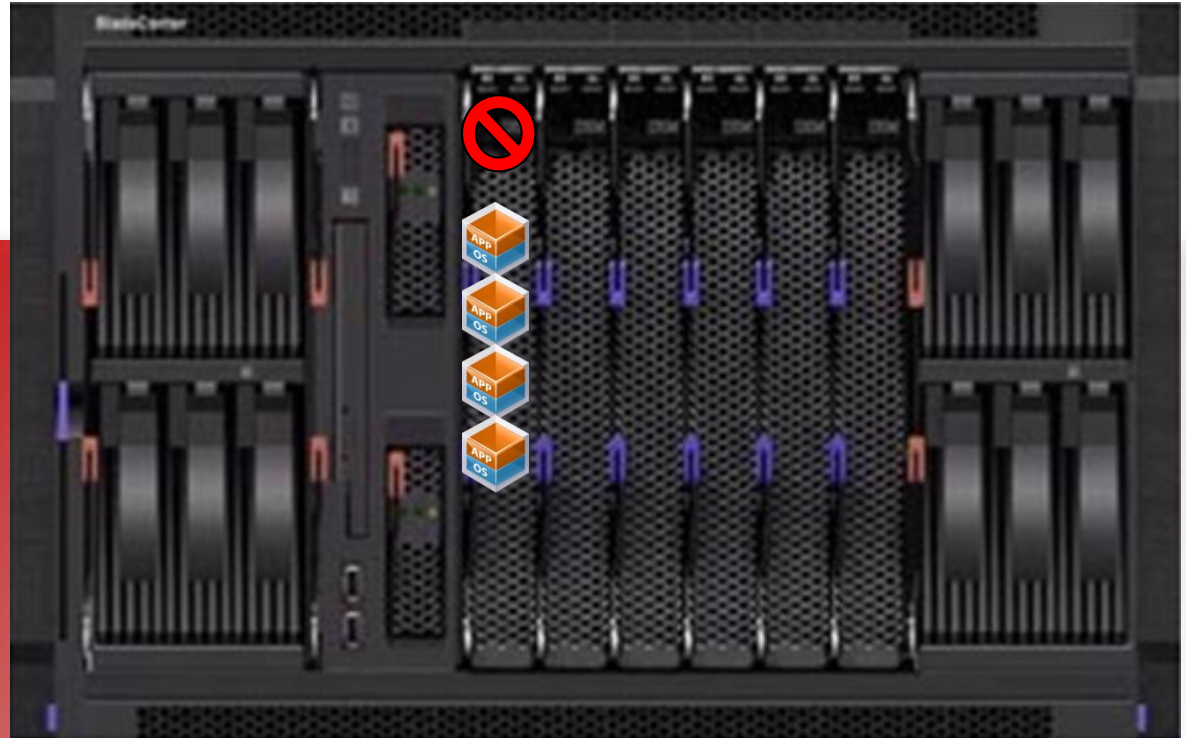

6 Years



Reducing Open Systems Churn

Blade Redundancy Design

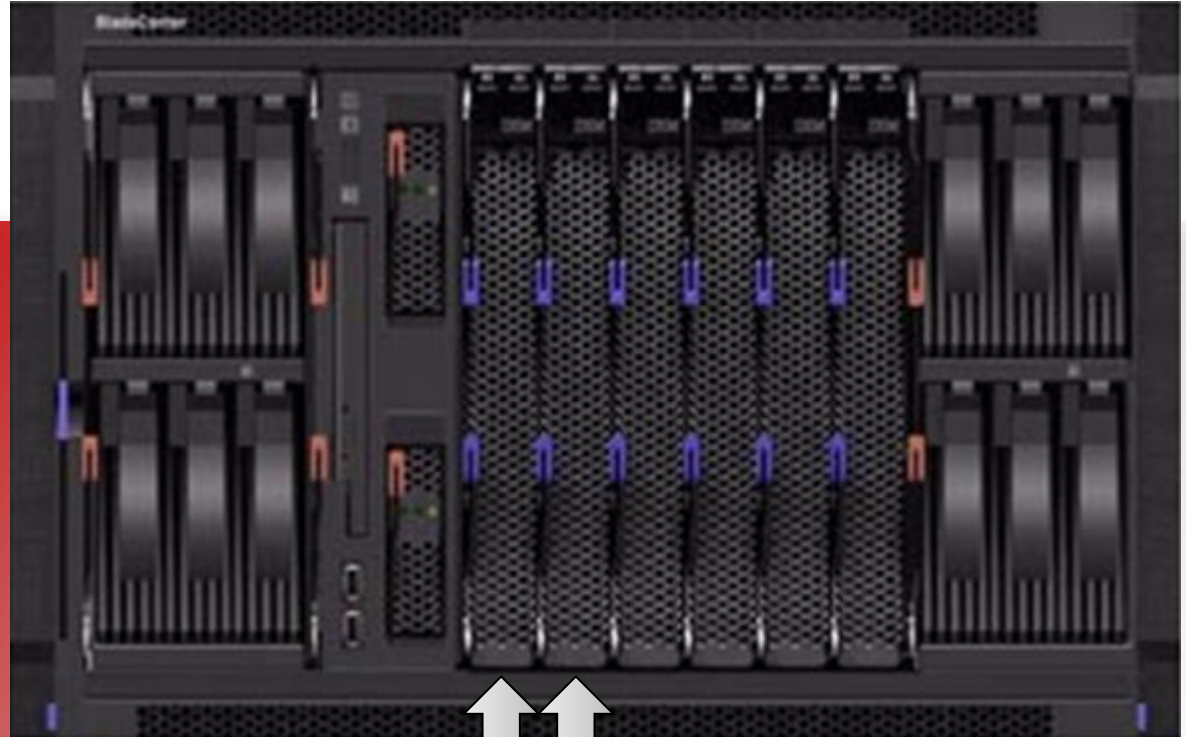
- Automatically recover from a failed blade
- Recover in minutes



HA Clusters 1 2 3

Minimize Impact

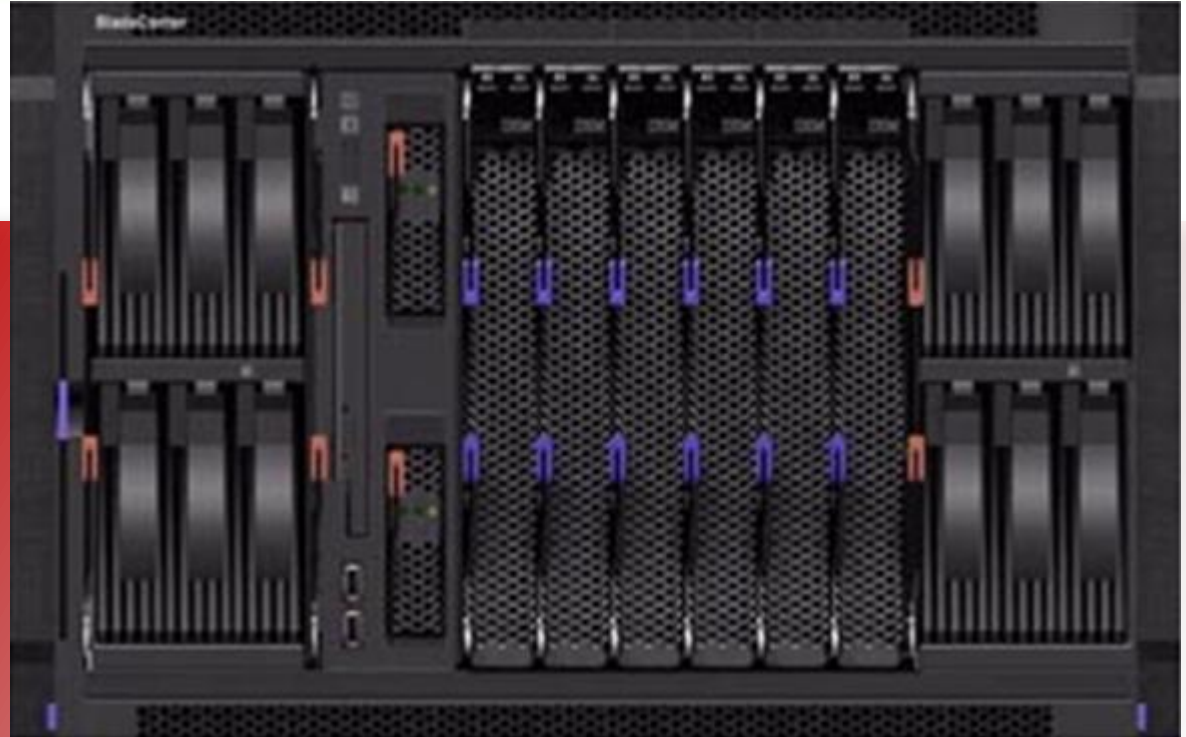
vMotion 



- **Seamlessly move a VM from one blade to another**
- **No impact to plant operations**
- **Transparent maintenance or expansions**

Improve Deployment

Pre-Configuration



- Pre-Installed ESXi
- Automatic config of hardware
- Shared Storage ready to go
- Pre-Configured IP for Management
- OS Included

Compact

Supportable



Simple & Scalable

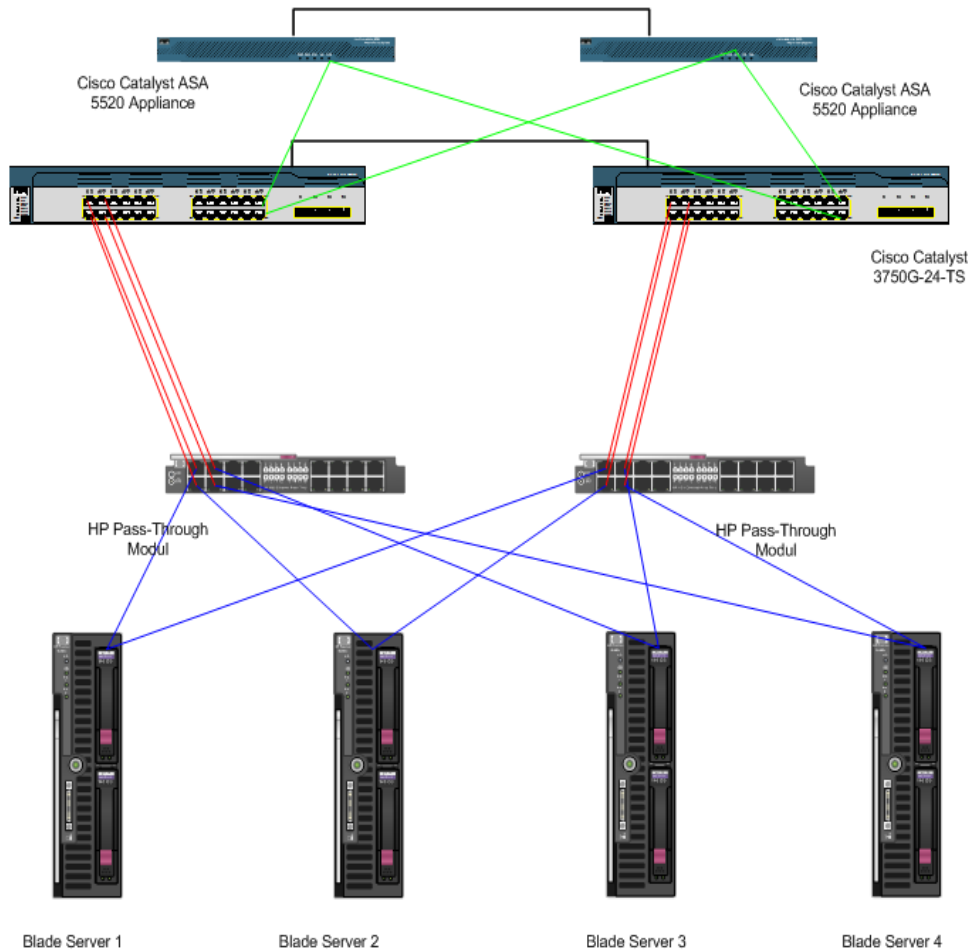
Reliable

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Design Opportunities

Basic Architecture

ETHERNET CONNECTIONS



2 x Cisco
ASA 5520 Appliance

2 x Cisco
Catalyst 3750

HP 1/8 G2 Autoloader
Management server
HP DL380 G5

HP EVA 4400
Disk Enclosure
HP EVA 4400
Controllers

HP c7000 enclosure with
4 HP Blade servers HP
BL 460c

Virtualization Thin Client

- Thin Client Dual Video (high Res)



- Thin Client Quad Video (high Res)



- Thin Client (Front left view, high res image)



- Thin Client (Front & Rear View)



Setting the Standard for Automation™

Virtualization of the Experion DCS

Standards

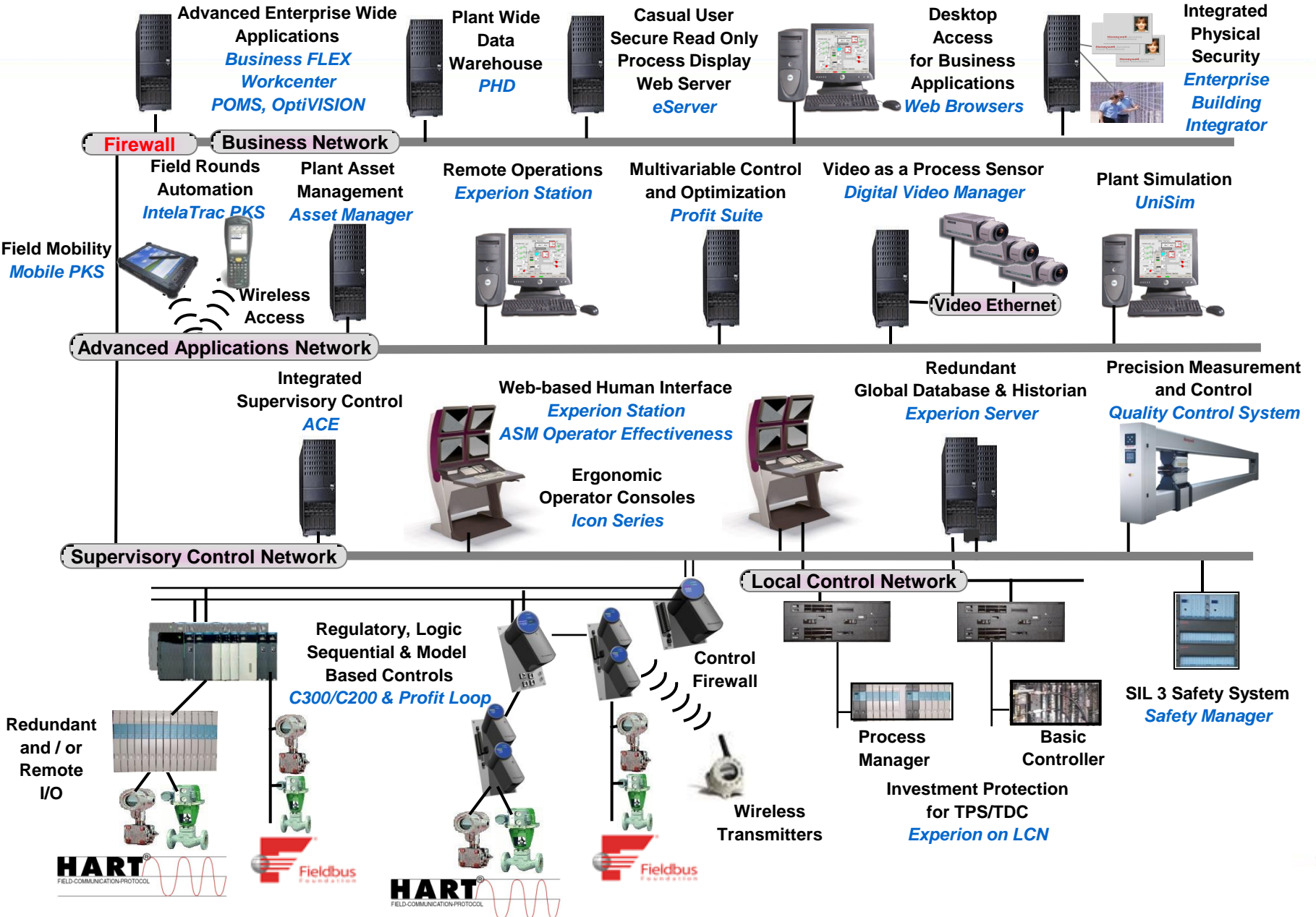
Certification

Education & Training

Publishing

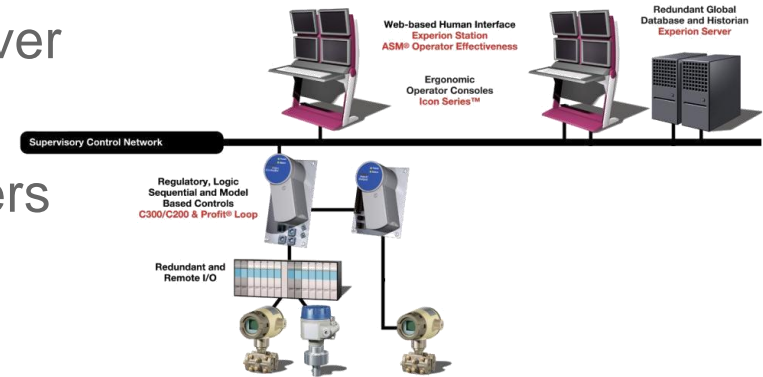
Conferences & Exhibits

Experion Platform Architecture



Virtualization for Experion DCS

- Provides support for....
 - Server Nodes such as Experion Server ACE and Domain Controllers
 - Connectivity to all C Series Controllers
 - Single and Multiple Clusters
 - FTE
 - Update to Honeywell's comprehensive Virtualization Planning and Implementation Guide including integration with L3 and L4
 - Load Virtual Machines from the Honeywell supplied Init Media
 - Support for Experion R400 and above.



Virtualization comes to the DCS!

Virtualization for Experion DCS

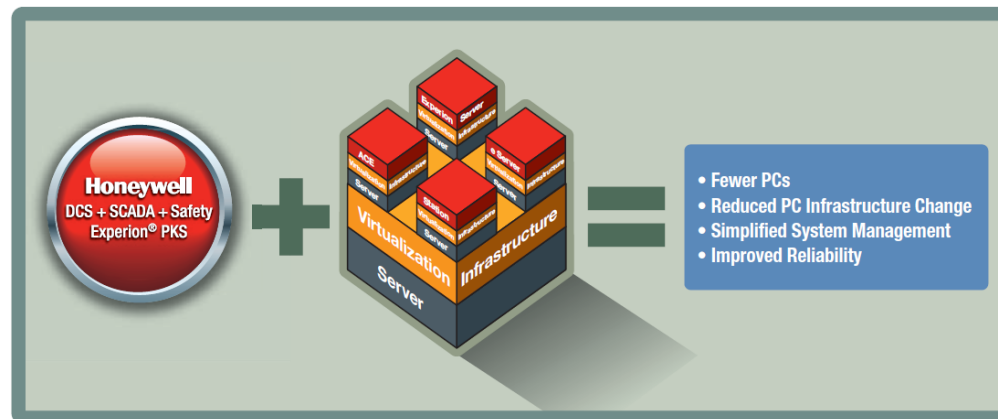
- Provides support for....
 - Both Flex Stations and Console Stations Virtualized
 - IKB Support
 - Multi Monitor support (up to 2 monitors)
 - Optional Dual Ethernet support from the Thin Clients to the immediate switch they are plugged into.
 - Thin Client Support
 - We are using the WYSE R10L
 - Highly secure and locked down Thin Client with no file system reducing attack surface.



Making Control Rooms quieter and more secure.

Benefits of Virtualizing the DCS

- Benefits,
 - Improved hardware utilization
 - Through consolidating nodes onto fewer pieces of hardware
 - Wider variety of Server and Client hardware to choose from
 - Virtualization provides hardware independence.
 - Improved, space, maintenance, power and security
 - Through the use of Thin Clients in the control room or other locations





Setting the Standard for Automation™

Why Honeywell?

Standards

Certification

Education & Training

Publishing

Conferences & Exhibits

Why Honeywell?

- Provide a solution not just a tick of approval
 - Full installation and configuration guide to aid in deployment
- Ability to Design, Supply and Support these solutions
 - VMware certified TAC engineers in every region
- Strategic, long-term approach to virtualization
 - Full roadmap outlining our vision
 - See virtualization as transformative and industry changing
- Joint development effort with the industry leader VMware.
- Domain expertise
 - Specific process control industry needs.

Why Honeywell?



- Honeywell is at the forefront of virtualization for process control and is the only supplier offering a complete, site-wide backup control center solution
- Honeywell provides a comprehensive range of virtualization products and solutions – not just a “tick of approval”
 - Full installation and configuration guide to aid in deployment
 - Performance guidelines for supported nodes
 - Ability to design, supply and support its solution



- Honeywell is taking a strategic, long-term approach to virtualization
 - Full roadmap outlining our vision
 - Large range of products supported
 - Regards virtualization as transformative and industry changing

Honeywell

Why Honeywell? (Cont'd)



- Honeywell has a joint development effort with the virtualization industry leader, VMware, to formulate a vision for virtualization in industrial automation
- Honeywell has deep process industry domain expertise
 - Other suppliers know about virtualization, but applying it to the needs of process control customers requires a totally different set of skills that only Honeywell provides

