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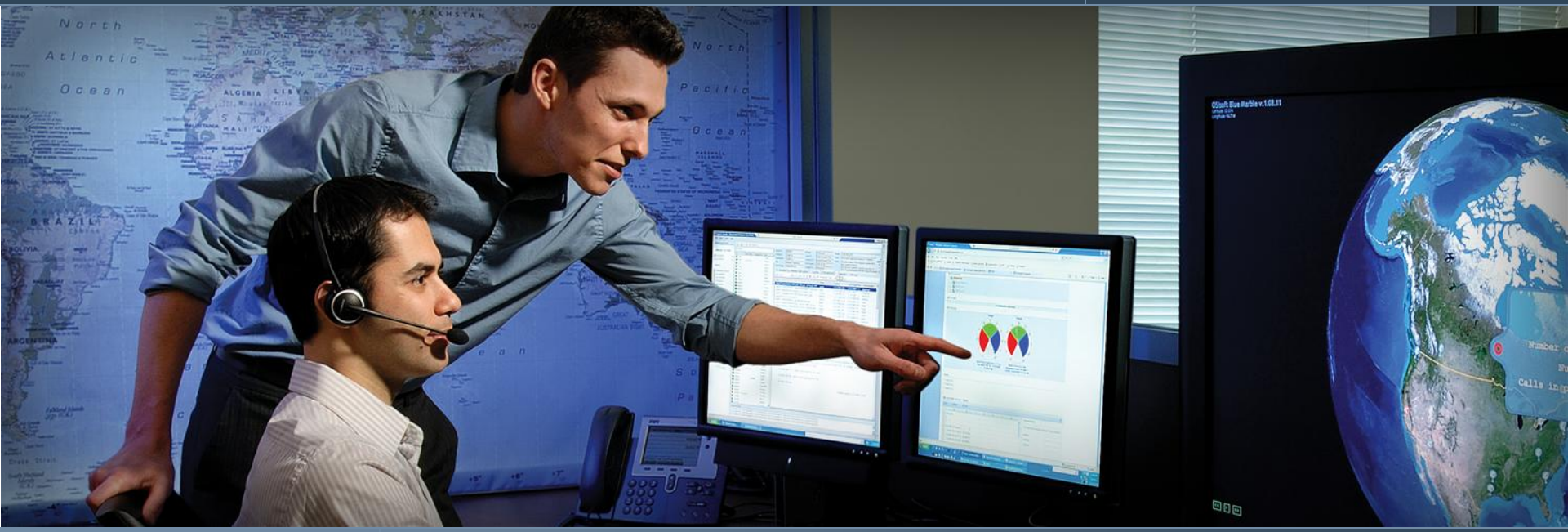

Architecture and Best Practices: Recommendations for PI Systems

John Daniels
Customer Support Engineer
OSIsoft, LLC

Empowering Business in Real Time.

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Overview

- PI Server with Windows Integrated Security (WIS)
- PI High Availability
- PI Interface Failover
- Virtualization and PI

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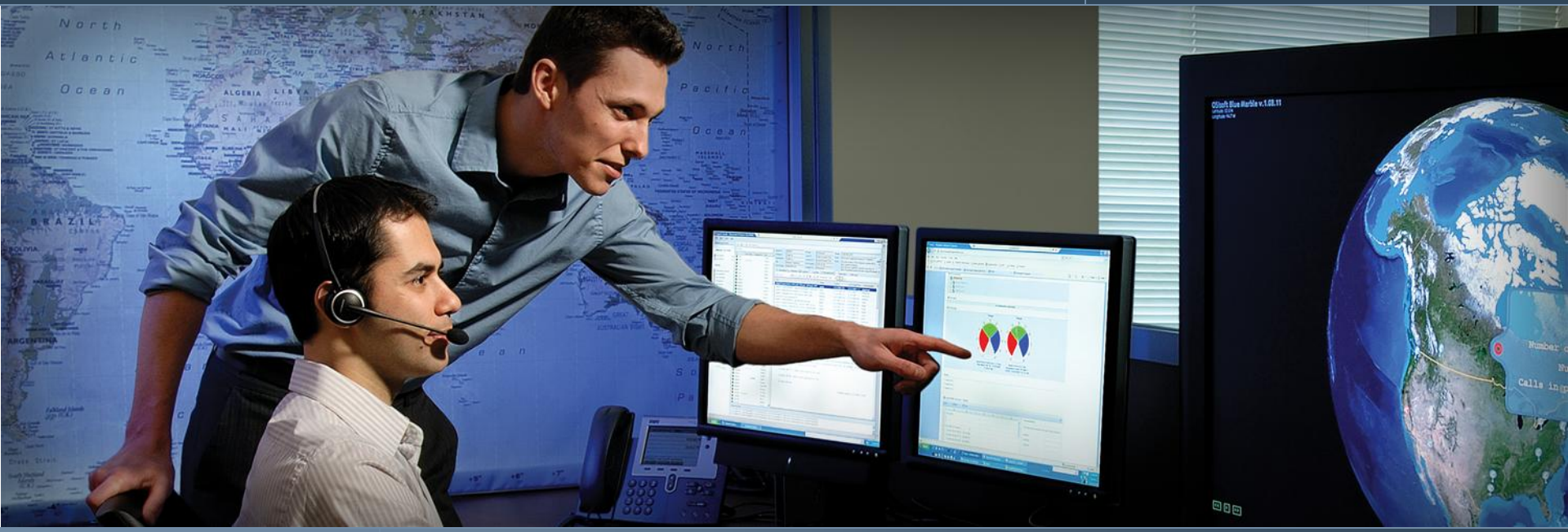

New PI Security Concepts

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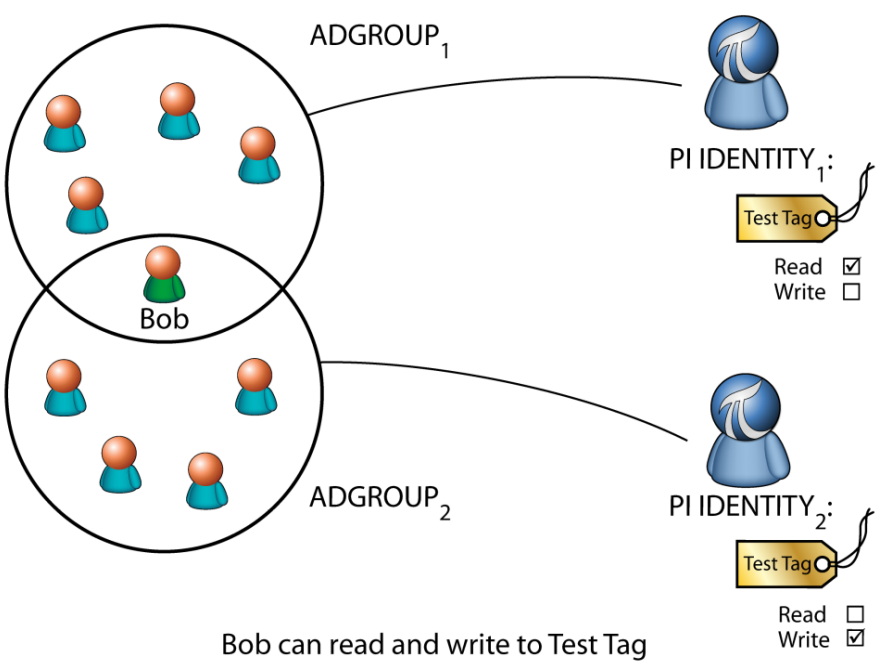
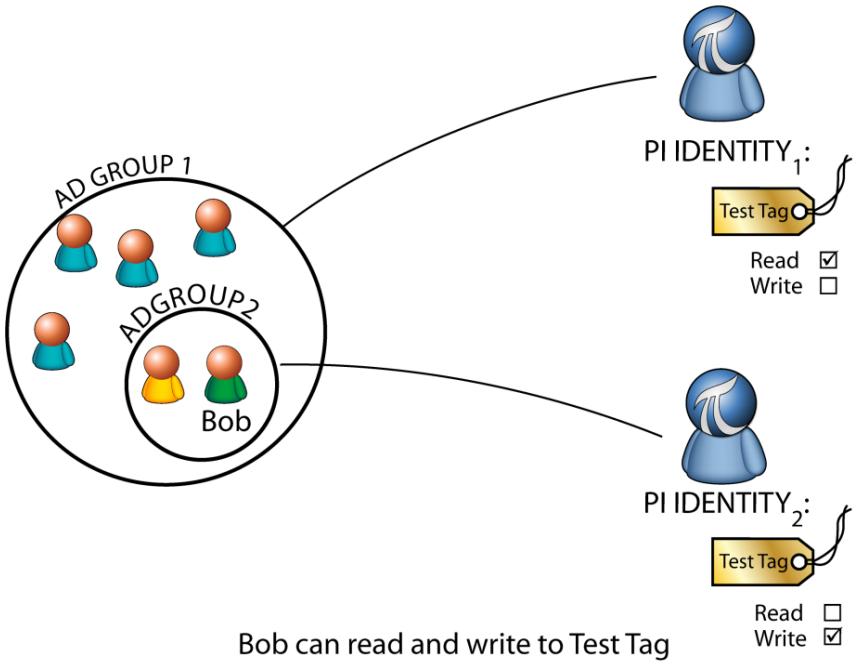
PI Identities, PI Mappings





- PI Identities = Security Principals within PI
  - Examples: PIOperators, PIEngineers, and PISupervisors
- PI Mappings – link AD Groups to PI Identities

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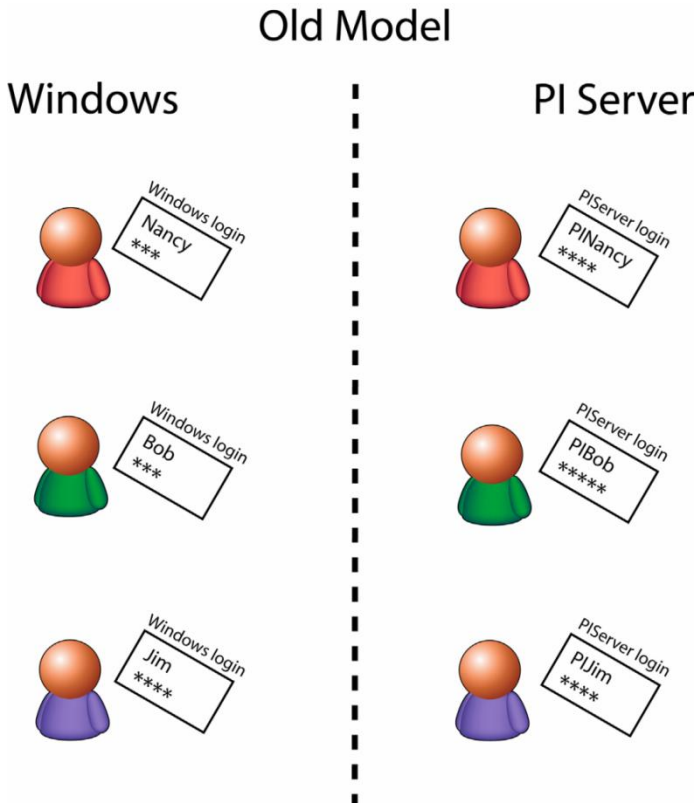
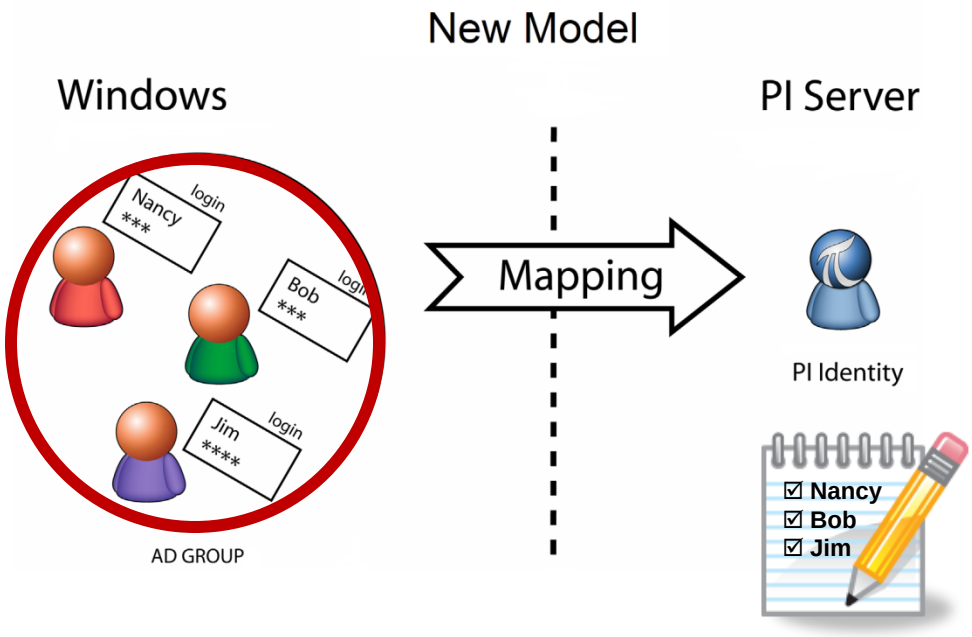
User Identity in the PI Server





- The security principal is the PI User
- Audit and Change logs reflect the PI User

- The security principal is the Windows User, not a PI User
- Audit and Change logs in the PI Server reflect the Windows User

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PI Identity vs. PI Groups and Users

- Differences between PI Identity and PI Users and Groups
  - Unlike PI Users, PI identities don't have a password and can't be used for explicit login
  - Unlike PI Groups, PI Identities can not contain PI Users
- Common Properties Shared by PI Identities, Users, and Groups
  - Can be used for PI Mappings or PI Trusts (except PIWorld)
  - Can be used in all Access Control Lists (ACL)
  - Have the same authentication control flags

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Active Directory Integration

- PI Server must be a member of a domain to leverage Kerberos authentication
- Multiple AD domains must have trusts established or users and groups from other domain cannot be used
  - One-way trusts are supported: the server domain must trust the client domain
- Users in Workgroups can be configured to use Windows Local Groups from the PI Server machine
  - Passwords have to match for NTLM authentication

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Active Directory Integration

- Considerations when Integrating with AD
  - Kerberos authentication can be used without creating domain groups
    - Create a Local Group then add users from AD into those local groups
  - Who will manage the AD Security groups?
    - Will IT allow you to manage them?
    - Do you want to manage them?
  - Design Identity mappings and AD or Local Groups to ensure consistent access management across your PI System(s) with Active Directory

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Identity Planning – Best Practices

- Develop a PI Identity Scheme for your Organization
  - Protect your data
  - Ease of maintenance
  - Organizational separation
  - Standardize
- Consider Kerberos
  - Map AD principals directly
  - Map AD principals to local groups

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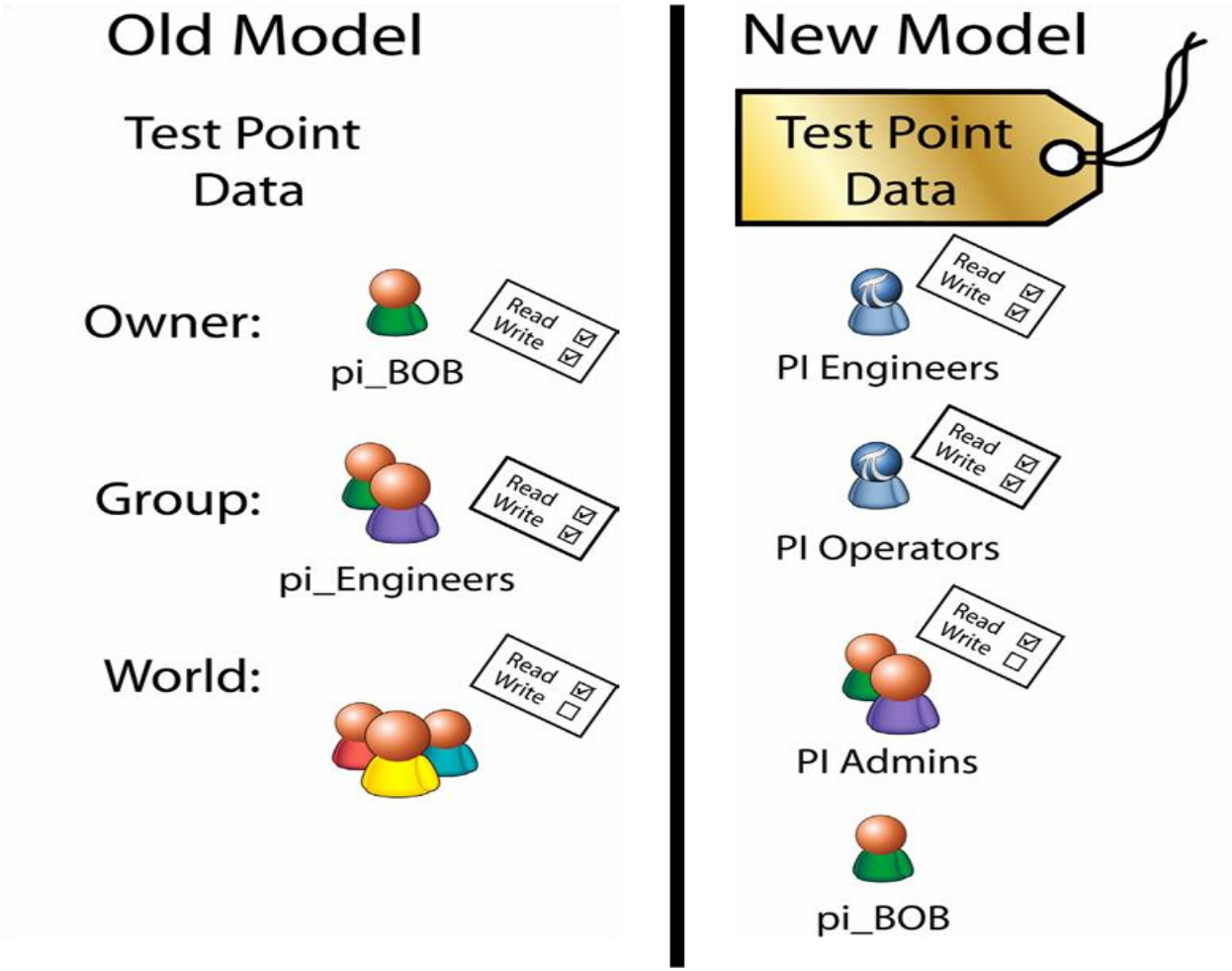
Object Level Security Model



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Automatic Backward Compatibility

Tag	dataaccess	datagroup	dataowner
sinusoid	o:rw g:rw w:r	pi_users	bob

Tag	datasecurity
sinusoid	pi_users:A(r,w) | bob:A(r,w) | PIWorld:A(r)

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Use PIWorld for generic read access

- Everyone is granted at least PIWorld privileges
- World access is controlled through a PI Identity
- Default setting: read-only access
- You can disable PIWorld

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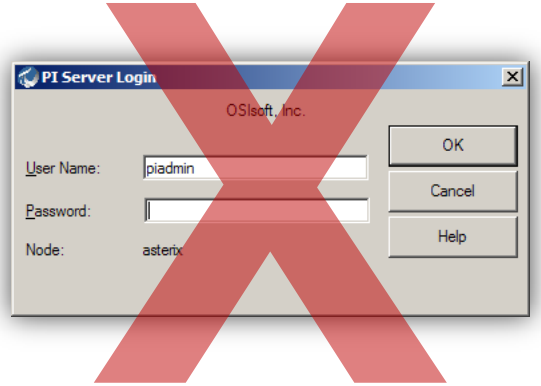
PI Client Considerations

- Clients
  - No more explicit logins
  - Seamless authentication from a Windows session
  - You can revert to the old method (explicit login) by selecting the authentication procedure in the SDK



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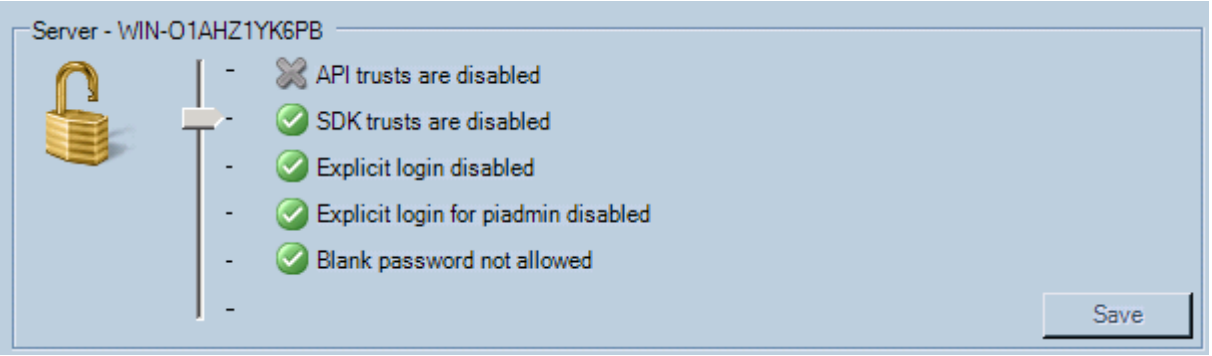
How to Tighten Security

1. Use the new Security Tool to help secure your PI Server
2. Disable or protect the PIADMIN account
3. Disable PI password authentication (Explicit Logins)
4. Secure piconfig by forcing login
5. Retire PI SDK-based Trusts
6. Configure the PI Server Firewall
7. Disable PIWorld Identity



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Migration Planning

- Perform impact and risk analysis
- Update your architecture
- Develop a migration plan
  1. Identify access roles “read-only” & “read-write”
  2. Create PI Identities
  3. Create AD Groups
  4. Create PI Mappings
  5. Plan for AD Group Maintenance (add/remove users)

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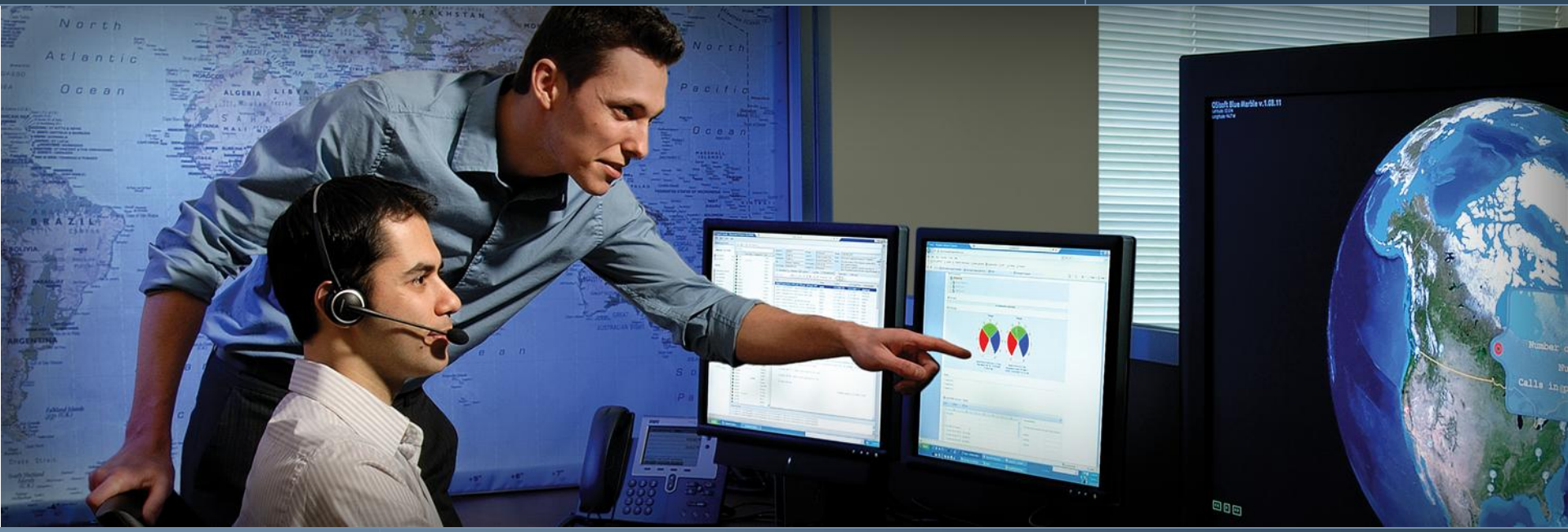

PI High Availability (HA)

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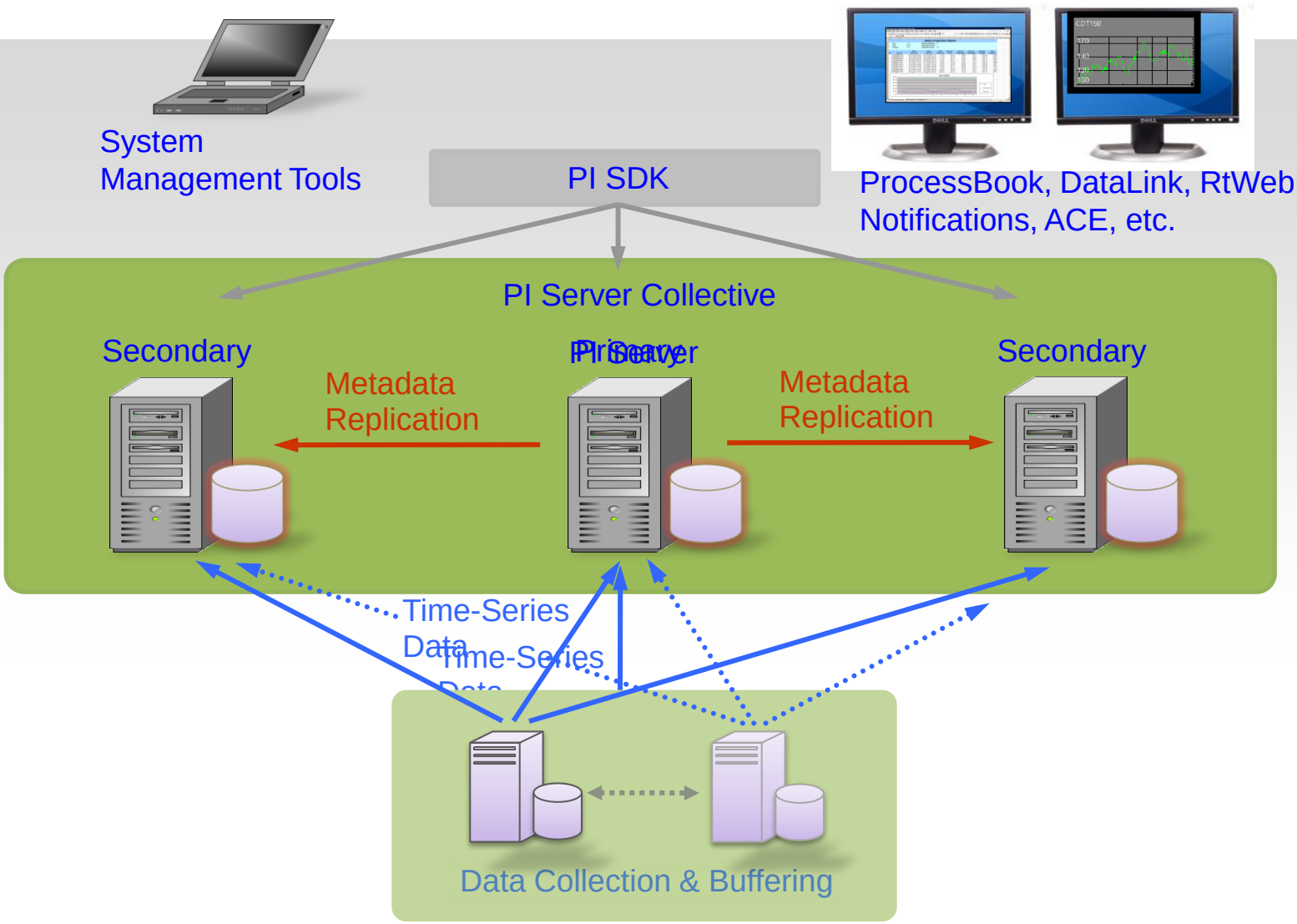
PI High Availability Architecture



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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)
- Dispersed sites can deploy collective members in each location for better client retrieval performance without losing synchronization (International Paper)
- Load balance the data retrieval by users (PJM, Cal ISO)
- 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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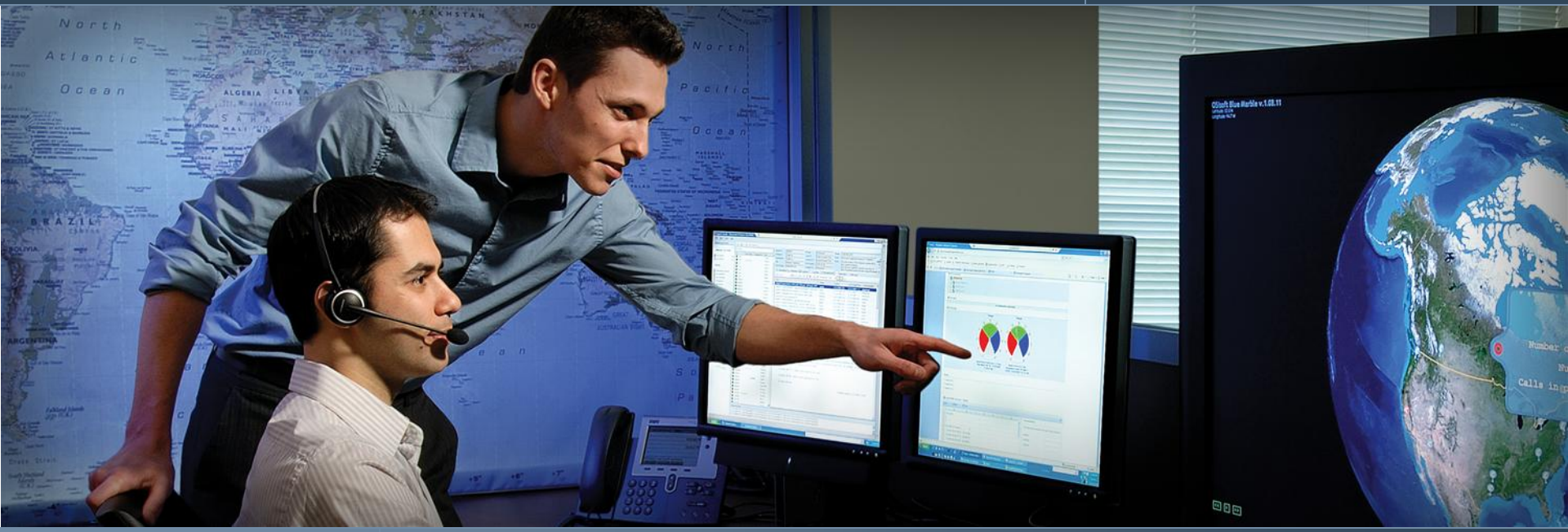

PI Interface Failover

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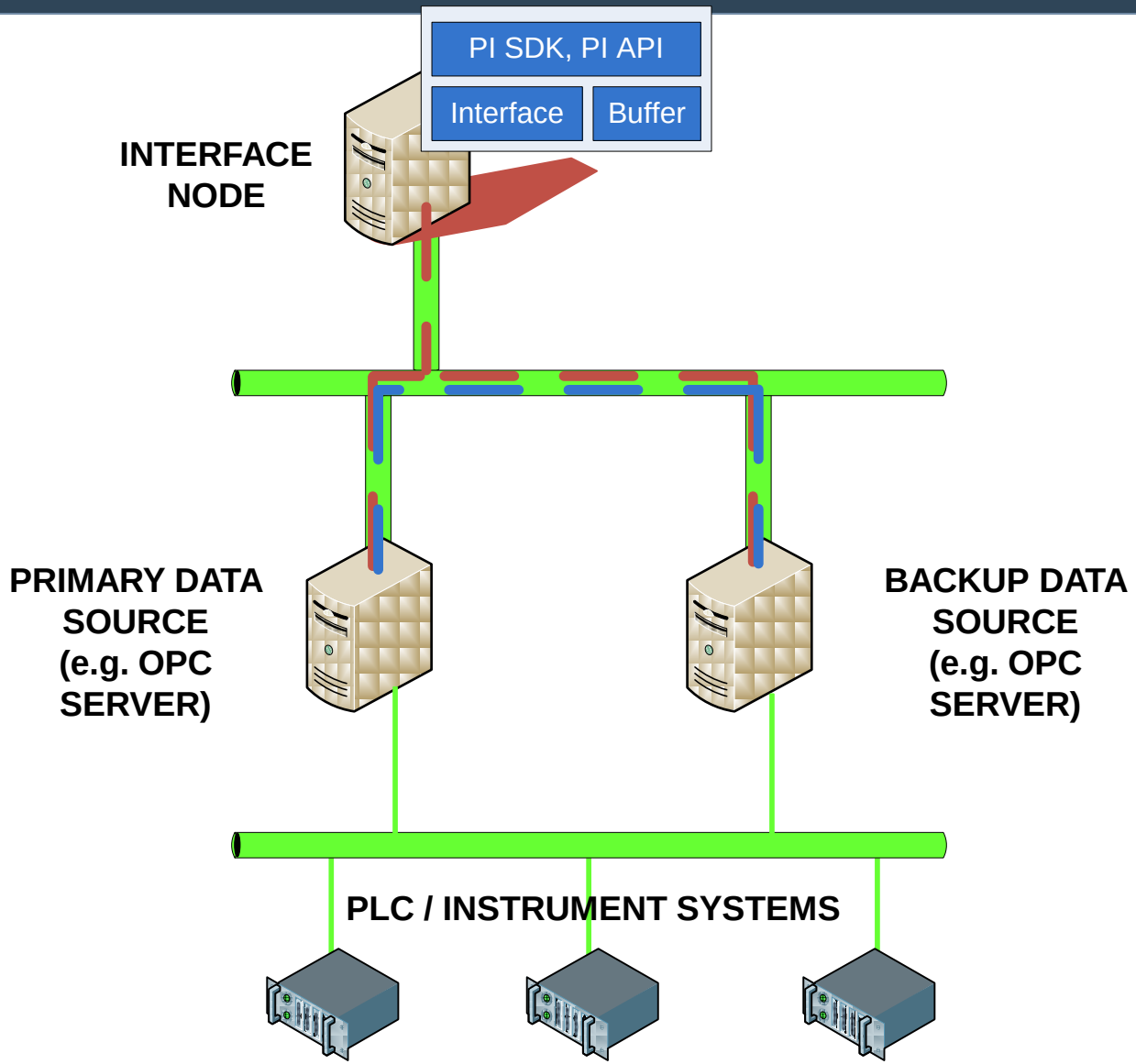
Native Data Source Failover for Data Collection



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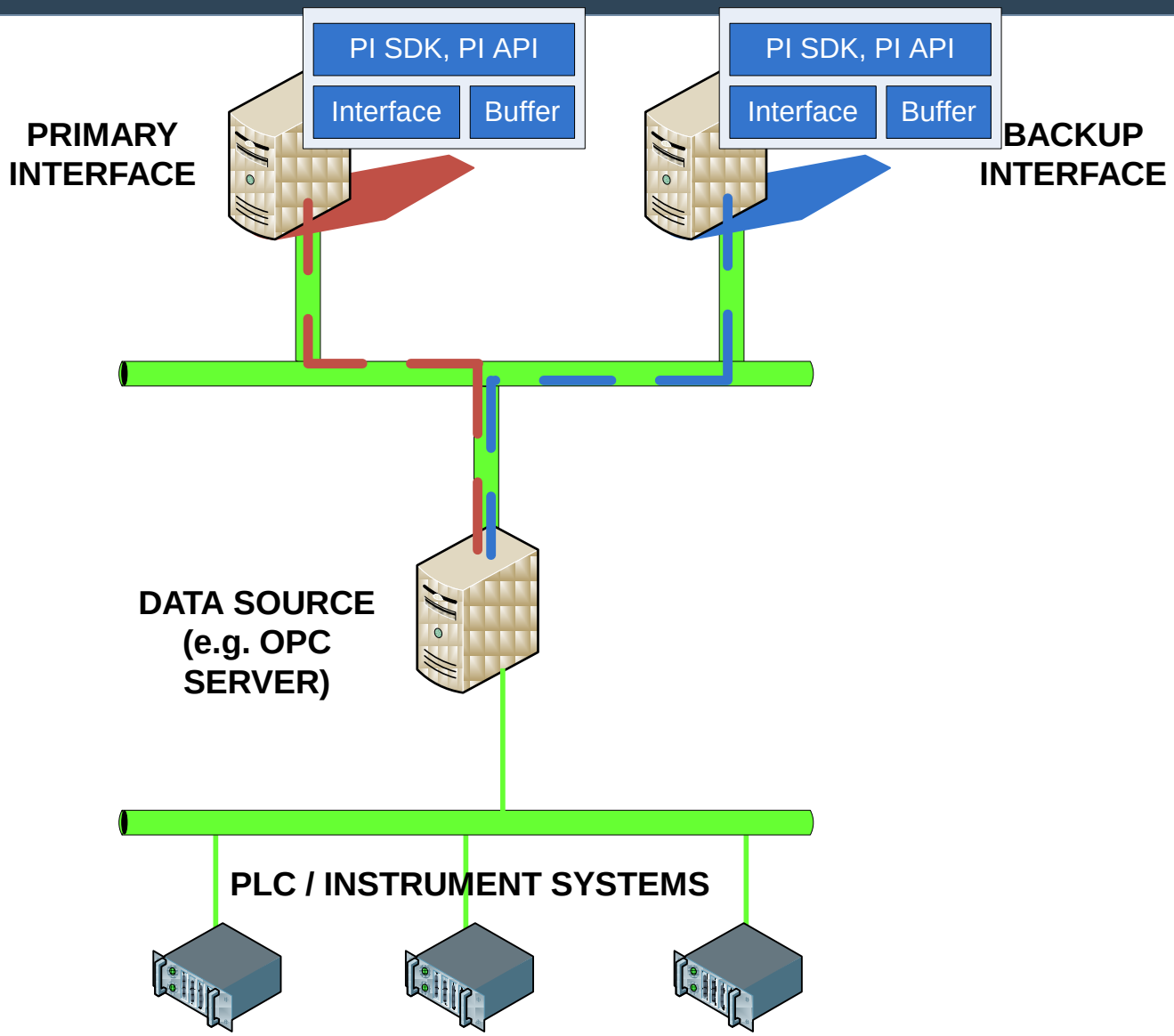
Interface Failover for Data Collection



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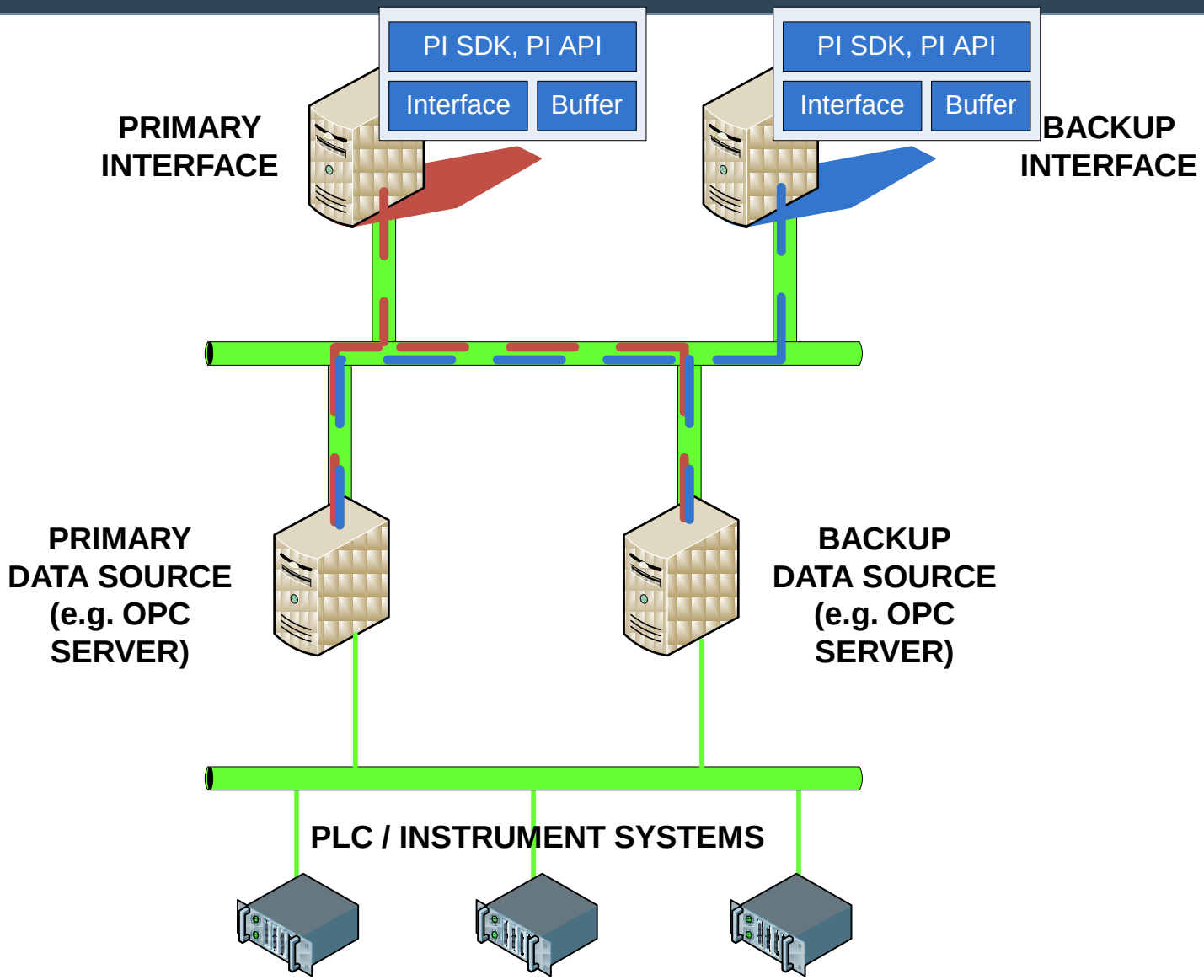
Combination of native Data Source and Interface Failover



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Types of Interface failover

- Phase 1
  - Maintains heartbeat via source data system
  - Only available for selected interfaces
- Phase 2
  - Maintain heartbeat via shared file
  - Many interfaces implement
  - OSIsoft recommended

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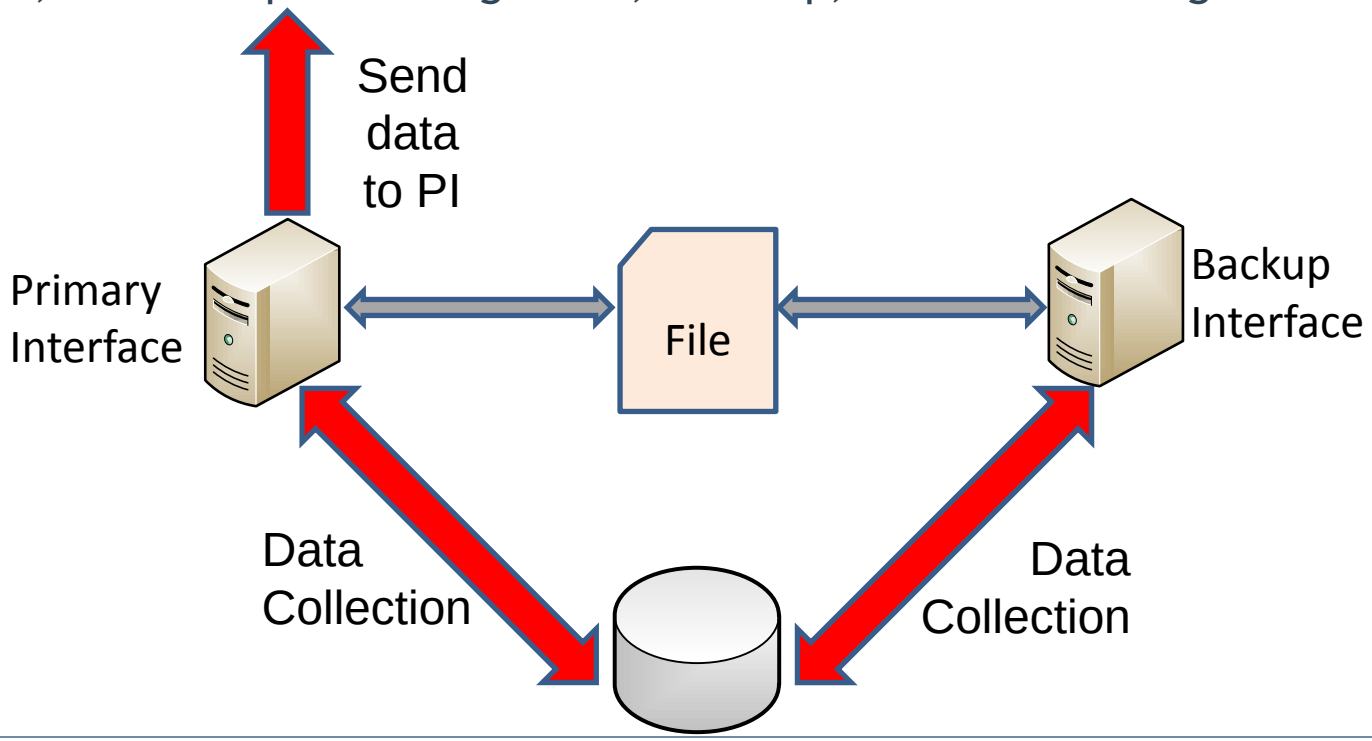
PI Interface Failover

- Interface failover provides
  - 2 instances collecting the same data from the data source.
  - Communication mechanism between 2 instances of the interface.
  - Backup interface is sleeping; it means no data is sent to PI.
  - If Primary fails, the Backup will recognize it, wake up, and start sending data.



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PI Interface Failover

- Interfaces “watch” each other’s **Heartbeat** and **Status**
- Failover Types
  - **Hot** = No data loss
  - **Warm** = Maybe data loss
  - **Cold** = Some data lost likely

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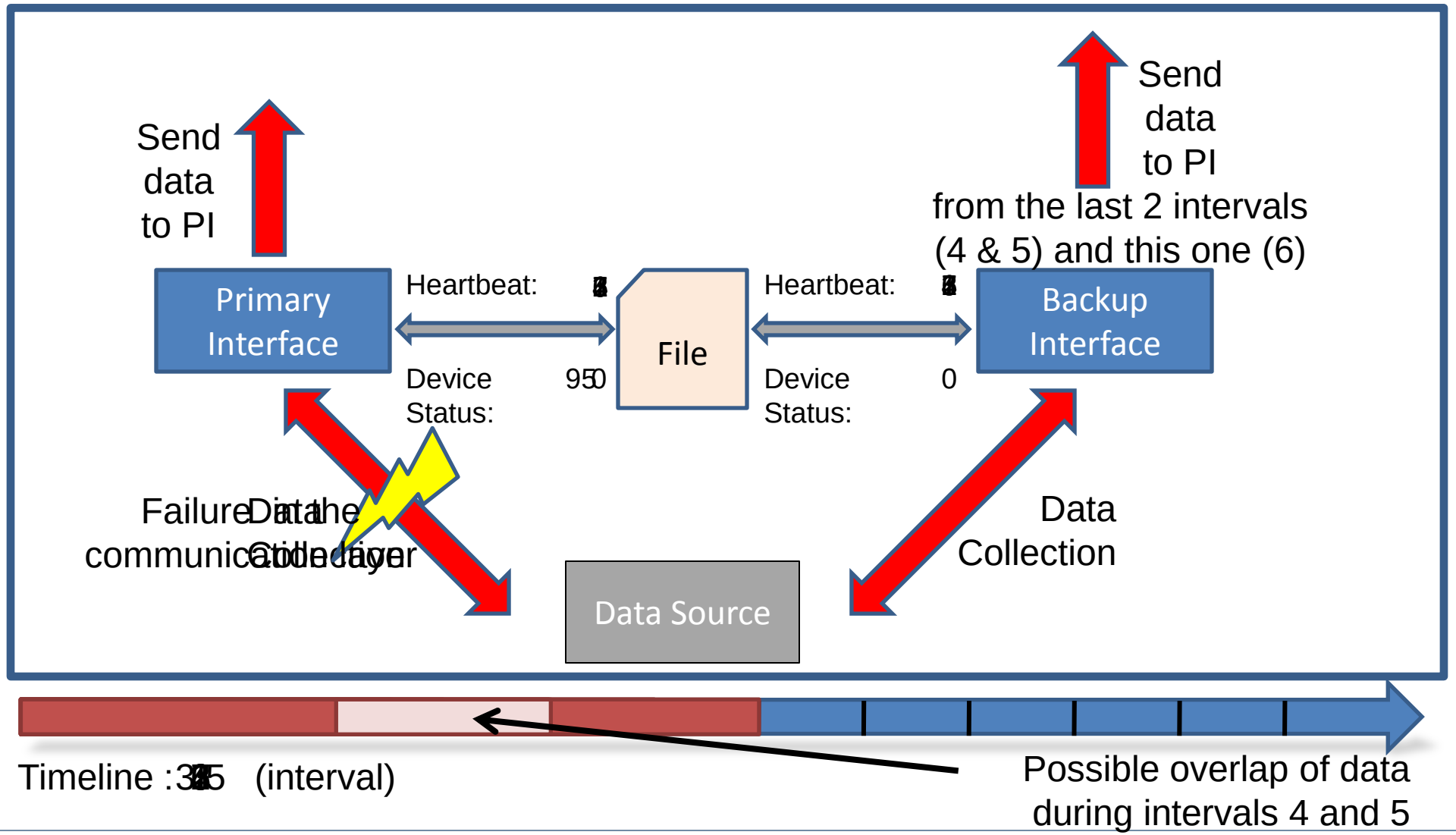
Hot Failover Example



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Prerequisites

- Make a plan
  - Verify the PLC and/or instrument systems can support doubling the requests, including license requirements.
  - Determine heartbeat interval. Ensure long enough to prevent false failover.
- Hardware will be needed
  - Computers for file sharing system for heartbeat and the backup interface node.
  - Supplemental networking equipment.
  - 3rd party software and hardware might be required.
- Security
  - Manage the security on computer for the file sharing system.

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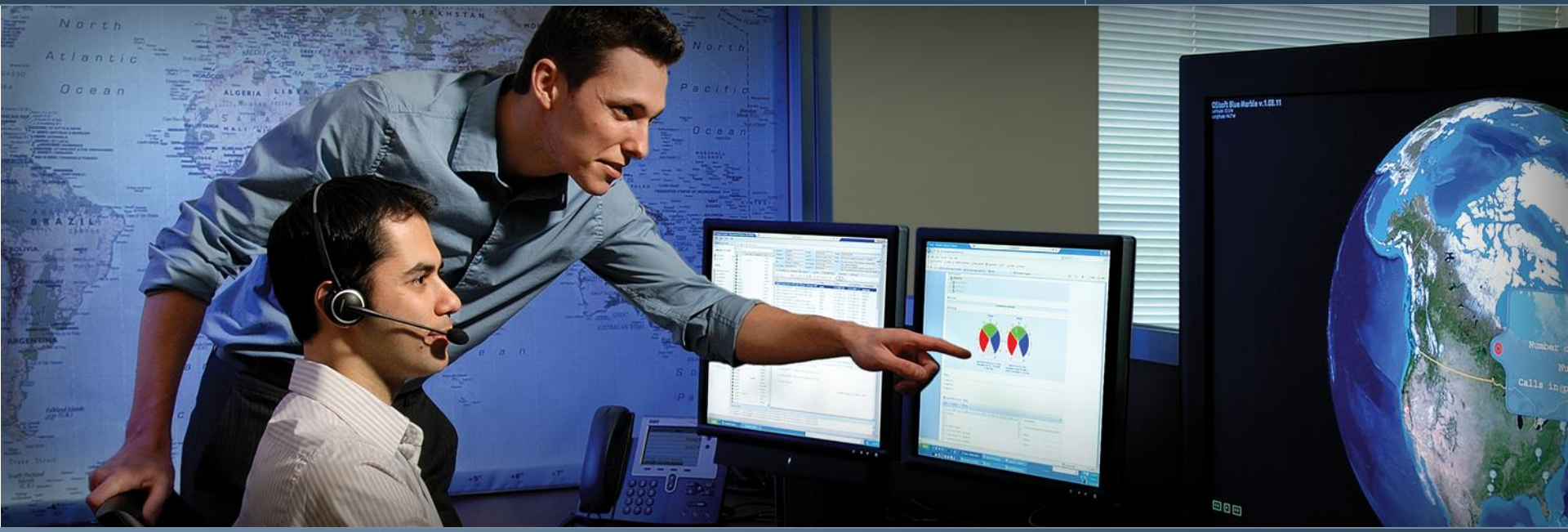

PI and Virtualization

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Virtualization

- Servers
- Storage
- Applications

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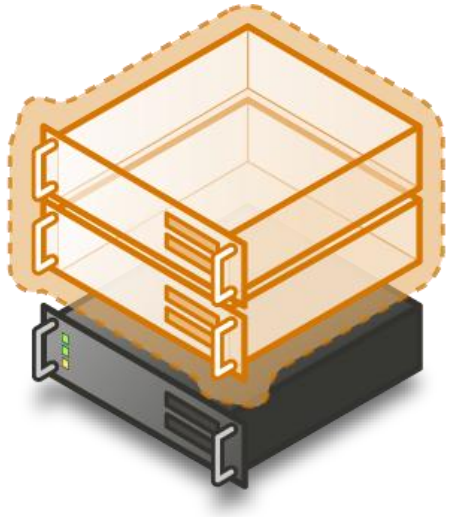
Server Virtualization

- 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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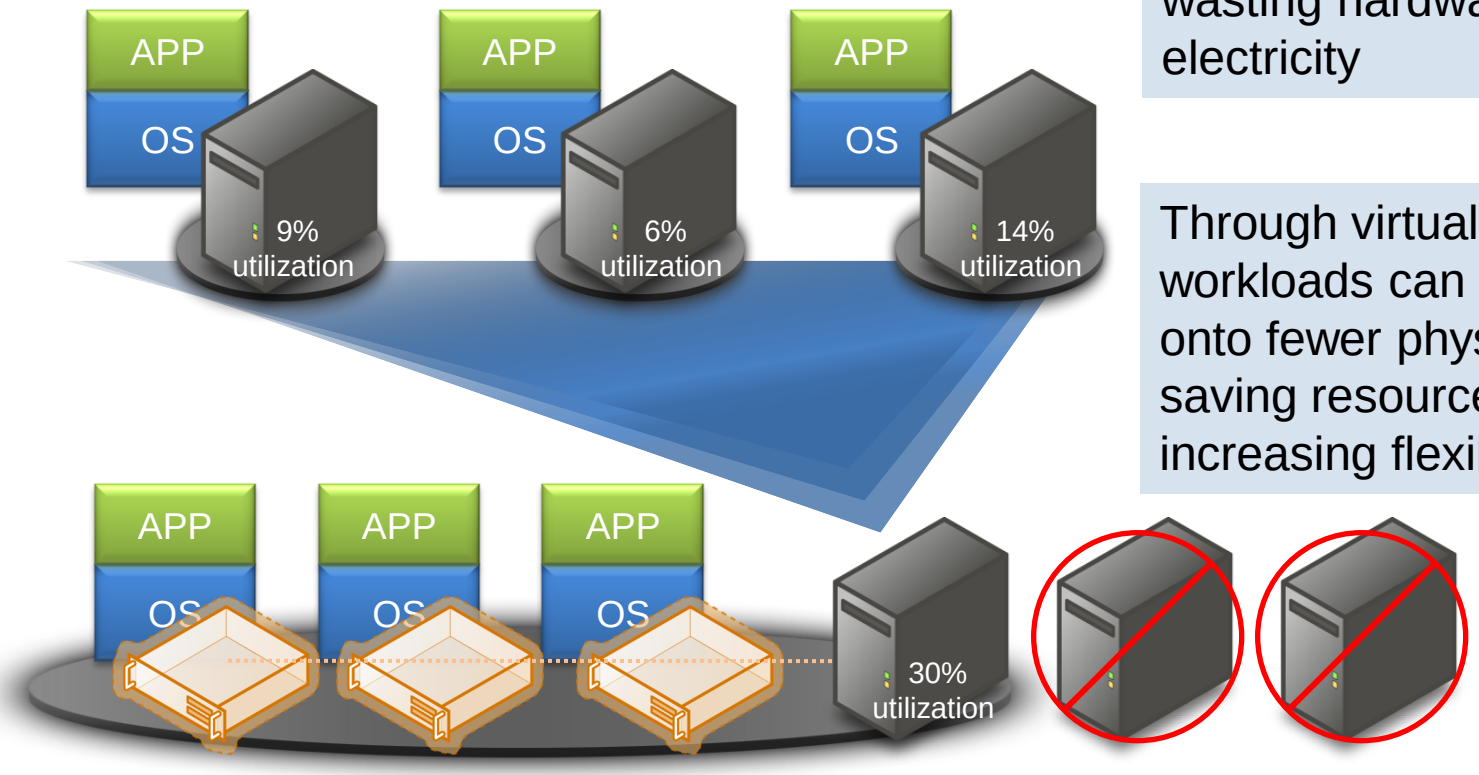
Example: Server Consolidation



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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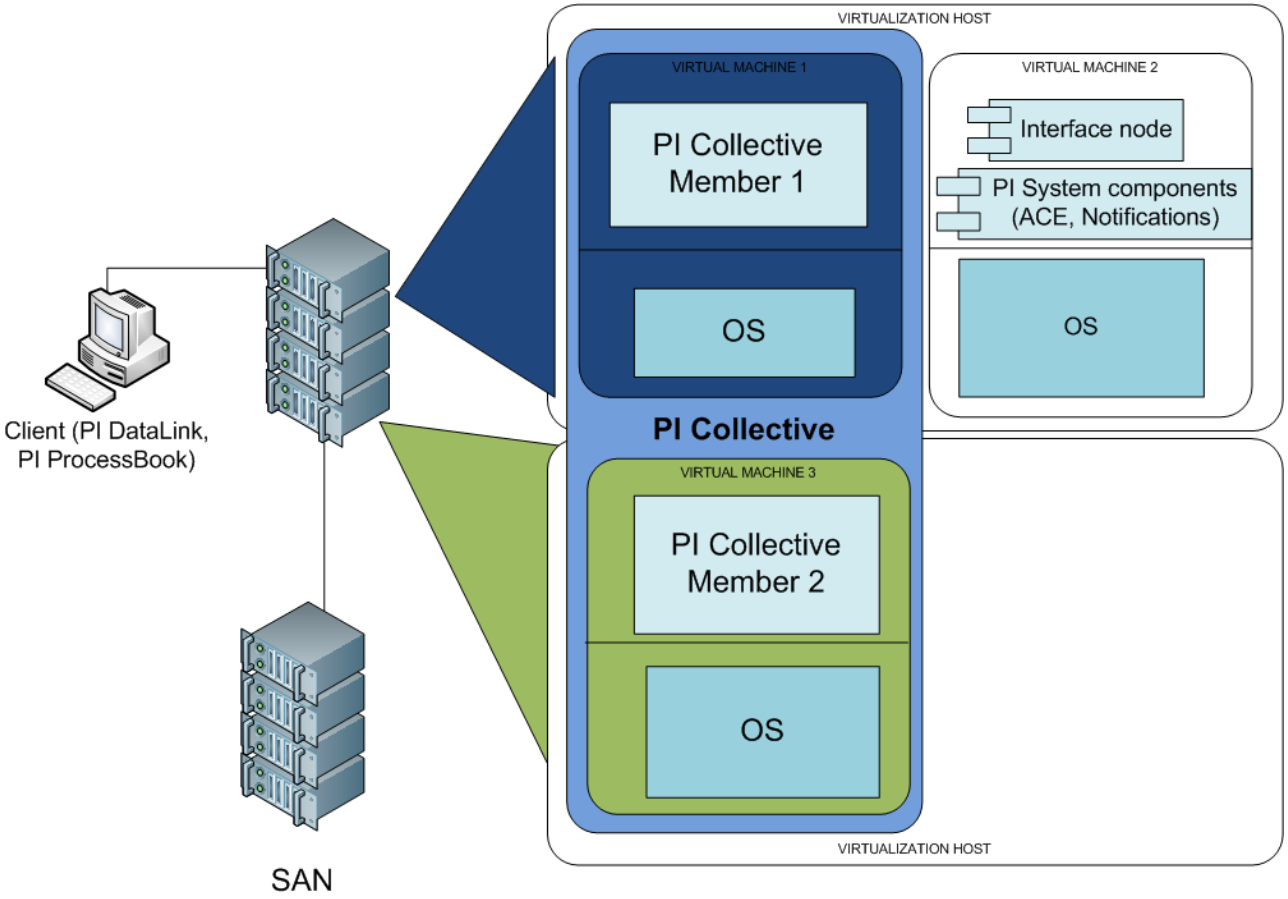
Virtualized PI



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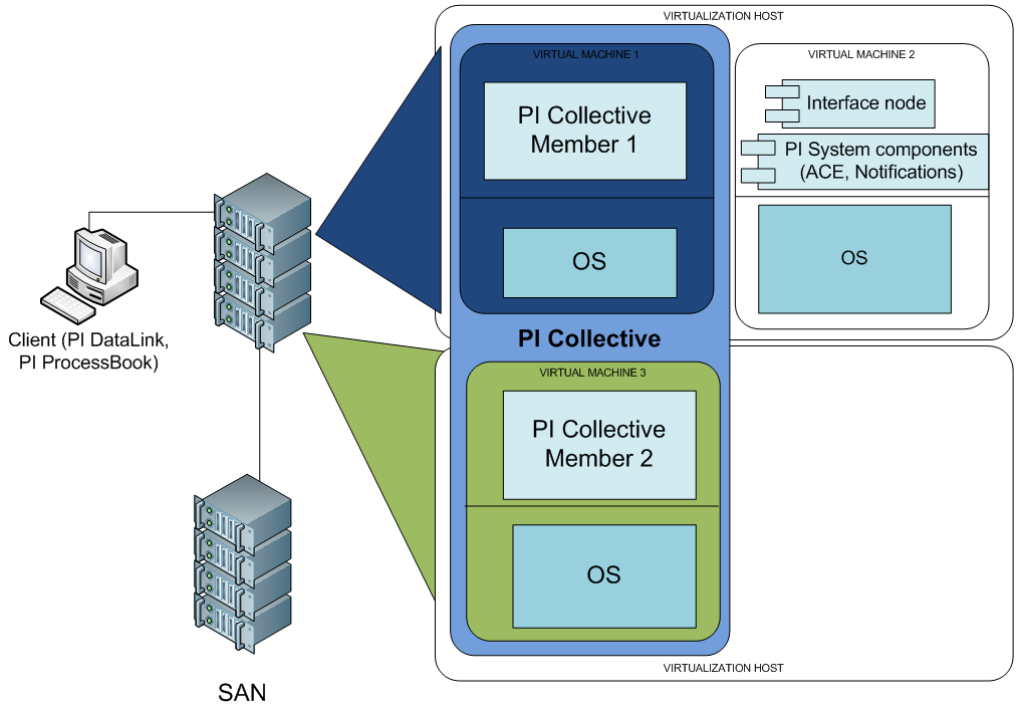
Recommendation: Virtualized PI System

- 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



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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)
- Flexibility in assigning resources (OSIsoft NOC for monitoring EA PI Systems)

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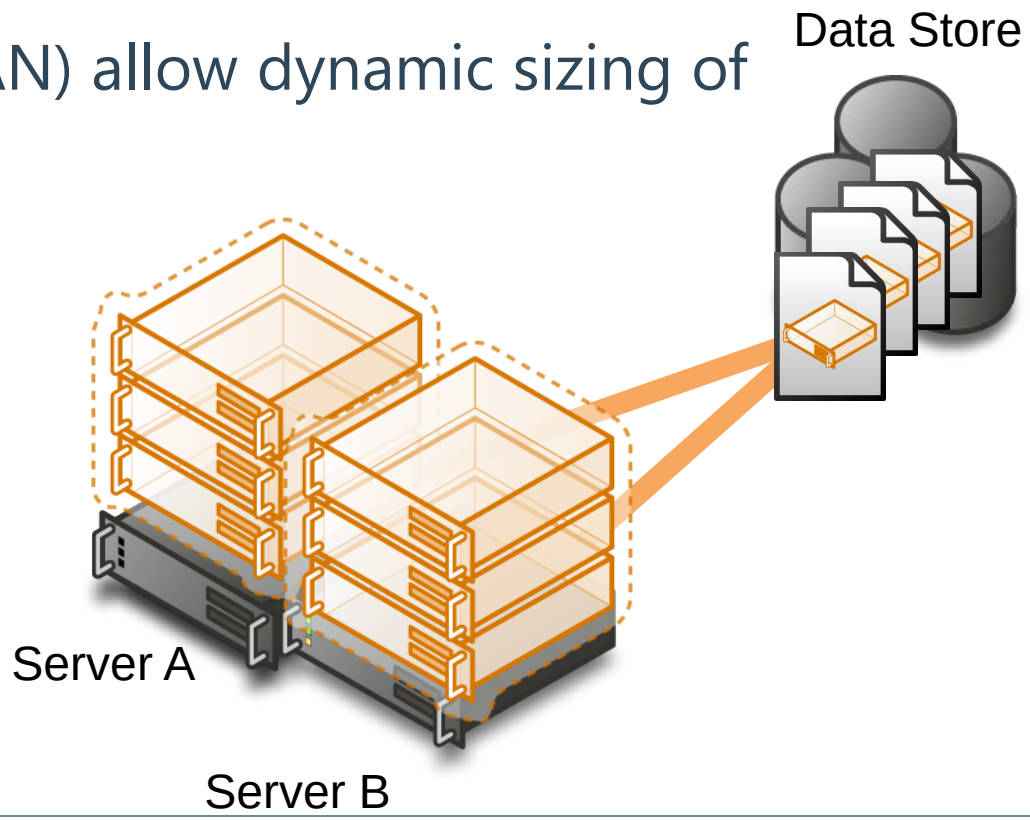
Storage Virtualization

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

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



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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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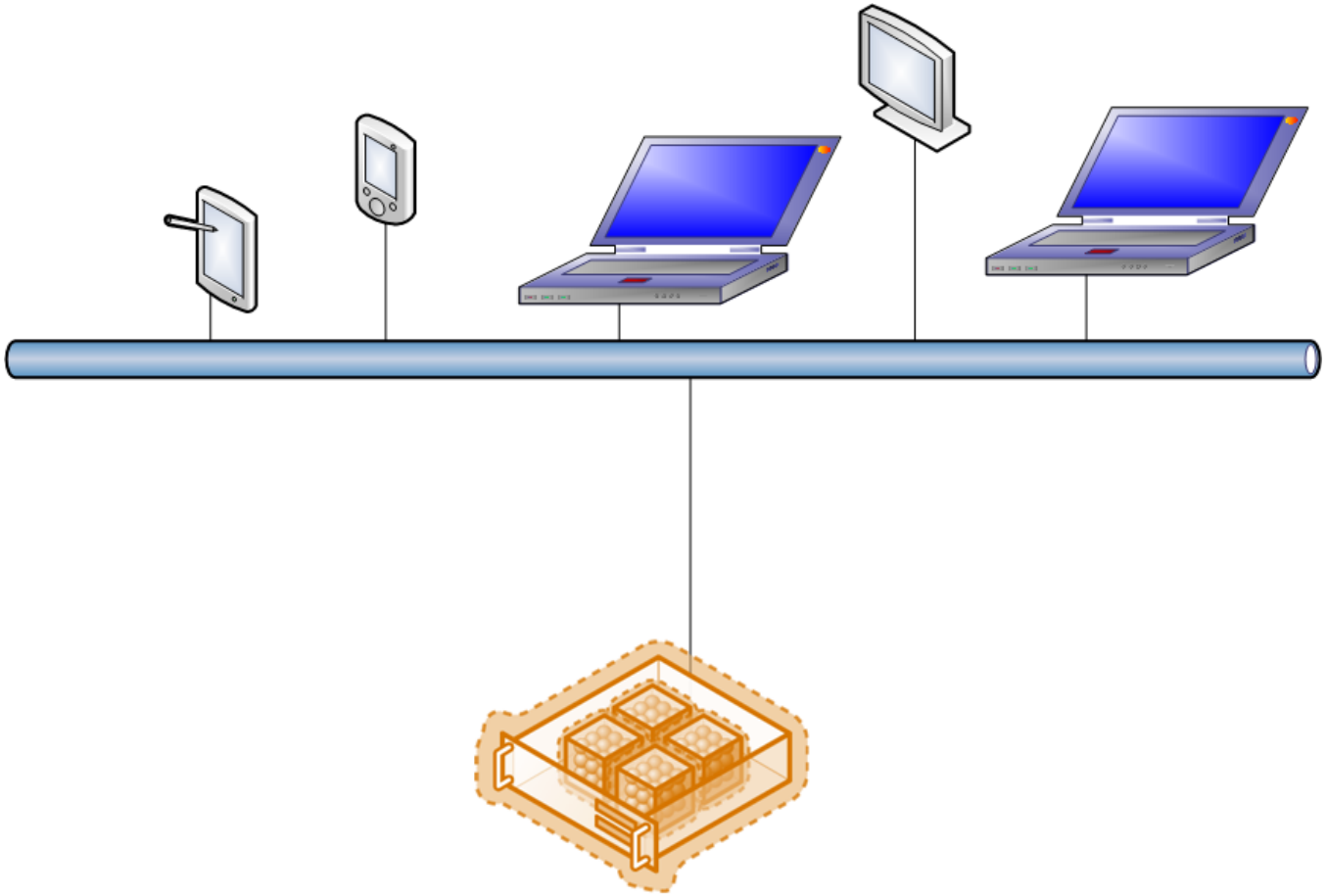
Application Virtualization



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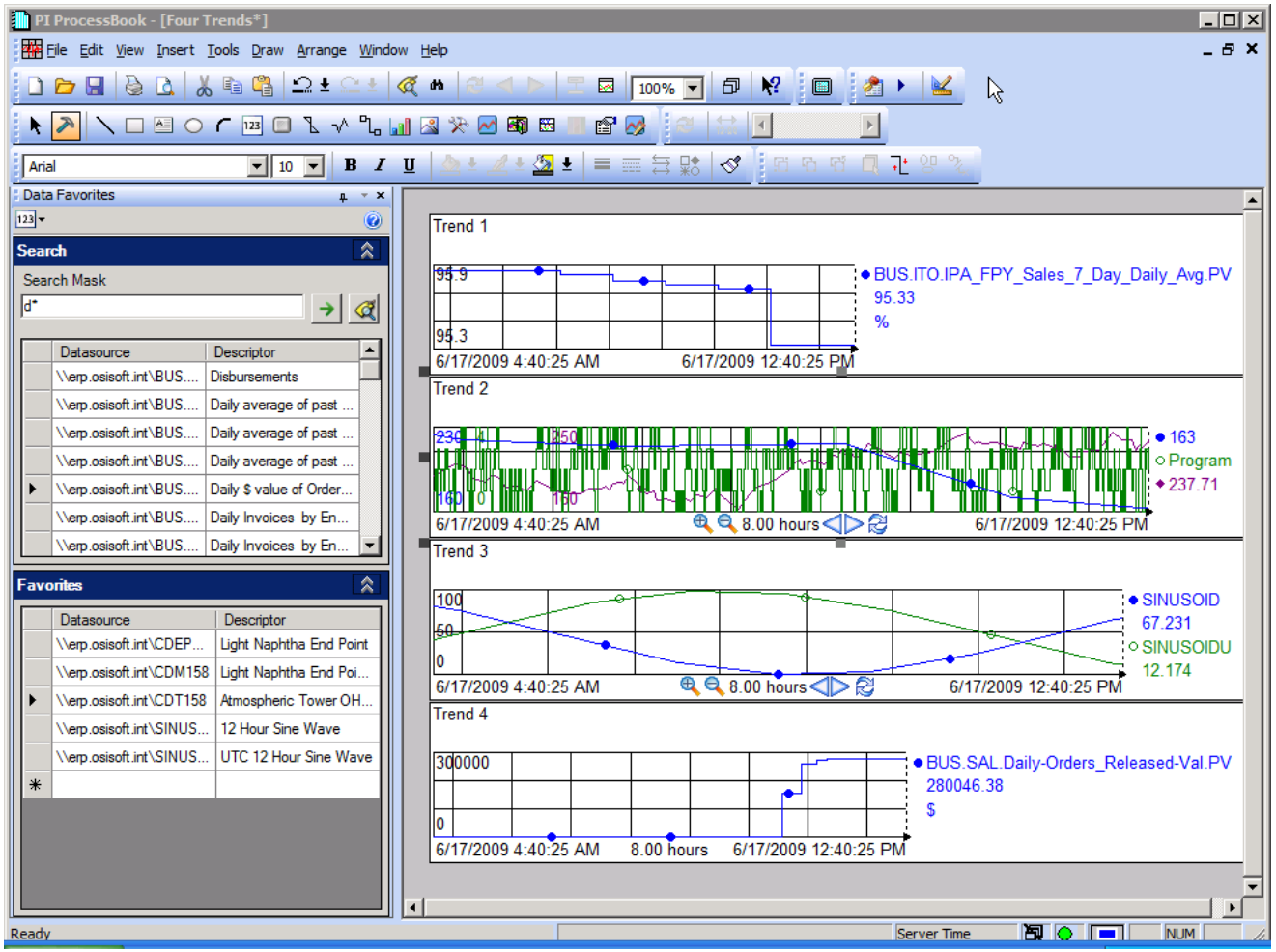
PI and Application Virtualization (ProcessBook)



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Application Virtualization

- Citrix or Terminal Server can 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 upgrade investments by deploying client software in one place

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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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Benefits: 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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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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