Configuring a Simple PI System

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Lesson 1 - Installing and Configuring PI Data Archive

Objectives

- Review the pre-installation check list
- Describe the steps to obtain a License File
- Know the installation steps of PI Server
- Become familiar with the directory structure of PI Data Archive (PI folder)
- Start and stop the PI Data Archive server

Pre-installation Checks

It is critical that you perform the pre-installation checks. If you neglect this step in some cases you will get an error, and in others, the installation will stop.

- Log on as Administrator (or with administrative privileges). The installer must be either the administrator or member of the local Administrators group. In addition, the account must have write permission to MS SQL Server. Validate that the user has the correct permissions.
- Always check the PI Data Archive Server operating system clock when installing any PI System. Ensure the clock on each machine has the correct time and it is in the correct time zone. In your work environment, all clocks should be synchronised from a network time source. Changing the clock after installation will cause problems.
 - **Update Windows**. A properly updated Windows Operating System will have the required prerequisites. If you require any prerequisite components, you will need to install them before the installation proceeds.
 - Install Microsoft SQL Server. The version you use is your choice. You now should know the pros and cons of each of the available offerings.
 - **Obtain your PI Server License File.** Download the file from the OSIsoft Customer Portal <u>https://my.osisoft.com</u>; an explanation is forthcoming.

Supported Operating Systems

Starting with PI Data Archive 2016, only 64-bit version is available and requires a 64-bit Operating System. For production systems, PI Data Archive version 2018 SP3 or higher can be deployed on the following Microsoft Windows Server operating systems, in decreasing order of recommendation:

• Windows Server 2019 - all editions; in both Full and Core installations

- Windows Server 2016 all editions; in both Full and Core installations
- Windows Server 2012 R2 all editions; in both Full and Core installations
- Windows Server 2012 all editions; in both Full and Core installations

License File Activation (For reference only – already completed on PISRV1)

A **License File** must be generated before the PI Data Archive server is installed. The OSIsoft Customer Portal allows you to generate your site-specific PI Server license file. This license file controls which applications can run on the PI Data Archive Server and displays running parameters, such as the point count limit.



When the license file is generated, view the PI Server Manifest to verify the server details.

In order to generate license file, a **Machine Signature File (MSF)** is required. The PI Server install kit is capable to generate the MSF by itself, you must copy the install kit to a local disk on the PI Data Archive Server computer and then run the kit.

The kit will generate the MSF file to Documents folder of user running it.

i.e. C:\Users\<username>\Documents

If the PI Data Archive Server is on a virtual machine (VM), run the utility on the VM. If you generate the MSF on the wrong computer (on your laptop, for example) then the license activation file will match the laptop computer. If you install PI Data Archive Server on a different computer or VM, the server will not run as expected. The license file must be present during the installation. It can be on a flash drive, CD, or any media that can be read by PI Data Archive Server during installation. The setup program copies the license file to the %PISERVER%\dat directory during installation; the original file will no longer be used.

License Generation

A machine signature file (MSF) is needed to generate a machine-specific license file from the <u>OSIsoft Tech Support</u> website. Setup has proactively created an MSF file in your Documents folder. Click <u>here</u> to show the MSF file in folder.

The MSF file created by this setup kit is guranteed to generate a license file that is compatible with PI Server Installer. For this reason use the MSF file created by this setup kit instead of an MSF file created by other tools.



Consult the License PI Data Archive section of the PI Server Installation and Upgrade Guide for full details.

Install the PI Server (For reference only – already completed on PISRV1)

Description

You are ready to begin the PI System installation.

You should have validated the prerequisites and Microsoft SQL Server, have the install kit and license file, and performed all the computer checks (clock, etc.) You did, didn't you?

Approach

- 1. In the installation folder, you will find the PI Server installation kit.
- 2. Right-click and "**Run as Administrator**". After the Welcome screen, where you can deselect the participation in PI System Customer Experience Improvement Program there is a feature selection screen where we check the components we would like to install. Select all except PI Notifications Service.

Feature Selection Choose server roles to s	elect typical server and client features. Fine tune your installation from the 'Individual Features' tab.	About
Welcome Feature Selection Feature Rules SQL Server Connection SQL Server Rules Data Archive RTQP Engine RTQP Engine Rules Service Accounts Summary Installation Progress Complete	Server Roles Individual Features	Summary
	PI Data Archive + I PI Data Archive will be installed. AF Server AF Server will be installed.	Will be installed (13) + PI Data Archive Server PI Totalizer Subsystem AF SQL database scripts AF SQL script execution PI AF Apolication Service
	PI Notifications Service Install now to configure email notifications. PI Analysis Service +	PI SQL Data Access Service PI SQL Data Access Service PI System Explorer PI System Explorer Management Plug-In PI Builder PI AF User Documentation PowerShell Tools for the PI System PI System Management Tools
	Select All Select Typical Unselect All Reset	Disk Space Requirements Update
	Installation directory: D:\Program Files\PIPC Installation directory (x86): D:\Program Files (x86)\PIPC	Drive C: 1.6 GB required, 69.1 GB available. Drive D: 846.3 MB required, 13.8 GB available.
	PI Data Archive directory: D:\Program Files\PI	
		< Back Next > Cancel

- 3. Select the installation directories for 64-bit and 32-bit PIPC folders and PI Data Archive Directory. In our case it is:
 - D:\Program Files\PIPC
 - D:\Program Files (x86)\PIPC
 - D:\Program Files\PI

Important Note: Since unified installation kit PI Server 2018, the fresh installation of PI Data Archive by default no longer installs these subsystems:

- PI AF Link Subsystem
- PI Alarm Subsystem
- PI Performance Equation Scheduler
- PI Batch Subsystem

If you wish to install those components, you switch to Individual Features section and tick the box. For upgrade from previous versions of PI Data Archive those components remain.

Feature Selection Choose server roles to	select typical server and client features. Fine tune your installation from the 'Individual Features' tab.	About
Welcome Feature Selection Feature Rules SQL Server Connection SQL Server Rules Data Archive RTQP Engine RTQP Engine Rules Service Accounts Summary Installation Progress Complete	Server Roles Individual Features PI Data Archive PI Data Archive Server - version 3.4.430.460 will be installed PI Data Archive Subsystem - version 3.4.430.460 will be installed PI Atam Subsystem - version 3.4.430.460 will be installed PI Atam Subsystem PI Af Link Subsystem PI Performance Equation Scheduler PI Batch Subsystem AF Server AF SQL database scripts - version 2.10.6.195 will be installed PI AF Application Service - version 2.10.6.195 will be installed PI SQL Data Access Server (RTQP Engine) - version 1.7.19246.2 will be installed Analysis and Notifications PI Notifications Service PI Nalaysis Service - version 2.10.6.195 will be installed Client Features PI Notifications version 2.10.6.195 will be installed	Summary → Will be installed (13) + PI Data Archive Server PI Totalizer Subsystem AF SQL database scripts AF SQL script execution PI AF Application Service PI SQL Data Access Server (RTQP Engine) PI Analysis Service PI System Explorer PI System Explorer PI System Explorer Management Plug-In PI Builder PI AF User Documentation PowerShell Tools for the PI System PI System Management Tools
ina size	Image: Select All Select Typical Unselect All Reset Installation directory: D:\Program Files\PIPC Installation directory (x86): D:\Program Files (x86)\PIPC PI Data Archive directory: D:\Program Files\PI	Disk Space Requirements Update Dive C: 1.6 GB required, 69.1 GB available. Drive D: 846.3 MB required, 13.8 GB available.

Since PI Server 2018 SP3, these PI Interfaces are no longer part of the installation kit:

- PI Interface for Performance Monitor
- PI Interface for Ping
- PI Interface for SNMP
- PI Interface for TCP Response
- PI Interface for Random Data Simulator Data
- PI Interface for RampSoak Simulator Data

Removing the PI Interfaces for Random and RampSoak Simulator Data from PI Server installation kit, eliminates default PI Points (SINUSOID, SINUSOIDU, CDT158, CDM158, CDEP158, BA:LEVEL.1, BA:TEMP.1, BA:CONC.1, BA:ACTIVE.1 and BA:PHASE.1) from being installed, therefore **NO PI POINTS ARE PRESENT** on PI Data Archive after the installation.

4. Select the SQL server provided. In our case **PISRV01\SQLEXPRESS**. Keep the checks that AF SQL Database scripts will be installed and executed. Ensure the MS SQL Server service is started before installation.

SQL Server Connection Enter the Microsoft SQI	Server name or named instance that will host the AF SQL database.	About
Welcome Feature Selection Feature Rules SQL Server Connection SQL Server Rules Data Archive RTQP Engine RTQP Engine Rules Service Accounts Summary Installation Progress Complete	SQL Server Connection PISRV01\SQLEXPRESS Example: <server name=""> or <server name="">\<named instance=""> Validate connection to SQL Server and version of the AF SQL database. Validation is required when a connection to AF is required during the installation when the "AF SQL script execution" feature is selected. AF SQL Database Setup ✓ AF SQL database scripts - version 2.10.6.195 will be installed ✓ AF SQL script execution - version 2.10.6.195 will be installed Since the PI AF Application Service will be installed, you have the option to change your feature selections related to AF SQL database setup on this view Script execution can run against local or remote SQL Servers.</named></server></server>	or

5. For PI Data Archive section select the License Directory and Data Directories

Data Archive Options for the PI Data	Archive feature.		About
Welcome			
Feature Selection	License directory: D	PI Install Kits\Training License	
Feature Rules	License information	nd generation	
SQL Server Connection			
SQL Server Rules	Data Directories		
Data Archive	Historical Archives:	F\DIArrhives	
RTQP Engine			
RTQP Engine Rules	Future Archives:	£:\PIArchives\future	😲
Service Accounts	Event Queues:	E:\PIEventQ	🕜
Summary			
Installation Progress		Modify Archive Settings	
Complete	Archive Settings	noon) i noni coccango in	
	Size in MB for histo	ical archives: 256 📀	
	Max point count for	historical archives: 131,072 😧	
	Automatic creation	or historical archives: Enabled	

- License Directory to D:\PI Install Kits\Training License
- Historical Archives to E:\PlArchives
- Future Archive to E:\PIArchives\future
- Event Queues to E:\PIEventQ

In Archive settings you can modify the size for historical archives to lesser size than precalculated size (viz. chapter Archive Sizing)

6. At the RTQP Engine page, keep the default port 5465. For SSL certificate select the only available certificate **PI RTQP Engine**

RTQP Engine Enter configuration info	rmation for the PI SQL Data Access Server (RTQP Engine).		About
Welcome Feature Selection Feature Rules SQL Server Connection SQL Server Rules Data Archive	HTTPS SSL Certificate thumbprint for port <u>5464</u> : <u>5D2B51D93DE901EE5773649AE9843A54DF29E1FC</u> Change Remove	Windows Security Select Certificate Please select a certificate for use. Only unexpired SHA-2 certificates that have a private key are displayed.	×
RTQP Engine RTQP Engine Rules Service Accounts Summary Installation Progress Complete	Net.Tcp Port: <u>5465</u> SSL Certificate Thumbprint: 5D2B51D93DE901EE5773649AE9843A54DF29E1FC	PI RTQP Engine Issuer: PIDC.PISCHOOL.INT Valid From: 1/14/2020 to 1/13/2022 Click here to view certificate properties	

- 7. Select the gMSA accounts:
 - PI AF Application Service: PISCHOOL\SVC-PIAF\$
 - PI Analysis Service: PISCHOOL\SVC-PIANALYT\$
 - PI SQL DAS (RTQP Engine): PISCHOOL\SVC-PIRTQP\$

About Service Accounts Specify service accounts. Welcome Service Account Name Password Feature Selection PI AF Application Service PISCHOOL\SVC-PIAF\$ Feature Rules SQL Server Connection v PI Analysis Service PISCHOOL\SVC-PIANALYT\$ SQL Server Rules Data Archive PI SQL DAS (RTQP Engine) PISCHOOL\SVC-PIRTQP\$ ÷ **RTQP Engine RTQP Engine Rules** Service Accounts Summary Installation Progress Complete

- 8. Click Next to the Summary page and start the installation.
- 9. If MS Excel page pops up, click on Install button to install PI Builder plug-in.
- 10. After the installation is complete manually stop the PI Data Archive by executing the script **%PISERVER%\adm\pisrvstop.bat**.

The installation created PI System folder in Windows Start Menu with a list of selected applications. Find out what they are used for...





Lesson 3 - Installing and Configuring a PI Interface

Video: <u>OSIsoft: Configuring a Simple PI System Online Course - Installing and</u> <u>Configuring a PI Interface</u>

Common PI Interfaces

As we saw in the previous exercise, some of our PI Interfaces are designed for a specific data source, while others are built using standard communication protocols. Below is a list of our most popular PI Interfaces.

1. PI Interface for OPC DA

Collects real-time data from OPC Servers using the OPC DA standard, arguably the most common communication protocol in the industrial automation industry.

2. PI Interface for Universal File and Stream Loading (UFL)

Collects real-time, historic or future data from ASCII files (e.g. txt, csv xml files, etc.), serial ports and POP3 email servers. The PI Interface can be configured to collect data no matter the format of the data in the source file, making it one of our most versatile interfaces.

3. Pl Interface for RDBMS

Collects real-time, historic or future data from any Relational Database Management System that supports ODBC drivers (e.g. Microsoft SQL Server, Oracle Database, IBM Informix, etc.)

4. PI Interface for Modbus Ethernet PLC

Collects real-time data from PLCs that use the Modbus communication protocol

5. PI to PI Interface

This PI Interface is used to send real-time, historic or future data from one Data Archive to another. A typical application of this PI Interface is to collect data from plant-level Data Archives to a centralized corporate Data Archive.

Define the components of a PI Interface

Once a PI Interface has been installed and configured on a computer, it consists of the following components:



- **PI Interface executable**: This is the executable file that will run and perform the operations to collect data from the data source.
- Pl Interface instance batch file: Although the executable performs all of the operations, it needs instructions, such as (1) which data source to collect from, (2) which Data Archive to send to, etc. A batch file will contain all of these instructions. Since you could have multiple data sources, you can create multiple batch files, and hence multiple *instances* of the Pl interface running on a single node.
- Windows Service running PI Interface instance: In order for an instance of the PI Interface to run automatically when the computer starts, and run in the background, a Windows Service is created.



Checking the services snap-in (services.msc) is a great way of identifying all of the PI Interfaces instances that are running on a single PI Interface node.

Define the PI Interface Configuration Utility

The PI Interface Configuration Utility (ICU) is a Graphical User Interface (GUI) that PI System administrators use to create and configure the PI Interface instance batch files and services.

The PI ICU will only configure batch files and services located on the computer where it is installed (it cannot be used to configure remote PI Interfaces).



Install and configure a PI Interface for OPC DA

Now that we are familiar with the PI Interface installation methodology, we can install and configure a new PI Interface to collect data in our Virtual Learning Environment. We will be doing so in the directed activities and exercises throughout the remaining sections of this chapter, by following the steps outlined in the section "PI Interface installation methodology"

Our data source is an OPC DA Server installed on PIINT01 (therefore, we are using architecture B from the previous group discussion). This OPC DA Server exposes real-time data from 5 pumps in our process. Our goal will be to collect this process data and store it in the Data Archive. We will be installing our PI Interface on PIINT01. Since we have already chosen our PI Interface and our architecture, we have completed steps 1 and 2 of the installation methodology.

What is an OPC DA Server?

We chose an OPC DA Server as the data source for this class because it is the most common data source among our customers, making the PI Interface for OPC DA our most widely used interface.

OPC DA is a standard communication protocol developed for the industrial automation industry. As previously discussed, automation systems communicate using a wide-variety of different, often proprietary protocols. This makes communication between different systems very difficult. To solve this problem, multiple vendors got together and developed a series of platform-independent standards called OPC (Open Platform Communication). OPC DA is the standard for real-time data collection.

There are two required software components when communicating using an OPC standard: the OPC Server and the OPC Client. The OPC Server is a software application that exposes data from a data source in the OPC standard. The OPC Client is a software application that consumes data from an OPC Server, and translates it to a different format. The PI Interface for OPC DA is an OPC Client. The OPC Server is a non-OSIsoft application developed by another company.



Note: We will discuss the OPC UA standard in the chapter "PI Connector Management".

Install the PI Interface for OPC DA and the PI ICU

Activity Objectives

Complete steps 3 and 4 from the PI Interface installation methodology we outlined in this chapter.

Step 3 : Install the PI Interface and the PI ICUStep 4 : Validate that the PI Interface can communicate with the Data Archive

Approach

Part 1 – Install the PI ICU and the PI Interface for OPC DA

- Step 1: On PIINT01, navigate to the folder C:\Course Folder\Install Kits
- Step 2: Right-click on the installation kit "PIICU_x.x.xx.xx_.exe" and select "Run as administrator".
- **Step 3**: Complete the steps in the installation wizard.
- **Step 4**: Repeat steps 2 and 3 with the following installation kits:
 - a. OPCInt_ReadOnly_x.x.x.xx_.exe
 - b. PIAPI-xxxx-for-Windows-Integrated-Security_x.x.x.xx_.exe

Note: The first install kit installs the Read-only version of the PI Interface for OPC DA. This version does not have the ability to write data back to the OPC Server. The read-only version is strongly recommended as an inherently safer technology that also simplifies compliance with security policy.

The second install kit installs the PI API for Windows Integrated Security. Although the PI OPC Interface comes with the PI API, this version is more secure. We will continue our discussion of PI API security in the section "PI System Security Management".

Part 2 – Validate that the PI Interface node can communicate with the Data Archive server over the network

- **Step 1 :** We will first test to see whether network packets can travel from the PI Interface node to the Data Archive Server. On PIINT01, run the command prompt and use the **ping** command to test the connectivity to PISRV01.
- **Step 2 :** Next, we will test to see whether network packets can travel from the Data Archive Server to the PI Interface node. On PISRV01, run the command prompt and use the **ping** command to test the connectivity to PIINT01.

- **Step 3**: Data sent to the Data Archive uses TCP port 5450. The final test is to verify whether that ping port is open on the Data Archive Server. On PIINT01:
 - a. Run the Windows Powershell application
 - b. Run the following command:

(new-object net.sockets.tcpclient PISRV01, 5450).connected

If port 5450 is open, you will receive the message

True

If port 5450 is blocked, you will receive an error message:

New-Object : Exception calling ".ctor" with "2" argument(s): "A connection attempt failed because the connected id not properly respond after a period of time, or established connection failed because connected host has fai espond 192.168.0.5:5450" At line:1 char:1? + \$test=new-object <<<< net.sockets.tcpclient pisrv1, 5450 + CategoryInfo : InvalidOperation: (:) [New-Object]. MethodInvocationException

+ CategoryInro Invallapperation: (:) INV-Object1, NethodinvocationException + FullyQualifiedErrorId : ConstructorInvokedThrowException,Microsoft.PowerShell.Commands.NewObjectCommand

Part 3 – Testing the two PI System connection protocols

There are two connection protocols that can be used to connect to the Data Archive: The older PI API and the newer PI SDK. PI Interfaces are typically built to use the PI API when sending data. Newer PI System software, such as the PI ICU, are built to use the PI SDK. Therefore, both need to work correctly on a PI Interface node. We will now verify whether we can connect to the Data Archive from the PI Interface using these protocols

Step 1 : First, we will test a connection using the PI SDK.

- a. Run the PI SDK Utility (AboutPI-SDK)
- b. In the pane on the left side of the window, select "Connections"
- c. In the second pane on the left, you should see the Data Archive name "PISRV01". Click the checkbox next to the name.
- d. If the connection is successful, you should see your username and "connected as" in the "Connected User" Field.

0		PI SDK Utility (Administra	ator)	_ 🗆 X
File Buffering Too	ols Connections He	lp		
E 🖉 PI SDK	PISRV01	Network Node:	PISRV01	
Connections		Port Number:	5450	¥
Connections Connections		Default User Name:	pidemo	
🗆 🛷 Tools		Connection Timeout:	10	Seconds
Message Log		Data Access Timeout:	60	Seconds
Support Data				
Tracing Setup		Connection Type:	PI3 protocol 3.5	
KST Cleanup		ServerID:	7a31e8fa-0206-4f85-ad2d	-606edc1c8426
		Description:		
		Connected User:	PISCHOOL\student01 as	piadmins PIWorld
		IP Address:	192.168.0.5	
		PI Version:	PI 3.4.405.1198	
		Operating System:	Windows NT AMD64 6.2	2.9200
				Save
	PISRV01 connected as p	iadmins PIWorld		.:

Step 2: Finally, we will test the PI API protocol

- a. Run the command prompt
- b. Navigate to the directory C:\Program Files (x86)\PIPC\bin
 Hint: type "cd %pihome%\bin"
- c. Run the command apisnap PISRV01
- d. If the connection is successful, you should see the message:



e. Enter the tagname "sinusoid". Do you get a value?

Note: We will continue our discussion of the PI API and PI SDK protocols in the section "PI System Security Management".

Validating the availability of data on the OPC DA Server

The PI System is responsible for reliably collecting and storing data. However, there is not much the PI System can do if data is not available at the data source. This is one of the most common issues with newly installed PI Interfaces, so it is important to validate data availability before moving on to PI Interface configuration.

When the data source is an OPC DA Server, OSIsoft provides a tool for this step, called the PI OPC Client Tool, which is installed with the PI Interface for OPC DA. In the section "What is an OPC DA Server?" we explained the concepts "OPC Server" and "OPC Client". The PI OPC Client Tool is an OPC client published by OSIsoft, designed to allow users to view data on the OPC Server, without collecting it.

Of course, the PI OPC Client Tool is not the only OPC Client that can be used to view data. Most OPC Server vendors include an OPC Client with the installation of the OPC Server. It is also recommended to test the availability of data on the OPC Server using this vendor-specific OPC Client.

Lesson 4 – Understanding Importance of Buffering

Video: <u>OSIsoft: Configuring a Simple PI System Online Course - Setting up</u> <u>Buffering on an Interface Node</u>

Defining the PI Buffer Subsystem

What is the PI Buffer Subsystem?

The PI Buffer subsystem is an OSIsoft application installed with every PI Interface. Once configured, it buffers data on the PI Interface node. A good analogy for the PI Buffer Subsystem is a reservoir.



PI Buffer Subsystem

Under normal operation, when the valve to the Data Archive is open, data simply passes through the reservoir. When the valve closes (i.e. The Data Archive is down, or the network is down), as the PI Interface continues to collect data, this data will start accumulating in the reservoir.



PI Buffer Subsystem

When the valve opens again (the Data Archive, or network, are restored), the data will flush out of the reservoir and be sent to the Data Archive.

Note: There is another, older OSIsoft buffering service called the API Buffer Server. The PI Buffer Subsystem is the best option for most environments. The API Buffer Server should only be used if (1) the PI Server receiving the buffered data is older than version 3.4.375 and (2) the PI Interface runs on a non-Windows platform.

How does the PI Buffer Subsystem work?

The PI Buffer Subsystem runs as a Windows Service.

The PI Buffer Subsystem does not just buffer data from a PI Interface. It can actually buffer data from any application (OSIsoft or custom-built) which is writing data to a Data Archive.

When the PI Buffer Subsystem has been configured, instead of writing data directly to the Data Archive, PI API applications (such as PI Interfaces) write the data to a "shared memory buffer".

The PI Buffer Subsystem performs the following steps:

- 1) Reads data from the shared memory buffer and transfers it to its "snapshot table"
- 2) From the snapshot table, marks the data for compression
- 3) Writes the data to a memory-mapped buffer queue file
- 4) Reads data from the buffer queue and sends it to the Data Archive



Note: Exception and Compression are mechanisms by which data is filtered, so that only meaningful data is kept in the Data Archive. The PI Interface is responsible for Exception. The PI

Buffer Subsystem marks events as either **Snapshot Only** (i.e. get rid of this value when a new one comes in) or **To Be Archived** (store this value). The Data Archive then treats the data accordingly.

The files involved in this process are:

- 1) Shared memory buffer: The location in memory where PI Interfaces write data. When this location is full, data is written to a file on disk called APIBUF_<Data Archive name>.dat
- 2) Snapshot table (pibufmem_<GUID>.dat): This table holds the most recent value received for all buffered PI Points.
- 3) Buffer queue file (pibufq_<GUID>.dat): This is the file that acts as our "tank". The default size of this file is 32 MB. When the file becomes full, a second file is created. When this file becomes fill, a third file is created. This will continue until the PI Interface node runs out of disk space.

Note: PI SDK and AFSDK applications write data directly into the PI Buffer subsystem's snapshot table, and so the first step above is skipped.

Configure Buffering

Activity Objectives

Complete step 9 from the PI Interface installation methodology we outlined in this chapter:

Step 9: Configure buffering with the PI Buffer Subsystem

OSIsoft recommends using designated Windows Service Accounts to run PI System services that communicate over the network. Before starting, you made a request to your IT department to create a Service Account:

• PISCHOOL\svc-PIBuffer (password: student)

Approach

Part 1 – Configure the PI Buffer Subsystem

Step 1: From PIINT01, run the PI ICU. Navigate to Tools > Buffering.



Step 2: Select "Yes" to continue with the PI buffer subsystem configuration wizard



Step 3: Select "Continue with configuration".

Step 4: You should see the Data Archive "PISRV01" and the PI Interface name we configured earlier. Check the box and click "Next".

@	Buffering Manager - New Install Wizard
Buffering Manag Configuration, monitoring,	ger , and troubleshooting of buffering
Detected PI Interfaces PI Data Archive Security Buffering Configuration Verification	Detected PI Interfaces Confirm the PI interfaces and services for which you want to configure buffering. Servers that are not selected will not be buffered. Detected PI interfaces are listed by server.
	Buffer Server Status
	PI-opcint_ReadOnly1 Running
	Don't see all your PI interfaces? Want to add another service? Select a service.
View messages Detected	Pl Interfaces help Next Cancel

- **Step 5 :** This step ensures that the PI Buffer Subsystem will the granted the correct security on the Data Archive.
 - i. The default service account for the PI Buffer Subsystem is LocalSystem. This account has more privilege on the local computer than is needed. Before proceeding, we will change this service account to our dedicated domain account. Click on "Change" next to "LocalSystem"

@	Buffering Manager - New Install Wizard	_ L _		X
Buffering Manage Configuration, monitoring, a	er and troubleshooting of buffering			
Detected PI Interfaces PI Data Archive Security Buffering Configuration	PI Data Archive Security Review/update a mapping or trust for the selected PI Data Archive server. Windows account to run the PI Buffering service: LocalSystem Change			
Verification	Servers PISRV01 Secure Close of the constraint of the constrain			
	Pl identity Create Revert		Brow	se
View messages PI Data Arc	chive Security help Previous N	lext	Canc	el

ii. Select "Use Windows account". Enter the account "PISCHOOL\svc-PIBuffer" with password "student". Click on "Next".

@	Buffering Manager - New Install Wizard
Configuration, monitoring, Configuration, monitoring, Detected PI Interfaces Windows Security PI Data Archive Security Buffering Configuration Verification	Buffering Manager - New Install Wizard Image: Image
View messages Windows	Security help Previous Next Cancel

iii. Once you've returned to the security test window, we will create the PI Mapping we need to authenticate on the Data Archive. Click on "Browse..." in the PI Identity field, and select the identity we created earlier called "PI Interfae & PI Buffers", then click "OK".

0	Select PI Identity, PI Group, or PI User
Select from server PISRV0 Type: Pl identity Defining a PI mapp mapping.)1 v ing against a PI identity is the preferred method of configuring a PI
Name PI Coresight	Description
Pl Interfaces & Pl Bu PlEngineers PlOperators PlSupervisors	Any individual with engineering duties Any individual with operational duties Any individual with supervisory duties
	OK Cancel

iv. Once you return to the Data Archive Security window, click "Create". You should now have a green checkmark on this page. Click "Next".

R	Buffer	ing Manager - New Install Wizard	_ 🗆 🗙
Buffering Manage Configuration, monitoring, a	er and troubleshooting of bufferir	ng	
Detected PI Interfaces Windows Security PI Data Archive Security	PI Data Archive S Review/update a mapping of Windows account to run the	eCUrity r trust for the selected PI Data Archive server. PI Buffering service: PISCHOOL\PIBuffer Change	
Buffering Configuration Verification	Servers	PISRV01 Success Retry security test Authentication method: SSPI PI identity: PI Interfaces & PI Buffers PIWorld	Change
View messages PI Data Arc	chive Security help	Previous Next	Cancel

- Step 6: You can now select the Buffer Queues location. For this environment set the location to E:\OSIsoft\Buffering. If possible, it is strongly recommended to separate the buffer queue from the OS drive in order to avoid failure on the interface node by filling the main drive.
- **Step 7:** The last window will run a verification on the status of the PI Buffer Subsystem. If there is no errors, you can **exit the installation wizard**.

3	Buffering Manager - New Install Wizard	X
Buffering Manag	er	
Configuration, monitoring,	and troubleshooting of buffering	
Detected PI Interfaces Windows Security PI Data Archive Security Buffering Configuration Verification	Verification Check the health between PI Buffer Subsystem and each PI Data Archive server. PI Buffer Subsystem successfully started. PI Buffer Subsystem is now operational. Server Status PISRV01 Connected successfully	
	The upgrade to PI Buffer Subsystem is complete.	
View messages Verificatio	n help Exit new installation wi	zaro

- **Step 8 :** Once the installation wizard completed and closed the Buffering Manager window will open showing the status and statistics of the PI Buffer Subsystem. To re-open this window from the PI ICU, navigate to Tools > Buffering.
- **Step 9 :** Each interface must be configured individually to enable buffering from the PLICU general tab.

Port:	5450	
Buffering Status:	Off	Enable

In order to buffer data from a PI Interface, the PI Buffer Subsystem must start before all the PI Interfaces on the machine. Since both are run using Windows Services, it is possible to configure a dependency on the PI Buffer Subsystem.

You can verify the configuration by navigating to the PI ICU > Service tab, and verifying the "Dependencies" field. The PI ICU will automatically detect if a dependency on PIBufss is missing. Notice PIBufss is added to the interface service dependencies when we select "yes."



<mark>گر</mark>	PI Interface Configuration	on Utility - OPCInt_ReadOnly	1 – – ×
Interface Tools Help Interface: OPCInt_Rea Type: OPCInt Description:	PI Interface Configuratio	rension 4.6.2.4	PI Data server Connection Status PI Data server Connection Status PISRV01 Witeable tup Type Auto Manual Disabled Remove
PI SDK Disconnected Startup Debug IO Rate Interface Status	Password:	Adobe	ed services: beARMservice ^ bokupSvc DSvc fo v III > e Acrobat Update Service
Ready	Running	OPCInt_ReadOnly1 - Installed	

Part 2 - Validate buffering

A very important troubleshooting tool is how to verify whether data is truly buffering on our PI Interface node. Since version 4.3 of the PI Buffer Subsystem, this task has been made much easier with the introduction of the "Buffering Manager" GUI. Since this tool is not available with older versions, we will demonstrate how to verify the buffering status in both scenarios

Method 1: Buffering Manager

- Step 1: From PIINT01, Run the PI ICU. From the top of the window, select Tools > Buffering
- **Step 2:** In the Buffering Manager, the buffering statistics update in real-time to show the Global Buffering Status, the estimated buffer capacity, the events in queue, and the total events sent in real time:



To confirm that events are flowing through the buffer, make sure that the "total events sent" is increasing. The buffering manager will also report issues such as low disk space, important error messages, etc.

Method 2: Command line utility pibufss

- Step 1: From PIINT01, run a command prompt, navigate to the directory C:\Program Files\PIPC\bin Hint: type "cd %pihome%\bin"
- Step 2: Run the command pibufss -cfg

This command will show you the overall buffering status.

```
C:\Program Files\PIPC\bin>pibufss -cfg
*** Configuration:
Buffering: On (API data buffered)
Loaded physical server global parameters: queuePath=C:\ProgramData\OSIsoft\Buffering
authenticationOptions=SSPI;TRUST
*** Buffer Sessions:
    1 non-HA server, name: pisrv1, session count: 1
    1 [pisrv1] state: SendingData, successful connections: 6
    PI identities: PIBuffers, auth type: SSPI
    firstcon: 16-Jul-19 02:17:53, lastreg: 25-Sep-19 09:14:02, regid: 4
    total events sent: 144184296, snapshot posts: 17764427, queued events: 5
```

Step 3: Run the command pibufss -qs

This command will show you the statistics of the buffer queue file. A healthy buffer queue will have reads and writes from this file.

C:\Program Files\PIPC\bin>PIBUFSS	-QS		
Current buffered servers:			
1. pisrv1			
pisrv1 is automatically selected f	or the command.		
Current buffer sessions:			
1. pisrv1 (PISRV1)			
pisrv1 is automatically selected f	or the command.		
Counters for 25-Sep-19 09:51:59.38	994 (pibufq_6b93	fc02-590e-	4cd5-a39d-decf24ecbf46.00
00.dat)			
Primary File Size:	33554432	0	
Primary Page Size:	65536	0	
Primary Data Pages:	511	0	
Write Page Index:	8	0	
Read Page Index:	8	0	
Current Write Queue File:	0	0	
Current Read Queue File:	0	0	
Total Page Shifts:	8	0	
Available Pages:	510	0	(99.8%)
Average Events per Page:	0	0	
Estimated Remaining Capacity:	1288030	0	
Bytes in Primary File:	104	0	
Events in Primary File:	4	0	
Total Event Writes:	144181716	0	
Total Event Reads:	144181712	0	
Number of Queue Files:	1	0	
Events in Queue:	4	0	

Step 4: To stop the statistics, press Ctrl+C

Lesson 5 - Creating and Managing PI Points

Video: OSIsoft: Configuring a Simple PI System Online Course - Creating and Managing PI Points

Objectives

- Define a PI Point
- Describe the different point types
- Describe the basic point attributes
- Build and edit points with Point Builder
- Describe a digital state set
- Create a digital state set
- Create digital state points
- Build and edit points with the PI Builder add-in to Excel.
- Connect the OPC data to PI points

What is a PI Point?

A PI point is a unique storage point for data in the PI Server.



For more information see "PI Point Classes and Attributes" in PI Data Archive System Management Guide.

Some examples are:

- A flow rate from a flow meter (would use floating point [also known as float, real] data)
- A DCS controller's mode of operation (may use digital or discrete data)
- The batch number of a product (can use one of float, integer, or string data)
- Text comments from an operator (using string [character] data)
- The result of a calculation (float or integer data)
- Memory % usage in a server (uses floating point data)

Note: Some industries and customers use the term "tag." In the PI system, point, tag and data stream are synonymous.

Point Class

The Point Class is simply the name for a defined set of point *attributes*. The PI Data Archive is preconfigured with the point classes you will need. The typical PI System has no need for additional point classes.

All points are based on the **Base** point class. However, these points do not have the complete set of attributes required to collect data via an interface. Although points created by PI Connectors are of Base point class

The Classic point class contains all the Base point class plus all of the attributes required by the interface to connect to the data source and collect data.

Point Type

The PI Data Archive, designed to collect and store **time-series** data, can store almost any data type.

There is no absolute when selecting point type but matching the PI point type with the data type on the source is usually a good start. For example, if the data source indicates that the data collected is a REAL32 then you would most likely use Float32 (a 32-bit floating-point value).

Creating and Managing PI Points with SMT

There are many ways to create points in the PI Server. Throughout the course, we will show you the most common.

One tool that may be used to build and edit points is **Point Builder** in PI SMT.

The Point Builder plug-in for PI SMT is a graphical tool that allows the user to create and edit PI points. This tool allows the system manager to set the attributes for each point individually during PI point creation and allows you to edit them afterward. Some attributes are system assigned and cannot be changed.

Another tool tool best suited to bulk build and edit points is **<u>PI Builder</u>**.

The PI Builder is an add-in to Microsoft Excel. The spreadsheet format is convenient when viewing and editing in bulk, with a row for each point or element and a column for each attribute.

PI Builder requires the spreadsheet to have the following layout:

• The attribute names are listed in the top row.

- The point names are listed in the second column.
- Each point has its attributes listed under the headings in the top row, one point per row.
- Select a point row by putting **X** in the first column. Import or export operations are performed on these selected points only.

PI Point Attributes and PI Interfaces

Remember the statement, "always reading the documentation manual"? Each interface can use point attributes in a different manner. That is why each interface documentation specifies what point attributes are used and how.

Listed below are the common point attributes and how they are **commonly** used.

ALWAYS consult the interface manual!

Instrument Tag	Name of the point/location in the source data system. Often it must match the data source exactly!		
Extended Descriptor	Place for detailed query instructions.		
Future Data	If defined as 'Allow' it means that events with time stamps in the future may be stored.		
Exception Specifications	Defines a significant change in value.		
Point Source	Must match the value set in the interface configuration. See the /PS parameter in the interface start-up file.		
Location1	Typically, the Location1 field is used for the interface instance number (/ID)		
Location4	Typically, the field is the scan class number. (/f)		
Scan	Include the PI point in the list of points to scan (always set to ON)		

Lesson 6 - Troubleshooting a PI System

Message Logs

The first step in troubleshooting is always the same: check the message logs! All PI System software write messages to log files. It is therefore important to learn which log files to check, and how to read them.

1. PI Message Logs

Also known as the "SDK Logs", these are the logs of all applications based on the PI SDK. There is one PI Message log per computer where an SDK application is installed. The logs are managed by the PI Message Subsystem.

Applications that write to this log:

- Data Archive subsystems
- PI Interfaces (UniInt version 4.5.0.x and later)
- PI Client applications

How to access these logs:

- On the Data Archive: SMT > Operations > Message Logs
- On all computers with PI-SDK 1.4.0 and greater:
 - **Step 1**: Run the program "PISDKUtility"
 - **Step 2:** In the left pane, select Tools > Message Logs
 - **Step 3**: Set the filters to obtain messages (start time, severity, etc.)

Step 4: Click on "Get Messages"

🥐 PI SDK Utility (Administ	rator)		
File Buffering Tool	s Help		
PI SDK About PISDK Connections Snapshot Tool	P Get Messages Piters Time Filters Start Time: * End Time: *-1h	Source1: * Severity: Del	bug 👻
Message Log	Time	Severity	Message 4
 Support Data Error Lookup Tracing Setup KST Cleanup 	14/04/2016 2:19:08.675 PM 14/04/2016 2:19:08.675 PM 14/04/2016 2:19:08.675 PM 14/04/2016 2:19:08.675 PM 14/04/2016 2:19:08.675 PM 14/04/2016 2:19:08.675 PM 14/04/2016 2:17:08.08501 PM 14/04/2016 2:17:08.08501 PM 14/04/2016 2:17:08.08501 PM 14/04/2016 2:17:08.08501 PM 14/04/2016 2:17:08.08501 PM 14/04/2016 2:17:08.08501 PM	Information Information Debug Debug Information Information Information Information Information Debug Debug Information Inform	Disconner Disconner ID: 1172; ID: 1171; Deleting c Disconner Disconner ID: 1170; ID: 1169; Deleting c Deleting c
	14/04/2016 2:16:58.8058 PM	Error	Error conr
	206 messages retrieved		

- On a PI Interface node: PI ICU > Press the "View Current PI Message Log continuously" button
- On all computers, you can use the command line utility pigetmsg.exe
 - Step 1: Open a command prompt window
 - **Step 2**: Change the directory to pi\adm or pipc\adm
 - **Step 3**: Type **pigetmsg –f** to view the logs continuously
 - **Step 4 :** For more filtering options, type **pigetmsg -?**

2. Event Logs

Event Logs are the centralized logs on a Windows machine. There are two different types of logs:

- Windows Logs: These logs includes all important events on the operating system, split up into the following categories: Application, Security, Setup, System and Forwarded Events.
- Applications and Services Logs: These logs are specifically for applications, with each application writing to its own log.

PI System applications write to the Windows Application Log, and sometimes to a dedicated log under Applications and Services.

It's also a good idea to look at the other Windows logs (Security, System) if you suspect an issue might have occurred at the operating system level.

Applications that write to these logs:

- AF Application Service
- PI Analysis Service
- Data Archive Subsystems (occasionally)

How to access these logs:

- Step 1: Run the application "Event Viewer"
- Step 2: To access the Windows Application log, browse to Windows Log > Application. Look at the "Source" column to find messages written by PI System applications. You can also use the filter functionality of Event Viewer.
- **Step 3 :** To access a specific application's log, browse to Application and Services Logs, then find the name of your application (e.g. AF)

🛃 Event Viewer				
File Action View Help				
🗢 🔿 🔰 🖬 🚺 🖬				
Event Viewer (Local)	Application Number	of events: 23,177		Actions
E Gustom Views	Level Da	te and Time	Source	Application 🔺
Application	 Information 4/1 	13/2016 5:57:05 PM	PISDK	💣 Open Saved Log
Security	Information 4/1	13/2016 5:57:00 PM	pitotal	😽 Create Custom View
Setup	Information 4/1	13/2016 5:56:59 PM	WindowsAzureTelemetr	Import Custom View
Forwarded Events	Information 4/1	13/2016 5:56:57 PM	pisnapss	Charles
Applications and Services Logs	Information 4/1	13/2016 5:56:57 PM	PISDK	
AF	Information 4/1	13/2016 5:56:56 PM	PISDK 🔹	Filter Current Log
Internet Explorer				Properties
Key Management Service	Event 2, pisnapss		×	Find
⊞ Microsoft ∭ Microsoft Office Alerts	General Details			Save All Events As
				Attach a Task To this Log
⊕ OSIsoft-PISystemSearch ⊕ OSIsoft-Search ⊕ OSIsoft-Search ⊕	Starting PI process pisnapss.			View
E PIWebAPI				Q Refresh
Windows Azure				👔 Help 🕂 +
G Subscriptions	Log Name:	Application		Event 2, pisnapss
	Source:	pisnapss	Logged:	Event Properties
	Event ID:	2	Task Category:	💿 Attach Task To This Event
	Level:	Information	Keywords: I	Сору
	User:	N/A	Computer: I	Save Selected Events
	OpCode:			Q Refresh
	More Information:	Event Log Online Help		
			Þ	
	<i>p</i>			ny

3. PIPC Logs

These logs are only used by older, PI API based applications. You should only need to access these logs if you are running older software.

Applications that write to these logs:

- PI Interfaces with a UniInt version earlier than 2.5.0.x
- PI API based applications

How to access these logs:

- On a PI Interface node: PI ICU > Press the "View current pipc.log continuously" button
- Open the file PIPC\dat\pipc.log

Where to Look for Answers

So you found an error message, now what? There are a few resources you can use to translate that message and find your solution:

1. Search for a Solution on the Tech Support website (https://techsupport.osisoft.com/Troubleshooting/)

This solution search crawls all of our online resources, including product documentation, Knowledge Base (KB) articles, PI Square forum discussions, Known Issues, and more.

2. Search the PI Live Library (<u>https://livelibrary.osisoft.com</u>)

This is an online repository of OSIsoft documentation. It contains all of the up to date administration and user guides for our products.

- 3. Ask the community on PISquare (<u>https://pisquare.osisoft.com</u>)
- 4. Contact OSIsoft Tech Support! (<u>https://my.osisoft.com</u>)

When contacting Technical Support, always make sure to have the following information on hand:

- a. A clear description of the issue
- b. Product and version information
- c. A copy of the relevant message logs
- d. Relevant screenshots, and if possible, steps to reproduce the issue
- e. Urgency and Impact of this case
- f. Your PI Server Serial Number (SMT > Operation > Licensing > InstallatonID)