PI WebParts 2013: User and Administrator

Version 2014

Conventions

The following conventions are used throughout this book.

Bulleted List — This represents different ideas on a topic.

- Item 1
- Item 2
- Item 3

Numbered lists — This represents a list of steps with a specific order to respect.

1. Item1
2. Item 2
3. Item 3

A **bold** font is to emphasize user interface element names, including names of buttons, dialog boxes, and menu items; it also highlights processes, utilities, system components and modules.

A `Consolas` font is used for code or computer input by the user or output to the display, also for filenames and path names and formulas.

A `Consolas` font with a border like the figure below represents a block of code.

```
' Variables / Objects.
Dim myvar as string
Myvar = …
```

A `Consolas` font with a border like the figure below represents a block of SQL query.

```
SELECT … FROM TABLE WHERE …
```

An *italic* font is used as placeholders for variables or information unknown that will be determined by you, the reader.

An underlined blue font is used to report URL.

The content you will retrieve in this rectangle is important and requires your attention.

This image represents:

- A group recap question to verify understanding of the material;
- A directed exercise (green);
- A self-paced exercise (blue).

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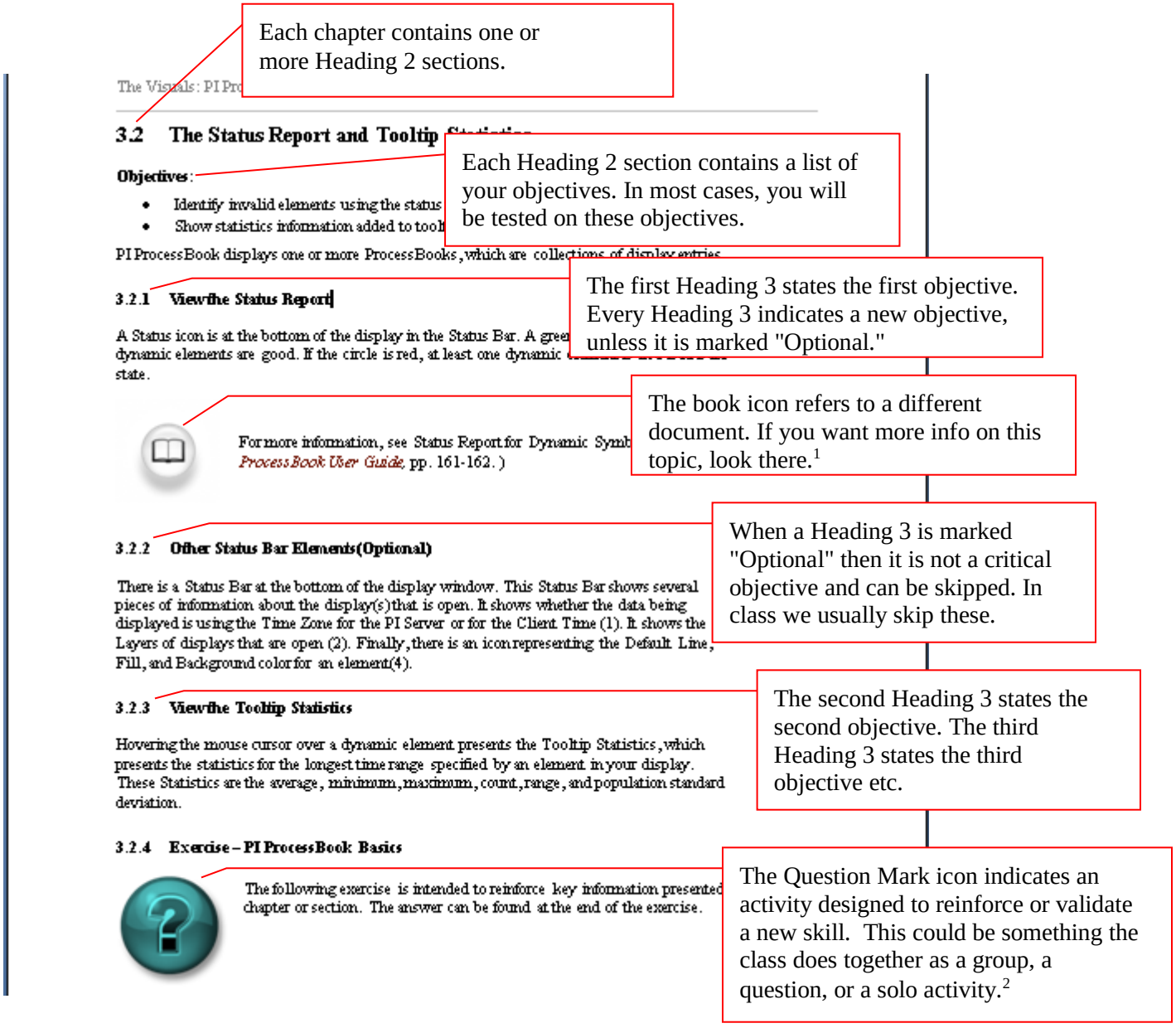
How to Use this Class Workbook



[1] Most of these references are to user manuals that can be downloaded from http://techsupport.osisoft.com > Download Center > Documentation > User Manuals. (Login to an OSIsoft technical support account is required.) Use the "Product" drop down list box to choose the correct user manual.

[2] You can download solutions to the self-paced exercises at http://training.osisoft.com > Downloads > Training Materials. Click on a class and download the .zip file that contains the class workbook and exercise solutions. (Login to an OSIsoft technical support account is required.

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1 PI System Basics

1.1 What is a PI System?

Objectives

- Define the components of a PI System.
- Draw a diagram of the architecture of a PI System.

1.1.1 The PI System Described

The PI System collects stores and manages data from your plant or process. You connect your data sources to one or more PI Interface Nodes. The Interface Nodes get the data from your data sources and send it to the PI Data Archive. Users get data from the PI Data Archive and display it with client tools.

There are generally the parts involved in a PI System:

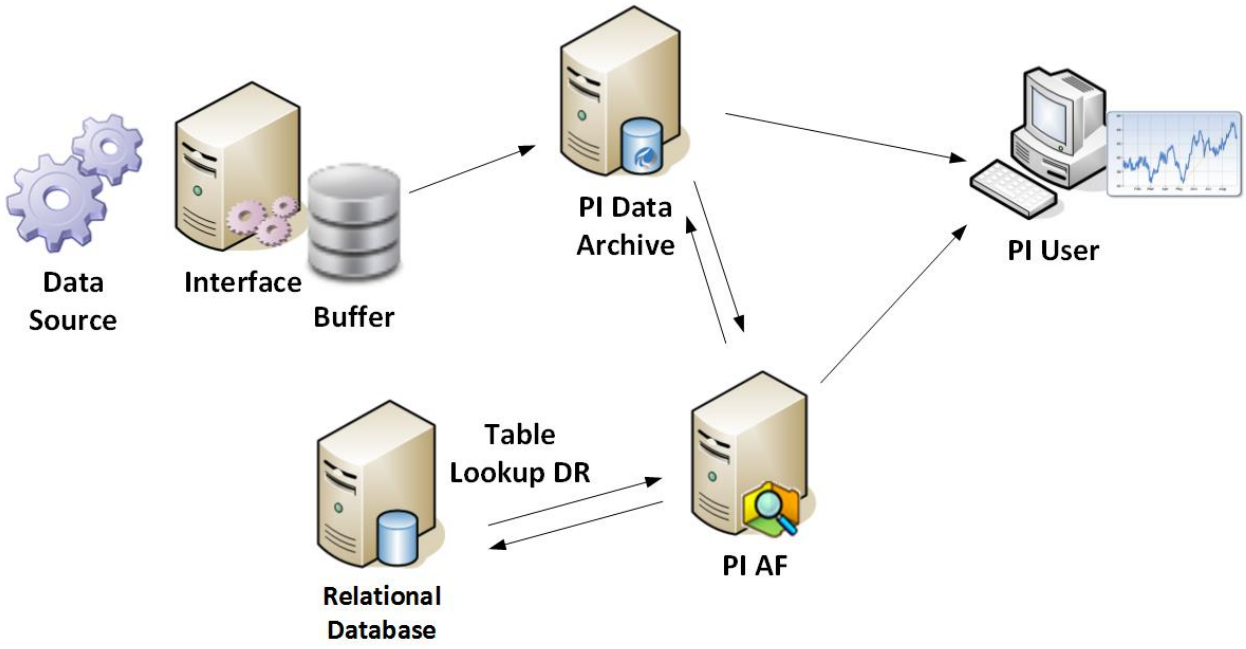

Figure1.1: PI System Data Flow

Data is collected from the source by the PI Interface program hosted by the acquisition node. The data is sent to the PI Data Archive (asset data can be contained in the PI AF server). It is read from the PI System by the PI Visualization Suite (PVS), like PI ProcessBook.

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1.1.2 Architecture of a Typical PI System

Sometimes the architecture can be very simple. Some customers have as few as one or two interfaces feeding data to a PI Data Archive, from which the data can be read through various applications.

The PI Server = PI Data Archive + PI Asset Framework

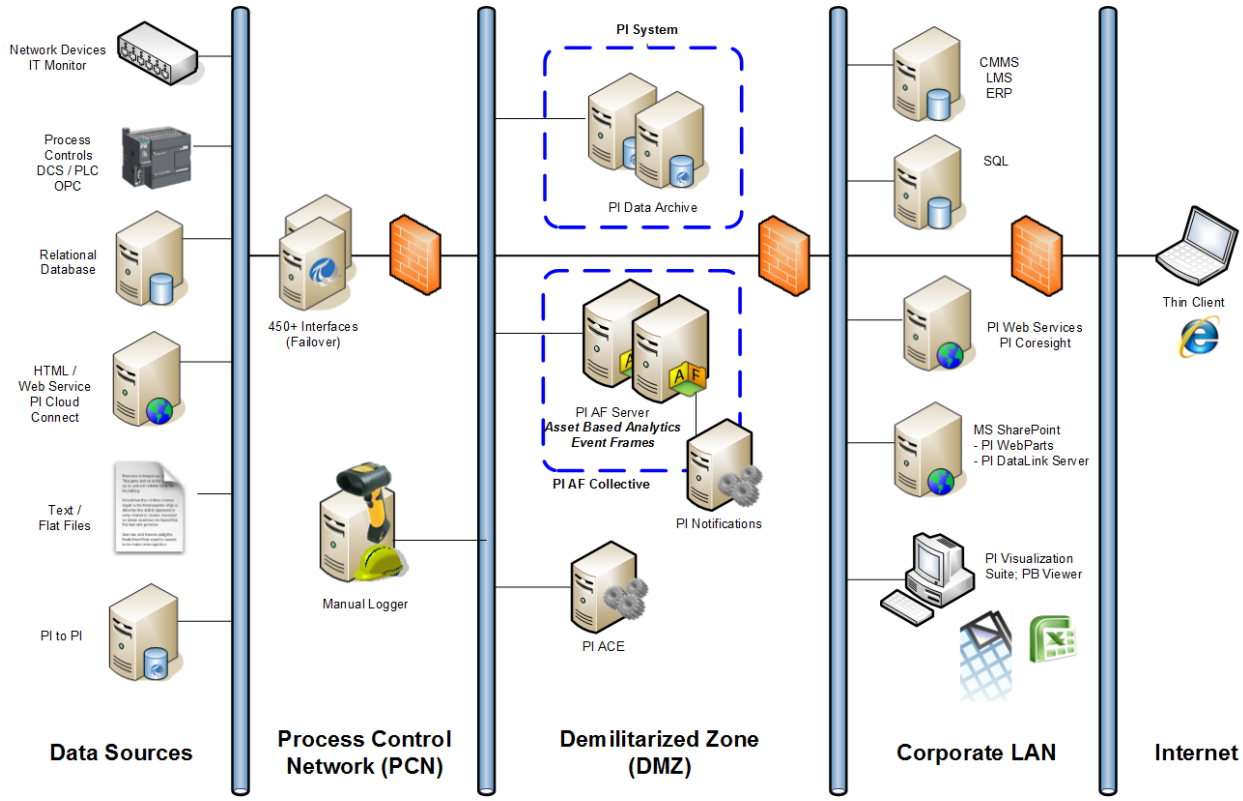

Figure1.2: PI System Architecture

In some companies, there are many PI Data Archives used for aggregating data.

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1.2 Assets and PI Points – The Basic Building Blocks in the PI System

Objectives

- Define the terms of PI Asset Framework (AF) asset and its components: elements and attributes.
- Define PI AF attribute types: static (none), PI Point, point array, formula, string builder, and table lookup.
- Create tags through PI AF PI Point Data Reference.
- Define the different data types that can be stored in PI Data Archive tags.

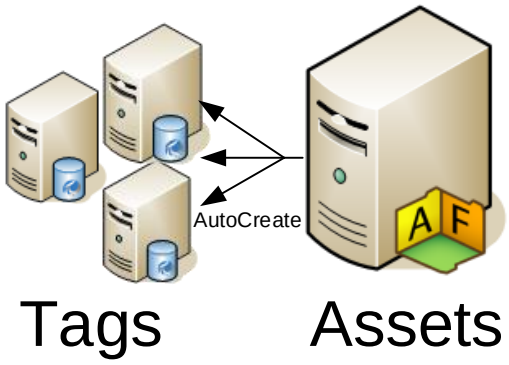

Figure 1.3: Tag Auto Creation

1.2.1 What is an Asset?

The PI AF Server is a part of the PI System. It contains asset or "metadata" usually organized according to the assets containing the attributes being monitored. PI AF can be helpful to users of the PI Data Archive who know the assets, but are not familiar with attribute nomenclature. With assets, data can be located without understanding the technical details of each piece of equipment. Organized assets help find all of the attributes associated with a specific piece of equipment.

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1.2.2 Directed Activity – Assets defined

You are invited to watch what the instructor is doing or perform the same steps at the same time to explore the different concepts presented in this chapter or section.

Problem Description

Identify the type of information represented in the PI AF Server.

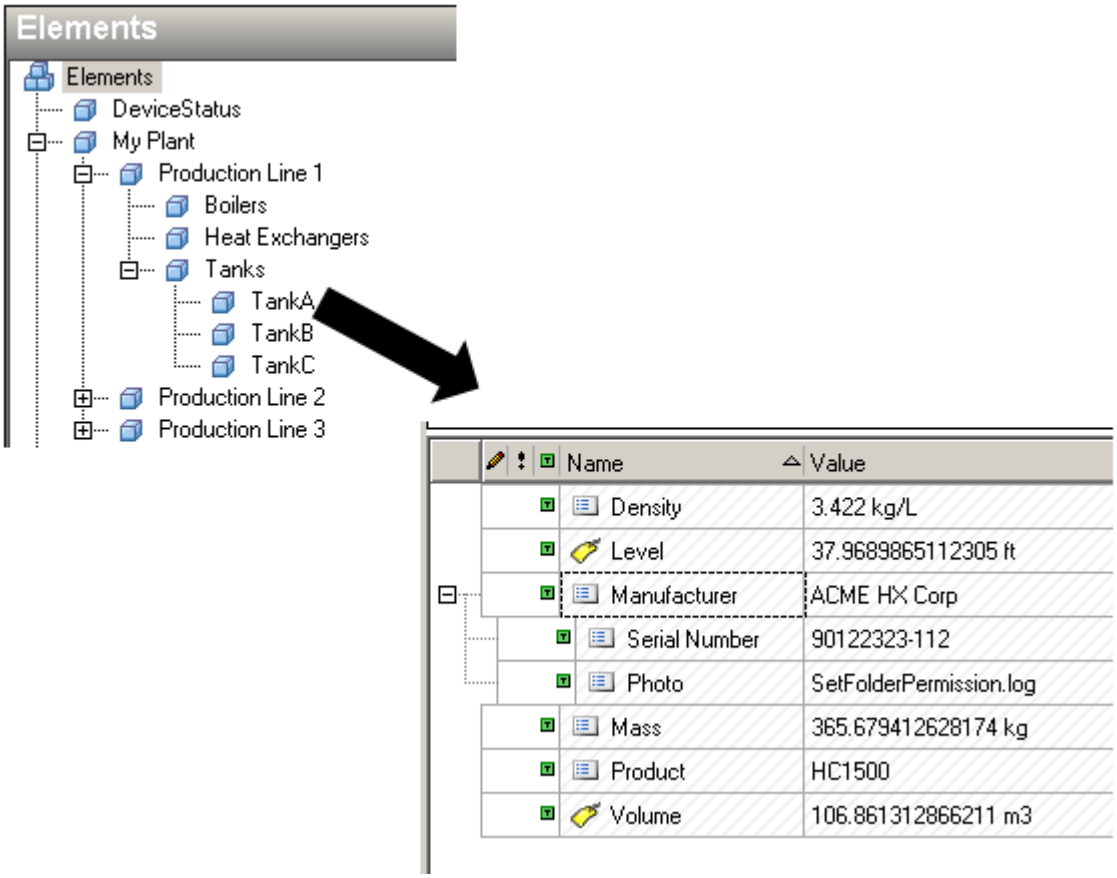

Figure 1.4: Attributes of an Element

List the data reference types for available for attributes.

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1.2.3 What is a PI AF Attribute?

Attributes represent a unique property associated with an asset. The attribute maybe a constant, a value from an internal PI AF table, a value from an external database or a storage point for data in the PI Data Archive. A PI AF attribute is simply a single point of measurement. The tag has been the traditional storage method of data in the PI Data Archive. The PI AF Server can automatically generate tags as assets are created.

1.2.4 Directed Activity – What Types of Data Can the PI Data Archive Store? (Point Types)

You are invited to watch what the instructor is doing or perform the same steps at the same time to explore the different concepts presented in this chapter or section.

Problem Description

The answer is pretty much everything. The crossword contains possible point types.

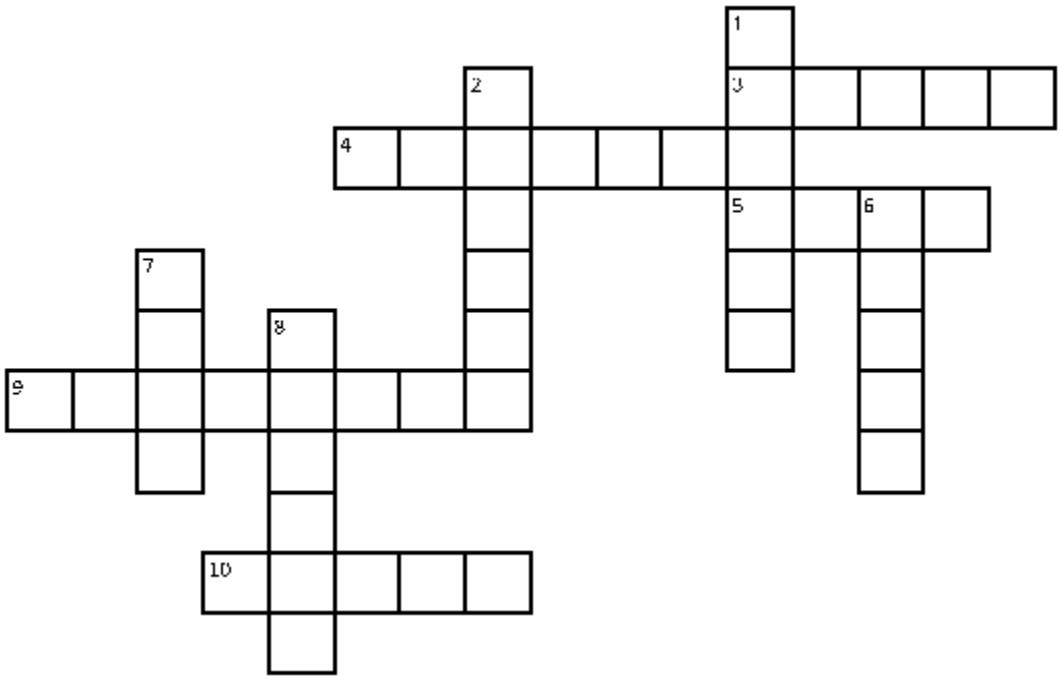

Figure 1.5: Data Types Crossword

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Across

3. Integer value, 32 bits (-2147450880 to 2147483647)
4. Discrete value (On/Off, Yes/No)
5. Global unique identifier – usually 128 bits long and formatted in chunks 8-4-4-4-12
9. Any Time/Date in the range 1-Jan-1970 to 1-Jan-2038
10. Integer value, 16 bits (0 to 32767, acc: 1/32767)

Down

1. Floating Point number, 32 bits (single precision)
2. Floating Point number, 64 bits (double precision)
6. Integer value, 64 bits (-2^{63} to 2^{63} -1).
7. 8 bits – generally used to represent an alphanumeric character
8. Text value up to 976 characters

1.2.5 Directed Exercise – Data types

You are invited to watch what the instructor is doing or perform the same steps at the same time to explore the different concepts presented in this chapter or section.

Problem Description

Identify the *pointtype* attribute that might be associated with each of the following:

Example: A temperature sensor: Float32

A switch position: _____

A Batch ID: _____

Operator comments: _____

The results of a calculation: _____

Memory available on a server: _____

Current phase of the reaction: _____

Current product count: _____

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1.2.6 Some Basic Properties and Why They are Important to You

PI AF attributes and PI Data Archive tags have a set of properties that define them. Some common properties used in client tools are for display or informational purposes.

Attribute name

The attribute name is similar in concept to the tag description. A detailed name for the attribute may help the user identify the source of the information.

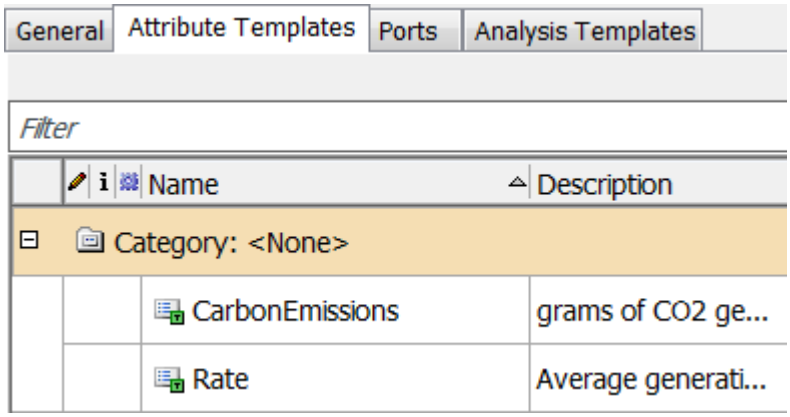

Figure 1.6: Attribute Name

Tag name

Unique name is used to create tags for storage in the PI Data Archive. Tags for data attributes storage can be built through PI AF templates using substitution parameters for ***local naming convention*** **or can be searched for on the PI Data Archive.** Creating tags through templates, lends consistency in nomenclature making searches easier for PI Administrators. For example, which might be easier to locate in a search?

Tag: M03_E1P1_MOTDRV1202_RUNSTAT

Attribute: Machine3 Enclosure 1 Panel 1 Motor Drive 1202 Run Status

---

Substitution parameters are variables placed in attribute templates for PI point and PI point array data references representing portions of the PI AF hierarchy.

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For example, %Element% is a substitution parameter that represents the element name. After you create an element based on that template, you tell PI AF to create the data reference. When PI AF creates the reference, it substitutes the current element name wherever %Element% is present.

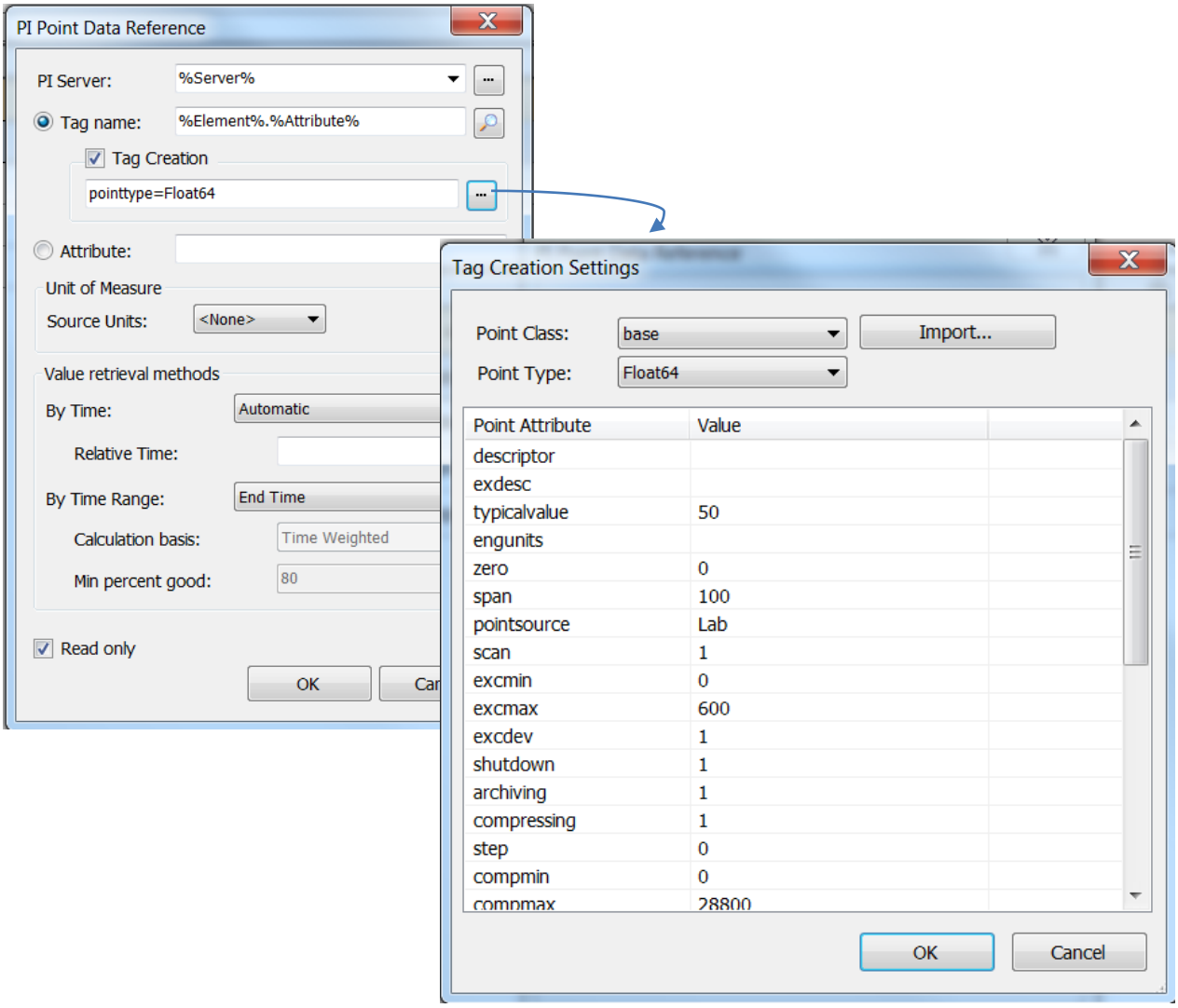

Figure 1.7: Point Attribute Settings for Tag Creation

Descriptor

This is the human-friendly description of the PI Data Archive Tag, similar to the attribute. The descriptor is often a **search criterion** since the tag name is not always intuitive. Often the tag name is some sort of abbreviated convention and the descriptor captures the "full name."

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Point source

Tags can be related to their interfaces that collect the data by a point attribute called ***pointsource***. Grouping by point source allows all of tags associated with a particular device to be identified by searching for all tags of a certain **point source**. This assumes that the user knows the point sources in use and that will not be true in most situations.

Point type

The PI point attribute that specifies the data type for the values that a point stores. The possible point types include int16, int32, float16, float32, float64, digital, string, BLOB, and timestamp.

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1.3 Time and the PI System

Objectives

- Define the time abbreviations in the PI System.
- Define the time expressions in the PI System.
- Explain how the PI System handles times zones and daylight savings time (DST).

You can use a special syntax, called PI System time, when specifying inputs for time stamps and time intervals. The PI System time uses specific abbreviations, which you combine to create time expressions.

1.3.1 PI System time abbreviations

When specifying PI System time, you can use specific abbreviations that represent time units and reference times.

Abbreviation	Time unit
s	second
m	minute
h	hour
d	day
mo	month
y	year
w	week

Table 1.1: Time Unit Abbreviation

To specify time units, you can specify the abbreviation, the full time unit, or the plural version of the time unit, such as s, second, or seconds. You must include a valid value with any time unit. If specifying seconds, minutes, or hours, you can specify a fractional value. You cannot specify fractional values for other time units.

Abbreviation	Full version	Reference time
*		Current time.
t	today	00:00:00 (midnight) of the current day
y	yesterday	00:00:00 (midnight) of the previous day
sun	sunday	00:00:00 (midnight) on the most recent Sunday
mon	monday	00:00:00 (midnight) on the most recent Monday

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Abbreviation	Full version	Reference time
tue	tuesday	00:00:00 (midnight) on the most recent Tuesday
wed	wednesday	00:00:00 (midnight) on the most recent Wednesday
thu	thursday	00:00:00 (midnight) on the most recent Thursday
fri	friday	00:00:00 (midnight) on the most recent Friday
sat	saturday	00:00:00 (midnight) on the most recent Saturday
YYYY		00:00:00 (midnight) on the current day and month in year *YYYY*
M-D or *M/D*		00:00:00 (midnight) on the *D*th day of month *M* in the current year
DD		00:00:00 (midnight) on the *DD*th day of the current month

Table 1.2: Reference-time Abbreviation

1.3.2 PI System Time Expressions

The PI System time expressions can include a reference-time and a time offset, indicated by a direction (either + or -) and a time unit with a value. PI System time expressions might include:

- Only a reference time, such as y
- Only a time offset, such as +3h
- A reference time with a time offset, such as y+3h

A reference time can be a fixed time, such as 24-aug-2012 09:50:00, or a valid reference-time abbreviation, such as t.

You can only include one time offset in an expression. Including multiple offsets can lead to unpredictable results. For example, the following time expressions are not valid:

```
*+1d+4h
t-1d+12h
```

1.3.3 Time-stamp Specification

To specify inputs for time stamps, you can enter time expressions that contain:

Fixed times

A fixed time always represents the same time, regardless of the field or the current time.

Input	Meaning
23-aug-12 15:00:00	3:00 p.m. on August 23, 2012
25-sep-12	00:00:00 (midnight) on September 25, 2012

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Reference-time abbreviations

A reference-time abbreviation represents a time relative to the current time.

Input	Meaning
*	Current time (now)
3-1 or 3/1	00:00:00 (midnight) on March 1 of the current year
2011	00:00:00 (midnight) on the current month and day in the year 2011
25	00:00:00 (midnight) on the 25th of the current month
t	00:00:00 on the current date (today)
y	00:00:00 on the previous date (yesterday)
tue	00:00:00 on the most recent Tuesday

Reference-time abbreviations or fixed times with a time offset

When included with a fixed time or a reference-time abbreviation, a time offset adds or subtracts from the specified time.

Input	Meaning
*-1h	One hour ago
t+8h	08:00:00 (8:00 a.m.) today
y-8h	16:00:00 (4:00 p.m.) the day before yesterday
mon+14.5h	14:50:00 (2:30 p.m.) last Monday
sat-1m	23:59:00 (11:59 p.m.) last Friday
1-jan-11-1d	00:00:00 (12:00 a.m.) 31 December 2010

Time offsets

Entered alone in a time field, time offsets specify a time relative to an implied reference time. The implied reference time depends on the field where you enter the expression:

- For a start time, the reference time is the current clock time.
- For an end time, the reference time is the start time.
- For a single time stamp, the reference time is the current clock time.

Time field	Input	Meaning
Start time	-1d	One day before the current clock time (24 hours before the current clock time)
End time	+6h	Six hours after the start time
End time	-30m	30 minutes before the start time
Time stamp	-15s	15 seconds before the current clock time

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1.3.4 Time Zone Differences and DST?

The short answer is, we don't!

When we collect data, we convert it to UTC (Universal Coordinated Time), or what used to be called Greenwich Mean Time (GMT). This means that each day has exactly 24 hours. The local machine clock of the user looking at the data makes any adjustments for time, such as time zone or DST.

If your region observes DST, once a year the day will look like it has 23 hours and another 25, but the PI Server never knows anything other than 24-hour days.

In addition, because the clients and PI Server know what time zone they are in, the data can be viewed with respect to the *server time* or the *client time*. This is determined by a setting in the client tool.

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1.3.5 Directed Exercise – PI System Times

You are invited to watch what the instructor is doing or perform the same steps at the same time to explore the different concepts presented in this chapter or section.

Problem Description

Determine the "real" dates and times indicated by the PI System times in the table below:

Abbreviation	Answer
* - 30m	
y + 8h	
T	
Y	
12 8:	
Thursday	
* + 1h (why is this useful?)	
Tuesday – 2d	

Express the following times in valid PI System time abbreviations:

Abbreviation	Answer
Today at 6:00 AM	
Monday at 6:30 am	
12 hours ago	
The first day this month	
The end of the week - Friday	
7:00 am yesterday	
15 minutes ago	

How many ways can you express 8am today using PI System time expressions?

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1.4 Finding Data

Objectives

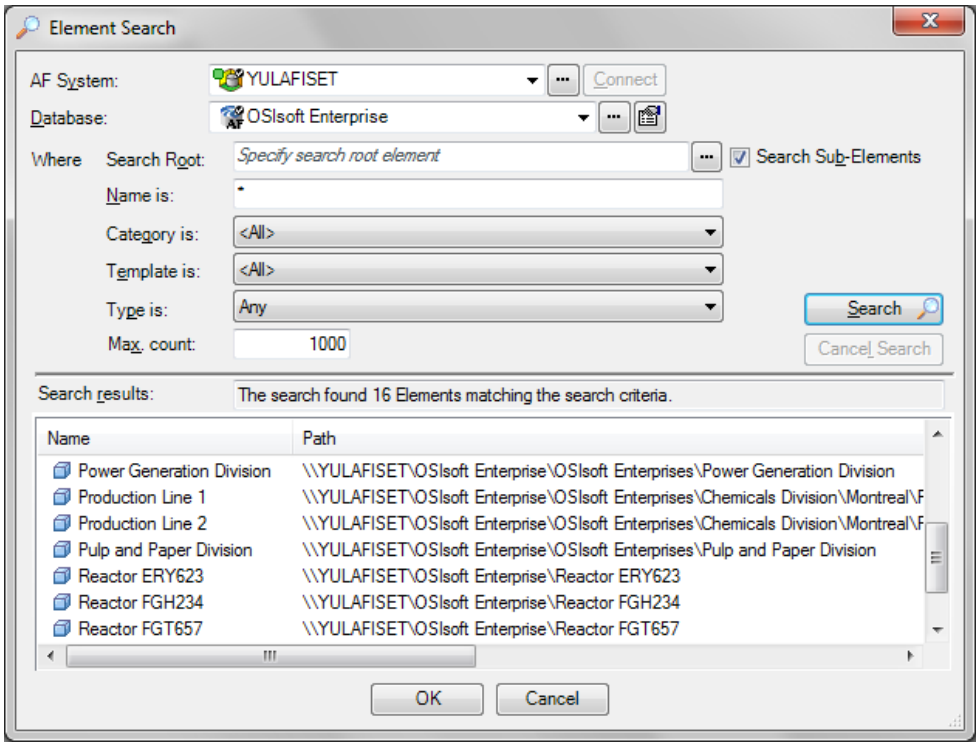
- Demonstrate the ability to find element data within the PI Asset Framework (AF) hierarchy.
- Demonstrate the ability to search for tags from within PI System Explorer (PSE).
- Examine point attributes.

1.4.1 Finding Data in the PI Asset Framework Server

Most PI applications will give you the option of searching for elements or element attributes. When you drill down to an element, you can inspect its attributes.

Elements represents assets. Element attributes reflects data from PI tags, PI AF tables, external SQL databases, etc.

Below are examples of search results.



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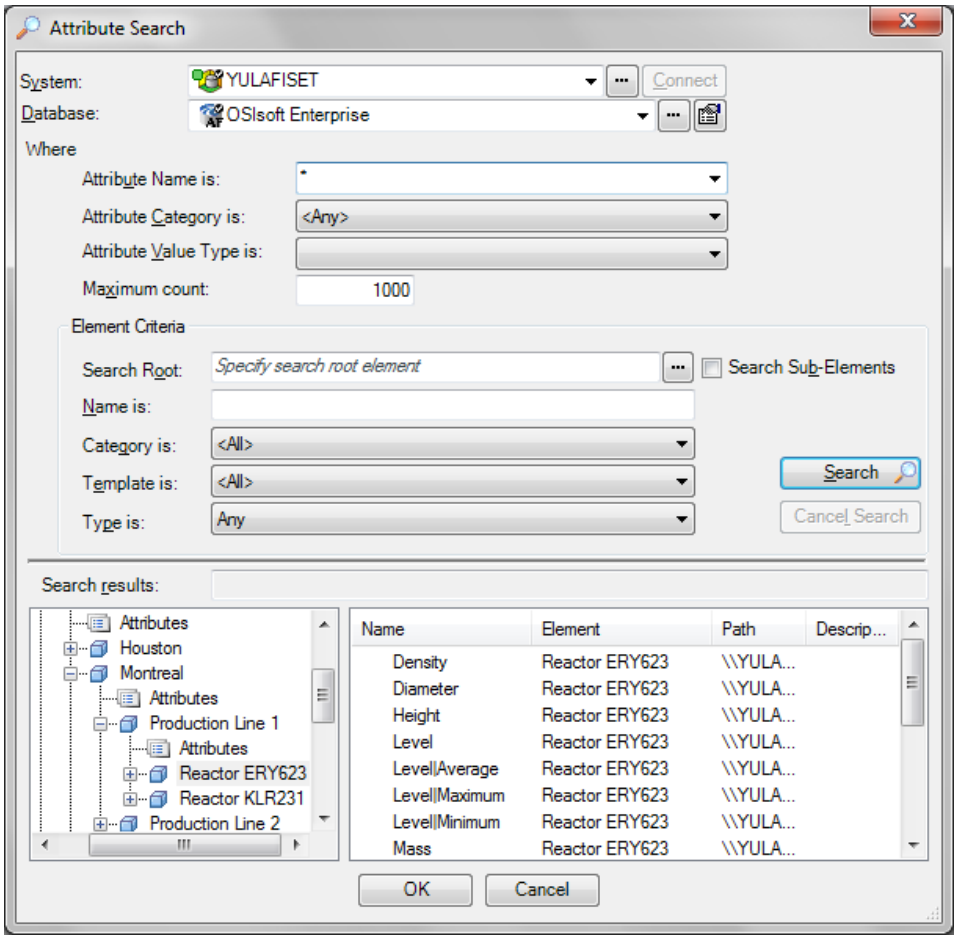
In the majority of cases, you will be looking at data contained in elements, just as you would have looked at tag data.



The advantage to using elements and attributes over tags is that you can clearly see what other data is associated with an asset – something you cannot determine using tags,

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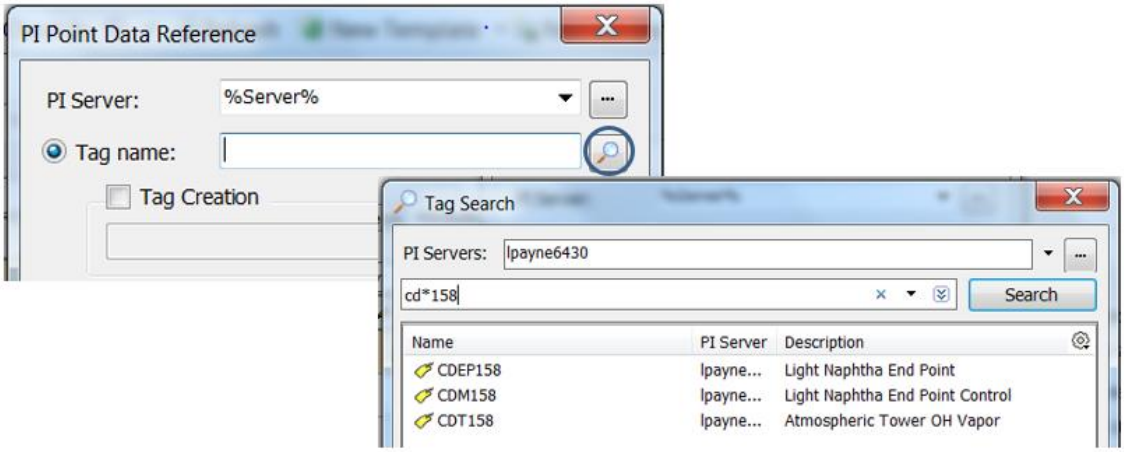
1.4.2 Search for PI Tags

Tag search is another common functions performed by users.



Use * to replace any number of characters like in this example:

cd*158 = CDEP158, CDM158, CDT158

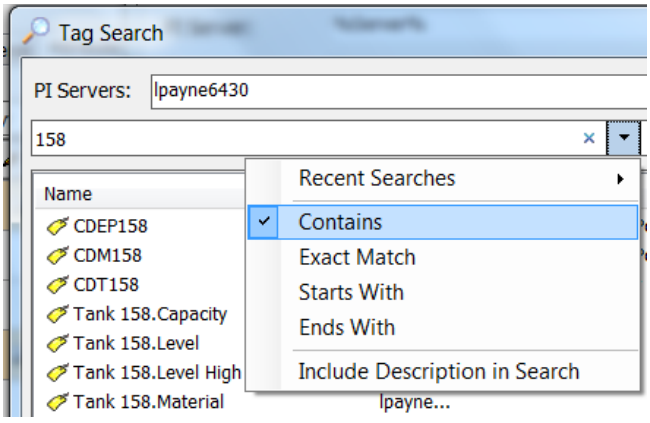
Use ? to replace one character like in this example:

cd?158 = CDM158, CDT158

cd??158 = CDEP158

Some applications will use different formats, but they all accomplish the same functions.

In place of using wildcards, search criteria options are available to aid in identifying tags.



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1.4.3 Look at Point Attributes Using a Common Dialog Window

The way we collect, aggregate, and store data is all determined by a tag's configuration – called point attributes.

Common point attributes reviewed earlier included the tag name, point source and description.

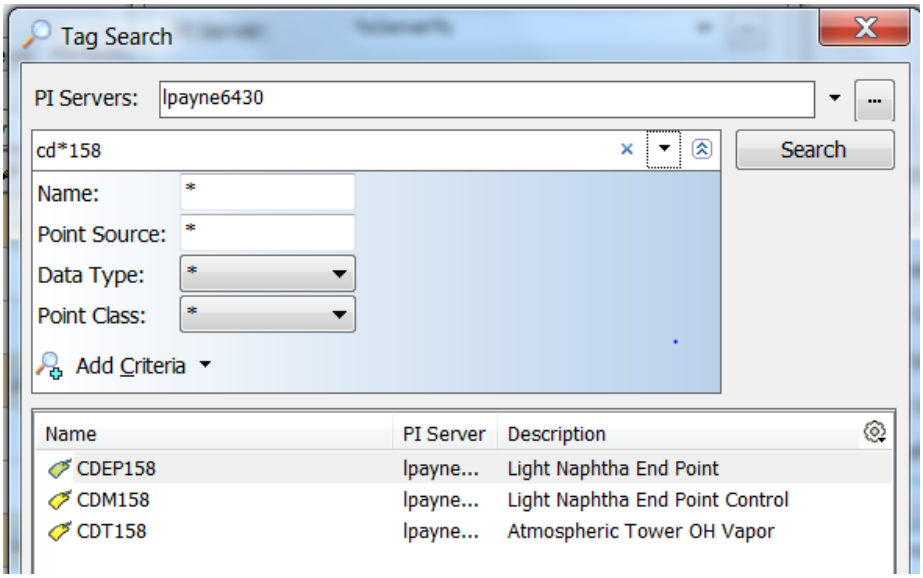

Figure 1.8: Common attribute search fields

Have you ever wondered how to view tag attributes?

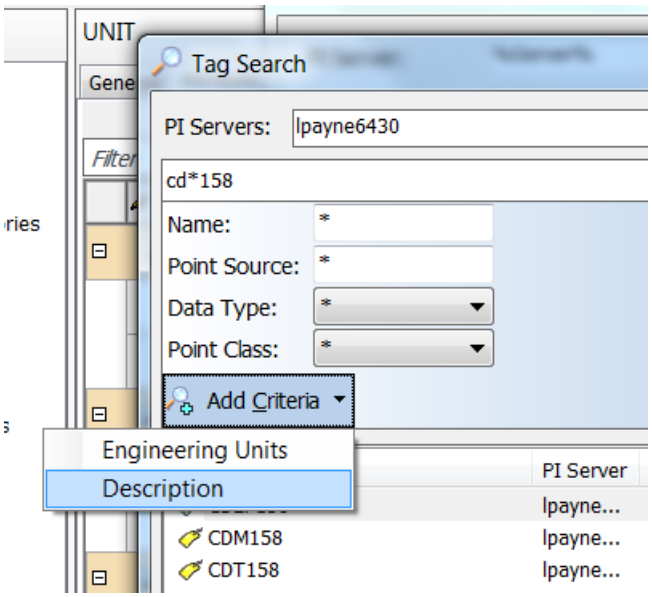

Figure 1.9: Additional attributes available during searches

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Simply open a tag search, find a tag, and right click then select properties.

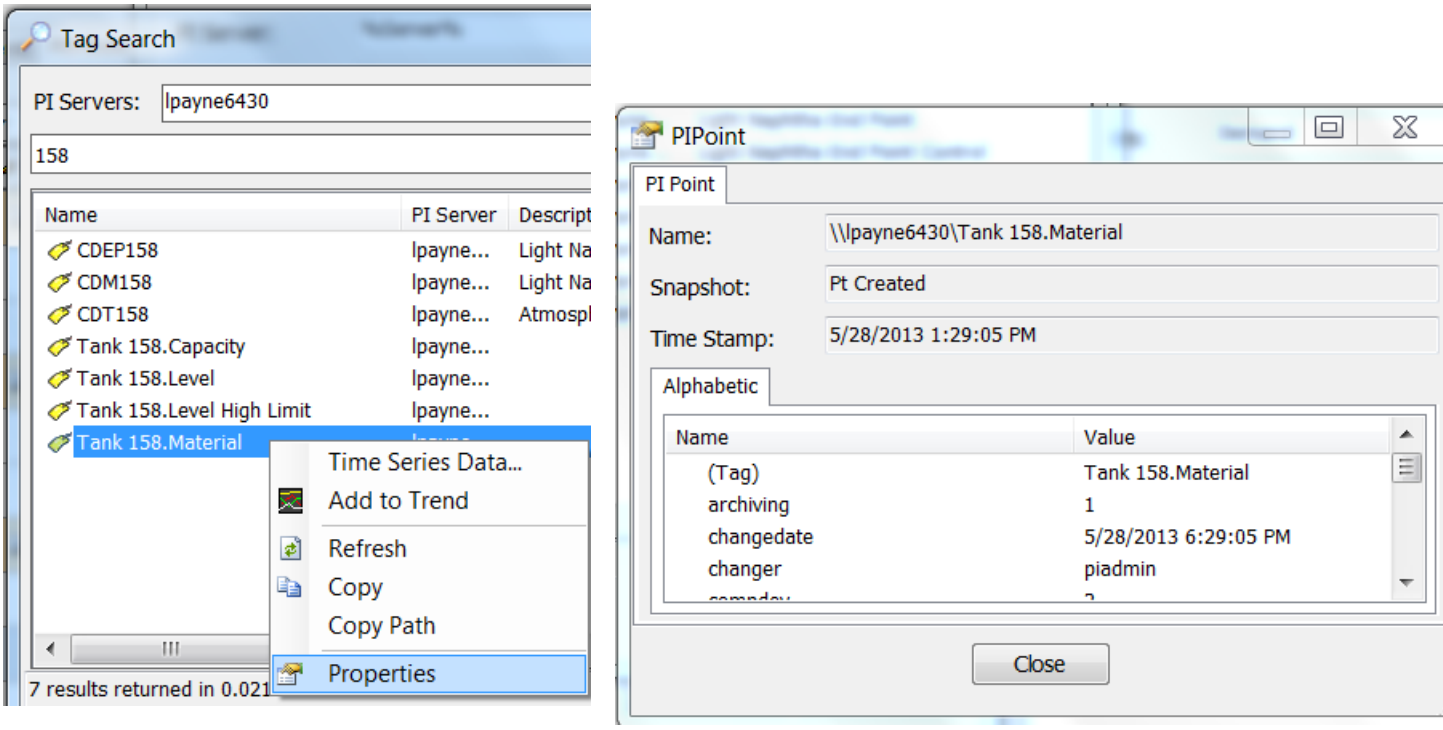

Figure 1.10: Property selection display to view all point attributes

For more information see about point attributes (*Introduction to System Management 2012*).

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1.4.4 Exercise – Finding data

The following questions are intended to reinforce key information presented in this chapter or section.

Objectives

- Discover data in the PI Data Archive

Problem Description

You need to familiarize yourself with the principles of searching for data.

Note: You must use the ***Training Sample AF Database*** for this exercise. If this is not available your instructor will give you alternate details for the exercise below.

Approach

Answer the following questions using either the PSE or tag search (your instructor will give you appropriate details):

What is the current head pressure of the asset YUL Pump 009? _____

Where is that asset located? _____

How many flow meters are in Montreal? _____

How many seem to be working at the moment? _____

How many tags begin with the characters "ba**:**"? _____

How many tags appear where the compression deviation is greater than 1 and the point class is 'Base' in the advanced tag search? _____

Which data search method do you prefer? _____

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1.5 How Data Moves through the PI System

Objectives

- Explain the benefits of efficient data processing.
- Explain how data is processed by the PI System.
- Explain how the Exception Test works.
- Explain how the Compression Algorithm works to store only meaningful data and define meaningful.

1.5.1 Benefits of Efficient Data Processing

Any system that handles large amounts of data must provide efficient ways to process and store the data. The PI System can acquire process, store and display millions of PI tags over very long periods of time. Some customers have up to 30 years of historical data stored in their PI Systems.

Efficiently processing of the historical data stored in your PI System gives you the following benefits:

Storage: it reduces the amount of space needed to store data, freeing up valuable space on a hard drive. Some historical data can be reduced to 90 percent and more of their original size.

Transmission Speeds: the amount of time it takes to send data sets over the network depends on the size of the transmitted data set. Reducing data sets minimizes the amount of time it takes to move PI System Data in the network by a considerable margin. This also reduces the financial cost of running a network, since less equipment and bandwidth is needed to transmit the data sets.

Archiving and Backup: reducing your data allows other processes to be faster and more efficient such as archiving and backups. By reducing the time to backup historical data, we can perform more frequent and more comprehensive backups, reducing the potential of data loss.

PI System Performance: the ultimate result of efficient data processing is an increase in performance that allows the PI System to store more data for a given disk size, with faster data retrieval time for display and in a more secure way with backup features that prevent data loss.

1.5.2 How Data is Processed by PI System

The PI System combines two processes to efficiently handle large amounts of data. At the interface level, an exception test filters redundant data points. At the PI Server level, the data is filtered once again with a compression algorithm before it is archived. These two processes together, commonly refer to as *exception* and *compression*; provide a powerful and efficient way to handle all PI Data.

It is important to understand how these two processes work and the impact that they have in the data being archived and the performance of the PI System. Every new installation of the

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PI System has the exception and compression enabled with default values. It is important that you review these values and determine if they need to be changed and calibrated in a way that is optimal for each one of the tags being collected. There might be situations also where you want to turn these processes off.

1.5.3 Exception Test

In an ideal world, the interface would apply some sort of logic or test to data collection. This exception test is often referred to as "Reporting by Exception". It works by removing values that are not changing with time or values whose change is insignificant and below the instrument's accuracy threshold. For example an interface that reads an instrument accurate to within 1/100, and receives the following values: 1.00000, 0.99999, 1.00001, 0.99999, will only store the 1.00000 value and show a straight line after that, because all changes were below the instrument's accuracy threshold.

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1.5.4 Exercise – Exception Test

The following questions are intended to reinforce key information presented in this chapter or section. The answers can be found in the next step-by-step instruction section.

Objectives

- Discover how the exception test is applied at the interface level.

Problem Description

You need to apply logic to the process of data collection so that you filter out values with the exception test.

Approach

Split into partners (optional). Open the spreadsheet **Exercises.xlsx –** Your instructor will direct you to the location of this file.

Determine which events you will keep by highlighting those cells in YELLOW or circling them.

If you finish early repeat the process for the second worksheet.

The exception reporting in the PI Data Archive uses a simple deadband algorithm to determine whether to send events to the PI Data Archive. For each point, you can set exception reporting specifications that create the deadband. The interface ignores values that fall inside the deadband.

How do I know what the deadband measurement is?

The deadband is created by applying the tag attribute **ExcDev** in both a plus and minus direction.

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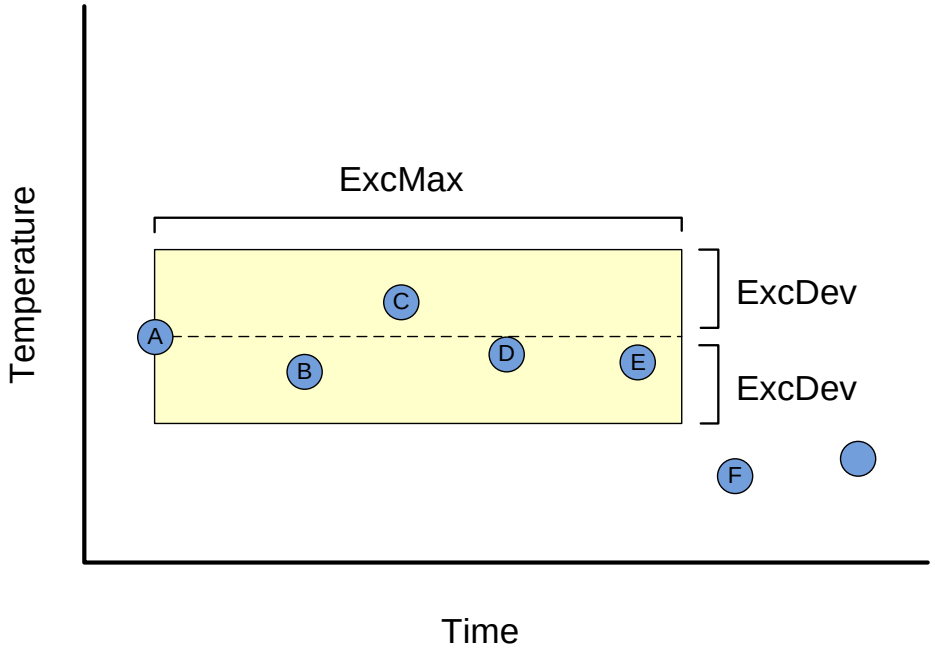
The exception reporting at the interface level uses a simple deadband algorithm to determine whether to send events to the PI Server. For each point, you can set exception reporting specifications that create the deadband. The interface ignores values that fall inside the deadband.



In the illustration above, which values will be sent to the PI Data Archive?

Answer: Values _____, _____, and _____.

Why do we need the previous value?

We send the previous value for a very basic reason: without the previous value it would not be possible to correctly draw the historical trend.

Consider the series of points below. Draw one trend using just the initial value (Value A) and the value that jumps out of the deadband (Value B). Then draw a trend line that includes not only those two points but the value previous (Value C).

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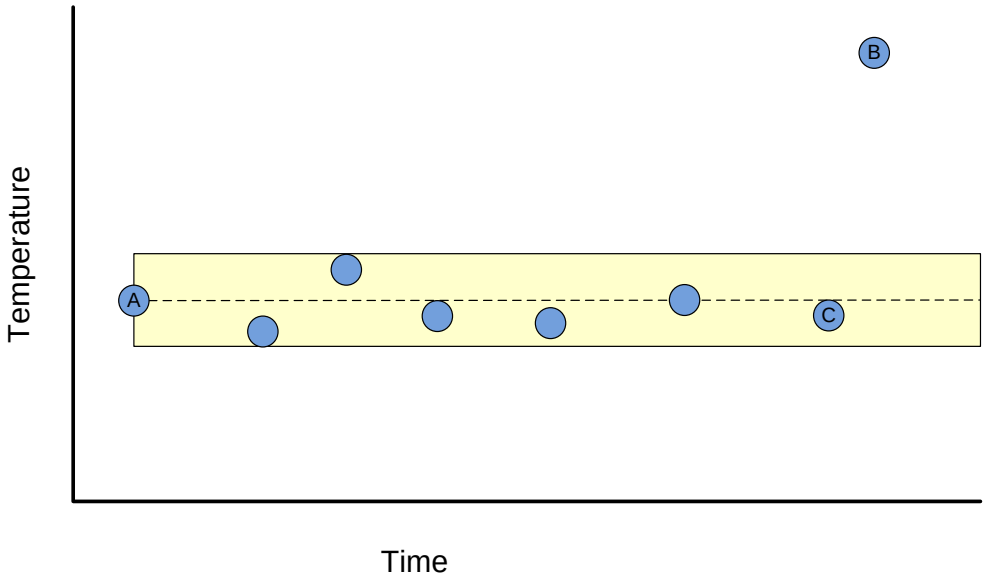

Of the two trend lines you just drew, which trend is more accurate?

But what if my values never go outside the deadband?

No problem. The **ExcMax** attribute sets a limit on how long the interface can go without reporting a value to PI. After the **ExcMax** time period, the interface sends the next new value to PI, regardless of whether the new value is different from the last reported value.

Note: Some interfaces do not support exception reporting. See the documentation for your interface to determine whether it supports this capability.

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1.5.5 Directed Exercise – Exception Testing

You are invited to watch what the instructor is doing or perform the same steps at the same time to explore the different concepts presented in this chapter or section.

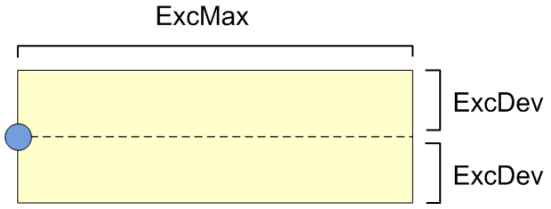
Problem Description

You want to determine from the raw data which values will pass the exception test and which will be filtered out.

Approach

Consider the following parameters:

- ExcDevPercent: 2
- Span: 200
- ExcMax: 180



Which pass the exception test, not including previous values?

PI Interface Node		PI Data Archive	
Time	**Value**	**Snapshot Time**	**Current Snapshot**
10:00:00	70.3	10:00:00	70.3
10:01:00	67.1		
10:02:00	71.4		
10:03:00	70.1		
10:04:00	68.2		
10:05:00	66.0		
10:06:00	65.8		
10:07:00	64.2		
10:08:00	60.0		
10:09:00	63.1		

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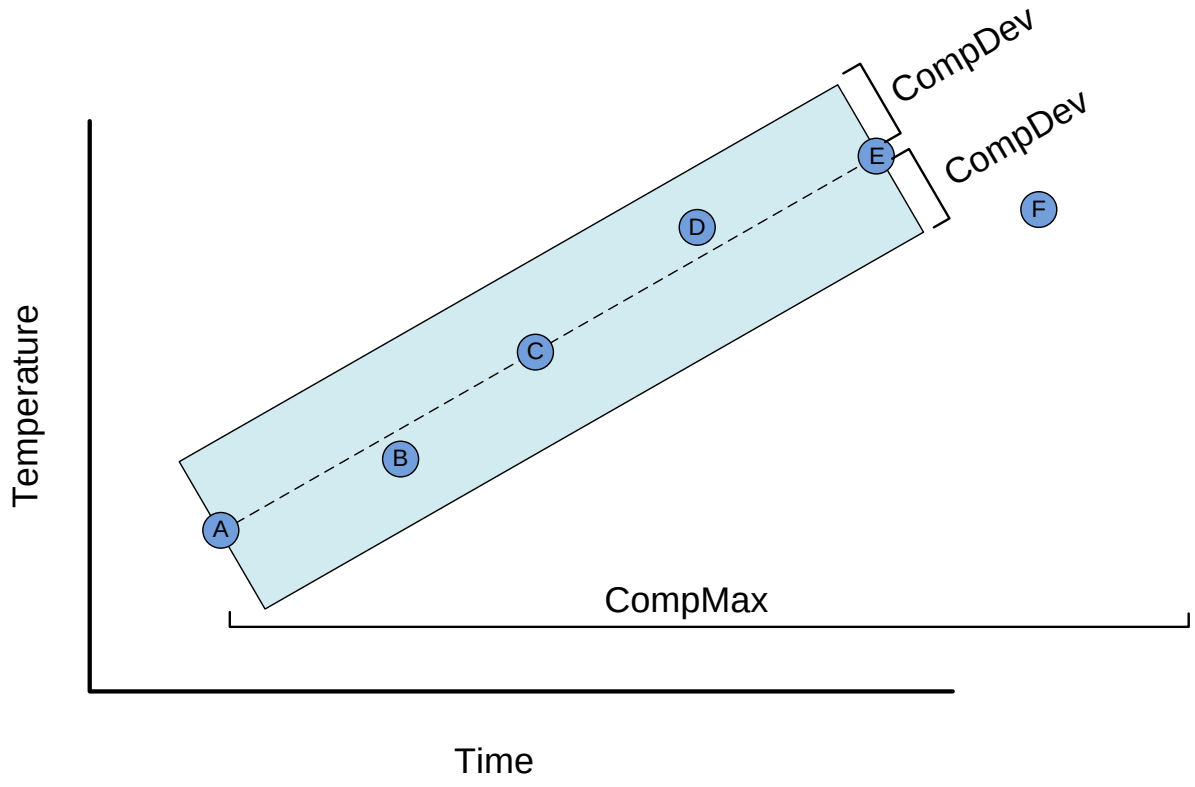
1.6 The Compression Algorithm

The PI Server uses a *compression algorithm* to determine what events need to be saved in the PI Server archives, or what is *meaningful*.

Meaningful: The data required to accurately reproduce the original data from the data source.

But isn't everything meaningful?

Not necessarily. For example, consider the following illustration. Which values would you require to accurately represent the movement of the value at a later date?



In the above illustration, which value(s) will be sent to the PI Server?

Answer: Values _____ and _____.

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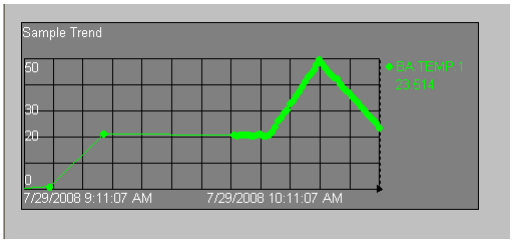
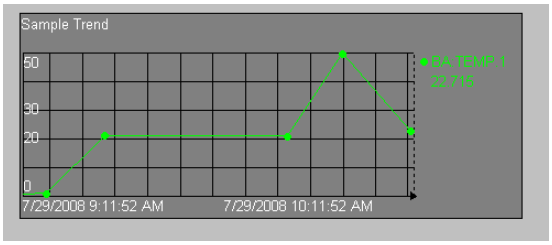
1.6.1 Effects of Exception and Compression on Displayed Data

Often you will experience a situation where one of the following conditions will be true:

- You are watching a trend and you can see many values, but when the trend is refreshed most of them disappear.





- You query for historical data in Microsoft Excel. You are sure the device is being scanned every ten seconds, yet you see an uneven recording of data (what appear to be gaps in timestamps).

This is completely normal behavior and what you are witnessing is the results of exception and compression being applied.

1.6.2 Default Values for Exception and Compression

The default values for exception and compression are as follows:

- **ExcDevPercent** = 1 (% of span);
- **ExcMax** = 600 seconds (10 minutes);
- **CompDevPercent** = 2 (% of span);
- **CompMax** = 28800 seconds (8 hours);
- **Zero** = 0;
- **Span** = 100.

Why are the default values important to me?

Because a deadband that is too wide will filter too much of your data and a deadband that is too narrow may give you a lot of unnecessary data.

On the other hand, there are instances where you would want to capture everything you collect with no exception or compression. You might be performing a calculation and want to capture every result, or you may have regulatory requirements that require you to store every reading.

Everyone's situation is unique – we simply present the options.

For more information see the "Exception Reporting and Compression Testing" section of the *PI Server 2012 System Management Guide*, p. 46.

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1.6.3 Group Recap Questions

The following questions are intended to reinforce key information presented in this chapter or section. The answers can be found at the end of the book.

Questions

1. What are the names of the two processes used in the PI Data Archive to handle data?

2. What are some reasons why you would want to turn these features OFF (store all data collected)?

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2 Introduction to PI WebParts

2.1 Fundamentals

PI WebParts provides a gallery of web widgets which empowers organizations to visualize PI Data on a web page rendered by Microsoft Windows SharePoint. The product also includes the backend components to bring data to these widgets from PI System, as well as a set of administrative pages to configure datasets and advanced web part features.

The collection of PI WebParts will be presented in an exercise. First, however, we will examine the PI Gauge to gain an initial concept of what PI WebParts can do.

2.1.1 PI Gauge Web Part

The PI Gauge web part displays an analog style gauge with a pointer that indicates, by default, the real-time value of one tag or attribute in PI. The value will update in real-time while this web part is visible on a webpage.

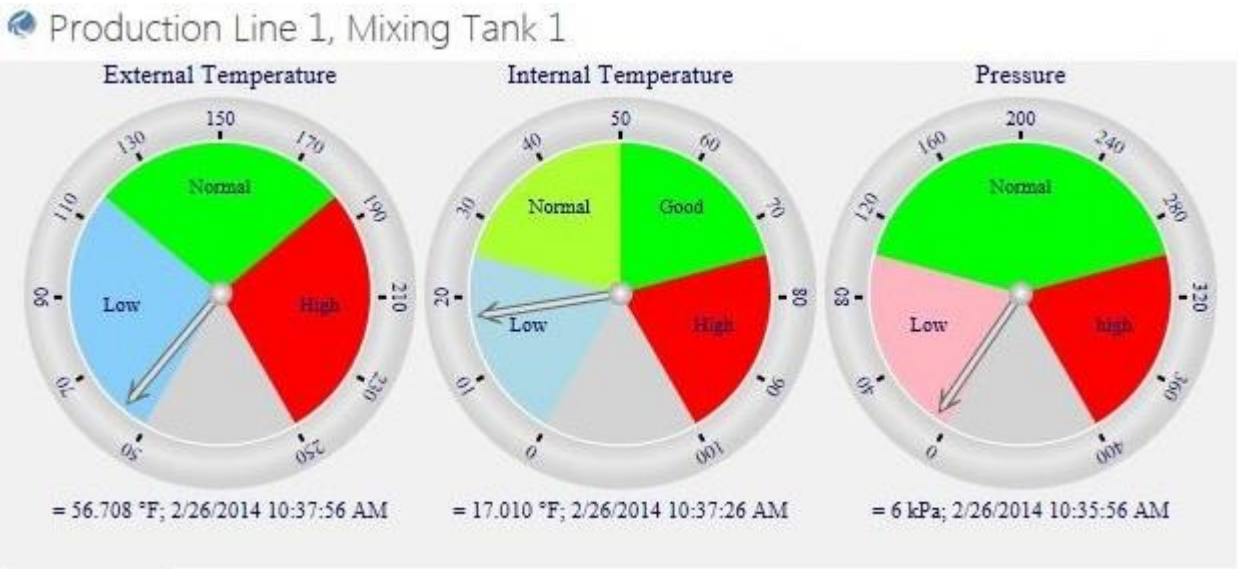

Figure 2.1 PI Gauge web part

In addition to specifying the PI AF attribute or PI tag to be displayed in each gauge, one is also able to define other web part properties including:

- Column & PI Gauge Title
- Range
- Zone: scale, label & color

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These aspects are all configurable and aid in understanding the data. For example, it would be easy for someone who is new to the production line to recognize a low tank pressure and thus take immediate actions as long as the gauge is set properly. Configuration is done using a graphical editor which will be introduced later.

2.1.2 PI WebParts Connections

PI WebParts become more powerful in displaying and interpreting data when they are interconnected to one another or other web parts.

For example, the following web part, PI TimeRange, is used to specify the time range from which we wish to see data. PI TimeRange can provide its data (the desired time range) to other PI WebParts so they know over what time range to display data.

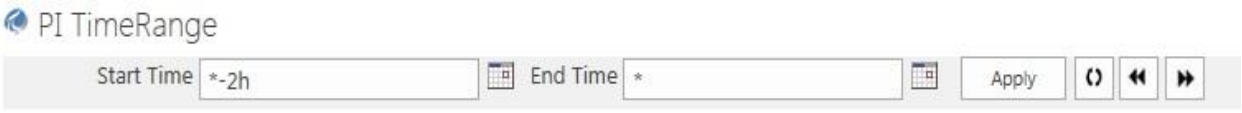

Figure 2.2 PI TimeRange web part

The web part below, PI Tree View, renders elements from PI AF in a hierarchical structure. It can be linked to tell other PI WebParts which element's data to show.

Figure 2.3 PI TreeView web part

The mechanics of this will be covered later.

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2.2 Exercise – PI WebParts on Paper

Objectives

- Examine the available PI WebParts for the first time
- Identify a user case for PI data on a SharePoint page

Problem Description

Back home, you are likely to encounter reports on a daily basis. Whether you create production reports, view them, or simply wish that your coworkers or subordinates could see data which would help them do their jobs, it is a safe assumption that data availability is a constant quest.

Approach

You will be handed a packet of PI WebParts which you may not have seen before. Your task is as follows:

1. Think of a report which would be helpful "back home" in your company. This can be a real-time dashboard or a scheduled analysis report.
2. Examine the PI WebParts you are given. What do they appear to do?
3. Get in touch with your inner artist and engineer: Create your report on the paper provided. You are not limited to using the PI WebParts. If you wish to show data from your maintenance system, sketch it in.

This is an open-ended exercise. What you create now will be used as a starting point for additional exercises.

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2.3 Exercise – Paper Pages: Discussion & Expansion

Objectives

- Reflect upon the paper report pages created in the previous exercise

Problem Description

A report's beauty is in the eye of the beholder. Sometimes, other eyes can spot areas where the report can be even more useful, or has ideas of other types of information to include and how to present it.

In small groups, present your creation from the previous exercise. Show them what your report does, and for whom. Do they have any ideas of information that could be useful?

Approach

Examples of things to look for:

- Other information which could be useful (for a batch production report, ingredient inventory levels could be key)
- 'Missing' PI WebParts. The goal was never to use every available PI WebParts on this one page, but of those which were not used, what could they be used for?
- Can the page be made more intelligent and interactive by leveraging connections among PI WebParts? E.g., end users might want to easily switch between and inspect similar assets or to input and change the time range themselves.
- Can any non-PI web parts or technologies be invoked to improve the page?

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3 Introduction to Microsoft SharePoint

Microsoft SharePoint is a Web application platform developed by Microsoft to facilitate integrating information, people and processes across organizational boundaries. It provides a secure unified access point, often in the form of a web-based user interface, and is designed to aggregate and personalize information through application-specific web parts.

Structurally, think of SharePoint as a *collection of containers*.

3.1 Sites & Pages

On a given SharePoint server, sites are a logical division – a place for a team to collaborate. Acetate division may have a SharePoint site of its own, just as Human Resources has one. Sites hold items such as pages (e.g. a dashboard for acetate production at Site 51) and libraries (safety data sheets, maintenance reports, etc.).

A given SharePoint page can hold various types of content, adapting to the need at hand. Dashboards, reports, collaborative spaces, policy notices, and procedures are all common examples of uses of a SharePoint page.

Figure 3.1 Hierarchy of a SharePoint Site

In order to achieve this functionality, pages are populated with bits and snippets of information: a gauge here, a table there, some paragraphs of text above it all. These pieces of information are **web parts**, which get placed in slots known as **Zones** on a page. Many web

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parts are included with SharePoint, and companies such as OSIsoft sell custom web parts to extend SharePoint to include, for example, PI data.

3.1.1 Creating a Site

Creation of new SharePoint sites is, in SharePoint 2013, handled from **Central Administration**. Go to **Application Management** and click **Create site collections**. It will be directed to the Create Site Collection dialog window.

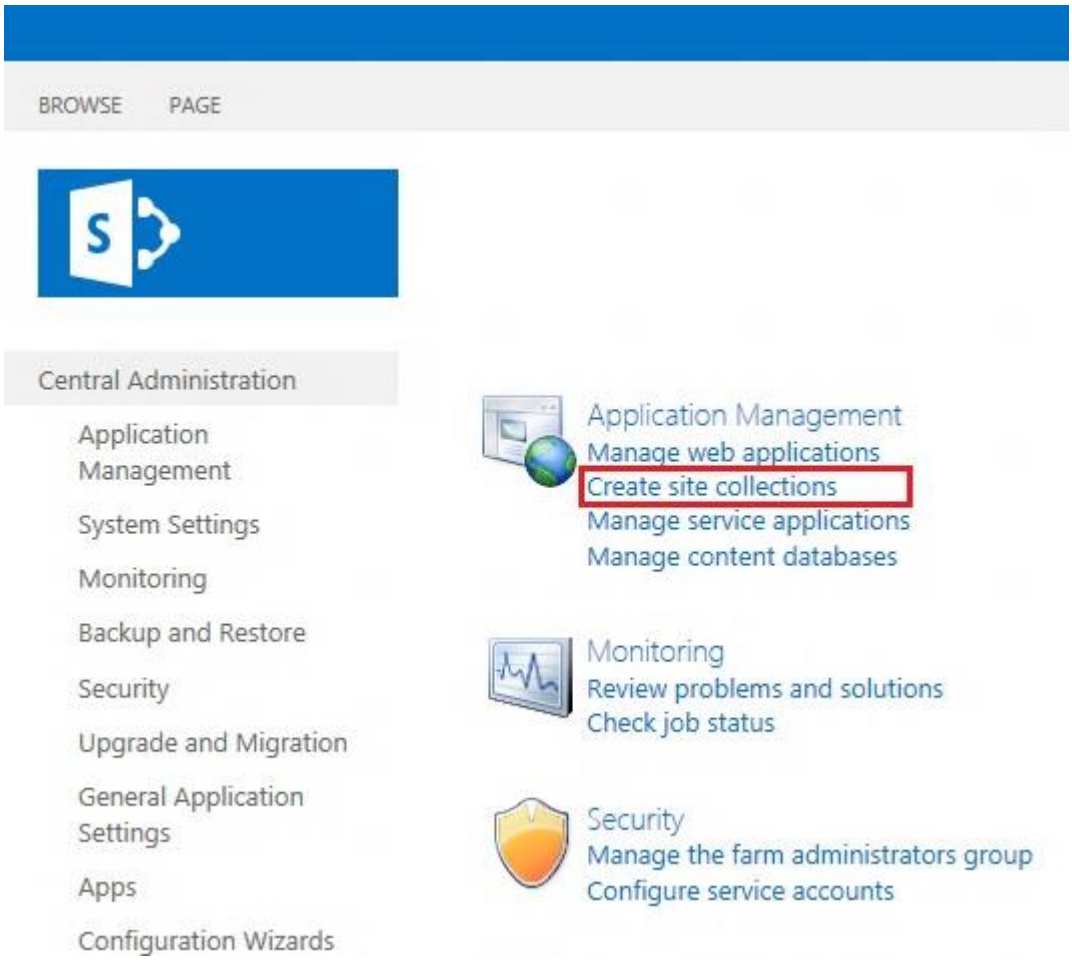

Figure 3.2 Create New Site from SharePoint 2013 Central Administration

Give the new site a title and specify a unique URL path. In the **Template Selection**, it is recommended to use the default setting – **Team Site**, which is a layout intended for posting materials and dynamic pages, and for collaboration. After designating the Primary Site Collection Administrator, click OK to create the new site.

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3.1.2 Navigating Sites & Pages

Time to navigate the new site just created. Open it in Internet Explorer by entering the URL. It will take us to the Main Page.

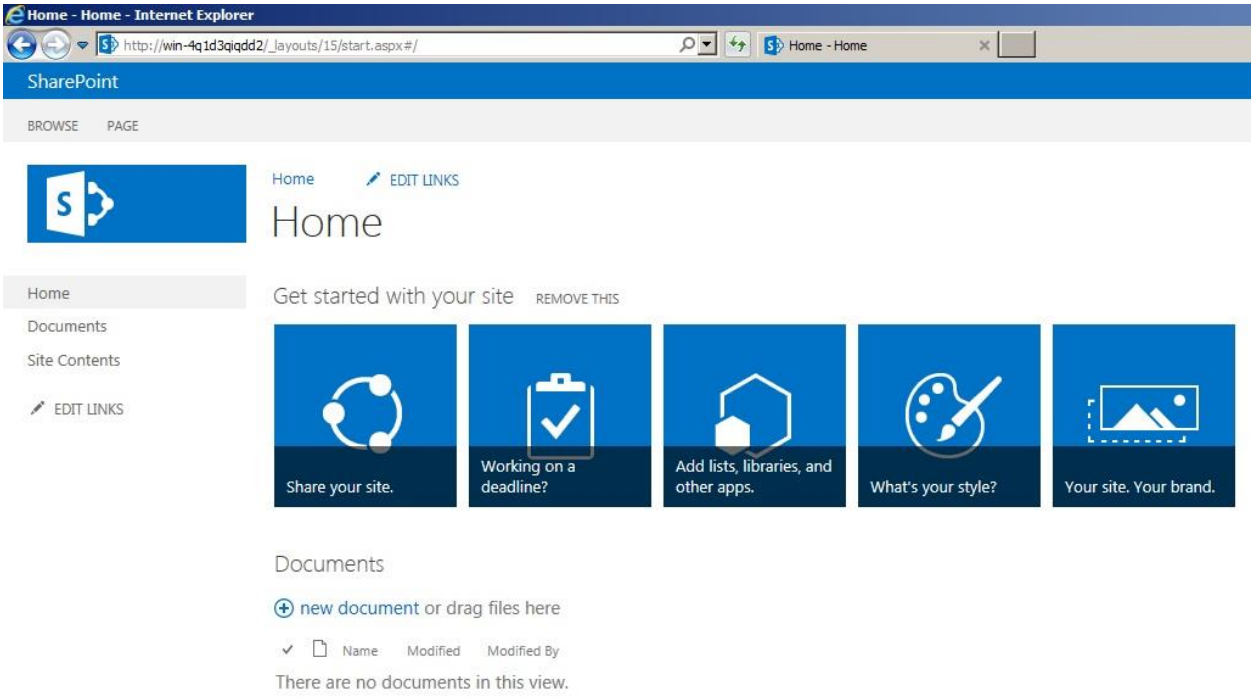

Figure 3.3 Home Page of a New SharePoint Site

On the left edge, **Documents** is a library that allows users to share files with other site users. It displays a page that lists all files or folders and their properties, as well as a hyperlink to each file. The page includes commands for adding files and folders, sorting and filtering the list of files, switching to a different view of the library, and changing the design of the library. You can also create alerts so that you will be notified of any changes to specific files in the library.

Libraries are used by PI WebParts to store PI DataLink spreadsheets and PI ProcessBook displays.

Below Documents, **Site Contents** is a handy link to display all of the SharePoint data structures on your site.

In the middle of the main page, **Get Started** tasks are enabled for a new SharePoint site by default. It can be removed without any affects to the course.

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3.1.3 Creating a Page

On the main page of the new SharePoint site, **Add a page** is located under the **Settings** at the upper right corner.

Give it a unique name and click **Create**, a new page will be created.

The default page layout is one column. Other options are available under **Text Layout** on the **FORMAT TEXT** toolbar.

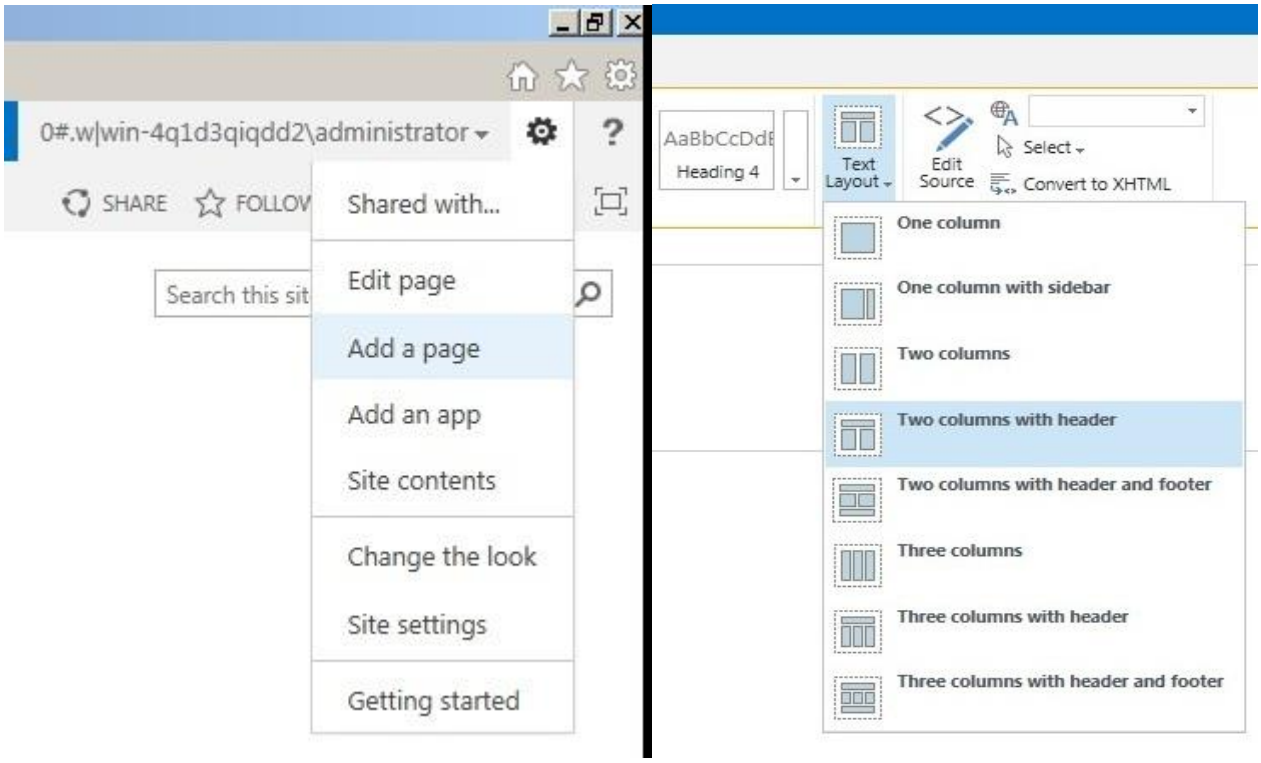

Figure 3.4 (a) Add a Page; (b) Choose Page Layout, in SharePoint 2013

3.1.4 Insert a Web Part to the Page

Browse the page and click to activate the column or zone where you want to insert the web part. On the **INSERT** toolbar, click **web part**. It will list out all the available web parts on the SharePoint site. Browse through the categories and select one (certainly it would be PI WebParts in this instance). Choose the web part of interest and click **Add** on the lower right corner of the web parts window. Congratulations! A web part has been inserted to the page.

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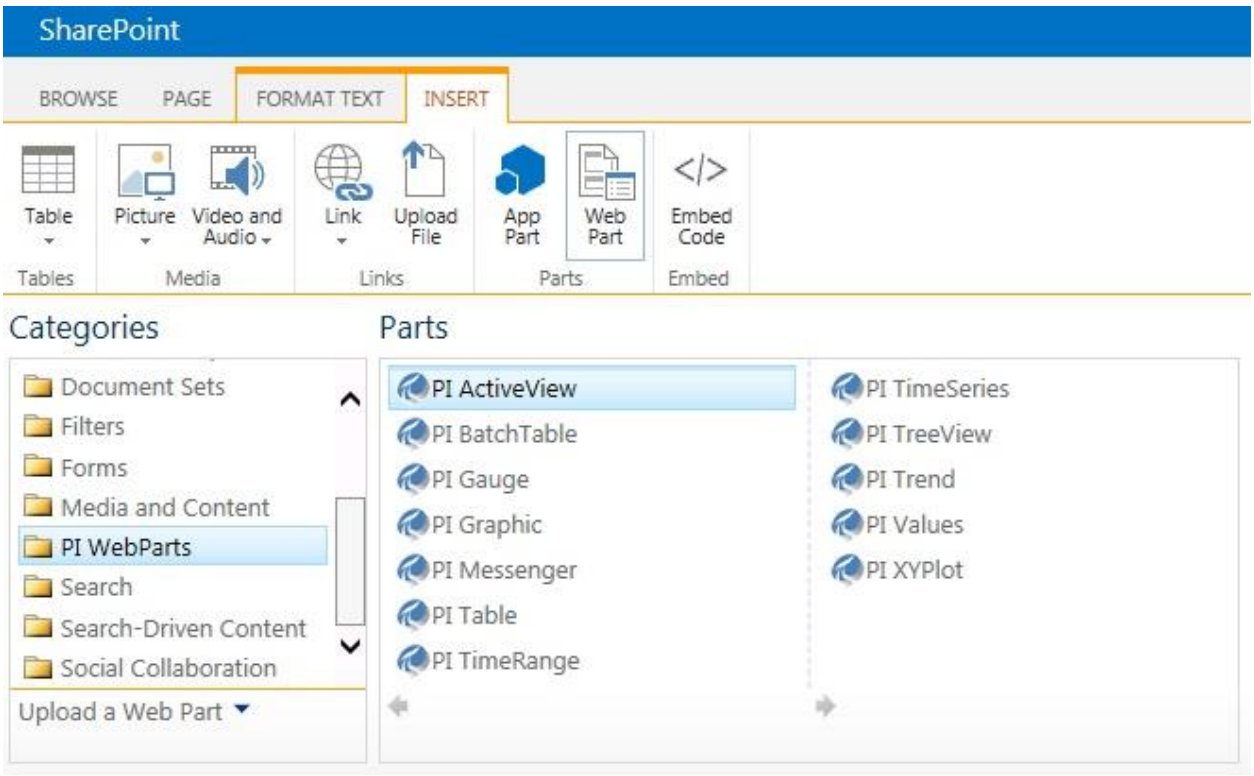

Figure 3.5 Add a web part to the Page

3.1.5 Web Part Properties

A web part is a modular unit of information that has a single purpose and forms the basic building block of a web part page. A web part is actually composed of a web part description file (.dwp) and some external code that provides the functionality, such as a .Net assembly or .dll file. Understanding how web parts work can help you share them in more creative and interesting ways and avoid problems.

Each web part shares a set of common properties (also called base class properties) organized into sections in the tool pane that control its appearance (such as the title, height and width), layout (such as the web part order in the zone and the direction of the content), and advanced characteristics (such as the image icon and description).

Many web parts also have custom properties that are unique to the web part. These are usually displayed either above or below the common web part properties in the tool pane. For example, the PI Gauge web part has additional custom properties, including gauge title, range and zone configurations, and option to display simultaneous data below the web part.

More discussions about web part properties and demonstration are provided in Chapter 5.

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3.1.6 Web Browser Requirements

With the exception of simple viewing programs such as Microsoft Silverlight and Adobe SVG Viewer, nothing more than a web browser is required to view PI WebParts 2013 from a client machine, the following web browsers are required:

- Internet Explorer v8 or better (32-bit versions only)
- Mozilla Firefox
- Google Chrome (with SharePoint 2013 only)

The PI Graphic, PI Gauge, PI Trend and PI XYPlot web parts render their contents in SVG (scalable vector graphics). In Firefox and Chrome, SVG is rendered natively in the browser and no plugin is required. The same is true with Internet Explorer 9 or higher, except that the default master page in SharePoint 2010 enforces IE8-compatibility and therefore requires the Adobe SVG Viewer (version 3.0). This component can be downloaded from Adobe at: http://download.adobe.com/pub/adobe/magic/svgviewer/win/3.x/3.03/en/SVGView.exe.

Note that though some 64-bit operating systems are supported, 64-bit versions of Internet Explorer cannot be used, due to the lack of support for 32-bit ActiveX controls such as PI ActiveView and the Adobe SVG Viewer.

For more details about this topic, please refer to *PI WebParts 2013 Release Notes*, pp 16 – 17.

3.2 Versions of SharePoint

PI WebParts 2013 supports Microsoft SharePoint Foundation 2010, Microsoft SharePoint Server 2010 Standard, Microsoft SharePoint Server 2010 Enterprise, Microsoft SharePoint Foundation 2013, Microsoft SharePoint Server 2013 Standard, and Microsoft SharePoint Server 2013 Enterprise.

Simply speaking, SharePoint Server is SharePoint Foundation with additional features. So is the difference between SharePoint Server Standard and Enterprise. SharePoint Foundation is free while SharePoint Server requires a license. Detailed comparison and differences between different versions of SharePoint are out of the scope of the course. However, PI DataLink Server requires Excel Services in SharePoint, which is only available in Enterprise versions. More discussions about PI DataLink Server will be covered later.

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3.3 Directed Activity – Create a SharePoint Site

Follow along as we learn to create SharePoint sites of our own.

Problem Description

For subsequent class exercises, we need a SharePoint site to hold all of the pages we will create.

Approach

Create a SharePoint Team site named after yourself.

It may be a good idea to bookmark the site in your web browser for ease of access.

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4 Architecture and Setup

4.1 Basic IIS and SQL Server

To set up and use SharePoint 2013, Internet Information Services (IIS) 6.0 or higher is required. IIS is Microsoft's web server software. It is part of the Windows 2008 SP2, 2008 R2 and 2012 operating systems. It is easy to setup and maintain through Internet Information Services Manager, which is accessed through Microsoft Management Console and Administrative Tools in the Control Panel. For more information on IIS, go to the official Microsoft IIS site http://www.iis.net/.

4.1.1 IIS Home Directory

The home directory is the central location for your published pages. It contains a home page or index file that welcomes customers and contains links to other pages in your site. The home directory is mapped to your site's domain name or your server name. For example, if your site's Internet domain name is www.microsoft.com and your home directory is C:\Website\Microsoft, then browsers use the URL http://www.microsoft.com to access files in your home directory. On an intranet, if your server name is AcctServer, then browsers use the URL http://acctserver to access files in your home directory.

Each web site must have one home directory. If you are setting up both a web site and an FTP site on the same computer, you must specify a different home directory for each service (WWW and FTP). The default home directory for the WWW service is C:\inetpub\wwwroot. The default home directory for the FTP service is C:\inetpub\ftproot. You can choose a different directory as your home directory.

SharePoint does not store its pages or files in a standard Windows directory. Instead pages and files are stored and maintained through the content and configuration databases in a Microsoft SQL Server.

4.1.2 Microsoft SQL Server

The SQL Server is Microsoft's relational database. There are different editions of SQL Server. Some are free, the others require licensing. Consult Microsoft for more information about SQL Server licensing.

The **stand-alone** installation of SharePoint 2013 (development environments) comes with a free SQL Server 2008 R2 Express Edition with SP1, while the other type of installation of SharePoint 2013 – **complete** (production environment) – requires a SQL Server 2008 R2 SP1 or higher. With regards to PI WebParts 2013, it works with any editions of SQL Server as long as it's compatible with SharePoint 2010 or 2013.

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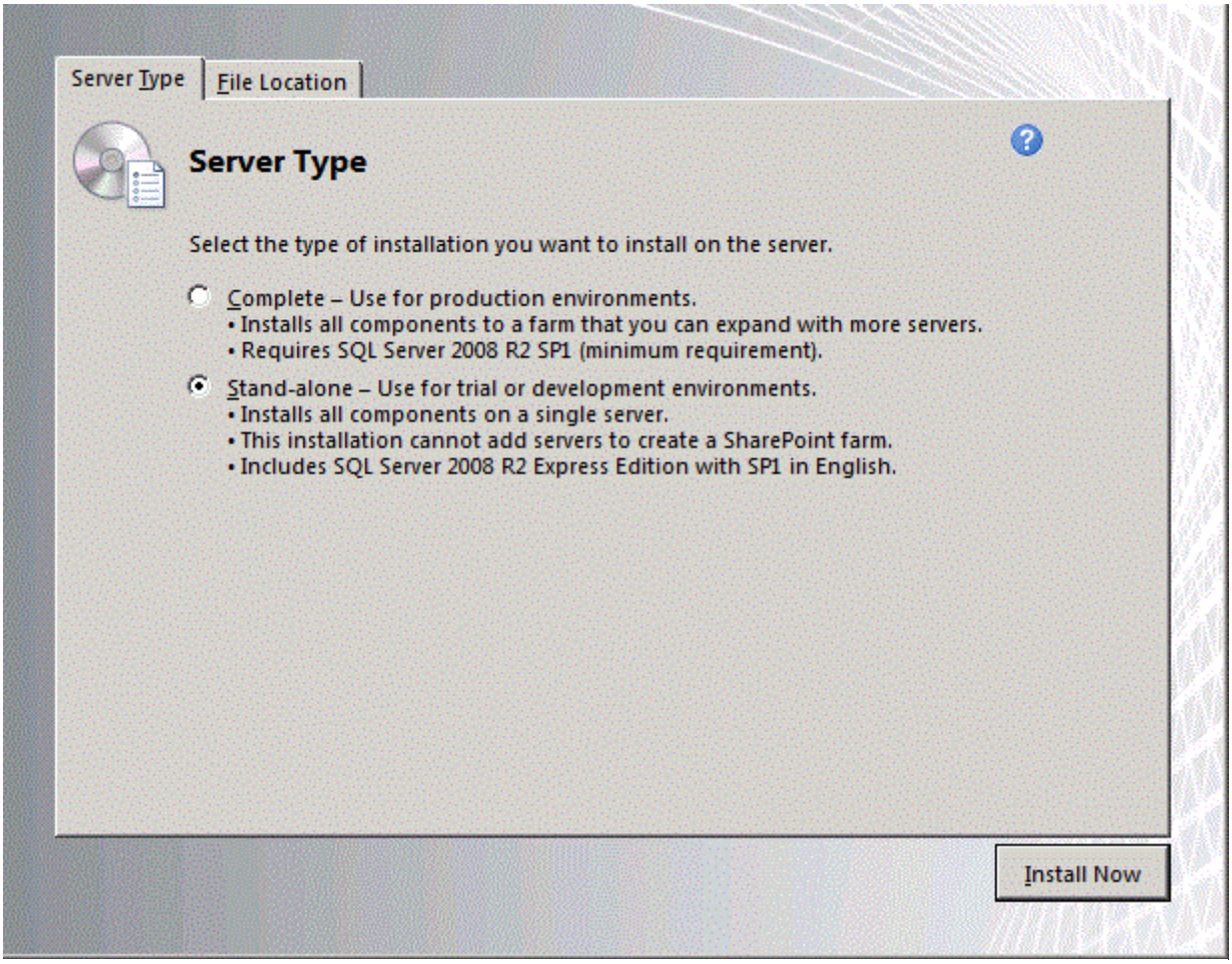

Figure 4.1 Type of Installation of SharePoint 2013

4.2 PI WebParts 2013 Architecture

PI WebParts 2013 requires a server equipped with SharePoint, where you deploy the PI WebParts solution, and an application server for PI WebParts Services, which manages all communication with the PI System.

• PI WebParts SharePoint solution

PI WebParts SharePoint solution must be installed to the SharePoint server. Once installed, the solution must be deployed through SharePoint Central Administration. If the SharePoint server is part of a farm, the solution can be deployed throughout the entire farm.

• PI WebParts Services

PI WebParts Services is a single, dedicated application service that supports all the SharePoint servers in a farm. PI WebParts Services requires a non-SharePoint website. It contains the data-access components needed to connect and retrieve data from your PI Data

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Archive and PI AF server. These components include PI SDK, PI AF SDK, and PI OLEDB Enterprise.

PI WebParts Services can be installed on the same computer as the SharePoint server or on a different computer. It may be installed on a different computer due to security requirements or to support scalability. PI WebParts Services can support a single independent SharePoint server or a single SharePoint farm. It the case of a SharePoint farm, a single application server can provide data access for multiple websites in that farm. PI WebParts Services uses a centrally located data cache for all web servers, preventing frequent calls to PI Server.

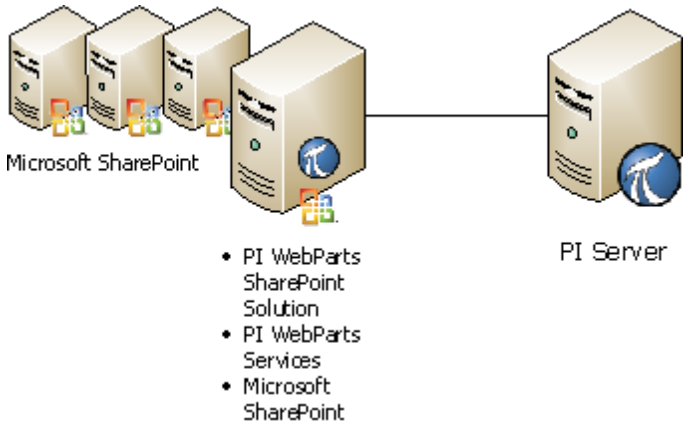

Figure 4.2 Installation of PI WebParts Services on Same the Computer as SharePoint

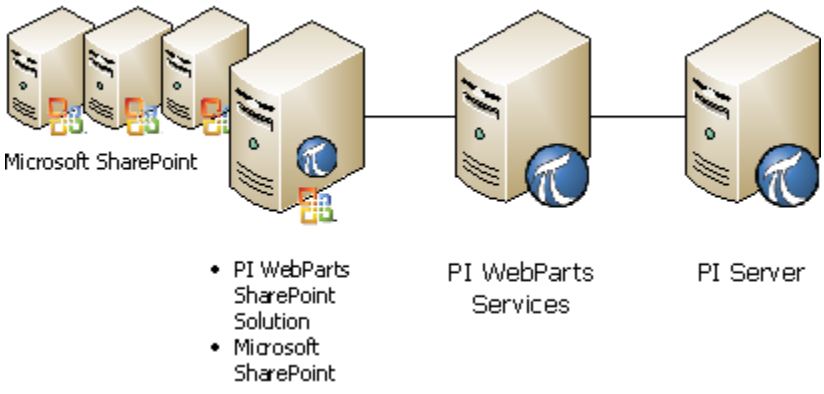

Figure 4.3 Installation of PI WebParts Services on a Different Computer as SharePoint

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4.3 Install PI WebParts 2013

The installation procedure is briefed as the following.

1) Verify the fulfillment of all pre-installation requirements.
2) Install PI WebParts SharePoint solution.
3) Deploy PI WebParts solution to SharePoint web applications.
4) Install PI WebParts Services.
5) Configure SharePoint for PI WebParts
6) Activate PI WebParts as a site-collection feature.

Please refer to PI WebParts 2013 Administrator Guide, pp 7 – 21 for details.

4.4 Exercise – Install PI WebParts 2013

The following questions are intended to reinforce the key information presented in this chapter or section.

Objectives

- Follow PI WebParts 2013 Administrator Guide, pp 7 – 21 to install and configure PI WebParts 2013 on the same box as SharePoint 2013.

Problem Description

PI Data Archive, PI AF, SQL, and SharePoint are all installed and tested to be working properly. Your goal is to follow PI WebParts 2013 Administrator Guide, pp 7 – 21 to install and configure PI WebParts 2013 on the same box as SharePoint 2013.

The administrator guide does a great job in detailing this task, from pre-installation all the way to post-installation check. Things should work out without a problem by following the guide.

After installing both PI WebParts SharePoint solution and PI WebParts Services, verify that PI WebParts is operational by adding a PI Trend web part (or any other one) to a page and configuring it to retrieve data from PI System (simply ask the instructor to help you configure one for the current test as this topic will be covered later).

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4.5 Group Recap Questions

The following questions are intended to reinforce key information presented in this chapter or section. The instructor will discuss about answers.

Questions

1. What are the 2 components of PI WebParts 2013, and what do they do?
2. What are the possible architectures to deploy PI WebParts 2013?

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5 Configuring PI WebParts

The configurations of most PI WebParts will follow the same basic scenario after inserting them onto the web page:

- Open Web Part Properties panel
- Configure the Time Range
- Configure the Data Source(s)
- Configure Formatting
- Configure Appearance and Layout (optional)

In Section 4.1, PI Gauge will be taken for example to demonstrate the abovementioned procedure.

5.1 Configuring a PI Gauge

Open Web Part Properties panel

After inserting PI Gauge to the target zone on the web page, the web part will show up in the right position but without any data (functionality is not there yet). In order to make it fully functional and display data properly, certain configurations need to be done in the web part properties panel.

- Select the web part on the page.
- Hover the mouse cursor over it, a drop-down list arrow will appear.
- Click the arrow and select **Edit web part** to open the panel.
- Another way to edit the web part is to click the **Web Part Properties** on the WEB PART toolbar.

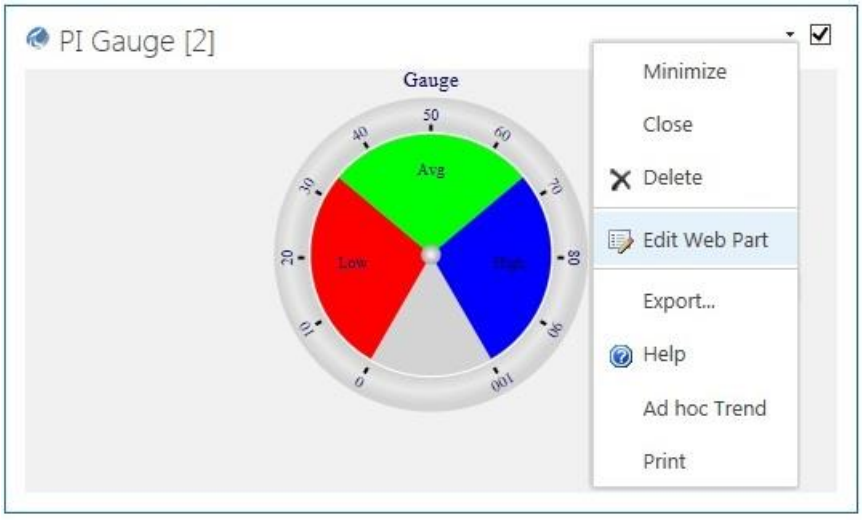

Figure 5.1 Select *Edit Web Part* to open web part Properties Panel

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Configuring the Time Range

Every PI WebParts has a Start Time and an End Time, even the ones that show only a single value in time. **For those web parts, like the PI Gauge web part, only the End Time is used for the display.** The Start Time and End Time parameters are used as the default time range when opening an **Ad hoc Trend** from the PI Gauge. The update frequency can also be specified here as well.

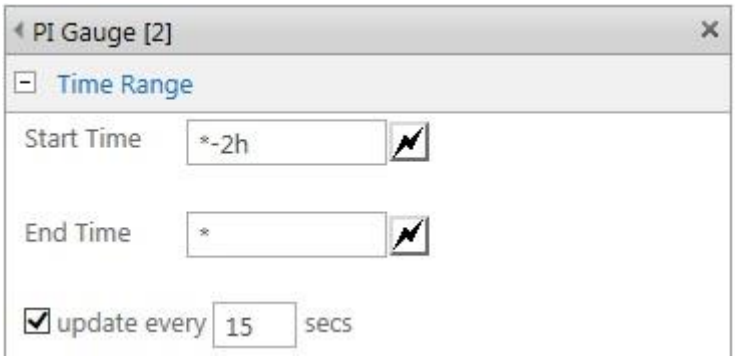

Figure 5.2 Select *Edit Web Part* to open web part Properties Panel

Configuring the Data Sources

Next, select the appropriate data. This could be a PI tag, an AF attribute, or a dataset.

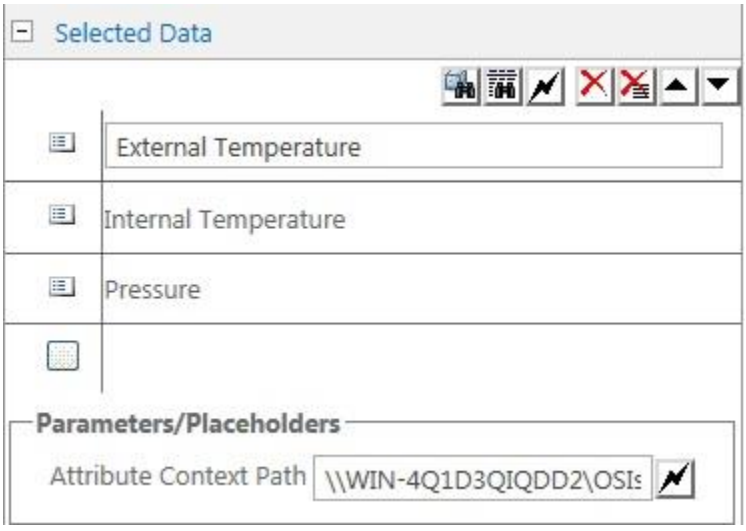

Figure 5.3 PI Attributes Selected as Data Source

Note: Ignore the **Lightning Bolts** at this point in the class. They are addressed in detail later.

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Search for PI System Data

More often than not, the desired PI AF attributes and PI tags are not committed to memory.

The button offers a familiar method to search for PI AF attributes and PI tags as you would experience in many other PI products such as PI System Management Tools, but with a slightly different user interface. Wildcard characters (* and ?) are supported.

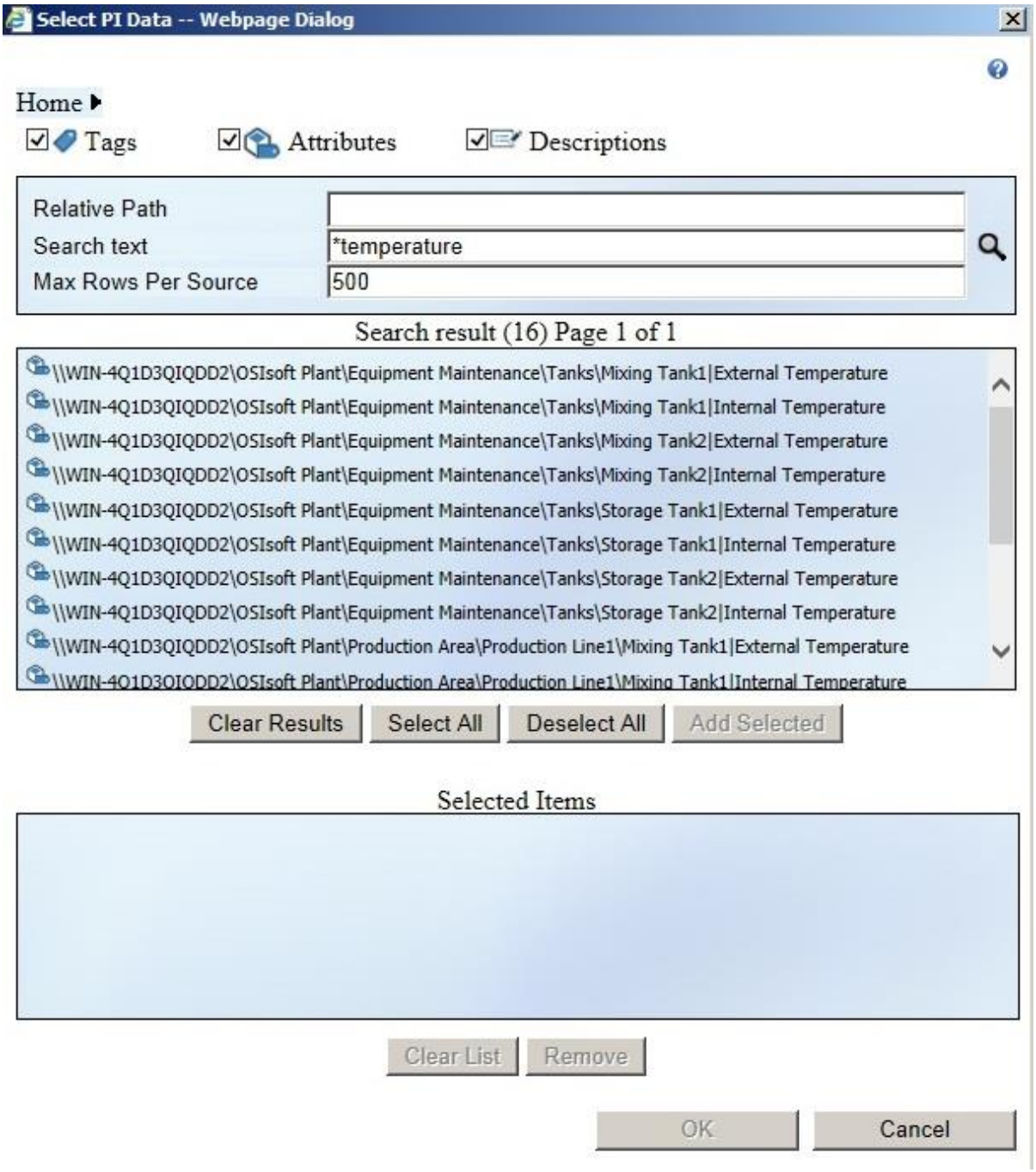

Figure 5.4 Select PI Data Dialog Provides a Way to Search for Target Data

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Configuring Formatting

Each web part will have its own formatting settings. These will apply to the web part as it is visually displayed. For example, the PI Gauge has options to set the dial or face colors, which is not applicable to any other PI WebParts. Other configurable properties include legend items to be displayed in the gauge, range and zone settings, etc.

Additional details are available in PI WebParts 2013 User Guide, pp 54 – 57.

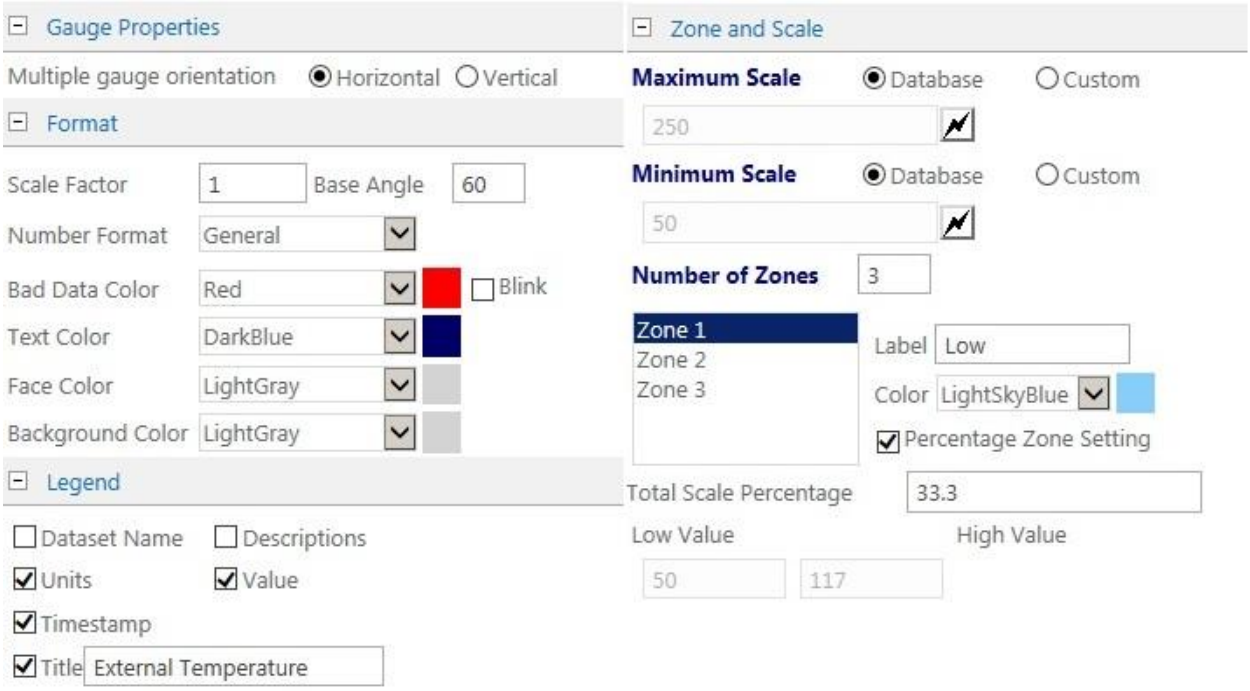

Figure 5.5 Special web part configurations of PI Gauge

Quick Tips:

- Formatting selections only apply to the selected data reference. This is the reference highlighted under the **Selected Data** section of the **Configuration** pane.
- Colors are listed by their name. These names are defined in the X11 standard found at http://en.wikipedia.org/wiki/X11_color_names.
- The number of zones defaults to 3 for all tags, except digital tags. A gauge showing a digital tag will have 1 zone corresponding to each digital state associated with that digital tag.
- You can adjust the size of the zones by percentage. The total percentage of all zones must equal 100% or the changes will not be accepted.

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- Online help is available. Simply select the **Help** item in the same drop-down menu as **Edit web part** and the *PI WebParts 2013 User Guide* will appear in a new window.

Configuring Appearance and Layout

The *Appearance and Layout* sections appear in every web part. These are mostly used to adjust the size of or create a custom title for the web part. Most other options are left to their defaults.

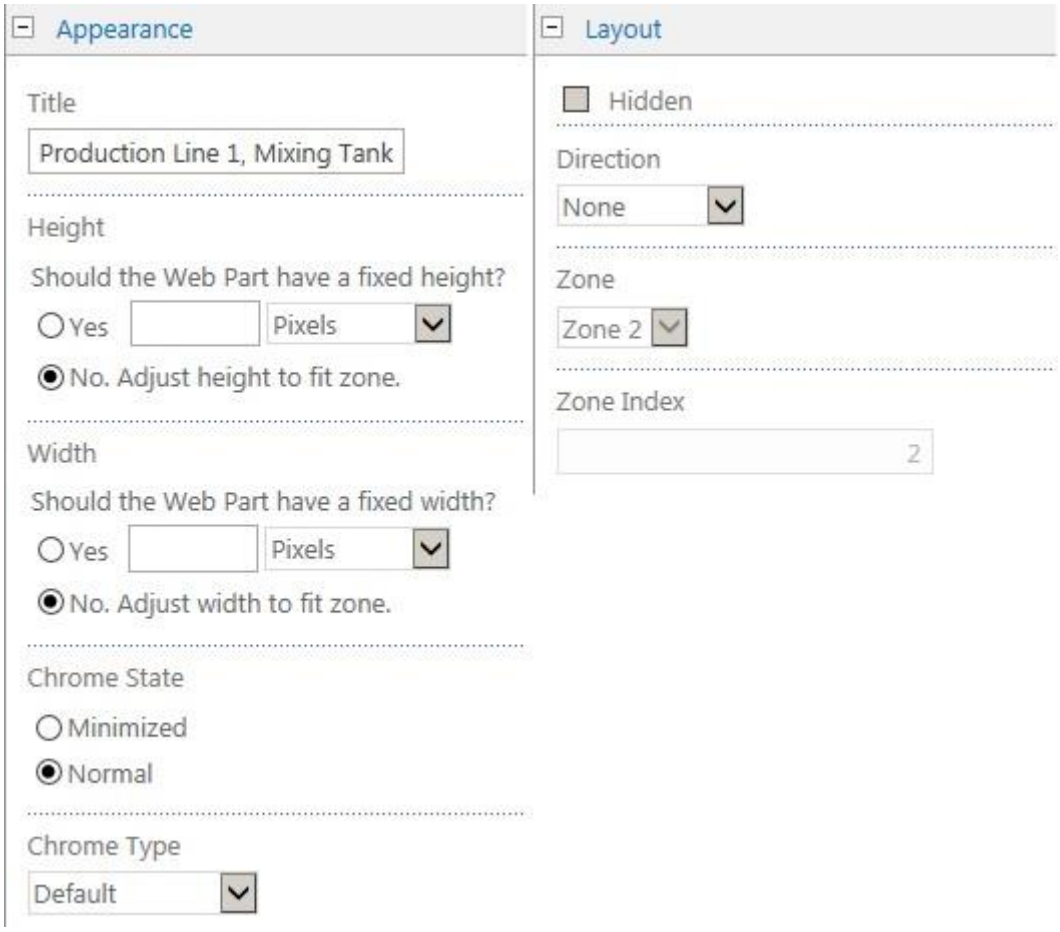

Figure 5.6 Appearance & Layout Settings of web part

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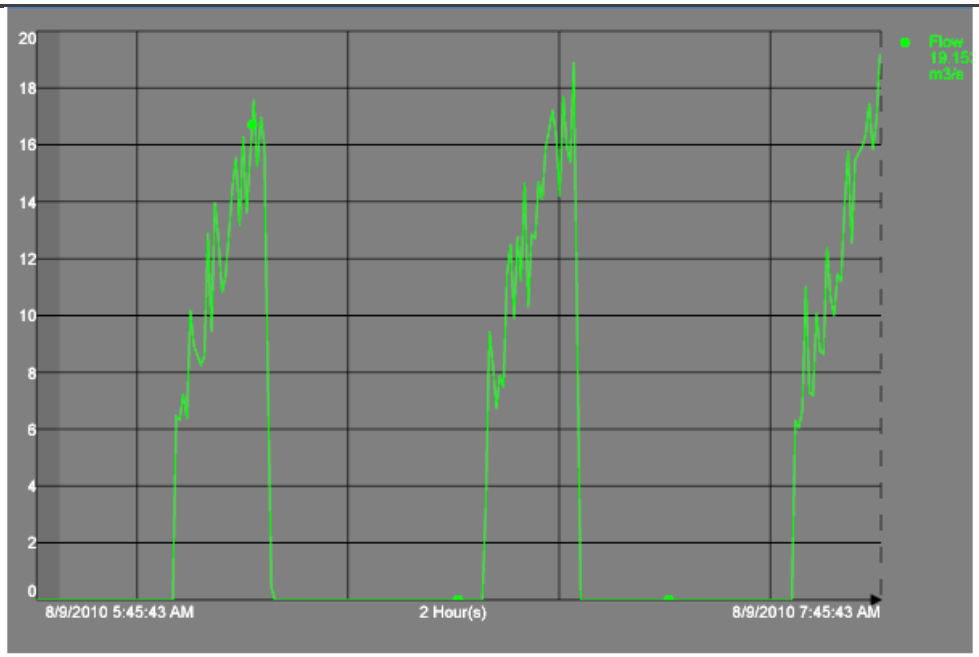
5.2 Common PI WebParts

Go through the other common PI WebParts – PI Values, PI TimeSeries, PI Table, PI Trend, PI TimeRange, PI TreeView, and PI Graphic as per *PI WebParts 2013 User Guide*. Summarize the most important facts of each one and the differences among them.

5.2.1 Group Recap Questions

The Following questions are intended to reinforce the key information presented in this chapter or section. The answers can be found at the end of the book.

For the following common web parts, identify each, and summarize its capabilities.



Which PI web part is this and what does it do?
Notes:

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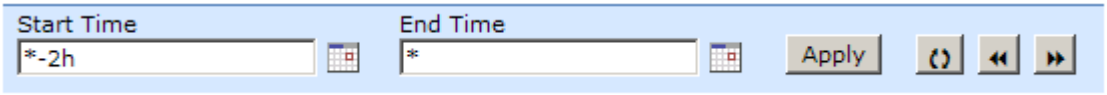

Which PI web part is this and what does it do?

Notes:

Dataset	Time	Value	Average	Min
\\192.168.1.19\BA:ACTIVE.1	8/9/2010 9:06:05 AM	Inactive	N/A	0
\\192.168.1.19\BA:CONC.1	8/9/2010 9:06:05 AM	43.736	25.853	0
\\192.168.1.19\BA:LEVEL.1	8/9/2010 9:02:05 AM	0.96655	23.397	0
\\192.168.1.19\BA:TEMP.1	8/9/2010 9:05:35 AM	6.879	20.558	0

Which PI web part is this and what does it do?

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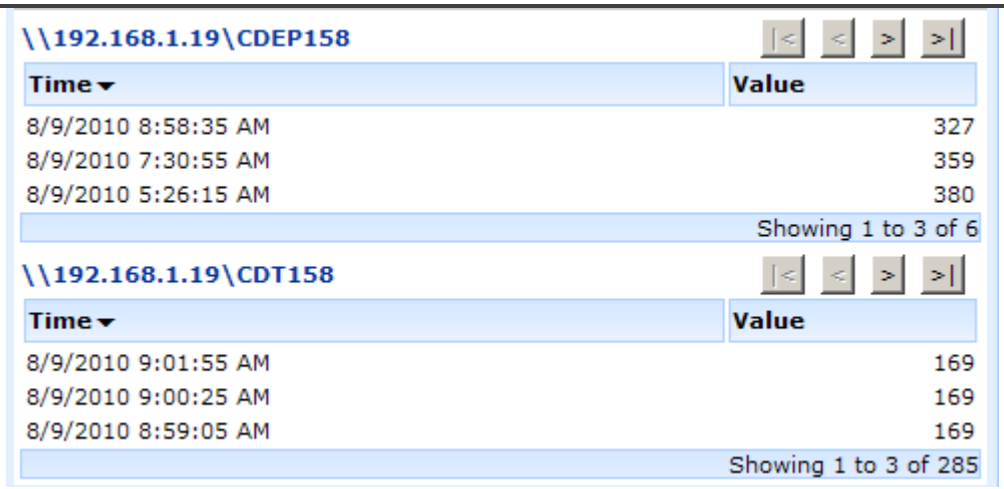


\\192.168.1.19\CDEP158

Time	Value
8/9/2010 8:58:35 AM	327
8/9/2010 7:30:55 AM	359
8/9/2010 5:26:15 AM	380

Showing 1 to 3 of 6

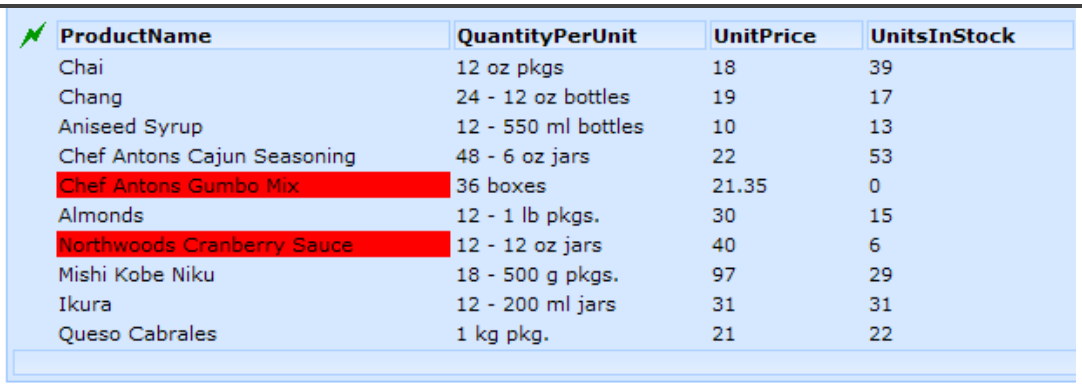
\\192.168.1.19\CDT158

Time	Value
8/9/2010 9:01:55 AM	169
8/9/2010 9:00:25 AM	169
8/9/2010 8:59:05 AM	169

Showing 1 to 3 of 285

Which PI web part is this and what does it do?

Notes:



ProductName	QuantityPerUnit	UnitPrice	UnitsInStock
Chai	12 oz pkgs	18	39
Chang	24 - 12 oz bottles	19	17
Aniseed Syrup	12 - 550 ml bottles	10	13
Chef Antons Cajun Seasoning	48 - 6 oz jars	22	53
Chef Antons Gumbo Mix	36 boxes	21.35	0
Almonds	12 - 1 lb pkgs.	30	15
Northwoods Cranberry Sauce	12 - 12 oz jars	40	6
Mishi Kobe Niku	18 - 500 g pkgs.	97	29
Ikura	12 - 200 ml jars	31	31
Queso Cabrales	1 kg pkg.	21	22

Which PI web part is this and what does it do?

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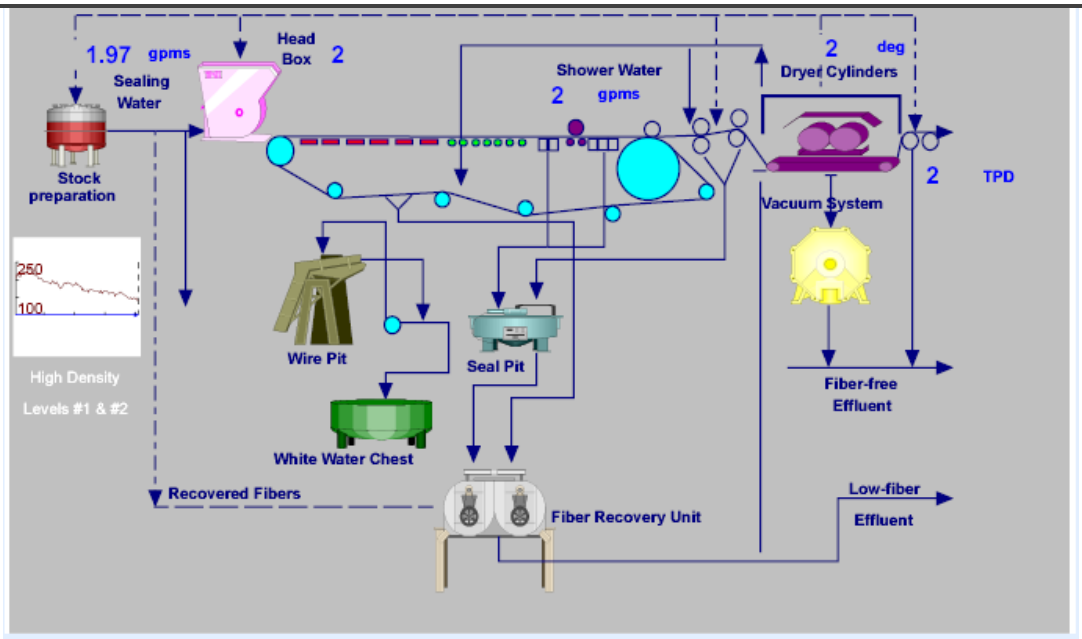
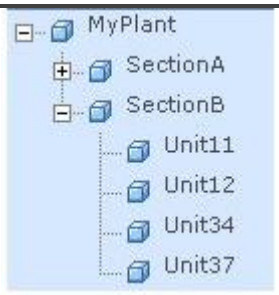


Which PI web part is this and what does it do?

Notes:



Which PI web part is this and what does it do?

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5.2.2 Exercise – Create a Dashboard with PI WebParts

The following questions are intended to reinforce the key information presented in this chapter or section. This is an open-ended question. Each student ought to have his/her own solution. There is an example solution attached to the end of the material.

Objectives

- Leverage various common PI WebParts to create a dashboard that serves your organization's business needs.

Problem Description

Leverage the PI WebParts we have covered so far to create a dashboard that you would use in your organization. A good reference would be the one you came up with in Exercise 2.2 & 2.3. It doesn't need to be "perfect" at the moment, for you will always have chances to come back and complement it later as you learn more.

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5.3 Connecting PI WebParts

Web parts can be connected by passing data, such as a row or filter data, from one web part to change the display of the other web parts' data. The entire process is depicted in Figure 5.7.

1. A web part connection is a way to pass data from one web part to another and synchronize their behavior.
2. One web part provides the data.
3. Data can be lists, rows, cells, or parameter values.
4. The other web part receives the data.

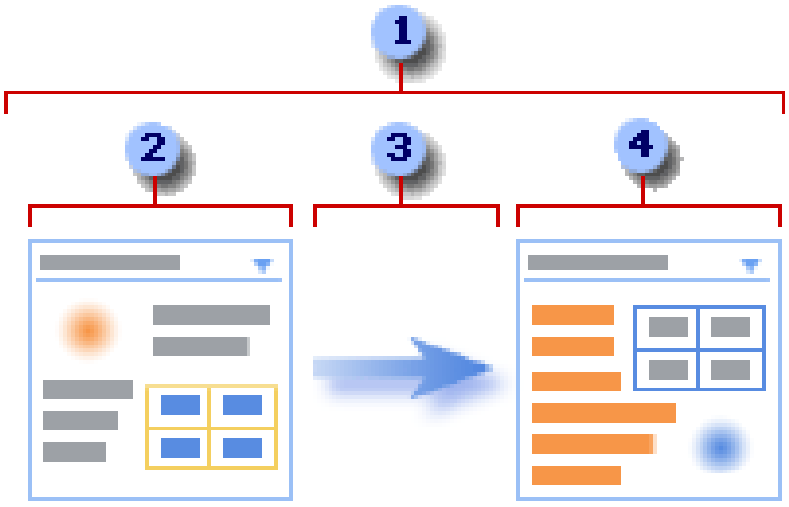

Figure 5.7 Process of web part *Connections*

5.3.1 Connection Types

There are 3 connection types:

- client-side parameters
- server-side parameters
- filter data

The choices available in a PI WebParts **Connections** menu (Figure 5.8) will depend on the types of PI WebParts that you choose to connect. In general, if both client-side and server-side connections are available, the client-side connection is preferable because it does not require the PI WebParts to post back to the server (reload the page) when retrieving information.

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Once two web parts are connected, the receiving web part needs to be set properly to accept the data. Open the **web part properties** pane of the receiving web part. Click on the **connections** icon that appears to be a lightning bolt next to the item to be linked. This will bring up the connection dialog box where the **connection parameters** from the sending web part can be selected (Figure 5.9). Once the connection is corrected configured, the lightning bolt icon will turn green – a quick way to identify connected parameters.

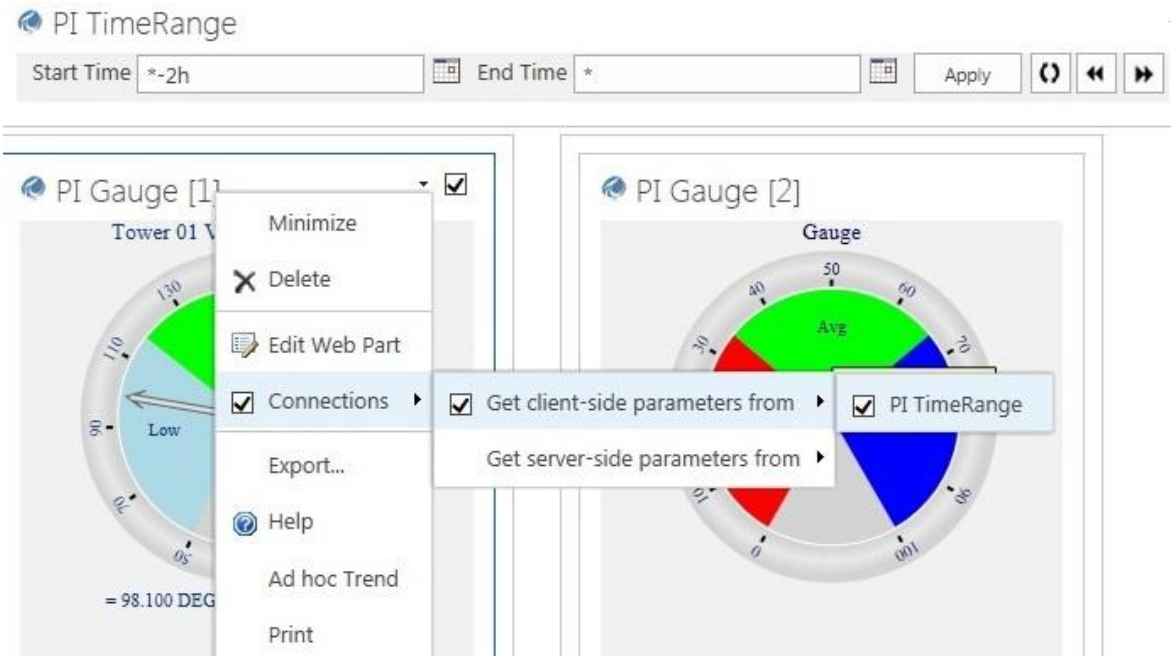

Figure 5.8 Select the connection type

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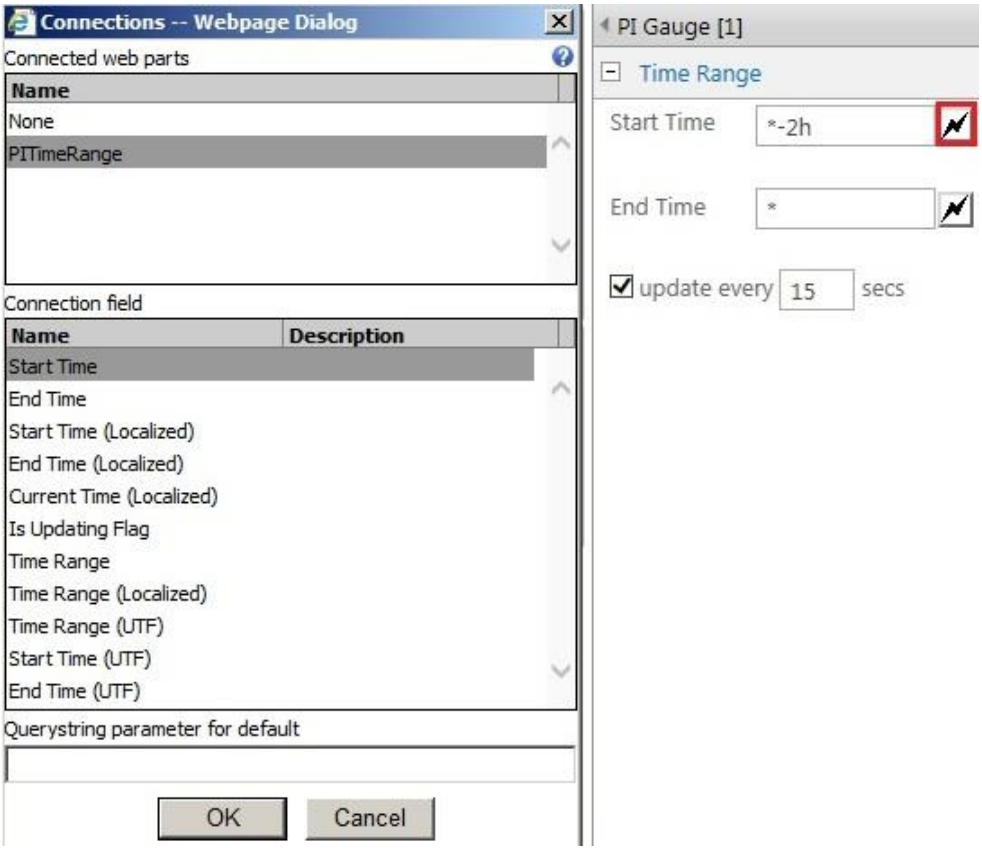

Figure 5.9 Specify the parameter to be connected

5.3.2 Implicit Connections

Implicit connections take effect as soon as the provider is inserted to the web page, without any explicit settings.

Among PI WebParts, PI TimeRange is the only one that features implicit connections and it only passes the **Start Time** and **End Time** parameters. All PI WebParts, except the PI TreeView, are designed to use the client-side event-based mechanism for receiving time range changes. These PI WebParts and any others that support the IParametersOutConsumer web part connection interface can be specifically configured to use the **Start Time** and **End Time** parameters from the PI TimeRange web part.

To turn off an implicit connection, make an explicit connection.

5.3.3 Explicit

To establish explicit connections between PI WebParts, the page must be in **Design** mode by opening **web parts Properties** panel.

- The **Connections** menu will not be seen if the page is in **View** mode.
- The connection can be initiated by either the Provider or the Consumer.

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- In the Connections menu, it will say **Get client-side/server-side parameters values from…** on the Consumer side or **Send client-side/server-side parameter values to…** on the Provider side. This merely establishes the connection and selects the Provider and the Consumer. It does not select which data is to be sent.
- Some web parts can be both Providers and Consumers, so it is important to determine which is sending and which is receiving data.
- To configure the data to be sent, you must be in **Design** mode and **Edit** the web part.

Any field in a consumer PI WebParts that can receive data will have a **connection** icon, which looks like a lightning bolt , next to it.

- For example, every PI WebParts, with the exception of the PI TimeRange, can receive the **Start Time** and **End Time** parameters.
- Use the **connections** icon in the receiving PI WebParts configuration panel to designate where the data should be used.
- When you click the **connections** icon of a parameter field in the consumer PI WebParts, it opens the connections dialog. From here, you must select the desired provider. It is possible to configure multiple providers for a single consumer, so it is important to accurately select which provider is passing the specific parameter you are interested in.
- Once the provider is selected, a list of the parameters that it can pass will be listed. Select the desired parameter and click the **OK** button.
- The lightning bolt icon will be green colored when connected.

You can disconnect the PI WebParts connection by repeating the connection selection (toggle).

5.3.4 Group Recap Questions

The following questions are intended to reinforce key information presented in this chapter or section. The instructor will discuss about answers.

Questions

1. What PI WebParts do you think are providers?
2. What PI WebParts do you think are consumers?
3. What PI WebParts do you think are both?
4. List some of the possible connections you can make using different PI WebParts.

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5.3.5 Exercise – Adding PI WebParts Connections

The following questions are intended to reinforce key information presented in this chapter or section. This is an open-ended question. Each student ought to have his/her own solution. There is an example solution attached to the end of the material.

Objectives

- Improve your existing dashboard by adding some PI WebParts connections to it.

Problem Description

You have already created a dashboard made of PI WebParts. Now, try adding some PI WebParts connections to it to improve its functionality and practicality.

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5.4 Excel Services + PI DataLink Server

PI DataLink Server is a server version of PI DataLink that uses Microsoft SharePoint technologies Excel Services to enable servers to retrieve data from the PI System and view it in Microsoft Excel spreadsheet format on a PI WebParts Page.

5.4.1 Excel Services

Excel Services was introduced in Office SharePoint Server 2007 and is available only in the Enterprise edition of SharePoint Server 2010 and 2013. Excel Services is used primarily for business intelligence scenarios, where Excel workbooks can be published to a SharePoint document library. When a user opens the workbook from the document library, it is rendered in the browser by using Excel Services. The external data connection in the workbook is maintained and the data is refreshed if necessary. This allows broad sharing of reports throughout an organization.

Excel Services consists three basic components that interact with each other and together form the overall structural design.

Excel Calculation Services (ECS) is the "engine" of Excel Services that loads the workbook, calculates in full fidelity with Microsoft Office Excel, maintains external connections, and refreshes external data.

Excel Web Access (EWA) is a web part that displays and enables interaction with the Microsoft Office Excel workbook in a browser without the need for downloading ActiveX controls on the client computer, and can be connected to other web parts on dashboards or other web part pages. Excel Web Access displays data and charts from an Excel Workbook, has a similar "look and feel" to Microsoft Office Excel, such as sheet tabs, outline buttons, and drop-down arrows, and provides a number of ways to customize the web part.

Excel Web Services (EWS) is a web service that provides several methods a developer can use as an application programming interface (API) to build custom applications based on the Excel workbook.

Because Excel Services is a SharePoint technology, features such as security and access management, server-based performance, and scalability can be taken advantage of.

5.4.2 PI DataLink Server

PI DataLink Server leverages Microsoft SharePoint technologies and expands the access to real-time PI System data (such as current value, historical values, and calculation results based on them) to more consumers, regardless of their locations or familiarity with either Microsoft Excel or PI DataLink functions. PI DataLink Server 2010 supports all PI DataLink, PI BatchView, and PI Notifications functions provided by the Excel Add-ins in a typical PI client configuration. Users can choose to publish workbooks directly to SharePoint document libraries or upload them from a local drive.

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5.4.3 Making Your Reports Interactive

What the users can do when the spreadsheet is displayed is determined by their SharePoint security permissions. If you have Viewer access you will only be able to open the snapshot or download a copy. Fortunately, it is possible to create interactive spreadsheets without having to allow the spreadsheets to be edited or altered permanently by letting the users enter variables into the spreadsheet directly or via web part connections.

Some examples of this are:

- change PI tag or PI AF attribute name
- alter start or end time
- change the module or asset based context

In order to make this happen you will need to take 3 additional steps:

1. Name the cells that will allow interaction using the **Define Name** function in Excel.
2. Publish / upload the spreadsheet to a SharePoint Document Library.
3. Open it in the web browser and configure parameters.

Note: Excel functions cannot be defined as names and hence cannot be used for parameters. Often encountered when **Start Time** and **End Time** cells used in PI DataLink functions have Excel Times (=NOW() for example).

5.4.4 Connecting Filter Data

As discussed in Section 5.3, PI WebParts connections can be established by providing parameters or filter data, and the consumer web part determines which pieces of data it will use and where (the lightning bolts). However, the EWA web part cannot perform this action. It cannot decide. The data must be filtered before it is sent.

Filter Connections are the standard way to provide parameters to an Excel Web Access web part. A wide selection of filter web parts is provided with SharePoint Sever 2013. Each filter serves a specific purpose and can provide the EWA web part with one parameter.

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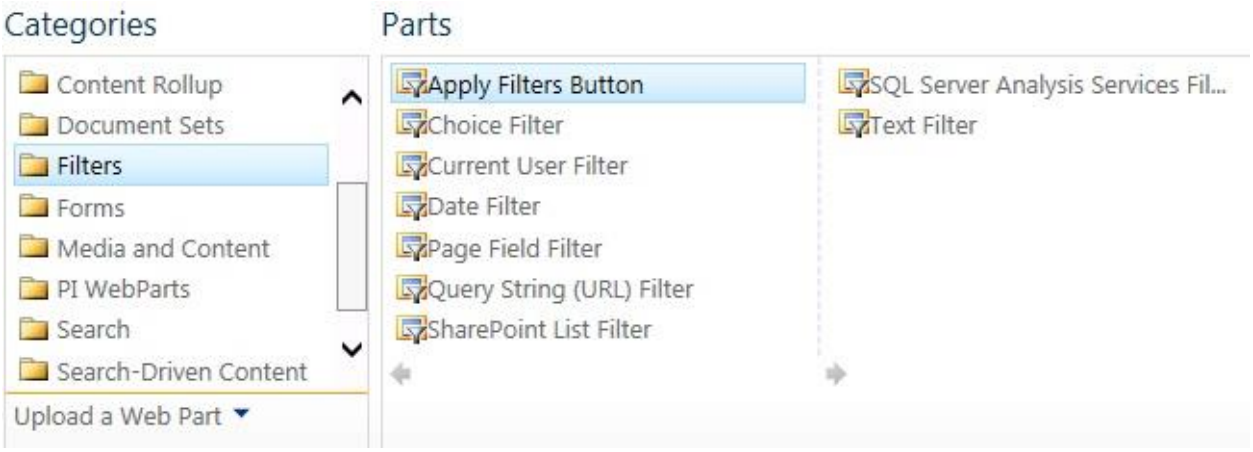

Figure 4.10 Filters Web Parts Provided in SharePoint Server 2013

With properly configured connections, PI WebParts can be used to display or drive a spreadsheet with embedded PI DataLink functions. Some common interactions are:

- Receiving a workbook URL, named item, or module context from PI TreeView.
- Accepting tag names from a PI Table, PI TimeSeries or PI Values web part.
- Consuming Start and End time values sent by PI TimeRange.

5.4.5 Consideration for the PI TimeRange Web Part and EWA

If PI Time Range provides both a **Start Time** and an **End Time**, they will appear as one semicolon-delimited concatenated string in the receiving spreadsheet. Thus, you will require Excel functions to parse the time. It will be of the form:

`YYYY-MM-DDThh:mm:ss;YYYY-MM-DDThh:mm:ss.`

Excel string manipulation functions (for example. `LEFT`, `RIGHT`, `MID`, `SEARCH`) can be used to parse the Time Range parameter into separate **Start Time** and **End Time** components. The results can be distributed to separate cells for use with PI DataLink functions.

It can also be interesting to hide the cell that contains the raw values and only expose the separated results. The PI DataLink function uses the parsed cells.

Notice that the 2 times are delimited by a semicolon ";" in the string. When it is passes as **filtered data** to the Excel Web Access web part, it reads it as one item and therefore has no way to parse the data on its own.

The syntax for the solution is:

Start Time cell `=LEFT(timecell,FIND(";",timecell) - 1)`

End Time cell =`RIGHT(timecell, LEN(timecell) - FIND(";", timecell))`

where **timecell** is a cell reference to the cell which will receive the time passed from the PI TimeRange web part.

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5.4.6 Excel Web Access Companion

Normally, the Excel spreadsheet will only refresh if the entire page is refreshed. The Excel Web Access Companion, a third party product, refreshes all Excel Web Access web parts in a given web part Zone at a specified interval. This can be especially useful if you are doing real-time calculations in your DataLink spreadsheet.

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5.4.7 Exercise – Bring Your Production Reports Online

The following questions are intended to reinforce key information presented in this chapter or section. This is an open-ended question. Each student ought to have his/her own solution. There is an example solution attached to the end of the material.

Objectives

- Publish your PI DataLink reports on a web page.

Problem Description

To facilitate information flow across your organization, you need to publish the production reports that are made of PI DataLink functions on your intranet. Additionally, it would be more convenient to the users if the online reports are interactive.

You are encouraged to design and create a simple PI DataLink report for this exercise.

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6 Special-Purpose PI WebParts

6.1 PI ActiveView

The PI ActiveView web part is configured almost exactly the same as the PI Graphic web part. This web part differs in that it displays .PDI files instead of .SVG files. The advantage of PI ActiveView web part is that you can maintain the use of PI ProcessBook files that rely on VBA, PI SQC Charts, PI BatchView, and other ActiveX controls.

Using the PI ActiveView web part requires the following 2 conditions to be met:

- A direct connection to the PI Data Archive from the client machine.
- PI ActiveView must be purchased and installed on the client machine, which is licensed separately from PI WebParts.

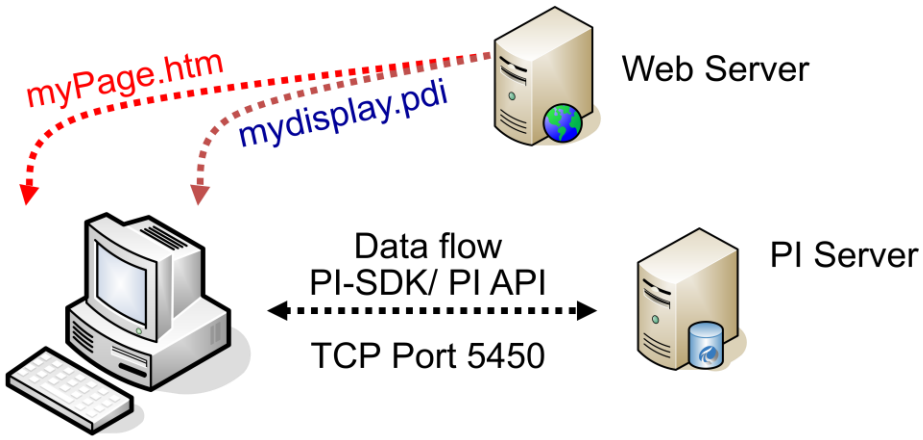

Figure 6.1 Client Machine Needs Access to PI Data Archive

Because using the PI ActiveView web part destroys the advantages of a thin client, its use should be carefully considered. It is most often suited for an intranet environment where a direct connection to the data source and an installation of PI ActiveView application can be handled appropriately.

6.2 PI BatchTable

The PI BatchTable web part provides a means to search for PI batch information and exchange batch data with other web parts.

Batch searches can be configured to execute automatically on loading a page, or run with parameters supplied to the PI BatchTable web part by other web parts.

A successful batch search returns a list of batches that match the search criteria. Selecting a batch in the table can pass batch data to connected web parts.

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6.3 PI Messenger

The PI Messenger web part displays the online status of a list of instant messaging (IM) contacts provided through Microsoft Windows or MSN Messenger service. It uses the local instant messaging client to interact with contacts. The Lightweight Directory Access Protocol (LDAP) must be configured to use Active Directory contacts.

The PI Messenger allows users to add contacts by manually entering an IM address, by importing it from their Outlook Address Book, by selecting a PI WebParts Services data set, or by configuring Active Directory groups.

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7 PI WebParts Services

PI WebParts Services is a server-side data access layer application that provides a common interface for client applications to retrieve data from a variety of sources (e.g. PI Data, relational databases, web services, etc.) It also includes utilities for data administrators to define server-side data source connections and queries that can be used by client applications through these interfaces.

Prior to the development of PI WebParts Services, client applications had to implement their own solutions for defining connectivity to disparate data sources. This approach resulted in the need for administrators to recreate the same definitions in multiple places (once for each client application). Support for specific types of data sources varied from one application to another. PI WebParts Services addresses these problems by providing centralized data source definition features. Through the use of PI WebParts Services, a client application can access any of the data sources and queries defined on the server via a common querying interface. Data from any sources are returned to the client application in a standard format, simplifying the application's data processing.

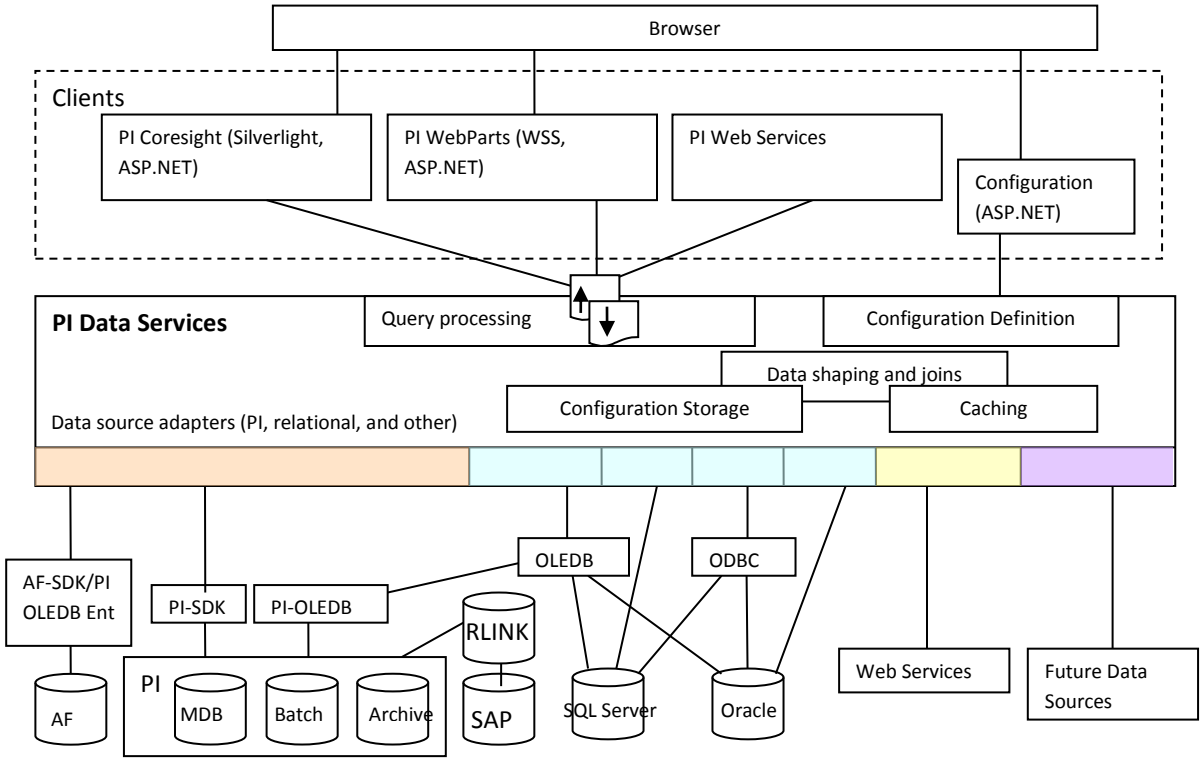

Figure 7.1 Architecture of PI WebParts (Data) Services

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7.1 Accessing PI WebParts Services

PI WebParts Administration page is the top-level page of the PI WebParts Services Administration, which groups administration tool pages by function. Web part Specific Settings pages let users apply custom formatting or create interactive features to visualize data in PI WebParts. Data Sources pages define how PI WebParts Services performs authentication and connects to PI System, relational databases, and web services. Data Sets pages define columns, terms, and parameters that specify a set of meaningful data for retrieval from a data source.

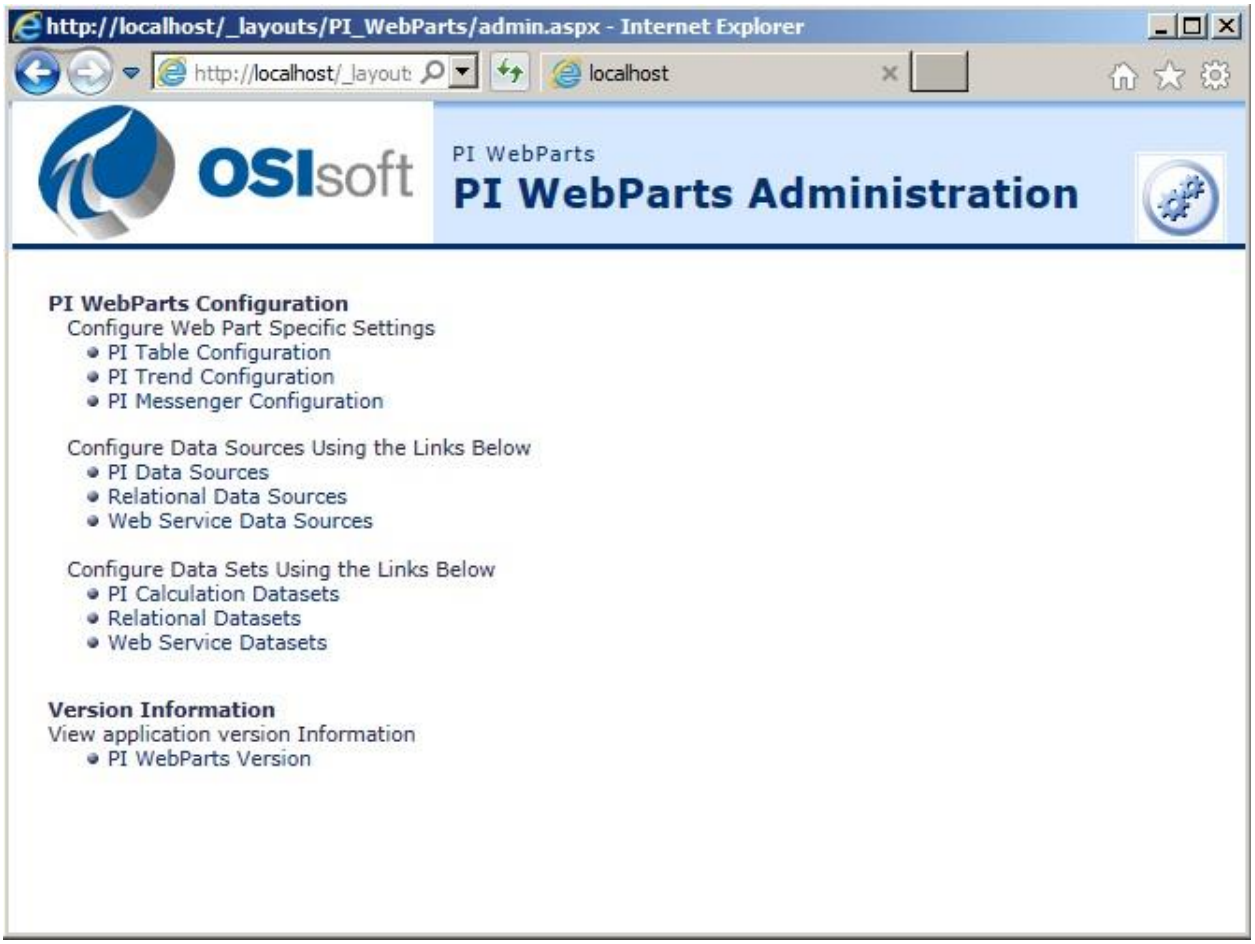

Figure 7.2 PI WebParts Administration Web Page

The URL to the page is different for standalone SharePoint Server and farm. Please refer to PI WebParts 2013 Administrator Guide, pp 22 for details.

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7.2 Web Part Specific Settings

The settings are used for creating and managing presentation configurations for the PI Trend, PI XYPlot, and PI Messenger web parts, as well as any tabular web parts. In a configuration, users can apply custom formatting or create interactive features to visualize data in PI WebParts. After the creation, the configuration can be applied to matching PI WebParts when building a web part page.

7.2.1 PI Table Configuration

Data set-specific templates can be created to customize the display of columnar data in the PI Table, PI TimeSeries, and PI Values web parts. Configurations created here are available to the corresponding PI WebParts in the property configuration panel.

Note: RtArchive and **RtSnapshot** are the default configurations for PI TimeSeries and PI Value, respectively. Only change them when you are certain and wish to.

Each column in the resulting table can have a unique behavior. Each column in the table can have one of the following behaviors:

Default - Normal behavior.

Ad hoc Trend - Columns with Ad hoc behavior provide content as hyperlink; when clicked, each link opens an Ad hoc Trend dialog box using the PI attribute configured for that row. This assumes a valid PI attribute is the result.

Current State – The column displays the current state in bar graph. This is only useful if the resulting query contain the actual value, a minimum value, and a maximum value.

Hidden - Columns set to use **Hidden** behavior can provide data to other web parts but are not displayed.

Hyperlink - The column is formatted as a hyperlink to a web page, web image file (e.g., GIF or JPEG) or file (e.g., SVG). This assumes a valid link.

Figure 7.3 PI Value Web Part Before & After Configuration Changes

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7.2.2 PI Trend Configuration

PI Trend and PI XYPlot web parts plot data points in configurable formats that update in real time. With a configuration template, you can preset formatting options, such as multiple-line styles, fonts, color coding, and markers.

7.2.3 PI Messenger Configuration

PI Messenger shows online presence for a list of contacts. Use the PI Messenger Configuration page to configure settings for contacts lists stored in a data set or an LDAP Active Directory location.

7.2.4 Exercise – Customize Web Part Specific Settings

The following questions are intended to reinforce key information presented in this chapter or section. This is an open-ended question. Each student ought to have his/her own solution.

Objectives

- Create new PI Table, PI Trend, and / or PI Messenger configurations that fit your business case.

Problem Description

Every organization has its own requirements for presenting real-time data. Create new PI WebParts templates that fit your business case. You are encouraged to create templates for as many PI WebParts as possible.

7.3 Managing Data Sources

Data Sources pages on the PI WebParts Administration site are used to add, view, test, or delete connections to available data sources.

7.3.1 PI Data Sources

Any PI Data Archive that can be seen across the network can be configured. A successful connection will require the proper security, typically a valid PI Trust, to be set up on each PI Server. The security requirements are described in detail in a later section. The timeout parameters can also be set.

It achieves the same result as using PI SDK utility or PI System Management Tools on the PI WebParts Services application server to add a connection to a PI Data Archive.

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7.3.2 Relational Data Sources

PI WebParts Services supports a variety of relational databases and connection options. The following relational database and connection options are supported:

- ODBC
- Microsoft Jet 4.0 OLE DB (Access)
- OLE DB
- Oracle
- PI OLEDB
- SQL Server

When PI WebParts Services (or any other applications) connects to a database, it needs a provider to do the job. All the information the provider needs to know in order to be able to establish a connection to the database is stored in a connection string. UDL file saves the connection string in text format.

Contact your IT department for a proper connection string. You can find a reference to connections strings for various database by going to to http://www.connectionstrings.com/.

7.3.3 Directed Exercise – Connecting to a Relational Data Server

You are invited to watch what the instructor is doing or perform the same steps at the same time to explore the different concepts presented in this chapter or section.

Problem Description

You want to connect a Relational Data Source. You will need a **Connection String** to do this.

Approach

Create a UDL file and read the **Connection String**. Then login to the PI WebParts Administration page and connect the Relational Data Source.

7.3.4 Web Service Data Sources

PI WebParts supports data provided by web services, including PI ACE 2.x calculations and other web data sources. Web services are the fundamental building blocks in the move to

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distributed computing on the Internet and are becoming the platform for application integration because of:

- open standards
- focus on communication
- collaboration among applications

Applications can use multiple web services from various sources to work together regardless of where they reside or how they were implemented.

7.4 Datasets

Data sets from configured data sources can be created on these pages. Once a data source is created and PI WebParts Services can connect to the data provider, a dataset that uses the data source can be created.

PI WebParts Services supports PI calculation data, relational queries, and web-service queries as data sets.

Note: All 3 types of data sets have a **Preview** button that should be used to determine if the dataset works as expected.

7.4.1 PI Calculation Datasets

PI Calculation datasets evaluate an Expression that you provide. This Expression must follow PI Performance Equation syntax. Datasets support both:

- PI Summary data (e.g., averages, minimums, and standard deviations);
- PI Expression data (e.g., the result of an evaluated PI Performance Equation).

Note: Open the PEReference.chm file on your computer (found in the `\\PIPC\Help` folder) and review the syntax rules and functions.

7.4.2 Exercise – PI Calculation Datasets

The following questions are intended to reinforce key information presented in this chapter or section. This is an open-ended question. Each student ought to have his/her own solution. There is an example solution attached to the end of the material.

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Objectives

- Leverage PI calculation datasets in your dashboard.

Problem Description

In order to avoid consuming tags on your PI Data Archive, you will need to create PI calculation datasets and add them to your organization dashboard. Try to configure at least one PI summary calculation and one PI expression calculation to provide appropriate data.

7.4.3 Relational Datasets

Relational datasets are based upon Structured Query Language (SQL). The specific syntaxes required can be different depending on the specific database. A simple data query might look like:

```
SELECT * FROM TABLE WHERE COLUMN = SOMETHING
```

Although queries have various ways of interacting with a user, they all accomplish the same task. They present the result set of a `SELECT` statement to the user. The `SELECT` statement retrieves data from SQL Server and presents it back to the user in one or more result sets. A result set is a tabular arrangement of the data from the `SELECT`. Like a SQL table, the result set comprises columns and rows.

This `SELECT` statement below finds the product ID, name, and unit price of any products whose unit price exceeds $40 and then sorts the result by unit price:

```
SELECT ProductID, ProductName, UnitPrice FROM Products WHERE UnitPrice > $40 ORDER BY
UnitPrice ASC
```

The column names listed after the `SELECT` (ProductID, ProductName, and UnitPrice) are keywords form the select list. This specifies that the result set has three columns, and each column has the same name, data type, and size as the associated column in the Products table. Because the `FROM` clause specifies only one base table, all column names in the `SELECT` statement refer to columns in that table.

The `FROM` clause lists the single table, Products, from which the data is to be retrieved.

The `WHERE` clause specifies that the only rows in Products that qualify for this `SELECT` are those in which the value of the UnitPrice column exceeds $40. Very often a placeholder will be used in the `WHERE` clause to use a variable from another web part.

The `ORDER BY` clause specifies that the result set is to be sorted in ascending sequence based on the value in the UnitPrice column.

7.4.4 Placeholders in Datasets

A placeholder ('?' character) is a text character used in a SQL statement or stored procedure in place of a PI tag or text. When the SQL statement is executed, the '?' character is replaced by

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a specified value or expression before it is passed to the relational data source. The placeholder acts as a variable, allowing users of the query to supply parameters that produce different data using the same SQL query.

Placeholders can have the following types:

Text – the placeholder replaces the "?" with a text string.

StartTime or **EndTime -** the placeholder replaces the "?" with the start or end time for the data collection interval.

ResolveTag -The placeholder replaces the "?" with a value obtained from a PI tag.

7.4.5 Exercise – Relational Datasets

The following questions are intended to reinforce key information presented in this chapter or section. The answers can be found at the end of this document.

Objectives

- Familiarize students with creating relational datasets in PI Data Services

Problem Description

You must create an SQL server connection to your customer database in order to display customer data with your real time data. Your IT Department has set up a connection for you to the database. Your users expect to see this data in a PI Table.

Approach

Navigate to the PI WebParts Services Administration page by entering the following URL in the browser: `http://<<servername>>/_layouts/PI_WebParts/Admin.aspx`

Select the **Relational Datasets** item from the menu on the left. Create a new dataset called *<<yourname>>-CustomerList*.

Note: Your instructor will indicate which data source to use, or if they will decide to have you create a data source.

In the **SQL Statement** area, enter the following:

select CustomerID,CompanyName from customers

Verify the query and save your dataset.

Create another new dataset called *<<yourname>>-Details*.

*select * from customers where CustomerID=?*

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Click on **Verify SQL**.

Enter the information for the placeholder

- Name: Placeholder 1
- Display name: CustomerID
- Default Value: ALFKI
- Type: Text

Click on **Preview** to see the results.

In a new SharePoint page called *CustomTable*, insert a PI Table web part and configure it to display this new dataset.

Try to do this exercise on your own before proceeding to the step-by-step solution.

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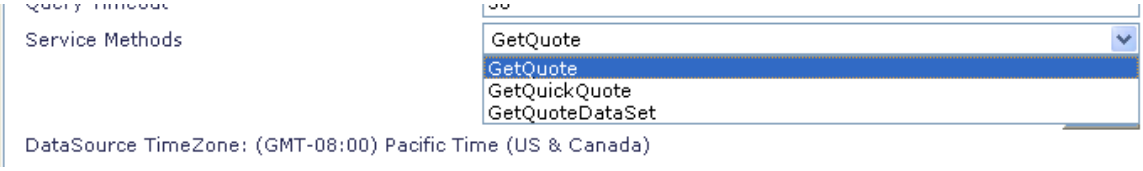
7.4.6 Web Service Datasets

Web Service Datasets are accessed via a URL (with optional username and password). There are usually a fixed set of inputs and outputs. You can determine the inputs by contacting the web service and examining the Service Methods.



You can then customize the labels for the Inputs (parameters) and Outputs (columns).

Configuration options:

Service Method – specifies the web service method that provides the data for the data set columns. Selecting an entry in this field populates the list of parameters under Method Parameters.

Type – the type of parameter. Type can be Text, StartTime, EndTime, and ResolveTag.

7.5 Group Recap Questions

The following questions are intended to reinforce key information presented in this chapter or section. The instructor will discuss about answers.

Questions

1. What is the difference between PI WebParts Services and PI WebParts?
2. Review the requirements examined in *PI WebParts 2013 Administrator Guide*. For example: operation system, IIS, .NET Framework, etc.

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8 Backups

Because the configuration data of PI WebParts are stored in two places, a complete backup must consists of a strategy that backs up both the SQL databases and the PI Data Archive.

Note: Although Since 2010, the PI System has migrated the Module Database to Asset Framework, the %OSI module is not migrated out of the local module database. The PI Data Archive is still the place of record for the %OSI module, which is where PI WebParts Services configurations are stored. Therefore, this module is not backed up with AF, but with PI Data Archive.

8.1 SQL Server Backup

There are generally 3 acceptable ways to back up the SharePoint databases in SQL Server. They are listed and explained below in in an order of good to best.

1) Through SharePoint Central Administration => Backup and Restore: this is a default UI option that comes within Central Administration. It allows to take full and differential backups. You have the additional flexibility to backup and restore Search functionality. This is not a fool proof backup plan though due to limitations in scheduling, backing up configuration databases, configuration settings in the farm and failure of timer jobs.
2) Use **stsadm**, the SharePoint command line tool. The following example command is to be run in one line:

   ```
   "C:\Program Files\Common Files\Microsoft Shared\web server
   extensions\12\BIN\stsadm.exe"
   -o backup -url <<your SharePoint URL>>
   -filename <<your path and filename>>
   -overwrite
   ```

   The –overwrite switch must be used if it is running a script and using the same filename each time.

   Scripting gives you high amount of flexibility in taking full or differential backups. Windows task scheduler helps in scheduling the scripts. It also takes backup of content databases and search index files and is much more reliable than Central Admin Backup. This also has limitations like lack of backup of configuration and IIS settings.

3) Through SQL Server Management Studio – SQL full and differential backups enable us to bring back the SharePoint sites and configuration databases almost 100 percent. This is comparatively the fastest backup and restore method, with more reliability than the above methods. But lacks backup of farm, IIS settings and search crawl indexes, which will have to be done manually.

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Information Sources:

- Microsoft Technet Articles
- http://sharepoint.stackexchange.com/

Directed Exercise – Perform a Site Collection Backup

You are invited to watch what the instructor is doing or perform the same steps at the same time to explore the different concepts presented in this chapter or section.

Problem Description

As a non-SQL administrator, the quickest way to back up your site content is through Central Admin. And since all the PI WebParts pages are held in 1 site, a site collection backup should be performed instead of a farm / server backup. Make sure the operation is successful.

Figure 11 Granular Backup Job Status

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Approach

Browsing from SharePoint Central Administration page, click **Backup and Restore** in menu on the left-hand side. Under **Granular Backup**, choose **perform a site collection backup**.

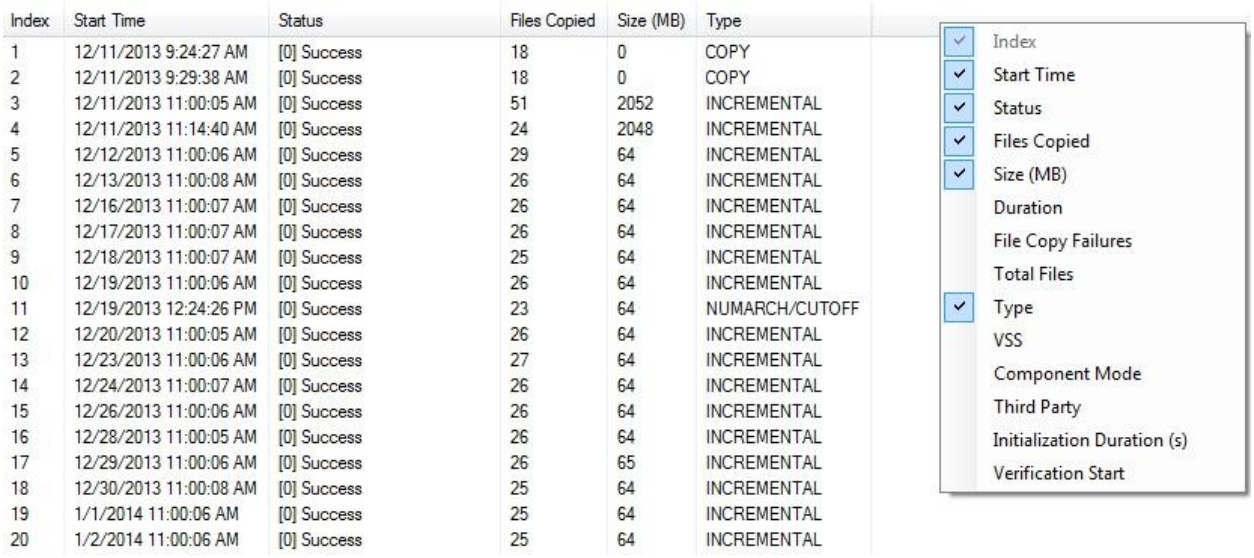
On the site collection backup window, select the target site collection to be backed up, and specify the file location and filename for the backup package. Click **Start Backup**, the operation would be in progress now.

The page will refresh when the job is finished. Check the previous job's status to confirm whether it is successful.

8.2 PI Data Archive Backup

To verify that the PI Data Archive is being backed up properly, the easiest way is to use PI System Management Tools (SMT) Backups tool:

1) Open PI SMT.
2) Under Collectives and Servers, select the server want to check.
3) Under System Management Tools, select Operation > Backups.
4) In the PI Server drop-down list, select the server want to examine. The list includes all of the servers selected under Collectives and Servers. The backup history for that server appears.
5) Right-click a column heading to see a complete list of columns that can be displayed.



Index	Start Time	Status	Files Copied	Size (MB)	Type
1	12/11/2013 9:24:27 AM	[0] Success	18	0	COPY
2	12/11/2013 9:29:38 AM	[0] Success	18	0	COPY
3	12/11/2013 11:00:05 AM	[0] Success	51	2052	INCREMENTAL
4	12/11/2013 11:14:40 AM	[0] Success	24	2048	INCREMENTAL
5	12/12/2013 11:00:06 AM	[0] Success	29	64	INCREMENTAL
6	12/13/2013 11:00:08 AM	[0] Success	26	64	INCREMENTAL
7	12/16/2013 11:00:07 AM	[0] Success	26	64	INCREMENTAL
8	12/17/2013 11:00:07 AM	[0] Success	26	64	INCREMENTAL
9	12/18/2013 11:00:07 AM	[0] Success	25	64	INCREMENTAL
10	12/19/2013 11:00:06 AM	[0] Success	26	64	INCREMENTAL
11	12/19/2013 12:24:26 PM	[0] Success	23	64	NUMARCH/CUTOFF
12	12/20/2013 11:00:05 AM	[0] Success	26	64	INCREMENTAL
13	12/23/2013 11:00:06 AM	[0] Success	27	64	INCREMENTAL
14	12/24/2013 11:00:07 AM	[0] Success	26	64	INCREMENTAL
15	12/26/2013 11:00:06 AM	[0] Success	26	64	INCREMENTAL
16	12/28/2013 11:00:05 AM	[0] Success	26	64	INCREMENTAL
17	12/29/2013 11:00:06 AM	[0] Success	26	65	INCREMENTAL
18	12/30/2013 11:00:08 AM	[0] Success	25	64	INCREMENTAL
19	1/1/2014 11:00:06 AM	[0] Success	25	64	INCREMENTAL
20	1/2/2014 11:00:06 AM	[0] Success	25	64	INCREMENTAL

Figure 8.2 PI SMT Backup Tool

6) Double-click a backup entry to see details about that particular backup. A backup summary or the entire list of backed up files can be viewed.

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By default reports for the last 100 PI Data Archive backups can be viewed. Each report tells whether or not that backup of PI Data Archive was successful.

PI Server 2012 System Management Guide dedicates the entire Chapter 4 to the topic of PI Data Archive Backup. Please refer to it for complete details.

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9 Troubleshooting

The best way to troubleshoot any system is to narrow down the source of the problem. Often this is accomplished by excluding various factors.

9.1 PI WebParts Services

After installing and configuring PI WebParts 2013, the first thing to check is whether PI WebParts Services is healthy. To do this, go to **Internet Information Services (IIS) Manager**, expand the site of **PI WebParts Services**, select **PIWebPartsServices**, switch to **Content View** at the bottom, select **PIWebPartsService.svc**, and click **Browse** on the right-hand side. If the service is operational, the page should look like Figure 9.1. Otherwise, detailed error messages should display which will be helpful to further troubleshooting.

Figure 9.1 PIWebPartsService.svc Page Indicating Healthy PI WebParts Services

Next, from **Central Administration** navigation pane, click **Configuration Wizards**, and then select **PI WebParts Configuration**. Click the "Test" button at each step and make sure all them are passed with a green check.

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Refer to PI WebParts 2013 Administration Guide, pp 19 – 20 for details of setting and checking **PI WebParts Configuration**.

9.2 PI Data Access

In order to consume PI Data in PI WebParts, PI WebParts needs to be able to communicate with PI WebParts Services. To check this, click **PI Data Source** on the **PI WebParts Administration** page. If PI WebParts can connect to PI WebParts Services, all known PI Data Archives should be listed. Otherwise an error message indicating a configuration issue would pop up, such as

Some application Services are not available at this time. Please try again. Note: This message may indicate a configuration issue

Check Table 9.1 to see what the setting requirements are based on the setup being used. More descriptive error messages can also be found in Windows Event Log and PI Message Log.

Architecture	PI Server authentication method	Type of SharePoint site	Configuration requirement
PI WebParts Services and SharePoint server on same computer	Windows integrated security (recommended)	Classic mode	• Kerberos delegation for PI WebParts Services
		Claims mode	• Kerberos delegation for PI WebParts Services
	PI trusts (not recommended)	Classic mode	None
		Claims mode	None
PI WebParts Services and SharePoint server on different computers	**Windows integrated security (recommended)**	**Classic mode**	• **Kerberos delegation for SharePoint server** • **Kerberos delegation for PI WebParts Services**
		Claims mode	• **Kerberos delegation for PI WebParts Services** • **Certificates on SharePoint server and PI WebParts Services**
	PI trusts (not recommended)	**Classic mode**	• **Kerberos delegation for PI WebParts Services**
		Claims mode	• **Certificates on SharePoint server and PI WebParts Services**

Table 9.1 Kerberos and Certificate Requirements for Various Installation Architectures

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9.3 Windows Event Logs

Event logs have been a feature of Windows NT since its original release in 1993. Applications and operating system components can make use of this centralized log service to report events that have taken place, such as a failure to start a component or completing an action. The system defines three log sources, "System", "Application", and "Security".

Event IDs are used to define the uniquely identifiable events that a Windows computer can encounter. For example, when a user's authentication fails, the system generates Event ID 672.

PI WebParts Services (called PI Data Services in event logs), IIS, ASP .NET, or the PI SDK can write message to the Windows Event Log.

To view event logs, go to **Start>Run…** and enter *eventvwr* to open the Event Viewer, which is a component of Microsoft's Windows NT line of operating systems that lets administrators and users view the event logs on a local or remote machine.

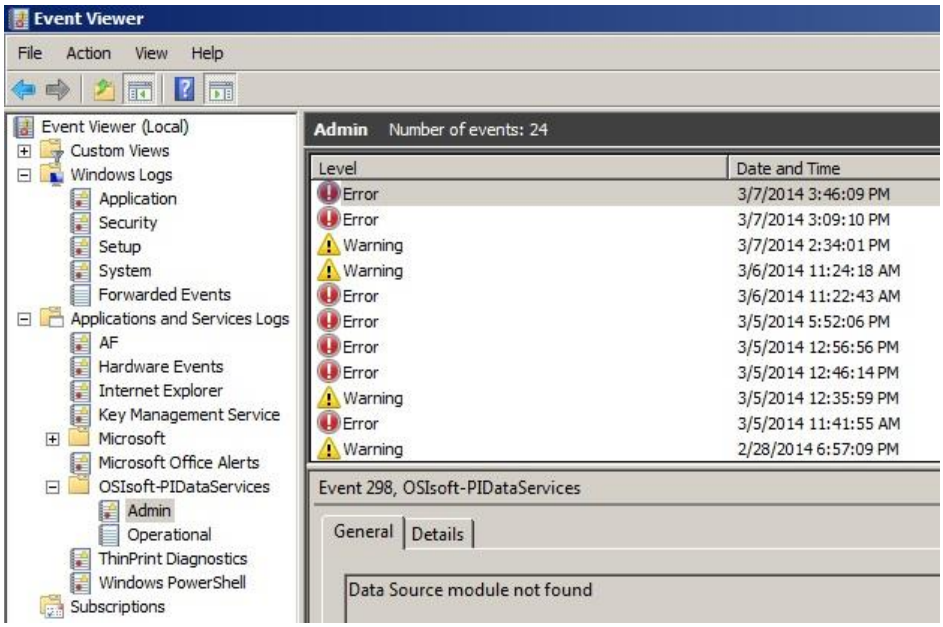

Figure 9.2 View Event Logs in Event Viewer

9.4 PI Message and PIPC Logs

PI Message Log:

During normal operation, the PI Message Subsystem maintains a central log file for messages from all PI subsystems. These log files are stored in binary format in the `\PI\log` directory. These files shift every night at midnight. Log files are maintained for 35 days before the PI System deletes them.

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To view the log files, you must use either the command line tool *pigetmsg* or the PI System Management Tools program to read it.

The PI Server and all its subsystems write messages and errors to the PI Message Log file. Incoming connections and backup-related issues are written here as well. This log should be checked on a daily basis for errors or problems.

PIPC Logs:

Most interfaces write messages to the pipc.log file. New UniInt-based interfaces, however, write to the PI Message log. On Windows, messages from the pipc.log file are also copied to the PI Message log for convenience.

On Windows, pipc.log file is stored in the \PIPC\dat directory.

9.5 Restarting IIS

IIS can be restarted by running the `iisreset` command-line. This might be necessary in order for certain configuration changes take effect. This will stop and start the entire Web server, including all of the application pools and web sites. It is the harshest solution, so should be avoided if at all possible. IIS 6.0 or greater includes application pool recycling and several other features that provide alternatives to restarting IIS.

Application Pool Recycling

IIS worker process recycling can be set to be triggered based on elapsed time, number of requests served, scheduled times, or virtual/private memory usage.

Application Pool can also be recycled manually using the IIS Manager in Windows Administrative Tools. More information can be found on Microsoft's Web site.

9.6 Performance Monitor

Like most PI related applications, PI WebParts Services supports performance counters (they are under PI Data Services in Performance Monitor). These performance counters can be read with the PI PerfMon interface and provide an excellent method of obtaining not only crash-time data but also baseline values for everyday operations.

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Directed Activity – Monitoring PI WebParts Services

You are invited to watch what the instructor is doing or perform the same steps at the same time to explore the different concepts presented in this chapter or section.

Problem Description

PI WebParts Services is an application worth monitoring. In an enterprise environment, understanding the usage and health of PI WebParts Services can enable more proactive administration and can aid in knowing when a server hardware upgrade should be performed.

Approach

Install the PI Performance Monitor interface on your machine.

Configure it (create & run the service) in the Interface Configuration Utility.

Using an appropriate template, create PI tags to monitor PI WebParts Services.

Consult the *PI WebParts 2013 Administration Guide*, pp 107 – 113 for details on the various performance counters exposed for monitoring.

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10 Security

Because there are so many different components involved in a PI WebParts deployment, there are equally many levels of security need to be taken into account in order to set it up. These different security levels involved are:

- Internet Explorer (client)
- Network security
- SharePoint security
- IIS security
- Application pool identities & Kerberos
- SharePoint security
- PI Data Archive security
- PI Asset Framework (AF) security

Note: Knowledge of PI Security, including the new Windows Integrated Security introduced in PI Version 3.4.380, is presumed in the following discussion. Your instructor may choose to provide a PI Security primer, covering the very basics of PI tag and asset security using Windows authentication.

10.1 Internet Explorer (Client) Security Settings

In general, the Medium browser security setting (applied to the Zone that includes the SharePoint server) in Internet Explorer is sufficient and does not need to be adjusted. If the Medium setting is not permitted for the zone in which the PI WebParts server is accessed, click **Customer Level** to set each of the following individual settings to **Enabled**:

- Run ActiveX controls and plug-ins
- Script ActiveX controls marked safe for scripting
- Active Scripting
- Binary and script behaviors
- Automatic Prompting for file downloads
- File download
- Allow script-initiated windows without size or position constraints (Internet Explorer)
- Drag and drop or copy and paste files

And the following to Disabled:

- Use Pop-up Blocker
- Enable protected mode.

If necessary, the site can be added to the Trusted Sites zone so that custom security settings are not applied to other web sites in the same zone.

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Note: Internet Explorer Enhanced Security Configuration (IE ESC) also needs to be disabled if you are using IE on a server.

10.2 Network Security

Network security is normally controlled by a router and a firewall. The following is a list of the ports used that must be opened:

- **TCP Port 80** must be open to allow communication between the Application Server (where PI WebParts Services is installed) and the PI WebParts client. Any other ports used for HTTP or HTTPS by the website should also be opened. HTTPS and SSL (Secure Sockets Layer) are normally configured to use **TCP Port 443**.
- Permit access from the SharePoint Server to all data sources at ports **1433** (the default for Microsoft SQL Server), **5450** (PI Data Archive 3.x), and **1521** (Oracle SQL*Net), respectively.
- Permit access from the Application Server to all data sources at ports **5457** and **5459** (PI AF), **5450** (PI Data Archive 3.x), and **1521** (Oracle SQL*Net).

10.3 IIS Security

IIS security plays a role in determining which users have access to the PI WebParts application. 6 types of authentication are available for IIS, among which OSIsoft highly recommends integrated Windows authentication for SharePoint installation.

- Anonymous
- ASP .NET
- Basic
- Digest
- Forms
- **Windows**

In the integrated mode, all website users have a Windows operating system account, and Windows integrated authentication identifies and authorizes users for login. The Windows group, RtWebPartsAdmin, controls access to pages on the PI WebParts Administration website. For new installations, this group needs to be created on the PI WebParts Services computer; for upgrades, this group already exists.

10.4 Application Pool Identities & Kerberos

If Kerberos is not invoked, the selection for the identity of the Application Pool will impact the level of security the end users are granted to access PI Data Archive and PI AF. In this case, one PI Mapping for this identity or one PI Trust for the entire machine would give all the end users the same access to PI data. However, if a more complex level of data access (i.e. some users can see certain data while others cannot) is required, then Kerberos

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delegation or certificate will need be configured. Please refer to PI WebParts 2013 Administration Guide, pp 97 – 106 for the steps to configure Kerberos delegation and certificates.

10.5 SharePoint Security

Access to SharePoint pages are controlled by SharePoint security. Each SharePoint object (site, list, library, etc.) can be secured independently through a role-based membership system by which users are assigned to roles that authorize their access to SharePoint objects.

To give a user access to an object, site administrator can add the user to a group that already has permissions to the object, or create a role assignment object and set the user for the role assignment.

By default, objects use the same permissions as the parent object (inheriting both the roles and users). They can also be set to use unique permissions, which enables fine management of user access to objects.

10.5.1 Exercise – Team Site Security

The following questions are intended to reinforce key information presented in this chapter or section. The answers can be found at the end of this document.

Objectives

- Familiarize students with site security.

Problem Description

You want to control access to your team site.

Note: This exercise may not be able to be completed in self-study mode if you do not have full permissions on your team site.

Approach

You want to remain the owner of your team site. Enter the **Site Settings** and make the following changes:

- Your username must have full control of the team site (the equivalent of Home Owner in SharePoint group).

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- Select some of the other usernames in the domain (your instructor will give the range of valid user IDs). Give a couple of these user IDs Read Only access to the site (the equivalent of Home Visitor in SharePoint group).
- Exclude everyone else from the team site.

Test your settings by observing the following:

- When logged in as yourself you should have full access;
- When logged in as a read only user you should be able to see the site but not see the EDIT features;
- When logged in as a user not defined you should not be able to find the site. Test this by moving up one level in the hierarchy and login as a user that has been excluded. You should not even be able to see your team site.

10.5.2 Claim-Based Authentication

SharePoint 2010 introduced a claims-based authentication (CBA) option for creating new web applications. In SharePoint 2013, web applications use CBA by default. The PI System is not aware of claims. Therefore, on a CBA site, PI WebParts accesses PI System resources (and external resources) with the same level of privileges (those of the specified application-pool identity). However, on CBA sites with Windows authentication enabled, users can log in to the site with a Windows account, which gives each user a unique privilege level to access resources.

Figure 10.1 illustrates how CBA works when a user who doesn't already have a SharePoint security token accesses a secured SharePoint web page in an architecture where PI WebParts Services is installed on a different machine from SharePoint.

1) User requests a web page.
2) SharePoint requests Windows credential using NTLM, Kerberos, or basic protocols.
3) User sends the Windows credentials for the user account.
4) SharePoint validates the user's Windows credentials with Active Directory (AD). The Security Token Service on the SharePoint machine is the authority that is contacting AD for the credential verification.
5) SharePoint obtains the group membership list for the user account from AD.
6) SharePoint creates a SharePoint security token, sends an authorization code and the requests web page.
7) User has a PI WebParts on the page which requests data from PI.
8) Since the App Server (server where PI WebParts services is installed) is on a separate machine, the SharePoint server will pass the token of the client to the App server node.
9) The App server node receives the token and checks if the token came from a trusted source by checking the list of trusted Security Token Services (STSs). This is where certificate configuration comes into play.

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10) If the source of the token is trusted, the App server checks all the claims of the token.

11) The Claims to Windows Token Service (C2WTS) on the App node will transform this token back into a windows account so that it can be passed to the PI server.

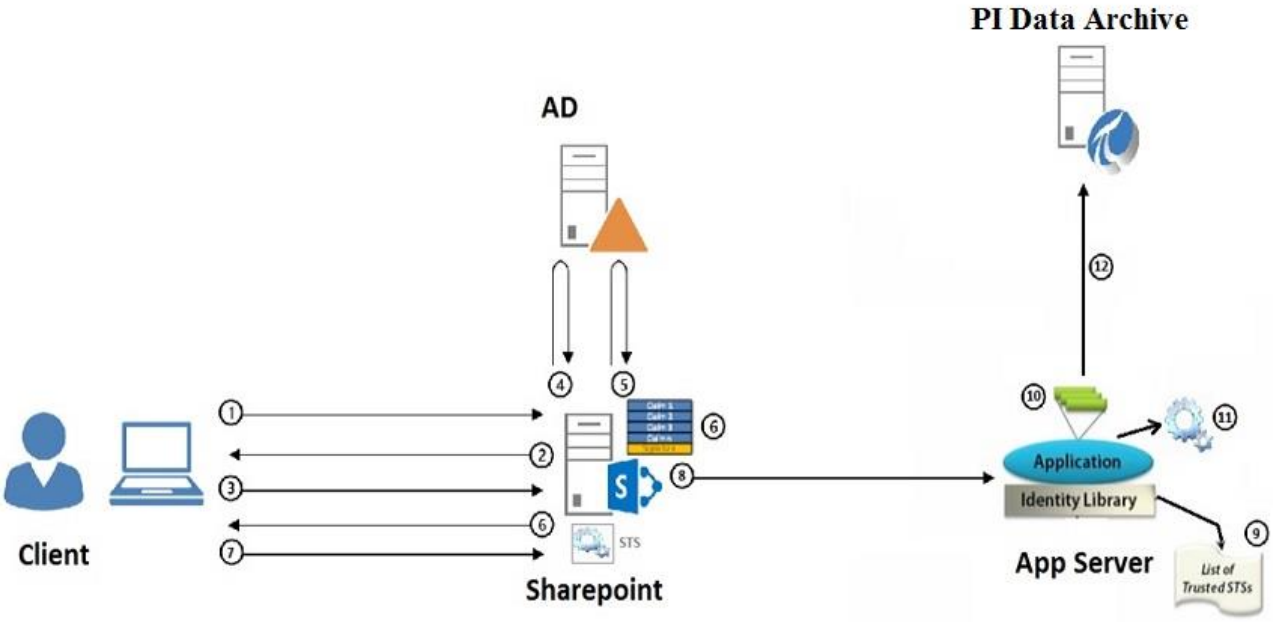

Figure 10.1 Remote Application Server Claims Architecture

10.6 PI Data Archive Security

PI Data Archive does not have the ability to tie Active Directory entities to objects like points or data tables. In PI Data Archive, **PI Identities** is used to set security on a PI database or PI tag basis. Mappings and trusts are created to authenticate connection and to decide with which PI Identity that connection is associated, as illustrated in Figure 10.2.

End users that access older versions of PI Data Archive (versions prior to 3.4.380) have to rely on PI trusts to obtain access granted to pre-approved network entities. To access any PI Data Archive version 3.4.380 or later, OSIsoft recommends using PI mappings rather than PI trusts as it offers more control over authentication policies and access permissions, enables single sign-on experience, and provides Windows account traceability in logs and audit-trail records.

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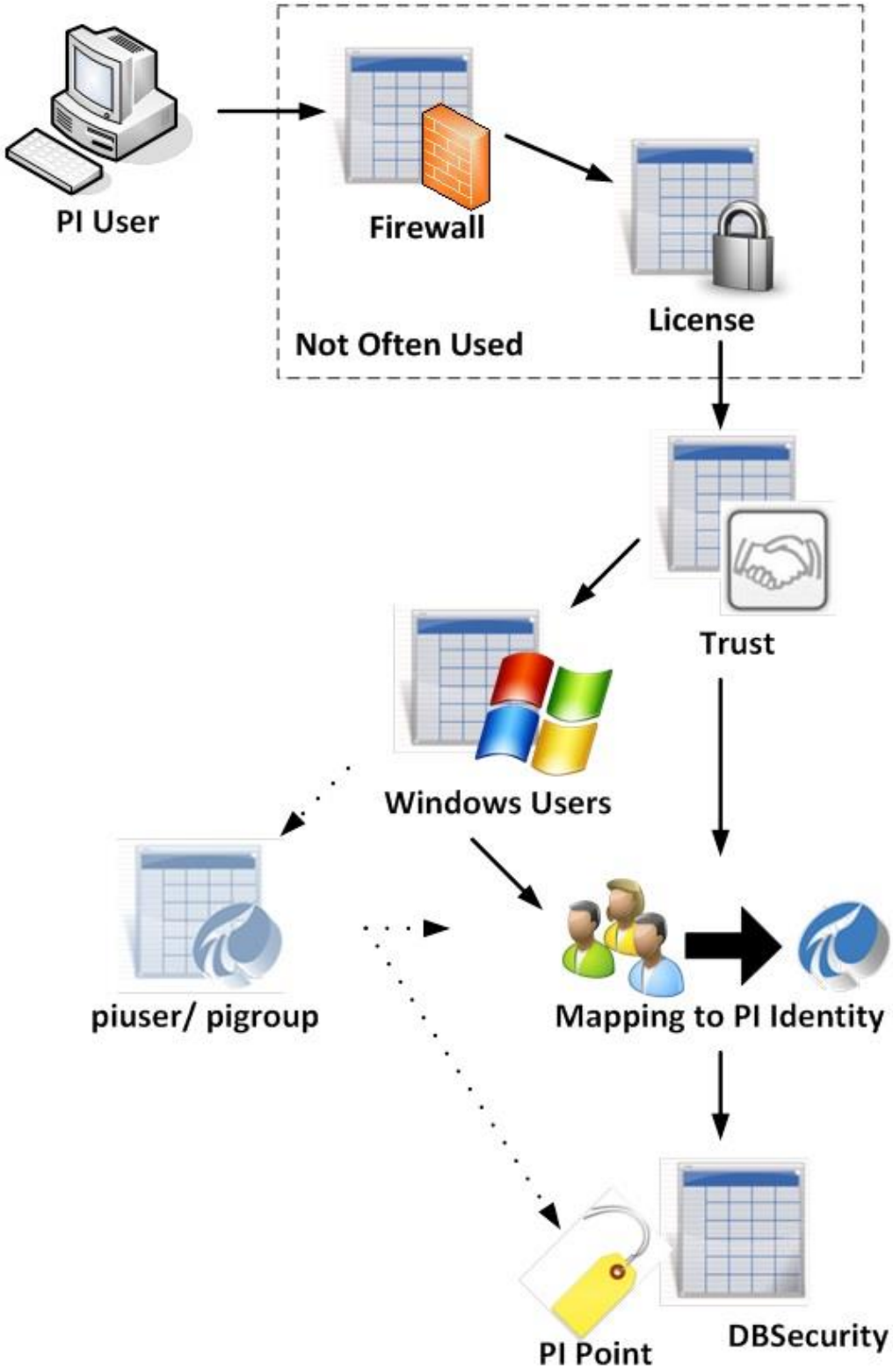

Figure 10.2 Authentication Logic within PI Data Archive

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Regardless of authentication method to be used, the end users and PI WebParts Services would need read access to all the data to be displayed in the PI WebParts page. In addition, PI WebParts Services would also need read access to **PIModules** database, which contains all the configuration information. Naturally, for administrative users to create, modify, or delete PI WebParts configurations, write access to PIModules database would be required.

See the *PI Server 2012 Configuring PI Server Security* for more details.

10.7 PI Asset Framework (AF) Security

Security settings in PI Asset Framework resemble the file security controls within Windows or within SQL Server. Each PI AF objects (with the exception of attributes themselves) have its own security settings. To control attribute security, set security on the attribute's referenced data source (PI tag, table lookup, etc.).

Because the SharePoint server is trusted for delegation, users will experience the same level of permissions to PI AF via WebParts as they do through PI System Explorer or any other clients running with their domain account credentials.

For a comprehensive guide to administering PI AF security, please see the *PI System Explorer User Guide*.

10.8 Exercise – Security Scenarios

The following questions are intended to reinforce key information presented in this chapter or section. The answers can be found at the end of this document.

Objectives

- Inspire students to figure out the appropriate security settings based on their PI WebParts architecture and business needs

Problem Description

Below are several hypothetical security scenarios. Please review them and decide on the correct actions and settings that are required to achieve this level of security.

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Approach

Scenario 1: Open Security

Read Access to all tags.

All users can define data sources.

All users can create datasets and behaviors.

Document how you might set this up:

Scenario 2: Basic Security

Read Access to all tags.

Specific users can define data sources.

Specific users can create datasets and behaviors.

Document how you might set this up:

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Scenario 3: Tag-level Security

Read Access to specific tags.

Specific users can define data sources.

Specific users can create datasets and behaviors.

Document how you might set this up:

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11 Capstone Exercise

Objectives

- Practice knowledge gained in class by completing custom reporting pages

Problem Description

Design a SharePoint dashboard to monitor your organization key performance indicators. Base the webpage on PI AF modeling. Test your knowledge in the creation, by starting simple and building up the web page to meet your needs.

Task list:

- Add and configure built-in web parts to a Web Part page.
- Identify the various web part galleries and their uses and know where to find PI WebParts.
- Identify the different PI WebParts and their uses.
- Configure common PI WebParts (Gauge, Trend, XYPlot, TimeRange, Graphic, Values, and TimeSeries)
- Configure explicit connections between web parts. PI TreeView **MUST** be used.

Extra Credits:

- Customer datasets.
- Custom PI Table or PI Trend template.
- Insert a PITable web part.
- Involve PI DataLink production reports.
- Make the reports interactive by consuming parameters from other web parts.

Approach

This is open-ended. Go nuts. Your instructor, as well as the various pieces of documentation on your computer, may prove invaluable. An example is attached below.

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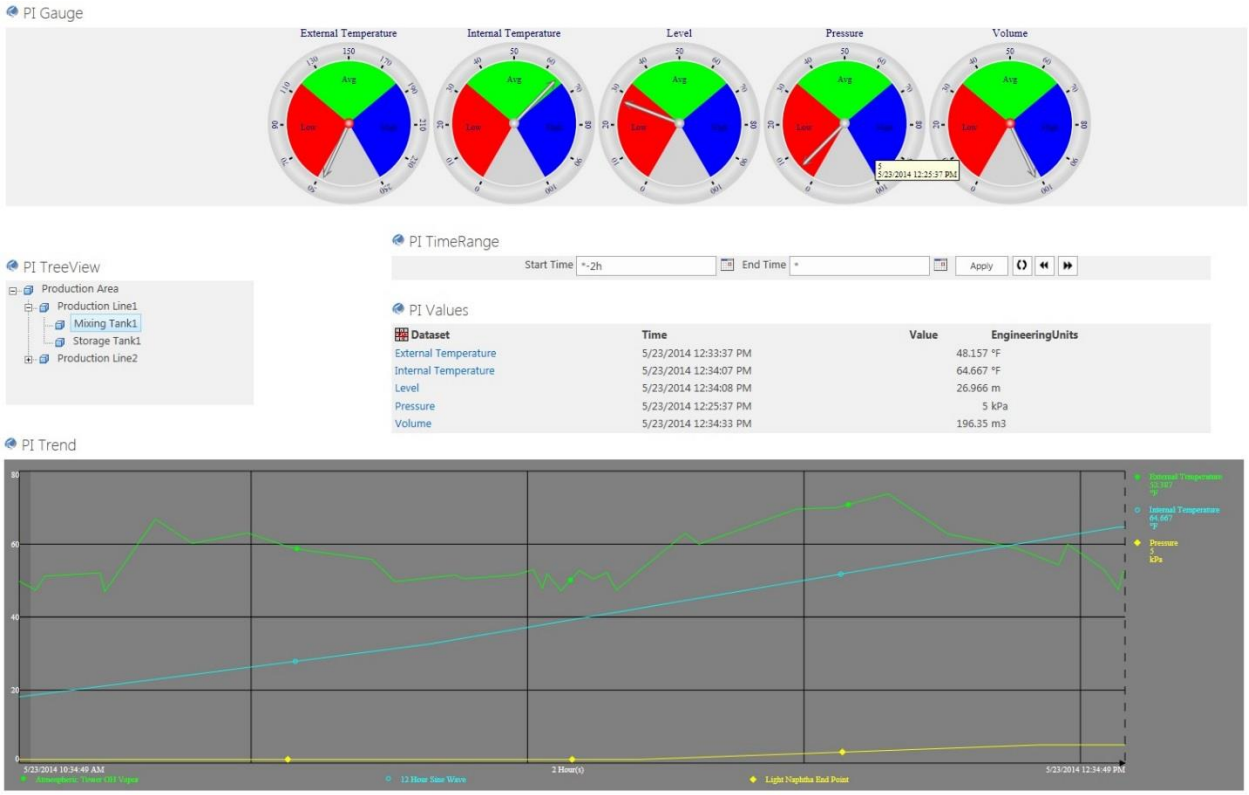

Figure 12.1 An example dashboard monitoring assets in OSIsoft plant

In the example, we are monitoring all the 4 tanks in OSIsoft plant. The KPIs are internal & external temperatures, pressure, level and volumes. Only one asset is displayed at a time, but we can easily and conveniently switch back and forth among the tanks by select them in the PI TreeView. PI TimeRange can be used to control time and time range in the dashboard.

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