

Project Managing a PI System Implementation

Module 2: Initiation and Planning

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- About this course

About this course

Welcome, this module is the second part in a three-part series from the “Project Manager” learning path. This series of modules will give you the knowledge and insight you need to effectively manage a PI System implementation. I will guide you all the way from OSIsoft introductions, to planning, implementation and adoption.

In this second part of the series, we will start developing our PI System implementation plan by considering and recording important aspects of the process into the Gantt chart template provided.

You will also gain a better understanding of using the customer portal to create and manage support cases, as well as begin thinking about the fundamental elements of your PI System Architecture (such as components, hardware, security).

By the end of this module you'll have...

- understood the importance of defining and pursuing specific success metrics
- experience accessing the customer portal and managing support cases
- began developing your project Gantt chart, and added elements such as project milestones, user groups, resources, and task ownership.

Audience

This course is designed for people who are just starting their journey with OSIsoft and who would like to learn more about the company, our products, and services, and how customers are gaining valuable business impacts.

Level: Intermediate

Study time: 2 hours

Prerequisites

- Optionally, Module 1: “Getting Started with OSIsoft”.
- This course should be part of your first steps as a PI System user or project manager.

Software Requirements

- There is no software requirement for this course. For the time being, simply watch the video tutorials.
- Microsoft Office or equivalent is required to access the workbook and presentation provided.

Further information

- This is a self-paced course. Any questions or assistance needed about the material can be asked in this [course's space in the OSIsoft PI Square community](#)
- When you complete the examination at the end of the course, you will receive a certificate of completion which can be shared and directly posted on LinkedIn.
- For more information about our Online Courses please visit our [FAQ page](#)

You can audit the full video lecture content **right now** on the [OSIsoft Learning YouTube Channel](#).

- Lesson 1: Project Initiation

Learning outcomes

After completing this lesson, you will:

- understood the importance of defining and pursuing specific success metrics
- developed a well-rounded impression of other customer use cases
- documented a list of potential stakeholders

Introduction

Welcome to the “Project Manager” learning path. This series of modules will give you the knowledge and insight you need to effectively manage a PI System implementation. I will guide you all the way from OSIsoft introductions, to planning, implementation and adoption.

In this second part in the series we will start developing our PI System implementation plan by considering and recording important aspects of the process into the Gantt chart template provided.

Welcome to the module.

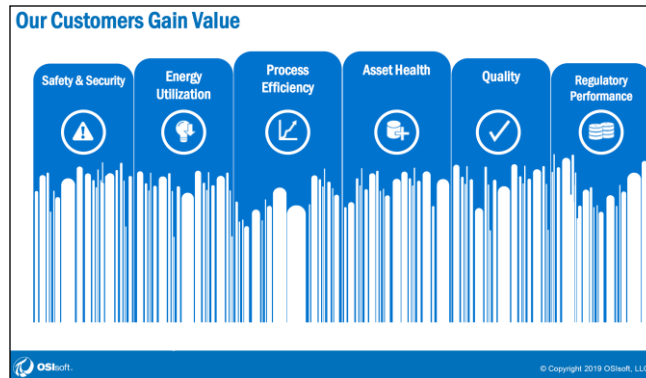
Define your success metrics: Business Impacts

OSIsoft provides a proven data infrastructure to deliver solutions for different industries, businesses and partners, including power and utilities, oil and gas, metals and mining, pharmaceuticals and others. With a 92% customer satisfaction rating and more than 1100 case studies available for review, make sure to look at the success stories of others to help you define your own goals, identify challenges and measure your progress towards success.

Over the years, OSIsoft has been collecting numerous success stories that our customers share, which showcase different ways the PI System has impacted them. Understanding the possible outcomes of implementing it can help you shape your goals and define your success metrics more confidently.

When beginning to define your own success metrics it is helpful to be aware of the domains in which the PI System can impact your business: Asset health, Energy efficiency, Process productivity, Regulatory reporting, Quality tracking, Safety & security. If you already have a PI System implemented in your organization, chances are it was installed to fulfil a need under one of these groups.

Think about your organization. Rank these business impacts from most important to least important. This may give you some inspiration in the next exercise – where you’re going to pick two outcomes for your PI System project.



	Asset Health - Impacts organizations with critical or expensive assets	Enable condition-based maintenance (rather than calendar or run-to-failure maintenance), root cause analysis, predictive insight, and smart expense allocations.
	Energy Efficiency - Impacts organizations with high resource costs	Reduce energy, water and raw material costs. Establish baselines for asset / process / site-specific consumptions and identify underperforming assets.
	Process Productivity - Impacts organizations in highly competitive process industries	Avoid unexpected downtime, process defects, monitor asset performance, standardize best practices and maximize efficiency. Automatically report standard KPIs to measure performance.
	Regulatory Reporting - Impacts organizations reporting to governing bodies or management	Automatically and accurately roll data up to create reports without manual data entry or analysis. Environmental, safety, business and compliance reporting.
	Quality Tracking - Impacts organizations that demand high quality products	Reveal process variability or defects affecting product quality to improve consistency and quality across batches, shifts, and sites. Traceability for reporting and audits.
	Safety & Security - Impacts organizations with dangerous equipment or cyber security concerns	Identify operational risks, before they happen. Alert operators, plant and business managers of conditions that could harm employees. Allow operational data to be viewed securely from outside the control network.

Exercise – Pick your Project

During this course you should be thinking about a specific project – we’re going to keep it simple and try to keep the scope small. Ideally the PI System will be involved with achieving and/or measuring the outcome of the project. The process we’ll cover can be used for very small projects up to very large projects.

Try to think of one to two measurably outcomes to an upcoming project, or possible project involving the PI System for your organization. Example measurables could be “build a dashboard for remote maintenance staff so they can measure their effectiveness while in the field” or “supply

the data science team with the data they need to classify wind turbine health”. Although in real life your project will have many outcomes and this is an oversimplification, it will be useful as we go through this module.

It doesn’t matter if you already have a PI System or are planning a completely new installation. Try to think of measurable outcomes like this so we can set your goal. Write down one to two measurable outcomes below. We’ll use this project as an example for planning out a timeline.

We’ll be using an example throughout this series of modules and designing a Gantt chart for our own project. Our fictitious company has only one plant and does not already have a PI System installed. Our project outcomes will be the following:

1. Replace an aging home-grown daily reporting system, showing plant production and environmental regulatory metrics
2. Allow engineers in the corporate headquarters to collaborate with site engineers when researching failures and monitoring production in real time.

Do your research

OSIsoft provides a proven data infrastructure to deliver solutions for different industries, businesses and partners, including power and utilities, oil and gas, metals and mining, pharmaceuticals and others. With a 92% customer satisfaction rating and more than 1100 case studies available for review, make sure to look at the success stories of others to help you define your own goals, identify challenges and measure your progress towards success.

Understanding how others have used the PI System will enable you to reflect on you own processes and begin engaging with individuals in your organization to facilitate appropriate change. So, make sure to explore our customer stories archive by visiting the website: <https://tinyurl.com/sdotbpk>, filtering by industry, keyword and/or year and be inspired by how the PI System has supported others with their digital transformation.

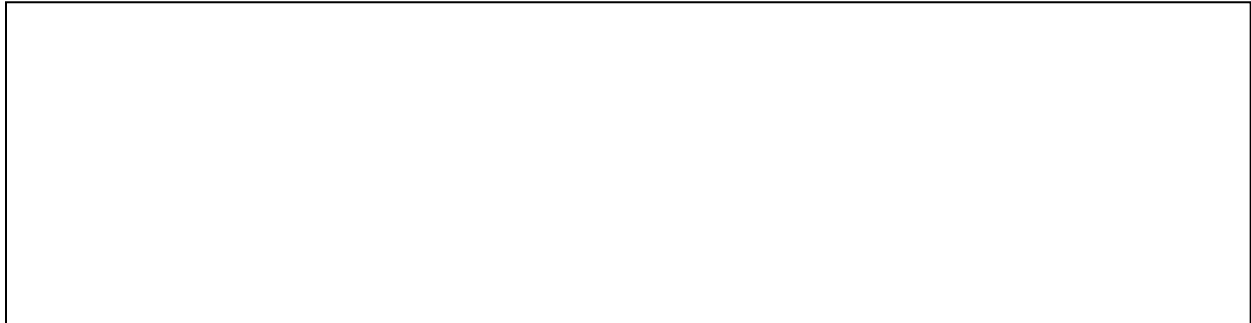
Presentations are recorded at both annual PI World conferences (North America and Europe), and various Regional Seminars around the world. Visit this website: <https://tinyurl.com/vh2ohy2> and try filtering by your industry. Watch a few conference presentations that talk about ideas with similar goals to your project.

This will help you define your own success metrics and formulate an appropriate strategy for your PI System implementation.

Exercise - Explore our collection of customer stories

So, have a look at other customer stories (<https://tinyurl.com/sdotbpbk>) and share with us your findings over at PI Square (<https://pisquare.osisoft.com>).

- Which customer success story resonated with you the most?
- Which business impact would you be most interested in affecting through the PI System?



Access more customer stories:

Hear from the customers themselves through the “*My PI Stories*” video playlist available here: <https://tinyurl.com/rj6bgm9>

Identify project stakeholders

Stakeholders are individuals, groups or organizations that can be positively or negatively impacted by the project and/or exert influence over its outcome. Getting stakeholders right can impact the project. Too many and it may make decision making slower, but not enough and you may miss important requirements or risk progress without the necessary buy-in.

When assigning a group or organization as a stakeholder it helps to select one individual as a representative for that group. They can then be the responsible person for relaying communications and decision making for the group. For example, with OSIsoft as a stakeholder in your project then your CSM would be the point of contact for OSIsoft.

- Types
 - Decision Makers, single person or group of people, provide authority for integrating systems, set direction and vision
 - Check signers (procurement) – engage early on or after full business case; right supporters to engage procurement
 - Influencers – can drive the decision but don’t have authority or responsibility for it; trusted advisors
 - Stakeholders – directly affected by decision, different organizational units, it’s the stakeholders that tell us if we’ve succeeded; they drive the goals and success metrics; they might have to follow a different process, change will affect them more; manage the change process
 - Opponents – include them in the process to address their concerns and transform into supporter; concerns might be very valid (no resources, manpower, skill set, technical hurdles, security issues, job security, “we’ve always done it this way”); recognize what narrative to use to manage concerns
- Make a list of PI supporters with the tool:

- [illegible]

Download the Gantt Chart Template

1. Download the template from the appropriate section on the module page.
2. Open the spreadsheet with a spreadsheet application, like Microsoft Excel
3. Follow along with the module as we guide you through the spreadsheet

[Learn More](#)

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- Lesson 2: Using the myOSIsoft customer portal

Learning outcomes

After completing this lesson, you will:

- Understand how to access the customer portal.
- Be familiar with the process of creating a new case.
- Be able to search for an article in the Knowledge Base.

Overview of the customer portal

The OSIsoft Customer Portal is where you can manage your interactions with OSIsoft. From creating a case with OSIsoft's world-class customer support to taking care of payments and scheduling services, OSIsoft Customer Portal helps you take care of business and stay up to date on all your ongoing tasks with OSIsoft.

The **myOSIsoft.com** website has a lot of tutorials on how to do support related activities as well as quick links to take you to commonly used support pages:

Login to Customer Portal	Customer Portal How To's	Partner EcoSphere
See Your Downloads	How to Get an OSIsoft Customer Portal Login	OSIsoft Partner Portal Login
Create a New Case	How to Create a New Case	OSIsoft Partner Portal How To's
View your Cases	How to Download Products	Partner Access to Customer Portal
Use the Enhanced Search	How to Search for Articles	OSIsoft Partner Marketplace
See your Upcoming Services	How to Manage Users	Partner Accreditation
Manage Your Team		

And from the Customer Portal, you can:

- Download any PI product your company is licensed for using.
- View the PI System Roadmap to get information about the most current releases and what new features and products are on the horizon.
- Login and view your open and previously closed **Support Cases or create a new one.**
- Search through our **Knowledge Base** to try and troubleshoot any issues you may be having by referring to the rich collection of available KB Articles.

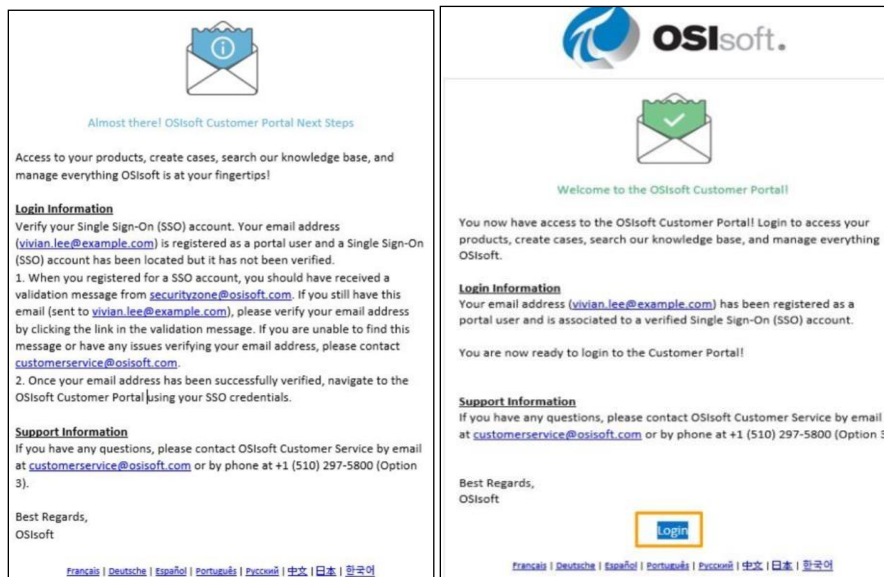
In this lesson, we'll explore how to request and receive access to the customer portal, how to create a case and how to search through the knowledge base.

Getting a login to OSIsoft customer portal

To gain access to OSIsoft Customer Portal:

- Identify colleagues that may have been granted Admin access. This is most likely people who have contacted us for quotes and renewals. Site Admins can add others to sites that they are admins for. Once you've been added, one of the three scenarios listed below will trigger.
 - Your account is already created and your SSO account is activated: You will receive an email that provides your login information and link to the portal

- Your account is already created, but you should verify your SSO account email address: you should have an email from securityzone@osisoft.com. Click the link in the message to validate your email address.
- Your account is already created but you need to sign up for an OSIsoft SSO account: you will receive an email that asks you to create an account. Go to the registration link and fill out the SSO form. You will then need to validate your email address as in the previous item on this list
- If you can't identify your Admin and do not have access to OSIsoft Customer Portal, please contact a local OSIsoft technical support team or 24/7 Global Technical Support (English) +1 510 297 5828 with your Site Name, Site Number / PI Server Serial Number ready.



If for any reason the above process does not work for you, please contact customer service through: customerservice@osisoft.com

Support may be provided in languages other than English in certain centers based on availability of attendants. If you select a local language option, we will make best efforts to connect you with an available Technical Support Engineer with that language skill. If no local language tech-support engineer is available to assist you, you will be routed to the first available attendant.

How to create and manage a case

Creating a case is a three-part process. The first part is identifying the category your issue falls under. Next is notifying OSIsoft of your product type and version and finally clicking "Submit" to complete your case. This will generate a unique case number with a link to view your case.

The specific steps are:

1. Log into the Customer Portal
2. Open a New Case through the homepage Cases list or from the Cases tab.
3. Use the drop down to 'Choose Your Site', associated with the case to be logged.
4. Select a category from six available types (see image below).
5. Click 'Next'
 - a) If this is a Technical Issue, the next step is to select your Product & Version,

- b) If this is not a Technical Issue, you will skip the Product & Version step and proceed to the support case creation.

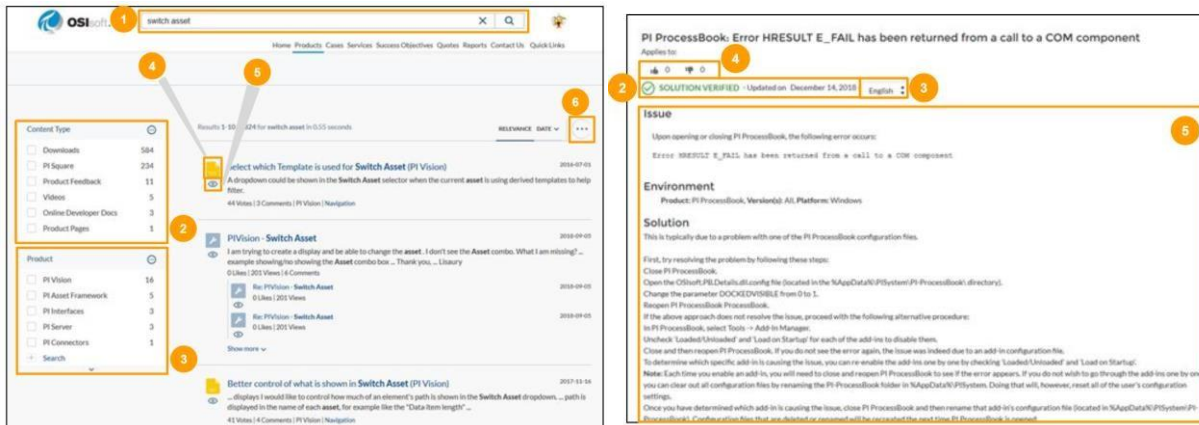
Types of Cases					
Sales & Licensing	PI Developers Club	Customer Portal	Class Registration Help	Technical	Product Feedback
<ul style="list-style-type: none"> Licensing Questions Billing Assistance Transaction assistance 	Questions about PI Dev Club subscriptions	Issues/ Questions related to OSIsoft Customer Portal: <ul style="list-style-type: none"> Gain access to appropriate sites Correct any inconsistent information in OSIsoft Customer Portal Errors in OSIsoft Customer Portal 	<ul style="list-style-type: none"> Class Registration Rescheduling of classes 	Questions or issues related to OSIsoft products	Submit enhancements, suggestions, and ideas about OSIsoft products and services

6. Select 'Product Family', Product, and version from populated list based on what your site is licensed for. If you're not sure, please select the option "not sure".
7. Complete the case form: Subject and Description.
8. On right side, suggested articles will dynamically update as you input the subject and description. If you'd like to reference any article, click on the title to open it in a new tab. If this solves your issue, feel free to close the case tab to exit the case submission process.
9. Finally Click 'Submit' to complete your case.

OSIsoft will use its best efforts to respond all Technical Support queries within four hours.

How to find support materials through the Knowledge Base

The search bar (1) in the OSIsoft Customer Portal returns your secure case information as well as knowledge articles, User Guides, PI Square posts and learning materials. Results may be filtered by information source or product. Use advanced search options to specify syntax rules, and apply date, language and content filters.



Embedded search provides informational options when you seek a solution online. When you begin to open a case, intelligent embedded search features offer helpful information in the Suggested Articles panel. You may see knowledge articles or content from other sites and downloadable files.

Knowledge articles are now created more frequently based on product cases. Articles marked as **Solution Verified** (2) contain solutions that have been validated by an experienced engineer and satisfy OSIsoft's writing quality standards. These articles are generally trustworthy, but they may still contain small mistakes or out-of-date information.

Articles marked as **Solution Not Verified** have not been reviewed and should be considered a "best guess" at the solution. Use these articles at your own risk. It is highly recommended that you backup your data before performing any changes that could result in data loss.

Learn More

Find more information on using the Customer Portal here: <https://tinyurl.com/wvs8hz8>

- Create an OSIsoft SSO Account
- Getting Access to Additional Sites
- How to Download Products and Generate Licenses
- ...and more!

- Lesson 3: Project Planning

Learning outcomes

After completing this lesson, you will:

- Considered and added important elements into your Gantt chart, such as project milestones, user groups, resources, and task ownership.

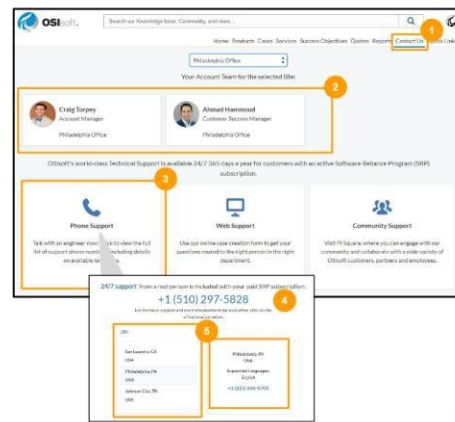
The CSM role

All OSIsoft customers are assigned a Customer Success Management Team. To find the team who works with your account, go to the **Contact Us** tab in the OSIsoft Customer Portal. There you will find the contact information for your Account Manager (AM) and Customer Success Manager (CSM).

Contact Us

Your OSIsoft Team

1. Select the Contact Us tab to see your account team and other resources to find support
2. Your dedicated OSIsoft Account Team will populate along with their contact details so that you can easily contact them
3. Select Phone Support to:
4. See the Global 24/7 English Support number
5. Changing the country and selecting an OSIsoft office will update support number for that specific office and show the supported languages for that office



The Customer Success Manager is there to assist you at the beginning of your PI System implementation planning and help you develop an initial adoption roadmap. Their role is to make sure you are aware of the resources and services OSIsoft has available for you. That way, you have the support from OSIsoft to accelerate deployment and time to value of your PI System.

The customer success manager will walk you through setting objectives for your project.

Project Milestones

The first step to using the Gantt chart will be to fill in some milestones. A project milestone is a task with zero length that symbolizes a deadline, prerequisite, or important achievement within the project.

A reader should be able to read through the milestones of a project and have a fairly good idea of progress. Once milestones are defined, the milestones can be broken down into deliverables which helps break project work into actionable chunks. These chunks are then allocated times and assigned ownership.

Common **important milestones** for a PI System project are:

- Develop an architecture that will achieve the defined outcomes
- Obtain budget approval for the implementation
- Hardware in place and prerequisites installed
- 3rd party installers/trainers confirmed
- Software licenses obtained

- Solution delivered
- Project acceptance
- Change management and governance plan written and accepted

Depending on the implementation, there are many other potential milestones, but these are the ones that tend to cause delay if they are not met.

Exercise: What project milestones will you need to include?

Take a few minutes to think about potential roadblocks or milestones you'll need to make sure you hit during your project, along with when you'd like to achieve them. Engage in discussions with all stakeholders to brainstorm and capture all the necessary milestones. Write them here:

Exercise: Add your milestones to your Gantt Chart

It is time to add the milestones you came up with in the previous exercise to your Gantt chart. Define some assumed dates that these milestones should be finished, but don't spend too much time thinking about them. They'll move around a fair bit throughout the rest of this module.

1. Open the Gantt chart template
2. Enter the name of the milestone in column B
3. Enter the date that the milestone should be complete in column E
4. Keep column F blank. This should generate a flag on the calendar symbolizing the milestone.

Identifying and classifying task ownership

On the Gantt chart we've been using, there is a column to assign a task to a group or person. We'll talk about that column more now. In a previous section (list on page 8) we identified potential stakeholders; now we will identify the role/ownership for each of the stakeholders.

There are a few parties that will be involved with the project, both employees of your organization and most likely third parties too. The people in these parties commonly overlap, and individuals are commonly members of more than one.

- **Program Manager/Project Manager (PM)** – ensures that the project scope is defined, and the project executed to that scope.
- **Project Sponsor (Sponsor)** – owns and/or uses the outcome of the project and provides expertise and guidance to the PM. Sponsors may also be part of the Power Users or Users groups, depending on their area of expertise.
- **IT Department (IT)** – is responsible for ordering and preparing hardware and assisting in secure access to the solution.

- **Administrators (Admins)** – are responsible for maintaining the solution. Depending on the organization, these individuals may configure PI Points, PI Interfaces, install new software, and be the first line of support for users of the solution.
- **Power Users** – use their domain expertise to build the solution. This group builds the Asset Framework layer of the PI System, as well as some high-level visualizations. They may be a team in the corporate headquarters or distributed around several sites. Without the work done by this team, the PI System is simply an infrastructure, not a full solution to a problem.
- **Users** – provide feedback while the solution is being implemented and use the solution after it is complete. This is by far the largest group involved and is made up of both staff on site and in headquarters. Anyone that needs to access any solution based on the PI System is in this group.
- **3rd Party** – Install, configure and train the users of the software and/or solution. This task is usually assigned to 3rd parties but can also be company employees if the expertise is available in-house. This group usually consists of OSIsoft Field Service and/or OSIsoft Partners or other consultants.

Exercise: Other groups or resources

Which other groups or resources do you think you'll need to define? Write out a short description of their roles here:

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- Lesson 4: PI System Architecture

Learning outcomes

After completing this lesson, you will:

- theoretically conceptualized components and aspects of your own PI System architecture.
- become familiar with OSIsoft recommendations in terms of hardware sizing and security.

Introduction to PI System Components & Architectures

In this section we will discuss the benefits and trade-offs of various PI system architectures.

We'll look at the PI System environment at a high level, including its role in an enterprise and an example of a robust architecture. The PI System major components have already been discussed in module 1, on the section on PI System Basics.

Here in this diagram, we see many different networks separated by these firewalls. On the left lay the data sources as well as the PI Interfaces.

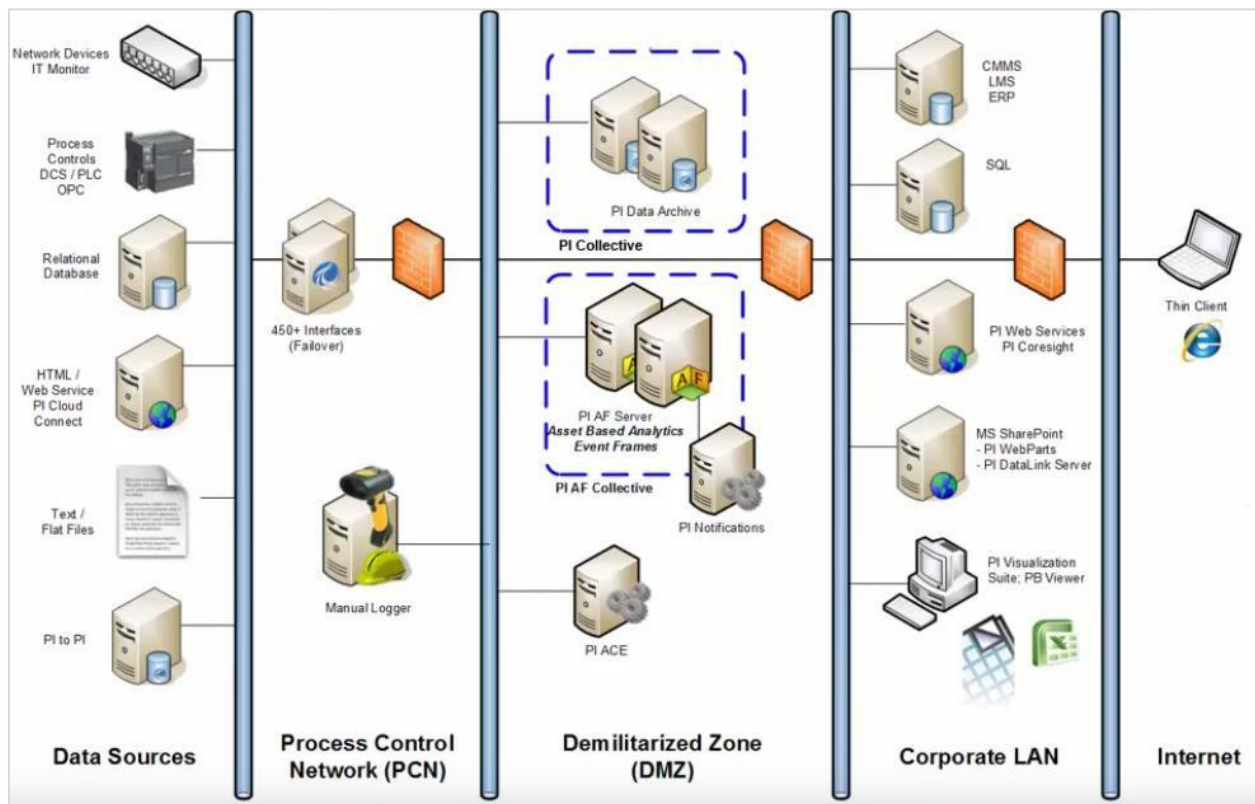


Figure 2. Robust PI System Architecture

These can sit on our process control network which is usually a very sensitive environment that many users shouldn't be accessing. Then data can be sent to a different network here labeled demilitarized zone or DMZ which acts as a layer between the sensitive process control network and the rest of the organization. In the DMZ you see Data Archives as well as AF Servers in a sort of redundancy structure allowing data to be available even in the event of a failure. Next, the corporate LAN is where most of the users of the PI System live. Here is where you can find the

majority of the PI Client tools like PI ProcessBook, PI DataLink, PI Vision (previously known as PI Coresight). Lastly, even from the internet or outside the company; controlled access can be granted to those that need to see the company's PI System data. An example can be plant managers who need to monitor their process from home. Or field technicians that need access to real-time data away from the corporate site.

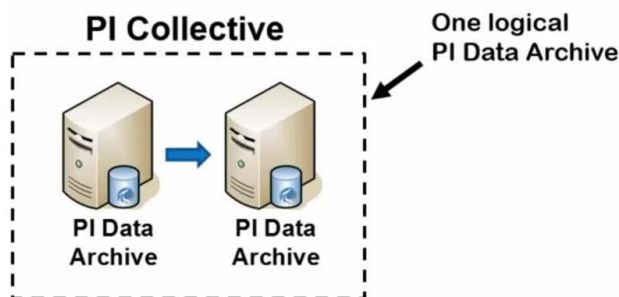
A PI System is designed to scale out to a robust network that also considers security and fault tolerance factors.

Considerations when Planning your PI System Architecture

It is important to understand your options when either drawing a blueprint for a new PI System or expanding on an existing PI System infrastructure. There is a good amount of flexibility when it comes to planning and designing a PI System environment. For example, for data that's considered highly critical, a combination of identical Data Archives allows data to be continuously available even in the event if one server goes down.

Another design consideration includes whether to place individual PI components on a single computer or spread them apart across different machines and even separate networks. But as the architecture gets larger, more tradeoffs emerge. This could come in the form of a financial tradeoff like purchasing more computer hardware or it could come in the form of personnel like dedicating more human resources to help manage the support of a larger PI System.

The first of many architecture options is PI Server High Availability. Two or more Data Archives are grouped into what is called a collective and each contains a separate but identical copy of information. This helps to provide uninterrupted access to data. From the user's perspective it all resembles one logical Data Archive.



One alternate approach to high availability is with the use of a firewall. Say we have a PI Collective in the DMZ and many users in the corporate network. These users all need access to PI System data. If all the Data Archives live in the DMZ, access between the corporate network and the DMZ would need to be granted through the firewall.

Another design approach is the use of interface fail over. Like PI Server High Availability, interface fail over involves redundant copies of a PI Interface run on separate computers. If only a single instance is responsible for collecting data, any maintenance or unplanned failure would stop data flow to the Data Archive. But in fail over, an available interface copy is ready to take over data collection responsibilities.

Another consideration with PI Interfaces is a feature called disconnected start-up. By saving a copy of PI Point configuration locally on the interface machine, interface instances can start-up without a connection to the Data Archive. This provides a local copy of PI Points on the interface itself.

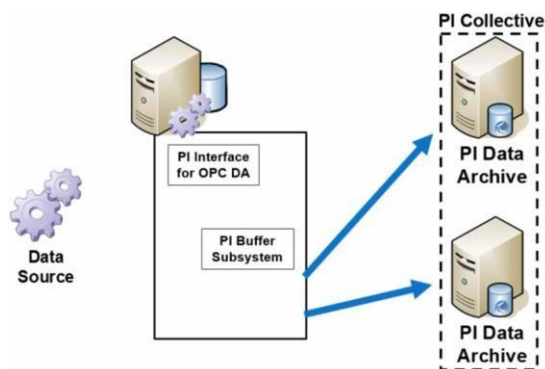
When it comes to the PI System's inclusion into your network, many suitable approaches can be made. What is most common in terms of security is using the PI System with Windows Active Directory. PI Interface Nodes need to be given fixed IP addresses as opposed to ones handed out by DHCP Servers. By attaching a fixed IP address to machines hosting PI Interfaces, PI System Administrators now have a means to refer to just that one computer and assign its appropriate permissions.

Expanding your PI System from a Simple to Complex Architecture

There are a lot more paths for our data to flow through like from one company to another and through custom applications built on top of the PI System. Let us suppose the Data Archive and the PI AF Server are both on the same machine. Assuming that the number of PI Points is expected to increase, we can place the Data Archive separate on its own computer.

Let us also assume that the data in the Data Archive is vital and must be made highly available for users in the organization. This calls for a PI Collective consisting of multiple Data Archives. This highly available design allows for independent storages of the same time series data. The end users utilize PI Client applications to retrieve and view data; these include PI Vision, PI ProcessBook and PI DataLink. All of these PI Client tools are built on a PI System platform called PI SDK. When a PI Client application connects to the PI Collective, PI SDK recognizes this and retrieves a list of all the members in the PI Collective. When an issue arises between a PI Client tool and it's connected to PI Collective members, PI SDK automatically switches over to a different available member.

But how do PI Collective members contain identical sets of the same time series data? This would not be possible without the PI Interface node. Along with one or more PI Interfaces running, there is another PI System component called the PI Buffer Subsystem that must also be running. Specifically, the PI Buffer Subsystem has a feature called N-Way buffering that creates and sends copies of time series data.



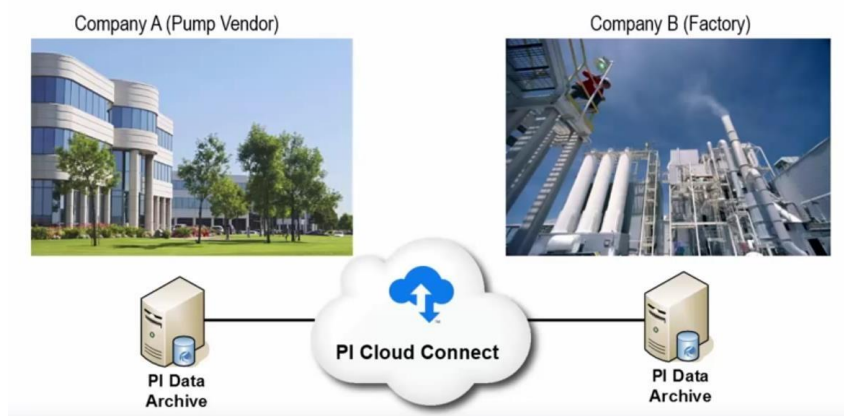
Let's say this machine is running just one interface, namely the PI Interface for OPC DA. There is a data value, timestamp and a value produced by the data source. The PI Interface then retrieves this value. As it leaves the PI Interface, the data value is picked up by the PI Buffer Subsystem and then duplicated for each member of the PI Collective. Finally, each replicate is sent along its

way. The PI Buffer Subsystem via N-Way buffering is the key component in creating identical sets of time series data for every member of the PI Collective.

Another point to make with buffering is in the name itself. In the scenario that one of the Data Archives goes offline, interface buffering will begin to buffer data, or hold onto it temporarily while it waits for the Data Archive to become available again. When it is available, it will flush all the held data to the now available Data Archive.

At this point we can also incorporate interface fail over into our architecture. This is like a PI Collective in that multiple instances are configured, so if one PI interface goes down, there is another instance that can pick right back up. Note that for PI Interface fail over, a maximum of two instances can be configured for this. Also, while many common and newer PI Interfaces support interface fail over, there is still some that do not. The user manuals for a PI Interface will explicitly state if it supports interface fail over.

Next, let's say that there are two entirely different companies that need to exchange PI data. One can be a vendor who sells pumps, and another is the vendor's customer. The vendor provides services to help maintain its pumps that it sells. Rather than having to wait for the customer to report any faulty issues with the pumps, the vendor could be more proactive if it had real-time data access to the pump's performances. Here PI Cloud Connect can step right in and make this possible. It allows for easy and secure exchange of PI System data between companies.



PI Cloud Connect uses secure pathways via the cloud or internet to facilitate this data exchange so that no VPN is necessary. Another way to use PI System data is with PI System Access. This is a suite of products designed to support the implementation of custom applications on top of the PI System. Think of this as libraries that help bring data out of the PI System entirely so that you can use them in your own custom programs.

Finally, the PI AF Server is integrated with MS SQL Server and the high availability portion can be applied to either the PI AF Server application or with built-in features of SQL Server. There is a lot of variation when it comes to making the PI AF Server highly available. For more details please consult the PI AF installation and upgrade guide.

Data Archive Hardware Sizing & IT Recommendations

At the beginning stages of implementing a new PI System, it's important to understand some of the pre-requisites and OSIsoft's best practices. This helps ensure that the Server is built to handle all current data needs as well as to minimize periods of extended maintenance. When deciding

the number of machines required, it ultimately depends on the size and complexity of your PI System. This factors in the number of PI Points, the number of units represented in the PI AF Server, usage of redundancy, the amount of data online at once etc.



When you start to go higher in point count and AF assets, this is the next recommended architecture: the AF Server and SQL Server are hosted on their own machine while the Data Archive is on a separate machine. Providing better allocation of resources, you will notice two Data Archives on two machines and a PI Collective. When multiple PI Collectives and redundancy in the AF Server and SQL Server are needed, you may work towards an environment that resembles this. This is more of a true distributed system that handles the largest workloads so far. While the biggest trade off has to do with understanding and maintaining multiple machines, you get the best level of performance and scalability. For completely new PI Systems, this architecture is a great place to begin.

The screenshot shows the 'PI Data Archive Hardware Sizing' spreadsheet. The spreadsheet is divided into several sections with yellow input cells and red output cells. The sections include:

- Expected Historical Point Count:** 50,000 points
- PI Interface Nodes:** 1 node
- 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:** 10,000 events/sec
- Estimated Event Size (on Disk):** 6 bytes
- Estimated Archiving Rate:** 5,000 events/sec
- STORAGE:**
 - Minimum Archive Size: 100 MB
 - Recommended Archive Size: 250 MB
 - Required Online Storage: 8.11 GB
 - Estimated Archive Count: 3,525 files/year
 - Estimated Storage Consumption (per server node): 108 MB/hour, 79 GB/month
- DISK I/O:**
 - Minimum Disk Bandwidth: 1 MB/sec
 - Minimum Disk Throughput: 100 I/O/sec
 - Recommended Disk Bandwidth: 10 MB/sec
- PI Collective Nodes:** 1 node (no HA)
- Estimated Bandwidth per Interface Node:** 250 KB/sec
- Active Client Applications:** 10 applications
- Average Query Interval:** 60 seconds
- Average Query Range:** Enter the typical rate of archive queries (e.g. display refresh, pan & zoom) expected by each client application.
- Average Points per Query:** Enter the typical rate of archive queries (e.g. display refresh, pan & zoom) expected by each client application.
- Estimated Archive Query Rate:** 1,700 events/sec
- PROCESSOR:**
 - Minimum CPU Count: 4 cores
 - Recommended CPU Count: 6 cores
- MEMORY:**
 - Minimum RAM: 512 MB
 - Recommended RAM: 1 GB
 - Estimated Cache Capacity: 7 hours
 - Estimated Cache Efficiency: 98 %
 - Non-Cached Archive Reads: 1,700 events/sec
- NETWORK:**
 - Minimum Bandwidth: 10 Mbps

At the bottom of the spreadsheet, there are tabs for different PI applications: PI Data Archive, PI ACE, PI AF, PI Notifications, Interface Node, PI WebParts, PI Coresight, RReports, PI ProcessBook, PI DataLink, PI Manual Logger, and PI Builder.

OSIsoft provides a hardware system sizing recommendation spreadsheet shown above which helps with selecting hardware for PI System applications. This file can be downloaded from the [OSIsoft technical support site](#). At the bottom of the spreadsheet, you'll find a number of tabs, each corresponding to a different PI application. And on the Data Archive tab for example, you provide values for these yellow cells with your expected parameter values. If you are unsure what sort of

cells it's asking for, you can click on them and a description will be provided. The red cells underneath correspond to both minimum and recommended hardware sizes.

OSIsoft fully supports virtualization of the PI System. Some examples are Microsoft's Hyper-V platform as well as the VMWare Server. When you are sizing PI systems using the sizing recommendation spreadsheet, all the hardware sizes apply the same to virtual machines. And as with on any physical piece of hardware, you should also test new PI Systems on virtual machines. With these recommendations in mind, it's possible to start drawing a layout for your PI System, whether it involves putting the majority of the PI components on one machine or a larger architecture involving redundancy like for the PI net archive.

Overview of Data Archive Security & Connections

End users who will be retrieving data from the PI System are almost always on a machine separate from the Data Archive, like on their own laptop for example. By default, the Data Archive grants access to only applications running on the machine itself. So, user access to PI System resources must be understood and taken care of in order to allow the rest of the organization to take advantage of the PI System.

During the beginning PI System planning stage, the PI Server integrates the best with the Windows Active Directory security design. In the PI Server, data and information primarily reside in either the Data Archive or the AF Server. With the AF Server, security is relatively easy. You take any type of Active Directory entity, whether it's individual or a group and associate it with resources in AF. The point to make here is that you only need to consider the actual Active Directory user or group and the AF resource you are concerned with.

For resources inside the Data Archive, like security for the AF Server, we need to take note of the specific Active Directory users or groups and the resource. Whether it's to read PI Point values or to change settings in the tuning parameters. But there are two distinct steps in between:

- The first is a PI Mapping, PI Trust - as a mechanism for authenticating who you say you are
- The second is a PI Identity - assists with authorizing what resources you have access to.

During the creation of a PI Mapping, the two important parameters are the Active Directory user or group and the PI Identity which is a collection of PI System permissions. When a user attempts to connect to the Data Archive, their user and groups that they belong to will be verified by the Data Archive. If a PI Mapping is found for this individual, they will be associated with the specified PI Identity. Note there could be multiple PI Mappings for one person.

On the other hand, there are also PI Trusts. These aren't integrated to Windows Active Directory as PI Trusts are used mainly for allowing specific machines, applications, access to a Data Archive. The best example is for PI Interfaces running on remote nodes. You'd create a PI Trust that associates the machine, the machine name or IP address and the PI Interface with the required Data Archive resources via PI Identity.

In summary, OSIsoft recommends to reserve PI Trusts only for unattended applications like a PI Interface while user access should be granted by PI Mappings.

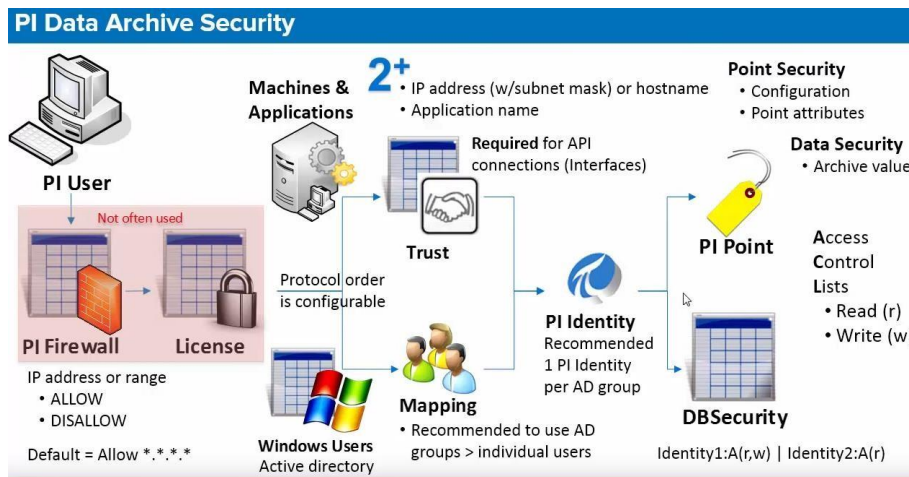
PI Mapping

Here, the PI Identity is being used to assign the connecting application specified in the PI Trust permissions on the PI Data Archive.

PI Trust

Next is the authorization stage where the correct permissions are assigned for the now authenticated user. Here is where PI Identities comes into play. Successful connection via a PI Mapping or a PI Trust associates a PI Identity with the user or computer. PI Identities are associated with a set of configurable permissions to resources. For example, there can be a PI Identity called PI System administrator that has access to read and write permissions on every Data Archive resource. Users who are associated with this PI Identity can create PI Points, add or unregister PI archives, change tuning parameters and even edit security for other users.

The PI License Subsystem is one of many components of the Data Archive and is designed to work with the PI Server license to enforce any restrictions provided in the license file. Lastly there is a section in PI SMT called security settings which shows this slider for changing Data Archive security on a wide scale. For example, a client tool like PI ProcessBook which uses the PI SDK protocol can use a PI Trust to authenticate in the Data Archive. Remember PI Trusts should in general be reserved for unattended applications like PI Interfaces while real people should access the Data Archive via PI mappings by sliding this bar up to SDK trusts are disabled. The user using PI ProcessBook that depends on a PI Trust will not be allowed in. But in many environments some exceptions are bound to be made. So OSIsoft recommends setting this to at least explicit login disabled. Explicit logins used to be the common way to connect to the Data Archive using a dedicated PI System username and password.



Now in the image above is the big picture of the connection logic between an end user and the Data Archive. Let's say the user opens PI System Management Tools or PI SMT and wants to view data for a PI Point. The first point of contact is the PI firewall but in our case all IP addresses are allowed, so we get through this and then reach the PI License Subsystem. This subsystem will let the user through even if for some reason PI SMT isn't explicitly allowed by the license file. Now assume the user's machine is configured to check for available PI Trusts first. But let's say there isn't a PI Trust configured for his machine. It will then move onto PI Mappings which take into account the user's Active Directory username. From here there is a PI Mapping which grants a specific PI Identity to the user. And finally let's assume the PI Identity has been configured to read data for all PI Points in the Data Archive. Then finally reaches the PI Point itself. The user will now be able to see data for the PI Points that he searches for.

Please note:

- In "[Seven best practices for securing your PI Server](#)", **OSIsoft recommends the use of Windows authentication instead of PI Trusts**. PI Trusts are a weak form of authentication due to potential for fake credentials and should be avoided, unless technically required for application compatibility. Once PI Data Archive and client applications have migrated from PI Trust to Windows Integrated Security, PI Trust authentication can be disabled globally for all applications. PI Trusts are still available as a method for authenticating PI interfaces, or any other PI API-based client application. However, you should only use PI Trusts when Windows authentication cannot be used.
- Also, after 25 years, OSIsoft is **retiring PI ProcessBook** using a phased approach over several years. PI ProcessBook was the leading face of PI System for many years, paving the way for self-service visualization. Since then, technology and your expectations around mobility, scalability, and collaboration have evolved beyond what PI ProcessBook can deliver. OSIsoft has been actively developing and investing in PI Vision to provide you that next-generation, modern visualization experience. For additional dates such as when PI ProcessBook will no longer receive security updates and fixes, or when technical support will end, please see [this article](#).

Learn More

- Take our course on "Implementing PI System High Availability" to learn more about the topics surrounding the design and implementation of a highly available PI System.
- Seven best practices for securing your PI Server ([link](#))
- Buffering and Security in Live Library ([link](#))

- Lesson 5: Performance and control

Learning outcomes

After completing this lesson, you will have:

- Become familiar with OSIsoft's recommendations on development, test, and production systems.
- Understood how the "on site" and "in headquarters" environments fit together into an complete example architecture.
- Began to consider the nuances of development, test, and production systems.

Introduction and recommendations

It is recommended to have separate development, test, and production systems for any critical project – and the PI System is no exception. However, having three identical environments is usually too much or even impossible, depending on the data source. Deciding how to configure these environments, the processes and change control around them can be very complex.

A system could be very locked down, but this means that it's unlikely that new projects would start up around it. A system could be very open, but this means that it is likely that breaking changes will be made.

In this lesson we will recommend a solution that would work for most small to medium sized systems, with a balanced approach to governance.

The site interfaces and Data Archives should have strict change control on them and most likely follow practices already present in your business.

We recommend allowing for independent servers for at least:

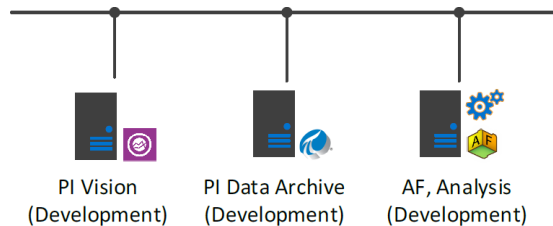
- Data Archive
- Asset Framework/Analytics
- PI Vision (optional – if developing custom symbols)

It is most common to have these development and test environments only in the environments found in headquarters. This does not apply to the interfaces and Data Archives found on sites; the only changes on these systems tend to be creation of new tags, which is a fairly simple process.

Development

The development environment is commonly described as the "sandbox". Power Users develop calculations and asset framework structures on this set of servers. Developers and third parties use this environment before their applications are approved for production. The development environment can contain some of, or all production PI Points and AF structure, along with sandbox AF structures for Power Users or developers.

Steps should be taken to prevent users from using the development environment for daily work. Frequent resetting of the AF databases and Data Archive should be scheduled, moving back all changes that have been made to Production to keep it up to date and dissuade this practice.

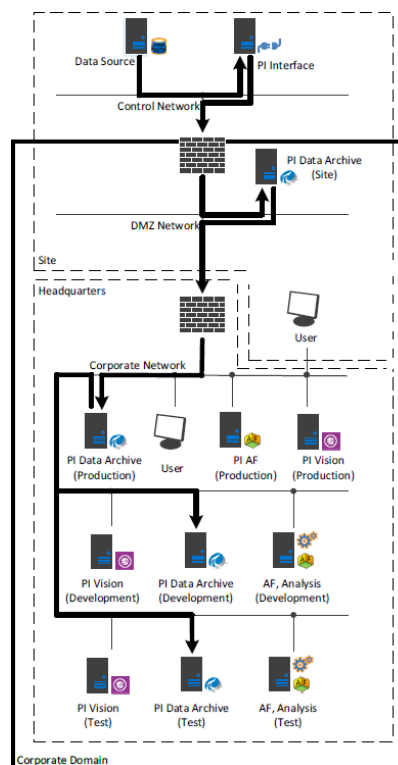


Production

On site: In our earlier example, the diagram only included the production environment. First, we'll look at the environment on-site. This is a lot simpler as there is no AF or PI Vision servers. The only changes that need to be managed are interface configuration and tag creation. A change control process should be set up around these changes and maintained by the team on site.

In headquarters: The production environment in headquarters is what most users should be using for their daily needs. It is mission critical, and changes to it should be controlled. However, the more projects and models built in the system, the more value you will draw from it. The change control model should welcome new additions if they do not make breaking changes. If the test AF database has been rigorously tested, it can be ported over to production.

The following diagram shows how these environments fit into our example architecture, including the time series data flow from server to server, represented by thick arrows. Note that this is a very simplified architecture diagram. There are a lot more services involved in sending data around, but we have included the most important ones to demonstrate data flow.



Exercise: Dev, Test, Prod and You

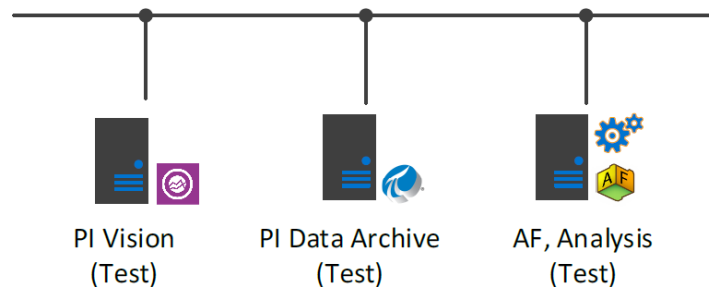
- Which groups should be allowed to change which parts of the system?
- How does the model described in this lab fit in with your current change control processes?
- Is there anything that can be improved about this model?

Test

The test environment is a replication of the production environment, with current potential changes applied. A recommended workflow for the test environment would be:

1. Proposed changes are reported to a designated team of Power Users or administrators.
2. The team moves the changes to the test environment.
3. The team validates that the changes will not break reports or dashboards when moved to production, and performance is not impacted with the new calculations running.
4. The team moves the entire test database from test to production, replacing the old production database

The validation step is the most complex step in this process. There are many methods to do this, but the method with the least setup and maintenance is to create spreadsheets using PI DataLink that gather the same data that production reports and dashboards gather. We use spreadsheets here because they are simple to modify and change the data source from production to test. A strategy should be set up to standardize a method of doing this that works for your organization and team.



- **Next Steps**

In this module you had the opportunity to develop a well-rounded impression of other customer use cases and began considering and adding important elements into your Gantt chart, such as project milestones, user groups, resources, and task ownership. Moreover, you documented a list of potential stakeholders and conceptualized technical components and security aspects of your own PI System architecture.

In the next module we will look at the “Implementation and Adoption” of the PI System. This includes: PI System installation, preparing user software and facilitating adoption through appropriate training and support structures.