

IBM Predictive Maintenance and Quality
Version 2.5.1

*Asset Analytics for Rotational
Equipment in Oil and Gas Solution
Guide*

IBM

Note

Before using this information and the product it supports, read the information in "Notices" on page 41.

Product Information

This document applies to IBM Predictive Maintenance and Quality Version 2.5.1 and may also apply to subsequent releases.

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Introduction

The IBM Asset Analytics for Rotational Equipment in Oil and Gas solution gives you the information and insight that you need to provide proactive service to your customers.

Audience

This guide is intended for administrators and users of the Asset Analytics for Rotational Equipment in Oil and Gas solution. It provides information on installation, configuration, and use of the Asset Analytics for Rotational Equipment in Oil and Gas solution.

Finding information

To find product documentation on the web, including all translated documentation, access IBM® Knowledge Center (<http://www.ibm.com/support/knowledgecenter>).

Accessibility features

Accessibility features help users who have a physical disability, such as restricted mobility or limited vision, to use information technology products. Some of the components included in the Asset Analytics for Rotational Equipment in Oil and Gas have accessibility features.

Asset Analytics for Rotational Equipment in Oil and Gas HTML documentation has accessibility features. PDF documents are supplemental and, as such, include no added accessibility features.

Forward-looking statements

This documentation describes the current functionality of the product. References to items that are not currently available may be included. No implication of any future availability should be inferred. Any such references are not a commitment, promise, or legal obligation to deliver any material, code, or functionality. The development, release, and timing of features or functionality remain at the sole discretion of IBM.

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Chapter 1. Overview

IBM Asset Analytics for Rotational Equipment in Oil and Gas is a prepackaged solution that works with IBM Predictive Maintenance and Quality (PMQ).

Important: Before you install the solution, IBM Predictive Maintenance and Quality (PMQ) must be installed on your system.

IBM Asset Analytics for Rotational Equipment in Oil and Gas is an solution designed to help industries with operations that depend upon rotating assets such as pumps, motors, turbines, transmission devices, and auxiliary equipment.

The solution is used to provide real-time data on the performance of electric submersible pumps (ESPs), used in the oil and gas industry. This solution helps the oil and gas industry to

- enhance exploration and production
- improve global operations
- improve refining and manufacturing efficiency

What need does the solution address?

Modern technology has made previously inaccessible petroleum resources available. In the past, a single drill pad would typically be associated with a single well bore; that is, a single well. With the advent of directed and horizontal drilling techniques, a single well pad can now be the home to many well bores reaching a vast expanse of underground resources. Sophisticated new drilling equipment is also highly instrumented. Consequently, thousands of wells generate large volumes of real-time data that can be used to monitor and assess the overall performance, health, and productivity of a well.

Increased efficiencies, along with new technologies and methods, now require a production engineer to manage a large number of wells. In addition, the new extraction methods have added complexity. Producers must now contend with water waste that results from the fracturing process and the required separation of oil, gas, and water before it is pumped to the surface. Extraction of unconventional resources is less certain due to the additional complexity. However, performance data obtained from the well and extraction equipment can significantly help producers monitor operations, equipment, and the overall production process.

IBM Asset Analytics for Rotational Equipment in Oil and Gas provides production engineers and their supervisors with the ability to anticipate and quickly correct production shortfalls that can be attributed to extraction equipment. The will be able to predict when equipment is trending towards a complete shutdown, which will lower operations costs, cut lost productivity, and reduce expensive repairs.

What does the solution provide?

IBM Asset Analytics for Rotational Equipment in Oil and Gas can detect all performance modes of an electric submersible pump (ESP) using change point analysis. The solution's modes include low performance, high levels of pollution, and trending to failure.

The ESP is a long, vertical, inground piece of machinery at the center of a wellbore. The purpose of an ESP is to extract fluids from the wellbore and pump them to the surface. Failure of an ESP that brings the well to a halt and requires removal of the ESP will negatively impact production. This may cost days of nonproductive time and result in lost revenue and expensive repair.

The solution uses operational data obtained from the ESP to develop a predictive model of the ESP's performance. The solution captures a number of data sets related to the ESP operational data (historian, maintenance logs, production performance, and technical specifications), and generates an analysis related to ESP operational health. It monitors ESP performance in real time and determines if the ESP is in danger of failure.

If a potential failure is detected, the solution can recommend whether to repair, rehabilitate, or replace the ESP, based upon current asset health and maintenance models developed by the producer. Recommendations can also include tuning the pumps to improve performance towards higher yield and efficiency. Some of these recommendations can be integrated with Enterprise Asset Management (EAM) systems, such as SAP Plant Maintenance or IBM Maximo, to accelerate repair time and to provide maintenance personnel with a detailed assessment of the problem.

How is the solution used by an organization?

The solution may be used by maintenance or operations organizations.

A maintenance organization uses the detailed performance data, assessment of the asset health and current conditions, and recommendations associated with a problematic electric submersible pump (ESP) to optimize the maintenance schedule with appropriate calibration and maintenance orders. The solution can rank problematic ESPs for priority attention based on fault analysis.

An operations organization uses the solution to assess the production impact related to the ESP performance. If an ESP is performing suboptimally or is in danger of failure, the solution will recognize this situation and assess the overall production efficiency impact. The operational team can develop production models based on the ESP's historical performance. The operations team can then modify or update business rules that generate recommendations based on insight provided by these models.

Chapter 2. Installation and configuration

The Asset Analytics for Rotational Equipment in Oil and Gas solution is for use with IBM Predictive Maintenance and Quality.

Overview of the installation and configuration process

This is an overview of the general tasks that you must perform to install and configure the Asset Analytics for Rotational Equipment in Oil and Gas solution.

You will need to perform the following tasks:

1. On the server from which you want to install the solution, download the tar.gz file from IBM Passport Advantage.
2. Plan where you want the various parts of the solution to reside.
3. Open the ports that are required for the installation. You can do this by running the firewall.sh script, manually opening the ports on the installation node, or disabling the firewall. You will also have to open ports on the other node computers.
4. On the installation computer, run the setup.sh file to install the solution installer.
5. Run the solution installer to deploy files to the locations that you specify.
6. Create the DB2 database on the data node computer.
7. Import the SPSS project streams, models and rules on the Predictive Analytics node computer.
8. Configure the data view for SPSS models on the Predictive Analytics node computer.
9. Install the Cognos content on the BI node computer.
10. Install the EAR file.

Planning the installation and configuration of the solution

Before installing the solution, you must decide which computers you want the various parts of the solution to reside on.

You must ensure that no application is listening on the ports that will be used during the installation of the solution.

Prerequisites

Before you install the Asset Analytics for Rotational Equipment in Oil and Gas solution, there are prerequisites that must be met.

The following conditions must be met before the solution can be installed:

- IBM Predictive Maintenance and Quality 2.5.1 is installed and configured.
- You have a Linux system that you can install to. The application installer works only on Linux.
- You understand your existing environment so that you can determine where you want the various components of the application to reside.
- You have administration rights and the ability to copy files between computers.

Installing R software

You must install R software RPMs on the Analytics node computer for the Asset Analytics for Rotational Equipment in Oil and Gas solution.

The RPMs must be installed in the following order:

Install this set first:

- `libRmath-3.1.0-5.el6.x86_64`
- `libRmath-devel-3.1.0-5.el6.x86_64`
- `texinfo-4.13a-8.el6.x86_64`
- `texinfo-tex-4.13a-8.el6.x86_64`
- `R-java-devel-3.1.0-5.el6.x86_64`
R-java-devel-3.1.0-5.el6.x86_64 must be installed using `--nodeps` in the command.

Install this set second:

- `liblzma5-5.2.1-94.1.x86_64`
- `libcicu-devel-4.2.1-9.1.el6_2.x86_64`
- `lapack-3.2.1-4.el6.x86_64`
- `xz-devel-5.2.1-94.1.x86_64`
- `tcl-devel-8.5.7-6.el6.x86_64`
- `tk-devel-8.5.7-5.el6.x86_64`
- `pcre-devel-7.8-6.el6.x86_64`
- `blas-devel-3.2.1-4.el6.x86_64`
- `blas-3.2.1-4.el6.x86_64`
- `lapack-devel-3.2.1-4.el6.x86_64`

Install this set last:

- `R-core-3.1.0-5.el6.x86_64`
- `R-java-3.1.0-5.el6.x86_64`
- `R-core-devel-3.1.0-5.el6.x86_64`
- `R-devel-3.1.0-5.el6.x86_64`

You can download the packages from a site such as rpm.pbone.net.

Procedure

1. Log on to the Analytics node computer as the **root** user or as a user with **sudo** permissions.
2. Install any package that is not already installed.

You must download any missing package, and then install the downloaded package by typing the following command:

```
rpm -i full_package_name.rpm
```

For example, to install `libRmath-3.1.0-5.el6.x86_64`, type `rpm -i libRmath-3.1.0-5.el6.x86_64.rpm`.

To install a package using `--nodeps` in the command, type `rpm -i --nodeps R-java-devel-3.1.0-5.el6.x86_64.rpm`.

Installing SPSS Modeler Essentials for R on the Analytics node computer

You must install IBM SPSS® Modeler Version 17 Essentials for R on the Analytics node computer.

For more information about R and Essentials for R software for IBM SPSS, see the IBM SPSS documentation (https://www.ibm.com/developerworks/community/wikis/home?lang=en#!/wiki/We70df3195ec8_4f95_9773_42e448fa9029/page/Downloads%20for%20IBM%C2%AE%20SPSS%C2%AE%20Statistics).

Procedure

1. Log in to the Analytics node computer as the **root** user or as a user with **sudo** permissions.
2. Check the installation path for R software by using the following command:

```
rpm -q | R-core-3.1.0-5.el6.x86_64 | more
```
3. Check the location of the `pasw.stats` directory in the SPSS Modeler Server installation directory. The default path is `/usr/IBM/SPSS/ModelerServer/17.0/ext/bin`.
4. Download and install the IBM SPSS Modeler Version 17 Essentials for R software. You can download the installer from Tools for SPSS Products website (<https://www.ibm.com/marketing/iwm/iwm/web/preLogin.do?source=swg-tspssp>).
5. Go to the directory where you downloaded the installer.
6. Enter the following command:

```
chmod +x filename
```
7. Run the `bin` file to install the software.

Installing R software packages

You must install additional R software packages on the IBM Predictive Maintenance and Quality Analytics node computer.

You must install the following R packages. Ensure that you install the versions listed below. Some versions may not be the most current. These versions can be found on the **Old sources** link on the package page.

- zoo (version 1.7-11)
- changepoint (version 1.1.5)
- mclust (version 4.4)
- mAr (version 1.1-2)
- NORMT3 (version 1.0-3)
- Outliers (version 0.14)

Important: You must install the zoo package first.

Procedure

1. Log in to the Analytics node computer as the **root** user or as a user with **sudo** permissions.
2. Download the R software packages. You can download the installer from The Comprehensive R Archive Network (CRAN) website (http://cran.r-project.org/web/packages/available_packages_by_name.html).
3. Start the R console.

For example, in a terminal windows, type R and press Enter.

4. Install each of the packages by using the following commands in the R console:

```
install.packages("path/package", repos=NULL, type="source")
```

For example, to install zoo version 1.7-11, enter the following command:

```
install.packages("/home/zoo_1.7-11.tar.gz", repos=NULL, type="source")
```

Install each package individually.

Downloading the solution

You must download the Asset Analytics for Rotational Equipment in Oil and Gas solution from IBM Passport Advantage.

Before you begin

Before you can install the package from Passport Advantage, you must have a Passport Advantage account and be entitled to the package.

About this task

Passport Advantage contains package repositories. Instead of downloading the package from Passport Advantage and creating a repository locally, you access the repository on Passport Advantage.

Procedure

1. Set the Passport Advantage preference to connect to Passport Advantage.
2. Download the tar.gz file.
3. Move the tar file to the Linux node from which you want to run the installation.
4. Uncompress the tar file.

Contents of the download package

The Asset Analytics for Rotational Equipment in Oil and Gas solution package, which you download from Passport Advantage, contains several parts.

The following parts are included in the package:

- Analytics node artifacts—The IBM SPSS content is provided in a .pes file that you import into the IBM SPSS Collaboration and Deployment Services Content Repository. It consists of a training model and job, a scoring model and job, and the decision management rules stream.
- Data node artifacts—SQL files for creating the production data table in the **IBMPMQ** database and for importing data for those tables.
- Business Intelligence node artifacts—IBM Cognos Business Intelligence dashboards, images that are used in the dashboards, a map specification, and the Framework Manager model.
- Integration Bus node artifacts—IBM Integration Bus solution bar files for custom flows to onboard data and trigger the analytics training and scoring jobs. It also includes WebSphere MQ scripts, properties, and xml files that are required by the custom flows and for IBM Predictive Maintenance and Quality core components.

Modifying the sudoers file for the user who runs the installation

To run the Asset Analytics for Rotational Equipment in Oil and Gas installation, you must be either **root** user or have **sudo** permission on each node computer, and you must disable `requiretty` during the installation.

To install with **sudo** user permissions, you must also add the user to the sudoers file.

Procedure

1. Log in as **root** user.
2. Enter the following command to open the sudoers file for editing:
`visudo -f /etc/sudoers`
3. Locate the following line:
`Defaults requiretty`
4. Press the I key to insert text.
5. Type a number sign (#) in front of `Defaults requiretty` to comment out the line. For example, the line should appear as
`#Defaults requiretty`
6. If you run the installer as a user with **sudo** user permissions, go to the end of the file, and add the following line for your user:
`username ALL=(ALL) NOPASSWD: ALL`
7. Press the Esc key, and enter `:wq` to save and close the file.
8. Repeat these steps on each computer on which you install a Asset Analytics for Rotational Equipment in Oil and Gas node.

Using the setup script to copy content to the nodes

The solution installer copies the content required for the Asset Analytics for Rotational Equipment in Oil and Gas solution to the locations that you specify.

Before you begin

The Industry Solution Installer runs on the latest versions of Chrome and Firefox. It is not tested on Safari and will not run on Internet Explorer.

About this task

The solution installer will copy the various parts of the solution to the locations that you specify.

Procedure

1. Extract files on the Linux installation node.
2. Open firewall ports or run open firewall script.
3. Run the setup shell script `setup.sh`.
4. A browser will be started (if one is installed) or you can use a URL to connect to the UI.
5. Click **Create New Configuration**.
6. Create a node and provide node credentials.
7. For every node that you want to add content to, you need to drag content objects onto the appropriate node.

A check box provides the option of decompressing the files after they are copied.

8. Validate the path.
9. Run.

Computer firewall settings required for the installation

The solutions installer requires bidirectional communication with each node when you install a server component or server artifact component, and your firewall can interfere with this communication.

To ensure this bidirectional communication, you must configure your firewall settings for the installation. Alternatively, you can temporarily disable your firewall during the installation.

A script is provided to open all necessary ports on the installation node. You can either use the `firewall.sh` script, open the nodes manually, or disable the firewall settings.

In addition to opening ports on the installation node computer, there are some ports that must also be opened on each computer to which content from the solution will be copied.

Configuring your firewall settings on the installation node computer by using the Firewall script

You can run the `firewall.sh` script to open the ports on the installation node.

About this task

The `firewall.sh` script will open the following ports on the solution installer node:

- 8080 incoming
- 443 incoming
- 9683 incoming
- 22 outgoing

Procedure

1. Log on to the computer that contains the solution installer node as the root user or as a user with sudo permissions.
2. Back up your existing firewall settings by typing the following command:
`/etc/init.d/iptables save`.
3. Run the `firewall.sh` script.

Manually configuring firewall settings on the installation node

If you prefer not to use the `firewall.sh` script, you can manually configure your firewall settings on the installation node.

Procedure

1. As the root user or as a user with sudo permissions, log on to the computer that contains the solution installer node .
2. Back up your existing firewall settings by typing the following command: .
`/etc/init.d/iptables save`

3. On the computer that contains the solution installer node, add rules for the ports that are required by the installer by typing the following commands:

```
iptables -I INPUT -p tcp --dport 8080 -j ACCEPT
iptables -I OUTPUT -p tcp --sport 8080 -m state --state
RELATED,ESTABLISHED -j ACCEPT

iptables -I INPUT -p tcp --dport 443 -j ACCEPT
iptables -I OUTPUT -p tcp --sport 443 -m state --state
RELATED,ESTABLISHED -j ACCEPT

iptables -I INPUT -p tcp --dport 9683 -j ACCEPT
iptables -I OUTPUT -p tcp --sport 9683 -m state --state
RELATED,ESTABLISHED -j ACCEPT

iptables -I OUTPUT -p tcp --dport 22 -j ACCEPT
iptables -I INPUT -p tcp --sport 22 -m state --state
RELATED,ESTABLISHED -j ACCEPT
```

Configuring firewall settings on other computers that will contain content from the solution

On all node computers to which content from the application will be copied, the ports 443, 9683, and 8080 must be opened for the installation process.

Procedure

1. On each of the computers to which content for the solution will be copied, add rules for the ports that are required by the installer by typing the following commands:

```
iptables -I OUTPUT -p tcp --dport 443 -j ACCEPT
iptables -I INPUT -p tcp --sport 443 -m state --state RELATED,ESTABLISHED -j ACCEPT

iptables -I OUTPUT -p tcp --dport 9683 -j ACCEPT
iptables -I INPUT -p tcp --sport 9683 -m state --state RELATED,ESTABLISHED -j ACCEPT

iptables -I OUTPUT -p tcp --dport 8080 -j ACCEPT
iptables -I INPUT -p tcp --sport 8080 -m state --state RELATED,ESTABLISHED -j ACCEPT
```
2. Type the following command to save your firewall settings:

```
/etc/init.d/iptables save
```
3. Type the following command to restart your firewall:

```
/etc/init.d/iptables restart
```
4. Verify that your changes have been applied by using the following command:

```
iptables -L
```

The added port will appear in the list.
5. Repeat these steps on each computer on which you will install an IBM Asset Analytics for Rotational Equipment in Oil and Gas node.

Disabling firewall settings during installation (optional)

If you choose to temporarily disable your computer's firewall during the installation of the IBM Asset Analytics for Rotational Equipment in Oil and Gas application, ensure that you enable the firewall on each node after the installation is complete

About this task

Important: If you disable your computer's firewall during the installation, you must still ensure that the required ports are opened on each node computer when you restart your firewall.

Procedure

1. Log on to the computer as the root user or as a user with sudo permissions.
2. Type the following command:
`/etc/init.d/iptables stop`
3. Repeat these steps on each computer on which you install a node and on the server from which you are running the installation.

What to do next

After the installation is complete, on each node, type `/etc/init.d/iptables start` to restart your firewall.

Running the setup script to install the solution installer

The `setup.sh` script will install nodejs, chef client, and chef server. It will extract and upload the cookbooks, and will set up everything so that chef can be used to install the software for the solution.

About this task

The `setup.sh` script uses the following 5 arguments:

`<username> <first name> <last name> <e-mail> <password>`

- `username`: the username to create in chef server, which is used to log on to chef server. It must use all lowercase characters.
- `first name`: the first name of the user created in chef. It is for display purposes only.
- `last name`: the last name of the user created in chef. It is for display purposes only.
- `e-mail`: a valid e-mail address for notifications from the chef server.
- `password`: a password for the chef user. This argument is optional. If it is not included on the command line, then a password will be prompted for.

Procedure

1. Log on to the solution installer node computer as the root user or as a user with sudo permissions.
2. Run the `setup.sh` script.

For example, enter the following command:

```
sh setup.sh myusername myfirstname mylastname myemail@mail.com  
chefpassword
```

Creating the database tables

Before you can use the IBM Asset Analytics for Rotational Equipment in Oil and Gas application, you must create the tables in the IBMPMQ database.

Procedure

1. Log on to the data node computer as root user.
2. On the data node computer, if the compressed file is not already decompressed, then decompress it.
3. Open a terminal window, and go to the directory where the content files were decompressed.

4. Type the following command to change the permissions for the files: `chmod -R 755 *`
5. Open the `create_prod_table_ESP.sql` file in a text editor.
6. Ensure that you enter the correct user and password for the database instance owner.
db2inst1 is the default **user** parameter. If you did not use the default database users, ensure that you enter the correct user name. Ensure that you enter the correct password in the **using** parameter.
7. Save and close the file.
8. Change to the database instance owner. For example:
`su db2inst1`
9. Run `db2 -tvf ./create_prod_table_ESP.sql`.
10. Disconnect from the database.

Creating new directories on the Integration Bus node

Content must be loaded to the IBM Integration Bus server from specific directories. You must create the directories before the content can be loaded.

Procedure

1. Log in to the Integration Bus node computer as the **mqm** user.

Important: The user must be the **mqm** user or a member of the **mqm** group. If you copy the files as another user, they might not be processed by the Integration Bus node components.

2. Go to the `/var/PMQ/MQSIFileInput` directory.
3. Create the following directories:
 - `esppaggregatein`—The input folder for the aggregated data.
 - `esptriggersfolder`—The input folder for triggering batch jobs.
 - `maintenancedatain`—The input folder for the maintenance data.
 - `welltestdatain`—The input folder for the well test data.
 - `espsensordatain`—The input folder for the raw sensor data.

Moving properties, orchestration, and solution definition files

You must move the properties, orchestration, and solution definition files to the appropriate directories on your Integration Bus node computer.

Procedure

1. Log in to the Integration Bus node computer as the **mqm** user.

Important: The user must be the **mqm** user or a member of the **mqm** group. If you copy the files as another user, they might not be processed by the Integration Bus node components.

2. Go to the directory where you installed the solution content files, and decompress the `REOilGas_AssetAnalytics_IIBContent.zip` file. For example, type `unzip REOilGas_AssetAnalytics_IIBContent.zip`.

The default path where the files are deployed is `/opt/IBM/IS_REOilGas_AssetAnalytics_1.0`.

3. Copy the following files from the `Scripts` directory to the `/var/mqsi/shared-classes` directory on the Integration Bus node computer.

- ESP_BatchScoring.properties
 - ESP_SensorData.properties
 - ESP_MaintenanceData.properties
 - ESP_WellTestData.properties
 - ESP_AggregateData.properties
 - PMQ_solution_definition.xml
4. Copy the PMQ_orchestration_definition_esp.xml file from the Scripts directory to the /var/mqsi/shared-classes/orchestrations directory on the Integration Bus node computer.
 5. Copy the PMQ_orchestration_definition_batch.xml file from the Scripts directory to the /var/PMQ/MQSIFileInput/properties directory on the Integration Bus node computer.

Configuring the orchestration files

You must update the orchestration files to include the server name and port number for your IBM SPSS Collaboration and Deployment Services server that is running on your IBM Predictive Maintenance and Quality Analytics node.

Procedure

1. On the Integration Bus node computer, go to the /var/PMQ/MQSIFileInput/properties, and open the PMQ_orchestration_definition_batch.xml file in a text editor.
2. In the <ESPTrainingTrigger> identifier section, do the following steps:
 - a. In the <webservice> section, change the <url> value to the server name and port number for your IBM SPSS Collaboration and Deployment Services server.
 - b. In the <scheduler> section, change the values to set a frequency for when the training job is to be run.
 - c. Remove the comments from the <scheduler> to enable it.
3. In the ESPScoringTrigger identifier section, do the following steps:
 - a. In the <webservice> section, change the <url> value to the server name and port number for your IBM SPSS Collaboration and Deployment Services server.
 - b. In the <scheduler> section, change the values to set a frequency for when the scoring job is to be run.
 - c. Remove the comments from the <scheduler> to enable it.
4. Save and close the file.
5. On the Integration Bus node computer, go to the /var/mqsi/shared-classes/orchestrations, and open the PMQ_orchestration_definition_esp.xml file in a text editor.
6. In the pmq.espscoring orchestration_cd section, do the following steps:
 - a. Change the <host_name> value to the server name for your IBM SPSS Collaboration and Deployment Services server.
 - b. Change the <port_number> value to the port number that IBM SPSS Collaboration and Deployment Services server is using.
7. Save and close the file.

Creating an execution group and queue

You must create an execution group on the IBM Maintenance and Quality Integration Bus node computer for the Asset Analytics for Rotational Equipment in Oil and Gas solution.

You must also create the queue in IBM WebSphere MQ.

Procedure

1. On the Integration Bus node computer, in a terminal window, go to the *installation_location/mqsi/9.0.0.1/bin* directory. For example, if you installed to the default location, go to the */opt/ibm/mqsi/9.0.0.1/bin* directory.
2. Change to the mqm user. For example, `su mqm`.
3. Enter the following command to load the profile that is needed for the mqm user, and press Enter:
`. ~/.bash_profile`
4. Enter the following command to create an execution group:
`mqsicreateexecutiongroup pmqbroker -e espcustomflows`
5. Type `runmqsc pmqmanager`, and press Enter.
6. Enter the following command to create the queue:

```
DEFINE QL(ESP.TR.TIMER.IN) REPLACE +
      MAXDEPTH(5000) +
      DESCR('Input Local Queue of ESP Training batch flow')
DEFINE QL(ESP.SCORE.TIMER.IN) REPLACE +
      MAXDEPTH(50000) +
      DESCR('Input Local Queue of ESP Scoring batch flow')
```

Deploying the broker archive files

You must deploy broker archive (.bar) files on the IBM Predictive Maintenance and Quality Integration Bus node computer for the Asset Analytics for Rotational Equipment in Oil and Gas solution.

The .bar files contain custom flows that are used to load Integration Bus data as events into the Predictive Maintenance and Quality data store. There are four flows, one each for aggregated data, well test data, maintenance data, and sensor data. The file also contains custom flows for running the training and scoring models in batch.

You must deploy 2 .bar files.

Procedure

1. Log on to the Integration Bus node computer as the mqm user.
2. Enter the following command:
`mqsideploy pmqbroker -e espcustomflows -a path/`
`REOilGas_AssetAnalytics_CustomFlows.bar`
The default *path* where the .bar files are deployed is */opt/IBM/IS_REOilGas_AssetAnalytics_1.0/BAR*.
3. Enter the following command:
`mqsideploy pmqbroker -e pmqgroup1 -a path/`
`REOilGas_AssetAnalytics_EventLoad.bar`

Importing IBM SPSS analytic content

You must load the IBM SPSS analytic content for the IBM Asset Analytics for Rotational Equipment in Oil and Gas application. You load the analytics content by using IBM SPSS Deployment Manager.

Procedure

1. Copy the .pes file from the location where you deployed the Asset Analytics for Rotational Equipment in Oil and Gas on the Analytics node computer to the computer where IBM SPSS Collaboration and Deployment Services Deployment Manager is installed.
2. In IBM SPSS Collaboration and Deployment Service Deployment Manager, right-click **Content Repository**, and click **Import**.
3. Browse to the REOilGas_AssetAnalytics_CDS.pes file
4. Select the following options:
 - Resolve conflicts globally
 - Add new version of target item or rename source item, Use labels from source.
 - Continue import even if some objects cannot be imported due to locking conflicts.
 - Resolve Invalid Version Conflicts, Import.
 - Resource Definitions, Recommended - Import if there are no Duplicate ID conflicts or Duplicate Name conflicts.
5. Click **OK**.

Results

Content folders and resource definitions are added to the repository alongside any existing content.

Configuring the training and scoring jobs

The training job is loaded as part of the REOilGas_AssetAnalytics_CDS.pes deployment file that you loaded into SPSS Modeler Deployment Manager. You must add the credentials and ODBC connection information for your IBMPMQ database to the **ODBC Data Sources** tab for the job.

Procedure

1. In SPSS Modeler Deployment Manager, expand **Content Repository > ESP**, and select **ESP_TRAIN_JOB**.
2. On the **ODBC Data Sources** tab, click each entry in the **ODBC DSN** column, and select the credentials for your IBMPMQ database.
3. Click **OK**.
4. Expand **Content Repository > ESP**, and select **ESP_SCORE_JOB**.
5. On the **ODBC Data Sources** tab, click each entry in the **ODBC DSN** column, and select the credentials for your IBMPMQ database.
6. Click **OK**.

Deploying the IBM Cognos content

For IBM Cognos Business Intelligence, you must catalog the database, create a data source connection, and then deploy the content files for the IBM Asset Analytics for Rotational Equipment in Oil and Gas solution.

Moving the IBM Cognos content

You must copy the IBM Cognos® content for the IBM Asset Analytics for Rotational Equipment in Oil and Gas application to the appropriate locations in your IBM Cognos installation to be able to deploy the content.

Procedure

1. Copy the IBM Cognos content from the computer where you deployed the Asset Analytics for Rotational Equipment in Oil and Gas Business Intelligence content to the *Cognos_Install_location*\Deployment folder on the Business Intelligence node computer.

The Asset Analytics for Rotational Equipment in Oil and Gas IBM Cognos content file is named REOilGas_AssetAnalytics_BIContent.zip.

2. Copy the IBM Cognos report image file to the *Cognos_Install_location*\webcontent\ReportImages folder on the Business Intelligence node computer.

You must create the ReportImages folder if it does not already exist.

The report images file is named REOilGas_AssetAnalytics_Images.zip.

3. Decompress the file.
4. Copy the following images from the *Cognos_Install_location*\webcontent\ReportImages folder to the *Cognos_Install_location*\webcontent\samples\images folder.

You must create the samples\images folder if it does not already exist.

Copy the following files:

- ibmLogo.png
- IS_HamburgerMenu_Black0_32px.png
- User.png
- ESP_About_darkgrey.png
- ESP_TopFactors_darkgrey.png

5. Copy the IBM Cognos map specification file to the Business Intelligence node computer.

The map specification file is named REOilGas_AssetAnalytics_Map_Rave.zip.

6. Decompress the report image file in the *Cognos_Install_location*\webcontent folder.

You should have a *Cognos_Install_location*\webcontent folder that contains the report image files.

7. Copy the IBM Cognos Framework Manager model file from the computer where you deployed the application to the computer where you installed IBM Cognos Framework Manager, and decompress the file.

The Framework Manager file is named REOilGas_AssetAnalytics_FMPProject.zip.

8. If you want to edit the Framework Manager models, you must catalog the Asset Analytics for Rotational Equipment in Oil and Gas database on the computer where Framework Manager is installed.

Deploying the IBM Cognos reports

You must deploy the Asset Analytics for Rotational Equipment in Oil and Gas reports using IBM Cognos Administration.

Procedure

1. Open a web browser.
2. Go to the IBM Cognos BI portal URL.
3. On the **Welcome** page, click **Administer IBM Cognos Content**.
4. On the **Configuration** tab, click **Content Administration**.
5. On the toolbar, click the **New Import** button.
6. In the **Deployment Archive** pane, select deployment archive, and click **Next**.
The deployment archive is named REOilGas_AssetAnalytics_BIContent.zip.
7. In the **Specify a name and description** pane, accept the default or enter a new name, and click **Next**.
8. In the **Select the public folders and directory content** pane, select all of the packages in the table, leave the **Options** as default, and click **Next**.

Note: Ensure that the **Disable after import** option is cleared.
9. In the **Specify the general options** pane, accept the defaults, and click **Next**.
10. On the **Review the summary** page, click **Next**.
11. On the **Select an action** page, select **Save and run once**, and click **Finish**.
12. On the **Run with options** page, accept the defaults, and click **Run**, and then click **OK**.
13. Select **View the details of this import after closing this dialog** and click **OK**.
14. In IBM Cognos Administration, click the **Home** button.
The Asset Analytics for Rotational Equipment in Oil and Gas content is available in **Public Folders > Wealth_ClientInsight_BIContent**.
15. Rave libraries are also available as part of the solution. They are packaged in the Wealth_ClientInsight_Rave.zip file.
16. Go to the IBM Cognos BI portal URL. For example, go to http://bi_node_name/ibmcognos/.
17. On the Welcome page, click Administer IBM Cognos Content.
18. On the libraries tab, click the **Import** button .
19. Select the Wealth_ClientInsight_Rave.zip file, and click **Import**.

Importing the map specification to IBM Cognos BI

The Asset Analytics for Rotational Equipment in Oil and Gas application includes a map specification for the Executive Dashboard. You must import the map specification into IBM Cognos Business Intelligence.

Procedure

1. Open a web browser.
2. Go to the IBM Cognos BI portal URL.
3. On the **Welcome** page, click **Administer IBM Cognos Content**.
4. On the **Library** tab, click **Import Visualization**.
5. Browse to and select the REOilGas_AssetAnalytics_Map_Rave.zip file.
6. Follow the steps in the wizard to import the file.

Onboard pump data

Custom flows are provided with the Asset Analytics for Rotational Equipment in Oil and Gas solution. You use the custom flows to onboard pump data and to trigger training and scoring models.

Master and metadata must be loaded into the IBM Predictive Maintenance and Quality database, and you must also load the event data, before you can run the analytic training or the scoring models.

Asset Analytics for Rotational Equipment in Oil and Gas provides the following custom flows:

- `ESPAggregateFlow.msgflow`—Formats aggregated data as Predictive Maintenance and Quality events
- `ESPMaintenanceFlow.msgflow`—Formats maintenance data as Predictive Maintenance and Quality events
- `ESPScoringTrigger.msgflow`—Flow that triggers scoring model for each pump
- `ESPSensorRawDataFlow.msgflow`—Formats raw sensor data as Predictive Maintenance and Quality events
- `ESPTrainingTrigger.msgflow`—Flow that triggers the training model
- `ESPWellTestFlow.msgflow`—Formats well-test data as Predictive Maintenance and Quality events

The data onboarding flows write event data files directly to IBM Integration Bus `eventdatain` folder.

The flows are provided in a file that is named `ESPCustomFlows_PI.zip`. The

The `ESPCustomFlows_PI.zip` file is deployed to `/opt/ibm/IS_REOilGas_AssetAnalytics_1.0/Source` by default.

Flow property files

Each `msgflow` file has a properties file that you can configure.

Section in property file	Description
JDBCProperties	Includes properties for JDBC connection name and the schema name.
Header record	Holds the header record for the output event file.
Values for event fields	Properties for setting default values for Predictive Maintenance and Quality event attributes.
Measurement name mappings	For setting different measurement type names.

Master data and metadata for the solution

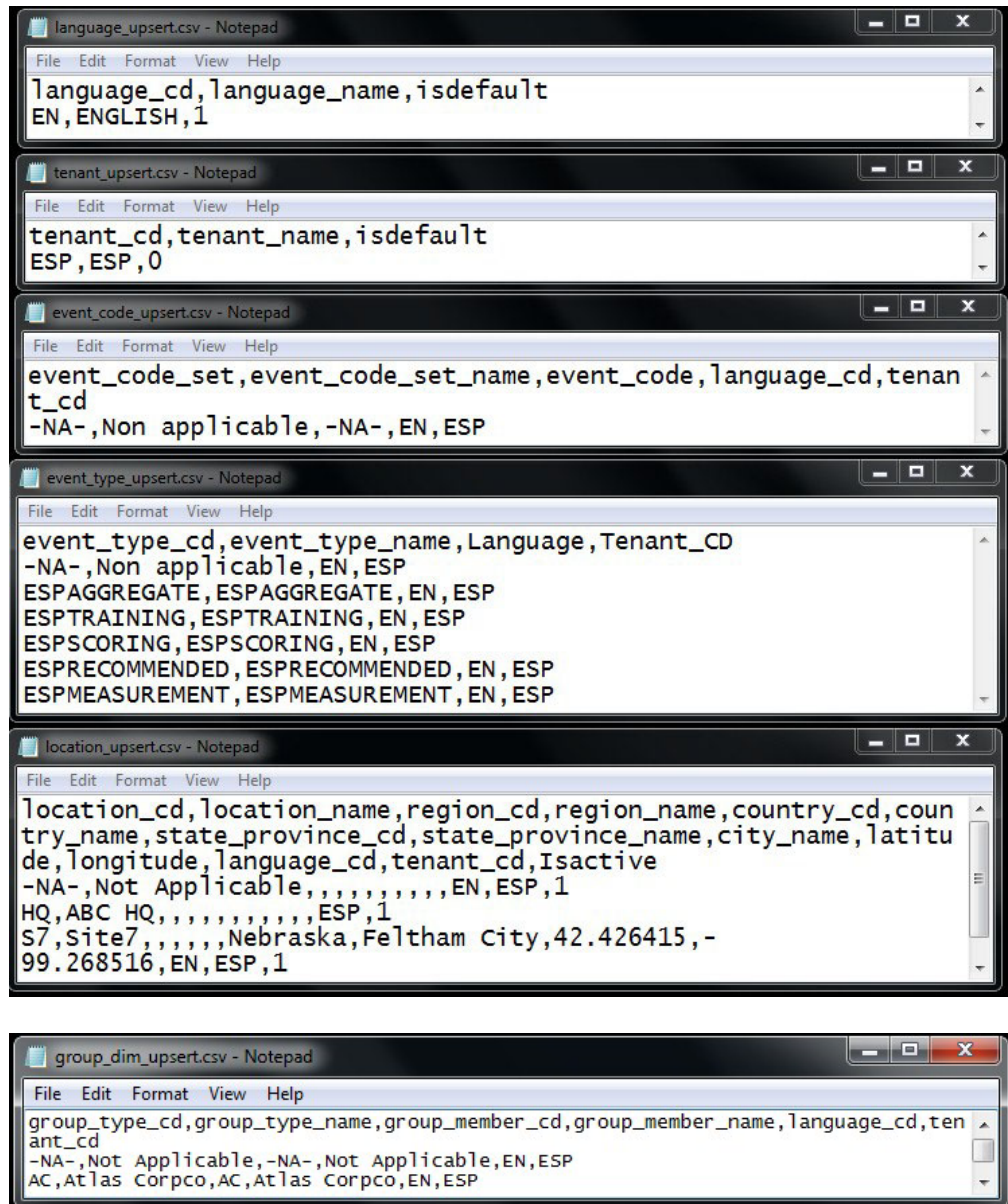
You must provide the master data and metadata for the Asset Analytics for Rotational Equipment in Oil and Gas solution. You must prepare the CSV files before you can load them into the environment.

The master data and metadata must be provided in the CSV files that are shown in the following table.

File name
language_upsert.csv
tenant_upsert.csv
event_code_upsert.csv
event_type_upsert.csv
location_upsert.csv
group_dim_upsert.csv
measurement_type_upsert.csv
production_batch_upsert.csv
material_upsert.csv
source_system_upsert.csv
supplier_upsert.csv
value_type_upsert.csv
resource_type_upsert.csv
product_upsert.csv
process_upsert.csv
material_type_upsert.csv
resource_upsert.csv

The following are examples of the contents that each of the CSV files that you must prepare must contain.

group_dim_upsert.csv, location_upsert.csv, and resource_upsert.csv should be based on the pump details, including its hierarchical relationship to other entities, such as wells and platforms, and organization relationships and suited to your environment.



```

measurement_type_upsert.csv - Notepad
File Edit Format View Help
measurement_type_cd,measurement_type_name,unit_of_measure,carry_forward_indicator,aggregation_type,event_code_indicator,language_cd,tenant_cd
Motor_Temp,Motor_Temp,deg C,0,0,EN,ESP
DH_Amps,DH_Amps,amp,0,0,EN,ESP
Output_Freq,Output_Freq,0,0,EN,ESP
Pump_Intk_Pres,Pump_Intk_Pres,Kpa,0,0,EN,ESP
PCM_System_Error,PCM_System_Error,0,0,EN,ESP
Status,Status,0,0,EN,ESP
TEST_TYPE,TEST_TYPE,0,0,EN,ESP
OIL_RATE,OIL_RATE,0,0,EN,ESP
GAS_RATE,GAS_RATE,0,0,EN,ESP
WATER_RATE,WATER_RATE,0,0,EN,ESP
GAS_OIL_RATIO,GAS_OIL_RATIO,0,0,EN,ESP
TUBING_PRESS,TUBING_PRESS,0,0,EN,ESP
ALLOCATABLE,ALLOCATABLE,0,0,EN,ESP
WATER_CUT,WATER_CUT,0,0,EN,ESP
PROD_HOURS,PROD_HOURS,0,0,EN,ESP
TEST_HOURS,TEST_HOURS,0,0,EN,ESP
DATE_MODIFIED,DATE_MODIFIED,0,0,EN,ESP
PRIMARY_REASON,PRIMARY_REASON,0,0,EN,ESP
JOB_COST_TOTAL,JOB_COST_TOTAL,0,0,EN,ESP
Changepoint_Time,Changepoint_Time,0,0,EN,ESP
Mode_startTime,Mode_startTime,0,0,EN,ESP
Stoppage_Prob,Stoppage_Prob,0,0,EN,ESP
Failure_Prob,Failure_Prob,0,0,EN,ESP
samplenumPIP,samplenumPIP,0,0,EN,ESP
PIPROC,PIPROC,0,0,EN,ESP
PIPAVG,PIPAVG,0,0,EN,ESP
PIPMAX,PIPMAX,0,0,EN,ESP
PIPMIN,PIPMIN,0,0,EN,ESP
flagPIP,flagPIP,0,0,EN,ESP
samplenumMTRT,samplenumMTRT,0,0,EN,ESP
MTRTROC,MTRTROC,0,0,EN,ESP
MTRTAVG,MTRTAVG,0,0,EN,ESP
MTRTMAX,MTRTMAX,0,0,EN,ESP
MTRTMIN,MTRTMIN,0,0,EN,ESP
flagMTRT,flagMTRT,0,0,EN,ESP
samplenumAmp,samplenumAmp,0,0,EN,ESP
AmpROC,AmpROC,0,0,EN,ESP
AmpAVG,AmpAVG,0,0,EN,ESP
AmpMAX,AmpMAX,0,0,EN,ESP
AmpMIN,AmpMIN,0,0,EN,ESP
flagAmp,flagAmp,0,0,EN,ESP
samplenumOutputFreq,samplenumOutputFreq,0,0,EN,ESP
OutputFreqROC,OutputFreqROC,0,0,EN,ESP
OutputFreqAVG,OutputFreqAVG,0,0,EN,ESP
OutputFreqMAX,OutputFreqMAX,0,0,EN,ESP
OutputFreqMIN,OutputFreqMIN,0,0,EN,ESP
flagOutputFreq,flagOutputFreq,0,0,EN,ESP
Bad,Bad,0,0,EN,ESP
StatusTime,StatusTime,0,0,EN,ESP
TotalRunTime,TotalRunTime,0,0,EN,ESP
AggrStatus,AggrStatus,0,0,EN,ESP
PCMSystemError,PCMSystemError,0,0,EN,ESP
JOB_NAME,JOB_NAME,0,0,EN,ESP
Mode,Mode,0,0,EN,ESP
ChangePointTime,ChangePointTime,0,0,EN,ESP
ESPRC,ESP Recommendation,0,0,EN,ESP

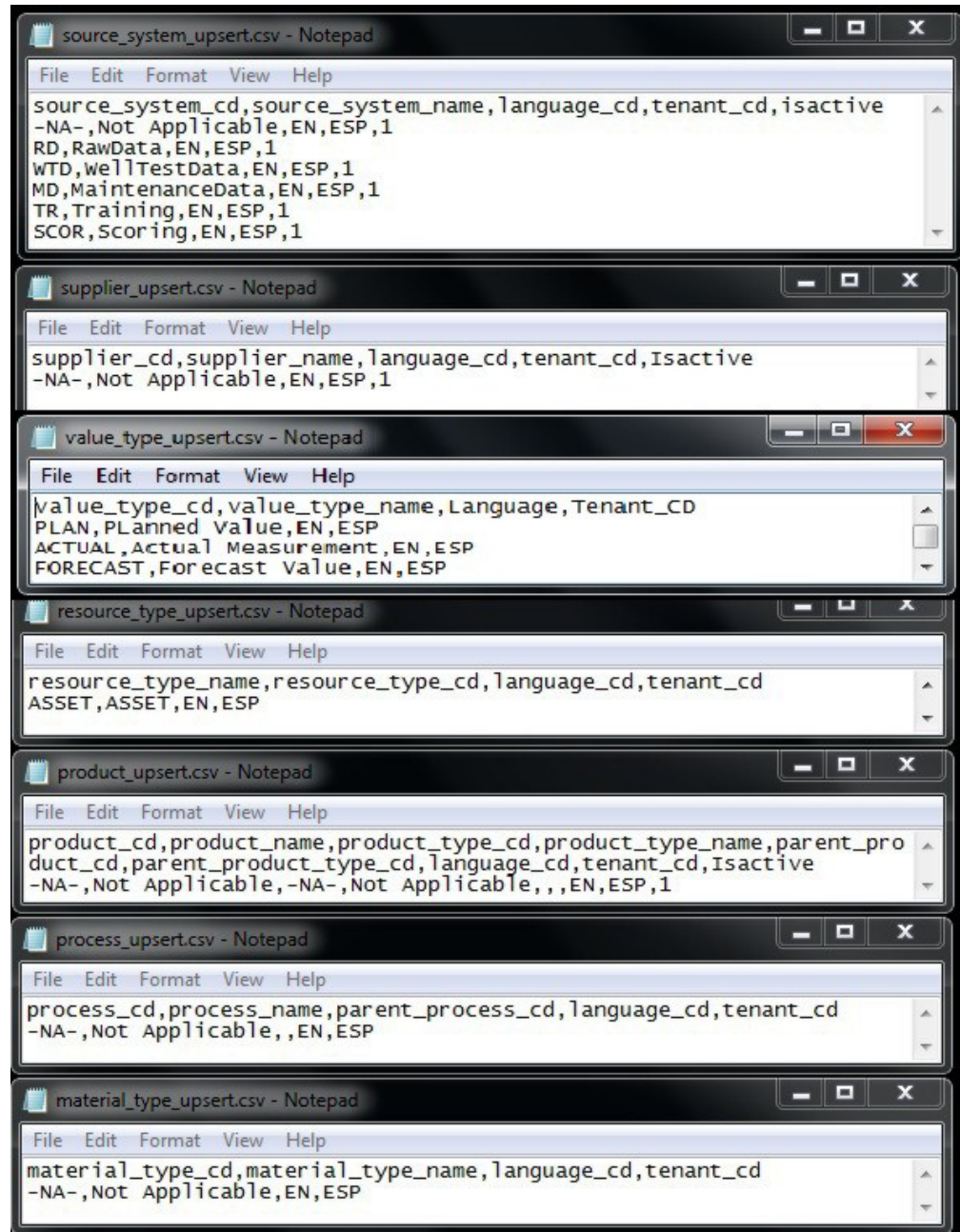
```

```

production_batch_upsert.csv - Notepad
File Edit Format View Help
production_batch_cd,production_batch_name,product_cd,product_type_cd
,produce_date,language_cd,tenant_cd
-NA-,Not Applicable,-NA-,-NA-,2011-01-01,EN,ESP

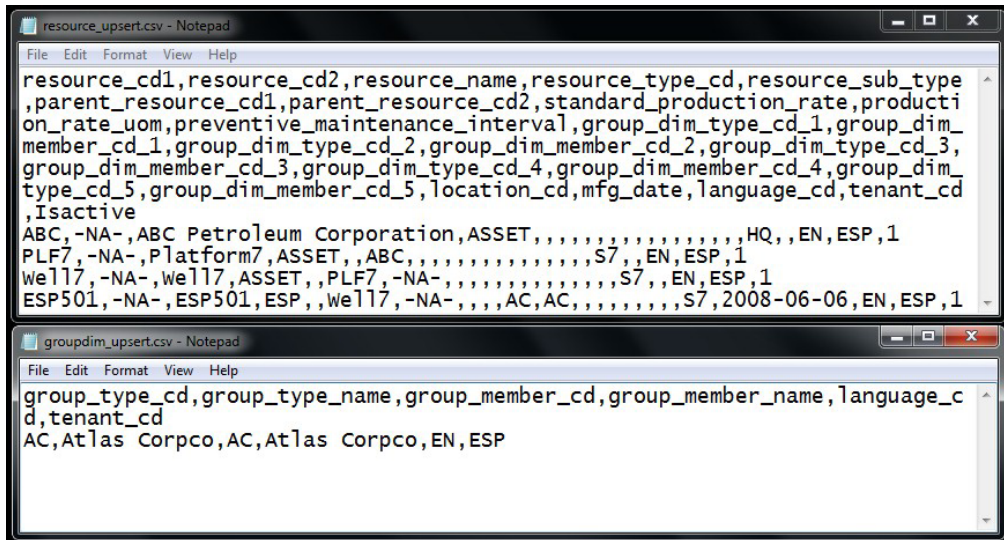
material_upsert.csv - Notepad
File Edit Format View Help
material_cd,material_name,material_type_cd,supplier_cd,language_cd,tenant_cd,Isactive
-NA-,Not Applicable,-NA-,-NA-,EN,ESP,1

```



The Asset Analytics for Rotational Equipment in Oil and Gas solution provides for defining multilevel resource hierarchies that are augmented by group dimensions. A number of associations and relationships between resources and attributes can be defined. Any number of pumps can be defined, and associations can be defined to group them by any dimension; for example, OEM or Vendor can be defined as a dimension and associated with a pump.

The examples contain a base level of data that can be used for a fictional resource that is named ESP501 of type ESP and a child of an ASSET that is named Well17. ESP is associated with the manufacturer specified by the attribute group_dim_member_cd_1 as AC. Irrespective of the resource hierarchy and group dimension associations that are defined, all electrical submersible pumps in this example content are associated with the resource type ESP.



Loading the master data and metadata

You must load the master data and metadata for the Asset Analytics for Rotational Equipment in Oil and Gas solution in a specific order.

Procedure

1. Log in to the Integration Bus node computer as the `mqm` user.
2. Copy the files to the `/var/PMQ/MQSIFileInput/masterdatain` directory in the order that is shown in the table:

Order	File name
1	language_upsert.csv
2	tenant_upsert.csv
3	event_code_upsert.csv
4	event_type_upsert.csv
5	group_dim_upsert.csv This file should be based on the pump details, including its hierarchical relationship to other entities, such as wells and platforms, and organization relationships.
6	location_upsert.csv This file should be based on the location of the pumps.
7	material_type_upsert.csv
8	measurement_type_upsert.csv
9	process_upsert.csv
10	product_upsert.csv
11	resource_type_upsert.csv
12	source_system_upsert.csv
13	supplier_upsert.csv
14	value_type_upsert.csv
15	material_upsert.csv
16	production_batch_upsert.csv

Order	File name
17	resource_upsert.csv This file should be based on any other attribute that can be associated with a pump and defined as a group dimension. For example, Vendor or OEM can be defined as a dimension and associated with a pump.

Important: The files must be copied one at a time.

For more information about master and metadata for IBM Predictive Maintenance and Quality, see the following topic in IBM Knowledge Center:

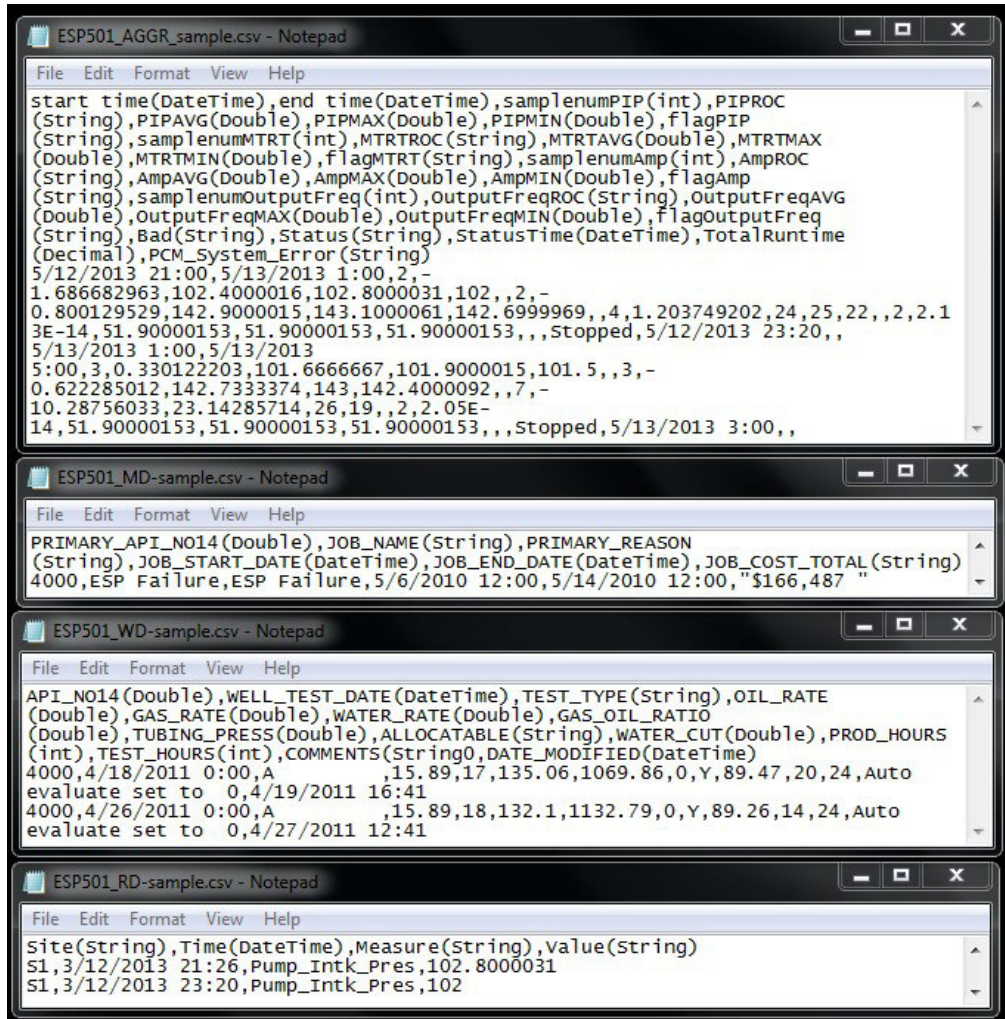
- Master data process
- File format and location
- The flat file API

Event data

Event data must also be loaded for the Asset Analytics for Rotational Equipment in Oil and Gas solution.

Event data includes information such as maintenance data, well test data, and time variable data.

The following are examples of the contents that each of the CSV files that you must prepare must contain. The CSV files that you use should reflect your environment.



The example custom flows expect event and other supporting operational data in the formats shown in the image.

When you create the event data, ensure that:

- An event or operational data file must have data for only a single pump.
- The names of the event data files should be prefixed with <SerialNo_>. For example, well test data for a pump with serial number of ESP501 should be named ESP501_***.csv. The custom flow looks up the location and model of the pump based on the Serial_Number of the pump in the file name.

Onboarding event data

You must load the event data for the Asset Analytics for Rotational Equipment in Oil and Gas solution.

Procedure

1. Log in to the Integration Bus node computer as the **mqm** user.
2. Copy the event data files that you created to the following directories:

Example file name	Target input directory
ESP501_AGGR_Sample.csv	/var/PMQ/MQSIFileInput/espaggregatein
ESP501_MD.csv	/var/PMQ/MQSIFileInput/maintenancedatain

Example file name	Target input directory
ESP501_WTD.csv	/var/PMQ/MQSIFileInput/welltestdatain
ESP501_RD.csv	/var/PMQ/MQSIFileInput/espsensordatain

Configure and prime Maximo

If you are using IBM Maximo®, you must create an enterprise service for the Asset Analytics for Rotational Equipment in Oil and Gas solution.

The work order creation service is called by an IBM Integration Bus flow in IBM Predictive Maintenance and Quality. You must configure the web service to receive work order creation requests from IBM Integration Bus.

For more information, see the Creating a work order service in IBM Maximo Asset Management topic in IBM Knowledge Center (www.ibm.com/support/knowledgecenter/SSTNNL_2.5.1/com.ibm.swg.ba.cognos.pmq_solution_guide.2.5.1.doc/t_create_work_order_maximo.html?lang=en).

After the web service is configured, the Maximo instance must be primed to map the master data in the Predictive Maintenance and Quality data mart. That is, you must map the resources and locations details in Maximo to enable it to receive, identify, and process work orders against these resources.

For more information, see the IBM Maximo Asset Management topic in IBM Knowledge Center (www.ibm.com/support/knowledgecenter/SSTNNL_2.5.1/com.ibm.swg.ba.cognos.pmq_solution_guide.2.5.1.doc/c_integ_maximo.html?lang=en).

Manually triggering batch training and scoring jobs

You can manually trigger a batch training or scoring job in your Asset Analytics for Rotational Equipment in Oil and Gas solution by copying a file to the `esptriggersfolder` directory.

Procedure

1. To trigger a training job:
 - a. Log in to the Integration Bus node computer as the `mqm` user.
 - b. Create a file that is named `esptraining.txt`. The file can be blank.
 - c. Copy the file to the `/var/PMQ/MQSIFileInput/esptriggersfolder` directory.
2. To trigger a scoring job:
 - a. Log in to the Integration Bus node computer as the `mqm` user.
 - b. Create a file that is named `espscoring.txt`. The file can be blank.
 - c. Copy the file to the `/var/PMQ/MQSIFileInput/esptriggersfolder` directory.

Chapter 3. Using Asset Analytics for Rotational Equipment in Oil and Gas

This section describes two typical use cases that show how to use the Asset Analytics for Rotational Equipment in Oil and Gas solution to predict pump failures.

Asset Analytics for Rotational Equipment in Oil and Gas provides dashboards that are designed to organize and categorize information for the various performance of modes of an electric submersible pump (ESP), as well as highlight the current mode of the ESP. The dashboards also highlight overall high, medium, and low risk ESPs.

The dashboards are designed for two personas: an executive and an analyst.

Workflow and user roles

This workflow shows how the solution can be used to thoroughly evaluate a potentially faulty pump with a high likelihood of failure. For this example, two primary users have been identified: an executive and an analyst. A typical process workflow is described.

Using the executive dashboard

Executives are one of the two primary users of the Asset Analytics for Rotational Equipment in Oil and Gas solution.

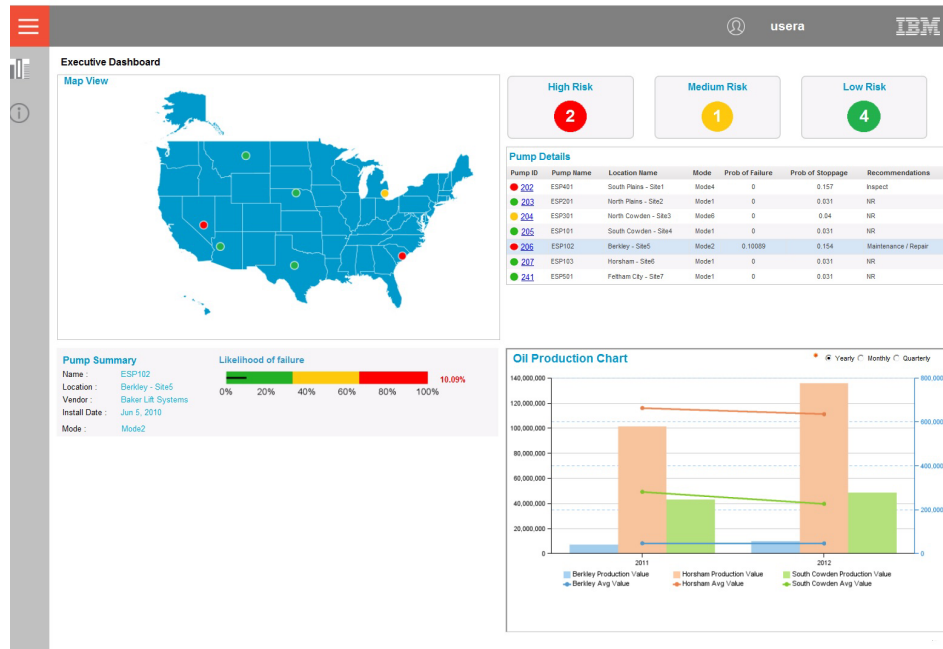
About this task

This task describes how a typical executive using the solution would identify a potentially faulty pump for further investigation. The screen shots shown are for example purposes and will vary depending on your particular implementation.

Procedure

1. Log on to the executive dashboard to scan for issues that need attention. Some of the pumps are in a critical state.
2. Using the **Pump Details** pane, select the ESP102 pump. The **Pump Summary** panel dynamically updates with each pump selection. ESP102 is at an 10%

probability of failure.



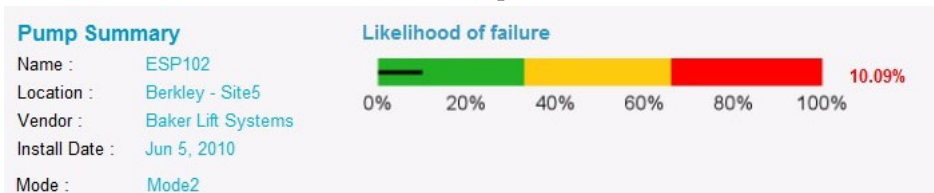
The individual panes on the dashboard provide further information on the pumps. The number of pumps at high, medium, and low is defined by the a calculation based on the probability of failure or stoppage of the pump.



The **Pump Details** Pane provides the pump's current mode, probability of failure, and probability of stoppage, and recommendations. The Pump ID is highlighted in blue.

Pump ID	Pump Name	Location Name	Mode	Prob of Failure	Prob of Stoppage	Recommendations
202	ESP401	South Plains - Site1	Mode4	0	0.157	Inspect
203	ESP201	North Plains - Site2	Mode1	0	0.031	NR
204	ESP301	North Cowden - Site3	Mode6	0	0.04	NR
205	ESP101	South Cowden - Site4	Mode1	0	0.031	NR
206	ESP102	Berkley - Site5	Mode2	0.10089	0.154	Maintenance / Repair
207	ESP103	Horsham - Site6	Mode1	0	0.031	NR
241	ESP501	Feltham City - Site7	Mode1	0	0.031	NR

Clicking on the **Pump ID** displays details of the pump, such as vendor and installation date, in the **Pump Summary** pane.



Finally, an executive can view the oil production chart for the last two years, providing yearly, monthly, and quarterly production and average production chart date for various locations. Use the radio button on the chart to switch

between yearly, monthly, and quarterly views.



Using the analyst dashboard

Analysts are one of the two primary users of the Asset Analytics for Rotational Equipment in Oil and Gas solution.

About this task

This task describes how a typical analyst using the solution would identify a potentially faulty pump for further investigation. The screen shots shown below are for example purposes and will vary depending on your particular implementation.

Procedure

1. Log on to the **Analyst Dashboard** for a detailed analysis of a specific pump.
2. In the **Pump Name** pane, enter the location, pump name, and dates to view the dashboard for a specific pump, in this case pump ESP102.



The individual panes provide key functionality or information. The **Pump Name** pane is used to filter pumps based on location, pump name, and date filters.

Pump Name : ESP102

Location:

Pump :

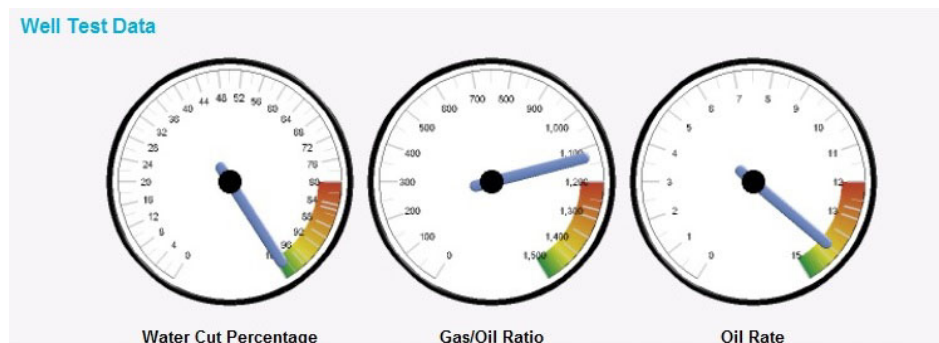
Dates : From:

Earliest date

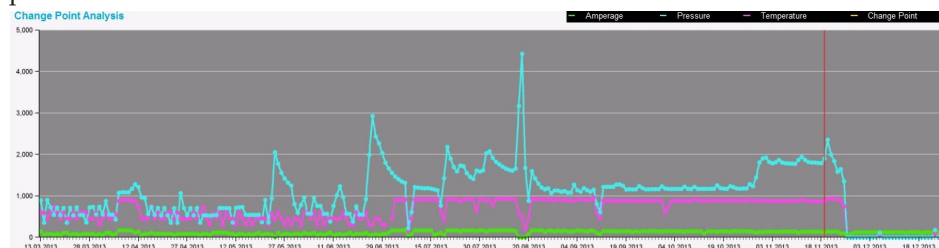
To:

Latest date

The dial charts present well test data for water cut percentage, gas/oil ratio, and oil rate.



The **Change Point Analysis** chart displays the trends for the temperature, pressure, and amperage sensors. Bars highlight the change points of the pump's performance.



Finally, the dashboard provides information on the **Maintenance Summary** of the pump, including a short description of the maintenance updates.

Maintenance Summary

Start Date	End Date	Task Name	Description
Jun 1, 2011 5:00:00 AM	Jun 10, 2011 5:39:00 PM	ESP Failure	ESP Failure
Jul 18, 2013 12:00:00 PM	Jul 18, 2013 12:00:00 PM	Planned Chemical Tre	Planned Chemical Treatment

Usage scenario

Asset Analytics for Rotational Equipment in Oil and Gas solution provides powerful predictive capabilities.

A typical process of extraction may take place from widely distributed oil and gas wells. In a given scenario, there could be thousands of wells and ESPs generating large volumes of real-time data.

For such a scenario, a predictive model could be built using data metrics for one year, such as intake and discharge pressure, drive amperage, and temperature. This data could be obtained from the historian, a database that logs time-based process data, as well as the Enterprise Asset Management database.

A small number of metrics could be used to characterize the performance of the ESPs, focusing on the optimal discharge pressure and key factors contributing to failures. This use case could then be used to provide real-time predictive scoring of ESP performance.

Appendix. Troubleshooting

This section contains troubleshooting information for the Asset Analytics for Rotational Equipment in Oil and Gas installation.

Troubleshooting resources

Troubleshooting resources are sources of information that can help you resolve a problem that you are having with an IBM product.

Support Portal

The IBM Support Portal is a unified, centralized view of all technical support tools and information for all IBM systems, software, and services.

The IBM Support Portal lets you access all the IBM support resources from one place. You can tailor the pages to focus on the information and resources that you need for problem prevention and faster problem resolution. Familiarize yourself with the IBM Support Portal by viewing the demo videos (https://www.ibm.com/rotlogs/SPNA/entry/the_ibm_support_portal_videos).

Find the content that you need by selecting your products from the IBM Support Portal (<http://www.ibm.com/support/entry/portal>).

Before contacting IBM Support, you will need to collect diagnostic data (system information, symptoms, log files, traces, and so on) that is required to resolve a problem. Gathering this information will help to familiarize you with the troubleshooting process and save you time.

Service request

Service requests are also known as Problem Management Reports (PMRs). Several methods exist to submit diagnostic information to IBM Software Technical Support.

To open a PMR or to exchange information with technical support, view the IBM Software Support Exchanging information with Technical Support page (<http://www.ibm.com/software/support/exchangeinfo.html>).

Fix Central

Fix Central provides fixes and updates for your system's software, hardware, and operating system.

Use the pull-down menu to navigate to your product fixes on Fix Central (<http://www.ibm.com/systems/support/fixes/en/fixcentral/help/getstarted.html>). You may also want to view Fix Central help.

IBM developerWorks

IBM developerWorks® provides verified technical information in specific technology environments.

As a troubleshooting resource, developerWorks provides easy access to the most popular practices, in addition to videos and other information: developerWorks (<http://www.ibm.com/developerworks>).

IBM Redbooks

IBM Redbooks® are developed and published by the IBM International Technical Support Organization, the ITSO.

IBM Redbooks (<http://www.redbooks.ibm.com>) provide in-depth guidance about such topics as installation and configuration and solution implementation.

Software support and RSS feeds

IBM Software Support RSS feeds are a quick, easy, and lightweight format for monitoring new content added to websites.

After you download an RSS reader or browser plug-in, you can subscribe to IBM product feeds at IBM Software Support RSS feeds (<https://www.ibm.com/software/support/rss>).

Log files

Log files can help you troubleshoot problems by recording the activities that take place when you work with a product.

Error messages

The first indication of a problem is often an error message. Error messages contain information that can be helpful in determining the cause of a problem.

Troubleshooting a problem

Troubleshooting is a systematic approach to solving a problem. The goal of troubleshooting is to determine why something does not work as expected and how to resolve the problem.

Review the following table to help you or customer support resolve a problem.

Table 1. Troubleshooting actions and descriptions

Actions	Description
A product fix might be available to resolve your problem.	Apply all known fix packs, or service levels, or program temporary fixes (PTF).
Look up error messages by selecting the product from the IBM Support Portal, and then typing the error message code into the Search support box (http://www.ibm.com/support/entry/portal/).	Error messages give important information to help you identify the component that is causing the problem.
Reproduce the problem to ensure that it is not just a simple error.	If samples are available with the product, you might try to reproduce the problem by using the sample data.

Table 1. Troubleshooting actions and descriptions (continued)

Actions	Description
Ensure that the installation successfully finished.	The installation location must contain the appropriate file structure and the file permissions. For example, if the product requires write access to log files, ensure that the directory has the correct permission.
Review all relevant documentation, including release notes, technotes, and proven practices documentation.	Search the IBM Knowledge Center to determine whether your problem is known, has a workaround, or if it is already resolved and documented.
Review recent changes in your computing environment.	Sometimes installing new software might cause compatibility issues.

If the items in the table did not guide you to a resolution, you might need to collect diagnostic data. This data is necessary for an IBM technical-support representative to effectively troubleshoot and assist you in resolving the problem. You can also collect diagnostic data and analyze it yourself.

Troubleshooting known errors

There are solutions for known errors that you may encounter in IBM Asset Analytics for Rotational Equipment in Oil and Gas.

Table 2. Solutions to errors or problems in the executive dashboards in IBM Asset Analytics for Rotational Equipment in Oil and Gas..

Error or problem	Action
<p>Model or package does not exist.</p> <p>This error occurs with this message:</p> <p>The model or package</p> <pre>/content/folder[@name='REOilGas_AssetAnalytics'] /package[@name='IBMPMQ']/model[@name='2015-06-16T05:18:25.171Z']</pre> <p>does not exist or you are not allowed to use it because of security settings.</p>	<p>Ensure IBMPMQ Mode is published on the Cognos server in Public Folders > REOilGas_AssetAnalytics.</p>
<p>Dashboards display “No Data Available” even if there is data available in the IBMPMQ database.</p>	<p>Ensure the Tenant ID is updated in the IBMPMQ model parameter, and the package is published.</p>

Table 3. Solutions to errors or problems in IBM Cognos dashboards in IBM Asset Analytics for Rotational Equipment in Oil and Gas..

Error or problem	Action
Electrical submersible pump (ESP) locations are plotted outside the map.	Map lenders locations are based on the latitude and longitude values for a location. The longitude value should have a -ve value stored in the Master_Location.Longitude column.
The map does not show all the ESPs .	If multiple pumps have the same latitude and longitude values, the ESPs data points will overlap and only one ESP will be plotted on the map.
The ESP's location name is not available when pointing to the circles on the map.	If the map is not showing the location name for the pump when you point to a circle on the map, view the Location Name in the Pump Details pane.
The Pump Details column headers disappear when there is scroll bar in the pane.	The Pump Details column headers scroll up or down with the list.
Oil production data is not available for entire data set stored in the ESP_PROD_DATA table.	Oil production data shows only the last two years of the ESP_PROD_DATA table. For example, if data is stored for 2011 through 2014, the dashboard will show only the 2013 and 2014 years.
The Oil Production Chart is not available on the dashboard	Ensure the data is populated in the ESP_PROD_DATA table.

Table 4. Solutions to errors or problems in the analyst dashboards in IBM Asset Analytics for Rotational Equipment in Oil and Gas..

Error or problem	Action
Change points do not appear in the Change Point Analysis chart.	This chart shows data based on an observation time stamp. The change point for a pump will be available only if any one of the three sensors (temperature, pressure, or amperage) has data on the selected date.
Red color bars appear in the Change Point Analysis chart.	Change points are highlighted using orange color bars in the chart. Red bars are for high severity mode. In the solution, mode 2 has red bars.

Table 4. Solutions to errors or problems in the analyst dashboards in IBM Asset Analytics for Rotational Equipment in Oil and Gas. (continued).

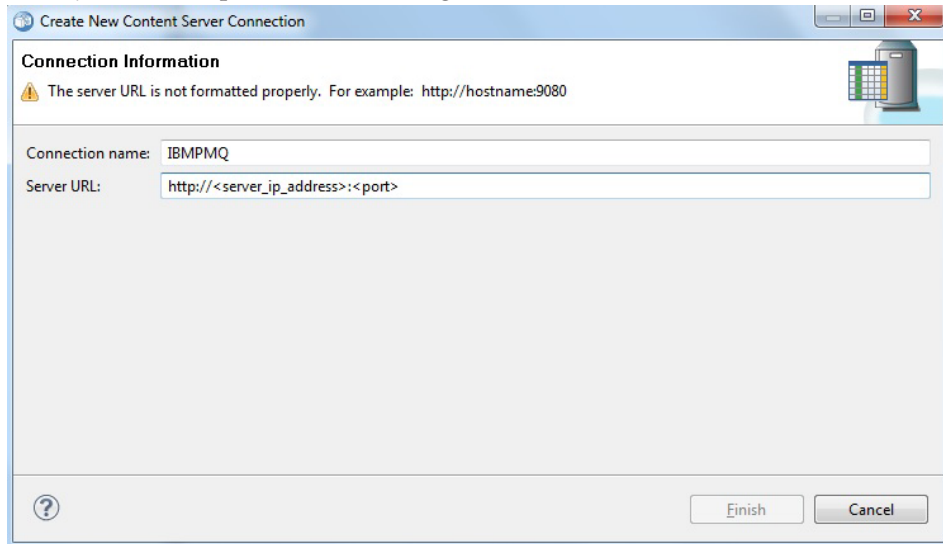
Error or problem	Action
Pump Name selections cause unexpected location and pump filter behavior.	The Pump Name filter is cascaded based on location. When a location is selected, the pump list is refreshed and the first pump in that location is selected. Please click on the Update button to refresh the dashboard.

Troubleshooting SPSS

If your SPSS job fails, there are some troubleshooting steps you can follow to resolve the issue. Troubleshooting the execution of SPSS jobs requires IBM SPSS Collaboration and Deployment Services Deployment Manager 7.0 to be installed on the workstation from which the server connection is to be established.

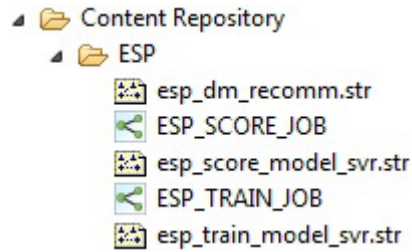
Procedure

1. Start IBM SPSS Collaboration and Deployment Services Deployment Manager 7.0.
2. Go to **File > New > Content Server Connection**.
3. Enter the **Connection name** and **Server URL** in the **Connection Information** dialog box, where *<server_ip_address>* is the IP address of the SPSS server node and *<port>* is the port number configured for the server connection.

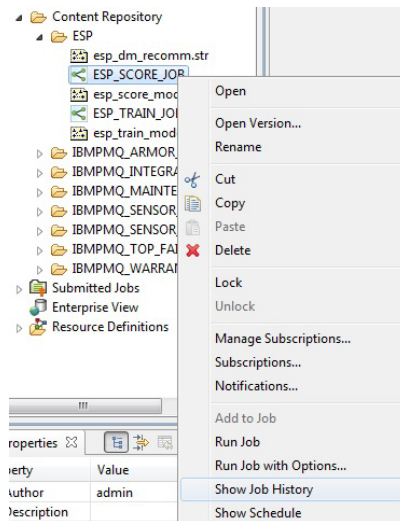


4. Expand the new **Content Server Connection** and provide the authentication details for the server.

- Expand the ESP folder in the Content Repository for the two job files: ESP_TRAIN_JOB, for model training, and ESP_SCORE_JOB, for model scoring.



- Right click on the job that you are troubleshooting and click **Show Job History** in the pull-down menu.



- Two logs will be visible for each job. The first log shows information related to the job itself, such as the parameters used for running the job. The second log shows information related to the stream contained within the job.

Name	Version	Status	Start Date	Run Time
/ESP/ESP_SCORE_JOB	52:2015-06-01 22:36:26.44	Success	6/4/15 3:46 PM	00:01:43.000
ESP_SCORE_JOB		Success	6/4/15 3:46 PM	00:01:43.000
Log				
esp_score_model_svr.str_step		Success	6/4/15 3:47 PM	00:00:29.000
Log				

- To find the source of the failure, scroll to the error information provided near the end of the log file. Use this for problem rectification and further debugging.

Troubleshooting the Integration bus node

The following topics apply to the IBM Integration Bus node for Asset Analytics for Rotational Equipment in Oil and Gas.

Event files are not processed by custom flows

If event files are not being processed by the custom flows, ensure that the file names are prefixed with `<PumpCode/Resource_Code>_`

Scoring requests are not being sent to the SPSS Collaboration and Deployment Services Server

Ensure that the aggregated data is loaded into the PMQ data mart.

Ensure that the aggregated data for measurement type `samp1enumPIP` is on the event observation table.

Java exception when you deploy the broker archive (BAR) files

You are deploying the BAR files, and you see the following error:

```
BIP4394E: Java exception: 'com.ibm.broker.plugin.MbUserException'; thrown from class name
```

Ensure that you have copied all of the properties files into the `shared-classes` folder.

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