OSIsoft®

# REGIONAL SEMINARS 2012

## The Power of Data

# Architecture and Best Practices for PI Systems

Presented by **Chris Lonsberry, Field Service Engineer**

# Topics

## Upgrading to PI System 2012

- Why Upgrade
- How to Upgrade

## Architecture

- Hardware and System Sizing
- Virtualization

## Best Practices

- PI Data Archive
- Interfaces
- AF

# Upgrading to PI System 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)

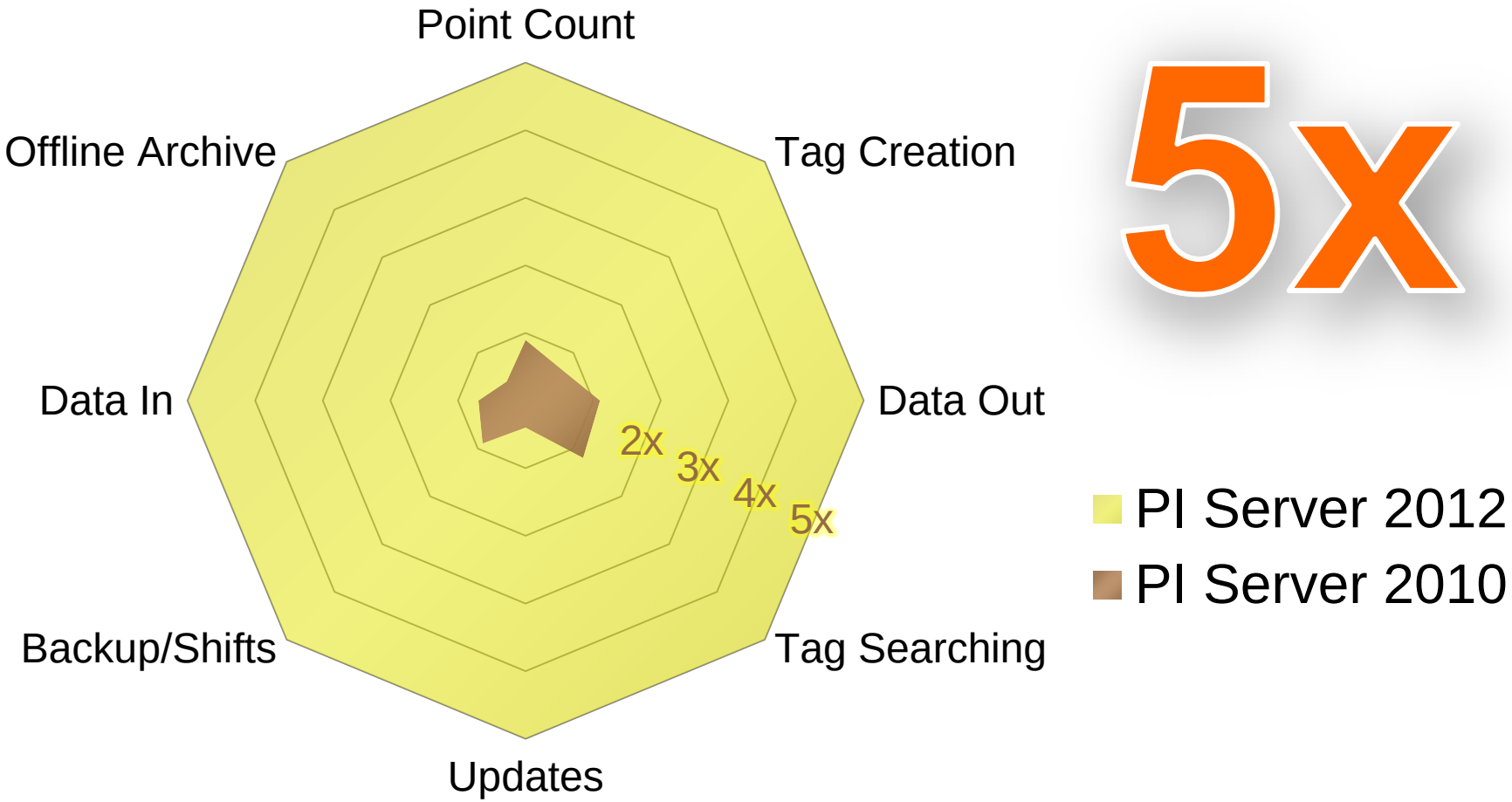
# PI Server 2012 Performance

## 2010 R3

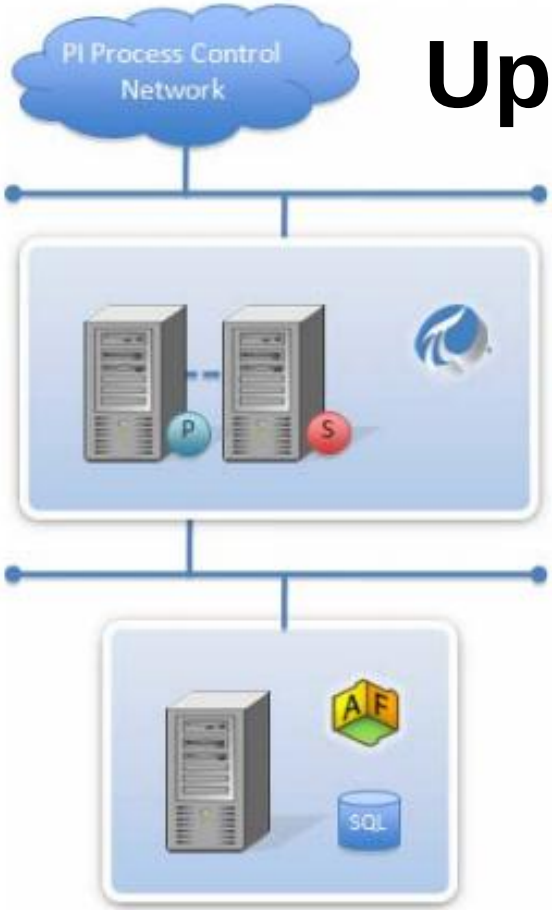
| | |
|---|---|
| Max Point Count | 2M+ tags |
| Max Data In Rate | <100K ev/sec |
| Max Data Out Rate | <5M ev/sec |
| Online Archives | 2-5K files |
| Real-time Updates | 200K signups |
| Point Changes | <10 pt/sec |
| Startup Time | >20 minutes |

## 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

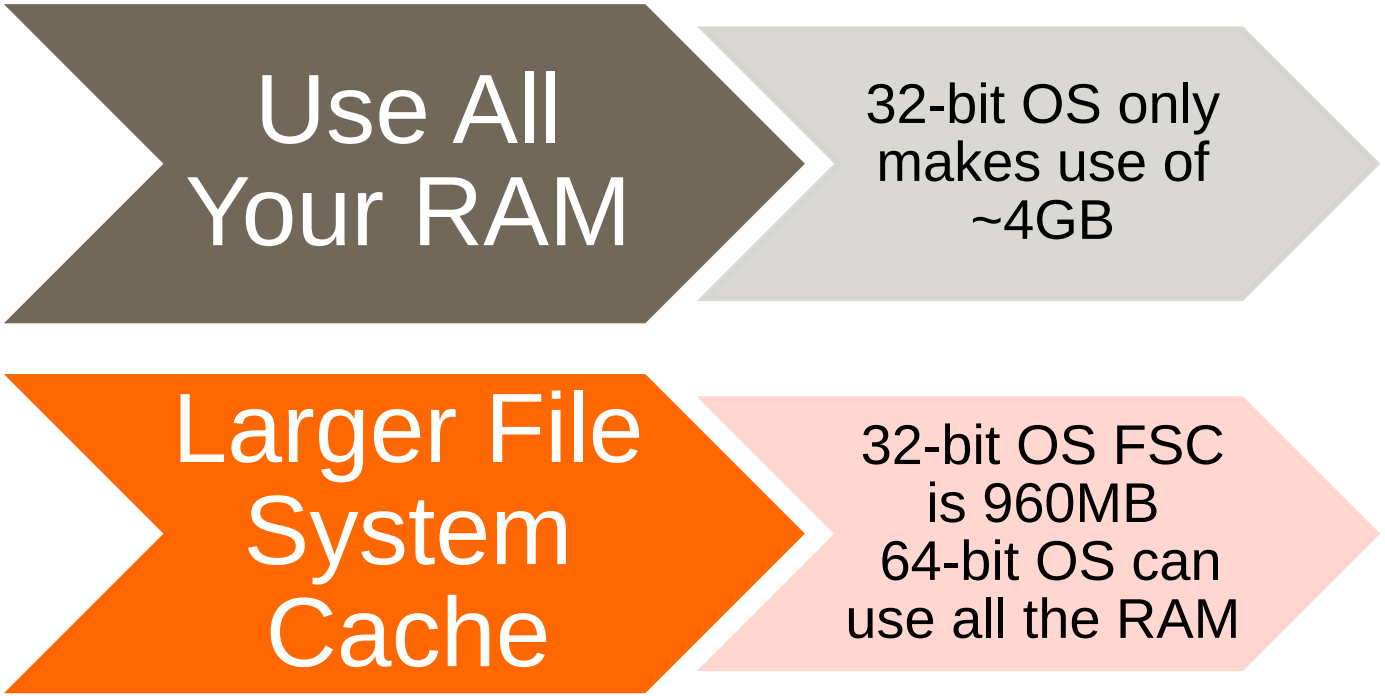
…on 64-bit OS

…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 hardware

…my current server runs on 64-bit OS

Uninstall and reinstall PI Server

Note: Likely an older PI Server. (v3.4.380 and newer do not allow 32-bit install on 64-bit OS.) Time for new hardware???

…my current server runs on 32-bit OS

Move current version of PI Server to new machine with 64-bit OS

Then upgrade to PI Server 2012.

# KB Article # KB00530

## Upgrading to 64-bit PI Server while moving to 64-bit hardware

**Product:** PI Server

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

**Platform:** Windows All

### Issue

You currently have an old, 32-bit version of the
then upgrade to the latest PI Server version. Thi
32-bit version on the old hardware. Upgrades wi
to the old version in case something unexpected

Review the following factors prior to upgrading:

- Except as noted in the table below, when
as was on the original hardware before m
installed on the original hardware, you m
move.
- Because you will need to install an old PI
Technical Support to get the old installatio
Center; however, most older installation
- Upgrading to PI Server 2010 or later may
and PI Asset Framework (PI AF) 2010 and
security settings on the PI AF and PI Serv
- Before upgrading to PI Server 2010 or lat
PI Server.
- If you are moving a PI Server collective,
Refer to known issue **23634OSI8** for a d

### 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<br>• Move PI Server.<br>• Upgrade to latest PI Server version<br><br>Note: Moving from an old PI Server version (between 3.2.357.8 an 3.4.375.38) directly to 3.4.375.99 is the exception to the rule. Un other circumstances, you should move PI Server database files on 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 same version of the PI Server that was installed on the 32-b Server machine. (For example, if 3.4.375.80 32-bit was insta 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 3 Server machine, you should install 3.4.375.99 64-bit on the Server.)<br>• Move PI Server |

# …I don’t have AF

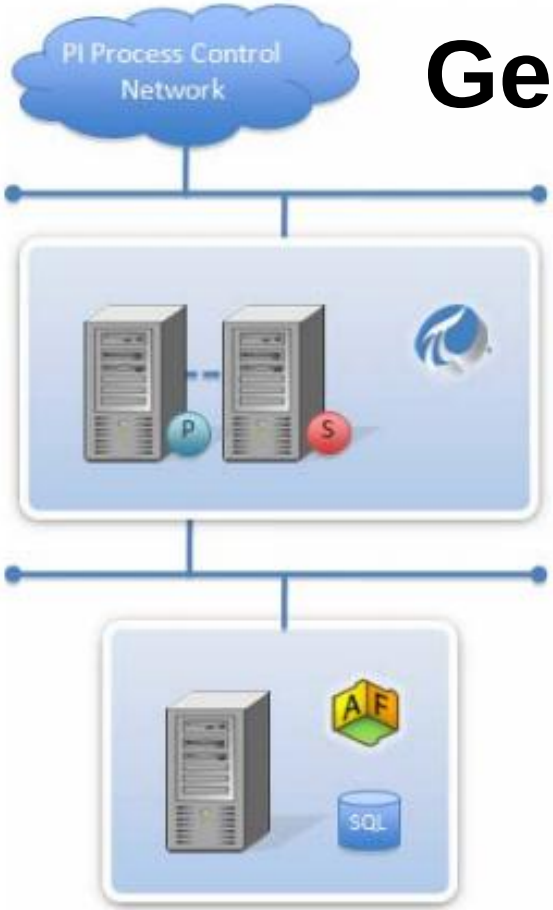
## …small system

- 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



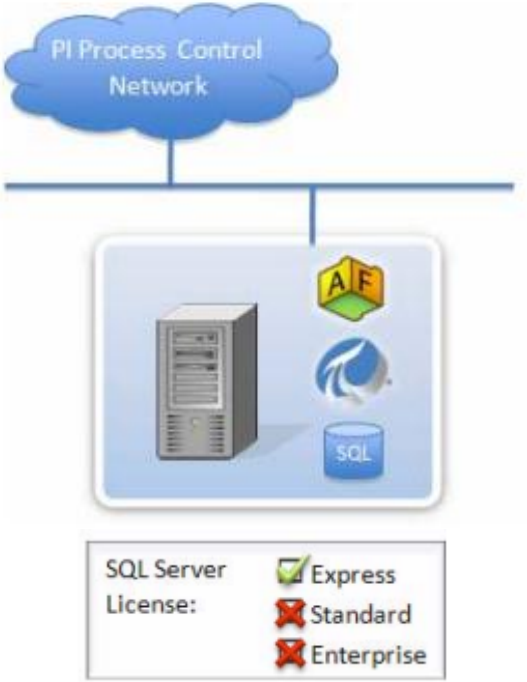

- PI AF has two components
  - AF Server
  - SQL Server Database

P Primary server of a collective

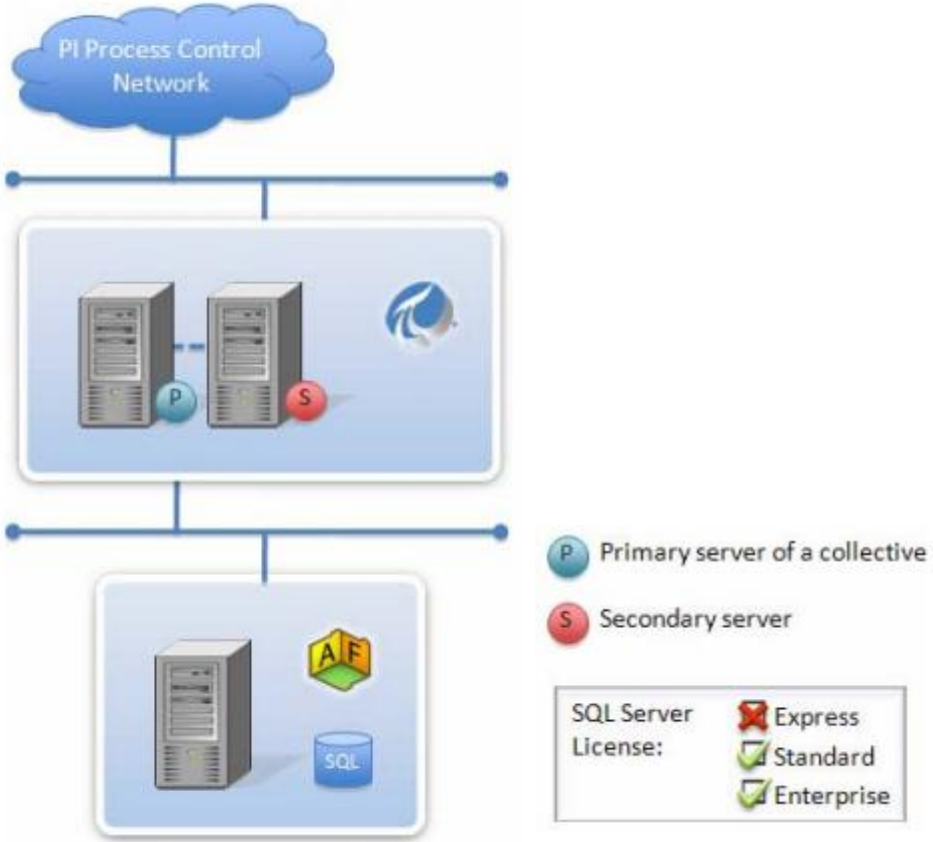
S Secondary server

| SQL Server License: | Express |
| --- | --- |
| | Standard |
| | Enterprise |

# Small AF (<10k Assets)

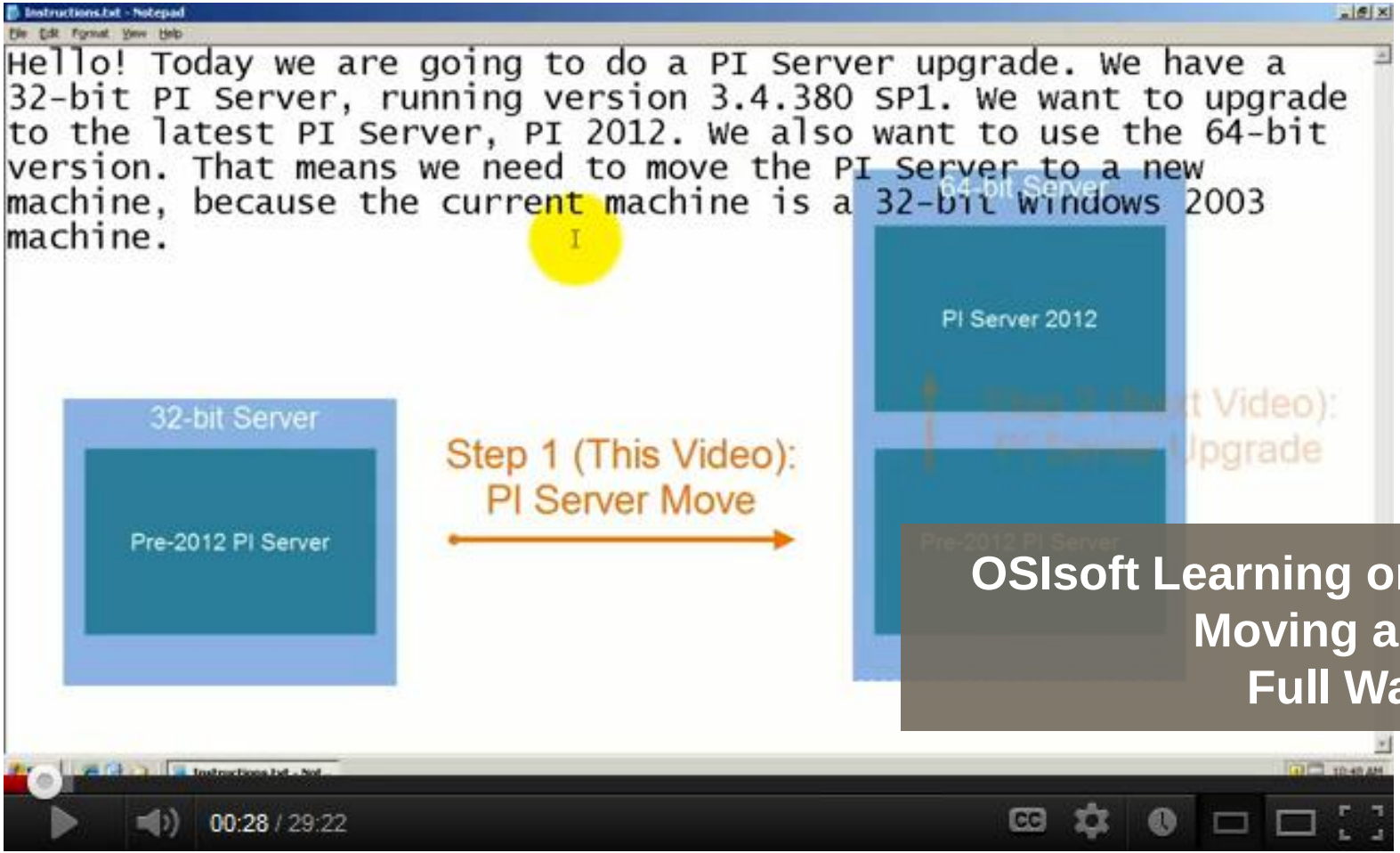



# Larger AF (>10k Assets)

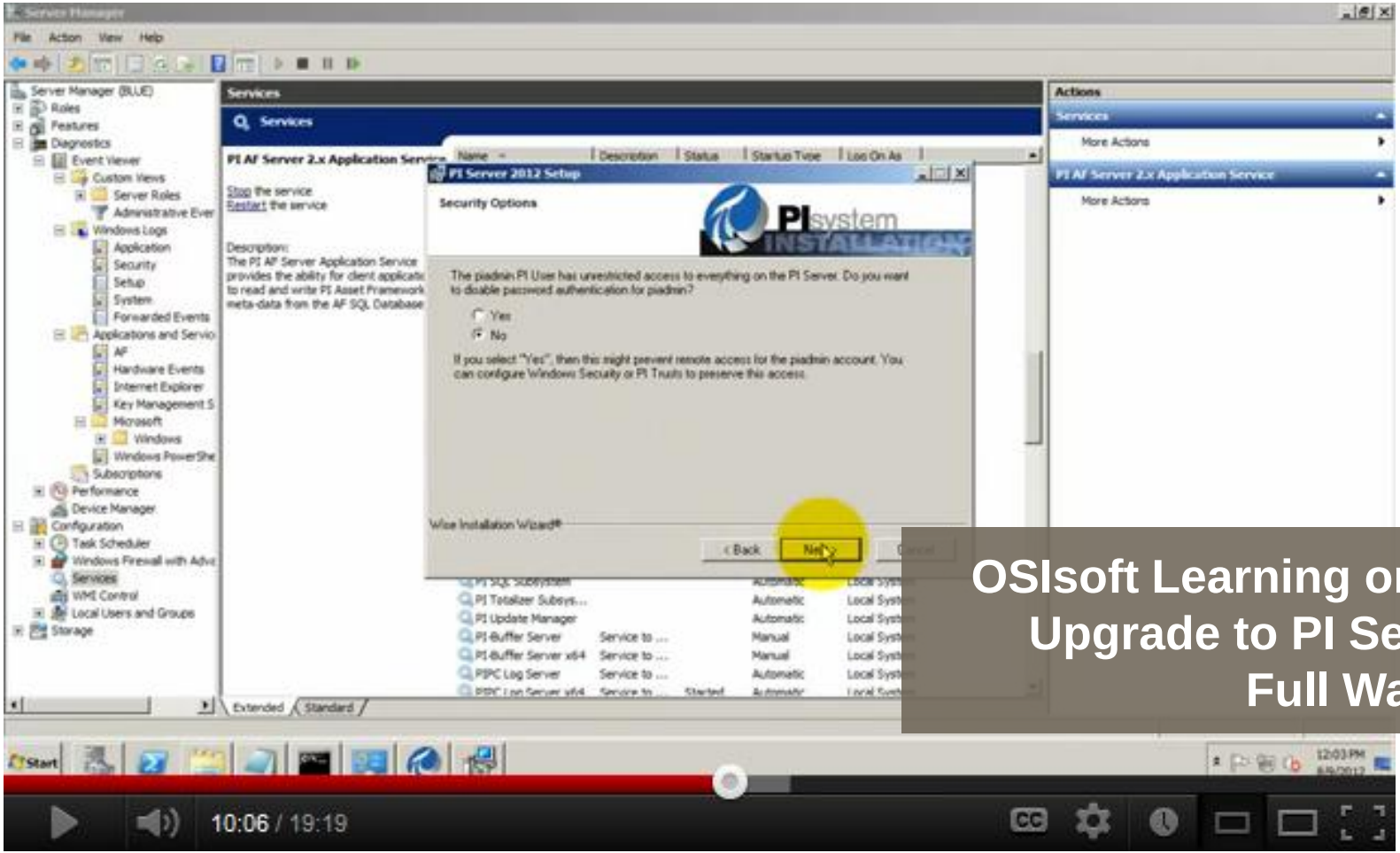


# Help!!!

| | |
|---|---|
| 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**



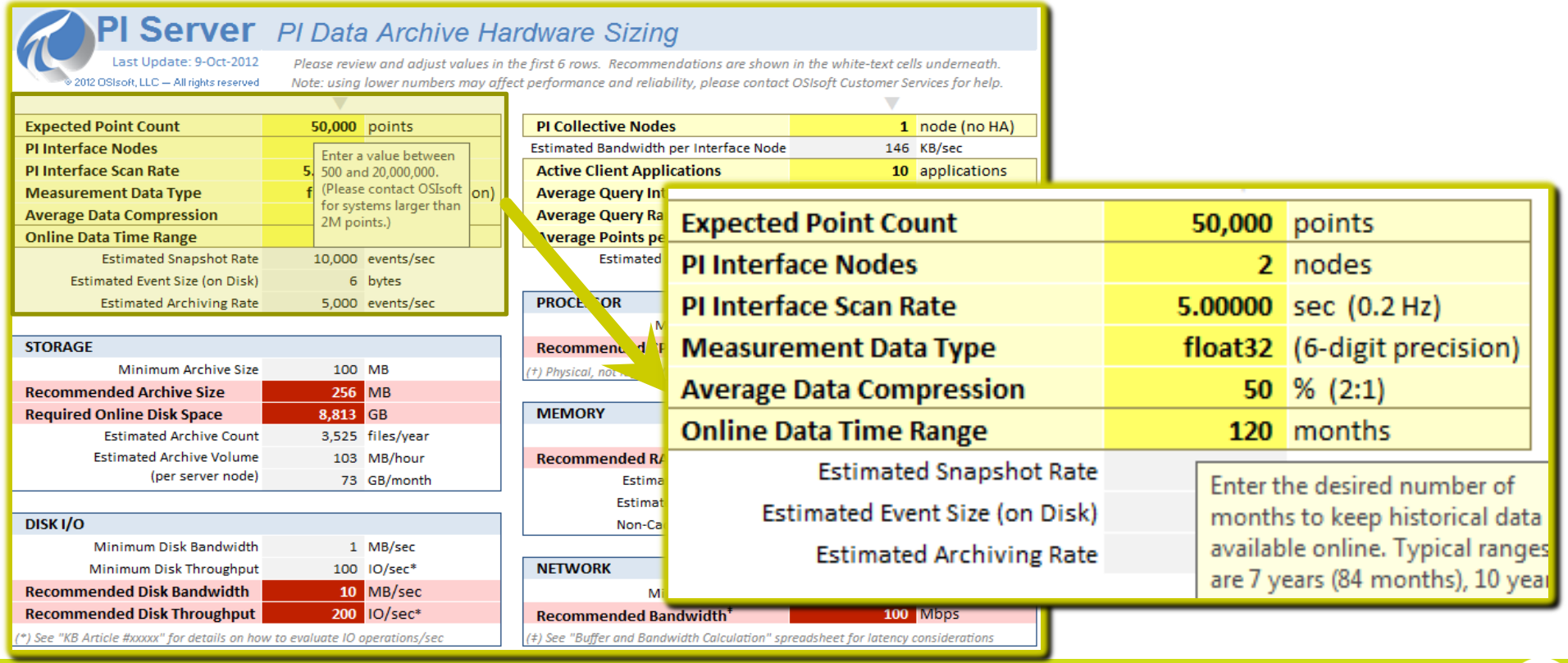
# Hardware and System Sizing

# 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) |

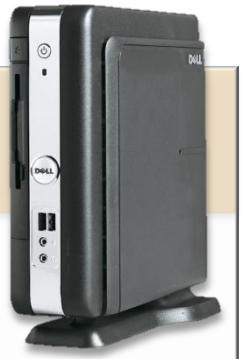
# PI Data Archive Hardware Sizing



# 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 |
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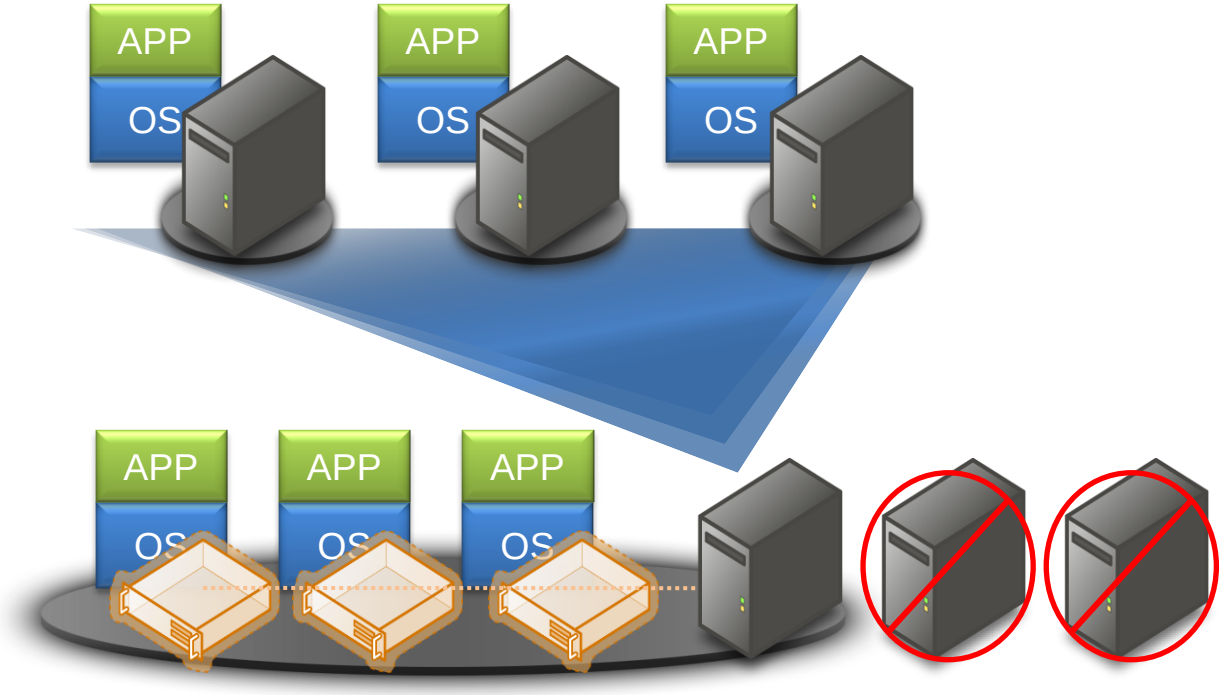
# Hardware Virtualization



# Operating System Virtualization

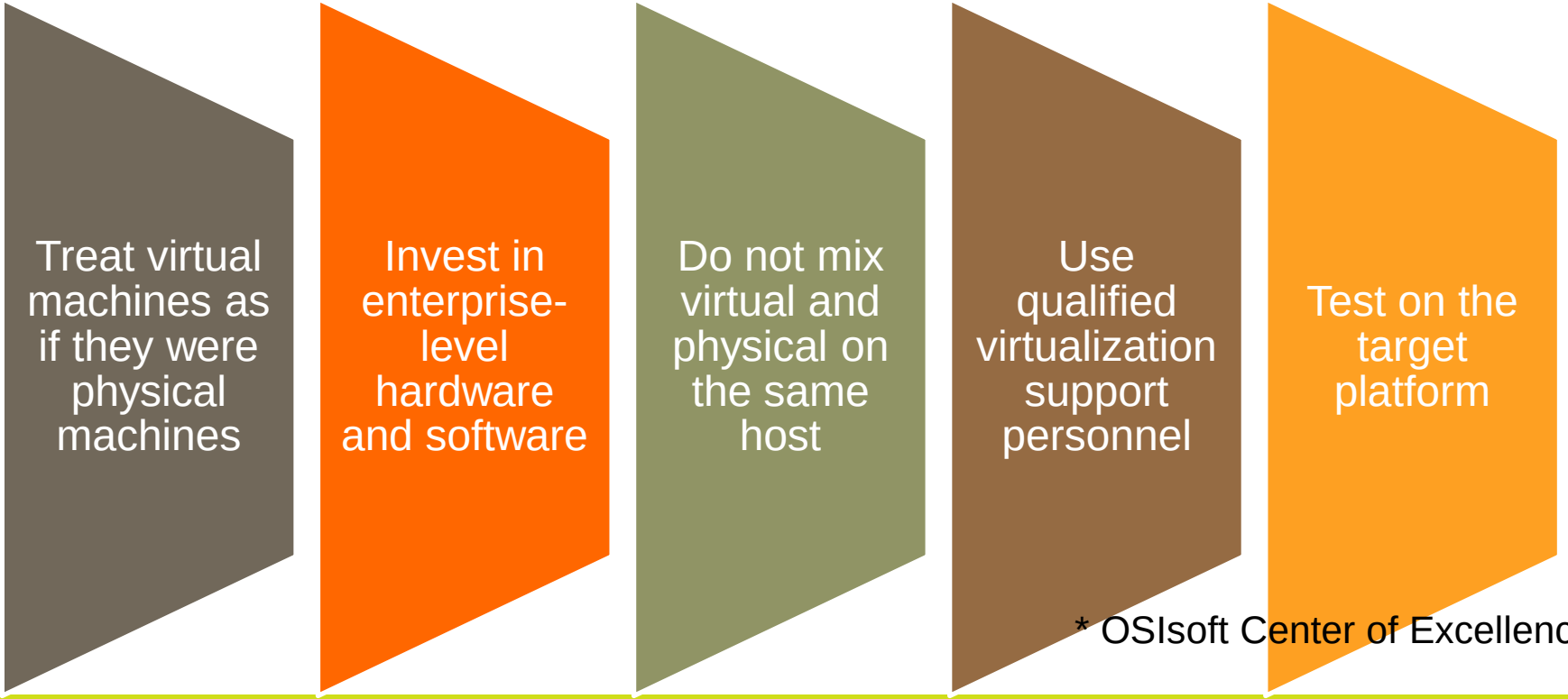
**Why are OSIsoft customers using virtualization?**

- 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

# PI Data Archive Best Practices

# PI Server High Availability

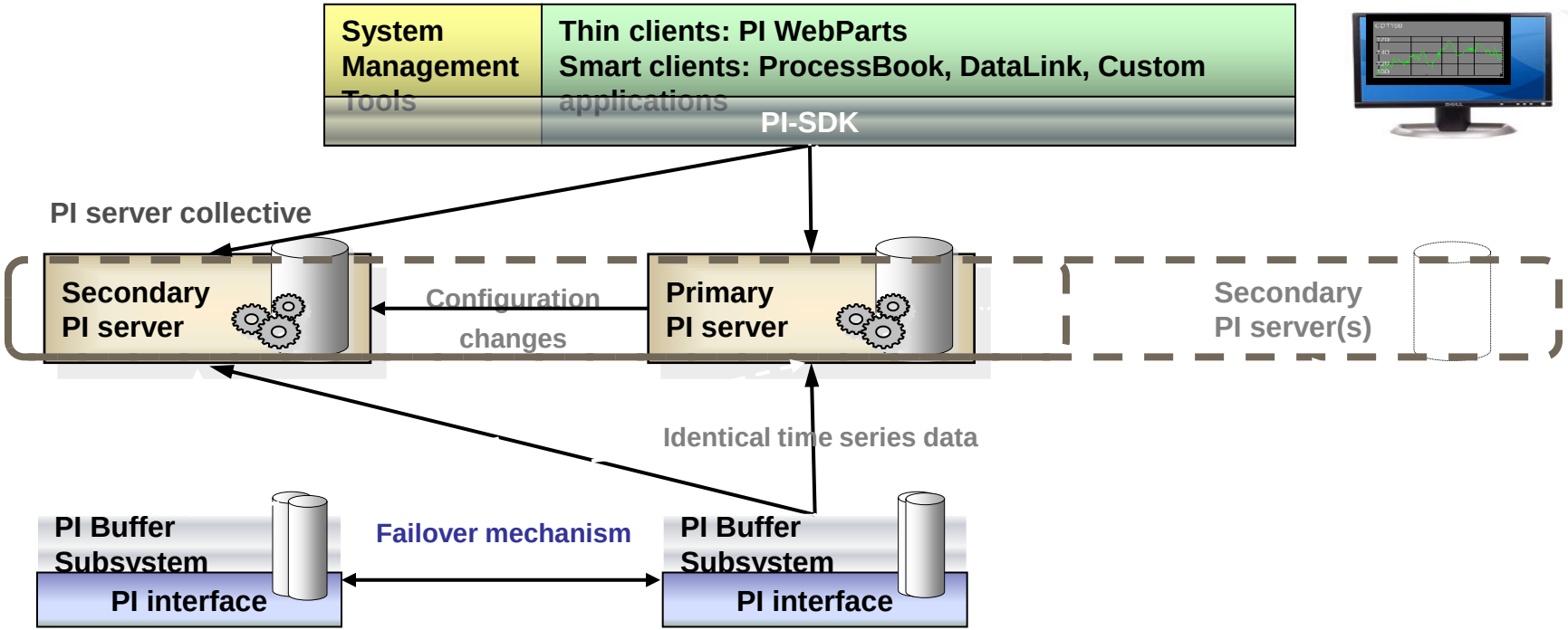
## Create a PI Server Collective

- Maximize data access for clients. Maintain availability during outages.
- Load balance by connecting clients to closest Collective member

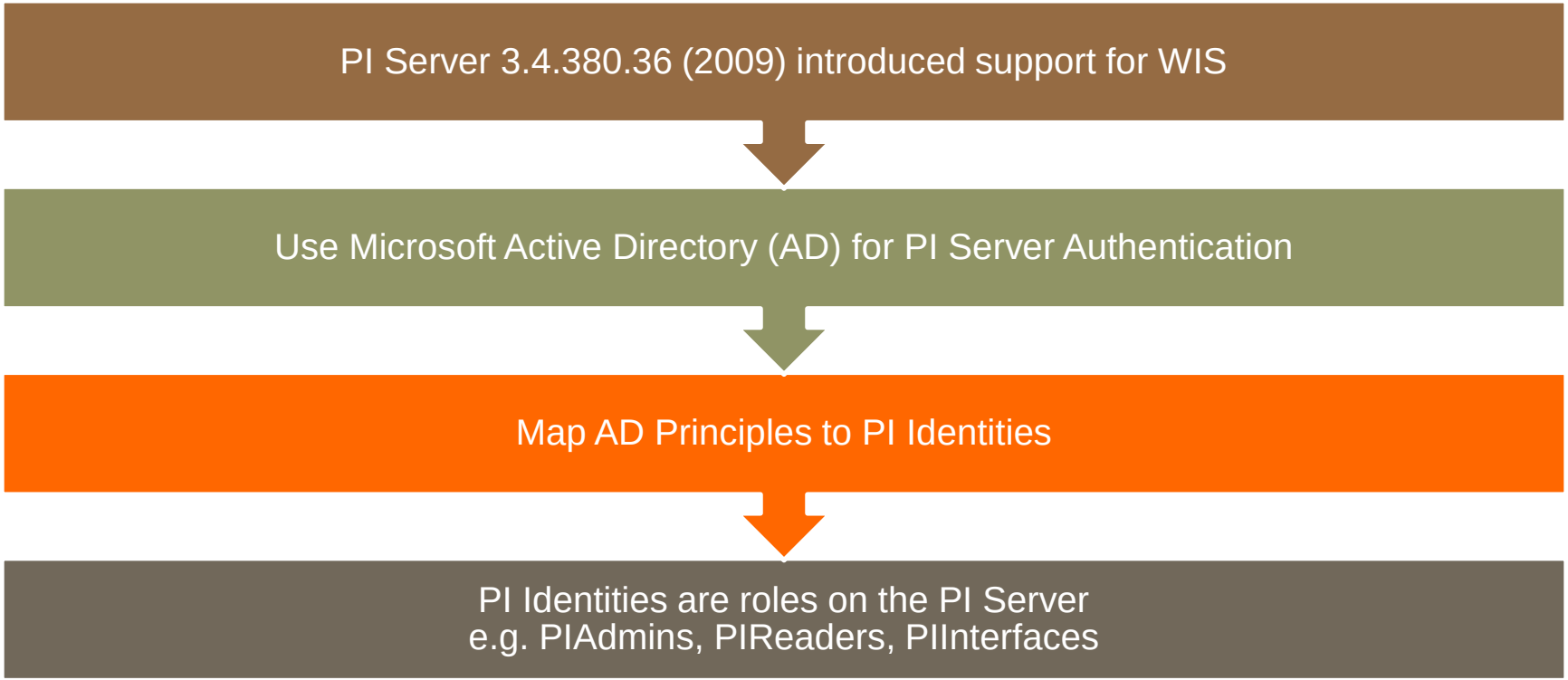
## Best Practices

- Implement PI Server High Availability
- No more support for Microsoft clusters in PI Server 2012

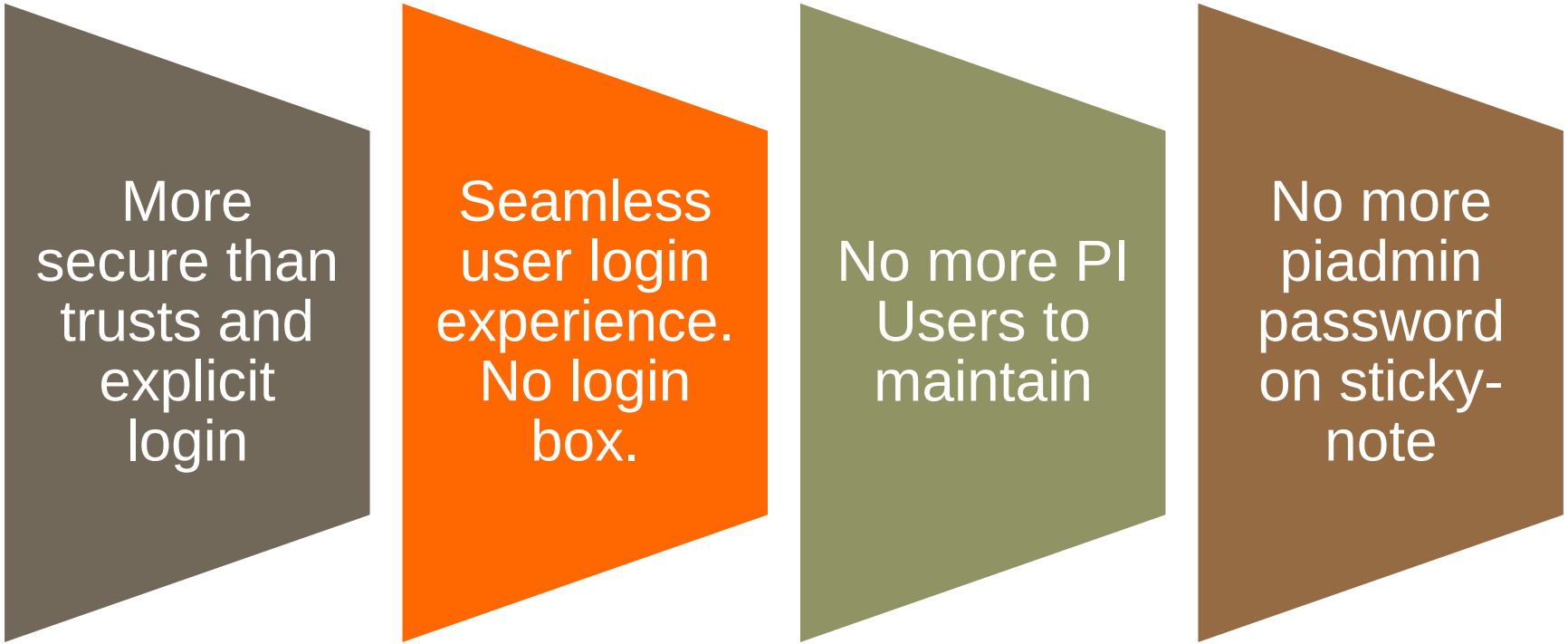
# High Availability Architecture



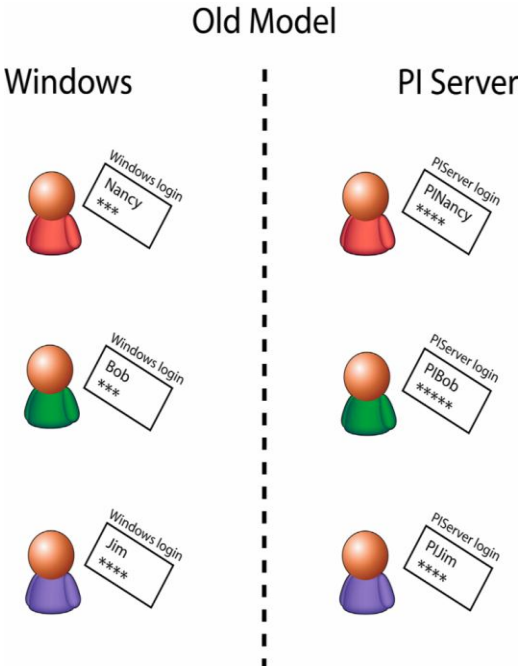
# Windows Integrated Security (WIS)

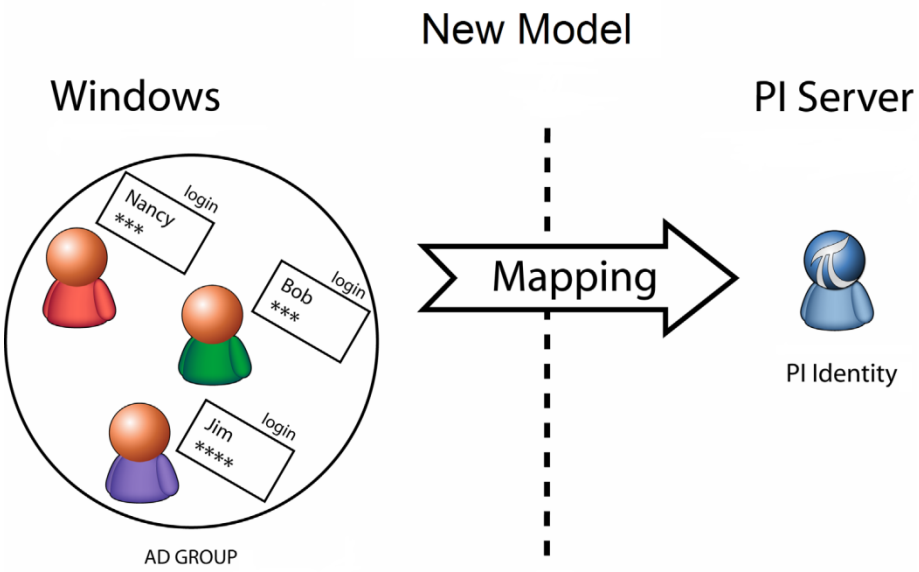


# What Does WIS Do for Me?



# Comparing PI Users and PI Identities



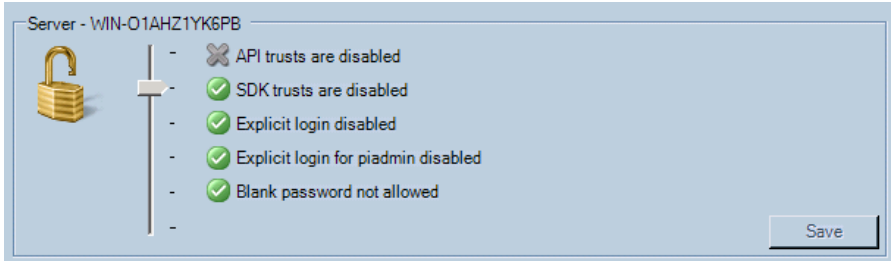



# PI Identity Planning with AD

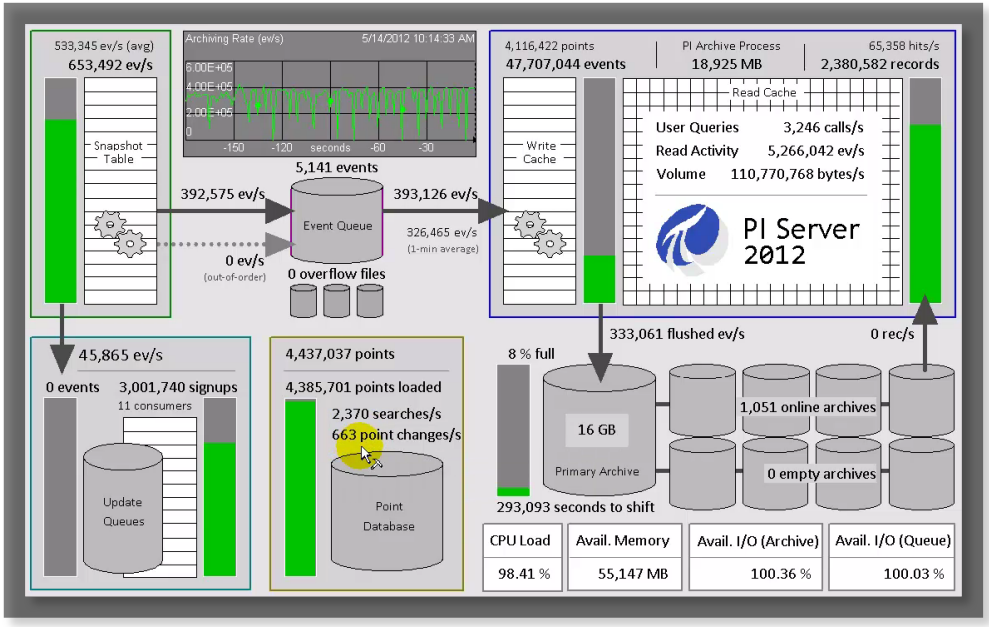
- Develop a PI Identity Scheme for your Organization
  - Who uses PI data?
  - Who writes to PI data?
  - Who needs Admin access?
- Who manages the AD Security?
  - Map identities and or groups directly
  - Add AD users to local groups that are mapped

# How to Tighten Security

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



# 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 Buffering and Failover

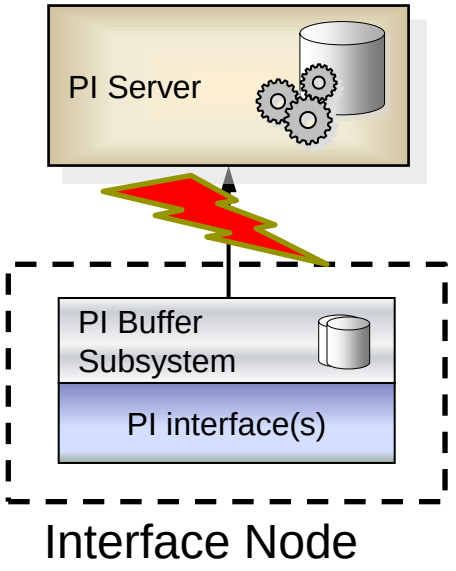
# Interface Buffering

**Prevent Data Loss**

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

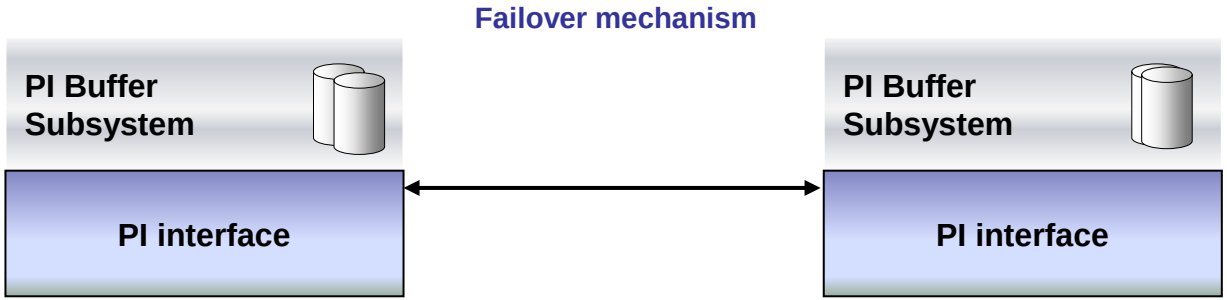
**Two Flavors**

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

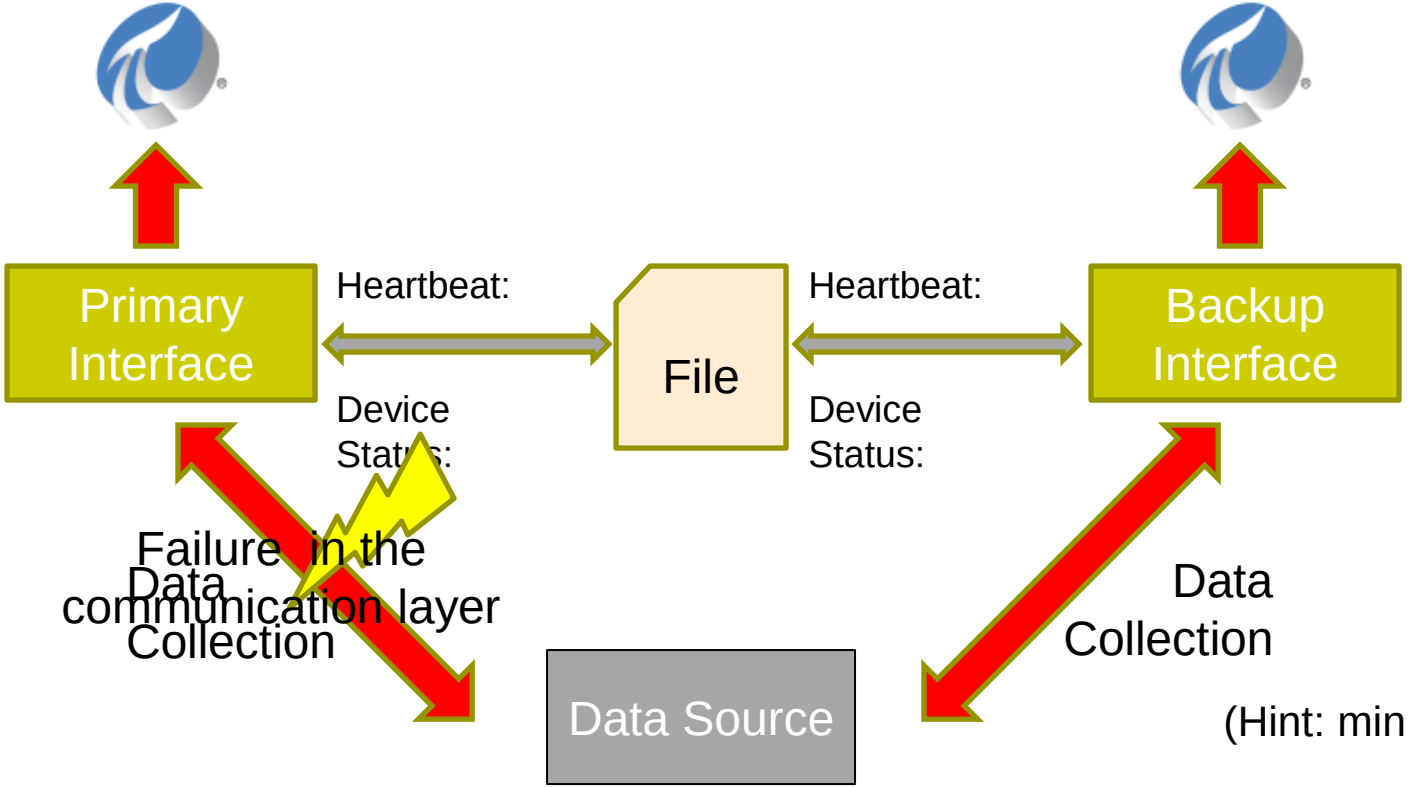


# What is Interface Level Failover?

- 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)

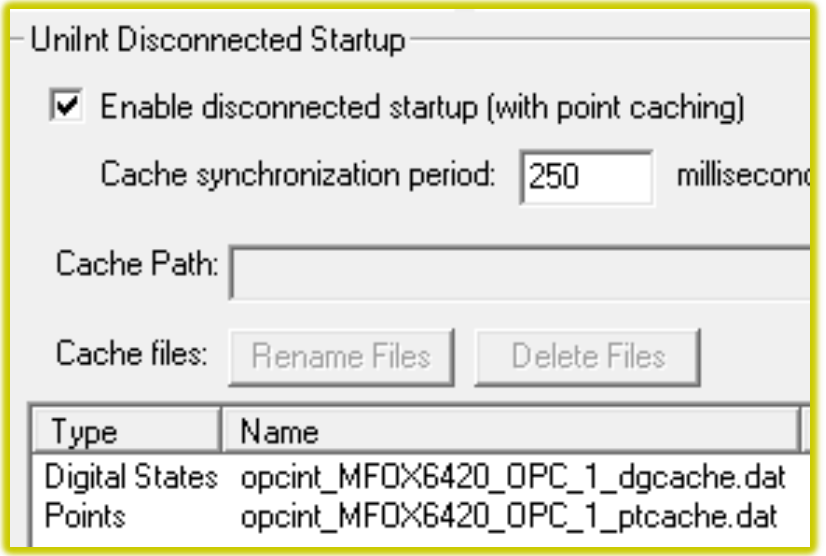
# Disconnected Startup

- 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 - Best Practices

- 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!

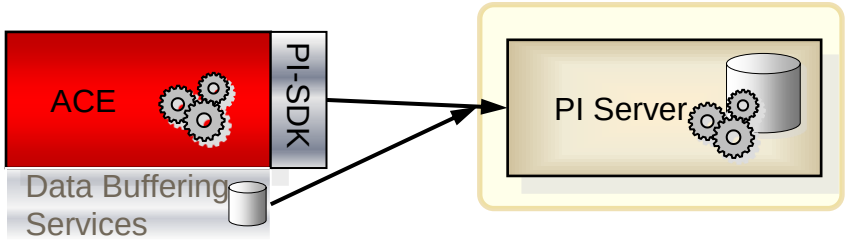
# PI ACE

# PI Advanced Computing Engine

| | |
|---|---|
| Develop calculations in Microsoft Visual Studio | • *Wizard* |
| Easy to manage and deploy calculations | • *Manager* |
| Service runs calculations | • *Scheduler* |
| Support for 64-bit | • *PI ACE 2010* |

# PI Advanced Computing Engine

- Best Practices
  - Configure buffering
    - *Buffer subsystem or buffer server*
  - Error handling
    - *Try…catch*
  - Performance Counters
    - *Calc in error, calc skipped, etc…*



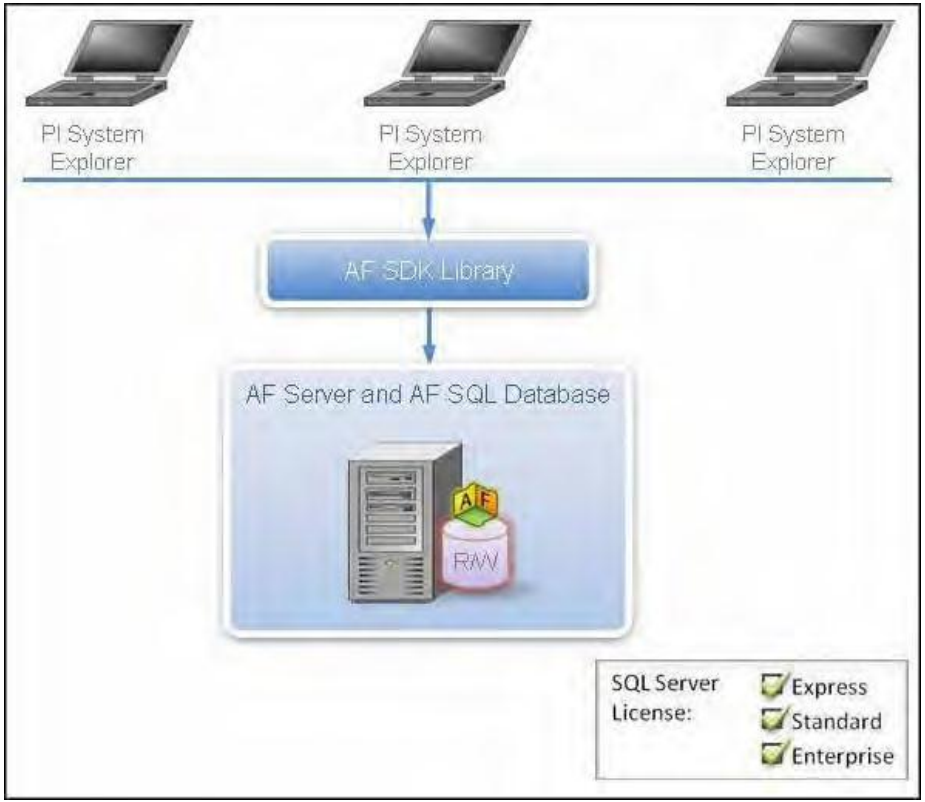
# PI Asset Framework and PI Notifications

# 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

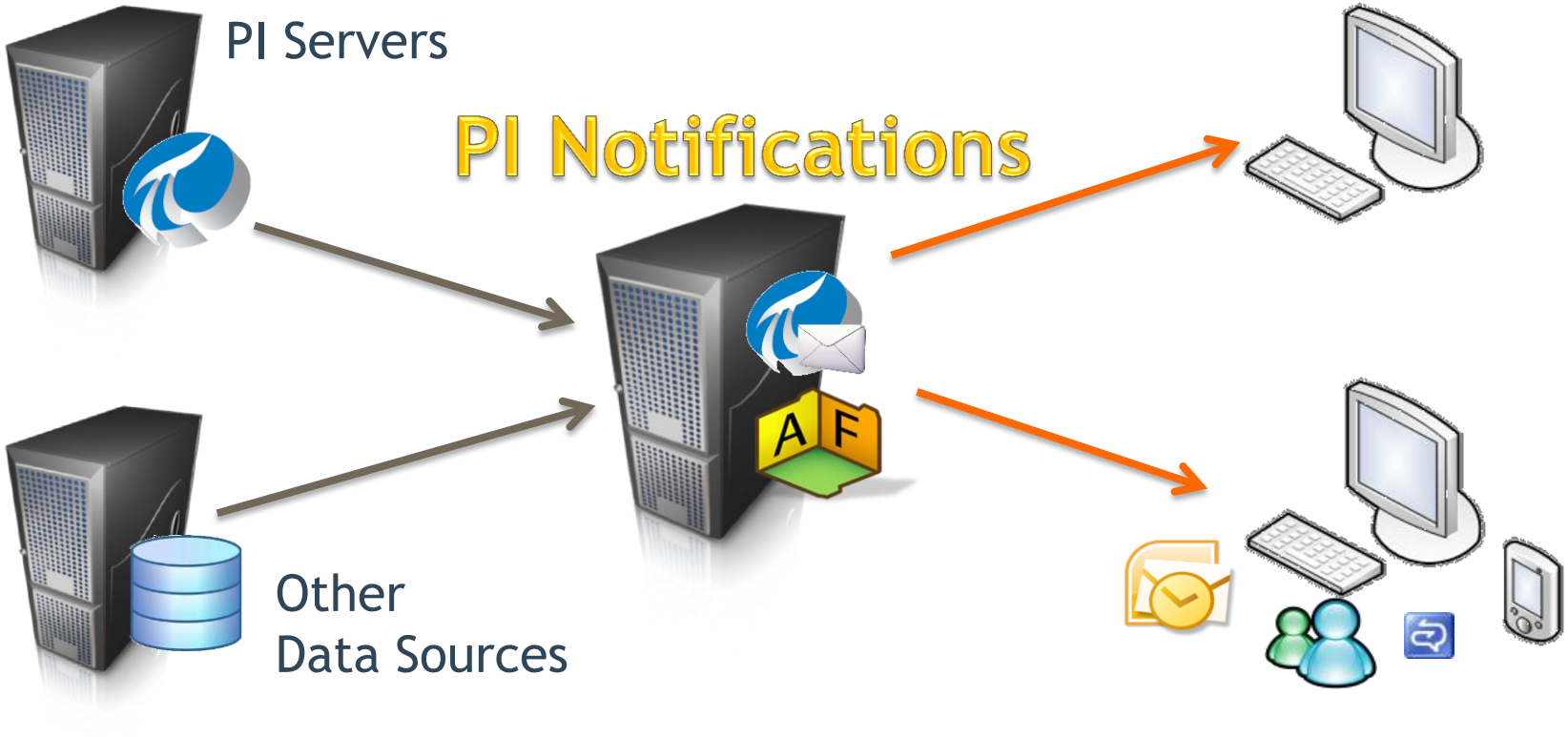


# PI AF Server – Best Practices

- 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

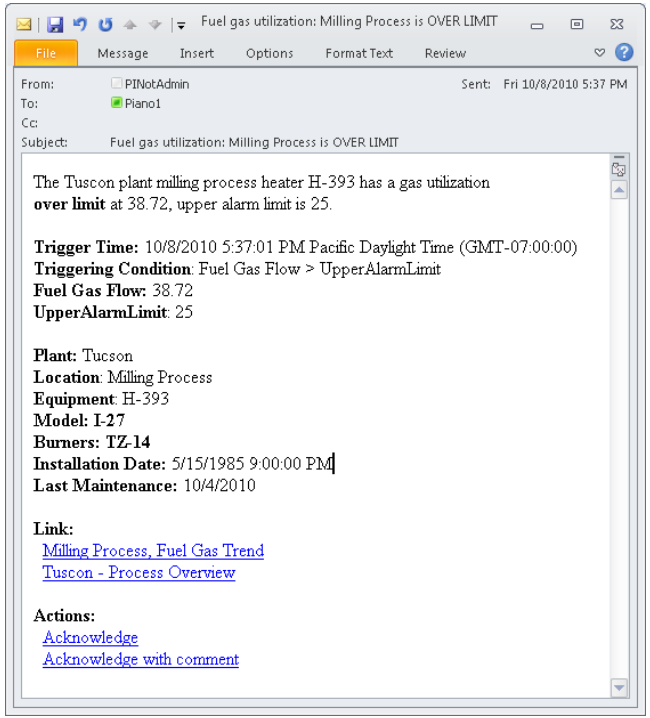
# PI Notifications - Overview

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



# THANK YOU

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