

Insights Foundation for Energy On Cloud
Version 1.6.0

Documentation



Note

Before using this information and the product it supports, read the information in "Notices" on page 85.

Product Information

This document applies to Industry Solutions Insights Foundation for Energy Version 1.6.0 and may also apply to subsequent releases.

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Contents

IBM Insights Foundation for Energy documentation	v
Solution overview	vii
Features	vii
Users and benefits	viii
Included products	viii
Concepts	ix
Supported asset classes and measurements	x
What's new	xiv
Chapter 1. Securing the solution	1
User roles and access	1
Adding users and groups	2
Modifying or removing users and groups	3
Mapping groups to license types	5
Chapter 2. Use case: Define a new asset class in the Data Model application	7
Defining the new asset class in the Data Model application	7
Adding an asset class	7
Defining the property type of an asset class	8
Adding a measurement reading table for use with asset classes	9
Prepare and load Static Data	10
Defining the data for the resource	10
Defining the terminal data	11
Defining the connectivity node data	12
Defining the measurement data	13
Defining the asset data	14
Configuring the data loader	15
Loading the static data	16
Prepare and load the dynamic data	16
Defining the reading data file	16
Configuring the data loader for the reading table	16
Running the data loader	17
Defining the asset style	17
Chapter 3. Viewing and analyzing energy data	19
Logging on to the Asset Health application	20
Task bar	20
Filter bar	21
Viewing assets on a map	22
Viewing the legend	22
Viewing assets as a list	22
Filtering assets	23
Searching for an asset	24
Adding additional filter criteria	24
Preview cards	24
Using the Connectivity Model	25
Logging onto the Connectivity Model application	25
Viewing the legend of the connectivity model application	26
Viewing the information of a substation with all its connections	26
Viewing all meter mismatches of a transformer	27
Exporting the asset information of a utility	29
Viewing asset reports	29
Single asset reports	29

Multiple asset reports	29
Report data	30
Viewing analytics dashboards	31
Exporting data	32
Creating input for a rate use case	32
Chapter 4. Customizing the solution	35
Configure the global settings of the Asset Health model	35
Configuration file format	35
Loading the default configuration	46
Update the default configuration	46
Configure the SPSS Asset Health model	47
Chapter 5. Running an Asset Health analysis	49
Running the analysis	50
Tracking the progress of an analysis	50
Chapter 6. Maintaining the solution	51
Restarting the IBM Insights Foundation for Energy components	51
Understanding the platform control tool components	51
Stopping the components	52
Starting the components	53
Appendix A. Troubleshooting and support	55
Techniques for troubleshooting problems	55
Known problems and solutions for IBM Insights Foundation for Energy	57
Browser back button does not return to the perceived previous page	57
Updated service passwords for the data loader are not automatically encrypted	57
Dissolved Gas Analysis graphic cannot be exported in the .xlsx file.	58
Drilled-down bar chart does not clear	58
A bar chart does not clear when user selects another asset.	58
An analysis on the ANA node causes a segmentation fault	59
IBM Insights Foundation for Energy messages.	60
Appendix B. Reference.	63
The Insights Foundation for Energy Data Model	63
Ontology	63
Logical Resource	66
Asset identity and Attributes	67
Geometry	76
Relationships and connectivity	77
License usage metrics	80
Supported browsers	82
Supported browsers	82
Accessibility	82
Notices	85
Index	89

IBM Insights Foundation for Energy documentation

Welcome to the IBM® Insights Foundation for Energy documentation, where you can find information about how to install, maintain, and use the product.

Product introduction

IBM Insights Foundation for Energy is an analytics platform for the energy and utilities industry. You can use the platform to develop new applications to support analytics use cases for your assets and networks, and to integrate existing applications with the solution.

You can use the extension capabilities that are provided by the user interface framework to build application user interfaces that meet your operational requirements.

Audience

IBM Insights Foundation for Energy is designed for personnel who are involved with analyzing energy and utility assets and determining maintenance plans.

Finding information

To find information 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. IBM Cognos® HTML documentation has accessibility features. PDF documents are supplemental and, as such, include no added accessibility features. For information about these features, see Accessibility features in this document.

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.

Solution overview

IBM Insights Foundation for Energy is an analytics platform for the energy and utilities industry. You can use the platform to develop new applications to support analytics use cases for your assets and networks, and to integrate existing applications with the solution.

Currently, data from multiple systems must be manually analyzed. IBM Insights Foundation for Energy provides an analytics platform and core services to consolidate and correlate the data.

IBM Insights Foundation for Energy is installed on IBM Predictive Maintenance and Quality, so that you can also use predictive maintenance capabilities to help you to anticipate asset failures and to predict the need for maintenance.

The product provides REST services that can be used to extend the product and provide integration interfaces to other systems.

Features

IBM Insights Foundation for Energy is an analytics platform that provides a broad range of analytics capabilities. It is based on IBM platform and analytics products.

IBM Insights Foundation for Energy provides built in applications for the situational awareness of grid assets and health, and risk analytics for these assets, along with predictive maintenance capabilities. Also, IFE enables energy companies to unify data and analytic processes across their operations to provide both visual and contextual insights.

IBM Insights Foundation for Energy provides data management, visualization and analytics capabilities, and includes a broad range of integrated analytic technologies. It can also be used as a foundation for other analytics applications.

This foundation can be used to:

- Unify systems and business processes by integrating multiple data sources such as sensors, SCADA, weather, EAM (Enterprise Asset Management).
- Deliver contextual awareness by correlating, analyzing and visualizing data within and across systems and processes.

Asset Health

Asset health assessment uses a predictive decision tree to help you do an in-depth analysis of the many factors affecting an asset's lifespan. For example, the health status of the pole is affected by multiple factors, some are based on a property of the asset (the species of the pole), some are based on a computed value (asset age based on installation date), and some based on result of a predictive model (failure risk). Asset health assessment combines different factors into a predictive asset health score and provides treatment options.

IBM Insights Foundation for Energy provides the capability to configure the user interface for the filter bar and connectivity filter. Based on requirement, you can also create new reports or customize existing reports.

Situation Awareness

Situation awareness helps you to monitor changes to the status of assets. Standard operating procedures inform you of any actions that are necessary in response to those changes. The changes to an asset status show in real time and can be seen with different views. Immediate response can be taken to solve issues or plan corrective action for future occurrences for assets within the regional or municipal boundaries.

Users and benefits

IBM Insights Foundation for Energy is designed for personnel who are involved with analyzing energy and utility assets and determining maintenance plans.

The following table describes the users and benefits that are associated with using IBM Insights Foundation for Energy.

Table 1. IBM Insights Foundation for Energy users and benefits

If you are a...	This software can help you...
Reliability planning engineer	Analyze data on assets and networks.
Data scientist	Create and configure analysis models.
IT Administrator	Configure custom services and user interface elements.
Software developer	Create new applications. Create new data models and services. Create new user interfaces for new applications.

Included products

IBM Insights Foundation for Energy is built on IBM products. Versions of these products are included for use with the solution.

- Apache Jena 0.2.3
- DB2[®] Enterprise Server Edition 10.5.0.5
- IBM Cognos Business Intelligence 10.2.2
- IBM HTTP Server 8.5.5.5
- IBM ILOG[®] CPLEX[®] Optimization Studio 12.6.0.1
- IBM Integration Bus 9.0.0.3
- IBM SPSS[®] Data Access Pack 7.1.1
- IBM SPSS Modeler 17.0
- IBM SPSS Modeler Batch 17.0
- IBM SPSS Modeler Collaboration and Deployment Services Adapter 17.0
- IBM SPSS Statistics 23.0
- IBM SPSS Statistics 23.0 Collaboration and Deployment Services Adapter 7.0
- IBM SPSS Analytic Server 2.0
- IBM WebSphere[®] MQ 7.5.0.4
- IBM WebSphere SDK Java[™] Technology Edition 7.1.2.10
- SPSS Collaboration and Deployment Services 7.0.0

- WebSphere Application Server Liberty Profile 8.5.5.5
- WebSphere Application Server Network Deployment 8.5.5.5

Concepts

IBM Insights Foundation for Energy has concepts that are unique to the solution and the energy industry. Understanding these concepts is important to understanding the data presented by the solution.

Asset health

Asset health indicates how well a specific asset will provide its service in the future in terms of a percentage figure.

IBM Insights Foundation for Energy provides an aggregate score for the health of each asset. Factors such as age, manufacture, overload time, and others are considered when calculating the health score. Asset health is shown in terms of a percentage figure. The higher the value for asset health, the less likely the asset will fail.

Failure probability

Failure is the probability that a single asset or a network will fail.

The failure calculation takes into consideration the probability, in percentage terms, that the asset itself will fail as well as the impact on assets upstream and downstream from the failing asset. Network failure probability takes into account four failure probabilities:

- The probability of failure of an individual asset. This is calculated as $\{(100 - \text{Asset Health score}) * \text{constant}\}$
- The probability of failure of an asset downstream from the individual failing asset.
- The probability of failure of an asset upstream from the individual failing asset.
- The probability of the physical failure of a supporting asset. A supporting asset is one that gives physical support to the individual asset, for example, an overhead cable is physically supported by 2 poles, then the physical failure probability of the cable $c1 = 1 - (1 - \text{Physical failure probability of } p1) * (1 - \text{Physical failure probability of } p2)$ where $c1$ is the overhead cable, and $p1$ and $p2$ are the supporting poles.

The higher the failure score, the more likely the asset will fail.

Consequence of failure

The consequence of an asset failing is a measure of the number of customers associated with that asset. Assets that support more customers are more important than assets that support fewer customers. As the number of downstream network nodes propagates, the real consequence of failure of one asset is the summation of all consequence values of all downstream nodes, plus its own value. In order to normalize the consequence value into the range of [0-100], we use the maximum value for the normalization factor for each asset.

For example: Three distribution transformers dt1, dt2, dt3 each have a number of customers: 5, 8, and 6 where 8 is the maximum value. The normalized factor value for dt1 = 5/8. This is converted to a percentage value to give a consequence of failure = 62.5%.

Table 2. The number of customers for each distribution transformers

Distribution transformer	Number of customers	Normalized factor value	Consequence of failure
dt1	5	5/8	62.5%
dt2	8	8/8	100%
dt3	6	6/8	75%

Risk

Risk is given as a percentage value and is the product of the failure probability and the consequence of failure.

For example, if the failure probability is 30% and the consequence of failure is 62.5%, then the risk of failure is 18.75%.

Supported asset classes and measurements

The default supported asset classes and measurements that are included with IBM Insights Foundation for Energy.

IFE includes algorithms for five asset class models:

- Substation transformer
- Distribution transformer
- Overhead cable
- Underground cable
- Pole

The following table shows the default support.

Table 3. The measurements associated with each asset class

Asset Class	Input measurements	Predictive model	Asset Health Factors	Output network risk

Table 3. The measurements associated with each asset class (continued)

Substation Transformer	Dissolved Gas Analysis Reading	Percentage summation of each of the weighted asset health factors.	Stage 3 Rating (MVA) Winter Emergency Rating (A) Summer Normal Rating (A) Operating Voltage Stage 1 Rating (MVA) Stage 2 Rating (MVA) Age Summer Emergency Rating (A) Phase Orientation Rated KVA	Upstream, downstream failure probability, consequence of failure and risk
Distribution Transformer	Load Energy	Percent aging coefficient model	Number of customers Rated KVA Is outage device Owner Age Operating voltage Percent Aging Coefficient	Upstream and downstream failure probability, consequence of failure and risk.
Overhead Cable	No measurement input		Age Length Age Operating voltage	Upstream and downstream failure probability, consequence of failure and risk. Failure probability of supporting poles

Table 3. The measurements associated with each asset class (continued)

Underground Cable	No measurement input		Age Length Age Operating voltage Phase designation	Upstream and downstream failure probability, consequence if failure and risk.
Pole	Pole Inspection result	Pole maintenance based asset health score	Reclaimed status Species Inspection status Age Length Inspection result Preservative Failure Risk Score	Upstream and downstream failure probability, consequence if failure and risk.

Asset Health calculation for a distribution transformer

The health score for the Distribution Transformer asset class is calculated from two drivers, condition and risk.

The condition driver has four input asset health factors:

- Percent Aging Coefficient is a statistical factor that is derived from the PMQ SPSS analysis model. The PMQ SPSS analysis model analyzes several properties and returns the analysis to IFE as the Ageing Coefficient statistical factor. The properties that PMQ analyzes are: subtypeCode, ratedKva, installationDate, removalDate and isActive.
- Outage Device is a raw factor that derives directly from the property isOutageDevice.
- Age is a calculation derived from the installationDate property and the current date.
- Operating Voltage is a raw factor that derives directly from the operatingVoltage property.

The risk driver has one input factor, Rated KVA, that derives directly from the ratedkva property.

Asset Health factors for a substation transformer

The health score for the Substation Transformer asset class is calculated from two drivers. Condition and Risk.

The condition driver condition has seven input factors:

- Stage 3 Rating (MVA) is a raw input factor derived directly from the `stage3Rating` property.
- Winter Emergency Rating (A) is a raw input factor derived directly from the `winterEmergencyRating` property.
- Summer Normal Rating (A) is a raw factor derived directly from the `summerNormalRating` property.
- Winter Normal Rating (A) is a raw factor derived directly from the `winterNormalRating` property.
- Operating Voltage is a raw factor derived directly from the `operatingVoltage` property.
- Stage 1 Rating (MVA) is a raw factor derived directly from the `stage1Rating` property.
- Stage 2 Rating (MVA) is a raw factor derived directly from the `stage2Rating` property.

The risk driver risk has three input factors:

- Age is a calculation derived from the `installationDate` property and the current date.
- Summer Emergency Rating (A) is a raw input factor derived directly from the `summerEmergencyRating` property .
- Rated KVA is a raw factor derived directly from the `ratedkva` property

Asset Health factors for an overhead cable

The health score for the Overhead Cable asset class is calculated from two drivers. Condition and Risk.

The condition driver condition has two input factors:

- Age is a calculation derived from the `installationDate` property and the current date.
- Phase Designation is a raw input factor derived directly from the `phaseDesignation` property.

The risk driver has two input factors:

- Length is a raw input factor derived directly from the `length` property.
- Operating Voltage is a raw input factor derived directly from the `operatingVoltage` property.

Asset Health factors for an underground cable

The health score for the Underground Cable asset class is calculated from two drivers. Condition and Risk.

The condition driver has four input factors:

- Length is a raw factor derived directly from the `length` property.
- Age is a calculation derived from the `installationDate` property and the current date.
- Sub Type Code is a raw factor derived directly from the `subtypecode` property.
- Phase Designation is a raw factor derived directly from the `phaseDesignation` property.

The risk driver risk has one input factor. Operating Voltage is a raw input factor, derived directly from the `operatingVoltage` property.

Asset Health factors for a pole

The health score for the Pole asset class, is calculated from two drivers. Condition and Risk.

The condition driver has three input factors:

- Height is a raw input factor derived directly from the length property.
- Age is a calculation derived from the installationDate property and the current date.
- Inspection Result is a computed factor derived directly from the measurement POLESTATUS.

The risk driver risk has three input factors:

- Species Type is a raw input factor derived directly from the speciestype property .
- Preservative Kind is a raw input factor derived directly from the preservativekind property.
- Feature based health is a statistical factor derived from the PMQ SPSS analysis model. The PMQ SPSS analysis model analyzes several properties and returns the analysis to IFE as the Feature based health factor. The properties that the PMQ analyzes are: speciestype, preservativekind, installationDate, reclaimedstatus, length, removalDate and isActive.

What's new

IBM Insights Foundation for Energy V1.6 is deployed on IBM PMQ 2.5.3. This new release includes simplified installation and operation, and improved customization and extension capabilities.

Revised architecture

IBM Insights Foundation for Energy now installs on four servers to support simplified installation, deployment, and operation.

User interface framework

Use the extension capabilities that are provided by the enhanced user interface framework to build application user interfaces that meet your operational needs. As an application developer, you can create customized user interface components to extend the user interface. Your administrator can register new user interface components, and configure the style, layout, widgets, access controls, and services for the pages in your application.

REST service framework

Use the extension capabilities that are provided by the enhanced Representational State Transfer (REST) service framework to create customized REST services with minimal coding. Your administrator can then register custom services, and assign access to the services to user roles in your solution.

Chapter 1. Securing the solution

Securing your IBM Insights Foundation for Energy solution is an important consideration. To ensure that the system is secure, you must manage who can access the system and assign the correct level of access within the solution.

Securing access to the solution

IBM Insights Foundation for Energy uses a WebSphere Application Server Liberty Profile basic user registry to authenticate and authorize users. For more information about Liberty profile user registries, see the related link.

Your administrator assigns access to features, data, and services in your solution based on the user role groups.

The following topics explain how to manage user access to IBM Insights Foundation for Energy.

Related information:

[WebSphere Application server 8.5.5 product documentation: Configuring a user registry for the Liberty profile](#)

User roles and access

IBM Insights Foundation for Energy implements security by limiting access to features, data, and services based on user roles.

To use a specific feature of IBM Insights Foundation for Energy, a user must be a member of a user role that provides the required access level to that feature. Users and user role groups are defined in a basic user registry that is deployed with IBM Insights Foundation for Energy. The basic user registry is defined in the WebSphere Application Server Liberty Profile `server_ife_frwk.xml` configuration file.

The following table shows the sample users and user role groups that are defined in the IBM Insights Foundation for Energy basic user registry, and the default access levels for the groups.

Table 4. User groups and sample users defined in the user registry

User role groups	Sample users	Default access levels
admins	Bob	Members of the admins role group have the following access levels: <ul style="list-style-type: none">Members can access the Administration Console view and the sample application.Members also have create, read, update, and delete access to the REST services that are provided with the solution.
users	user1, user2	Members of the users role group have the following access levels: <ul style="list-style-type: none">Members can access the sample application.Members have varying levels of access to the REST services that are provided with the solution.

After you define users for your organization, you can delete the sample users.

For more information about configuring access levels to pages and services in IBM Insights Foundation for Energy based on user role groups, see the related links.

Related tasks:

Configuring pages

If you are an administrator, you can add and configure custom pages. Each page has a style and a layout to manage the widgets on the page.

Configuring REST services

If you are an administrator, you can register and configure custom Representational State Transfer (REST) services.

Adding users and groups

To access specific features or services in the solution, a user must be a member of a user role group that provides the required level of access to that feature or service. IBM Insights Foundation for Energy uses a basic user registry to define users and user role groups. You can add users and user role groups to the solution by adding users and groups to the WebSphere Application Server Liberty Profile `server_ife_frwk.xml` configuration file on the application server.

Before you begin

Decide on the groups, users, and user passwords that you want to add to the IBM Insights Foundation for Energy basic user registry.

About this task

To add user role groups and users to IBM Insights Foundation for Energy, edit the `server_ife_frwk.xml` file on the application server.

Note: For each user entry that you add to `server_ife_frwk.xml`, you must include an encoded version of the user's password. The procedure describes how to use the Liberty profile `securityUtility` command line tool to encode the password for each new user. Add the encoded password that the utility outputs to the user entry in the XML file.

Procedure

1. Log on to the application server as a user who has edit access to the `server_ife_frwk.xml` file, for example, the root user.
2. Use the Liberty profile `securityUtility` command line tool to generate an encoded password for each new user. To encode a user password, run the following command:

```
/opt/IBM/WebSphere/Liberty/bin/securityUtility encode userPassword
```

Where *userPassword* is the password to encode.

3. As a precaution, make a backup copy of the `server_ife_frwk.xml` file that is in the `/opt/IBM/WebSphere/Liberty/user/servers/member01` directory.
4. To add groups and users, edit the `server_ife_frwk.xml` file.
5. To add a group, add a group element to the `basicRegistry` element. Then, add a member element for each user in the group. For example, to add a group that

is named `reliability_group` with a member named `reliability_engineer_1`, add the following entry to the `basicRegistry` element in the `server_ife_frwk.xml` file:

```
<group name="reliability_group">
  <member name="reliability_engineer_1"/>
</group>
```

6. For each new group member, add a user element to the `basicRegistry` element. Each user element has a name attribute and a password attribute.

Note: Copy the encoded password that you generated for the user with the `securityUtility` tool into the `server_ife_frwk.xml` as the value for the password attribute.

For example, to add a user with the user name `reliability_engineer_1`, add the following user element to the `basicRegistry` element in the `server_ife_frwk.xml` file:

```
<user name="reliability_engineer_1" password="{xor}KzosKw==" />
```

Where `{xor}KzosKw==` is the encoded password that you generated with the Liberty profile `securityUtility` tool for the `reliability_engineer_1` user.

Results

The new groups and users are added to the basic user registry, and the users can now be authenticated when they log on to IBM Insights Foundation for Energy.

What to do next

- To generate usage information for the IBM License Metric Tool, you must map each user role group to the relevant license type in the `slmtag_groups.properties` file on the application server. For more information, see “Mapping groups to license types” on page 5.
- If you are an administrator, you can now assign access to pages and REST services in the solution to each new user role. For more information about configuring access control for pages and services, see the related links.

Related tasks:

Configuring pages

If you are an administrator, you can add and configure custom pages. Each page has a style and a layout to manage the widgets on the page.

Configuring REST services

If you are an administrator, you can register and configure custom Representational State Transfer (REST) services.

Modifying or removing users and groups

You can change passwords and group membership for users in IBM Insights Foundation for Energy. Membership of a user role group gives users access to the parts of the solution that are appropriate to that user role. You can change the access level of a user by updating the basic user registry to remove the user from one group and add the user to another group. You can also update the basic user registry to remove users and groups that no longer require access to the solution. To update the basic user registry, edit the WebSphere Application Server Liberty Profile `server_ife_frwk.xml` file on the application server.

Before you begin

- While you update the basic user registry, ensure that the affected users are not logged on to IBM Insights Foundation for Energy.
- Before you remove groups from the basic registry, ensure that the groups are not assigned access to pages and services in the solution. For more information about configuring access to pages and services in IBM Insights Foundation for Energy, see the related links.

About this task

You can modify or remove users or user role groups for IBM Insights Foundation for Energy by editing the `server_ife_frwk.xml` file on the application server.

Note: To change a user password in the `server_ife_frwk.xml` file, you must first generate an encoded version of the new password. The procedure describes how to use the Liberty profile `securityUtility` command line tool to encode a new password. Add the encoded password that the utility outputs to the user entry in the XML file.

Procedure

1. Log on to the application server as a user who has edit access to the `server_ife_frwk.xml` file, for example, the root user.
2. Use the Liberty profile `securityUtility` command line tool to generate an encoded password for each user password that you want to change. To encode a user password, run the following command:

```
/opt/IBM/WebSphere/Liberty/bin/securityUtility encode userPassword
```

Where *userPassword* is the password to encode.

3. As a precaution, make a backup copy of the `server_ife_frwk.xml` file that is in the `/opt/IBM/WebSphere/Liberty/user/serves/member01` directory.
4. To modify or remove users and groups, edit the `server_ife_frwk.xml` file.
5. To add members to a group, see *Adding users and groups*.
6. To remove a member from a group, delete the member element from the group element in the `server_ife_frwk.xml` file.
7. To change the password for a user, copy the encoded password that you generated for the user with the `securityUtility` tool into the `server_ife_frwk.xml` as the value for the user's password attribute. For example, to change the password for a user with the user name `reliability_engineer_1`, edit the entry for the user in the `server_ife_frwk.xml` file as follows:

```
<user name="reliability_engineer_1" password="{xor}Lz4sLCgwLTs="/>
```

Where `{xor}Lz4sLCgwLTs=` is the new encoded password that you generated for the `reliability_engineer_1` user.

8. To remove a user from IBM Insights Foundation for Energy, delete the user element for that user, and remove any group member element for that user.

Results

The users and groups are modified or removed in the IBM Insights Foundation for Energy basic user registry.

What to do next

- If you modified or removed user role groups, update the license mapping for the affected groups in the `slmtag_groups.properties` file on the application server. For more information, see “Mapping groups to license types.”
- If you are an administrator, you can change access to pages and REST services in the solution based on the modified user role groups. For more information about configuring access control for pages and services, see the related links.

Related tasks:

Configuring pages

If you are an administrator, you can add and configure custom pages. Each page has a style and a layout to manage the widgets on the page.

Configuring REST services

If you are an administrator, you can register and configure custom Representational State Transfer (REST) services.

Mapping groups to license types

IBM Insights Foundation for Energy has standard user licenses and limited user licenses. To generate usage information for the IBM License Metric Tool, you must map each user role group to the relevant license type in the `slmtag_groups.properties` file on the application server.

Before you begin

For more information about license usage metrics in IBM Insights Foundation for Energy, see “License usage metrics” on page 80.

About this task

To map a user role group to a license type, edit the `slmtag_groups.properties` file that is packaged in the `ife_frwk_service` WAR folder. There are two properties in the file: `groups_StandardUser` is the property for the standard user license, and `groups_LimitedUser` is the property for the limited user license.

Procedure

1. Log on to the application server as a user who has edit access to the `slmtag_groups.properties` file, for example, the root user.
2. Edit the `slmtag_groups.properties` file. The default file content maps the `admins` sample group to the standard user license, and maps the `users` sample group to the limited user license:

```
groups_StandardUser=admins
groups_LimitedUser=users
```
3. To map a group to the standard user license, add the group name as a value for the `groups_StandardUser` property. Use a comma as the delimiter between group names. For example,

```
groups_StandardUser=standardUserGroup1,standardUserGroup2.
```
4. To map a group to the limited user license, add the group name as a value for the `groups_LimitedUser` property. Use a comma as the delimiter between group names. For example,

```
groups_LimitedUser=limitedUserGroup1,limitedUserGroup2.
```

Results

Usage information for the two types of licensed users in IBM Insights Foundation for Energy is generated for the IBM License Metric Tool.

Chapter 2. Use case: Define a new asset class in the Data Model application

In this tutorial, you are the administrator of a system and you have a new asset class called Meter as well as assets belonging to this asset class.

You want to integrate the new asset class called Meter into IBM Insights Foundation for Energy. Assets belonging to this asset class need to be integrated into current system. These are the steps required to integrate the new asset class Meter into IBM Insights Foundation for Energy with the Data Model application.

The custom data model application aims to help operators create and manage the asset classes and the measurement reading table.

Related concepts:

“The Insights Foundation for Energy Data Model” on page 63

The Insights Foundation for Energy data model is based on the Common Information Model (CIM) Data Model and needs to be populated with data through Data Loading.

Defining the new asset class in the Data Model application

You can add new asset classes to the IBM Insights Foundation for Energy data model application and define the properties of the asset classes.

IBM Insights Foundation for Energy integrates data from different data sources, for example EAM System, GIS System. Data from different sources are consolidated into a common asset class and properties definitions. The mapping between an external object ID and an internal object ID is also maintained by IBM Insights Foundation for Energy.

Adding an asset class

The resource type is the category of the asset. In this use case the resource type is *Meter*. When you have created the resource type you can add meter instruments to this resource type.

About this task

To define a new asset class type, you need to add the asset class to the resource type table in the data base for IBM Insights Foundation for Energy.

Procedure

1. Open IBM Insights Foundation for Energy and select **Custom data model > Asset Classes** from the drop-down menu.
2. On the Asset Classes tab, click **Add New** to open the attributes dialog box for the asset class.
 - a. Type the code. The code is a unique alpha-numeric code for the asset class. The letters a to Z and numbers 0 to 9 are supported.

3. Type the name of the new asset class. In the example Meter is the name of the asset class and is a globalization attribution. Click the edit icon and you will see the dialog. You can input one or more languages. Click the **Save** button to save the name.
4. Type the table name. The table name is in the form <schema name>.<table name>, in the example, CIM.METER.
5. Type the description for the asset class.
6. Select the asset type. Each asset type has a setting for the isAsset and isResource attributes.
 - Container,
 - isAsset = 0
 - isResource = 0
 - Logical resource
 - isAsset = 0
 - isResource = 1
 - Physical asset
 - isAsset = 1
 - isResource = 1
7. Click **Save**. The asset type and asset table are created with four default attributes for each asset type: serial number, is Active, Installation data, remove date.

Defining the property type of an asset class

You must add the property type to the new asset class in IBM Insights Foundation for Energy. The attributes of the new resource type are stored in a database table called CIM.Meter.

About this task

You can edit an asset class when you click the edit button in a row.

Procedure

1. Click the **Add New** icon in the row for the asset class that you want to add a property to.
 - a. Type the **Code**. The code is a unique alpha-numeric code for the asset type property. The letters a to Z and numbers 0 to 9 are supported.
 - b. Type the name of the property type in the **Column Name** field. The column name is the name of the property using the letters a to Z and numbers 0 to 9 without spaces. For example if the **Name** of a property is Serial Number, then the **Column Name** is SERIALNUMBER.
 - c. Type the length of the string **Column Name** in the **Column Length** field.
 - d. Type the scale of the asset in the **Column scale** field.
 - e. Type No in the **Allow null** field if you do not want the column to allow null values and you need a default value. If you do not need a default value, then type Yes.
2. Click **Save**.

Adding a measurement reading table for use with asset classes

The measurement reading table is used to store the data from measurements made on an asset class.

When you create one record, IBM Insights Foundation for Energy creates a measurement reading table in the database.

Defining the measurement type for an asset class

You can add a measurement type to an asset class.

About this task

This procedure add a measurement type to the .csv reading file located here: /opt/IBM/energy/data/reading. The columns 1 and 2 are generated with default names, **measurement** and **timestamp**, you are creating additional measurement types from the names already created in the reading .csv file.

Procedure

1. In the list of **Asset Classes** select the row for the asset class you want to edit and click the **Edit** icon.
2. Click the **Measurement** tab.
3. In the **Measurement Type** field type the measurement description. The letter a to Z and the number 0 to 9 are supported.
4. Select the target table. The target table is already defined in the data base. If not you can create a new measurement reading table.
5. Click the **Add New** icon.
6. Type the **Code**. The code is a column name in the .csv reading file. The code is a unique alpha-numeric code for the measurement type property. The letters a to Z and numbers 0 to 9 are supported.
7. Select the **Type**. The type is the column type in the .csv file.
8. Select the **Target Column**. This is the column in the database to where you want to import the .csv file.
9. Click **Save > save & back** to exit.

Defining a measurement reading for an asset class

The measurement reading defines the table name and description of the measurement. The measurement reading is used when defining the measurement type for an asset class.

Procedure

1. In IBM Insights Foundation for Energy, select **Administration > Custom Data Model**.
2. Select the **Measurement Reading** tab, and click the **Add New** icon.
3. Add the **Table Name**.
The table name must contain an existing schema name and a table name, for example **cim.testmeasurement**.
4. Add the **Description** of the measurement table.
5. Click **Save**.
6. Click the edit button to edit the newly created measurement reading table. You can add or delete table columns.

7. Click **save & back** to exit.

Prepare and load Static Data

When you have completed defining the new asset class *Meter*, you can prepare static data files, define the asset and load the data files to the database.

Defining the data for the resource

The resource data is saved in a .csv file that you need to create and add content to.

Procedure

1. Go to `/opt/IBM/energy/data/cityname/resources` on the application server, and create a file called `meter.csv`.
2. Add the following content to the file:

```
<isActive>, <mRID>,
      <resourceType>,<name>,<description>,<isContainer>,<container>,
<location>,<direction>,<mainAddress>,<phone1>,<phone2>,<secondaryAddress>,
<locationDescription>,<geometry>
```

The resource CSV file is loaded to the ObjectID, Resource and Location tables. The columns in the CSV file include:

Table 5. The columns in the .csv file

Field	Type	Description
isActive	CHAR(1)	Indicates if the asset is currently active, 1 = active, 0 = inactive.
mRID	VARCHAR(256)	Master resource id. A string based identifier of the logical resource.
resourceType	VARCHAR(128)	Code of the resource type defined in the ResourceType table.
name	VARCHAR(128)	The name of the logical resource.
description	VARCHAR(512)	The description of the logical resource.
isContainer	CHAR(1)	Indicates if the logical resources is a container (has children), 0 not container, or 1 is container.
container	VARCHAR(256)	The Master resource id of the container of the logical resource.
location	VARCHAR(256)	The master resource id of the location.
direction	VARCHAR(32)	The direction of a given asset. that shows field crews to quickly find a given asset. For example: NW shows to a field crew that a street light is located NW (northwest) of the customer's site.
mainAddress	VARCHAR(256)	Main address of the location.

Table 5. The columns in the .csv file (continued)

Field	Type	Description
phone1	VARCHAR(32)	Phone number
phone2	VARCHAR(32)	Phone number
secondaryAddress	VARCHAR(256)	Secondary address of the location. For example, a PO Box address may have different ZIP code than that in the mainAddress.
geometry	GEOMETRY	The geometry of the resource in Well-Known Text (WKT), normally this information comes from the Geographical Information System (GIS).
locationDescription	VARCHAR(256)	Description of the location.

3. Here is a sample CSV section that needs to be added to the meter.csv file:

```
isActive,mRID,resourceType,name,description,isContainer,container,location,
direction,mainAddress,phone1,phone2,secondaryAddress,
locationDescription,geometry
1,Meter_1813699,Meter,Meter_1813699,Meter_1813699,0,Substation_NIXON,
Loc_Meter_1813699,,Southern Yellow Pine,, ,CCA,
POINT (-83.4973760 42.5683241)
```

Defining the terminal data

The terminal data is saved in a .csv file that you need to create and add content to.

Procedure

1. Go to /opt/IBM/energy/data/cityname/terminals on the application server, and create a file named meter.csv.

2. Add the following content to the file:

```
<isActive>,<mRID>,<name>,<description>,<sequenceNumber>,
<connected>,<phases>,<resource>,<connectivityNode>
```

The resource CSV file is loaded to the ObjectID, Resource and Location tables. The columns in the CSV file include:

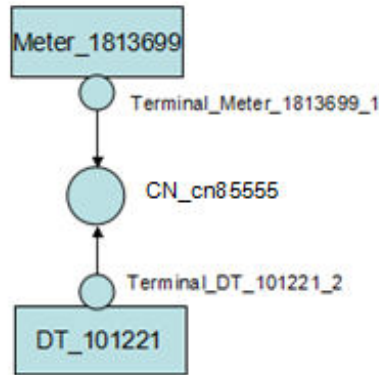
Table 6. The columns in the .csv file

Field	Type	Description
isActive	CHAR(1)	Delete tag, indicates if current terminal is active.
mRID	VARCHAR(256)	Master resource id. A string based identifier of the terminal.
name	VARCHAR(128)	The name of the terminal.
description	VARCHAR(512)	Description of terminal.
sequenceNumber	INTEGER	The sequence number of terminal. If a resource has multiple terminals, the sequence number is used to order the terminals in sequence.

Table 6. The columns in the .csv file (continued)

Field	Type	Description
connected	CHAR(1)	Indicates if the terminal is connected.
phases	VARCHAR(32)	The phases of the terminal.
resource	VARCHAR(256)	The mRID of the resource that the terminal is connected to.
connectivityNode	VARCHAR(256)	The mRID of the connectivity node that the terminal is connected to.

The meter asset is connected to distribution transformer through terminals and connectivity nodes. If the meter Meter_1813699 is connected to the distribution transformer DT_101221, the terminal of Meter_1813699 is Terminal_Meter_1813699_1 and the terminal of DT_101221 is Terminal_DT_101221_2. The two terminals are both connected to connectivity node CN_cn85555. Below is a diagram for the connection information:



- Here is a sample csv that needs to be added to the meter.csv file.

```

isActive,mRID,name,description,sequenceNumber,connected,phases,
resource,connectivityNode
"1","Terminal_Meter_1813699_1","Terminal 1","Terminal 1","1","1",,
"Meter_1813699","CN_cn85555"
"1","Terminal_DT_101221_2","Terminal 2",
"Terminal 2","2","1",,"DT_101221","CN_cn85555"
  
```

Defining the connectivity node data

The connectivity node data is saved in a .csv file that you need to create and add content to.

Procedure

- Go to /opt/IBM/energy/data/cityname/connectivityNodes on the application server, and create file called meter.csv.
- Add the following content to the file:

```
<isActive>,<mRID>,<name>,<description>,<container>
```

The connectivity node CSV file is loaded to the ObjectID, Resource and Location tables. The columns in the CSV file include:

Table 7. The columns in the .csv file

Field	Type	Description
isActive	CHAR(1)	Indicates if the asset is currently active, 1 = active, 0 = inactive.
mRID	VARCHAR(256)	Master resource id. A string based identifier of the connectivity node.
name	VARCHAR(128)	The name of the connectivity node.
description	VARCHAR(512)	The description of the connectivity node.
container	VARCHAR(256)	The Master resource id of the container of the connectivity node.

As the meter asset is connected to distribution transformer here is a sample csv section that needs to be added to meter.csv. In the terminal data file, it defines Meter_1813699 is connected to distribution transformer DT_101221, through 2 terminals and 1 connectivity node, so here below example defines the detail of the connectivity node.

```
isActive,mRID,name,description,container
"1","CN_cn85555","cn85555","cn5555","Substation_NIXON"
```

Defining the measurement data

The measurement data is saved in a .csv file that you need to create and add content to.

Procedure

1. Go to /opt/IBM/energy/data/cityname/measurements on the application server, and create a file named meter.csv.
2. Add the following content to the file:


```
<mRID>,<isActive>,<name>,<measurementType>,<phaseCode>,<unitMultiplier>,<unitSymbol>,<resource>,<terminal>
```

The measurement CSV file is loaded to the ObjectID and Measurement table. The columns in the CSV file include:

Table 8. Columns in the measurement table

Field	Type	Description
isActive	CHAR(1)	Delete Tag. Indicates if current measurement is active.
mRID	VARCHAR(256)	Master resource ID. a string based identifier of the measurement.
name	VARCHAR(128)	The name of the measurement.
measurementType	VARCHAR(128)	The type of measurement.
phaseCode	VARCHAR(32)	The phase code of the measurement.

Table 8. Columns in the measurement table (continued)

Field	Type	Description
unitMultiplier	VARCHAR(32)	Multiplier of unit. For example: k indicates one thousand, if the symbol is V, then the fully qualified unit is kV.
unitSymbol	VARCHAR(32)	The symbol of the unit. For example: V indicates voltage.
resource	VARCHAR(256)	The mRid of the logical resource that the measurement is measuring.
terminal	VARCHAR(256)	The mRid of the terminal that the measurement is measuring.

As the data of meter measurement indicates the power payload, the sample csv section needs to be added to meter.csv file.

```
mRID,isActive,name,measurementType,phaseCode,unitMultiplier,
unitSymbol,resource,terminal
"M_MT_148610_Payload","1","PayLoad","PayLoad",,"none","none","Meter_1813699",
```

Defining the asset data

The asset data is saved in a .csv file that you need to create and add content to.

Procedure

1. Go to /opt/IBM/energy/data/cityname/assets on the application server, and create file called meter.csv.
2. Add the following content to the file:

```
<mRID>,<serialNumber>,<isActive>,<installationDate>,<removalDate>,
<manufacturer>,<randomError>
```

Table 9. The columns in the .csv file

Field	Type	Description
mRID	VARCHAR(256)	Master resource id. A string based identifier of the physical asset.
serialNumber	VARCHAR(128)	The serial number of the physical asset.
isActive	CHAR(1)	Indicates if the assets is currently active, 1 = active, 0 = inactive.
installationDate	VARCHAR(512)	Date when the asset was installed.
removalDate	VARCHAR(256)	The date when the asset is to be removed.
manufacturer		Manufacturer of the meter.
randomError		Random error number of the meter.

Here is the sample csv section that needs to be added to meter.csv file.

```
mRID,serialNumber,isActive,installationDate,removalDate,manufacture,randomError
Meter_1813699,1813699,1,1973-01-01,,ABC,4
```

Configuring the data loader

The data loader needs to be configured and the config.properties file created.

About this task

Create the contents for the config.properties file.

Procedure

1. Go to /opt/IBM/energy/data/cityname/ and create a file called config.properties.
2. Add this content to the file for the resources/meter.cs to the adapters.1.file section. For example:

```
#namespace of the data
namespace=http://cityName#
#number of rows of single insert/update
batch=1000
#number of threadsconcurrency=10
#service url
serviceBaseUrl=https://<app_server_host_name>:<port_number>
serviceUser=<user in EnergyAdmin group>
servicePassword=<password>

#adapter and load sequence
#logical resources
adapters.1.name=com.ibm.ife.framework.adapter.Resource
adapters.1.file=resources/substation.csv,resources/meter.csv

adapters.2.name=com.ibm.ife.framework.adapter.ConnectivityNode
adapters.2.file=connectivityNodes/meter.csv

adapters.3.name=com.ibm.ife.framework.adapter.Terminal
adapters.3.file=terminals/meter.csv

adapters.4.name=com.ibm.ife.framework.adapter.Measurement
adapters.4.file=measurements/meter.csv

#physical assets
Adapters.5.name=com.ibm.ife.framework.adapter.Asset
Adapters.5.file=assets/meter.csv
Adapters.5.type=Meter
```

Where:

- The resource node /resources/meter.csv is in the adapters.1.file section.
 - The connectivity node connectivityNodes/meter.csv is in the adapters.2.file section.
 - The terminal terminals/meter.csv is in the adapters.3.name section.
 - The measurement measurements/meter.csv is in the adapters.4.file section.
 - The physical asset assets/meter.csv is in the adapters.5.file section.
3. Make sure that the service base URL is HTTPS.
 4. Save the file config.properties.

Loading the static data

About this task

Procedure

1. Find the data loader tool in the application server: `/opt/IBM/energy/data/runDataLoader.sh`.
2. Run the data loader tool to validate the `.csv` files with the following command:

```
[root@ioc16-app data]# pwd
/opt/IBM/energy/data
root@ioc16-app data]# ./runDataLoader.sh
validate <Path to data folder>
```

3. If the `.csv` files pass validation, run the data loader with the following command:

```
[root@ioc16-app data]# pwd
/opt/IBM/energy/data
root@ioc16-app data]# ./runDataLoader.sh <Path to data folder>
```

Prepare and load the dynamic data

Prepare the data files and tables for the dynamic data, load the dynamic data and define the asset style.

Defining the reading data file

About this task

This example applies the same use case, the asset *meter* that has payload reading data. The reading data files needs to be defined.

Procedure

1. Create and create file called `meterPayload.csv` on the application server, and save it to a temporary location.
2. Add the following content to the file:

```
<mrid>,<timestamp>,<serialNumber>, <payload>
```

3. Here is a sample CSV section that needs to be added to the `meter.cs` file:

```
mRID,timestamp,serialNumber,payload
M_MT_148610_Payload,2015-01-01 00:00:00.000,148610,20000
```

4. Copy the `meterPayload.csv` file to this location `/opt/IBM/energy/apps/simulator/incoming` on the application server.

Configuring the data loader for the reading table

The data loader needs to be configured for the reading table and the `config.properties` file created.

Procedure

1. Go to `/opt/IBM/energy/data/reading/` and create the `config.properties` file, or open the file if it already exists.
2. Edit the `config.properties` file. For example:

```
#namespace of the datanamespace=http://cityName#
#number of rows of single insert/update
batch=1000
#number of threads
```

```

concurrency=10
#service url
serviceBaseUrl=https://<app_server_host_name>:<port_number>
serviceUser=<user in EnergyAdmin group>service
Password=<password>

#adapter and load sequence
#logical resources
adapters.1.name=com.ibm.ife.framework.adapter.Reading
adapters.1.file=meterPayload.csv.del
adapters.1.resourceTypeCode=Meter
adapters.1.measurementType=Payload

```

3. Make sure that the service base URL is HTTPS.
4. Save the file config.properties.

Running the data loader

When you run the data loader it monitors csv files in the incoming folder. Valid measurements csv files are processed and put into the processed folder.

Procedure

1. Find the data loader tool in the application server: /opt/IBM/energy/data/runDataLoader.sh.
2. Run the data loader tool to validate csv files with the following command:

```

[root@ioc16-app data]# pwd
/opt/IBM/energy/data
root@ioc16-app data]# ./runDataLoader.sh
validate <Path to data folder>

```

3. If validation passed, run the data loader tool with the following command:

```

[root@ioc16-app data]# pwd
/opt/IBM/energy/data
root@ioc16-app data]# ./runDataLoader.sh <Path to data folder>

```

Defining the asset style

You can define icon of the the asset and how it will show on the map in IBM Insights Foundation for Energy.

About this task

The steps here are to illustrate the asset *Meter*.

Procedure

1. Go to the database, and open the AHA.ASSETSTYLE table.
2. Edit the table for the asset *Meter*.
 - ASSETTYPE 21, the resource type ID is 21.
 - GEOTYPE 0, the meter shops as a point on the map. If 1, then it shows as a line.
 - SHAPE, you decide what kind of icon you want to represent the asset on the map. You can also add your own icons here: /opt/IBM/WebSphere/Liberty/usr/servers/member01/apps/ife_aha_mig_app.ear/ife_aha_web.war/icon
 - MINSIZE and MAXSIZE defines the size of the icon.
 - DEVIDESCALE, keep empty

AHA.ASSETSTYLE					
ASSETTYPE [INTEGER]	GEOTYPE [SMALLINT]	SHAPE [VARCHAR(250)]	MINSIZE [DOUBLE]	MAXSIZE [DOUBLE]	DEVIDESCALE [DOUBLE]
7	0	ICN-AC-Node_Poles-...	5.0	15.0	6771.000255460459
8	0	ICN-AC-Node_Substa...	15.0	15.0	
9	0	ICN-AC-Node_DisTra...	5.0	15.0	6771.000255460459
10	1	ICN-AC_Cables-STD....	2.0	2.0	6771.000255460459
11	1	ICN-AC_Cables-STD....	2.0	2.0	6771.000255460459
12	1		2.0	2.0	6771.000255460459
13	0	ICN-AC-Node_Fuse-S...	5.0	15.0	6771.000255460459
14	0	ICN-AC-Node_Switch...	15.0	15.0	
15	0	ICN-AC-Node_Reclos...	5.0	15.0	6771.000255460459
16	1	ICN-AC-Node_BusBar...	2.0	2.0	6771.000255460459
21	0	ICN-AC-Node_Poles-...	15.0	15.0	

Figure 1. Define asset type style

Chapter 3. Viewing and analyzing energy data

Use IBM Insights Foundation for Energy to analyze the health and risks to the network grid.

IBM Insights Foundation for Energy is a web-based solution that uses portal technology. You can access the solution with any supported web browser.

Assets can be viewed on a geospatial map or as a list. The displayed assets can be filtered using criteria specified by the user.

Detailed reports can be displayed for individual assets, or groups of assets.

The User Interface

The application user interface is composed of four parts:

- Filter bar - to filter assets for different criteria, e.g. status, asset class, geography.
- Task bar - to show or hide the filter bar, legend panel, or switch between the content to map, list or report view.
- Content area - to visualize differing approaches of assets, including map, list, and report views.
- Legend panel - to show the different asset classes and the score ranges the representative colors.

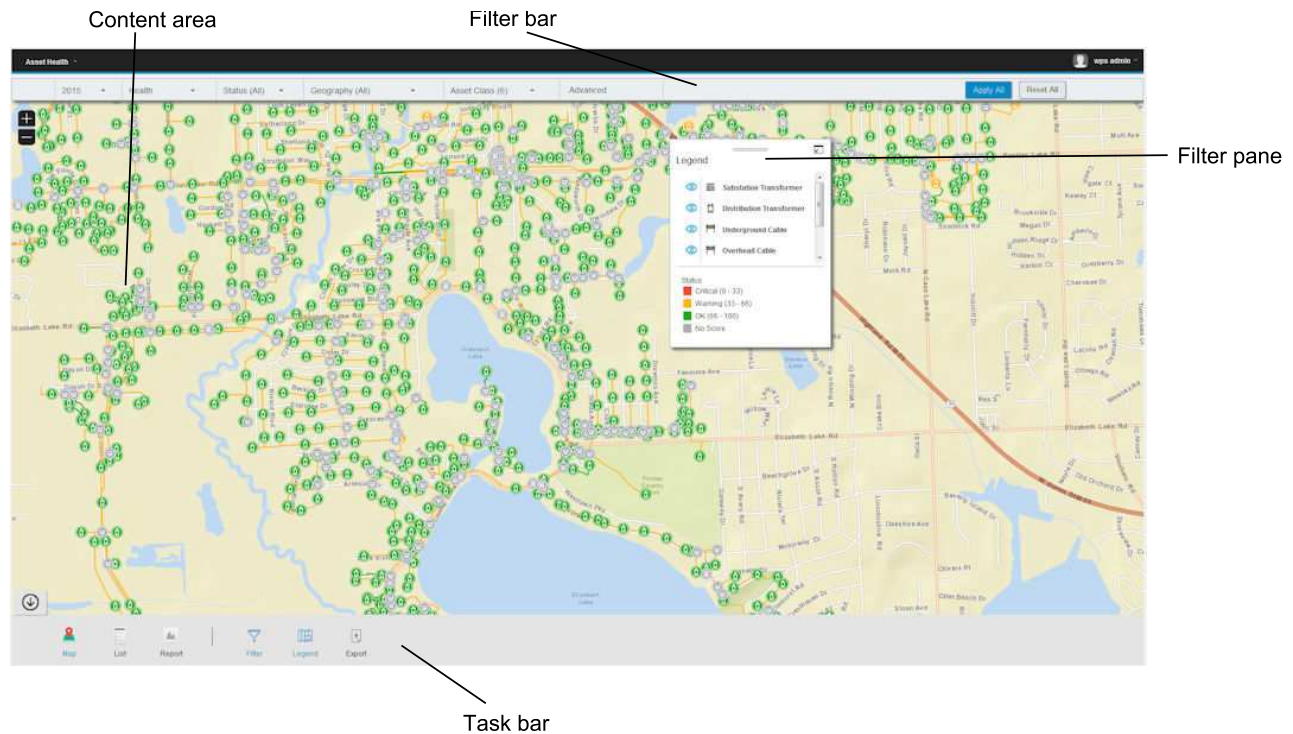


Figure 2. User interface

Logging on to the Asset Health application

Log on to access the IBM Insights Foundation for Energy user interface.

Before you begin

Contact your local administrator to obtain your user ID and password. Your administrator is responsible for ensuring that you have the security access level that is appropriate to your role in your organization. Your administrator will also supply you with the web address URL for accessing the solution portal.

About this task

Use the following procedure to start a new browser session and access IBM Insights Foundation for Energy.

Procedure

1. Enter the URL into the address field of the browser.

Note: The fully qualified domain name is required in the URL, for example, `https://web_hostname/wps/myportal` where `web_hostname` is the host name of the web server. If you use the IP address instead of the registered fully qualified domain name, some windows do not open correctly. Also, if you do not use the `https` protocol, the link is redirected to use the `https` protocol.

2. On the login page, enter your user ID and password.
3. Click **Log In**.
4. Click the down arrow at the top left hand corner, and click **Energy > Asset Health**.

Results

Only the pages, features, and data that you have permission to access are displayed. Contact your administrator if you require more access.

Task bar

The task bar contains the controls for how the various panels and filter options show in user interface.

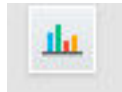
You can select how various panels, maps and reports show and also you can select the filter options that are available.



Map - used to select the map view.



List - used to show the data as a list.



Report

Report - used to show the summary and treatment asset reports.



Filter

Filter - used to show the filter bar for the filter options.



Legend

Legend - used to show or hide the legend panel on the content area.



Export

Export - used to export the list view as CSV or XLSX file, or a report as PDF or XLSX file.

Related tasks:

“Exporting data” on page 32

After filtering the data to the desired subset, information on the selected assets can be exported for use in other systems.

Filter bar

The filter bar contains the controls to filter assets for different criteria, e.g. status, asset class, geography.

You can select the filter control options that are available. The predefined filters are:

- Time - The period of time for the assets that you want to view.
- Score type - There are four types: Health, Risk, Failure and Consequences. where **Health** is the asset health as a percentage, **Failure** is probability of failure, **Consequence** is the consequence of failure.
- Status - Filters for the status for the score type you selected. There are four states, Critical, Warning, OK, No score
- Geography - Filters the area map that you require.
- Asset class - Shows the asset class that you want to view for the geographical area.
- Advanced - You can add your many filters and decide if they should be an **And** relationship or **Or** relationship by choosing **All criteria** or **Any criteria**.

Related tasks:

“Filtering assets” on page 23

The assets displayed on the map or list can be filtered based on selected criteria.

Viewing assets on a map

Assets and their connections within the energy network can be seen on a geographic map. Depending on the zoom level, either individual assets and their health, or an aggregation of assets and the health of the combined assets are displayed.

Procedure

1. Sign on IBM Insights Foundation for Energy as a user.
2. If the task bar is not displayed, display it by clicking the arrow in the circle on the bottom of the page.
3. In the task bar at the bottom of the page click **Map**. The map is displayed.
4. Zoom in or out of the map to see your desired view. IBM Insights Foundation for Energy displays assets and their selected filtered score as individual icons. If there are too many assets to be displayed individual icons, icons are grouped into predefined regions and the overall score for the region is displayed. Optionally you can click on a region and click **Zoom-In** in the preview card to display the assets of the region.
5. For further information on the asset or area, click the asset or area. A preview card with additional information and options is displayed.
6. If too many assets are displayed, change the filter values and click **Apply**. The assets meeting the filter criteria will be displayed in the map.

Viewing the legend

A legend showing the icons used for the various assets and the colors indicating their status can be displayed.

About this task

Procedure

1. If the task bar is not displayed, display it by clicking the arrow in the circle on the bottom of the page.
2. In the task bar click **Legend**. The legend is displayed.
3. To control which assets are displayed, select and deselect the icon to the left of the asset label in the legend.
4. To dismiss the legend, click **Legend** in the task bar again.

Related tasks:

“Filtering assets” on page 23

The assets displayed on the map or list can be filtered based on selected criteria.

Viewing assets as a list

Assets and their network health and risk values can be displayed as a list.

Procedure

1. Sign on IBM Insights Foundation for Energy as a user.
2. If the task bar is not displayed, display it by clicking the arrow in the circle on the bottom of the page.
3. In the task bar click **List**. The list is displayed.

4. IBM Insights Foundation for Energy displays assets and their health status as individual table rows. The table can be sorted by clicking on the desired table header. The list will be redisplayed sorted by that field.
5. For further information on the asset, click the asset. A preview card with additional information and options is displayed.
6. If too many assets are displayed, change the filter values and click **Apply**. The assets meeting the filter criteria will be displayed in the list.

Filtering assets

The assets displayed on the map or list can be filtered based on selected criteria.

About this task

IBM Insights Foundation for Energy has the following predefined filter options:

- Analysis Year
- Geography
- Score Type, where **Health** is the asset health, **Failure** is probability of failure, **Consequence** is the consequence of failure.
- Status
- Asset Class

Additional filter criteria can be specified using the **Advanced** option.

To reduce the number of displayed assets to those meeting the desired criteria, do the following.

Procedure

1. If the filter bar is not displayed at the top of the page, click the **Filter** option in the task bar on the bottom of the page. If the task bar is not displayed, display it by clicking the arrow in the circle on the bottom of the page.
2. Click the desired filter option and select the desired value.
3. Click **Apply**.

Results

The map or list view will display the assets meeting the selected filter criteria.

What to do next

To clear all filter values, click **Reset All**.

Related concepts:

“Filter bar” on page 21

The filter bar contains the controls to filter assets for different criteria, e.g. status, asset class, geography.

Related tasks:

“Viewing the legend” on page 22

A legend showing the icons used for the various assets and the colors indicating their status can be displayed.

Searching for an asset

You can reduce the number of displayed assets to those meeting the desired criteria.

Procedure

1. If the filter bar is not displayed at the top of the page, click the **Filter** option from the task bar on the bottom of the page.
2. If the task bar is not displayed, click the arrow in the circle on the bottom of the page.
3. In the search bar, input a string value that is part of the asset name you want to find.

Results

Related assets are listed on the search bar as search result, click on the asset to display it on the map.

Adding additional filter criteria

In addition to the provided filters, you can specify your own criteria to filter the data displayed in the map and list

Procedure

1. If the filter bar is not displayed at the top of the page, click the **Filter** option in the task bar. If the task bar is not displayed, display it by clicking the arrow in the circle on the bottom of the page.
2. Click **Advanced**. This option can only be selected when one or more asset classes is selected in the **Asset Class** filter.
3. Click **Add Filter**.
4. From the drop-down fields select the desired criteria.
5. Repeat the steps if multiple criteria are desired. If multiple criteria are desired, indicate if all conditions must be true (**All criteria**) for an asset to be selected or if only one of the conditions must be true (**Any criteria**).

Results

The map or list view will display the assets meeting the selected filter criteria.

What to do next

When additional filter criteria have been specified, the **Advanced** option in the filter bar indicates the number of additional filters that have been defined in parenthesis. To clear the advanced filter criteria, click **Advanced** in the filter bar and then click **Clear All**. To clear all filter values, click **Reset All** in the filter bar.

Preview cards

When a user clicks on an asset or region, a preview card is displayed with additional information on that asset or region.

If a region containing multiple assets is selected, the preview card will display the average scores for the region, the total number of assets by class within the region, and available actions.

If a single asset is selected, the preview card will display the scores for that asset as well as available actions.

Using the Connectivity Model

The Connectivity Model gives feedback to managers, data analysts and grid operators as to the accuracy of the phase and connectivity details of the network.

The Connectivity Model application ensures:

- The model is always current: The user is sure that the connectivity model represents the latest analytic results.
- The connectivity and reliability of information is quickly ascertained: The user can fully understand the state of assets in the network within 5 minutes or less.
- The network details are simplified: The user can focus on the assets and connections that are important to them.
- The analysis details can be reported and shared: The users can collect the necessary charts or maps, and download and share them with the key stakeholders.

Logging onto the Connectivity Model application

Log on to access the IBM Insights Foundation for Energy user interface for the Connectivity Model application.

Before you begin

Contact your local administrator to obtain your user ID and password. Your administrator is responsible for ensuring that you have the security access level that is appropriate to your role in your organization. Your administrator will also supply you with the web address URL for accessing the solution portal.

About this task

Use the following procedure to start a new browser session and access IBM Insights Foundation for Energy.

Procedure

1. Enter the URL into the address field of the browser.

Note: The fully qualified domain name is required in the URL, for example, `https://web_hostname/wps/myportal` where `web_hostname` is the host name of the web server. If you use the IP address instead of the registered fully qualified domain name, some windows do not open correctly. Also, if you do not use the `https` protocol, the link is redirected to use the `https` protocol.

2. On the login page, enter your user ID and password.
3. Click **Log In**.
4. Click the down arrow at the top left hand corner, and click **Energy > Connectivity Model**.

Results

Only the pages, features, and data that you have permission to access are displayed. Contact your administrator if you require more access.

Viewing the legend of the connectivity model application

The legend shows the icons used for the assets in the connectivity model and the colors indicating their status.

About this task

Via the legend you can filter the assets that show on the map for the connectivity model. The assets that show in the legend are:

- Electric Station
- Transformer
- Meter
- Laterals
- Meter Linkage

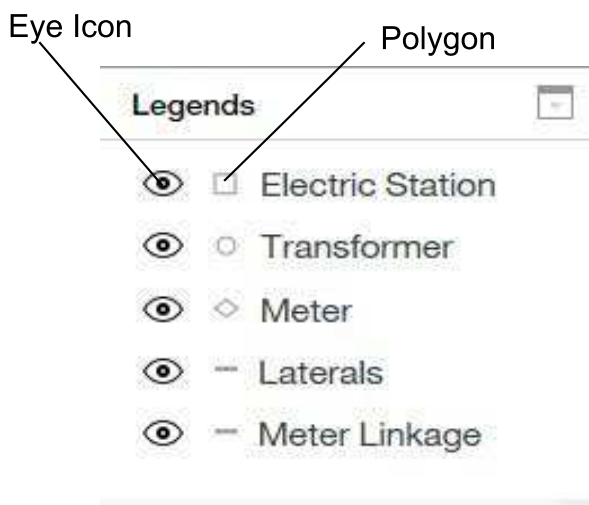


Figure 3. Legend for Connectivity Model

The eye icon hides or displays the asset type on the map.

The polygon represents the asset type on the map.

Procedure

1. Select **Connectivity Model** from the menu bar.
2. Click **Select Utility** from the drop down menu and select the utility you need. The list of associated substations show.
3. Click the substation that you need to view with the associated meters. The substation shows at the top level of the substation menu bar.
4. Click the up arrow in substation menu bar to open the legend.

Viewing the information of a substation with all its connections

You can view a substation with all the connected transformers, meters, and

About this task

After you have selected utility, you can see all the substations in the selected utility. The substation information contains two parts.

- The name of the substation.
- The total number of asset phase and connection errors if errors are present.

You can also see the substations of the selected utility on the map.

Procedure

1. In Insights Foundation for Energy, click **Select a Utility**.
2. Click the utility you want to view.
3. To search for a certain sub-station, in the search field type a letter contained in the name of the sub-station.
4. Click on the name of the sub-station you want to view.
5. Zoom in on the map to see the clusters of transformers connected to the sub station, and again to see the clusters of meters connected to the transformers.

Viewing all meter mismatches of a transformer

You can view the miss-matched information in general and in greater detail.

About this task

The hover function returns the general detail of miss-matches: the number of meters that have miss matched information, the name of the sub-station as the feeder for the transformer and the supply phase for the meters.

Title of the transformer
Number of miss-matches
Name of the sub-station




Supply phase for the meters

Figure 4. The detail of the transformer with the hover function

The preview panel for the transformer gives more detail information: the title, logical map, transformer information, search bar and meter detail information. The logical map shows the connectivity between the feeder, transformer, and meter.

Transformer name ——— DT_182419 ⊗

Logical map ——— 

Transformer information ———

Summary				
Existing Phase	Computed Phase (Voltage)	Computed Phase(Load)	Total Meters	Error Meters
A	?	A	6	3

Search bar ———

Meter details ———

Meter	Phase	Computed Phase(Load)	Computed Phase (Voltage)	Computed Transformer	Mismatches
Meter_1000375	A	C			1
Meter_1000376	A	C			1
Meter_1000377	A	A			0
Meter_1000378	A	A			0
Meter_1000379	A	C			1
Meter_1000380	A	A			0

Figure 5. Details of the preview panel

Procedure

1. In Insights Foundation for Energy, click **Select a Utility**.
2. Click the utility you want to view.
3. To search for a certain sub-station, in the search field type a letter contained in the name of the sub-station.
4. Click on the name of the sub-station you want to view.
5. Zoom in on the map to see the clusters of transformers connected to the sub station, and again to see the clusters of meters connected to the transformers.
6. Hover over a transformer on the map to see the general details of a transformer.
7. Click on the transformer to see the preview panel for the transformer.
8. To view a sub-station with all the transformers.
 - a. Click the sub-station on the logical map to see all the transformers that are fed by the sub-station.

- b. To view a certain transformer, type part of the name for the transformer in the search bar.
 - c. Click the transformer name in the results field.
 9. To view the details of all the meters fed by a transformer.
 - a. Click the **Meters** on the logical map.
 - b. Click the meter you want to view.

Exporting the asset information of a utility


You can export the meter or transformer detail information to a local system as a csv file.

About this task

The export option

Procedure



1. Click the Export icon  .
2. Select the asset type and substation.
3. Click **Export**. You can either view or save the exported data.

Viewing asset reports

You can view detailed reports on a single asset or on a group of assets.

Single asset reports

A report with details about a single asset can be displayed.

Procedure

1. On the map or list, click the desired asset. The preview card for the asset will be displayed.
2. Click **View Asset Report**.

Results

The report for the selected asset is displayed.

What to do next

Report data can also be exported.

Multiple asset reports

A summarized report about multiple assets selected by filter criteria can be displayed.

Procedure

1. On the map or list, use the filter criteria to specify the assets to be included in the report.

- In the task bar at the bottom of the page click **Report** . If the task bar is not displayed, display it by clicking the arrow in the circle on the bottom of the page.

Results

An aggregate report for the assets is displayed.

What to do next

The report can be further refined by changing the **Time**, **Geography**, and **Asset Class** filters. Report data can also be exported.

Report data

IBM Insights Foundation for Energy reports provide background information on single and multiple assets.

The tables describe the type of data included in each report.

Table 10. Data provided in IBM Insights Foundation for Energy single asset reports

Report Tab	Data	Description
Summary	Score	Current Health, Risk, Consequence of Failure score and change since last year.
Summary	Asset Map	Asset location in the map.
Summary	Asset Information	Selected year, asset id and other basic information.
Summary	Score over time	Health, risk, consequence of failure score over time.
Summary	Score breakdown	Calculation detail of health, risk, consequence of failure scores
Health Degradation	Asset Information	Selected year, asset id and other basic information.
Health Degradation	Health score over time	Health score over time.
Health Degradation	Health score breakdown over time	Calculation detail of scores(factor/driver/asset scores) over time.
Historical Data	Asset Information	Selected year, asset id and other basic information.
Historical Data	Advanced Analytics	Link to PMQ report.
Historical Data	Dissolved Gas Analysis	DGA report specific to substation transformer.
Asset Details	Asset Information	Selected year, asset id and other basic information.
Asset Details	Asset properties	All of property values of selected asset.
Treatment	Asset Information	Selected year, asset id and other basic information.
Treatment	Treatment Option	Treatment options over time.

Table 10. Data provided in IBM Insights Foundation for Energy single asset reports (continued)

Report Tab	Data	Description
Treatment	Minimal and Maximum Budgets by Year	The minimum and maximum annual treatment cost for the asset.

Table 11. Data provided in IBM Insights Foundation for Energy multiple asset reports

Report Tab	Data	Description
Summary	Aggregate Score	Current Health, Risk, Consequence of Failure score and change since last year.
Summary	Region Map	Assets region located in the map.
Summary	Asset Information	Selected filter.
Summary	Asset Breakdown	Number of selected assets for each asset class.
Summary	Aggregate Score over time	Aggregate health, risk, consequence of failure score over time.
Summary	Score by asset class	Aggregate health and risk score by asset class.
Summary	Score breakdown	Factor scores by asset class for health, risk, consequence of failure.
Treatment	Asset Information	Selected filter.
Treatment	Asset Breakdown	Number of selected assets for each asset class.
Treatment	Miminal and Maximum budgets by year	Aggregate minimum and maximum annual treatment cost for all included assets
Treatment	Treatment options	Treatment options for each asset over time

Viewing analytics dashboards

When viewing a report, additional analytic data is available from IBM Predictive Maintenance and Quality.

Procedure

When viewing a report, click **Advanced Analytics**.

Results

When viewing a single asset report, the Equipment Dashboard for that single asset is displayed. When viewing a multiple asset report, the site overview dashboard is displayed.

Exporting data

After filtering the data to the desired subset, information on the selected assets can be exported for use in other systems.

Procedure

1. Sign on IBM Insights Foundation for Energy as a user.
2. Using the map or list, filter the assets as desired.
3. If you want to export a report summarizing all the displayed assets displayed on a map, click **Report**. If you want to export a report with data about a single asset, click the asset on the map or list. On the displayed preview card, click **View Asset Report**. The list of assets displayed in the list view can also be exported.
4. Click **Export** to export the data into one of the following formats when viewing a list.
 - CSV
 - XLSX

When viewing a report, the report can be exported into one of the following formats.

- PDF
- XLSX

All the tabs in the report will be exported into a .zip file.

Related concepts:

“Task bar” on page 20

The task bar contains the controls for how the various panels and filter options show in user interface.

Creating input for a rate use case

Using IBM Insights Foundation for Energy, regional planning engineers determine where investment is required to maintain or improve reliability.

About this task

\$33.5 billion is spent annually maintaining distribution grids across the United States. North America has an estimated \$4 trillion backlog in electrical infrastructure. Customer minutes without power have increased 15% since 2002 while in the last decade the cost to maintain distribution equipment has gone up 42%.

The delivery of consistent and reliable energy is an important business. By having a better understanding of asset risks, preventative maintenance, and planning, the energy business can be better and more efficient.

Regional planning engineers need to easily manage and optimize regional budgets. They want to be able to generate budget plans quickly and efficiently without having to analyze masses of data. They want the information they need in an accessible, single location so their utilities can provide reliable, affordable energy for their customers.

Procedure

1. The regional planning engineer signs on IBM Insights Foundation for Energy as a user.

2. He clicks **Map**. The map is displayed.
3. He zooms in to determine an area he is interested in analyzing.
4. Clicking an area of interest, a preview card is displayed giving information on the health and risks of the assets in the area.
5. Wanting to look at the assets in the area, the regional planning engineer clicks **Zoom-in** to see more details on the area assets. The map is redisplayed with the individual assets displayed.
6. The regional planning engineer wants to look at high risk assets so he changes his **Score type** filter to **Risk score** and the **Score Range** to the high risk range and clicks **Apply**. The map is redisplayed with the assets at the highest risk.
7. Wanting to see the high risk assets as a list, he clicks **List**. The high risk assets are displayed as a list.
8. The regional planning engineer now wants to export the list so he can provide the information to the maintenance plan. To do so he clicks **Export** and selects the format for the data export, for example, CSV.

Chapter 4. Customizing the solution

You can customize the solution to suit your business requirements.

Use the Administration Console view to register custom user interface components and to customize the user interface to suit your particular operation.

Configure the global settings of the Asset Health model

The data scientist needs to define the configuration items to be able to configure the Asset Health Model. Some configuration items are global and shared by more asset classes, and some are more specific to certain asset classes.

The global configuration items are:

- **Business Driver:** the motivations behind the analysis. For example, the driver for treating a transformer could be maintain the condition or reduce risk. You can create as many drivers as needed for your analysis. The global level drivers can be referred to in Package when configuring an asset class specific analysis model.
- **Factor:** the analysis unit that the Asset Health Model is based on. The global factors can be referred to in a package when configuring asset class specific analysis model. You can extend the analysis health model by registering customized factors into the data base. There are 3 kinds of factor supported in the product, including raw factor, computed factor and statistical factor. This document will introduce how to register a new factor in Define New Factors section.
- **Treatment:** the improvement approach that is available for assets. For example, to improve a health condition of a transformer, there can be two approaches available. 1, Replace the transformer with a new one. 2, Repair the existing one. The global level treatment can be referred to in a package when configuring the asset class specific analysis model.
- **Asset default age:** the age of every asset is calculated from the installation date. Where the asset installation date is missing, the default age is used instead. The default age is the average maximum expected life of the asset based on the asset class.

Configuration file format

IBM Insights Foundation for Energy provides a default asset health configuration model. The default configuration can be found on the application server, `/opt/IBM/energy/metaData.CSV` in CSV format.

A configuration command line tool is used to load the CSV format configuration into database. The mapping relationship between the .csv file and the meta data is as follows:

- CSV file: AHA.ANALYSIS.csv
 - Meta data:
 - asset default age,
 - health failure factor,
 - asset class
 - package mapping
 - csv Format:

- <asset class id>
 - <package id>
 - <health failure factor>
 - <status>
 - <start_date>
 - <complete_date>
 - <default_age>
 - Table name in the database: AHA.ANALYSIS
- CSV file: AHA.ANALYSIS_YEAR.csv
 - Meta data
 - analysis start year
 - analysis duration
 - analysis interval
 - csv Format
 - <interval>
 - <duration>
 - <start year>
 - Table name in the database: AHA.ANALYSIS_YEAR
- csv File: AHA.DRIVER.csv
 - Meta data
 - driver
 - csv Format
 - <driver id>
 - <driver_name>
 - <driver_description>
 - Table name in the database: AHA.DRIVER
- csv File: AHA.FACTOR.csv
 - Meta data
 - factor
 - csv Format
 - <factor id>
 - <name>
 - <description>
 - <asset class code>
 - <factor type>
 - <property code>
 - <factor data type>
 - <implementation>
 - Table name in the database:: AHA.FACTOR
- csv File: AHA.PACKAGE.csv
 - Meta data
 - package
 - csv Format
 - <package id>
 - <name>
 - <description>
 - <is template>
 - <asset class>
 - Table name in the database: AHA.PACKAGE
- csv File: AHA.PACKAGE_DEGRADATION.csv
 - Meta data
 - degradation
 - csv Format

- <id>
 - <package id>
 - <factor id>
 - <age>
 - <description>
 - <cumulative degradation>
 - Table name in the database: AHA.PACKAGE_DEGRADATION
- csv File: AHA.PACKAGE_DRIVER.csv
 - Meta data
 - asset driver
 - csv Format:
 - <id>
 - <package id>
 - <driver id>
 - <driver weight>
 - Table name in the database: AHA.PACKAGE_DRIVER
- cvs File: AHA.PACKAGE_FACTOR.csv
 - Meta data
 - asset factor
 - csv Format:
 - <id>
 - <package id>
 - <driver id>
 - <factor id>
 - <factor weight>
 - <default value>
 - Table name in the database: AHA.PACKAGE_FACTOR
- csv File: AHA.PACKAGE_INDEX.csv
 - Meta data:
 - asset factor index
 - csv Format:
 - <id>
 - <package id>
 - <driver id>
 - <factor id>
 - <index sequence id>
 - <index type>
 - <from range>
 - <to range>
 - <string value>
 - <int value>
 - <index value>
 - Table name in the database: AHA.PACKAGE_INDEX
- csv File: AHA.PACKAGE_TREATMENT.csv

Table 12. The mapping between the csv file and the meta data

csv File:	Meta data:	csv Format:	Table name in the database:
	asset treatment	<id>, <package id>, <treatment id>, <unit>, <unit cost>, <service life extension>, <service level improvement> <description>	AHA.PACKAGE_TREATMENT
AHA.PACKAGE_TREATMENT_EXCLUDE.csv	AHA.PackageExclude rule	<id>, <package id>, <treatment id>, <driver id>, <factor id>, <sequence id>, <index type>, <from range>, <to range>, <string value>, <int value>, <filter name>, <filter description>	AHA.PACKAGE_TREATMENT_EXCLUDE
AHA.PACKAGE_TREATMENT_INCLUDE.csv	AHA.PackageInclude rule	<id>, <package id>, <treatment id>, <driver id>, <from range>, <to range>, <exclusion factor based >, <exclusion description > <exclusion location based >	AHA.PACKAGE_TREATMENT_INCLUDE

Table 12. The mapping between the csv file and the meta data (continued)

csv File:	Meta data:	csv Format:	Table name in the database:
AHA.TREATMENT.csv	treatment	<treatment id>, <treatment name>, <treatment description > <replace vs rehab >	AHA.TREATMENT

AHA.ANALYSIS.csv

asset class id

Column 1

Asset Class ID number

Asset Class Id, number

Column 2

Package ID number, the reference ID from AHA.PACKAGE table

health failure factor

Column 3

The factor needed to calculate the asset failure probability, a value between 0 and 1.

status

Column 4

The status of the analysis. The states are: open, started , completed or fail.

start_date

Column 5

The start date of the latest analysis run. A timestamp value that can be empty.

complete_date

Column 6

The completion date of the latest analysis run. A timestamp value that can be empty.

default_age

Column 7

The default age of an asset if the actual installation date is not known. Number.

AHA.ANALYSIS_YEAR.csv

interval

Column 1

Time interval of the analysis in years. Number. For example: A value of 3 means every 3 years there is an analysis.

duration

Column 2

The period of the analysis in years. Number. A value of 10 means the analysis will last for 10 years.

start year

Column 3

The year for the start of the analysis. Number.

AHA.DRIVER.csv**driver id**

Column 1

Driver ID, automatically generated number for the driver.

driver_name

Column 2

The name of the driver.

driver_description

Column 3

The description of the driver.

AHA.FACTOR.csv**factor id**

Column 1

Factor ID, automatically generated number for the factor.

name

Column 2

The name of the factor.

description

Column 3

The description of the factor.

asset class code

Column 4

The code in the CIM.RESOURCETYPE database table for the target asset class that the factor is registered against.

factor type

Column 5

The factor type can be Raw, Computed, or Statistical.

property code

Column 6

The property code in the CIM.PROPERTYTYPE database table that is used for the factor value.

factor data type

Column 7

The data type of the factor. NUM denotes a numeric data type. STR denotes a string data type.

implementation

Column 8

The command line needed to get the factor value. This is only needed for Computed and Statistical factors.

AHA.PACKAGE.csv

package id

Column 1

The package ID automatically generated number for the package.

name

Column 2

The name of the package.

description

Column 3

The description of the package.

template

Column 4

Determines if the current package is a template. The value is either 0 or 1.

asset class

Column 5

The asset class ID of the asset class that is associated to this package in the CIM.resourcetype table.

AHA.PACKAGE_DEGRADATION.csv

id Column 1

Degradation ID, automatically generated number.

package id

Column 2

Package ID, the reference ID from the AHA.PACKAGE table.

factor id

Column 3

Factor ID, the reference ID from AHA.Factor table.

age

Column 4

The age factor, number.

description

Column 5

The degradation description.

cumulative degradation

Column 6

The cumulative degradation value based on the asset factor age. Double.

AHA.PACKAGE_DRIVER.csv

id Column 1

Package driver id, automatically generated number for the AHA.package_driver table.

package id

Column 2

Package ID, the reference id from the AHA.PACKAGE table.

driver id

Column 3

Driver ID, the reference id from AHA.Driver table.

driver weight

Column 4

The weight value applied to the driver. Number. A value of 40 means the weight is 40%.

AHA.PACKAGE_FACTOR.csv

id Column 1

Package factor id, automatically generated number for the AHA.package_factor table

package id

Column 2

Package ID, the reference id from the AHA.PACKAGE table.

driver id

Column 3

Driver ID, the reference id from AHA.Driver table.

factor id

Column 4

Factor ID, the reference ID from AHA.Factor table.

factor weight

Column 5

The weight value applied to the factor. Number. A value of 40 means the weight is 40%.

default value

Column 6

The default factor value if the current factor does not have a value.

AHA.PACKAGE_INDEX.csv

id Column 1

The package index ID, automatically generated number for the AHA.package_factor table.

package id

Column 2

Package ID, the reference id from the AHA.PACKAGE table.

driver id

Column 3

Driver ID, the reference id from the AHA.Driver table.

factor id

Column 4

Factor ID, the reference ID from AHA.Factor table.

index sequence id

Column 5

The sequence number of the indexing.

index type

Column 6

The index type is either Range, String, Int. The actual value depends on the business requirements.

from range

Column 7

The included start value of a range. Required if the index type is Range.

to range

Column 8

The end value of a range. The end value is not included in the range. Required if the index type is Range.

string value

Column 9

Required if the index type is String.

int value

Column 10

Required if the index type is Int.

index value

Column 11

The mapping value for factor normalization from a factor value to a factor score. Values from 0% to 100%.

AHA.PACKAGE_TREATMENT.csv**id** Column 1

The package treatment ID, automatically generated number for the AHA.package_treatment table.

package id

Column 2

Package ID, the reference id from the AHA.PACKAGE table.

treatment id

Column 3

Treatment id, the reference id from the AHA.TREATMENT table.

unit

Column 4

The unit for each treatment.

unit cost

Column 5

The unit cost of treatment, number.

service life extension

Column 6

The number of years of service that can be added to the life of the asset due to the treatment. Number. A value of 40 means the service life extension is 40 years.

service level improvement

Column 7

The improvement to the level of service of the asset due to the treatment. Number. A value of 40% means that the service level improvement is 40%.

description

Column 8

The description of the treatment.

AHA.PACKAGE_TREATMENT_EXCLUDE.csv

id Column 1

The package treatment exclude ID, automatically generated number for the AHA.package_treatment_exclude table.

package id

Column 2

Package ID, the reference id from the AHA.PACKAGE table.

treatment id

Column 3

Treatment id, the reference id from the AHA.TREATMENT table.

driver id

Column 4

Driver ID, the reference id from the AHA.Driver table.

factor id

Column 5

Factor ID, the reference ID from AHA.Factor table.

sequence id

Column 6

The sequence number of the exclude roles.

index type

Column 7

The index type is either Range, String, Int. The actual value depends on the business requirements.

from range

Column 8

The included start value of a range. Required if the index type is Range.

to range

Column 9

The end value of a range. The end value is not included in the range. Required if the index type is Range.

string value

Column 10

Required if the index type is String.

int value

Column 11

Required if the index type is Int.

filter name

Column 12

The filter name of the exclude rule.

filter description

Column 12

The filter description of the exclude rule.

AHA.PACKAGE_TREATMENT_INCLUDE.csv**id** Column 1

The package treatment include ID, automatically generated number for the AHA.package_treatment_include table.

package id

Column 2

The package reference id from the AHA.PACKAGE table.

treatment id

Column 3

The treatment reference id from the AHA.TREATMENT table.

driver id

Column 4

The driver reference id from the AHA.Driver table.

from range

Column 5

The included start value of a range.

to range

Column 6

The excluded end value of a range.

exclusion factor based

Column 7

Null

exclusion description

Column 8

Null

exclusion location based

Column 9

Null

AHA.TREATMENT.csv**treatment id**

Column 1

The treatment ID, automatically generated number for the AHA.package_treatment table.

treatment name

Column 2

The name of the treatment.

treatment description

Column 3

The description of the treatment.

replace vs rehab

Column 4

Either replacement or retention and repair of the current asset. The value is either Replace or Rehab.

Loading the default configuration

To load the default configuration files to IBM Insights Foundation for Energy.

Before you begin

Before running the meta data loader, please first stop all sessions connecting to the database in case the loader can not get an immediate table lock.

To stop sessions connecting to database,

- if you are on the application server, log in as the db user, for example db2inst1 and run the command: db2 attach to <db2 node name> user <db2 instance user > using < db2 instance password> and then run the command db2 force application all.
- if you are on the database server, please log as db user, for example db2inst2 and directly run the command db2 force application all.

Procedure

1. Go to the meta data loader on the application server, and run the command `/opt/IBM/energy/metaDataCSV/load_client.sh -y <db2 instance user > < db2 instance password>`.
2. You can now open the Web User Interface to view the report.

Note:

As the FORCE APPLICATION command forces all applications off the system to allow the loader to be run, ignore the HTTP 500 error and wait for 2-3 minutes for the portal to rebuild its connection to database again.

Update the default configuration

This section gives examples of popular configurations.

You can update the configuration CSV files in `/opt/IBM/energy/metaDataCSV/` on application server.

You can then run the reload configuration to database using the command `load_client.sh`.

Update asset class and package mapping

You need to update existing entry of the AHA.ANALYSIS.csv file with the following format:

```
<asset class id>, <package id>, <healthfailure factor>, <status>, <start_date>, <complete_date>, <
```

The example entry adds a mapping between asset class with id 7 and package 1:

```
7,1,0.05,"Open",,,40
```

Configure the SPSS Asset Health model

As the asset health models are implemented as SPSS streams, the model configuration can be customized by editing the SPSS streams.

The user can open the streams with SPSS modeler and edit the SPSS streams.

These are hints to be aware of when doing customization:

Do not change the integration interface between streams without verifying the data source in the stream.

The integration interface includes the CIM data model and the flat file export node in the stream. If the CIM data model is changed, you must verify again the data source node in the stream.

The flat file export node gives .csv files as an output that can be used by other streams when doing streams integration. If the CSV file format changes, it can cause errors in other streams.

Make sure Python scripts in the stream are consistent with the GUI models.

Python scripts control the stream execution. If you change any node, flow, or variable to assigned to the SPSS modeler client, make sure the corresponding change is also made in Python. The nodes with customized annotation are referred to in Python.

You can customize the model configuration by editing the default formulas and values, or by assigning, changing, or deleting nodes. There are comments added in the streams to inform about the places can be customized. The user can refer to these comments when doing customization. For example: In the Pole_Health.str, the "Index" node, "Weight" node and "Individual Failure Score" nodes can be changed if user wants to change the asset health model configuration.

The asset specific configuration items are:

Asset Driver

A business driver for a specific asset class. You can define as many drivers as you need for your analysis, and give each driver a weighting to indicate the importance of the driver to the analysis. Asset drivers and their weightings are used to calculate an aggregated asset driver score.

Asset Factor

Is the analysis unit for the asset driver. A single asset factor can be selected for multiple asset drivers. The total of all weightings for all asset factors for an asset driver should be 100%. Asset factors and their weights are used to calculate an aggregated asset factor score.

Asset Factor Index

Normalizes and quantifies the asset factors. The index is an indication of the health score an asset should be assigned between 0 and 100. For example, if age as a asset factor and the age range of 10-20 years has a poor health index, then you should assign a lower score of 25% for the asset factor index value.

Note: Do not assign 100% as an asset factor index because 100% indicates that the asset in the best health and no risk score can be calculated for it.

Asset Treatment

the basic treatment information for a specific asset. Asset treatment references the global treatment, but adds specific information for a particular asset, including information about how the treatment improves the asset, and cost of treatment.

Treatment rule

Defines when a type of treatment should be applied to an asset based on asset current driver score. For example, if an asset has a asset driver condition score in the range of 50-100% (good health), then you can add the treatment inspect pole. If the condition score is less than 50% (poor health), then you can add the treatment replace pole.

Treatment information

Includes cost of treatment, service life extension and service level improvement.

Chapter 5. Running an Asset Health analysis

This section shows you how you can do an asset health scoring analysis and network risk analysis.

Prerequisites for an analysis

The data loading for asset health must be complete.

A file called year.txt must be available with a list of analysis years. The location of the file must be: /opt/IBM/energy/AssetHealth/SPSS_stream/score_input/year.txt. A every line on the file is an analysis year, do not have empty lines. An example contents of the file:

```
2016
2017
2018
```

The SPSS parameter template file must be complete. The location for the file is: /opt/IBM/energy/AssetHealth/SPSS_stream/script/ah_params_template.txt. An example contents of the file contains all the parameters required to pass into the SPSS modeler batch during analysis:

```
-server
-hostname _hostname_
-username _username_
-stream _modelPath_/stream/Pole/Pole_TTarget_Failure_Threshold.str-stream _modelPath_/stream/Pole/Pole_Health.str
-stream _modelPath_/stream/SubstationTransformer/ST_DGA_Category.str
-stream _modelPath_/stream/SubstationTransformer/ST_Health.str
-stream _modelPath_/stream/DistributionTransformer/DT_Health.str
-stream _modelPath_/stream/OverheadCable/OHC_Health.str
-stream _modelPath_/stream/UndergroundCable/UGC_Health.str
-stream _modelPath_/stream/Save_Score_to_DB.str
-stream _modelPath_/stream/Pole/Pole_Treatment.str
-stream _modelPath_/stream/SubstationTransformer/ST_Treatment.str
-stream _modelPath_/stream/DistributionTransformer/DT_Treatment.str-stream _modelPath_/stream/OverheadCable/OHC_Treatment.str
-stream _modelPath_/stream/UndergroundCable/UGC_Treatment.str
-stream _modelPath_/stream/Save_Prescription_to_DB.str
-PpoleTTargetModelTrainingOrPrediction=_poleTTargetModelTrainingOrPrediction_-PTTargetModelFile=_modelPath_/score_input/Pole_TTarget_Failure_Threshold.csv
-PstDGACatgOutputFile=_modelPath_/score_input/ST_DGA_Category.csv
-PanalysisYearFile=_modelPath_/score_input/years.txt
-PpoleTTargetOutputFile=_modelPath_/score_input/Pole_TTarget_Failure_Threshold.csv
-PinputFolder=_modelPath_/score_input-PcsvFolder=_modelPath_/score_input
-PlogFolder=_modelPath_/log-execute-appendlog
-log _modelPath_/log/AHBacth.log
```

Important:

The parameters starting with “-stream” define the streams and the sequences to be executed. Some of those streams are placed into folders named with the asset class code. For example, the stream Pole_Health.str is located in the folder named Pole and is an asset class related stream. Other streams are common streams and are not located in an asset related folder. For example the stream Save_Score_to_DB.str. Make sure that for the asset class related streams you remove the streams if you have no related asset class data loaded.

You can add and delete lines to the template, but the template file must not contain empty lines or comments.

If you add a new stream into the executable, it should be also added into this template.

Running the analysis

You can use the command line to start an analysis.

About this task

By default the command line first invokes the SPSS modeler batch to execute SPSS streams and then do the asset health score analysis.

When complete, it then invokes grid engine to do the network risk analysis.

Procedure

Type in the command line to start a network risk analysis:

```
/opt/IBM/energy/grid_engine/ife_aoms_core/scripts/run_cfp.sh  
/opt/IBM/energy/grid_engine/ife_aoms_core/scripts/run_cfp.sh -n
```

The second line requests to ignore asset health scoring and to execute network risk analysis only.

Tracking the progress of an analysis

You can track the progress of the analysis process.

About this task

There are 4 directories containing the output of the analysis.

Procedure

1. To check the log files, go to `/opt/IBM/energy/AssetHealth/SPSS_stream/log/`.
AHBatch.log is the common log. You can find the status of every SPSS stream in this log.
The validation logs are: `pole_assetHealth.log`, `st_assetHealth.log`, `dt_assetHealth.log`, `ohc_assetHealth.log` and `ugc_assetHealth.log`. All asset health model configuration related error messages are found in these validation logs, for example, the sum of driver weights are not 100.
2. To check the prediction output, go to `/opt/IBM/energy/AssetHealth/SPSS_stream/score_input/` and open the .csv files to see if they are correct.
3. To check the health score output, go to `/opt/IBM/energy/AssetHealth/SPSS_stream/score/` and open the .csv files to see if the score is generated correctly.
4. To check the grid engine log, go to `/opt/IBM/energy/grid_engine/ife_aoms_core/log/`.

Chapter 6. Maintaining the solution

Perform maintenance tasks to keep your solution running smoothly.

Restarting the IBM Insights Foundation for Energy components

After you install a custom application, or if you modify files in the system, for the changes to take effect, you might need to restart the IBM Insights Foundation for Energy components. Use the platform control tool to stop and start the components that are running on the servers.

Understanding the platform control tool components

The individual platform control tool components are organized into logical groupings called base components. It is recommended that you run a single `IFControl` command to stop or start all the components on a server. However, if necessary, you can stop or start the platform control tool components either at the base component level or at the individual component level. It is important that you stop and start the components in the correct order.

The following table lists the base components and their individual components on the three servers:

Table 13. Base components and their individual components on each server

Servers	Base components	Individual components	Started products or services
Database server	db	db2	DB2 Enterprise Server Edition
		jena	Apache Jena
Application server	app	appiib	IBM Integration Bus
		appliberty	WebSphere Application Server Liberty Profile
		appihs	IBM HTTP Server
Analytics server	ana	anacognos	IBM Cognos Business Intelligence
		anaihs	IBM HTTP Server for Cognos
		askliberty	WebSphere Application Server Liberty Profile for the Analytics Solution Kit (ASK)
		anacndsserv	WebSphere Application Server Network Deployment for SPSS Collaboration and Deployment Services
		anaspss	IBM SPSS Modeler

Stopping the components

Use the platform control tool to stop the components on the IBM Insights Foundation for Energy servers.

About this task

It is recommended that you run the IFEControl command with the -a option to stop all the components. However, in some cases, it might be necessary to stop only a selection of base components or individual components.

Note: If it is necessary to stop only a selection of base components or individual components, you must stop the components in the correct order.

Procedure

1. Log on to the analytics server as the `ibmadmin` user.

Stopping all the components

2. To stop all the IBM Insights Foundation for Energy components, enter the following command, where *password* is the topology password that was created during the installation process:

```
IFEControl -a stop -c all -p password
```

Stopping base components or individual components

3. To stop a base component or an individual component, enter the following command:

```
IFEControl -a stop -c component -p password
```

In the previous command, *component* is the name of the base component or the individual component, and *password* is the topology password that was created during the installation process.

Note: You must stop base components or individual components in the correct order that is outlined in Table 1. For example, if you want to stop only the app base component and the anacndsserv component, you must stop the anacndsserv component before you stop the app component.

Table 14. The order in which to stop base components or individual components

Order in which to stop base components	Order in which to stop individual components
1. ana	1. anaspss
	2. anacndsserv
	3. askliberty
	4. anaihs
	5. anacognos
2. app	6. appihs
	7. appliberty
	8. appmb
3. db	9. jena
	10. db2

Starting the components

Use the platform control tool to start the components on the IBM Insights Foundation for Energy servers.

About this task

It is recommended that you run the `IFEControl` command with the `-a` option to start all the components. However, in some cases, it might be necessary to start only a selection of base components or individual components.

Note: If it is necessary to start only a selection of base components or individual components, you must start the components in the correct order.

Procedure

1. Log on to the analytics server as the `ibmadmin` user.

Starting all the components

2. To start all the IBM Insights Foundation for Energy components, enter the following command, where *password* is the topology password that was created during the installation process:

```
IFEControl -a start -c all -p password
```

Starting base components or individual components

3. To start a base component or an individual component, enter the following command:

```
IFEControl -a start -c component -p password
```

In the previous command, *component* is the name of the base component or the individual component, and *password* is the topology password that was created during the installation process.

Note: You must start base components or individual components in the correct order that is outlined in Table 1. For example, if you want to start only the `anaspss` and the `anacognos` components, you must start the `anacognos` component before you start the `anaspss` component.

Table 15. The order in which to start base components or individual component

Order in which to start base components	Order in which to start individual components
1. db	1. db2
	2. jena
2. app	3. appmb
	4. appliberty
	5. appihs
3. ana	6. anacognos
	7. anaihs
	8. askliberty
	9. anacndsserv
	10. anaspss

Appendix A. Troubleshooting and support

To isolate and resolve problems with your IBM software, you can use the troubleshooting and support information, which contains instructions for using the problem-determination resources that are provided with your IBM products.

Techniques for troubleshooting problems

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.

The first step in the troubleshooting process is to describe the problem completely. Problem descriptions help you and the IBM technical-support representative know where to start to find the cause of the problem. This step includes asking yourself basic questions:

- What are the symptoms of the problem?
- Where does the problem occur?
- When does the problem occur?
- Under which conditions does the problem occur?
- Can the problem be reproduced?

The answers to these questions typically lead to a good description of the problem, which can then lead you to a problem resolution.

What are the symptoms of the problem?

When starting to describe a problem, the most obvious question is *What is the problem?* This question might seem straightforward; however, you can break it down into several more-focused questions that create a more descriptive picture of the problem. These questions can include:

- Who, or what, is reporting the problem?
- What are the error codes and messages?
- How does the system fail? For example, is it a loop, hang, crash, performance degradation, or incorrect result?

Where does the problem occur?

Determining where the problem originates is not always easy, but it is one of the most important steps in resolving a problem. Many layers of technology can exist between the reporting and failing components. Networks, disks, and drivers are only a few of the components to consider when you are investigating problems.

The following questions help you to focus on where the problem occurs to isolate the problem layer:

- Is the problem specific to one platform or operating system, or is it common across multiple platforms or operating systems?
- Is the current environment and configuration supported?

If one layer reports the problem, the problem does not necessarily originate in that layer. Part of identifying where a problem originates is understanding the environment in which it exists. Take some time to completely describe the problem environment, including the operating system and version, all corresponding software and versions, and hardware information. Confirm that you are running within an environment that is a supported configuration; many problems can be traced back to incompatible levels of software that are not intended to run together or have not been fully tested together.

When does the problem occur?

Develop a detailed timeline of events leading up to a failure, especially for those cases that are one-time occurrences. You can most easily develop a timeline by working backward: Start at the time an error was reported (as precisely as possible, even down to the millisecond), and work backward through the available logs and information. Typically, you need to look only as far as the first suspicious event that you find in a diagnostic log.

To develop a detailed timeline of events, answer these questions:

- Does the problem happen only at a certain time of day or night?
- How often does the problem happen?
- What sequence of events leads up to the time that the problem is reported?
- Does the problem happen after an environment change, such as upgrading or installing software or hardware?

Responding to these types of questions can give you a frame of reference in which to investigate the problem.

Under which conditions does the problem occur?

Knowing which systems and applications are running at the time that a problem occurs is an important part of troubleshooting. These questions about your environment can help you to identify the root cause of the problem:

- Does the problem always occur when the same task is being performed?
- Does a certain sequence of events need to occur for the problem to surface?
- Do any other applications fail at the same time?

Answering these types of questions can help you explain the environment in which the problem occurs and correlate any dependencies. Remember that just because multiple problems might have occurred around the same time, the problems are not necessarily related.

Can the problem be reproduced?

From a troubleshooting standpoint, the ideal problem is one that can be reproduced. Typically, when a problem can be reproduced you have a larger set of tools or procedures at your disposal to help you investigate. Consequently, problems that you can reproduce are often easier to debug and solve. However, problems that you can reproduce can have a disadvantage: If the problem is of significant business impact, you do not want it to recur. If possible, re-create the problem in a test or development environment, which typically offers you more flexibility and control during your investigation.

- Can the problem be re-created on a test system?
- Are multiple users or applications encountering the same type of problem?

- Can the problem be re-created by running a single command, a set of commands, or a particular application?

Known problems and solutions for IBM Insights Foundation for Energy

Some common problems with IBM Insights Foundation for Energy are documented, along with their solutions or workarounds. If you have a problem with IBM Insights Foundation for Energy, review the problem-solution topics to determine if a solution is available to the problem that you are experiencing.

Browser back button does not return to the perceived previous page

When you click the browser back button, the browser might return to a page other than where you think it should.

Symptoms

Clicking the browser back button results in a page other than what is expected being displayed.

Resolving the problem

Use product navigation to navigate through the product. The browser forward and back buttons might not navigate to the desired product pages.

Updated service passwords for the data loader are not automatically encrypted

If you update the service password in the data loader configuration file, the updated password is not automatically encrypted. You must run the encryption utility to store an encrypted version of the password in the configuration file.

Symptoms

If you change the service password in the data loader configuration file, the password is stored in plain text. Automatic encryption is not available for passwords that are stored in the data loader configuration file.

Resolving the problem

To update the service password for the data loader, you must run the encryption utility to store an encrypted version of the password in the data loader configuration file. Enter a new value in plain text for the `servicePassword` property in the `/opt/IBM/energy/data/cityname/config.properties` file. Then, run the `encrypt.sh` utility to encrypt the updated service password.

1. Log on to the application server as a user who has edit access to the `config.properties` file, for example, the root user.
2. Edit the `/opt/IBM/energy/data/cityname/config.properties` file, and enter a new value in plain text for the `servicePassword` property.
3. To encrypt the new service password in the data loader configuration file, go to the `/opt/IBM/energy/lib` directory and enter the following command:

```
./encrypt.sh /opt/IBM/energy/data/cityname/config.properties servicePassword encryptType
```

Where *encryptType* is the type of encryption to use. Advanced Encryption Standard (AES) and Base64 are the supported encryption types, so the value for *encryptType* is either aes or base64.

For example, to encrypt the service password using AES, enter the following command:

```
./encrypt.sh /opt/IBM/energy/data/cityname/config.properties servicePassword aes
```

Note: AES is the recommended encryption to use to encrypt the service password.

Dissolved Gas Analysis graphic cannot be exported in the .xlsx file

A Dissolved Gas Analysis graphic in the single asset report for Substation Transformer cannot be exported in the .xlsx file.

Symptoms

When you want to export the single asset report for **Substation Transformer** into .xlsx file, the Dissolved Gas Analysis graphic does not show in the exported .xlsx file.

Resolving the problem

Export the single asset report for **Substation Transformer** into a .pdf file.

Drilled-down bar chart does not clear

When you drill-down on a bar chart, it does not clear when you select another asset on a map or list.

Symptoms

When you are on the DNO sample application page and select an asset on a map or list, then select a measurement in the **Asset Details** list and drill down the bar chart, when you select another asset on map or list the drilled-down bar chart does not clear or refresh for the new measurement.

Resolving the problem

Drill up the bar chart to the top level. The normal bar chart can be refreshed correctly.

A bar chart does not clear when user selects another asset

Bar chart does not clear after user selects another asset on a map or list.

Symptoms

When you are on the DNO sample application page, and select an asset on map or list, and then a measurement in the Asset Details list, a bar chart will show for this measurement. If you then select another asset on map or list, the bar chart will not be cleared.

Resolving the problem

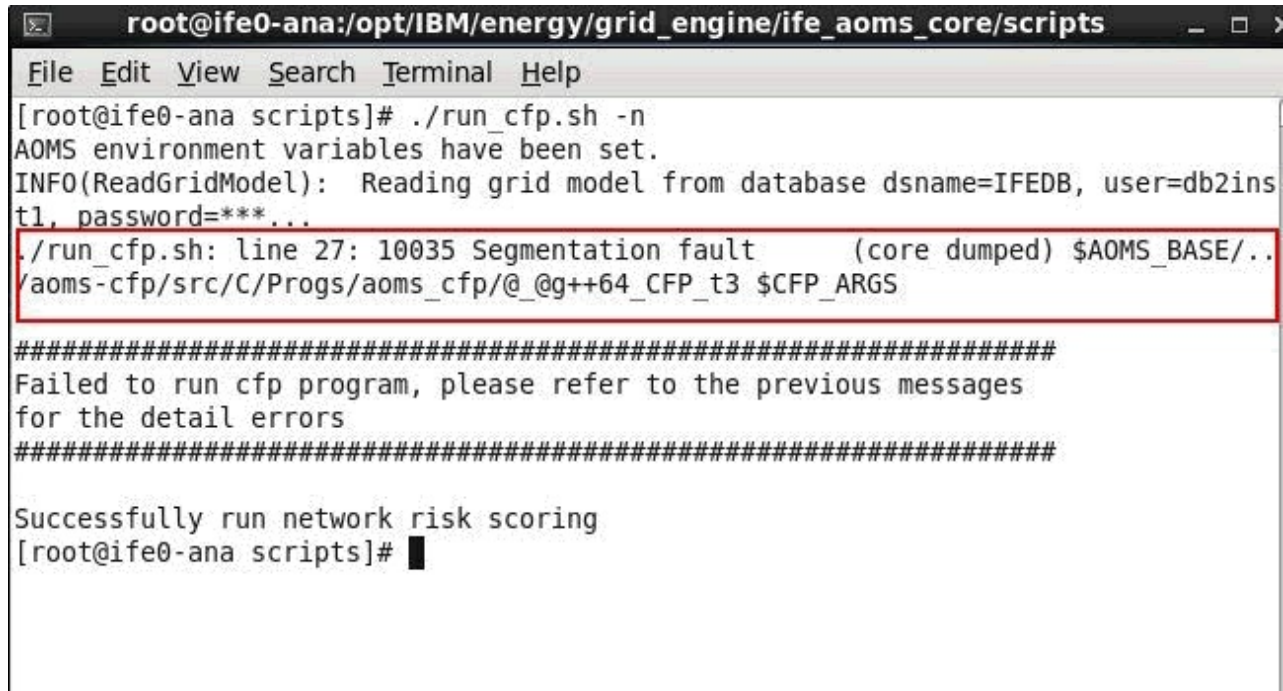
Select a measurement under the new selected asset, the bar chart will be updated.

An analysis on the ANA node causes a segmentation fault

A segmentation fault occurs when both the Asset Health and Wind 360 are installed, and both sample data are loaded too.

Symptoms

When an analysis is run on the analytics node (ANA node) and the Asset Health and Wind 360 applications are loaded at the same time, a segmentation fault occurs as Wind 360 sample data causes a conflict with the Asset Health application data.

A terminal window screenshot showing a segmentation fault. The terminal title is 'root@ife0-ana:/opt/IBM/energy/grid_engine/ife_aoms_core/scripts'. The user runs './run_cfp.sh -n'. The output shows 'AOMS environment variables have been set.' and 'INFO(ReadGridModel): Reading grid model from database dsname=IFEDB, user=db2inst1, password=***...'. A red box highlights the error message: './run_cfp.sh: line 27: 10035 Segmentation fault (core dumped) \$AOMS_BASE/./aoms-cfp/src/C/Progs/aoms_cfp/@_@g++64_CFP_t3 \$CFP_ARGS'. Below the error, it says 'Failed to run cfp program, please refer to the previous messages for the detail errors' and 'Successfully run network risk scoring'. The prompt returns to '[root@ife0-ana scripts]#'.

```
root@ife0-ana:/opt/IBM/energy/grid_engine/ife_aoms_core/scripts
File Edit View Search Terminal Help
[root@ife0-ana scripts]# ./run_cfp.sh -n
AOMS environment variables have been set.
INFO(ReadGridModel): Reading grid model from database dsname=IFEDB, user=db2inst1, password=***...
./run_cfp.sh: line 27: 10035 Segmentation fault (core dumped) $AOMS_BASE/./aoms-cfp/src/C/Progs/aoms_cfp/@_@g++64_CFP_t3 $CFP_ARGS
#####
Failed to run cfp program, please refer to the previous messages
for the detail errors
#####
Successfully run network risk scoring
[root@ife0-ana scripts]#
```

Figure 6. Segmentation fault

Resolving the problem

1. Run these commands on the DB node to update the container of the WPP resource type asset before you run the analysis on ANA node again.

```
su - <db2 instance user> for example: su - db2inst1
```

```
db2 connect to IFEDB
```

```
db2 "update CIM.RESOURCE set container=(select oid from CIM.RESOURCE where mrid='cityName') where resourcetype=(SELECT ID FROM CIM.RESOURCETYPE WHERE CODE='WPP') "
```

2. Run the analysis again on the ANA node.

3. Run these commands on the DB node to update the container of the WPP resource type asset.

```
su - <db2 instance user> for example: su - db2inst1
```

db2 connect to IFEDB

```
db2 "update CIM.RESOURCE set container=null where resourcetype=(SELECT ID
FROM CIM.RESOURCETYPE WHERE CODE='WPP') "
```

IBM Insights Foundation for Energy messages

Each message topic helps you to identify the cause of a particular error condition and recommends actions to take to resolve the error.

To help you understand the errors that you might encounter, each message topic is divided into three sections: the message that is displayed in the product or its logs, an explanation, and an action.

The message

Contains two identifiers, which are the error identification and associated text. The error identification is the message ID. It is a unique number that identifies a message. A final character of E indicates that the message resulted from an error, W indicates a warning message, and I indicates an information message.

The explanation

Contains an additional explanation of the message.

The user response

Suggests the corrective action for resolving the error.

Note: The topics in this section are specific to IBM Insights Foundation for Energy. For all other messages, see the appropriate product documentation.

CIYIF0001E Service Error - An internal error occurred.

Explanation: An error occurred in services provided by the product.

User response: Contact IBM Support to resolve the issue.

User response: See the WebSphere Application Server Liberty Profile log files for more information about why the database operation failed. The log files are named `console.log` and `messages.log`, and they are in the `/opt/IBM/WebSphere/Liberty/usr/servers/member01/logs` directory on the application server.

CIYIF0002E System Error - An internal error occurred.

Explanation: An internal error occurred with the product.

User response: Contact your administrator to resolve the issue. The administrator needs to check or possibly restart the system.

CIYIF0013E The extension cannot be deleted because it is used by one or more layouts.

Explanation: The extension cannot be deleted because one or more layouts are configured to use this extension.

User response: To delete the extension, you must first remove the extension from any layout configuration.

CIYIF0011E The style cannot be deleted because it is used by one or more pages.

Explanation: The style cannot be deleted because one or more pages are configured to use this style.

User response: To delete the style, you must first remove the style from any page configuration.

CIYIF0014E The extension cannot be deleted because it is used by one or more widgets.

Explanation: The extension cannot be deleted because one or more widgets are configured to use this extension.

User response: To delete the extension, you must first remove the extension from any widget configuration.

CIYIF0012E The database operation failed.

Explanation: The database operation failed.

CIYIF0015E The layout cannot be deleted because it is used by one or more pages.

Explanation: The layout cannot be deleted because one or more pages are configured to use this layout.

User response: To delete the layout, you must first remove the layout from any page configuration.

CIYIF0016E You must enter a valid value for the module name. The Module name field cannot be empty.

Explanation: There must be a valid value for the module name. The **Module name** field cannot be empty.

User response: Enter a valid value in the **Module name** field.

CIYIF0017E You must enter a valid value for the package name. The Package name field cannot be empty.

Explanation: There must be a valid value for the path name. The **Package name** field cannot be empty.

User response: Enter a valid value in the **Package name** field.

CIYIF0018E You must enter a valid value for the package location. The Package location field cannot be empty.

Explanation: There must be a valid value for the package location. The **Package location** field cannot be empty.

User response: Enter a valid value in the **Package location** field.

CIYIF0019E The widget cannot be deleted because it is used by one or more pages.

Explanation: The widget cannot be deleted because one or more pages are configured to use this widget.

User response: To delete the widget, you must first remove the widget from any page configuration.

CIYIF0020E The page cannot be deleted because it is used by one or more page hierarchies.

Explanation: The page cannot be deleted because one or more page hierarchies are configured to use the page.

User response: To delete the page, you must first remove the page from any page hierarchy configuration.

CIYIF0021E The call to the access control REST service failed because the resource ID input parameter was not provided.

Explanation: You must specify a resource ID as an input parameter for this access control REST service method.

User response: Specify a resource ID as a parameter to the access control REST service method.

CIYIF0022E The call to the access control REST service failed because the resource type input parameter was not provided.

Explanation: You must specify a resource type as an input parameter for this access control REST service method.

User response: Specify a resource type as a parameter to the access control REST service method.

Appendix B. Reference

These topics contain additional reference information to help you.

The Insights Foundation for Energy Data Model

The Insights Foundation for Energy data model is based on the Common Information Model (CIM) Data Model and needs be populated with data through Data Loading.

The CIM is a standard adopted by the International Electromechanical Commission (IEC) for the reporting and exchange of information about electrical supply networks. Three types of data need be loaded into the IFE Data Model:

- Ontology - used to define the supported assets classes and properties of the asset classes.
- Static data - used to define nameplate data, geographical location, network connectivity, measurement definitions and the relationships between assets.
- Dynamic data - is the data that changes over time.

Related concepts:

Chapter 2, "Use case: Define a new asset class in the Data Model application," on page 7

In this tutorial, you are the administrator of a system and you have a new asset class called Meter as well as assets belonging to this asset class.

Ontology

Ontology is used to define the supported assets classes and properties on asset classes. IBM Insights Foundation for Energy integrates data from different data sources that is consolidated into common asset class and properties definitions.

The mapping between external object id and internal object id is also maintained by IBM Insights Foundation for Energy.

Ontology can also be used to map between semantics from all the data sources and a common semantics. Data sources can have their own semantics; they often do not use the same vocabulary of terms and data concepts. For example, a PowerTransformer can be called differently in different data sources. IBM Insights Foundation for Energy maps semantics from all the data sources into the IEC CIM semantics.

There are three types of table in ontology:

- Object ID
- ResourceType
- PropertyType

ObjectID table

All objects are identified by a database generated object identifier, and a unique URI that is in two parts: namespace and local name. For example: for the URI `http://cityName#transformer1`, the namespace is `http://cityName#` and its local name is `transformer1`.

When data is loaded to IFE, we assume all data objects have an unique id in the format of a URI. IFE generates a unique number based oid for internal use only, e.g. as primary key or foreign key.

The ObjectID table is used to support this mechanism, providing the mapping between internal object id (oid) and external object URI. This table stores the mapping for Logical Resource, Geo Location, Connectivity Node, Terminal, Measurement, Support Association, Flow Role.

oid

BIGINT

Internal object ids which uniquely identifies an object.
It is generated by the database.

namespace

VARCHAR(256)

Namespace part of the URI.

localName

VARCHAR(256)

Local name part of the URI.

ResourceType table

The ResourceType table is use to store the metadata of the CIM **PowerSystemResource**. For example: The CIM asset classes **PowerTransformer**, and **Switch**, are subclasses of **PowerSystemResource**. The user can register these standard or custom defined power system resources to the ResourceType table.

In addition to "PowerSystemResource", IEC CIM also defines a set of class as asset containers, for example: GeoGraphicalRegion, SubGeographicalRegion, Substation, and Bay. The ResourceType table can also be used to register these standard or any custom defined container types.

id BIGINT

The primary key id of the resource type.

code

VARCHAR(128)

A unique string based code of the resource type.

name

VARCHAR(128)

Display name of the resource type.

description

VARCHAR(512)

Description of the resource type.

isAsset

CHAR(1)

Indicates whether resources of this type can be linked to physical asset.

1 = yes, 0 = no.

If isAsset = 1, then the table field holds the name of table used to store the properties of the asset.

isResource

CHAR(1)

Indicates whether this resource type is a power system resource or a container.
0 = is a container (for example, a geospatial region),
1 = is a power system resource. For example, a transformer.

cimID

VARCHAR(128)

Class name of this resource type as in the IEC CIM when the resource type is defined in IEC CIM. For example, PowerTransformer.

table

VARCHAR(256)

Used when isAsset = 1. The fully qualified table name used to store the properties of the asset.

serviceURL

VARCHAR(256)

The relative service URL which expose instance data of this resource type.

PropertyType table

The PropertyType is used to store the properties metadata of each resource type when ResourceType.isAsset = 1.

id BIGINT

The primary key, id of the property type.

resourceType

BIGINT

The foreign Key, the id of resource type.

code

VARCHAR(128)

A unique string based code of the property type.

name

VARCHAR(128)

Display name of property type.

description

VARCHAR(512)

Description of property type.

cimID

VARCHAR(128)

The property name of this property type in the IEC CIM when defined in IEC CIM. For example, Asset.lifecycle.installationDate.

column

VARCHAR(128)

Column name in target table which been used to store this property value.

dataType

VARCHAR(32)

The data type of the property.

length

INTEGER

The length of the property.

scale

INTEGER

The scale of the property.

isEnum

CHAR(1)

Indicates if the property value is an enumeration.

isReference

CHAR(1)

Not used.

isMinimal

CHAR(1)

Indicates if the property is a minimal property.

Minimal property is an important property to filter and sort data.

tag

VARCHAR(128)

Tags on property type.

group

VARCHAR(128)

The group name of the property. Used to group related properties.

unit

VARCHAR(128)

The unit of the property value.

Logical Resource

The logical resource is abstract of components of an electrical network.

When a transformer is referred to in an electrical network, we are interested in its role in the network, how it connected and physical device that is acts upon it. In this example the transformer is the logical resource within the electrical network.

The types of Logical resource varies; the type is defined in the ResourceType table. Some types of logical resources are associated with properties that are stored in a separate child table. For example, a logical resource can also have a location that is stored in the Location table.

Logical resources have different types that are defined in ResourceType table. Based on the definition in the ResourceType table, some types of logical resources can be associated with properties that are stored in a separate children table, for example: Pole, SubstationTrasformer.

The relationship between logical resources are described by a container and the objects it comprises. The container is used to group together components of an asset, or to group assets of a service region. For example, an overhead cable is

composed of line segments, the overhead cable is the container and the line segment are its objects. The aggregation of the relationship can be hierarchical, that is, a container can contain other containers.

Attributes for Logical Resources table

oid

BIGINT

Primary key, the object id of the resource type.
The Object ID is generated in the ObjectID table.

lastUpdateTime

TIMESTAMP

Generated last update time.

resourceType

BIGINT

Foreign key, the type of this logical resource with reference to the Resource Type table.

mRID

VARCHAR(256)

Master resource ID. The string based identifier of the logical resource.

name

VARCHAR(128)

The name of logical resource.

description

VARCHAR(512)

The description of the logical resource.

isContainer

CHAR(1)

Indicates if the logical resources is a container of other components.

location

BIGINT

Foreign key, the location of the logical resource with reference to the Location table.

container

BIGINT

Foreign key, the container or parent of this logical resource, with reference to self.

Asset identity and Attributes

The asset identity and attributes describe physical asset of a logical resource at a point in time.

Each logical resource can be associated with more than one physical asset. Each asset described indicates which physical asset is acting as this logical role over different time periods. For example the logical resource transformer1 is associated with two physical transformers, one was active from the year 2000 to 2010 and the other has been active from the year 2010 to the present day.

The separation of the logical resource from the physical asset has several benefits.

- You are able to track the replacement history of a logical resource.
- The role and responsibility is made clear: the role of the logical resource is to describe the measurement, the connections and location of an asset, and the relationship between assets. The physical asset focuses on the identity of the asset and the static attributes of the nameplate data.

Static attributes are the asset specific nameplate information including asset type, model, date of manufacture, manufacturer specifications, serial number, and default operating state. This information typically resides in an Enterprise Asset Management (EAM) system, an Asset Management System (AMS), or in a Geographic Information System (GIS) for assets in the distribution grid. The AMS captures asset attributes beyond what is available in the GIS system.

For each resource type registered, when `isAsset = 1` in the `ResourceType` table, there is a corresponding asset identity table used to store the attributes of the asset. Some attributes are also registered in the `PropertyType` table.

IBM Insights Foundation for Energy provides five asset identity and attribute tables:

- `Pole`: attributes for pole.
- `SubstationTransformer`: attributes for substation transformers.
- `DistributionTransformer`: attributes for distribution transformers.
- `OverheadCable`: attributes for overhead cables.
- `UnderGroundCable`: attributes for underground cables.

Common attributes for all assets

Note: Where an attribute is mandatory, it will be used in the analysis of asset health. You must provide values for these fields.

oid

BIGINT

Mandatory, the Primary Key, Foreign Key, object id of the logical resource.

serialNumber

VARCHAR(128)

Mandatory, the serial number of the physical asset.

isActive

CHAR(1)

Mandatory, indicates if the assets is currently active, 1 = active, 0 = inactive.

installationDate

DATE

Mandatory, the date when the asset is installed.

removalDate

DATE

Date when asset is removed.

lastUpdateTime

TIMESTAMP

Mandatory, Generated last update time.

Attributes for Pole assets

Note: Where an attribute is mandatory, it will be used in the analysis of asset health. You must provide values for these fields.

length

DECIMAL(8 , 4)

Mandatory, the length of the pole includes any section of the pole that is underground after installation. The unit is defined in the PropertyType table.

lengthClass

VARCHAR(32)

classification

VARCHAR(32)

Pole class: 1, 2, 3, 4, 5, 6, 7, H1, H2, Other, Unknown.

materialKind

VARCHAR(32)

The material the pole is made from. For example, wood, metal, cement.

speciesType

VARCHAR(32)

Mandatory, Pole species. Aluminum, Aluminum Davit, Concrete, Fiberglass, Galvanized Davit, Galvanized, Steel Davit Primed, Steel Davit, Steel Standard Primed, Steel, Truncated, Wood-Treated, Wood-Hard, Wood-Salt Treated, Wood-Soft, Wood, Other, Unknown.

reclaimedStatus

CHAR(1)

Mandatory, Indicates if the pole is made from reclaimed material.

treatmentKind

VARCHAR(32)

The treatment type for the pole.

preservativeKind

VARCHAR(32)

Mandatory, The type of preservative used for the pole.

originalGroundlineCircumference

DECIMAL(8 , 4)

manufacturer

VARCHAR(128)

The manufacturer of the pole.

ownerType

VARCHAR(32)

Type of pole owner, for example, company.

inspectionType
VARCHAR(32)

inspectionTreatmentType
VARCHAR(32)

inspectionStatus
VARCHAR(32)

Mandatory, Status of last inspection.

Attributes for Substation Transformer assets

Note: Where an attribute is mandatory, it will be used in the analysis of asset health. You must provide values for these fields.

operatingVoltage
INTEGER
Mandatory, the operating voltage.

summerEmergencyRating
INTEGER
Mandatory, the Summer Emergency Rating.

summerNormalRating
INTEGER
Mandatory, the Summer Normal Rating.

winterEmergencyRating
INTEGER
Mandatory, the Winter Emergency Rating.

winterNormalRating
INTEGER
Mandatory, the Winter Normal Rating.

stage1Rating
INTEGER
Mandatory, the Stage 1 Rating.

stage2Rating
INTEGER
Mandatory, the Stage 2 Rating.

stage3Rating
INTEGER
Mandatory, the Stage 3 Rating.

manufacturer
VARCHAR(128)
Mandatory, the manufacturer of the transformer.

subTypeCode
VARCHAR(32)
The substation type code.

feeder
VARCHAR(32)
Feeder for the transformer.

alterFeeder
VARCHAR(32)
Alter feeder of the transformer.

feederInfo
INTEGER
The feed information.

workorderi
VARCHAR(32)

electricTraceWeight
INTEGER
Electric trace weight.

GLNX
INTEGER

GLNY
INTEGER

protectiveGLNX
INTEGER
Protective GLNX

protectiveGLNY
INTEGER
Protective GLNY

owner
VARCHAR(32)
Mandatory, the owner of the transformer

groundreac
INTEGER

groundresi
INTEGER

highsidegr
INTEGER

highside_1
INTEGER

highsidepr
VARCHAR(32)

labeltext
VARCHAR(32)
Label text

phaseDesignation
INTEGER
The phase designation

nominalVoltage
INTEGER
Nominal Voltage

ratedkva
FLOAT(53)
Mandatory, rated KVA

highsideco
VARCHAR(32)

lowsidecon
VARCHAR(32)

lowsidegro
FLOAT(53)

lowsideg_1
FLOAT(53)

lowsidepro
VARCHAR(32)

lowsidevol
INTEGER

filledweig
FLOAT(53)
Filled weight

emptyweigh
FLOAT(53)
Empty weight

heightbush
FLOAT(53)

heightnobu
FLOAT(53)

ratedkva65
INTEGER

ratedterti
INTEGER

switchtype
VARCHAR(32)

tertiaryco
VARCHAR(32)

tertiaryvo
INTEGER

sectionalizer
VARCHAR(32)

Sectionalizer

cabinetcon
VARCHAR(32)

xfnumber
VARCHAR(32)

cableid
VARCHAR(32)

The identification number of the cable.

circuit
VARCHAR(32)

Circuit description

workLocation
VARCHAR(32)

Work location

phaseOrientation
VARCHAR(32)

The phase orientation

facilityId
VARCHAR(32)

constructi
INTEGER

isOutageDevice
CHAR(1)

Mandatory, indicates if the transformer is an outage device.

numberOfCustomers
INTEGER

Mandatory, the number of downstream customers supported by transformer.

Attributes for overhead cable assets

Note: Where an attribute is mandatory, it will be used in the analysis of asset health. You must provide values for these fields.

length
FLOAT(53)

The length of the cable. The units are defined in the PropertyType table.

feeder
VARCHAR(32)

The feeder for the cable.

operatingVoltage
INTEGER

The operating voltage

owner
VARCHAR(32)
The owner of cable.

labeltext
VARCHAR(32)
Label text

phaseDesignation
INTEGER
Phase Designation.

phaseOrientation
VARCHAR(32)
Phase Orientation

cableRatingASet1
INTEGER
Cable Rating A Set 1

cableRatingBSet1
INTEGER
Cable Rating B Set 1

cableRatingASet2
INTEGER
Cable Rating A Set 2

cableRatingBSet2
INTEGER
Cable Rating B Set 2

cableRatingASet3
INTEGER
Cable Rating A Set 3

cableRatingBSet3
INTEGER
Cable Rating B Set 3

cableRatingASet4
INTEGER
Cable Rating A Set 4

cableRatingBSet4
INTEGER
Cable Rating B Set 4

Attributes for underground cable assets

Note: Where an attribute is mandatory, it will be used in the analysis of asset health. You must provide values for these fields.

length
FLOAT(53)

The length of the underground cable. The unit is defined in the PropertyType table

feeder

VARCHAR(32)

Feeder of cable

subTypeCode

VARCHAR(32)

Sub type code

operatingVoltage

INTEGER

Operating Voltage

owner

VARCHAR(32)

The owner of cable.

labeltext

VARCHAR(32)

Label text

phaseDesignation

INTEGER

Phase Designation.

phaseOrientation

VARCHAR(32)

Phase Orientation

cableId

VARCHAR(32)

Cable ID

circuit

VARCHAR(32)

Circuit

cableNumber

VARCHAR(32)

Cable Number

cableRatingASet1

INTEGER

Cable Rating A Set 1

cableRatingBSet1

INTEGER

Cable Rating B Set 1

cableRatingASet2

INTEGER

Cable Rating A Set 2

cableRatingBSet2
INTEGER
Cable Rating B Set 2

cableRatingASet3
INTEGER
Cable Rating A Set 3

cableRatingBSet3
INTEGER
Cable Rating B Set 3

cableRatingASet4
INTEGER
Cable Rating A Set 4

cableRatingBSet4
INTEGER
Cable Rating B Set 4

Geometry

The geospatial information that specifies both the geometry and the location of a logical resource in a network.

Geospatial location is a key attribute in a physical infrastructure that enables geospatial analytics and visualization of the entities on a map.

Location attributes

The location attributes are typically stored in a GIS system, an example being the Environmental Systems Research Institute (ESRI) ArcGIS.

oid
BIGINT
Primary key, object id of the location.
Object id is generated in ObjectID table.

lastUpdateTime
TIMESTAMP
Generated last update time.

mRID
VARCHAR(256)
Master resource id. Which is a string based identifier.

isActive
CHAR(1)
Indicate if the location is active or not.

direction
VARCHAR(32)
The direction that allows field crews to find quickly a given asset. For example, a streetlight may be located at the 'NW' (northwest) corner of the customer's site.

mainAddress

VARCHAR(256)

Main address of the location.

phone1

VARCHAR(32)

Phone number.

phone2

VARCHAR(32)

Phone number.

secondaryAddress

VARCHAR(256)

Secondary address of the location. For example, PO Box address may have different ZIP code than that in the 'mainAddress'.

geometry

GEOMETRY

The geospatial location in GIS.

locationDescription

VARCHAR(256)

Description of the location.

Relationships and connectivity

The relationships that include network connectivity, the supporting structure, and flow roles are described here.

The IEC CIM is the template for model network connectivity between logical resources. In IEC CIM, ConnectivityNode and Terminal are used to model connectivity between conducting equipment.

- ConnectivityNode: points where terminals of conducting equipment are connected together with zero impedance.
- Terminal: An electrical connection point to a piece of electrical equipment. Terminals are connected at physical connection points called "connectivity nodes".

Using this model, the terminals are connected to a connectivity node, as in the following diagram.

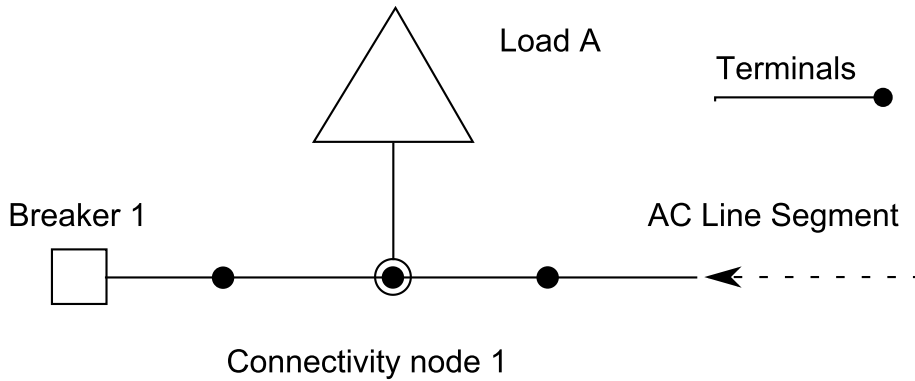


Figure 7. Terminals connected to a connectivity node

The same model is used to describe the connectivity between logical resources.

Attributes for the Connectivity Node

oid

BIGINT

Primary key, object id of the connectivity node.
Object id is generated in ObjectID table.

lastUpdateTime

TIMESTAMP

Generated last update time.

mRID

VARCHAR(256)

The master resource ID. This is a string based identifier for the connectivity node.

isActive

CHAR(1)

Indicates if current connectivity node is active.

name

VARCHAR(128)

The name of the connectivity node.

description

VARCHAR(512)

The description of the connectivity node.

container

BIGINT

A foreign key, the parent of this connectivity node with reference to the resource table.

Attributes for the terminals

oid

BIGINT

Primary key, object id of the terminal.
Object id is generated in ObjectID table.

lastUpdateTime
TIMESTAMP

Generated last update time.

mRID
VARCHAR(256)

The master resource ID. This is a string based identifier for the connectivity node.

isActive
CHAR(1)

Indicates if the current terminal is active.

name
VARCHAR(128)

The name of the terminal.

description
VARCHAR(512)

The description of terminal.

sequenceNumber
INTEGER

The sequence number of the terminal. If a resource has multiple terminals, the sequence number is used to put the terminals in order.

connected
CHAR(1)

Indicates if the terminal is connected.

phases
VARCHAR(32)

The phases of the terminal.

resource
BIGINT

A foreign Key, the resource end of the terminal, with reference to the Resource attributes.

connectivityNode
BIGINT

A foreign key, the connectivity node end of the terminal, with reference to the ConnectivityNode attributes.

The attributes for support association

For supporting structural relationships, the supporting structure relationship does not indicate any electric transmission between assets. For example, if several poles are used support the an overhead cable, then there is a supporting structure relationship between the poles and the overhead cable, however, this relationship cannot be modeled using the connectivity relationship as no electric current flows from the cable to the poles.

oid
BIGINT

The primary key, the object id of the support association.
The object id is generated in the ObjectID table.

lastUpdateTime
TIMESTAMP

Generated last update time.

mRID
VARCHAR(256)

The master resource id. This is a string based identifier for the support association.

isActive
CHAR(1)

Indicates if current support association is active.

supporter
BIGINT

A foreign key, the oid for the supporter resource, with reference to the Resource attributes.

supported
BIGINT

A foreign key, the oid of the supported resource, with reference to the resource attributes. For example if the supporter is a pole then the oid is for the pole, the supported is the oid of the cable.

The attributes for flow role

Flow role is used to describe the role of a logical resource in a network. For example, we can assign the role power source to one asset, and assign the role power sink of to another asset, we can then use these roles to calculate power flow.

oid
BIGINT

Primary key, foreign key, object id of logical resource.

lastUpdateTime
TIMESTAMP

Generated last update time.

isActive
CHAR(1)

Indicates if the current flow role is active.

role
INTEGER

The role of the logical resource in the network.

License usage metrics

IBM License Metric Tool helps Passport Advantage® clients determine their full and sub-capacity PVU licensing requirements.

Learn more: [IBM License Metric Tool](#).

<CONSUMING_PRODUCT_NAME> writes usage information to Software License Metric Tag (SLMTag) files. These files have the extension .slmtag and are read periodically by the IBM License Metric Tool (ILMT) after it has been configured to scan for these files. You can generate reports that summarize usage.

For more information about using IBM License Management Tool, see the IBM License Management Tool 9.0 Knowledge Center.

SLMTag logging

When IBM Insights Foundation for Energy is running, license management information is logged every day to the /opt/IBM/energy/properties/slmtags directory on the application server. The logged .slmtag files contain usage information for the three types of usage:

Standard user

The usage information that is logged is the number of licensed standard users in the system.

Limited user

The usage information that is logged is the number of licensed limited users in the system.

Asset analytics

The usage information that is logged is the number of managed assets in the system. This value is retrieved from the CIM database. For the IBM Insights Foundation for Energy 1.5 release, this value is always 0.

Note: The numbers of licensed standard users and limited users in the system is retrieved from the basic user registry that is deployed with IBM Insights Foundation for Energy. To ensure the accuracy of these numbers, the configuration file that maps user groups to license types must be kept up to date. For more information about mapping groups to license types, see the related link.

The following content is an example of usage information from an .slmtag file:

```
<SchemaVersion>2.1.1</SchemaVersion>
<SoftwareIdentity>
  <PersistentId>e137414b35d140dca5fd631df1098e0d</PersistentId>
  <Name>IBM Insights Foundation for Energy</Name>
  <InstanceId>/opt/IBM/energy</InstanceId>
</SoftwareIdentity>
<Metric logTime="2015-08-05T16:44:36+08:00">
  <Type>AUTHORIZED_USER</Type>
  <SubType>Standard User</SubType>
  <Value>5</Value>
  <Period>
    <StartTime>2015-08-05T16:44:36+08:00</StartTime>
    <EndTime>2015-08-05T16:44:36+08:00</EndTime>
  </Period>
</Metric>
<Metric logTime="2015-08-05T16:44:36+08:00">
  <Type>AUTHORIZED_USER</Type>
  <SubType>Limited User</SubType>
  <Value>5</Value>
  <Period>
    <StartTime>2015-08-05T16:44:36+08:00</StartTime>
    <EndTime>2015-08-05T16:44:36+08:00</EndTime>
  </Period>
</Metric>
<Metric logTime="2015-08-05T16:44:36+08:00">
  <Type>ASSET</Type>
  <SubType></SubType>
```

```
<Value>0</Value>
<Period>
  <StartTime>2015-08-05T16:44:36+08:00</StartTime>
  <EndTime>2015-08-05T16:44:36+08:00</EndTime>
</Period>
</Metric>
```

Related tasks:

“Mapping groups to license types” on page 5

IBM Insights Foundation for Energy has standard user licenses and limited user licenses. To generate usage information for the IBM License Metric Tool, you must map each user role group to the relevant license type in the `slmtag_groups.properties` file on the application server.

Supported browsers

The IBM Insights Foundation for Energy user interface is supported in several browsers.

Browsers

- Google Chrome 43 or later
- Microsoft Internet Explorer 11
- Mozilla Firefox 38 ESR
- Safari 8 for Mac OS

Known issues on Internet Explorer

- On the SOP administration page, for the HTTPS URI in the SOP Reference tab, the **Launch URI** button might not work. To open the URI, copy the URI and paste it in your browser.

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Accessibility

Accessibility features help users with physical disabilities, such as restricted mobility or limited vision, to use software products successfully.

The major accessibility features in this product enable users to do the following:

- Use assistive technologies, such as screen-reader software and digital speech synthesizer, to hear what is displayed on the screen. Consult the product documentation of the assistive technology for details on using those technologies with this product.
- Operate specific or equivalent features using only the keyboard.
- Magnify what is displayed on the screen.

In addition, the documentation was modified to include the following features to aid accessibility:

- All documentation is available in XHTML formats to give the maximum opportunity for users to apply screen-reader software technology.
- All images in the documentation are provided with alternative text so that users with vision impairments can understand the contents of the images.

The solution includes the following features to aid accessibility:

- The Administration Console view includes an accessibility prologue that describes a link that you use to skip over the navigation elements of the page.
- If you are using a screen reader and keyboard, click the **Enable accessibility mode** button to optimize your user experience. The button is displayed after you click the link to skip over the navigation elements on the Administration Console view.
- The following web browser and screen reader are recommended:

Web browser

Mozilla Firefox 31 ESR

Screen reader

Freedom Scientific JAWS 16

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Index

K

known problems 57

P

problems and solutions 57

T

troubleshooting 57