OSIsoft®

REGIONAL SEMINARS 2012

The Power of Data

Architecture and Best Practices for PI Systems

Presented by **Lily Wong, Field Service Engineer**

Topics

Upgrading to PI System 2012

- Why Upgrade
- How to Upgrade

Architecture

- Hardware and System Sizing
- Virtualization

Best Practices

- PI Server
- Interfaces
- AF

Upgrading to PI Server 2012

What's New in PI Server 2012?

Performance & Scalability

- More efficient use of RAM
- More efficient use of archive space
- Better management of connections

Manageability

- Auto recovery of corrupted queues
- Streamlined backfilling process (hours, not weeks)

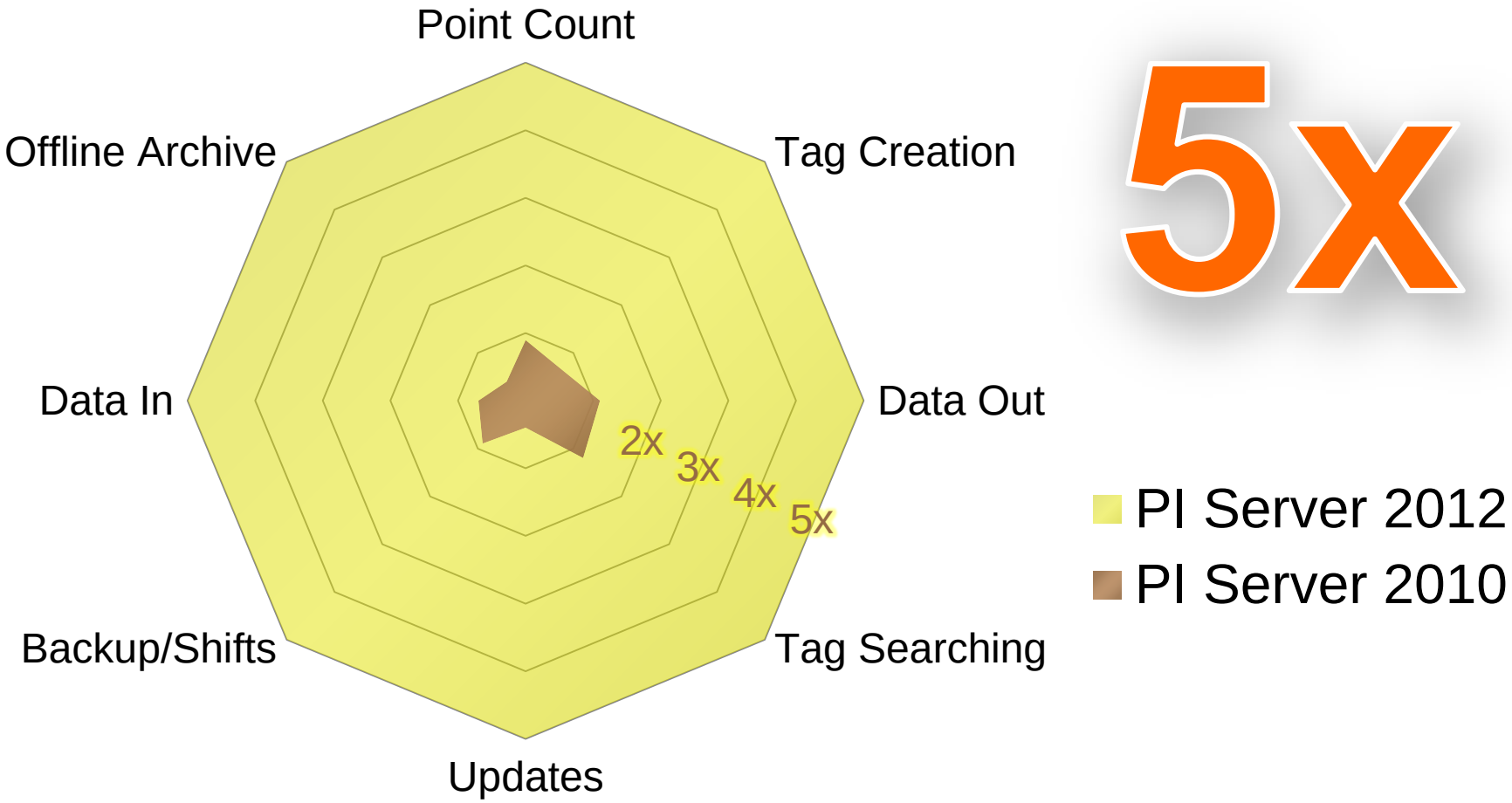
PI Server 2012 Performance

2010 R3

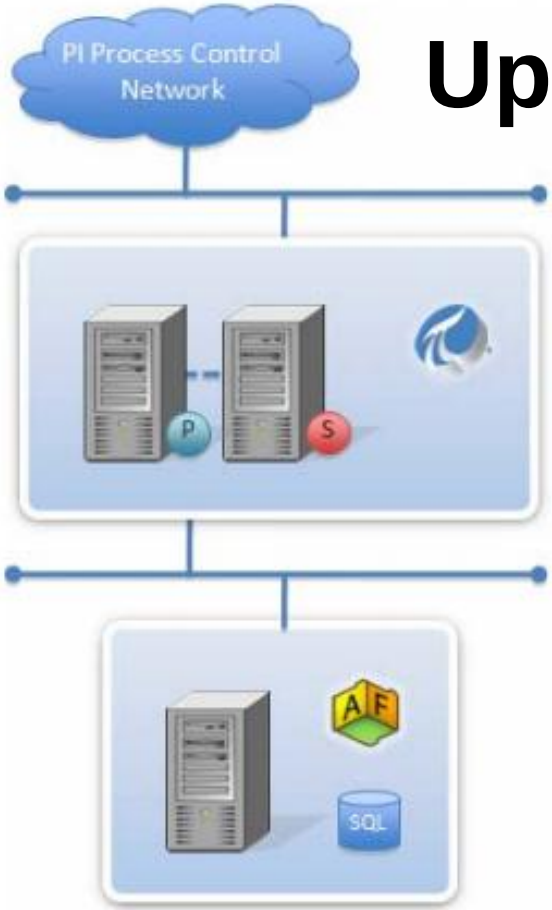
Max Point Count	2M+ tags
Max Data In Rate	<100K ev/sec
Max Data Out Rate	<5M ev/sec
Online Archives	2-5K files
Real-time Updates	200K signups
Point Changes	<10 pt/sec
Startup Time	>20 minutes

2012

Max Point Count	5M tags
Max Data In Rate	500K ev/sec
Max Data Out Rate	5M ev/sec
Online Archives	>10K files
Real-time Updates	>3M signups
Point Changes	>500 pt/sec
Startup Time	<2 minutes



Upgrading to PI System 2012



- PI Asset Framework is a required component since PI Server 2010

P Primary server of a collective

S Secondary server

SQL Server License:	Express
	Standard
	Enterprise

I want to upgrade to PI System 2012 but…

…my current PI Server is 32-bit

…I don't have AF

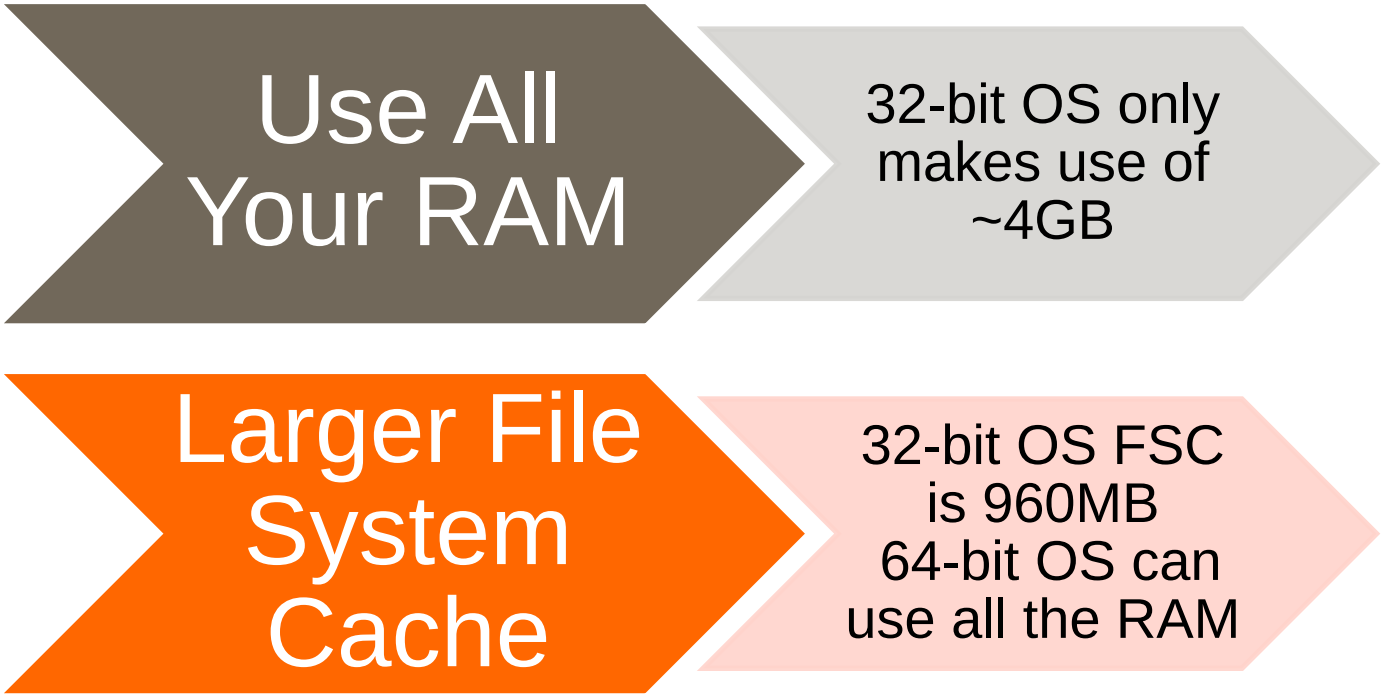
…on 64-bit OS

…on 32-bit OS

…for a small PI System

…for a large PI System

Why 64-bit?



…My Current PI Server is 32-bit

KB Article # KB00530

Upgrading to 64-bit PI Server while moving to 64-bit hardw

Product: PI Server

Version(s): 32-bit to 64-bit PI Server 2010 and later

Platform: Windows All

Issue

You currently have an old, 32-bit version of the PI Server installed. You
then upgrade to the latest PI Server version. This procedure assumes t
32-bit version on the old hardware. Upgrades will be isolated to the new
to the old version in case something unexpected goes wrong with the m

Review the following factors prior to upgrading:

- Except as noted in the table below, when moving a PI Server, yo
as was on the original hardware before moving the databases. F
installed on the original hardware, you must install PI Server 3.4
move.
- Because you will need to install an old PI Server version on the
Technical Support to get the old installation kits. Some older PI S
Center; however, most older installation kits require a manual o
- Upgrading to PI Server 2010 or later may require a number of p
and PI Asset Framework (PI AF) 2010 and later; synchronization
security settings on the PI AF and PI Server computers.
- Before upgrading to PI Server 2010 or later, the PI MDB to AF Pr
PI Server.
- If you are moving a PI Server collective, the current PI Server d
Refer to known issue **23634OSI8** for a discussion of the differe

Solution

Upgrade Table for Moving from 32-bit Hardware to 64-bit Hardware

Source 32-bit server	Actions on target 64-bit machine
Any 32-bit PI Server version between 3.2.357.8 and 3.4.375.38.	• Install PI Server 3.4.375.99 64-bit on target machine • Move PI Server. • Upgrade to latest PI Server version Note: Moving from an old PI Server version (between 3.2.357.8 and 3.4.375.38) directly to 3.4.375.99 is the exception to the rule. Und other circumstances, you should move PI Server database files only between exact same versions of the PI Server.
PI Server 3.4.375.80 32-bit or 3.4.375.99 32-bit	• Install PI Server 3.4.375 64-bit on target machine. Use the e same version of the PI Server that was installed on the 32-bi Server machine. (For example, if 3.4.375.80 32-bit was instal the source PI Server, you should install 3.4.375.80 64-bit on target PI Server. If 3.4.375.99 32-bit was installed on the 32 Server machine, you should install 3.4.375.99 64-bit on the t Server.) • Move PI Server

…I don’t have AF

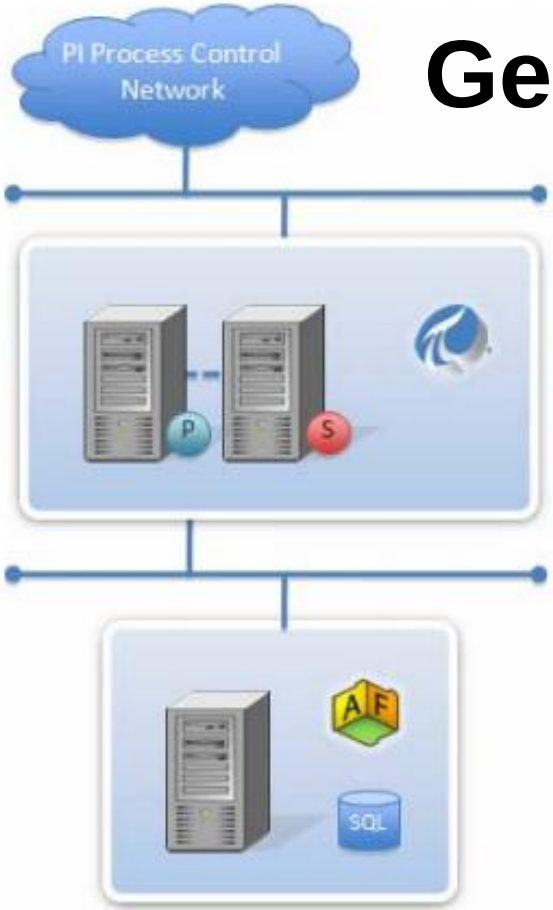
…small system

- Install SQL Server Express on the PI Server machine
- Install PI AF on the same machine

…large system

- Enterprise grade SQL Server installation
- Devote a machine (or several) to AF

Get AF



- PI AF has two components
  - AF Server
  - SQL Server Database

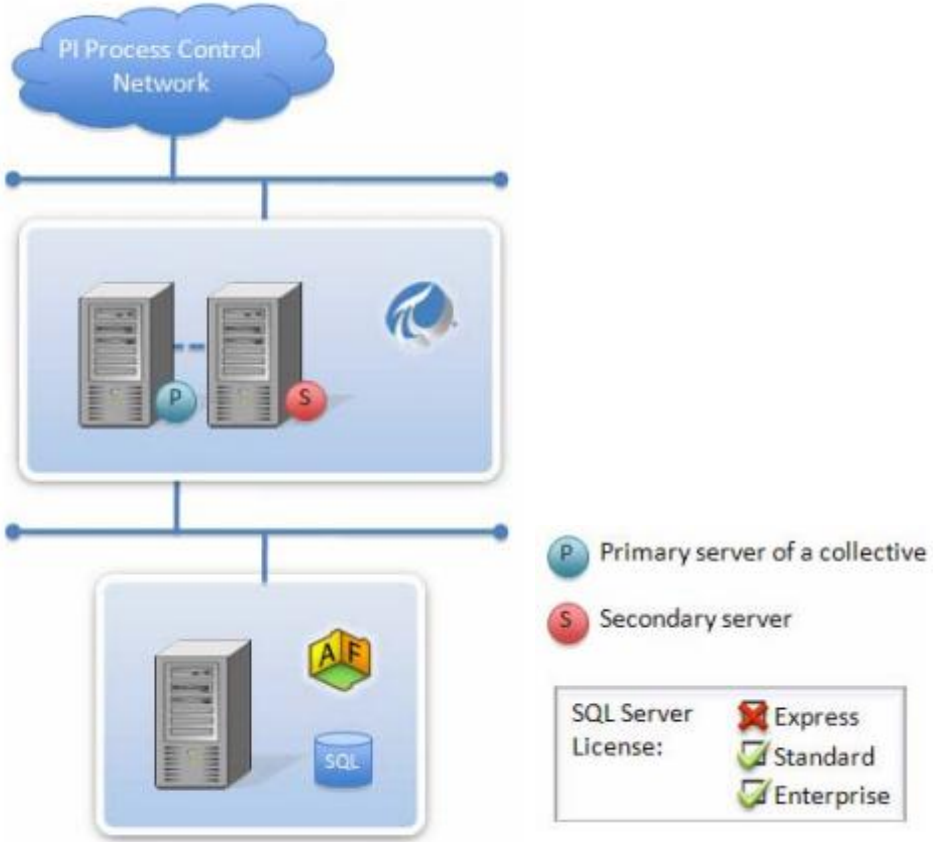
P Primary server of a collective

S Secondary server

SQL Server License:	Express
	Standard
	Enterprise

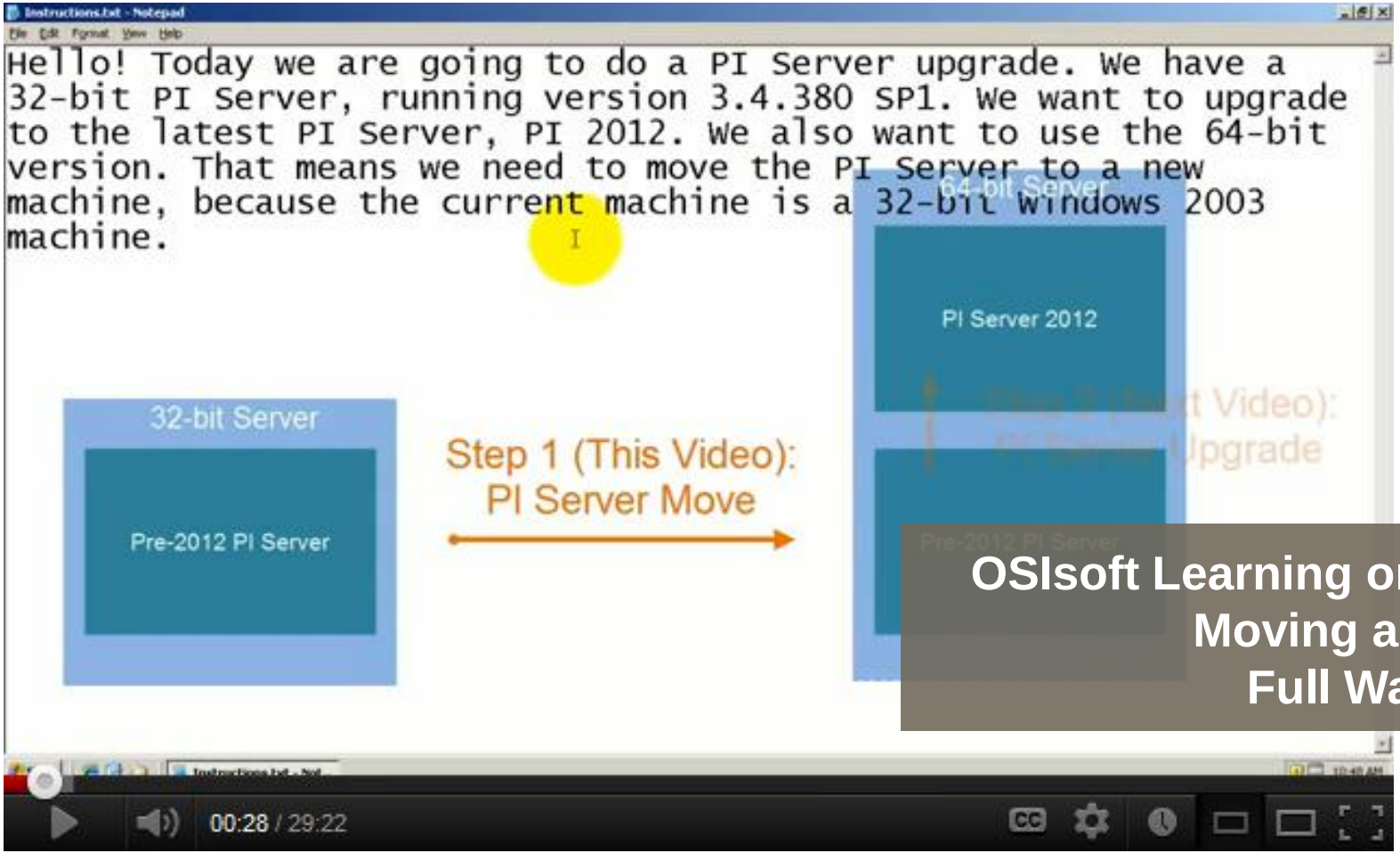
Small AF (<10k Assets)

Larger AF (>10k Assets)

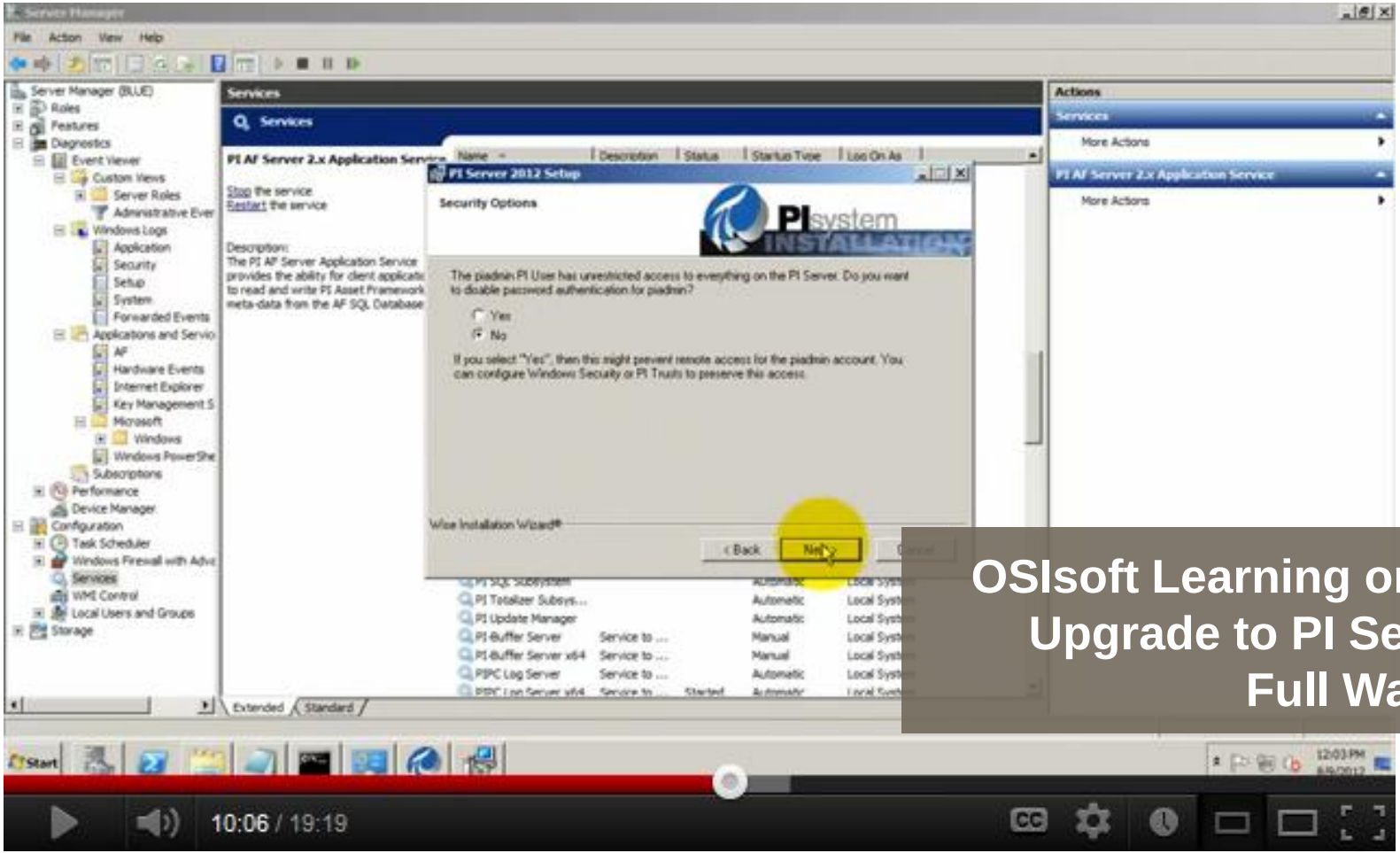


Help!!!

OSIsoft Field Service	• On-site or remote service. Typically a 4 day job.
Public Classes	• Practice with the product in a controlled environment.
YouTube Walkthroughs	• Step-by-step walkthrough. (Not a substitute for documentation)
OSIsoft Technical Support	• If there are problems during the upgrade.



OSIsoft Learning on YouTube
Moving a PI Server: Full Walkthrough



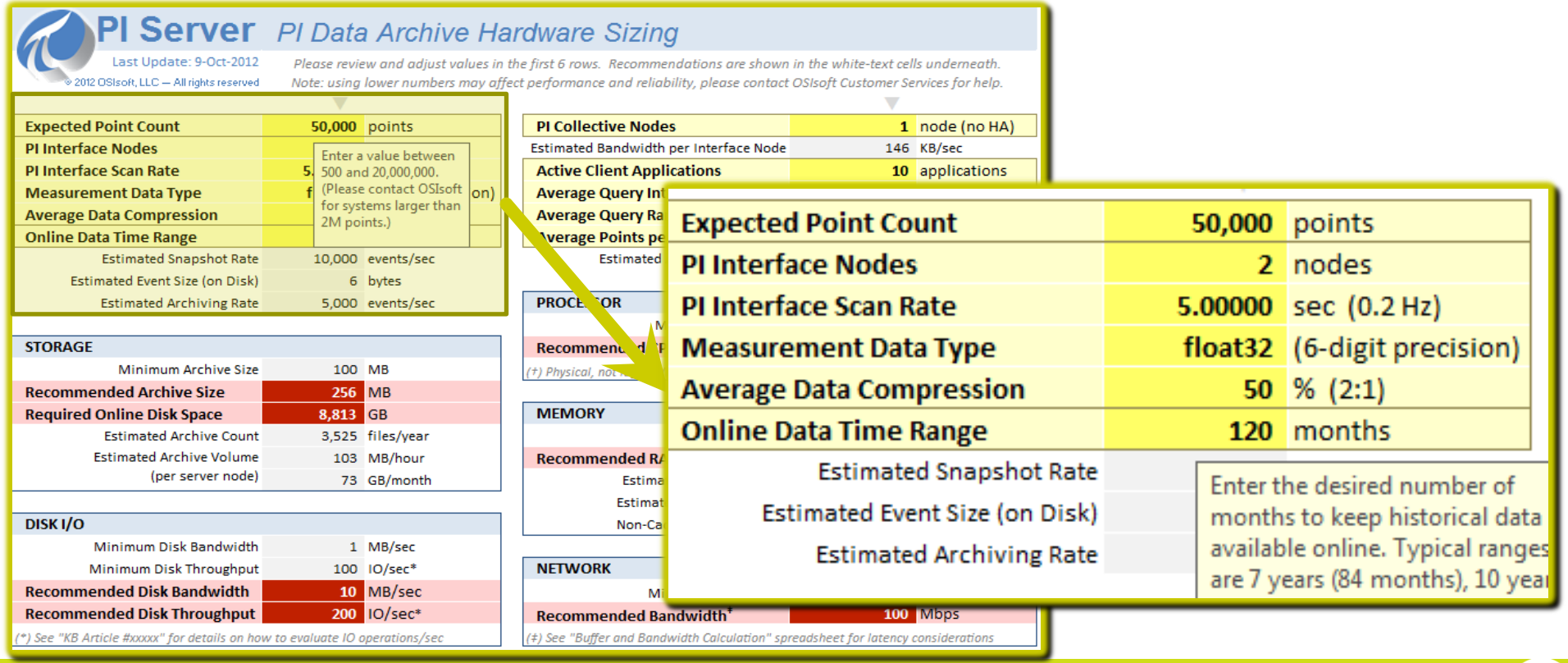
Hardware and System Sizing

Basic Hardware Guidelines

0. Windows ⇨ Latest OS (64 bits)
1. Memory ⇨ most bang/$
2. Storage ⇨ latency (IOPS)
3. Network ⇨ latency (RTT)
4. Computing ⇨ client workload

	RAM	Disk IO/s	Network	CPU Cores
Minimum	15KB per PI Point	Rate of Archived Events/50	100Mbps LAN	4 + Active Client Connections/5
Recommended	Enough to fit 2 full archives in RAM (file system cache)	Rate of Archived Events/10 + Read Workload (based on desired client response time)	1-10Gbps LAN (end-to-end latency is most critical)	4 + Active Client Connections/2 (more with multi-threaded clients)

PI Data Archive Hardware Sizing



PI Server — PI Data Archive Hardware Sizing

Last Update: 9-Oct-2012

Please review and adjust values in the first 6 rows. Recommendations are shown in the white-text cells underneath.
Note: using lower numbers may affect performance and reliability, please contact OSIsoft Customer Services for help.

Expected Point Count	50,000	points
PI Interface Nodes		
PI Interface Scan Rate	5.	
Measurement Data Type	f	
Average Data Compression		
Online Data Time Range		
Estimated Snapshot Rate	10,000	events/sec
Estimated Event Size (on Disk)	6	bytes
Estimated Archiving Rate	5,000	events/sec

Enter a value between 500 and 20,000,000. (Please contact OSIsoft for systems larger than 2M points.)

PI Collective Nodes	1	node (no HA)
Estimated Bandwidth per Interface Node	146	KB/sec
Active Client Applications	10	applications
Average Query In		
Average Query Ra		
Average Points pe		
Estimated		

STORAGE		
Minimum Archive Size	100	MB
Recommended Archive Size	256	MB
Required Online Disk Space	8,813	GB
Estimated Archive Count	3,525	files/year
Estimated Archive Volume	103	MB/hour
(per server node)	73	GB/month

DISK I/O		
Minimum Disk Bandwidth	1	MB/sec
Minimum Disk Throughput	100	IO/sec*
Recommended Disk Bandwidth	10	MB/sec
Recommended Disk Throughput	200	IO/sec*

(*) See "KB Article #xxxxx" for details on how to evaluate IO operations/sec

PROCESSOR

Recommend

(†) Physical, not

MEMORY

Recommended RA

Estima

Estimat

Non-Ca

NETWORK

Mi

Recommended Bandwidth‡	100	Mbps

(‡) See "Buffer and Bandwidth Calculation" spreadsheet for latency considerations

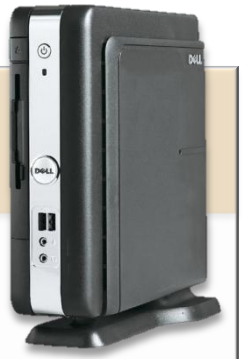
Expected Point Count	50,000	points
PI Interface Nodes	2	nodes
PI Interface Scan Rate	5.00000	sec (0.2 Hz)
Measurement Data Type	float32	(6-digit precision)
Average Data Compression	50	% (2:1)
Online Data Time Range	120	months
Estimated Snapshot Rate		
Estimated Event Size (on Disk)		
Estimated Archiving Rate		

Enter the desired number of months to keep historical data available online. Typical ranges are 7 years (84 months), 10 yea

Better Performance on Old Hardware

2012

Max Point Count	10K+ tags
Max Data In Rate	>40K ev/sec
Max Data Out Rate	>100K ev/sec
Online Archives	>1K files
Real-time Updates	>5K signups
Point Changes	>50 pt/sec
Startup Time	<1 minutes



Dell OptiPlex SX-260

- 32-bit Architecture
- Pentium 4 3GHz (1 CPU Core)
- 1GB 266MHz DDR RAM
- 40GB 5.4K IDE HDD

eBay ~ $30

2012

Max Point Count	20M+ tags
Max Data In Rate	1M ev/sec
Max Data Out Rate	>10M ev/sec
Online Archives	>50K files
Real-time Updates	10M+ signups
Point Changes	2,000 pt/sec
Startup Time	<10 minutes

2012

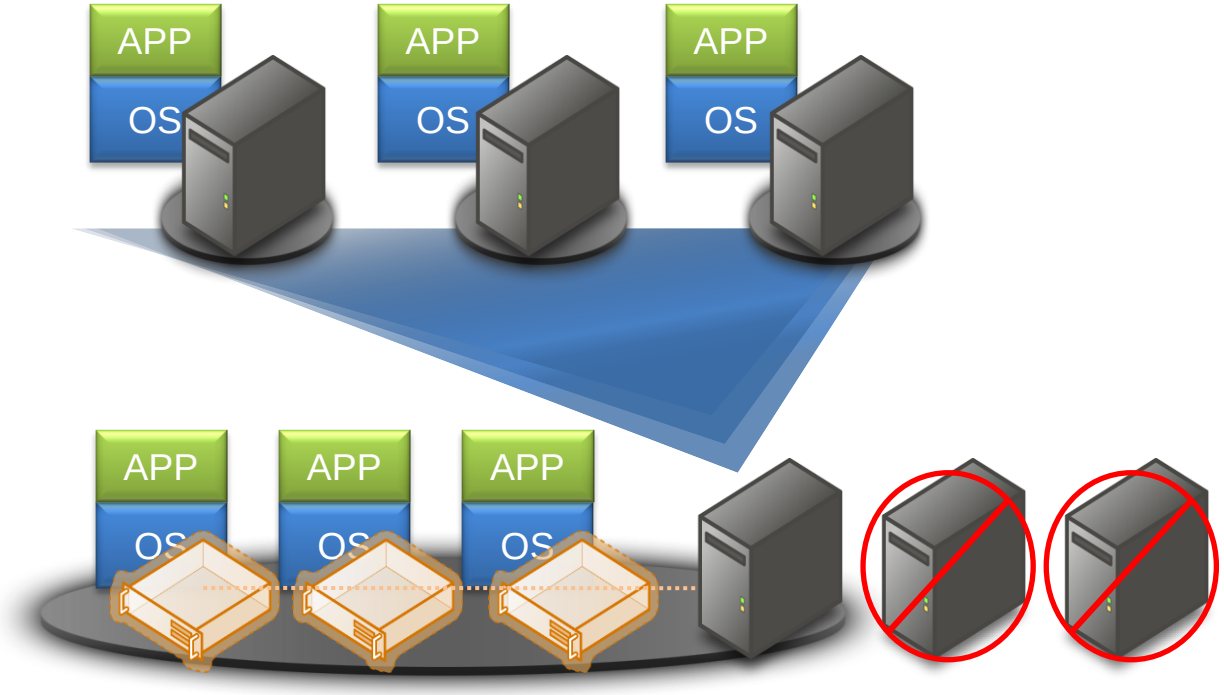
Max Point Count	5M tags
Max Data In Rate	500K ev/sec
Max Data Out Rate	5M ev/sec
Online Archives	>10K files
Real-time Updates	>3M signups
Point Changes	>500 pt/sec
Startup Time	<2 minutes

2012

Points	10K+ tags
Data In	>40K ev/sec
Data Out	>100K ev/sec
Online	>1K files
Updates	>5K signups
Points	>50 pt/sec
Startup	<1 minutes

Virtualization

Hardware Virtualization



Operating System Virtualization

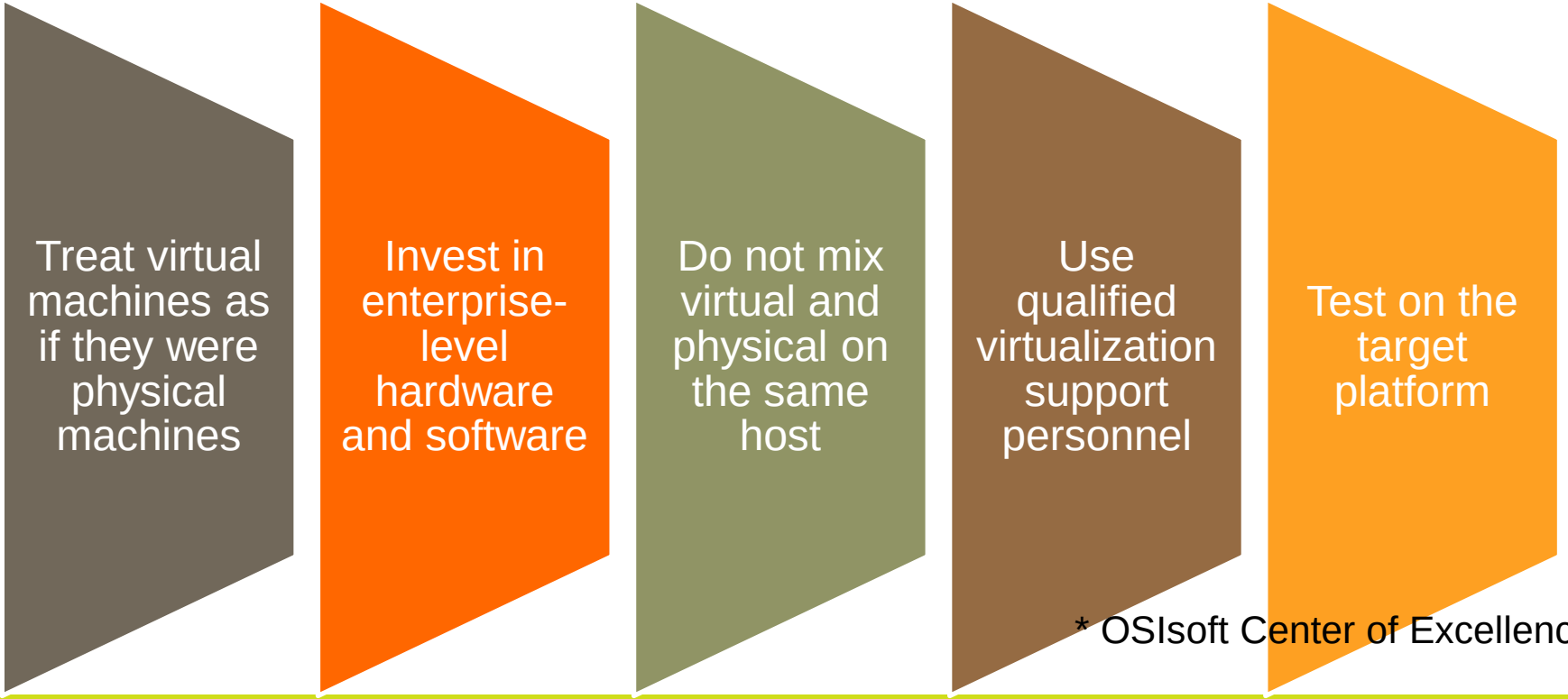
Why are OSIsoft customers using virtualization?

- Server consolidation
- Improved availability and provisioning

OSIsoft supports virtualization

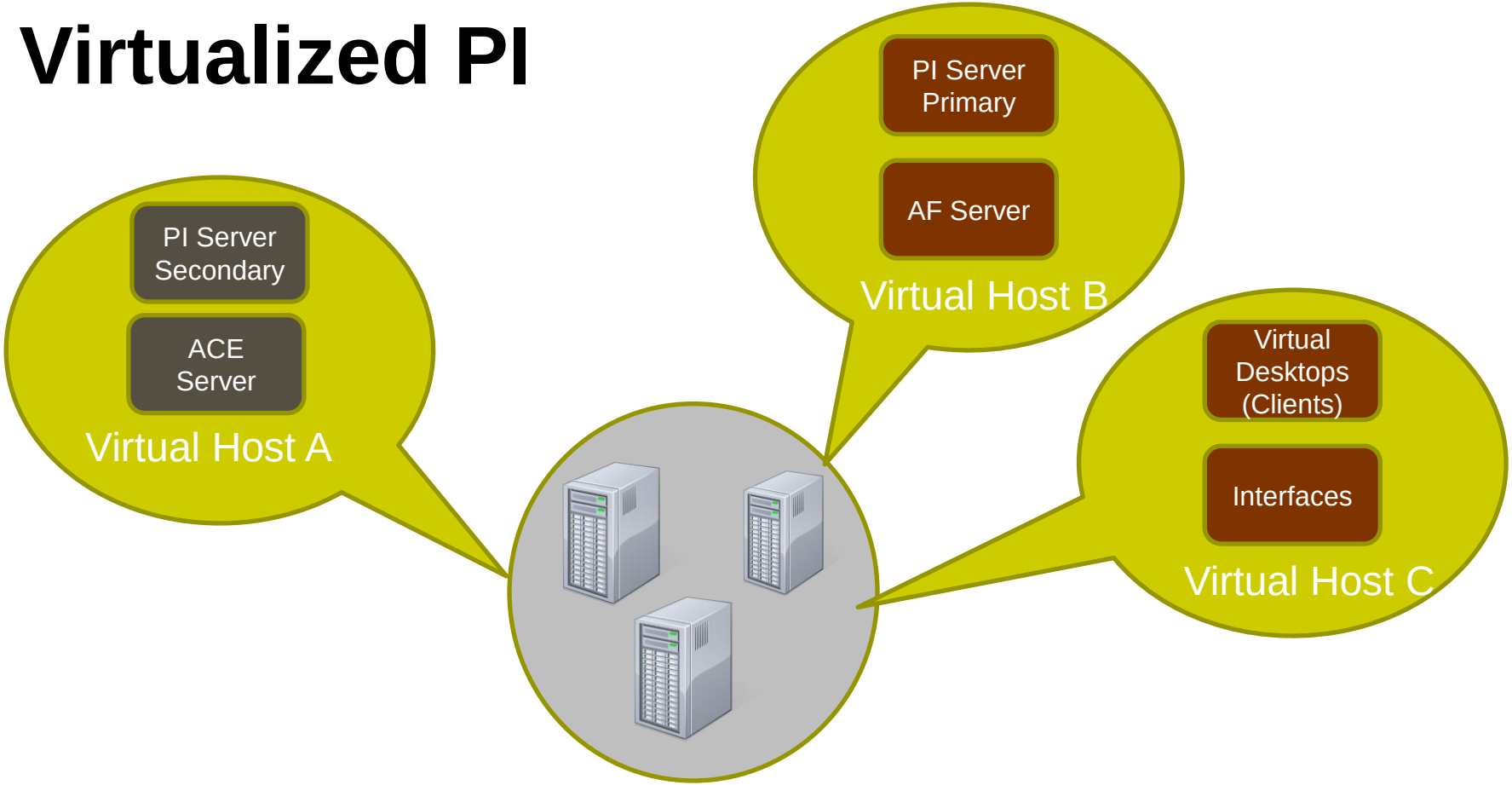
- OSIsoft Knowledge Base article 3062OSI8
- Consider shared resources implications

Operating System Virtualization*



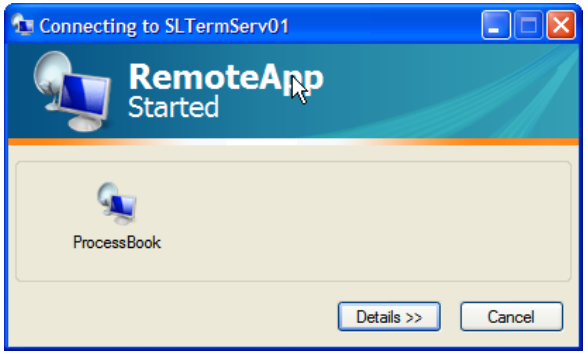
* OSIsoft Center of Excellence

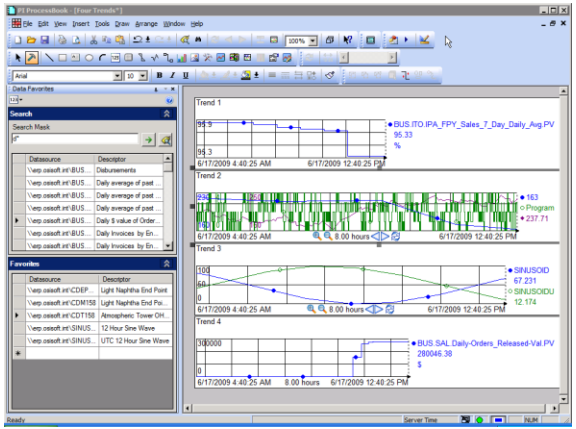
Virtualized PI



Application Virtualization

- Applications centrally installed and managed
- Users are remote
- OSIsoft customers are successfully using Microsoft and Citrix virtualization products





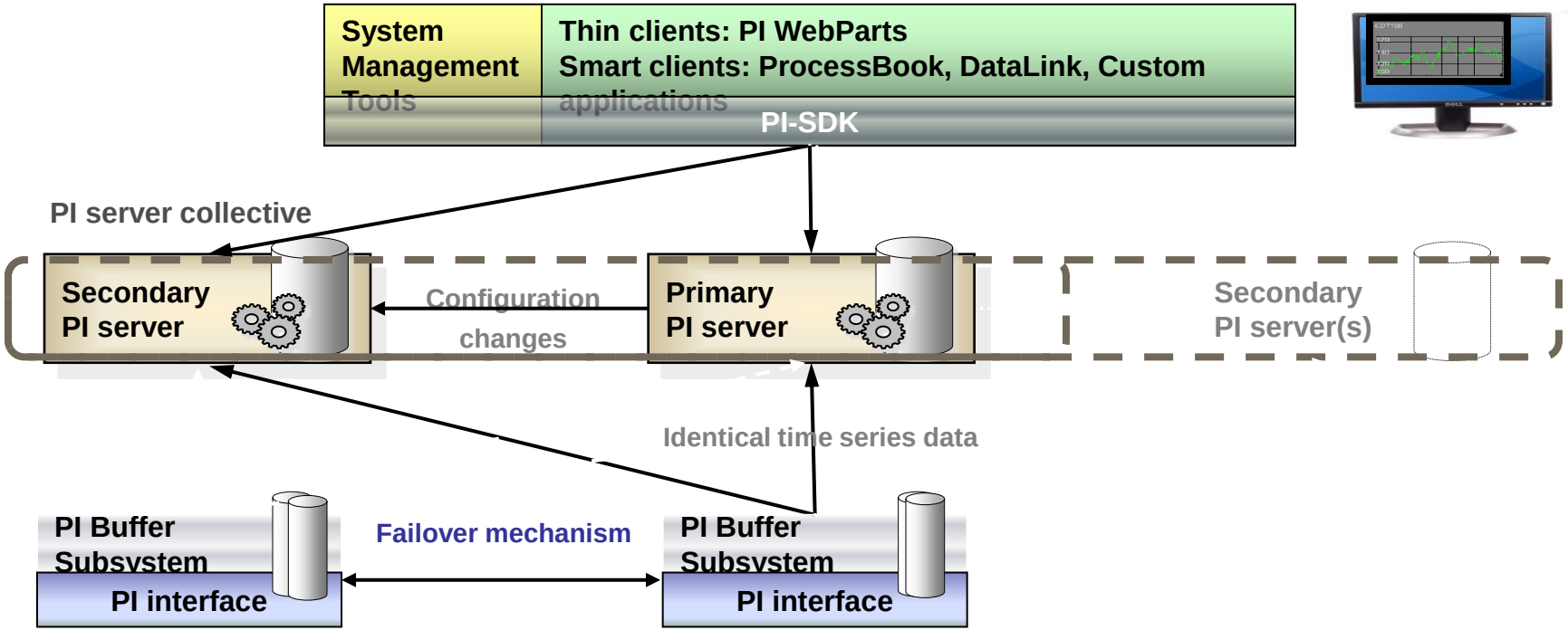
PI Server Best Practices

PI Server High Availability

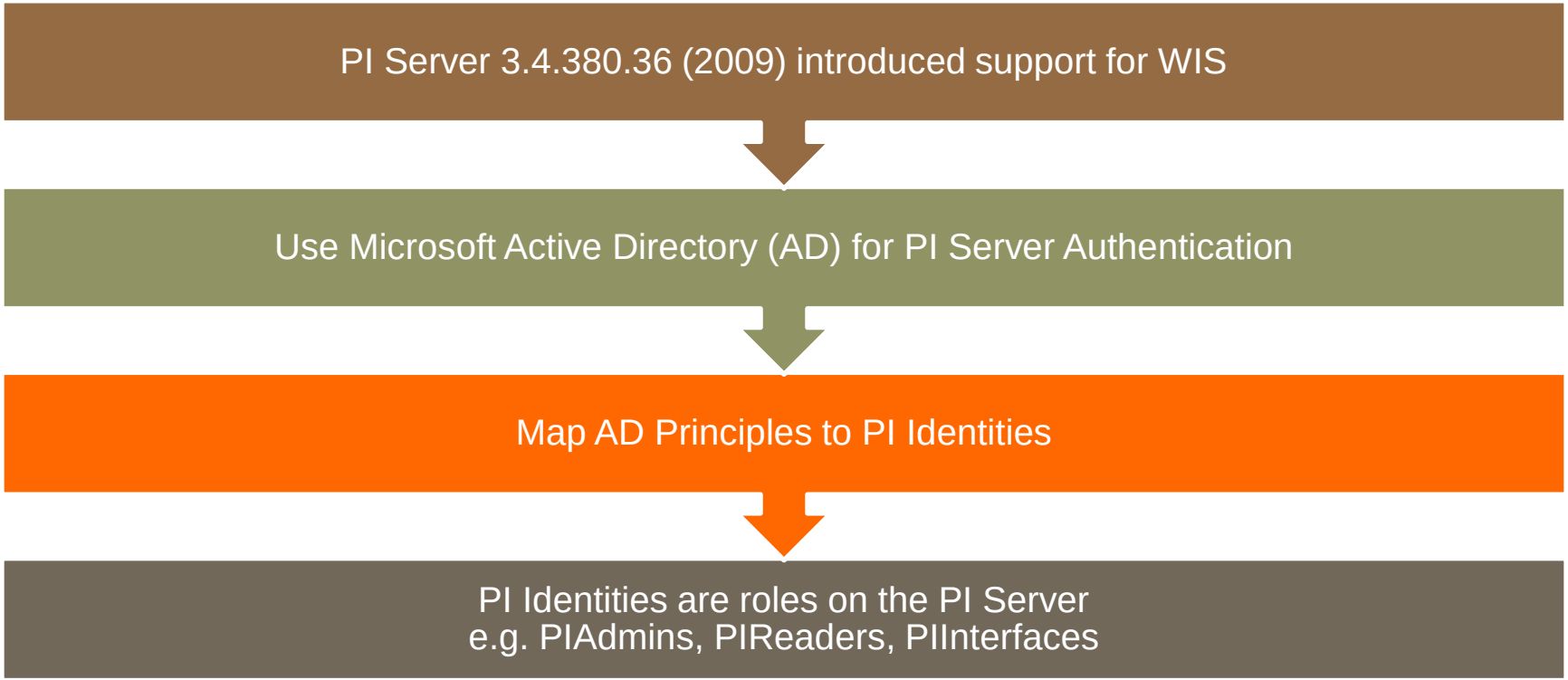
Create a PI Server Collective

- Maximize data access for clients. Maintain availability during outages.
- Load balance by connecting clients to closest Collective member
- MS Clusters no longer supported in 2012

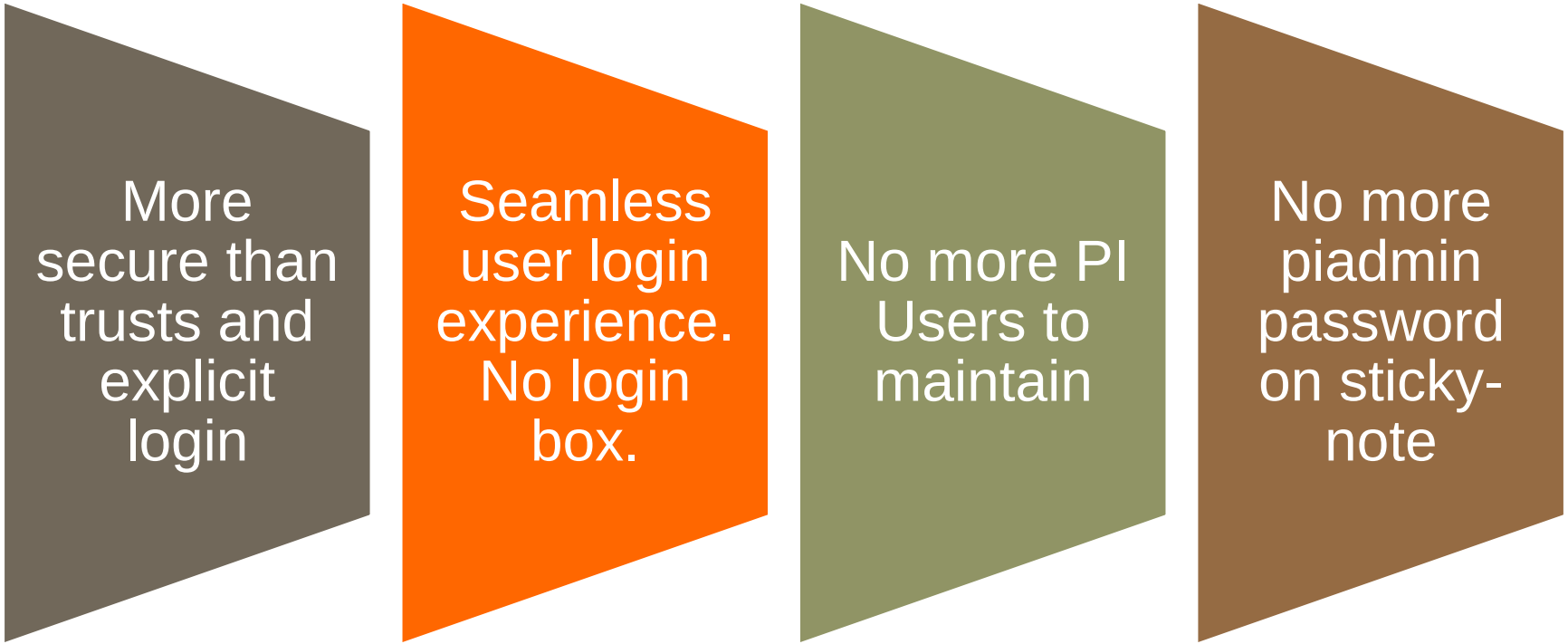
High Availability Architecture



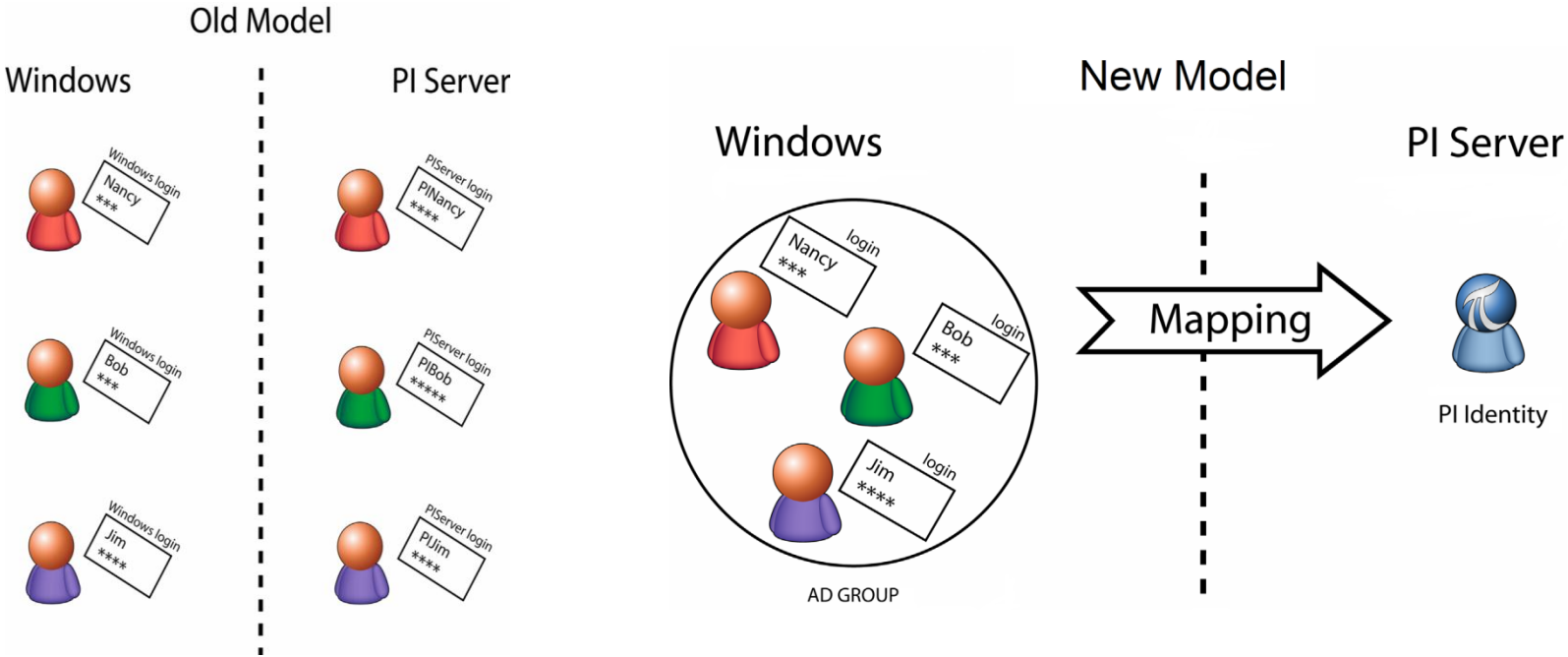
Windows Integrated Security (WIS)



What Does WIS Do for Me?



Comparing PI Users and PI Identities



Active Directory Integration

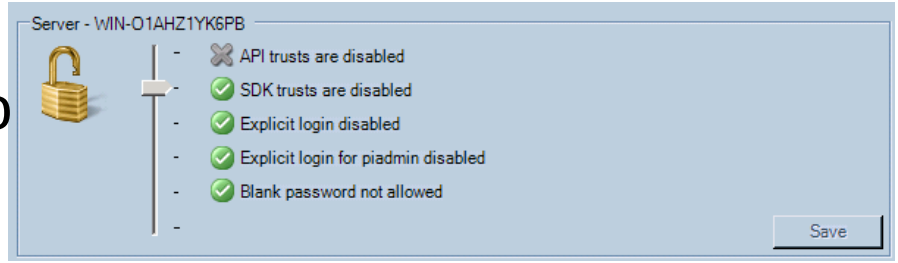
- PI Server must be a member of a domain to leverage Kerberos authentication
- Multiple AD domains must have trusts established
  - One-way trusts are supported: the server domain must trust the client domain

PI Identity Planning with AD

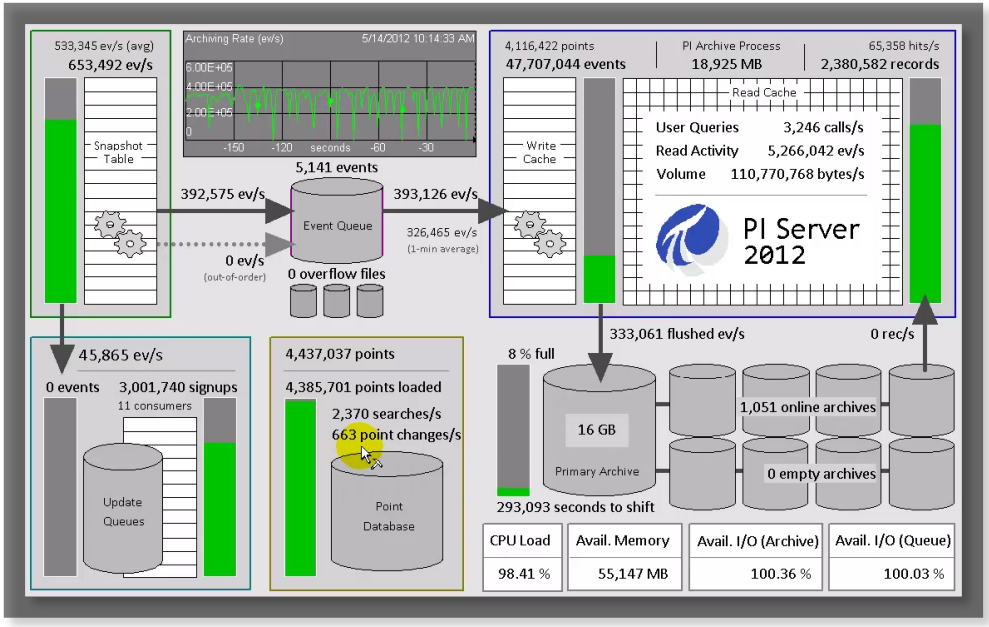
- Develop a PI Identity Scheme for your Organization
  - Who uses PI data?
  - Who writes to PI data?
  - Who needs Admin access?
- Managing Mappings
  - Map users and or groups directly
  - Add AD users to local groups that are mapped

How to Tighten Security

1. Physical and OS security are the first line of defense
2. Do not use the PIADMIN PIuser in trusts or mappings
3. Disable PI password authentication (explicit logins) (see KB00304)
4. Retire PI SDK-based Trusts
5. Use Windows Integrated Security
6. Use the new Security Tool to help secure your PI Server



PI Server Best Practices



- Look at the Logs
- Use the Security Features
- Monitor PI System Health with PI PerfMon
- Automatic Archive Creation
- Check Your Backups and Know How to Use Them

PI Interface Best Practices

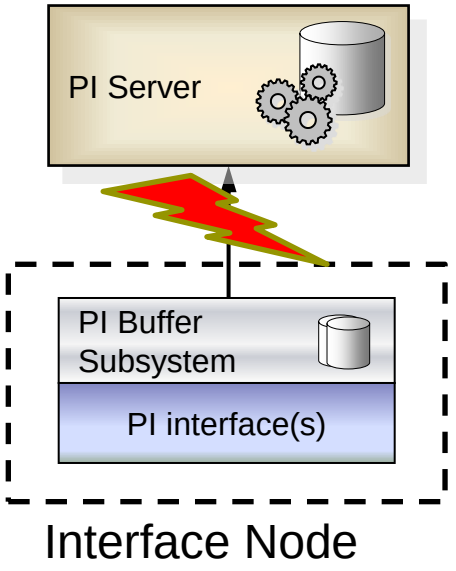
Enable Interface Buffering

Prevent Data Loss

- Stores data in the event of disconnection from PI Server(s)

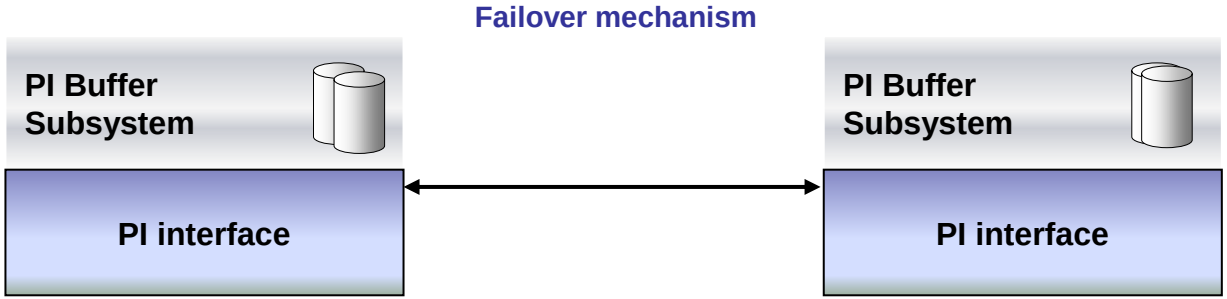
Two Flavors

- **PI Buffer Subsystem (pibufss)**
- PI Buffer Server (bufserv)

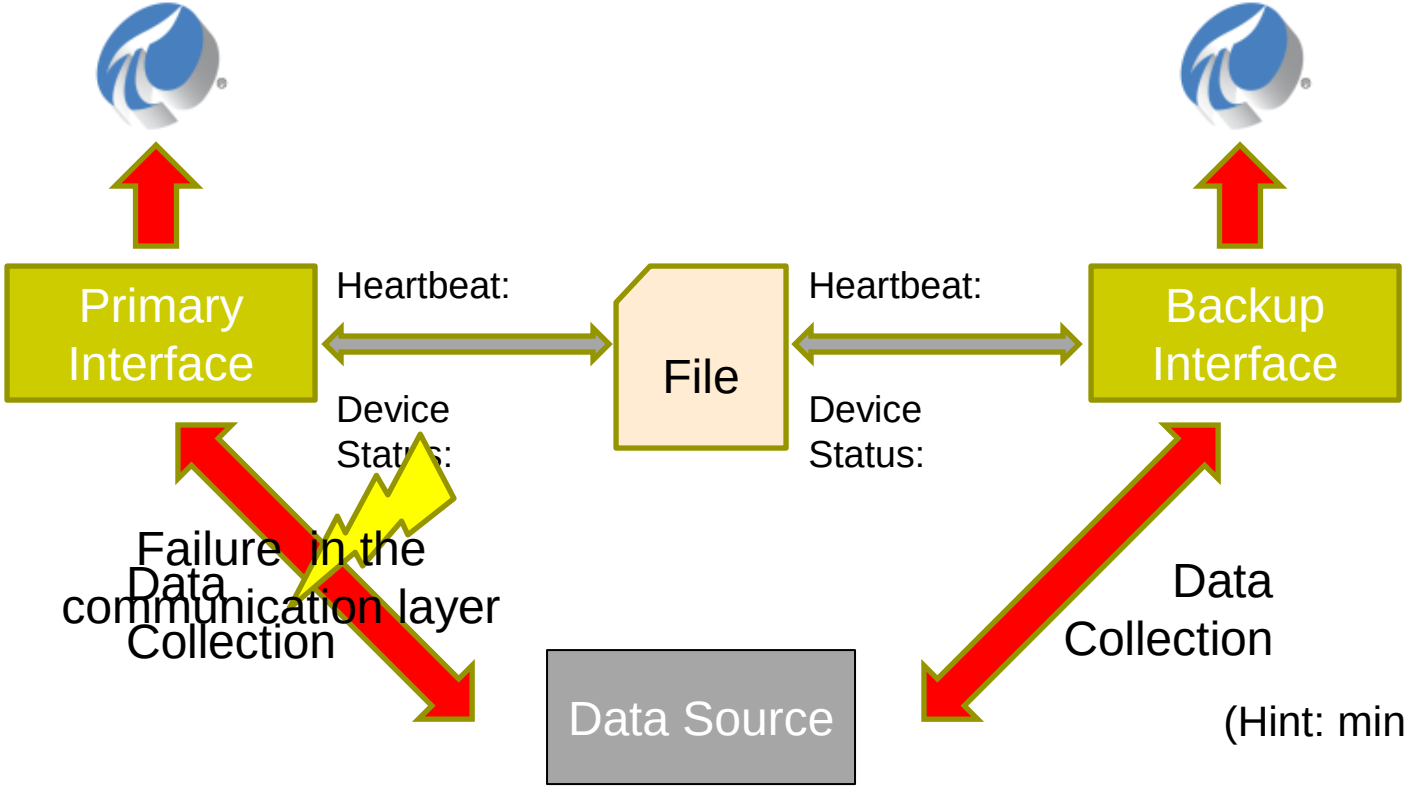


Enable Interface Level Failover

- Prevents (or minimizes) data loss if one of the interface machines fails.
- Each interface monitors the other's status and takes over if there is a problem.
- UniInt Phase 2 Failover uses a shared file.



How does interface failover work?



Hot = No data loss

Warm = Maybe data loss

Cold = Some data lost

(Hint: minimize data loss by using disconnected startup)

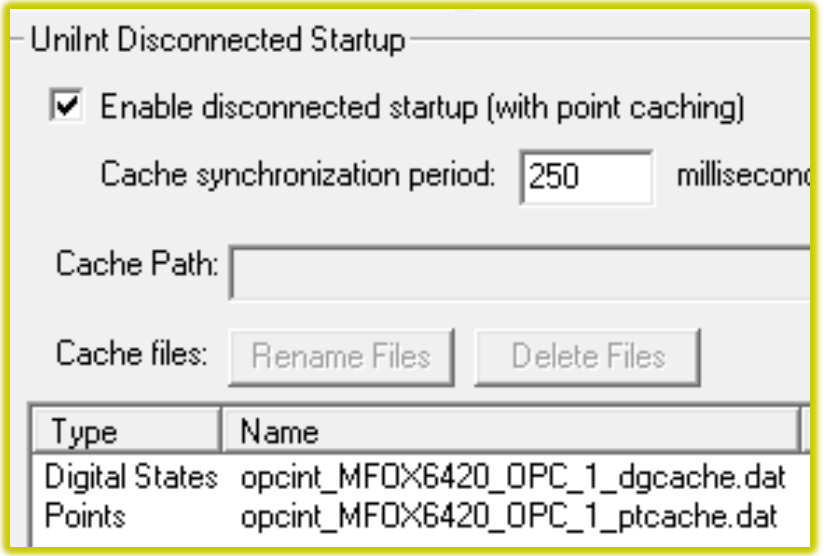
Enable Disconnected Startup

- Previously, if the PI Server was not available, it was not possible to start the interface
- Creates a local cache of all of the tags. Now the interface can start without connecting to the PI Server

Along with buffering, you know have an interface that can operate (almost) indefinitely without the PI Server!

Bonus: We have seen impressive decreases in interface startup time when this feature is enabled

Hint: If you make a lot of changes to this interface's tags consider shutting down the interface and deleting the cache files.



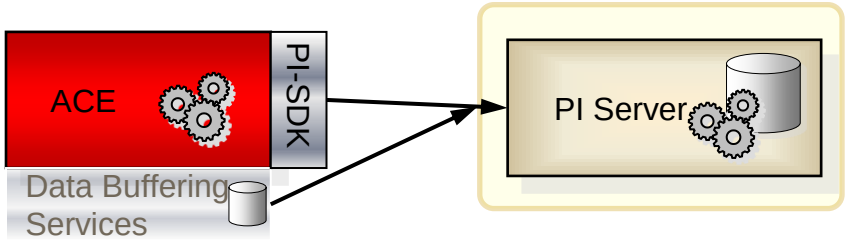
PI Interfaces – In Summary

- Configure buffering with PI Buffer Subsystem
- Consider implementing UniInt Failover
- Disconnected start-up
- Create interface health points
- Configure 2+ trusts using a limited account (not piadmin)
- Don’t forget to test!

PI ACE Best Practices

PI Advanced Computing Engine

- Best Practices
  - Configure buffering
  - Error handling
    - *Try…catch*
  - Performance Counters
  - Backup Code



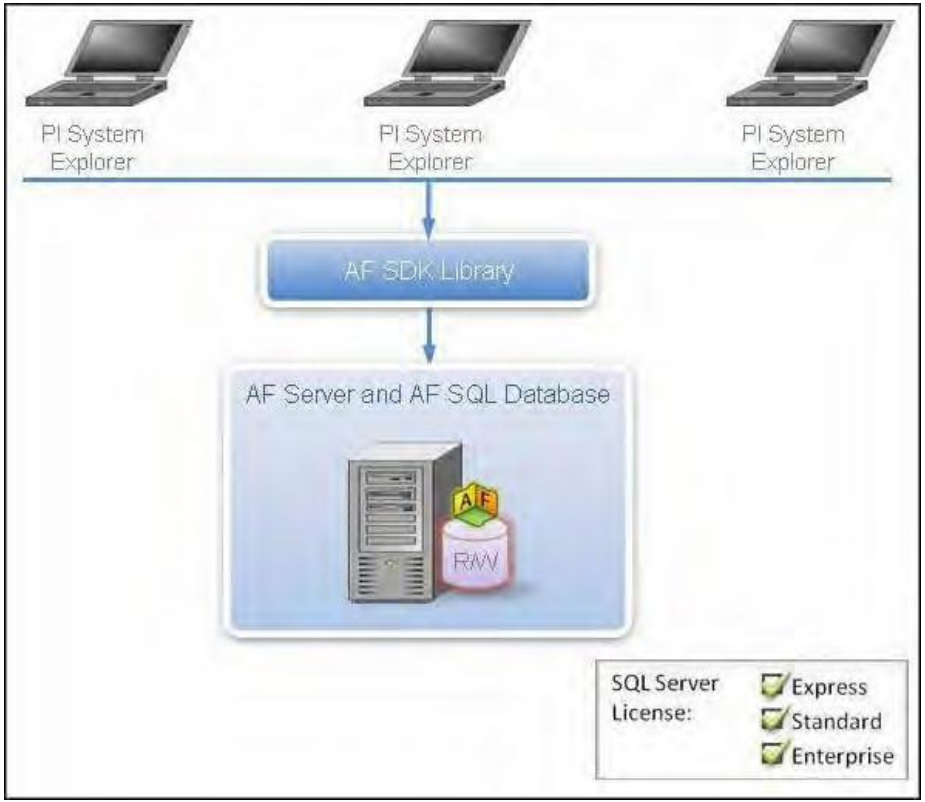
PI Asset Framework and PI Notifications

PI Asset Framework Overview

- Adds context to PI data
  - Define relationships
  - Build hierarchy
  - Relate to non-PI data
- Usable
  - Provides context to end users
  - Integrated calculations and search tools
- Scalable
  - 10s of 1,000s of assets
  - Connect to multiple PI Servers & data sources
- Extensible
  - Access with PI OLEDB & PI Webservices
  - Customizable data references and plug-ins

PI AF Server - Components

- Two key components
  - AF Server
  - SQL Server database
- SQL Server
  - Express, Standard
  - Cluster or Mirror
- AF Server
  - Behind a load balancer
  - AFSDK Collective

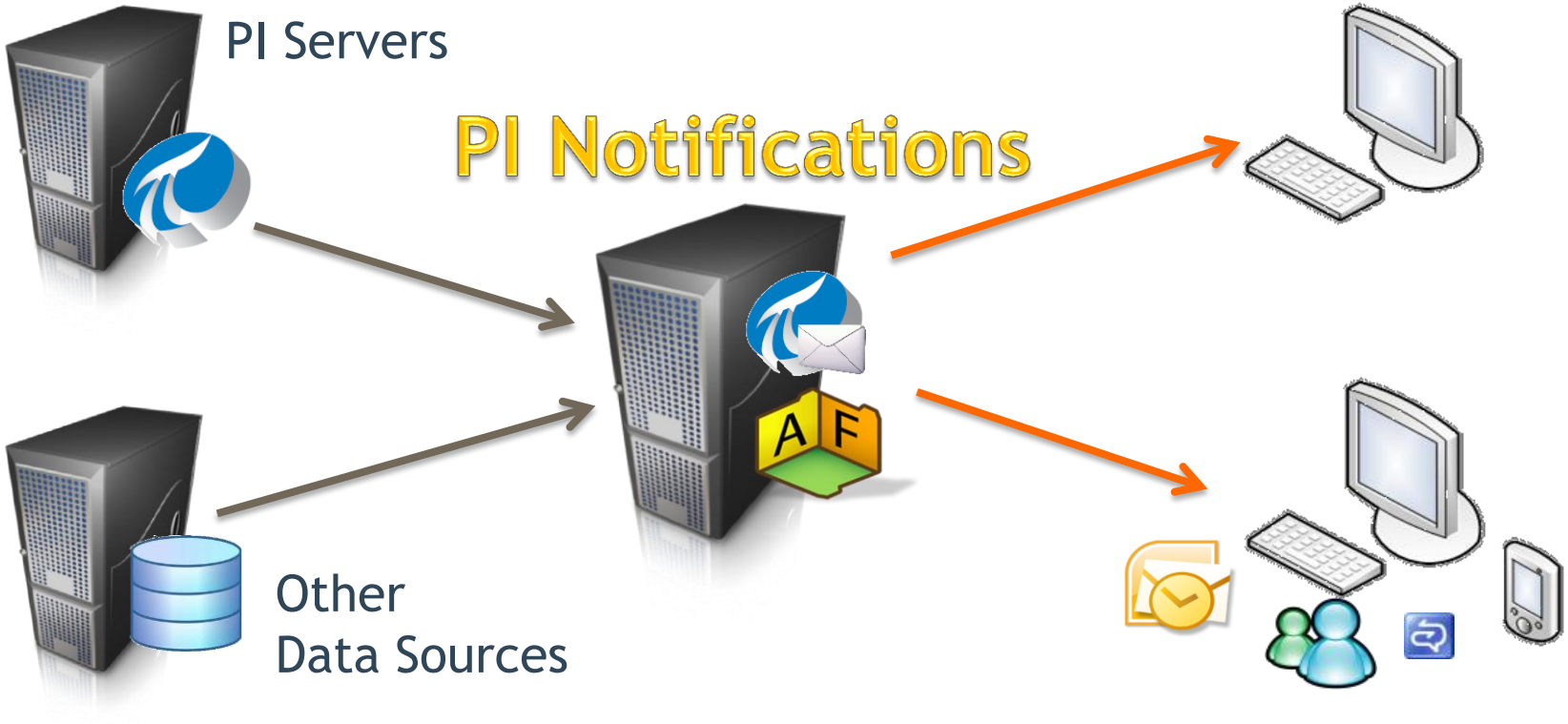


PI AF Server – Best Practices

- Configure AF backups – Backup PIFD and/or run afbackup.bat
- Monitor SQL Server health
- Do not run the SQL Server database engine as LOCALSYSTEM, admin, or domain admin.
- DO NOT RUN the AF Server with SysAdmin privilege (don’t use SA account, LOCALSYSTEM, or admin)
  - Use a domain account

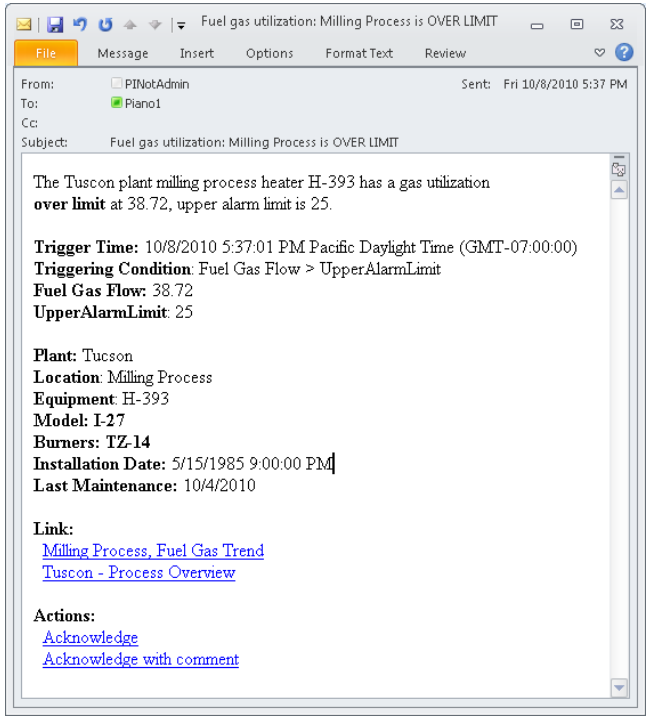
PI Notifications - Overview

PI ProcessBook
PI DataLink



PI Notifications – Best Practices

- Run PI Notifications as a domain account
- Configure PI Buffering
- Create redundant schedulers
- Monitor health with PI PerfMon tags



More Information

- Whitepapers and Tech Support bulletins on OSIsoft web site
- User Manuals
  - PI Server 2010 Configuring Security
  - Asset Framework 2010 User's Guide
- OSIsoft vCampus – Online community
  - Forums, Whitepapers, Webinars

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OSIsoft, LLC

THANK YOU

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