OSIsoft®

Virtualization and HA PI Systems:
Strategies to Keep Your PI System Available, Scalable, and Portable

Overview

- Virtualization

  - Storage (DAS, NAS, SAN)

  - Server

  - Application (Clients)

- How does PI High Availability play into virtualization?

  - Highly Available (HA) PI

  - HA PI in a virtual environment

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Why Virtualization and PI?

You can realize substantial benefits using the combined strategies of virtualization (storage, server and application) and PI Collectives (HA).

These strategies provide you with:

- Increased reliability

- Reduced hardware and maintenance costs

- Improved scalability

Use them separately or together

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Why Now?

- You need to do more with less

- Your projects need to show immediate ROI

- IT is challenged to increase service levels with less staff

- Virtualization and HA are valuable separately, but better together

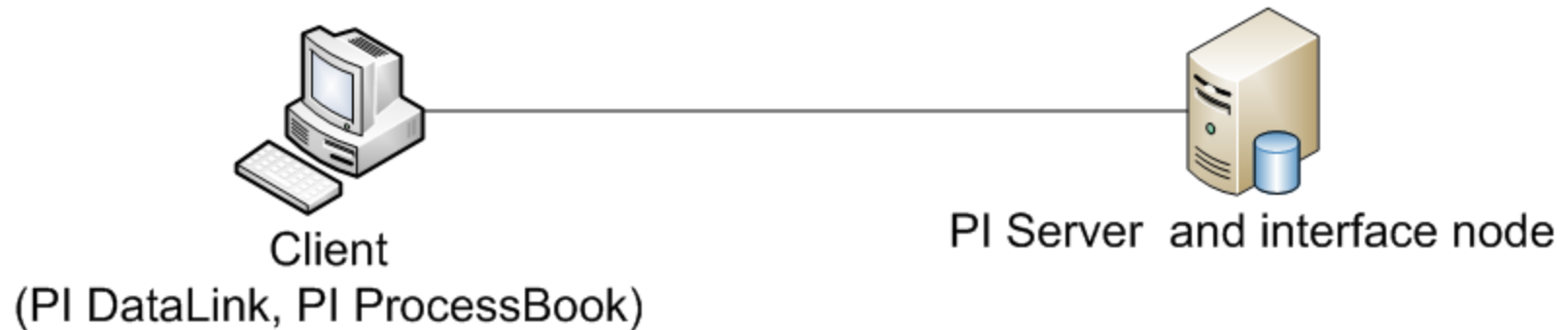Empowering Business in Real Time.

Who Needs This?

- PI users who cannot afford disruption in service (even for planned maintenance)

- IT organizations looking to consolidate management of computing resources (fewer servers to buy and maintain)

- IT organizations looking to streamline deployment of new tools for the user community (less IT time and resources)

- IT organizations investigating new ways to provide ever-increasing amounts of storage for mission critical systems
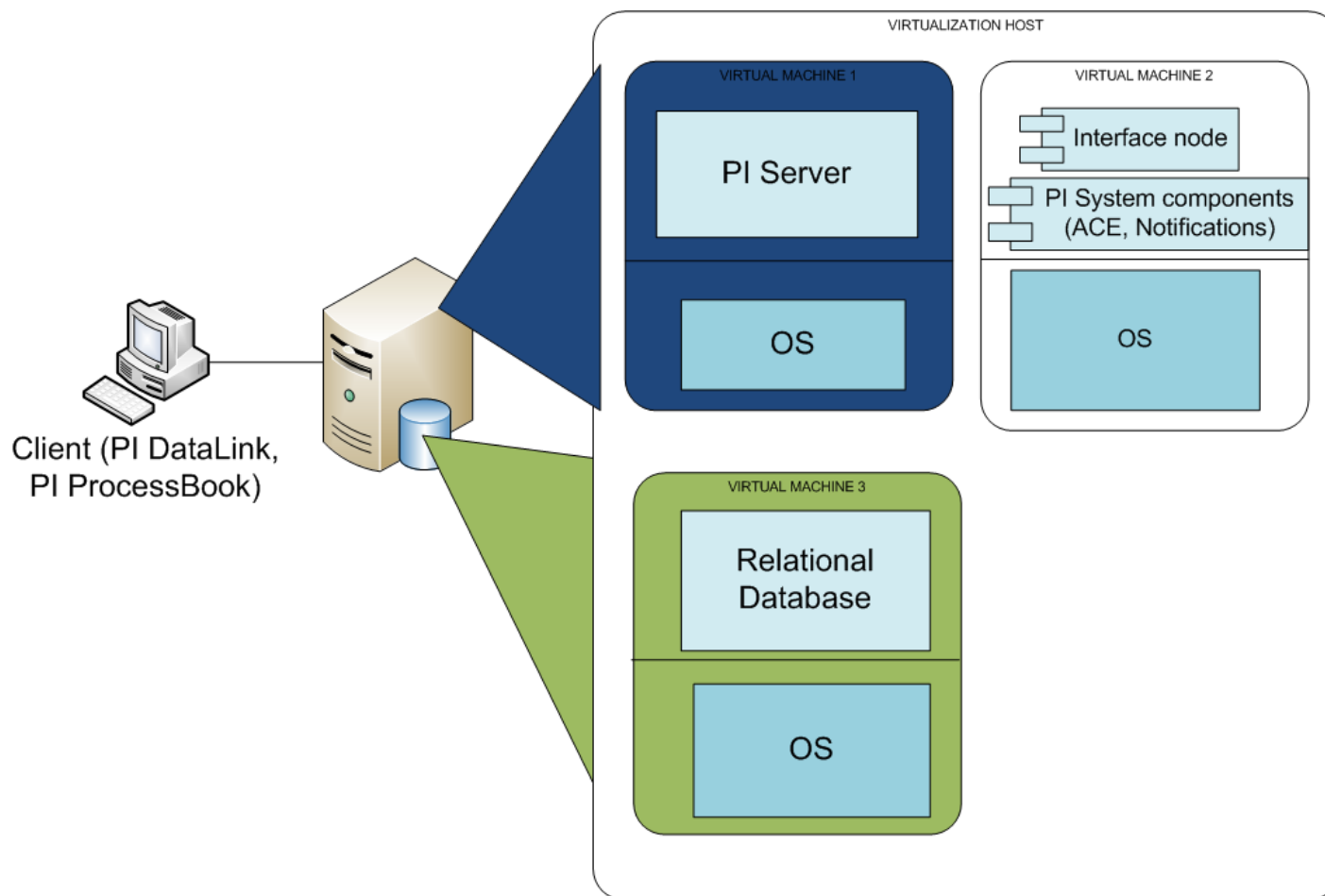
- A PI system administrator tasked with scaling PI to more users and other information systems

- Companies investigating virtualized test environments for validating new software purchases

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A Simple System

Client
(PI DataLink, PI ProcessBook)

PI Server and interface node

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A Simple Virtualized System

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Virtualization

- Servers

- Storage

- Applications

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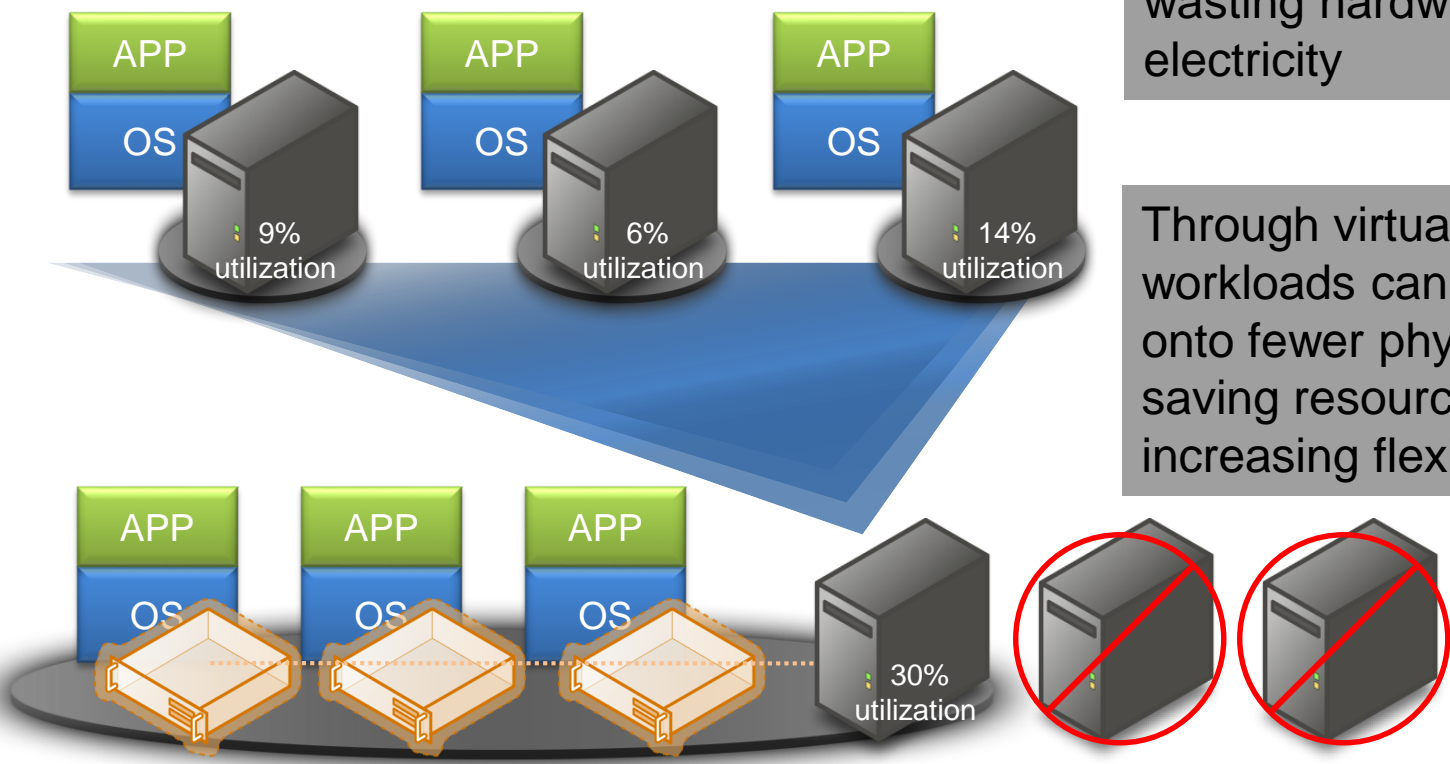
Server Virtualization

- Instead of having physical machines, virtual servers run on a physical host

- Case Study: AtlantiCare

  - Eliminated need to expand or relocate data center

  - Microsoft® Virtual Server 2005 used to consolidate infrastructure and legacy application servers

  - Consolidation ratio achieved of 33:2

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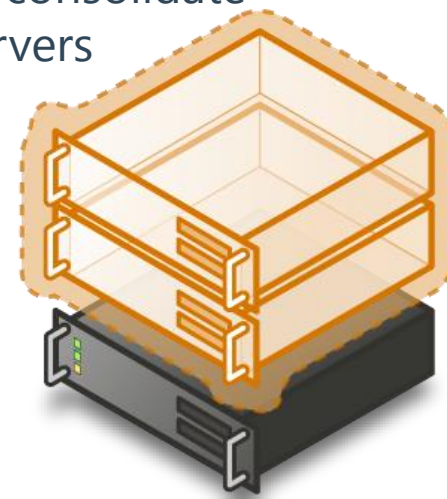
Example: Server consolidation

APP
OS
9% utilization

APP
OS
6% utilization

APP
OS
14% utilization

APP
OS

APP
OS

APP
OS

30% utilization

Typically server workloads only consume a small fraction of total physical server capacity, wasting hardware, space, and electricity

Through virtualization, these workloads can be consolidated onto fewer physical servers, saving resources and increasing flexibility

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Benefits of Server Virtualization*

- Less hardware required (HP went from 85 data centers to 6)

  - up to 35% reduction of annual server costs per user ($100-$200K per year per server)

- Better utilization of hardware (HP decreased servers by 40%)

- Reduce power consumption (HP reduced energy by 40%)

- Provide higher availability by supporting redundancy

- Rapidly deliver adaptive and reliable IT services

- Tie diverse components together into a single managed entity

- Storage efficiency can lead to higher storage utilization

*Gillen, A., Grieser, T., Perry, R. 2008. Business Value of Virtualization: Realizing the Benefits of Integrated solutions. IDC.

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PI and Server Virtualization

- Validated environments need a test bed (any pharmaceutical company; BMS; Shell)

- Environments that require portability of IT assets (Cargill Deicing Technology – Salt mining)

- Deploying new sites (Rio Tinto)

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Storage virtualization

- Challenge:
  Grow available storage space without disrupting applications and servers

- Solution:
  Storage Area Networks (SAN) allow dynamic sizing of available storage

Data Store

Server A

Server B

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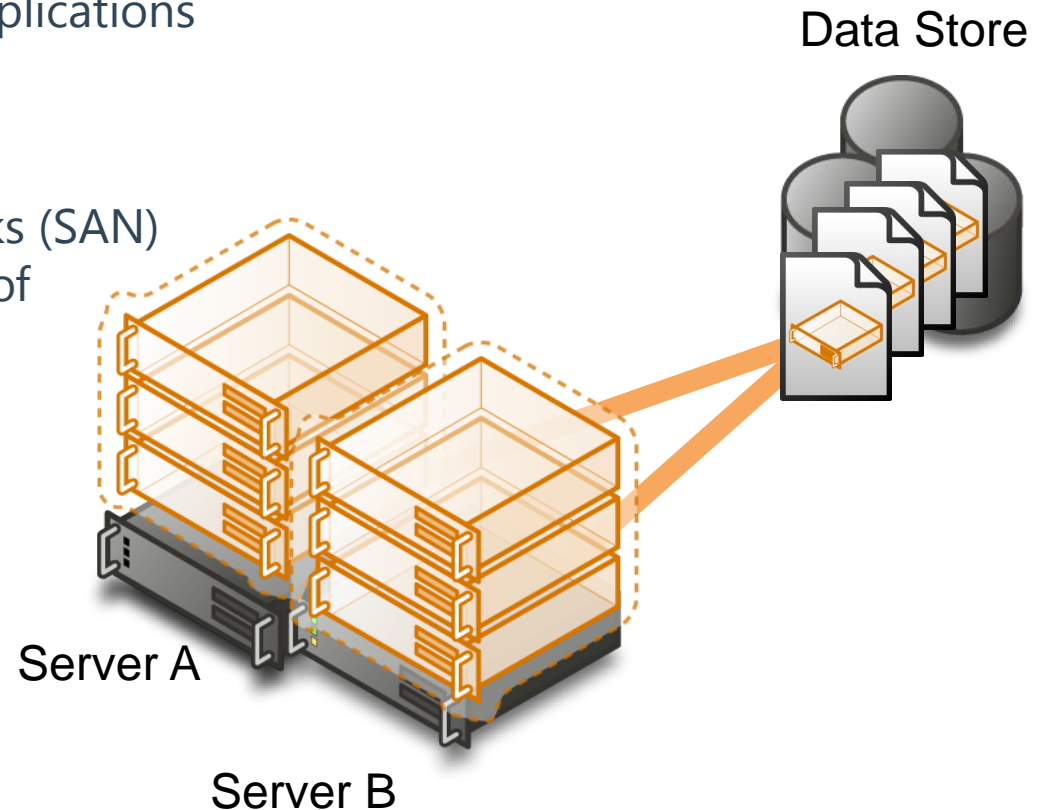
Storage Virtualization

- DAS: Direct Attached Storage (local hard drives)

- NAS: Network Attached Storage (e.g., mapped drives)

- SAN: Storage Area Network, essentially virtual storage

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Benefits of SAN Technology

- Additional storage appears to be local to the host so users don't have to know where the files are stored

- Improve the ties between centralized storage and virtual infrastructure

- Provide virtual-machine consistent backups for data stores and the ability to restore virtual machines in a few clicks

- Provide relief from disk subsystem access in virtualized environments (biggest performance hit on virtual host)

- Consolidate disk resources

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PI and Storage Virtualization

- Keep more and higher fidelity data online; add or expand PI archive files

- Support aggregated PI Systems; VSS support enables PI backups

- Store PI Client files centrally

- Backup virtualized application and data servers

- Backup virtualized Terminal Server hosts

- Complete system backup storage

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Application Virtualization

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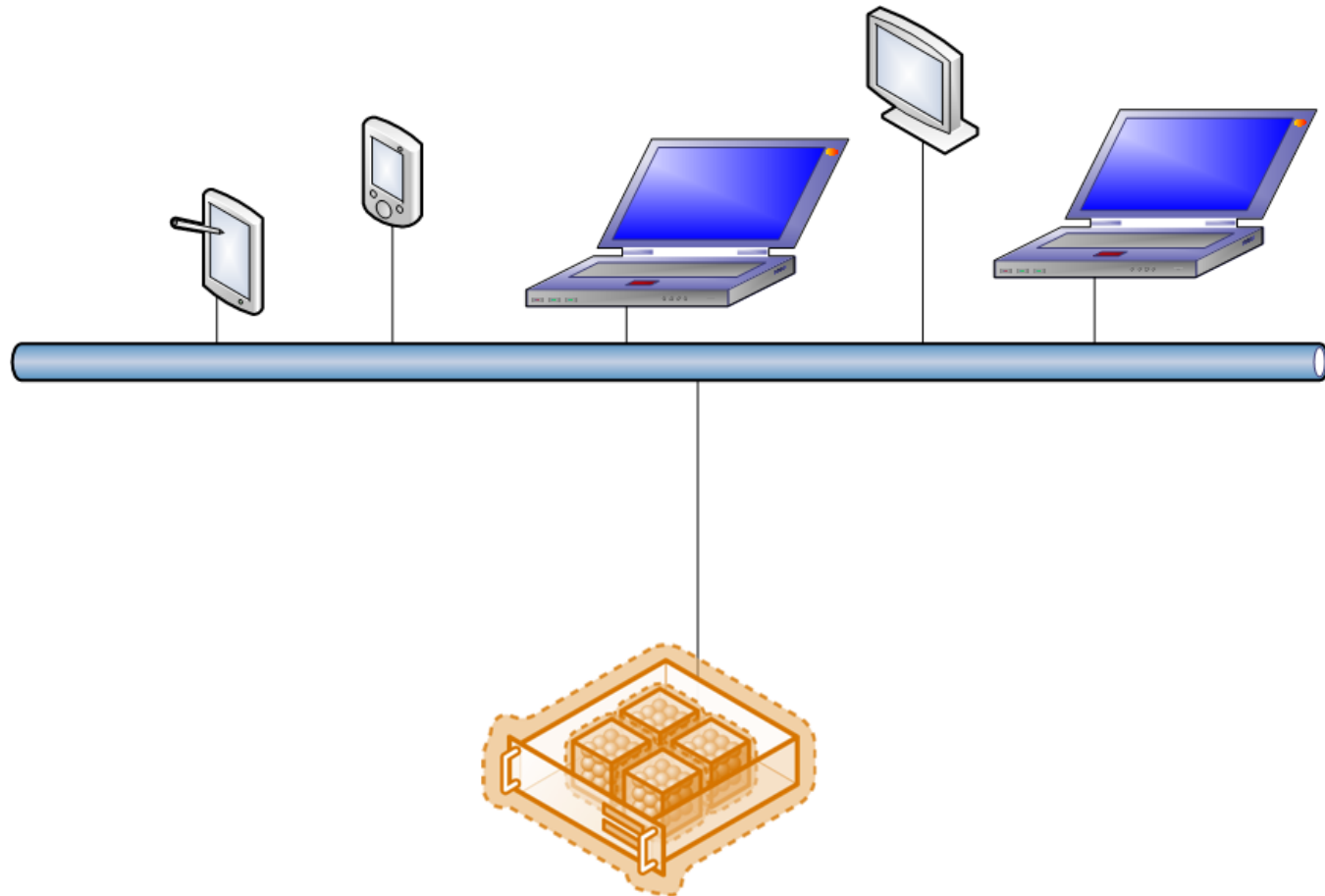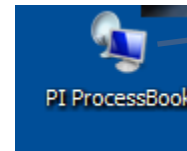
Application Virtualization

- Customers currently use Citrix or Terminal Server to reduce deployment costs and maintenance for client apps

- Windows 2008 Server offers a service that provides applications over an SSL connection (HTTPS) without client-side deployment (a thin deployment) – Terminal Services Gateway

- Terminal Services Gateway provides URL access to a host (like Remote Desktop connections, without the VPN requirement) or to specific applications on a host (even more secure for those outside the firewall)

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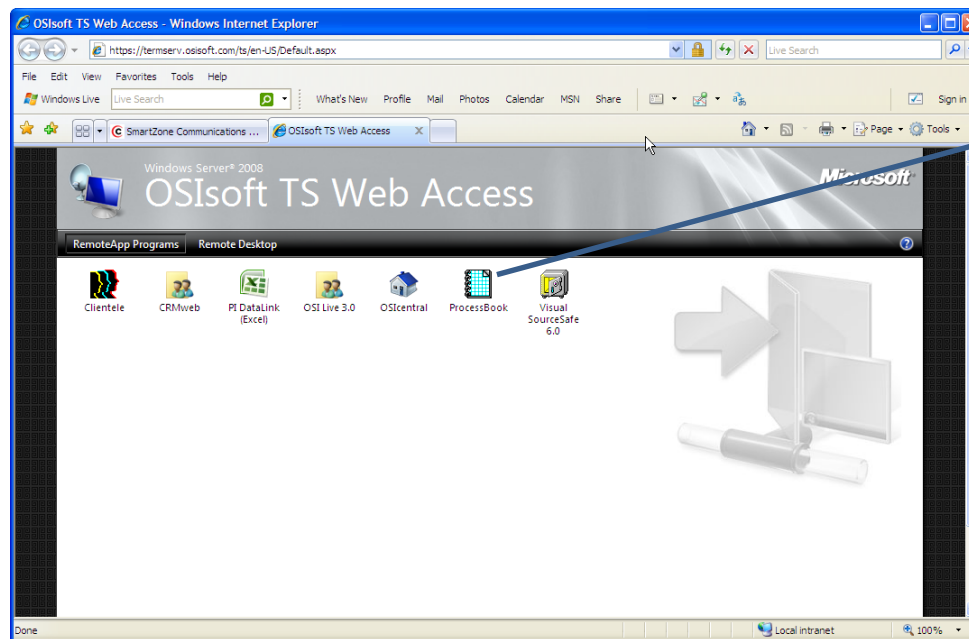
Benefits of Application Virtualization

- One point of installation makes deployment simpler

- Access to applications secured

- All users have the same version of the software; no version or compatibility issues

- Casual users do not need to install anything to get started

- Save money on hardware investments by deploying client software in one place

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PI and Application Virtualization (ProcessBook)

Launch from Desktop icon

OR

Launch from web page

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PI and Application Virtualization (ProcessBook)

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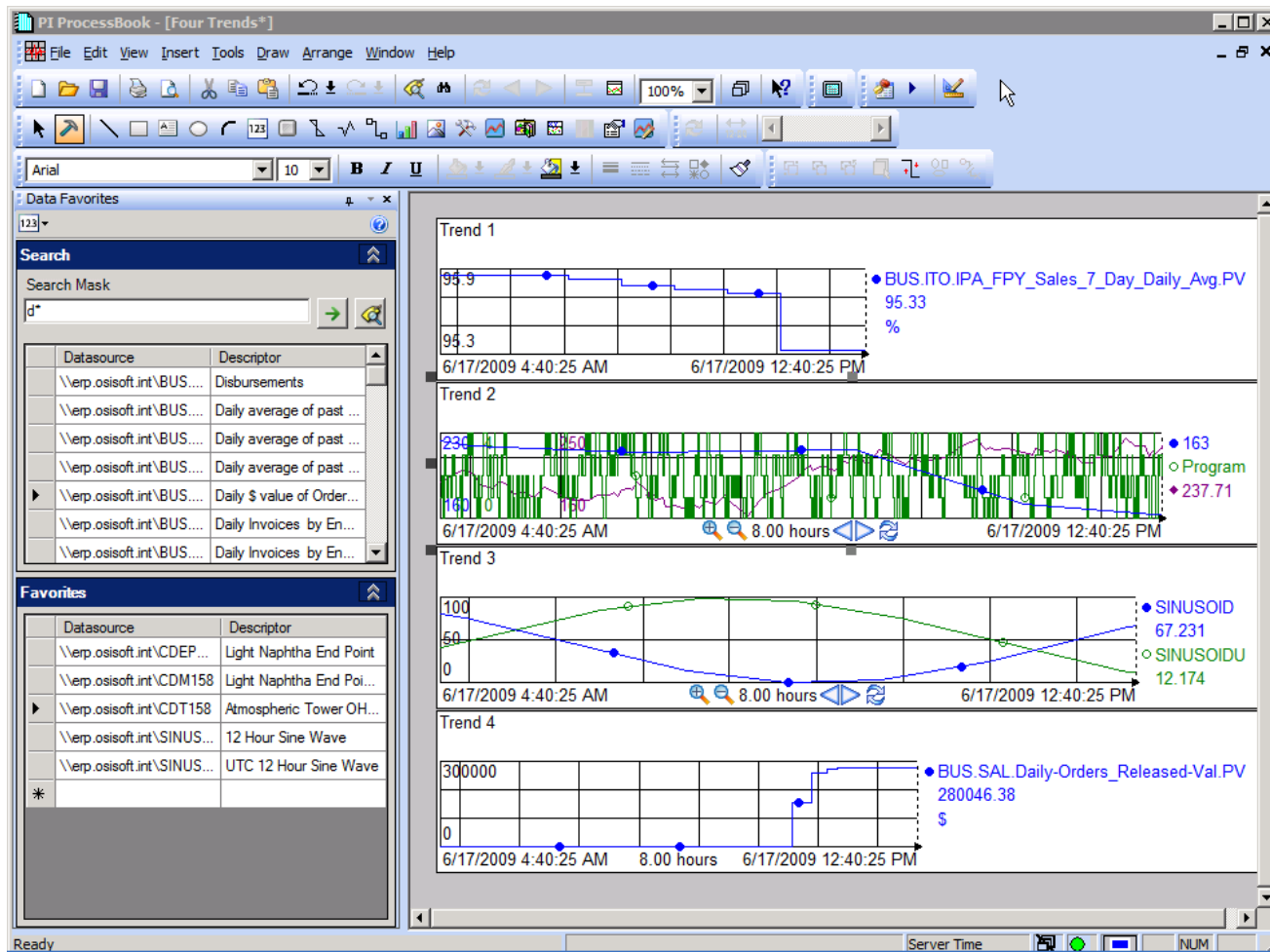
PI and Application Virtualization

- Environments with casual client users who need low barrier to entry for system access (Inco Limited)

- Terminal Server users (a partial list)

  - Georgia Pacific, Kellogg, SASO, SAPPI Fine Paper, Wacker Chemie, Alcoa, Eli Lilly, ExxonMobil Upstream, Iberdrola, Progress Energy Services

- Citrix users (a partial list)

  - SDG&E , Water Corporation, Amgen, Bayer Material Science, Genmab, PPG, Vaxgen, Katahdin Paper, Celanese Chemicals, Novo Nordisk, Queensland Alumina, Total

- Windows 2008 Terminal Services Gateway

  - OSIsoft

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Five Principles for Virtualization Success*

- Treat virtual machines as if they were physical machines

- Invest in Enterprise-level hardware and software

- Do not mix virtual and physical on the same host

- Use qualified Virtualization support personnel

- Test on the target platform

*OSIsoft Center of Excellence
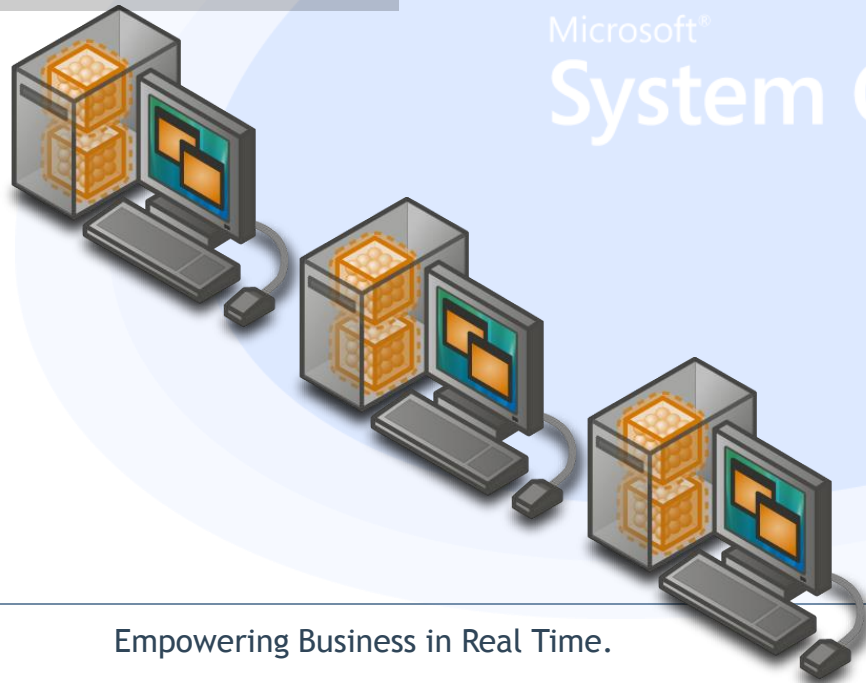
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Dynamic system management

Challenge:

Inability to respond quickly to changing needs at desktops and the data center

Solution:

Live migration and dynamic provisioning of servers and desktops are based on real-time needs using a single management platform

Microsoft®
System Center

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How does HA PI play into virtualization?

- PI collectives (HA) and interfaces

- Virtualized HA PI

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A Simple HA PI System

Client (PI DataLink, PI ProcessBook)

Collective Member 1

PI Collective

Collective Member 2

Interface node

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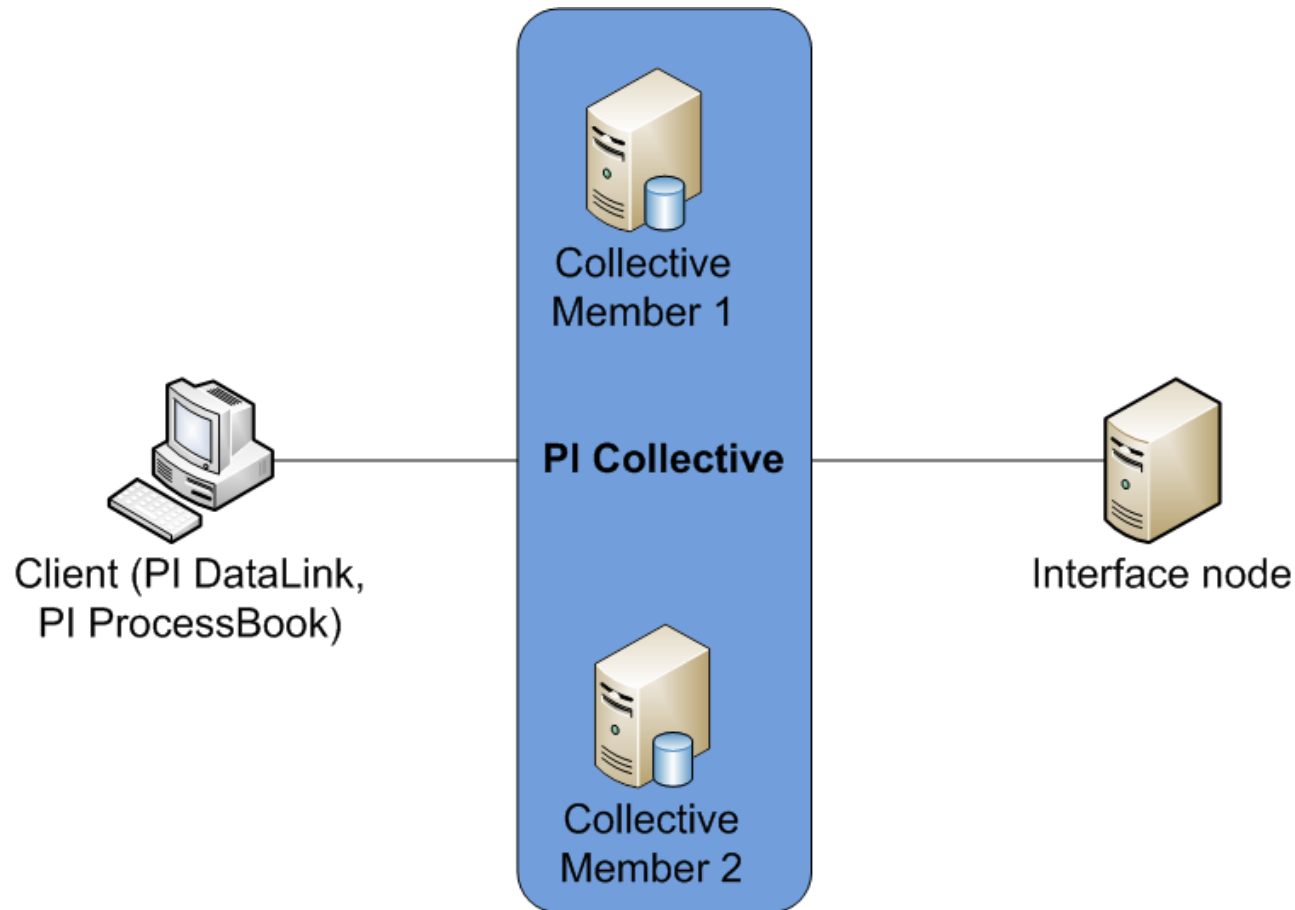
A Simple Virtual HA PI System

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Virtual HA PI with SAN

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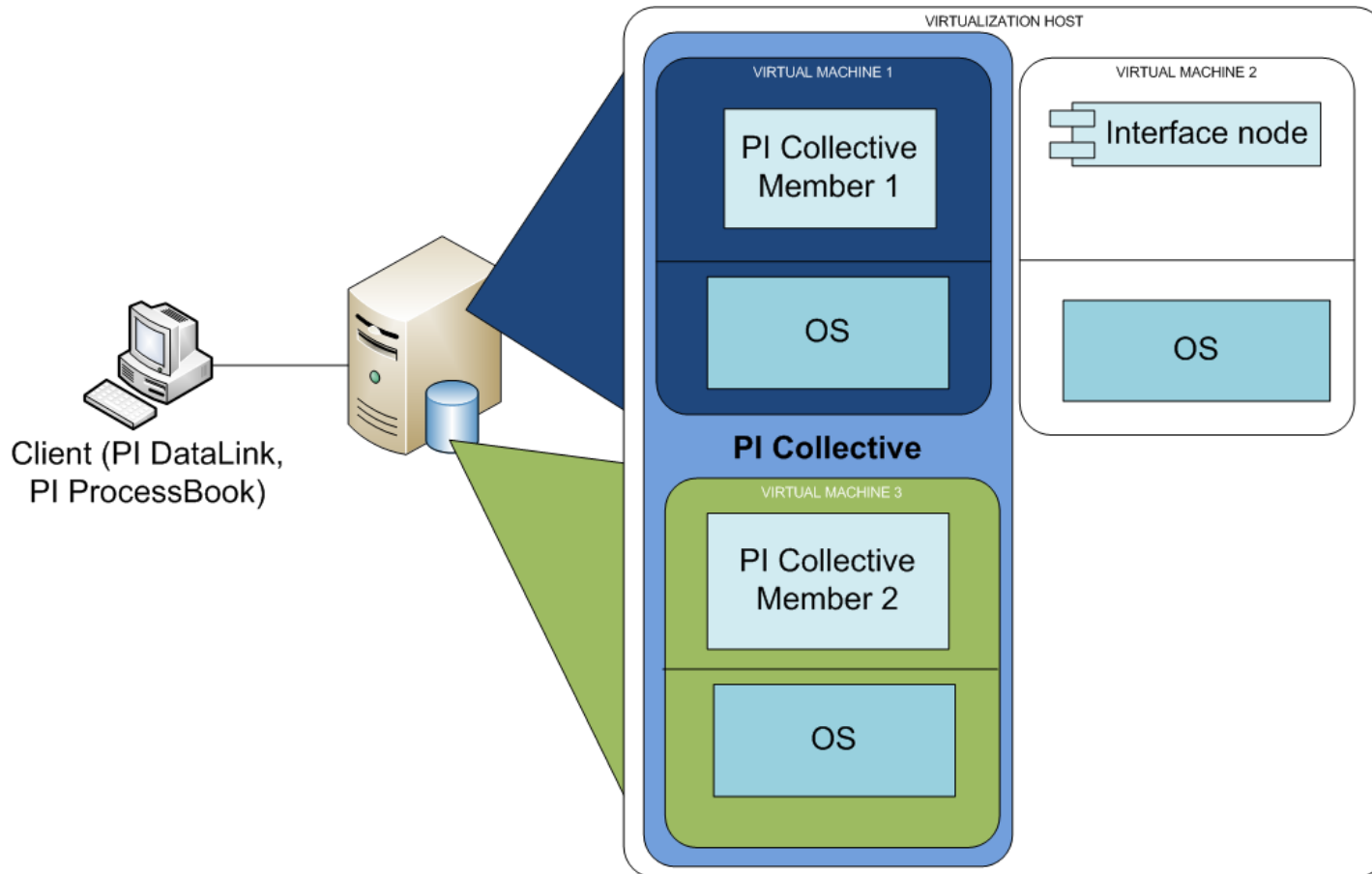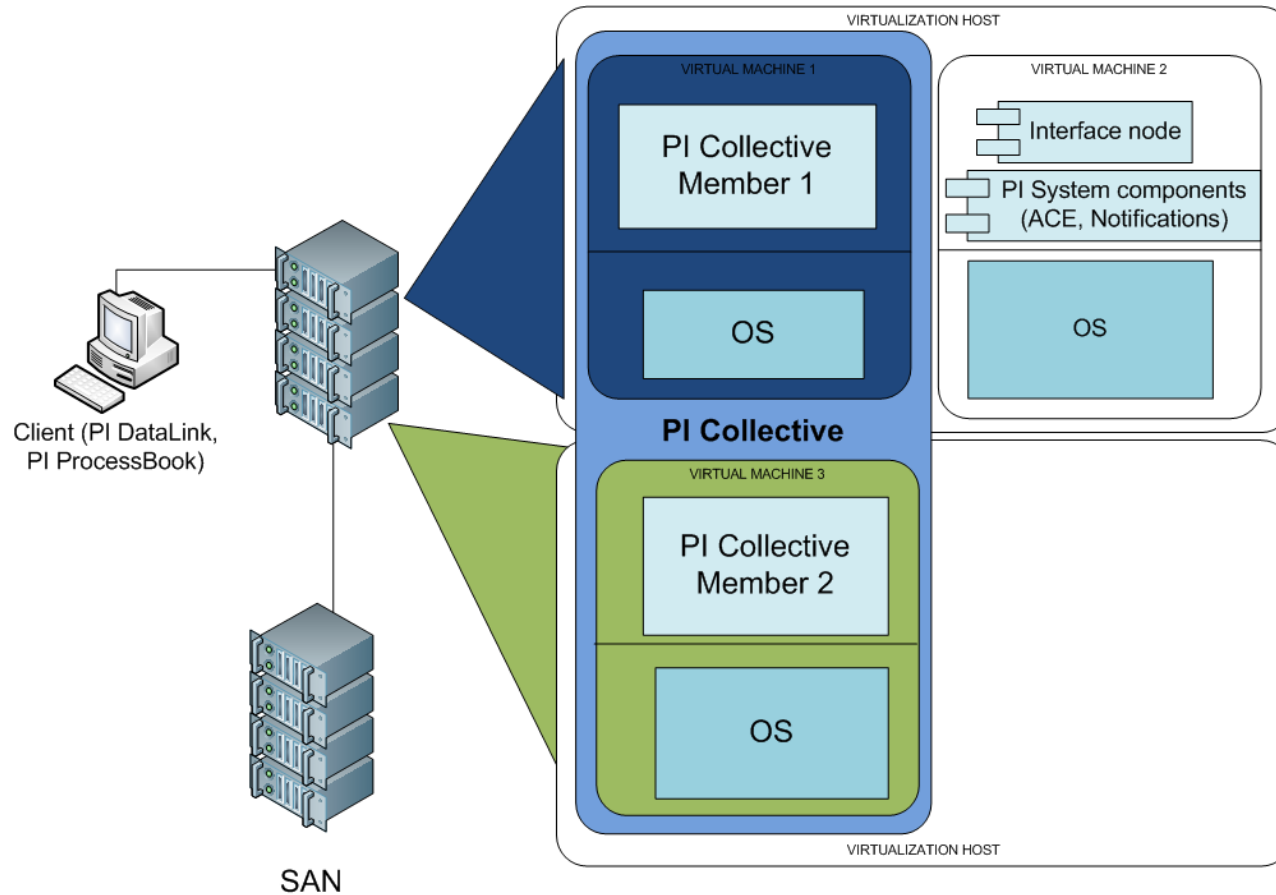
Virtual System including Clients

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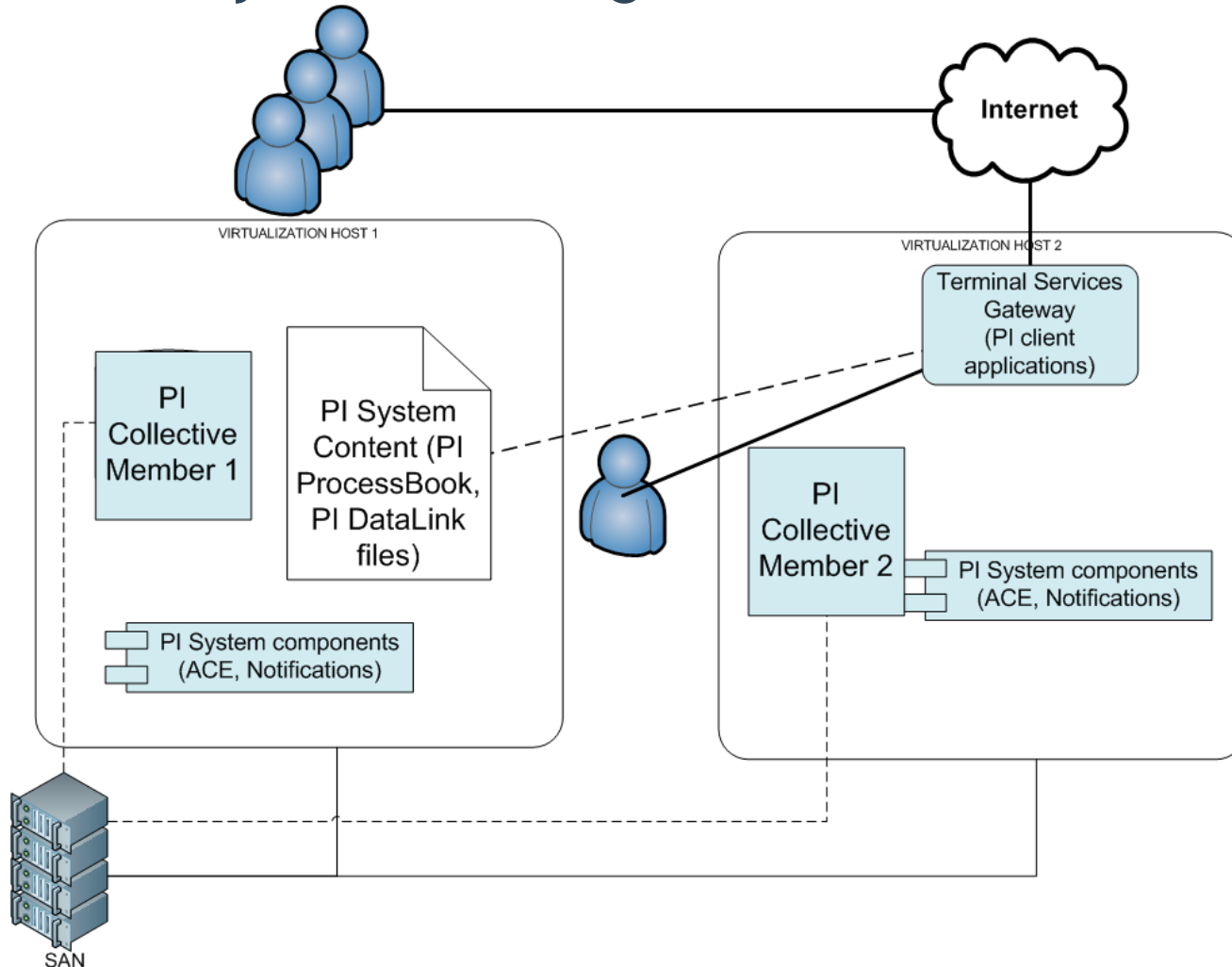
Recommendation: Virtualized PI System

- Multiple hosts (cluster)

- Collective can be split across hosts

- PI Server components can run as separate virtual machines for scalability and performance

- SAN can offload storage
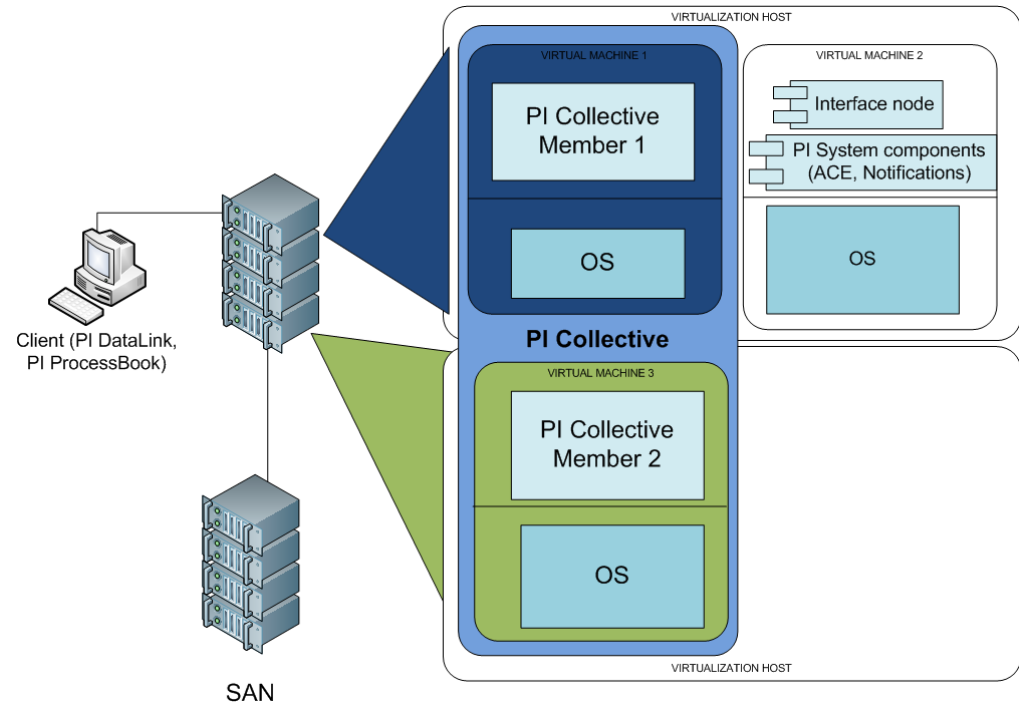
Built-in Benefits of HA PI

- PI is there all the time – users trust it

- No late night heroics to restore a backup or perform routine maintenance

- Removes fear of a bad backup

- Simple design is robust, low bandwidth and supported by WANs

- Geographical independence (replace PI to PI)

- Support more or specialized users

- Facilitates capacity planning

- Complements virtualization strategies:

  - PI is perfect for monitoring a virtualized environment (HyperV performance counters; VMWare SNMP interface)

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Customer Examples: HA

- Transmission & Distribution customers cannot lose visibility or the grid can go down (e.g., Cal ISO)

- Customers with dispersed sites can deploy collective members in each location for better client retrieval performance without losing synchronization (International Paper)

- Customers want to balance the load of data retrieval by many users (PJM, Cal ISO)

- Customers need to aggregate data into one large PI system (PSE&G)

- Load Balancing and Failover for virtual machines

- NERC CIP: dedicated PI server inside the security perimeter

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Benefits of PI in a Virtualization Project

- Value of HA PI—

  - Availability, Quality of Service (QoS)

  - No data loss

  - Scaling

  - Improved IT management

- Value of virtual machines and SAN

  - Consolidation

  - Scaling and hardware utilization

  - Centralized IT management

- All adds up to higher quality of service for less cost

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Benefits of PI in a Virtualization Project

- PI works as well in a virtual environment as it does on physical hardware

- PI is perfect for monitoring a virtualized environment

- If you are thinking about virtualization, it's a good time to consider the value of HA PI

- If you are thinking about network storage, it's a good time to consider the value of virtualization and PI with SAN support

- If you are thinking about problems with client software deployment, it's a good time to consider the value of Terminal Services Gateway, virtualization and PI

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Virtualization and HA Details

Costs to Start

- No 3rd party software or special hardware for HA PI

- Licensing models

  - One virtual PI server = one real PI server

  - One virtual PI client connection = one concurrent PI client connection

- Virtualization hardware/software (Dell estimate for complete solution ~$600K)

- Maintenance

  - Additional storage, memory, etc., as needed over time

- Virtualization Per user (from IDC)

  - Basic virtualization: $24.1 (over 3 years); benefit = $144.9

  - Advanced virtualization: $23.3 (over 3 years); benefit = $212.4

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When is Virtualization NOT a good solution?

- No one in the organization is familiar with managing virtual environments

- The project is geographically dispersed to the point where there is no benefit of having multiple virtual machines on a single host

- All the equipment being used is identical and it is easier to just clone machines than to manage a new virtual environment

- Cost to start may be prohibitive

- Performance notes:

  - Settings and parameters may be important for performance

  - Sizing the virtual machine appropriately makes a difference

  - Sizing the virtual host appropriately makes a difference

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Details of Server Virtualization

- Available virtual technologies (partial list)

  - Microsoft (Hyper V, in particular)

  - VMware (ESX server, in particular)

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Virtual Vendors, Compared

	VMware ESX Server	Microsoft Hyper-V
Support for 32/64 bit hosts	Yes	Only 64 bit hosts
Support for 32/64 bit guests	Yes	Yes
Device Driver Support	Hypervisor	Guest OS
Maximum RAM	64GB	64GB
Maximum Virtual CPUs	4	4
Shared VM Memory	Yes	No
Boot VMs from SAN	Yes	Yes
Live Migration	Yes	Yes
Maximum Active VMs	128	Unlimited

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Microsoft's Hyper-V R2

- Live Migration--increased reliability/availability

  - Clustered Shared Volumes

- Cluster Node Connectivity Fault Tolerance. Dynamic I/O redirection.

- Improved management of VMs. Including multiple servers.

- Improve Performance

  - VM Chimney/TCP Offload

  - Note--Intel now builds their chips with features to improve VM performance. (VM Chimney is an example).

- Green

  - Core Parking

- Simplified deployment.

  - .vhd files now the de facto standard.

  - Server 2008 R2 can boot from a vhd on local hard drive

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Microsoft Virtualization Options and Licensing

The following table outlines which Hyper-V–enabled product would suit your needs:

Virtualization Needs	Microsoft Hyper-V Server 2008	Windows Server 2008 Standard	Windows Server 2008 Enterprise	Windows Server 2008 Datacenter
Server Consolidation	✔	✔	✔	✔
Test and Development	✔	✔	✔	✔
Mixed OS Virtualization (Linux and Windows)	✔	✔	✔	✔
Local Graphical User Interface		✔	✔	✔
High Availability—Clustering			✔	✔
Quick Migration			✔	✔
Large Memory Support (Host OS) > 32 GB RAM			✔	✔
Support for > 4 Processors (Host OS)			✔	✔
Ability to Add Additional Server Roles		✔	✔	✔
Guest Virtualization Rights Included in Host Server License	None—Each Windows Guest VM Requires a License	1 Physical + 1 VM*	1 Physical + 4 VMs*	1 Physical + Unlimited VMs (Free)

*Each additional Windows guest VM requires a license.

If you need to acquire and host new server licenses, Windows Server 2008 Standard, Enterprise, and Datacenter provide the best value.

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Details of Client Virtualization

- Available Client virtualization examples

  - Terminal Server Gateway (Windows Server 2008)

  - Terminal Server 2003

  - Citrix

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Details of SAN

- Sample SAN vendors (compatible with virtual technologies)

  - NetApp

  - HP

  - EMC^2

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More Information

- Whitepapers and Tech Support bulletins on OSIsoft web site

- Vendor web sites

- OSIsoft internal expertise

- Microsoft representatives for Hyper V and Terminal Server Gateway solutions

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Next Steps

- Knowledge Base article #3062OSI8

- Learn whether there are plans for (or an existing) virtualization environment in your organization

- Estimate the hardware reduction to be gained by virtualizing your existing server applications

- Estimate the hardware reduction for server applications both with and without a SAN available (more hosted servers per host if data storage is offloaded, for example).

- Estimate the hardware, software and support reduction to be gained by moving your client applications to a hosted environment (e.g., Terminal Server)

- Consider the value of monitoring the virtualized environment with PI

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Thank you for your time

- Email your questions to:
  ProductManagers@osisoft.com or Ldieffenbach@osisoft.com

- Contact your salesperson for more detailed information

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