AVEVA™ BI Gateway

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Welcome to AVEVA™ BI Gateway

AVEVA BI Gateway is an enterprise manufacturing intelligence (EMI) solution that automates the extraction, transformation and storage of operational KPIs, metrics and related contextual information across the data structures of Insight. BI Gateway software organizes data from multiple assets and/or plants to reveal how disparate industrial operations affect each other.

What's New?

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Legal information

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What's new in AVEVA™ BI Gateway?

The following are the new features and enhancements available in AVEVA BI Gateway:

2024.4 (July 2024)

- Deployment of Bluegreen with Pendo and MES changes in Production.

2024.3 (May 2024)

- Hotfix deployment.

2024.2 (February 2024)

- Hotfix deployment to provisioning BI Gateway V2 if the folder or the account has multiple services subscribed.
- Documentation about third party integration.

2024.1 (February 2024)

- Cleanup of unused BI Gateway V1 resources.

2023.5 (December 2023)

- New Azure native architecture (Azure Kubernetes Services).
- Functional equivalence of the previous architecture.
- New logger (Azure Application Insight).
- AIM-Advanced reporting (Shared infrastructure & New APIs).
- New regions (Canada, Singapore) in addition to West US and North Europe.
- New tutorial videos on BI tools.

2023.4 (November 2023)

- Hotfix deployment to sort the issue of utilization event query.

2023.3.4 (October 2023)

- Updated OS image of the SF cluster.

2023.3.2 (August 2023)

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- Deployment of Monitoring Service to allow the automatic deletion of keys with infinite expiration.

2023.3.1 (July 2023)

- Fixed issue regarding the processing of measure events.

2023.3 (July 2023)

- ADH Generic Rest API Bug fixes.
- Connect SDK package upgrade for Model Builder.
- Decouple incremental update from dimension event refresh.
- Enhanced event API to delete the data based on collection of aaId.
- Online help in a new portal.

2023.2.1 (April 2023)

- Fixed issue regarding provision of a new tenant.
- Other bug fixes.

2023.2 (March 2023)

- Monitoring service.
- Audit logger.
- Enabling of client credentials option for ADH.
- Bug fixes.

2023.1 (February 2023)

- Fixes for Azure SQL server proxy setting.

2022.6 (December 2022)

- ADH (Data Hub in Generic Rest API) support.
- Latest version of connect SDK.
- Monitoring Service Deployment.

2022.5.3 (November 2022)

- Documentation update and custom query sample for ADH API.

2022.5.2 (November 2022)

- Enhancement and fixes for Insight Adapter class library.

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2022.5.1 (November 2022)

- Documentation update with new query samples for Insight CIM API.

2022.5 (November 2022)

- Fixes for Generic REST API Data Adapter.
- Replacement of the azure function insight connector with insight connector class library.

2022.4.1 (October 2022)

- Bug fixes.

2022.4 (September 2022)

- Change of Insight application, from classic Insight to log-analytic based.

2022.3.1 (August 2022)

- Fix for TDD starttime.

2022.3 (August 2022)

- Enhancements and fixes for tags in the Measure table.
- Incremental backfill logic update of dimension.
- Credit Usage Report at Solution Level.

2022.2.1 (July 2022)

- Support for:
  - AVEVA BI Gateway Analytics Client 2022.1.6 (Tableau Desktop).
  - AVEVA BI Gateway Dashboard Server 2022.1.6 (Tableau Server).

2022.2.0 (June 2022)

- Support for Generic REST API Data Adapter.
- Documentation updates for:
  - AVEVA Connect Workflow.
  - Generic REST API Data Adapter.
  - Context Link.

2022.1.0 (February 2022)

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- Support for Multifactor Authentication (MFA) for connecting to the BI Gateway datastore.
- Bug fixes.

2021.7.1 (October 2021)

- Bug fixes.
- Documentation updates.

2021.7 (October 2021)

- Enhancements and bug fixes.
- Documentation updates.

2021.6 (September 2021)

- Support for Engineering Units conversion in Insight Data adapter.
- Support for additional Insight Historian REST API Endpoints (News).
- Enhanced Model Builder user experience.
- Runtime performance improvement (Time Defining Dimensions consolidation logic and incremental update).
- Support for common aggregate function for all Insight Data adapter queries.

2021.5.1 (August 2021)

- Support for the Top parameter for the UtilizationEvents query.

2021.5 (July 2021)

- Support for retrieving data leveraging the Insight Counter retrieval mode.
- Branding alignment for Model Builder User Interface
- Support for on-demand contextual reprocessing (smart reprocessing) leveraging the Event API.
- Multi-data source support with incremental update for Time Defining Dimensions
- Enhancements and bug fixes.

2021.4 (May 2021)

- Support new Insight Historian REST API Endpoints (News).
- Updated documentation in a new framework.
- Support for TimeDeadband and ValueDeadband retrieval modes for ProcessValues and TDDProcessValues queries.

2021.3 (Mar 2021)

- Support for new MES REST API endpoint (OEECalculations).

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- Enhancements related to Online Insight Adapter.
- Enhancements related to Reporting API.

2020.5.1 (Jan 2021)

- Support for new MES REST API endpoint (DispositionReasons)
- Support for "StartTime" and "EndTime" for Dimension Refresh Event API.
- Enhancements related to Online Insight Adapter.
- Enhancements to Time Defining Dimension reprocessing logic.
- Updates to the Reporting database.

2020.5 and 2020.4.1 (Dec 2020)

- Updates to the Reporting API and the Reporting database.

2020.4 (Nov 2020)

- Support for enabling BI Gateway at the AVEVA Connect account level.
- Support for Reporting database (When a BI Gateway tenant is enabled, the Reporting database gets created in a dedicated Azure SQL server instance.)
- Support for white-listing IP for Reporting database using the BI Gateway Model Builder.
- Support for Event API.
- Enhancements and bug fixes.

2020.3 (Sep 2020)

- Upgraded .NET Framework to 4.8
- Support for ProductionEvents and ContextEvents queries in Insight Adapter.
- Documentation updates.

2020.2.2 (Aug 2020)

- Fixed issues related to Insight Data Adapter.

2020.2.1 (Jul 2020)

- Enhancement to support the purple icon for AVEVA Connect.

2020.2 (6 Jul 2020)

- Support for SQL Azure Data Adapter.

2020.1 (17 Apr 2020)

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- First release of AVEVA Insight - BI Gateway with support for only Insight Data Adapter.

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Get started with AVEVA™ BI Gateway

About
Get started

About

AVEVA Connect

AVEVA Connect is a unified industrial software platform that spans your entire business – from engineering, design, and procurement to optimizing operations and production. This includes on-boarding and upskilling your people. Designed to drive business excellence across asset and operations lifecycles, this platform is helping to evolve the industries that power our world.

AVEVA Connect is perfectly scalable, giving you a flexible, powerful set of tools that turn opportunities into business value.

- Connect your people to remove operational barriers and create a unified, empowered workforce.
- Connect your asset and operations value chains to maximize return on capital and improve profitability.
- Connect your processes to new capabilities such as machine learning, advanced analytics, early awareness, dashboards, and more.

AVEVA Connect is a web portal from which you can launch and manage your integrated applications in a unified way. Underneath the web portal is a set of services and libraries which registered applications use to integrate with the cloud platform and with each other.

For further information, see https://sw.aveva.com/aveva-connect.

AVEVA™ BI Gateway

BI Gateway is a web application made available in AVEVA Connect as a solution.

The AVEVA™ BI Gateway application allows you to build a BI Gateway Model by creating data sources, dimensions and measures, and configuring each of those objects. The application also displays the relationships between the objects using a dynamic and interactive graphical representation of all the objects in the model. You can export the BI Gateway model to a file; similarly, you can import a model from a previously generated model file. Finally, you can deploy your BI Gateway model so that the cloud Service starts executing your configured model to save data into the BI Gateway Datastore.

Note: This version of the document applies to AVEVA BI Gateway. AVEVA BI Gateway does not include all the Data Adapters, Configurator, and Analytics Client Data Source Generator, which are available in the on-premises offering.

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Quick start

Important terminologies
AVEVA Connect configuration workflow
Get started with AVEVA Connect
Whitelist corporate domain
Add users
Add groups
Add folders
Assign roles
Enroll to multifactor authentication
Start the BI Gateway model builder
Whitelist IP addresses
Switch solutions
Sign out from BI Gateway

Important terminologies

The important terminologies in AVEVA BI Gateway are:

Backfill

While configuring a refresh rate for a measure, you can provide a start date and time to start collecting data from the data source and populate the measure. You can provide a start date and time prior to the measure deployment date. The process of populating the measure for a period prior to the deployment date is called as back-filling.

Context

A context is established by relating a measure to a dimension. A context link provides a context for time-slicing. Time-slices obtained from time defining dimensions can have an associated context.

Dimension

A dimension is a structure that provides context to measures. Each dimension stores related items of data. A dimension stores contextual data. Dimension allows you to filter, group, and label measure data.

Data source

Data sources are the external source systems to which you can map the dimensions and measures in the AVEVA BI Gateway model. Data sources are the AVEVA BI Gateway objects in the AVEVA BI Gateway model. You configure the data source objects to provide connection information to the external data source systems.

Measure

A measure is a group of calculations that shares the same context. A measure consists of calculations for each source system, time period, and for each unique combination of dimension value.

BI Gateway model

An AVEVA BI Gateway model is a formal representation of the Data Sources, Dimensions, and Measures that are collectively called AVEVA BI Gateway "objects." The AVEVA BI Gateway model also represents the relationships

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and configurations of the AVEVA BI Gateway objects.

An AVEVA BI Gateway model is independent of any database schema and is optimized for manufacturing intelligence. The AVEVA BI Gateway model:

- Consists of three types of objects: Data Source, Dimension, and Measure.
- Contains measures typically representing quantitative aggregate operational data.
- Contains dimensions typically representing context for the measures.
- Defines relationships between the dimensions and the aggregated measures and how they map to the data sources.

The AVEVA BI Gateway model defines the dimensions and measures from one or more data sources as per mapping rules.

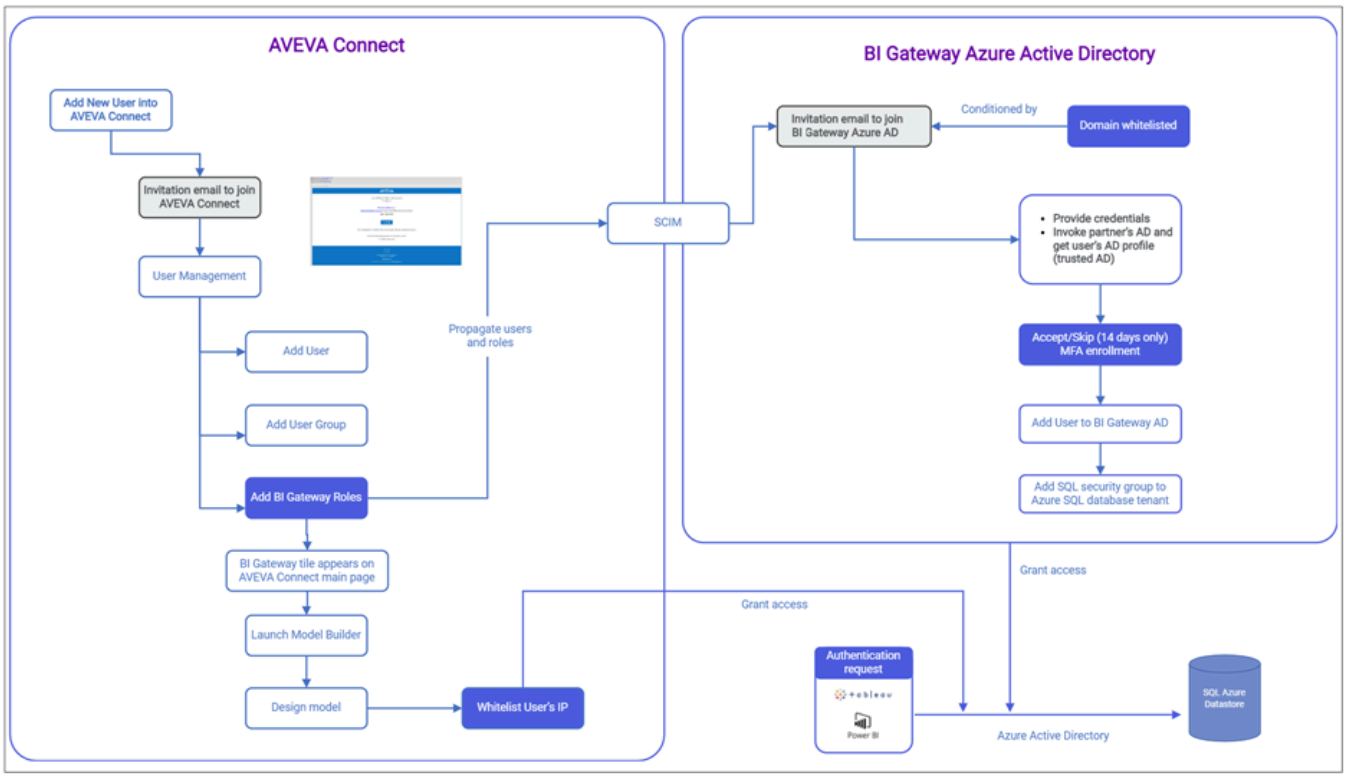
For more information about the Data Source, see "Data sources".

For more information about the Dimensions, see "Dimensions".

For more information about the Measures, see "Measures".

AVEVA Connect configuration workflow

The following diagram represents the configuration workflow from AVEVA Connect to AVEVA BI Gateway.



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Get started with AVEVA Connect

Create an AVEVA Connect account

Only "Connect Administrators" can create new AVEVA Connect accounts. If you have any questions, please contact feedback@aveva.com.

Next steps with AVEVA Connect

- Register with AVEVA Connect

  If you are a first-time user of CONNECT, you must first register yourself with CONNECT for an AVEVA user ID. An AVEVA user ID is required before you can proceed with the other steps. The registration is a one-time process.

  Note: If your organization has opted for Corporate Sign-in or has delegated the authentication of users to a third-party, the registration process is not applicable.

  To register with CONNECT:

  1. Select **Sign in** on the invitation email, the **Register** dialog box is displayed.

     Note: You can access the CONNECT sign-in page directly by following the https://connect.aveva.com/#/ URL and selecting the **Sign in** option. Then select **Register** to register.
  2. In the **Email** box, type your official email address.
  3. In the **Password** and **Confirm password** boxes, type a password.
  4. In the **First name** and **Last name** boxes, provide your first and last names.
  5. Select **Next** to go to the **Company information** page.
  6. In the **Company name** box, type your company name.
  7. In the **Local office address 1** and **Local office address 2** boxes, provide your local office address.

     Note: Local office address 2 is optional.
  8. In the **Postal code** box, type the postal code of your local office.
  9. From the **Country** list, select your country.
  10. From the **State/Region** list, select your region.
  11. Select the **Terms and Conditions** link to read the terms and conditions.
  12. Read the terms and conditions carefully and then select **I Agree** to accept the terms and conditions.
  13. Select **Register**. Your request is submitted and an email with a verification link is sent to your official email address.
  14. Select the link to verify your email address. An CONNECT **Sign in** page is displayed.
  15. Type your password and select **Sign in**.

      Your password must be at least eight characters long and must contain at least three of the following four types of characters: a lowercase letter, an uppercase letter, a number, and a special character. Note that the user account is locked after 10 failed login attempts from the same IP address. You do not need to provide a password if you are using your organization's single sign on.
  16. If your AVEVA user ID is approved by AVEVA's corporate compliance check, you are signed in to the account you are assigned to.

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Note: If your AVEVA user ID is pending approval, contact your account manager or your local AVEVA representative.

The data you have provided at the time of registering is saved as your profile information which can be updated from time to time. For details on how to update your profile, see Update Profile Information.

- Sign in to AVEVA Connect

  You can sign in to CONNECT using your email address and password with which you have registered, using your organization's single sign on, using a sign-in link, or through a connection code.

  Note: Signing in through a connection code is applicable to users who are authenticated using a federated connection. If you are a first-time user of CONNECT, you must first register yourself with CONNECT before you can sign in. For information on how to register with CONNECT, see Register with AVEVA Connect.

  If you attempt a sign-in ten times consecutively with a wrong password from the same location (IP address), then your user ID is blocked. If this happens, contact AVEVA Global Customer Support to unblock your user ID.

  You can sign in to only one account at a time. You must sign out from one account before signing in to another account.

  To sign in to CONNECT:

  1. Access the CONNECT sign in page.

     If you are accessing the CONNECT sign-in page directly by following the https://connect.aveva.com/#/ URL, select the **Sign in** option on the Home page.

     (OR)

     If you are signing in immediately after registering, select **Sign in**.

  2. Enter your registered email address and password.

     Note: If you are signing in for the first time after the introduction of AVEVA's Corporate compliance policies, you are prompted to provide your company information before you can sign in. You can sign in only after your AVEVA user ID has been screened for the compliance policies. For details about the company information, see Register with AVEVA Connect.

     If your organization has opted for single sign on, then you can sign in to your CONNECT account without entering a password. Note that the user account is locked after 10 failed login attempts from the same IP address.

  3. After a successful sign in, the list of accounts that you are a member of is displayed.

     Note: If you are a user with multiple user identities and do not find the required account in the list, you can try by switching your user identity. Select **signing in with a different user ID** and try signing in with another CONNECT user ID. This option is available only if the user ID you are using to sign in is a member of more than one accounts and if your organization has configured the Switch User functionality. For information on how to configure the Switch User functionality, contact your local AVEVA representative.

  4. Select the account you want to sign in to. You are signed in to that account.

     Note: If you are a member of only one account, you are signed into that account automatically.

- Update Profile Information

  You can update the following details of your profile:

  - First name
  - Last name
  - Company name

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- Local office addresses 1 and 2
- Postal code
- Country
- State

Note: Though your username is part of your profile, it cannot be updated. Further, the profile information cannot be updated if you are a federated user (that is, if your organization has opted for Corporate Sign-in or has delegated the authentication of users to a third-party).

To update your profile information:

1. Sign in to CONNECT.
2. On any page in CONNECT, select the profile icon.
3. On the **My AVEVA Profile** page, edit the fields according to your requirement, and select **Save**.

   A message is displayed that the profile has been updated successfully. All updated profiles are checked for compliance with AVEVA's corporate policies. If your profile is still compliant, you can continue to work with CONNECT. Else, a message that your profile is pending approval is displayed and you will be signed out after 60 seconds. In such cases, contact your AVEVA representative for assistance.

   Note: If you are a user with multiple user identities, the option **Sign in with a different user ID** is available if your current user profile is pending approval. Select the option to sign in using a different user ID.

- Sign out from AVEVA Connect

  Some CONNECT application environments are independent of each other. To switch between application environments, you must sign out before attempting to sign into another application.

  Also, when you have completed your session within CONNECT, you must sign out.

  To sign out from CONNECT:

  - Select the Profile icon on the top right corner and select **Sign out**. You are signed out of CONNECT.

    Signing out from CONNECT signs you out from the applications you have launched from CONNECT.

Other AVEVA Connect sign-in options:

- Sign in Using a Sign-in Link

  As an Account Administrator, you can share a sign-in link with your users.

  To view the sign-in link for your account:

  1. From the main menu, select **Settings**.
  2. On the **Account Settings** page, select the **Sign in Link** card.

     The **Sign in Link** page displays the sign in link for your account. You can copy the link and share it with your users.

  Note: When users sign in using the sign-in link, they are not presented with the list of accounts to choose from while signing in. They are directly signed in to the account from which the link was generated.

- Sign in Using a Connection Code

  Note: Signing in through a connection code is applicable to users who are authenticated using a federated connection.

  A connection code enables third-party users to access specific accounts associated with an Identity Provider.

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Any accounts that are not intended for the third-party users are hidden.

To sign in using a connection code:

1. Access the CONNECT sign in page.

   If you are accessing the CONNECT sign-in page directly by following the https://connect.aveva.com/#/ URL, select the **Sign in** option on the Home page to sign in.

   (OR)

2. If you are signing in immediately after registering, select **Sign in** to sign in.

   Note: You can also sign in using a direct sign-in link that is available in the email invitation.

3. Select **Have a connection code** option.
4. In the **Connection code** box, enter the connection code.

   Note: The connection code is provided by AVEVA. If you do not know the connection code, contact your Account Administrator.

   After validating the connection code, you are signed in and the list of accounts that you are a member of is displayed.

5. Select the account you want to sign in to. You are signed in to that account.

   Note: If you are a member to only one account, you are signed into that account automatically.

- Sign in Using Corporate Single Sign-On

  Some CONNECT accounts are configured to delegate authentication using a corporate directory or identity provider, which enables authentication and authorization to CONNECT applications using the corporate user identity. If your organization has opted for this, you can use Single Sign-On using the user account from the corporate domain.

  If Single Sign-On is enabled, you only need to provide your email address when signing in to CONNECT.

  Note: You may be prompted to sign into your organization's sign-in page or adhere to other authentication mechanisms used by your organization.

Whitelist corporate domain

Ensure that your corporate domain is whitelisted to receive the invitation email from the BI Gateway Azure AD. If you want to whitelist your corporate domain, contact the AVEVA Knowledge & Support Center.

Add users

You can create users who have access to AVEVA Connect.

You can create the following types of users:

- A user with the BI Gateway "Administrator" role has access to the BI Gateway Model Builder and the Azure SQL Database with Read-Only access to all Database objects.
- A user with the BI Gateway "Analytics User" role has Read-Only access to the BI Gateway datastore (dbo schema). This user does not have access to the BI Gateway Model Builder.

  Note: You must have "Administrator" privileges for the AVEVA Connect account to add users.

After you create a new user, an email is sent to the new user, indicating that the user can now connect to the

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newly created account. When the user clicks the link, the user is navigated to the AVEVA Connect Account page.

For more information about roles, see Assign roles.

For more information about creating users and assigning roles in AVEVA Connect, refer to the **Create Users** and **Assign roles** sections of the AVEVA Connect documentation.

Add groups

You can create groups in AVEVA Connect. For example, Administration, Admin_User, Analytics_User, and so on.

After you create a group, you can add users to these groups. For example, if you have created groups "Admin_User" or "Analytics_User," you can add users to these groups.

You can also assign roles to these groups. For example, you can assign the "Analytics User" role to the "Analytics_User" group and the "Administrator" role to the "Admin_User" group.

When you add a user to groups associated with "Administrator" or "Analytics User" roles, the user gets added to the BI Gateway Azure Active Directory.

Note:
- You must have "Datastore - Administrator" privileges for the AVEVA Connect account to add groups.
- While creating a new group, ensure that the group name is meaningful, is less than 31 characters, and does not contain special characters or space. The supported characters are uppercase letters, lowercase letters, numbers, and underscore.
- If you want to rename a group, remove the BI Gateway roles, rename the group, and then reassign the roles to this group.

For more information about users and roles, see Add users and Assign roles, respectively.

For more information about creating users, creating groups, and assigning roles in AVEVA Connect, refer to the **Create Users**, **Create Groups**, and **Assign Roles** sections of the AVEVA Connect documentation.

Add users to groups

1. From the Hamburger menu, click **User Management**.

   The **Users** page appears.
2. Click **Groups**.

   The list of available groups appears.
3. In the **Groups** tab, click the required group name.

   For example, to add a user to the "Analytics_User" group, click **Reporting - Analytics_User**.

   The selected **Group** Details page appears.
4. Click **+ Add users**.

   The **Add users** pane appears.
5. In the **Users** box, type the name of the user whom you want to add to the group.
6. Click **Save**.

   The user is added to the selected group.

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Add folders

You can use folders to partition data. You can add the required folder in AVEVA Connect.

Note:
- You must have "Administrator" privileges for the AVEVA Connect account to manage folders.
- Before you assign BI Gateway roles to the user group, we recommend that you wait for around 15 minutes for the capability to be deployed.

For more information about creating folders in AVEVA Connect, refer to the **Create folders** section of the AVEVA Connect documentation.

Provision capability

Once the folders are added in AVEVA Connect, enable the services for AVEVA BI Gateway.

Enable BI Gateway services

1. Click the toggle button on the service.
2. Select a region that supports BI Gateway. The default region is **US-West**.

   Note: AVEVA BI Gateway currently supports four regions - US-West, EU-West, Canada, and Singapore. If a region previously selected is not one of these four regions, then the default is set to US-West. Choose a region from the provided list.

The capability's region for a BI Gateway service is not determined by the folder region. The capability is executed in one of the four regions selected while enabling the service.

Assign roles

The BI Gateway solution supports the following roles:

- **Datastore - Administrator**: A user with the BI Gateway "Datastore - Administrator" role has access to the BI Gateway Model Builder and the Azure Database with Read-Only access to all Database objects.
- **Reporting - Analytics User**: Only users/groups with the "Reporting - Analytics User" role can view the reporting database information and later configure a database.
- **Datastore - Analytics User:** A user with the BI Gateway "Datastore - Analytics User" role has Read-Only access to the BI Gateway datastore (dbo schema). This user does not have access to the BI Gateway Model Builder.

You can assign these roles to groups in AVEVA Connect. For example, if you have created "Analytics_User" and "Admin_User" groups, you can assign the "Reporting - Analytics User" role and the "Datastore - Administrator" role to these groups, respectively.

Note: You must have "Datastore - Administrator" privileges for the AVEVA Connect account to assign roles.

For more information about groups, see Add groups.

For more information about assigning roles in AVEVA Connect, refer to the **Assign Roles** section of the AVEVA Connect documentation.

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Enroll to multifactor authentication

After a BI Gateway role is assigned, you will receive an invitation email from the BI Gateway Azure AD. After you accept the invitation email, you must complete the Multifactor Authentication (MFA) enrollment.

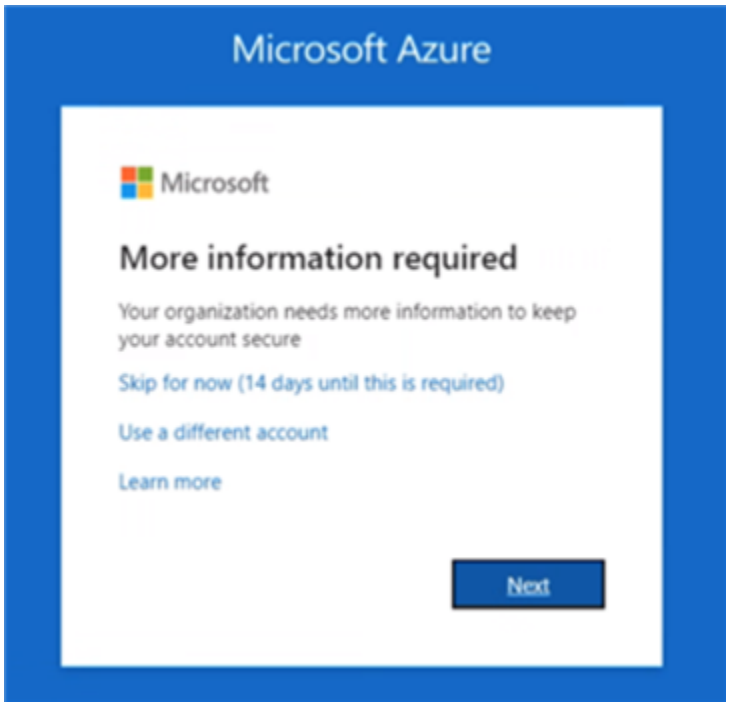
Multifactor Authentication is an authentication method that requires the user to provide two or more verification factors to access a resource. Multifactor Authentication improves the overall security of your data.

For more information about Multifactor Authentication, see the Microsoft Azure documentation.

Set up the multifactor authentication

1. As a BI Gateway user, you will receive an invitation mail from AVEVA Connect regarding the setup of MFA. Accept the invitation mail to begin the setup.

   The **Microsoft Azure** dialog box appears.



2. In the **Microsoft Azure** dialog box, do one of the following:
   - To complete the setup of the MFA, you are required to provide more information. Click **Next** to proceed with the MFA setup.

     The **Microsoft Authenticator** dialog box appears.
   - To set up the MFA later, click **Skip for now**.

     Note: You are required to set up the MFA within 14 days of being added to the Azure AD.
3. Install the Microsoft Authenticator app on your device. Click **Next** to continue the setup.

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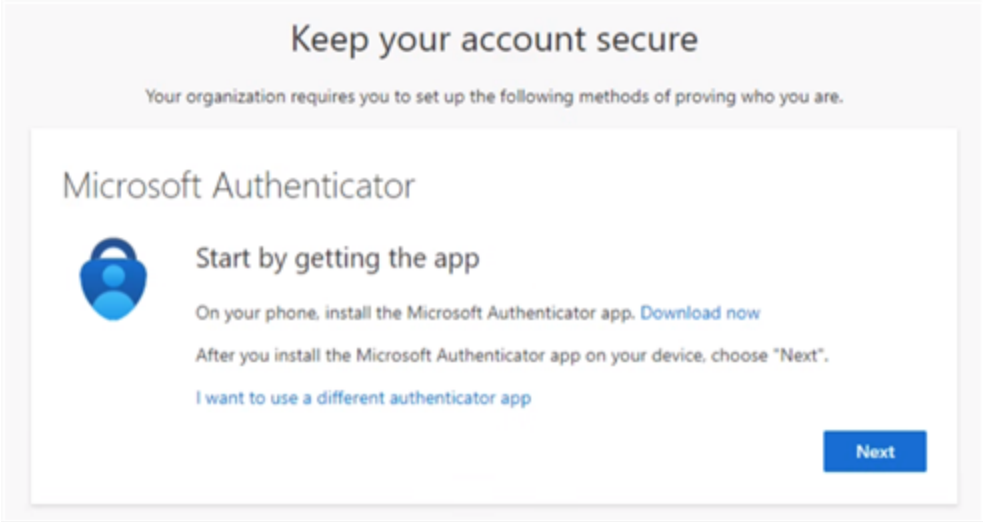

4. After the Microsoft Authenticator app is installed on your device, you can connect to the app by doing one of the following:
   - Enter your username and password.
   - Scan the QR code.
5. Click **Next**.

   The new AD instance is added, and MFA is enabled.

Start the BI Gateway model builder

AVEVA BI Gateway is used to visually configure information models that are multidimensional data models to represent business logic and relationship between various, unstructured source data items. The explorer view of the AVEVA BI Gateway Model Builder enables multidimensional data model visualization in a compact, single-screen format, depicting all of the many-to-many, dynamic relationships between different types of objects. In the explorer view of the AVEVA BI Gateway Model Builder, you can view all the objects (Data Sources, Dimensions, and Measures) of a model in a single view, and also the relationships that they share. For example, if you click a data source in the AVEVA BI Gateway Model, you can see the Linked Dimensions and Measures that are being used for the selected data source. You can also view the dynamics and the linking between objects of the same type. For example, if one of the Dimensions is leveraging another Dimension, you can see the linking when you click the Dimensions.

The explorer view also allows you to view the deployment status of the various objects in the Model using the three different pre-defined color codes as displayed in the Legends of the application.

The full model visualization with all the rich context greatly aids in the authoring of the Information model and creation of business dashboards showing key performance indicators based on the Models.

The differentiating details of the AVEVA BI Gateway Model Builder include:

- A single place to clearly and fully visualize the entire Information model
- All relationship between objects (many-to-many) fully captured and rendered
- A single object in context, showing all dependencies within the full model

To open the AVEVA BI Gateway Model Builder:

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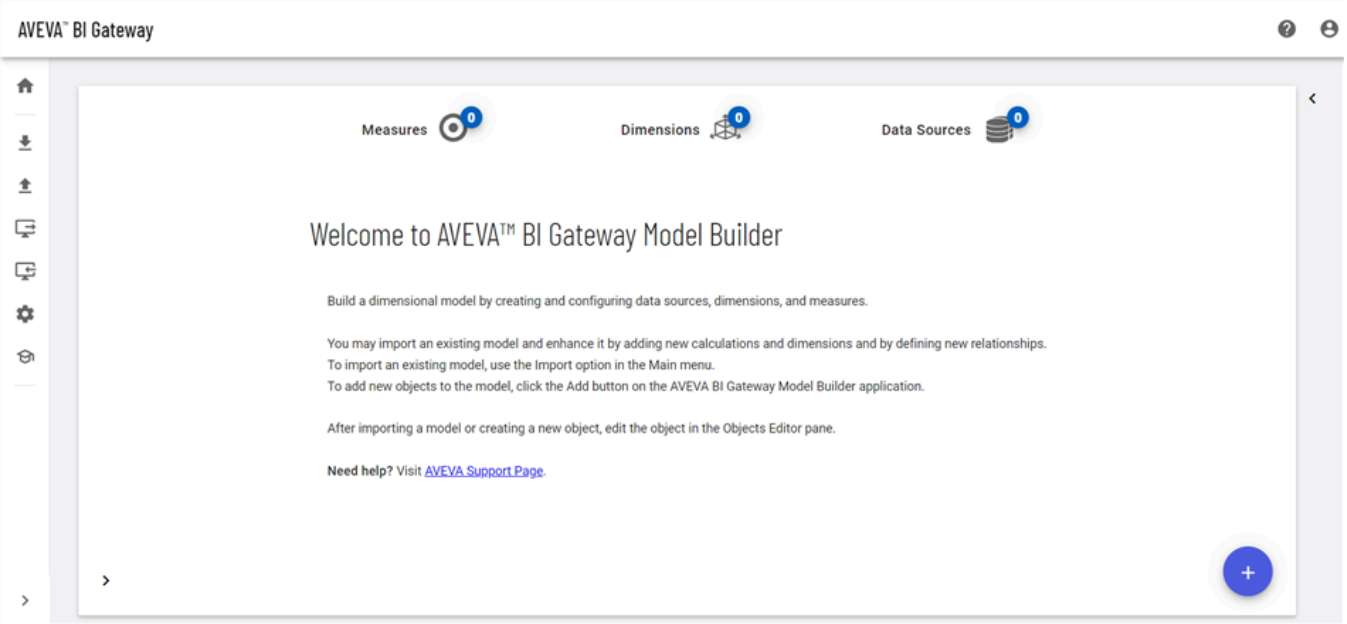
- In the AVEVA Connect page, click the AVEVA BI Gateway tile. The user is authenticated through OpenID Connect authentication. The user is connected to AVEVA Connect and then to AVEVA BI Gateway Model Builder. The data of one user data is isolated from that of the other user. For more information about AVEVA Connect, refer to the AVEVA Connect documentation.

When you open the AVEVA BI Gateway Model Builder for the first time, the page appears as follows.



The Home page also displays the **Floating Action Buttons (FAB)** menu. You can use the FAB menu to create a model. Once you create a model, then the AVEVA BI Gateway Model Builder opens up the page with the Model Explorer view. For more information on the Explorer view, refer to Work with Explorer View.

The following illustration is the layout of the AVEVA BI Gateway Model Builder with the Explorer View and the Object Editor pane.

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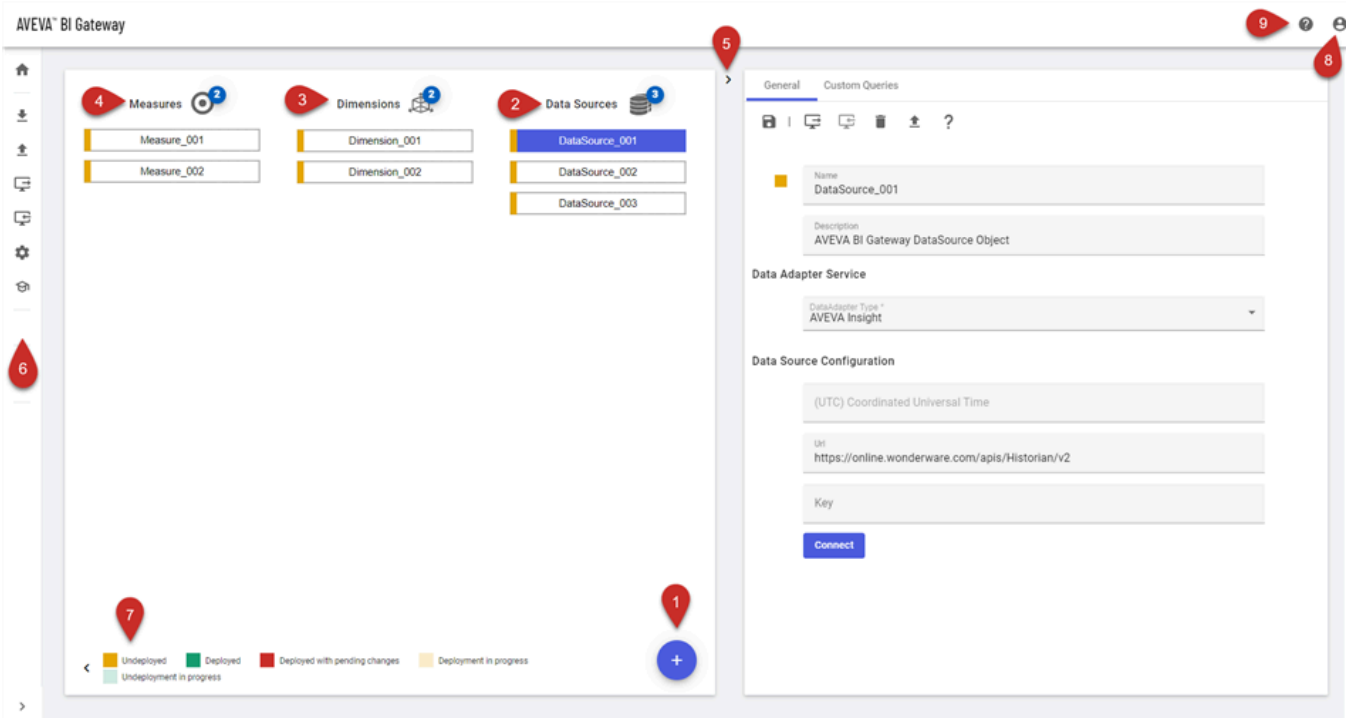

Area	Description
1	Floating Action Button (FAB). More action icons become available when you click the Add (**+**) icon.
2	List of Data Sources. The number on top of the data source column shows the number of configured data sources in the model.
3	List of Dimensions. The number on top of the dimension column shows the number of defined dimensions in the model.
4	List of Measures. The number on top of the measure column shows the number of defined measures in the model.
5	Click to expand the Object Editor in the right pane that allows you to manage AVEVA BI Gateway Objects.
6	The menu options allow you to Import/Export, Deploy/Undeploy, change Event Log Settings, and access Tutorials.
7	A legend that explains the color codes representing the deployment status of each of the objects.
8	The User information icon.

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Area	Description
	Click the User Information icon to explore various action items such as name of the user, view datastore information, whitelist client IP, sign out, and also view the Copyright and Legal information. You can also view the list of solutions for the currently logged-on user and switch solutions.
9	Click the icon to access the Online Help.

Whitelist IP addresses

Whitelist BI Gateway IP addresses
Whitelist client IP addresses
Whitelist tableau IP addresses

Whitelist BI Gateway IP addresses

If you want to whitelist the BI Gateway IP addresses, contact the AVEVA Knowledge & Support Center for the list of IP addresses. You must then whitelist these IP addresses.

Important: To whitelist reporting databases, ensure that the **Reporting Analytics User role** is assigned for the reporting database. To learn how to assign the Reporting Analytics User role, refer to Assign group and roles.

Whitelist client IP addresses

You can access the Datastore from the SQL Server Management Studio or any third-party tools from a client machine. However, the IP addresses of these client machines must be whitelisted to access the Datastore successfully. When you whitelist IP addresses, these addresses are considered as trusted addresses. You can define a single IP address or a range of IP addresses.

Whitelist a client IP address

Important: To whitelist reporting databases, ensure that the **Reporting Analytics User role** is assigned for the reporting database. To learn how to assign the Reporting Analytics User role, refer to Assign group and roles.

1. From the BI Gateway Model Builder Home Page, click in the upper right corner.

   A list with options appears. The current account is displayed.

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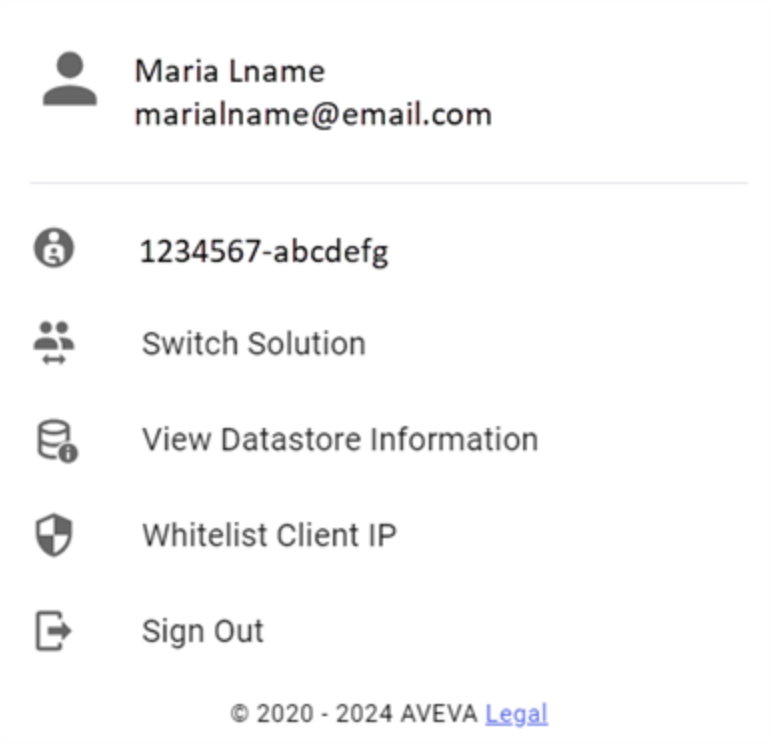
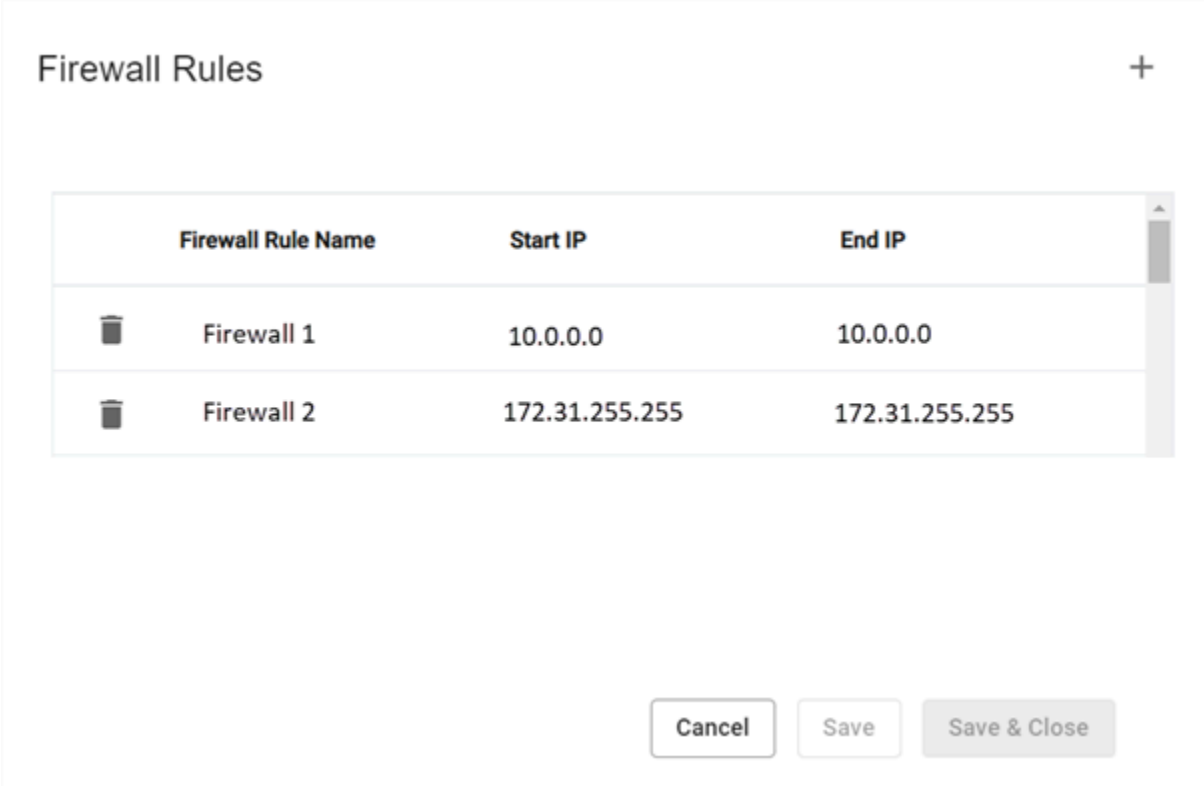


2. Click **Whitelist Client IP**.
   The **Firewall Rules** dialog box appears.



3. Click **+**.
4. In the **Firewall Rule Name** box, type the name for the rule.

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5. In the **Start IP** box, type the start IP address.
6. In the **End IP** box, type the end IP address range. This is the IP address at which the whitelisting ends.

   Note:
   - If you want to whitelist only one IP address, then enter the same IP address in the **Start IP** and **End IP** boxes. However, if you want to whitelist a range of IP addresses, enter the start IP address and end IP address range in the **Start IP** and **End IP** boxes.
   - We recommend that you do not whitelist the entire range of IP addresses from 0.0.0.0 to 255.255.255.255 to avoid any security risks.

7. Click **Save**.

   The selected IP addresses are whitelisted.

Edit an IP address

1. From the BI Gateway Model Builder Home Page, click in the upper right corner.

   A list with options appears.
2. Click **Whitelist Client IP**.

   The **Firewall Rules** dialog box appears with a list of the defined rules.
3. From the list of rules, edit the start and end IP addresses in the **Start IP** and **End IP** boxes, respectively, for the required rule.
4. Click **Save**.

   The selected IP addresses are whitelisted.

Delete an IP address

1. From the BI Gateway Model Builder Home Page, click in the upper right corner.

   A list with options appears.
2. Click **Whitelist Client IP**.

   The **Firewall Rules** dialog box appears with a list of the defined rules.
3. Click the icon in the row of the rule that you want to delete.

   The selected rule is deleted.

Whitelist tableau IP addresses

You must whitelist the range of IP addresses used by Tableau Online so that third party applications may access your data. This range varies based on the site location. You can obtain the site location from the URL when you log in to Tableau Online.

For more information about IP address ranges used by Tableau Online, see https://help.tableau.com/current/pro/desktop/en-us/publish_tableau_online_ip_authorization.htm.

Important: To whitelist reporting databases, ensure that the **Reporting Analytics User role** is assigned for the reporting database. To learn how to assign the Reporting Analytics User role, refer to Assign group and roles.

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Switch solutions

An account can have multiple solutions. If you have access to an account with multiple solutions, you can switch between solutions.

For example: Consider you have an account with access to two solutions, namely “Solution A” and "Solution B”. You can switch from Solution A to Solution B, and the reverse is also true.

Switch accounts

1. From the AVEVA BI Gateway Model Builder Home Page, click in the upper right corner.

   A list with options appears. The current account is displayed.
2. Click **Switch Solution**.

   The **AVEVA Connect** page appears with the list of applicable accounts displayed in the **My Folders** section.
3. Select the solution to which you want to switch.

   The information for the selected solution is displayed.

Sign out from BI Gateway

You can sign out from the AVEVA BI Gateway solution to end the session.

Sign out

1. From the AVEVA BI Gateway Model Builder Home Page, click in the upper right corner.

   A list with options appears.
2. Click **Sign Out**.

   A confirmation message appears.
3. Click **Yes**.

   You are successfully logged out of the solution.

Report a database configuration

Create a tenant
Assign group and roles
Configure the database

Create a tenant

1. Sign into AVEVA Connect and choose an account.
2. Select the hamburger icon, and then **Folder Management**.

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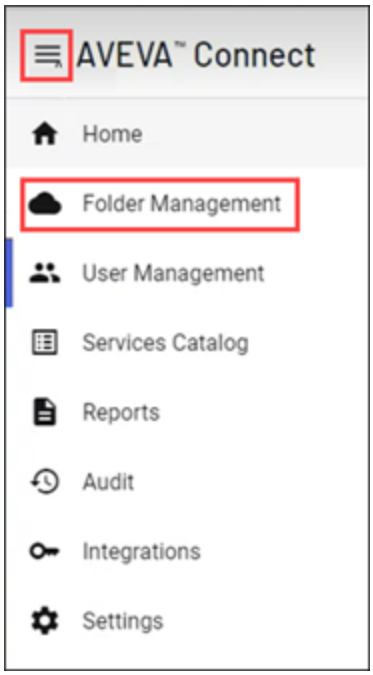
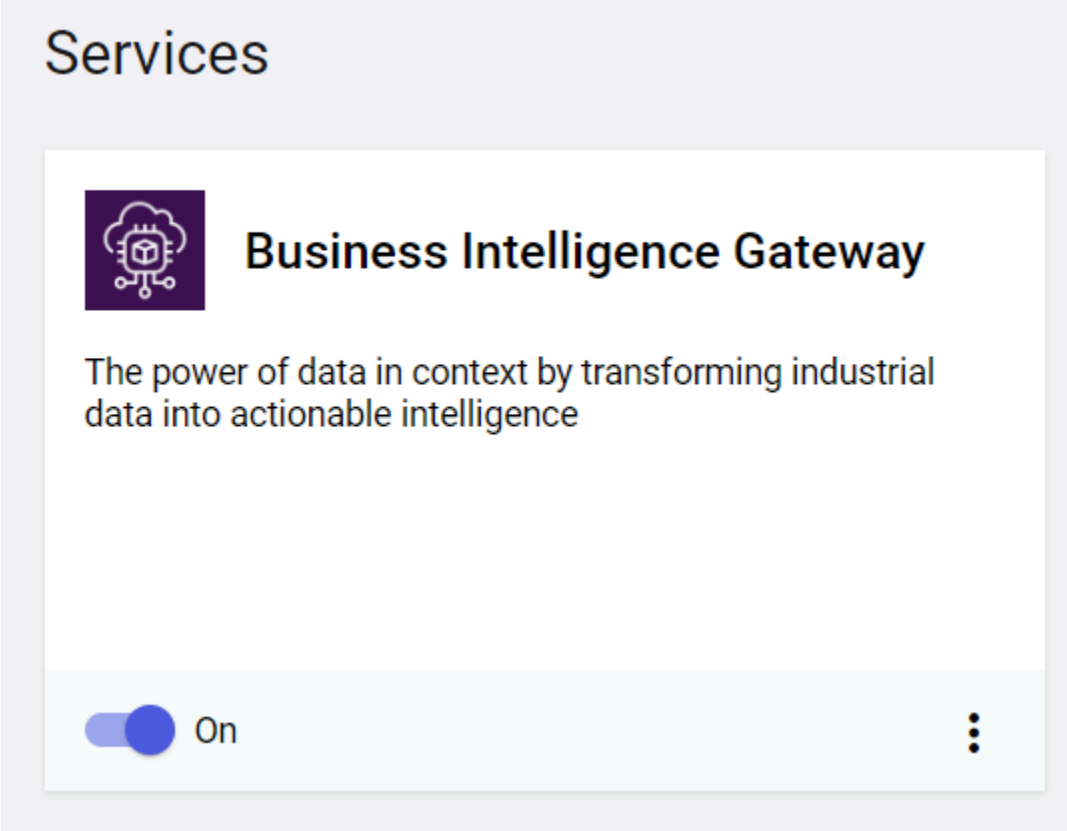


3. Select **Add Folder**, and then fill in the required details. A new tenant is created.
4. To enable the tenant service, click the toggle button to switch it **On**.
   Wait for about 10 minutes as the database gets created.



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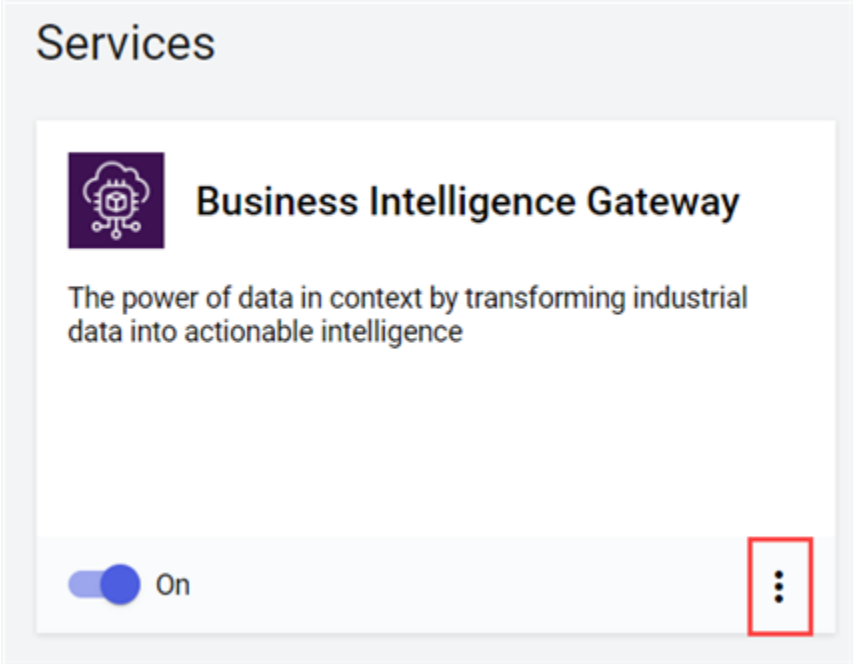
Assign group and roles

1. Once the database is created, click the vertical ellipsis icon , and select **Manage roles**.



2. Under the **Groups** tab, select **Assign group**. Create the required groups.
3. You require at least an **Admin** group and a **Reporting Database** group. Add the following:
   - Group name
   - Group description
   - Users

   Note: The only special character allowed is an underscore '_'.

   If you are added to the AVEVA Intelligence AD for the first time, accept the invite you will receive via email. However, if you are already in Azure AD, you will not receive an email. Follow the instructions:
4. Visit https://portal.azure.com/d9bde4ea-8859-4e11-9efa-491b97c4db44 in an incognito mode tab.
5. Log in with your credentials.
6. Accept the invite.
7. Under the **Roles** tab, select **Assign role**. It is compulsory to add the following roles:
   - **Datastore Administrator role** – Only users/groups with the Datastore Administrator roles can view the tenant model builder.
   - **Reporting Analytics User role** – Only users/groups with the Reporting Analytics User role can view the reporting database information and later configure a database.

   Important: To whitelist reporting databases, ensure that the **Reporting Analytics User role** is assigned for the reporting database.

Important: 1:1 mapping is only allowed within the same account. A BI Gateway role can be assigned to only one group and one tenant. The tables below demonstrate the 1:1 mapping within two accounts:

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Account	Tenant	Role	Group	Mapping Eligibility
Account1	Tenant1	Datastore Administrator	Grp1	Allowed
Account1	Tenant1	Datastore Administrator	Grp2	Not allowed
Account1	Tenant1	Reporting Analytics User	Grp1	Not Allowed
Account1	Tenant1	Reporting Analytics User	Grp2	Allowed
Account1	Tenant2	Reporting Analytics User	Grp2	Not allowed
Account1	Tenant2	Datastore Administrator	Grp1	Not allowed
Account1	Tenant2	Datastore Administrator	Grp3	Allowed
Account1	Tenant2	Reporting Analytics User	Grp4	Allowed

This demonstrates the 1:1 mapping within the first account. The same process can be repeated for another account. For example,

Account	Tenant	Role	Group	Mapping Eligibility
Account1	Tenant1	Datastore Administrator	Grp1	Allowed
Account1	Tenant1	Datastore Administrator	Grp2	Not allowed
Account1	Tenant1	Reporting Analytics User	Grp1	Not Allowed
Account1	Tenant1	Reporting Analytics User	Grp2	Allowed
Account1	Tenant2	Reporting Analytics User	Grp2	Not allowed
Account1	Tenant2	Datastore Administrator	Grp1	Not allowed
Account1	Tenant2	Datastore Administrator	Grp3	Allowed

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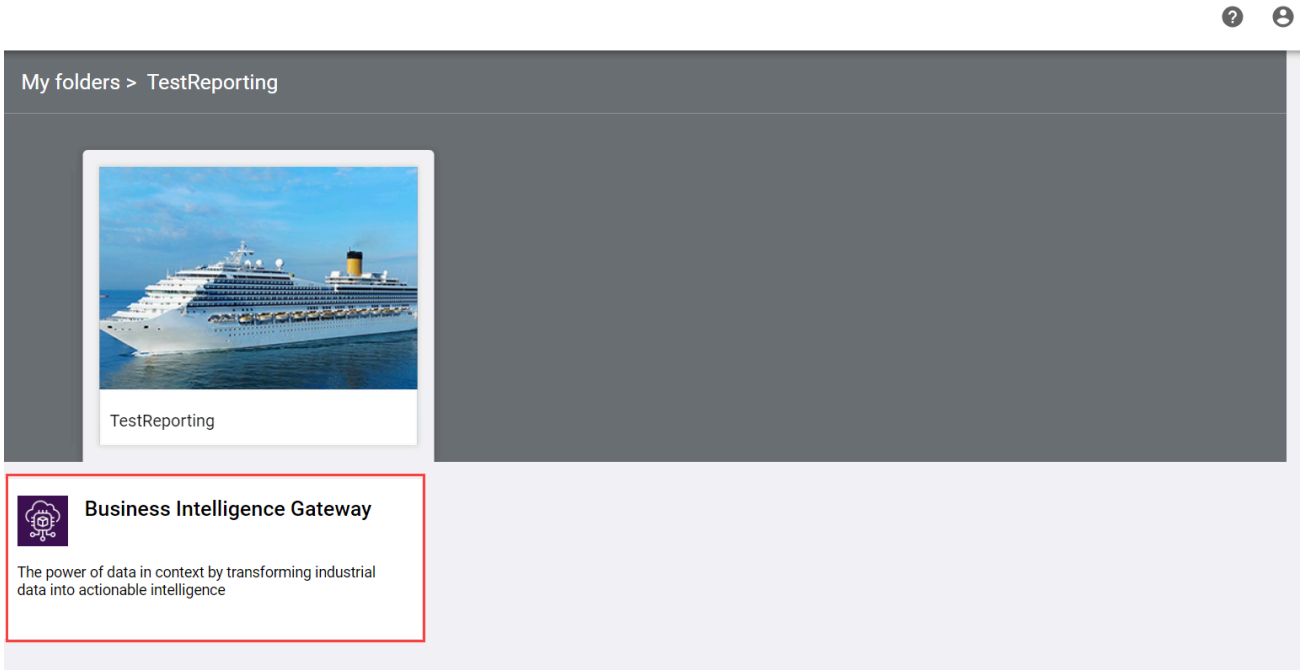
Account	Tenant	Role	Group	Mapping Eligibility
Account1	Tenant2	Reporting Analytics User	Grp4	Allowed

Configure the database

1. Return to the **Home** page from the task list and go to the tenant.

   Note: Only the user(s) with the Datastore - Administrator role can access the tenant model builder.



2. Under the profile icon, select **Whitelist Client IP**.

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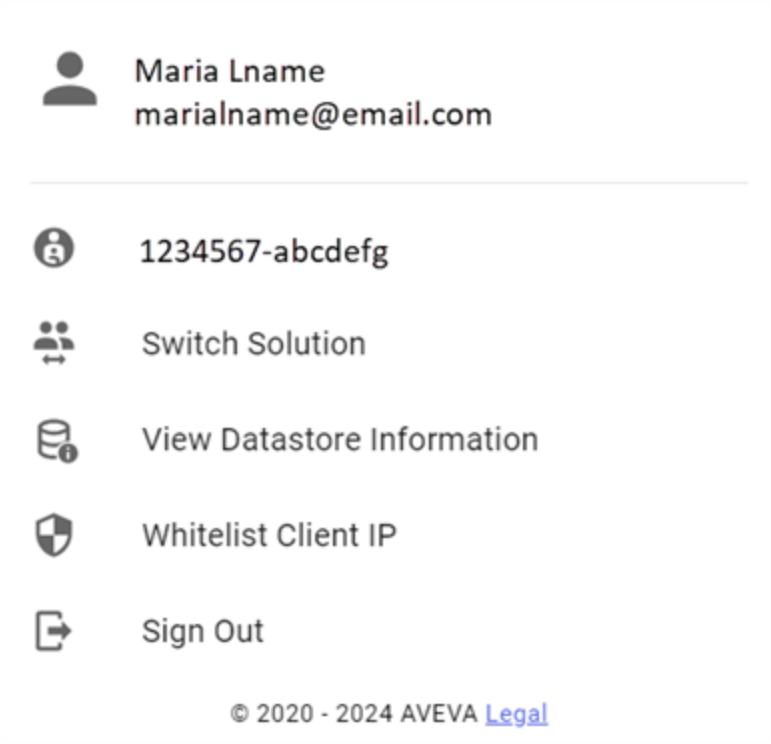

3. Add a new Firewall rule by pressing the **+** icon.

   You can add your own IP address for **Start IP** and **End IP**.
4. Under the profile icon, select **View Datastore Information**. You can copy the reporting database name and the reporting database service name from here.

5. Go to the program you use to configure databases. For example: Power BI, SQL Server or Management Studio.
6. Fill in the required information to connect to the server.

Use the Asset Information Management (AIM) register gateway with a Connection string to push the data into the tables in the server.

To get the Connection string for the AIM register gateway, raise a CDO request. You will then receive the information in an encrypted email.

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Video tour

Video tutorial: AVEVA BI Gateway product overview

https://player.vimeo.com/video/848800481?badge=0&autopause=0&player_id=0&app_id=58479

Video transcript (Select to expand)

Hello. Welcome to a short overview of AVEVA BI Gateway.

AVEVA BI Gateway is a web application with which you can build a BI Gateway model.

This model is a formal representation of the data sources, dimensions, and measures that are collectively called as BI Gateway "objects."

The model also represents the relationships and configurations of these objects.

A BI Gateway model is agnostic to any database schema and is optimized for manufacturing intelligence.

Data sources are the external source systems to which you can map the dimensions and measure fields in the model.

At run time, the data from the external source systems populates the dimensions and measures as per the mappings.

A dimension provides contextual information to measures in the model.

Each dimension typically stores related information.

For example, a product dimension can store the product ID, product name, and product description.

A measure is a group of calculations that shares the same context.

It consists of calculations for each source system, time-slice defined by time-slicing dimensions and the measure period, and for

each unique combination of static dimension

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context.

Typically, measures are metrics values computed from source systems and put into context with dimensions.

To know more about models, please read the AVEVA BI Gateway Help.

You can also go to the Video Tour page in the help for tutorial videos.

Thank you.

Video Tutorial - AVEVA BI Gateway UI Tour

https://player.vimeo.com/video/918429788?badge=0&autopause=0&player_id=0&app_id=58479

Video transcript (Select to expand)

Welcome!

This is a short demo on the AVEVA BI Gateway model builder user interface (UI).

Use the floating action buttons to create a model and create objects such as:data sources, in which you can create queries for the model; dimensions, which filter the data into qualitative categories; and measures, in which you decide how often to pull data from a data source via the refresh rate and update period.

You can import an existing model in the JSON file format if you do not need to create model objects from scratch.

You can also export a model in the same JSON file format.

You can deploy and undeploy the different objects within the model.

You can either deploy or undeploy specific objects, or the whole model itself.

Under Settings, you can configure and modify log types.

Visit the Video Tour page in the BI Gateway online help for video tutorials on each model object and other key features and functions.

For more information, view the online help, which opens in a different browser tab.

The User Information icon allows you to view the name of the user currently logged on to the system, the tenant ID,

datastore information, whitelist client IP, and the Copyright and Legal information.

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If you have access to multiple solutions, you can view the list of solutions and then switch to the required solution.

Lastly, you can sign out from the application.

This brings us to the end of the demo video.

Thank you.

Video tutorial: Create a data source in AVEVA BI Gateway

https://player.vimeo.com/video/948303902?badge=0&autopause=0&player_id=0&app_id=58479

Transcript (Select to Expand)

Welcome! This is a short demo of the Data Source object within the AVEVA BI Gateway Model Builder.

BI Gateway retrieves data from external data sources and provides this data to the reporting, analysis, and other visualization tools at the enterprise level.

Data sources are the external source systems to which you can map the dimensions and measure fields in the BI Gateway model at run time.

Let us look at how to add a data source.

We will begin with a data source with a custom query that sustains static dimension population.

The main purpose is to retrieve the asset collection from Insight Asset Model, which is specifically called the Common Intelligent Model (CIM).

In detail, we are looking to retrieve the list of assets configured through the Insight MES User Interface which are used for tracking operational utilization and OEE.

Go to the floating action button and click Data Source.

A new data source appears.

Let us call this one 'Generic REST API'.

Select Generic REST API as the Data Adapter type, and Bearer Token as the authentication type.

Fill in the URL and Token fields.

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You can retrieve this information from the Insight Solution.

The whole URL is split into two parts called the base URL and the ItemPath.

It is recommended to test the URL from an external tool such as Postman in order to properly address the different query parameters available as per the API endpoint.

Go to the Custom Queries tab and click the pencil icon, and then the + icon to create a custom query, which we will call ‘Asset'.

The query syntax is structured through four parts – the method, itempath, queryparameter, and APIType.

The adapter supports only the ‘get’ method.

Click the toggle button Preview Data to see the result set that the query returns.

As you can see, the data comes as a table result.

Let us now add a data source with a custom query that populates time-defining dimension.

The main purpose is to retrieve the utilization recorded as per each asset and subsequently populate the time-defining dimension with the event definition such as Asset ID, and utilization event starttime and endtime.

Once again, go to the floating action button, and click Data Source.

A new data source appears.

Let us call this one 'Insight'.

Select AVEVA Insight as the Data Adapter type.

Fill in the URL and Key fields.

You can retrieve this information from the Insight Solution.

In the Custom Queries tab, click the pencil icon and then the + icon to create a custom query 'UtilizationEvents'.

The query syntax is structured through few parts. Some parts are optional.

The query name should be configured with the API targeted endpoint.

The SelectColumn filter addresses the data source field that needs to be returned.

The Filter part conditions how to filter out the data.

The two parameters [RequestedStartTime] and [RequestedEndTime] within squared brackets are used as placeholders during execution for leveraging the incremental update mechanism.

It is recommended to filter the data from UtilizationEvents endpoint as per the LastModified datetime field.

Click the toggle button Preview Data to see the result set that the query returns. As you can see, the data comes as a table result.

Let us now add a custom query under the same data source 'Insight'.

This custom query supplies measure calculations.

The main purpose is to compute calculation leveraging Insight advanced retrieval mode, which means that is operated on the API side, such as the quantity of semi-finished goods measured by a flow meter.

The assigned tagnames should have a time-based engineering unit such as kg/h.

Click the pencil icon in the Custom Queries tab, and then the + icon.

Add the custom query ‘AnalogSummary’.

The query syntax is structured through two main parts: the main query and the nested query.

Let’s start with the nested query: It retrieves the eligible collection of tags

that match the filter condition.

Upon the Insight tagname configuration change, new configured tags are dynamically considered during the next

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execution.

The query name should be configured with the API targeted endpoint.

The SelectColumn filter addresses the data source field that needs to be returned.

The SelectColumn also supports field aliasing.

The Filter part conditions how to filter out the data.

The two parameters [RequestedStartTime] and [RequestedEndTime] within squared brackets are used as placeholders during execution for time slicing measure calculations.

You can preview your data by clicking on the Preview Data toggle button.

The query returns the integral calculation as per the list of tags within the specified StartDateTime and EndDateTime period.

Video tutorial: Create a regular dimension object in AVEVA BI Gateway

https://player.vimeo.com/video/848800426?badge=0&autopause=0&player_id=0&app_id=58479

Video transcript (Select to expand)

Welcome! This is a short demo of the Dimensions object within the AVEVA BI Gateway Model Builder.

A dimension provides contextual information to measures in the model.

Each dimension typically stores related information.

In this video, we will look at how to create a basic or a static dimension.

Let us look at how to create a basic dimension.

Go to the Floating Action Button (FAB) and click Dimension.

A new dimension appears.

Enter the name and description.

Next, go to Fields and select the pencil icon.

This step is important as we are now adding a data source to the dimension.

Select the data source icon.

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Search for the data source and click the checkbox.

The search result includes the custom queries within data sources and SQL table as well.

Select the required data source.

For this example, let us choose the Asset data source.

Click to select the Preview Source Data button.

The table set of the custom query appears.

Click OK.

The next step is to add fields to the dimension.

You can map the dimension fields to source data item fields.

You have to design the dimension by defining field name and map to the field name returned by the custom query selected.

As a best practice but still optional, it is recommended to keep the field name the same as the name provided from the custom query.

Define the fields that will become the primary key or contribute to a composite key, by clicking the toggle button.

The combination of the fields should contribute to the uniqueness of the record.

A combination of keys is called a composite key.

Once this is over, our Basic Dimension ‘Asset’ is created.

Since it is a basic dimension and there is no time-related information to the asset, you can select the appropriate refresh rate.

The options under the Advanced section are used for time-defining dimensions.

While you can use the Filter Expression option under the Filter section, it is less time-consuming to filter out data from the level of the data source into the custom query itself, rather than applying the filter on top of the whole result set returned by the data source, which subsequently eliminates more data.

The next step is to deploy the dimension.

The dimension has now changed from yellow to green which indicates that it is well configured, deployed and executed.

Note: 'Regular dimension' is the new term for 'static dimension' as of August 2023.

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Video tutorial: Create a time-defining dimension object in AVEVA BI Gateway

https://player.vimeo.com/video/848800410?badge=0&autopause=0&player_id=0&app_id=58479

Video transcript (Select to expand)

In this video, we will look at how to create a time-defining dimension, and then how to link two dimensions in a measure.

The initial dimension-creating process is the same as basic settings of the dimension:

Go to the Floating Action Button (FAB) and click Dimension.

Enter the name and description.

Go to Fields and select the pencil icon.

Then, select the data source icon.

Search for the data source and click the checkbox.

Select the required data source.

For this example, let us choose the Work Order data source.

Click to select the Preview Source Data button.

The table set of the custom query appears.

Click OK.

The next step is to add fields to the time-defining dimension.

The WorkOrderID custom query retrieves and returns records in an organized and timely manner, based on the StartTime and EndTime specified.

Hence, you will have to the make Plant, Asset, and also StartTime to contribute to the uniqueness of the composite keys.

Go to the Advanced section of the dimension and select the Time Slicing checkbox.

This is important, as the dimension is a time-contextual contributor to the measure and enforces the measure calculation to be time-sliced as per the work order events.

The Incremental Update is optional but recommended for a large data set.

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You can backfill the dimension from a specified date called Data Collection Start.

In BI Gateway, you have to define the relationship between the time defining dimension and the Asset dimension under the Links section, if they have a common field that needs to be mapped from each other.

This step is particularly important to enable the ContextLink feature in a measure object.

To create a new link, go to the Links section of the dimension selected.

In this video, we are still at the WorkOrder_TimeDefiningDimension.

Click the plus icon and rename as required.

The default name contains 'FK' which means foreign key, which is the opposite of the primary key.

The Foreign key points to the destination dimension, which in this case is the Asset_Dimension.

Choose and verify the dimension fields.

The link should be well configured when you have to define the context of a measure.

Create a measure and go to the Context section.

Select the dimensions to define the measure context.

Click the toggle button to enable the link.

It is crucial to have earlier defined the dimension link before, as we did in this video.

This brings us to the end of our dimensions object demo video.

Thank you.

Video tutorial: Introduction to AVEVA BI Gateway measures

https://player.vimeo.com/video/852660200?badge=0&autopause=0&player_id=0&app_id=58479

Video transcript (Select to expand)

Hello.

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Welcome to the demo of the Measures object within the AVEVA BI Gateway Model Builder.

A measure is a group of calculations that shares the same context.

It consists of calculations for each source system, time period, and for each unique combination of dimension value.

Measures are typically numerical values computed from source systems and put into context with dimensions.

You can configure measures by defining which calculations need to be computed, along with the context (dimensions) to which the calculations are related.

Go to the Floating Action Button (FAB) and click 'Measure.'

Enter the name and description as required.

Under 'Refresh Rate,' define how the measure instance will be executed.

The refresh rate recomputes calculations for the current time-slice and also verifies whether a new time-slice must be defined.

For this example, I will set the refresh rate as one hour with 15-minute offset.

This means that from the top of the hour, the dimension objects are refreshed every 1 hour and 15 minutes, and the measure is refreshed after the completion of all the dimensions refresh.

It is important to delay the refresh by 15 or 20 minutes, otherwise the dimension execution refresh will overlap with the measure refresh, and may cause temporary issues within the data consistency standpoint.

Next, define the 'Update Period' as required.

In addition to the Refresh Rate, the Update Period defines how much data is updated in the measure table.

For example, if you configure a Measure object with a refresh rate of 15 minutes and an update period of 1 hour, every 15 minutes the BI Gateway services update the last hour of data in the measure table.

The Measure Period is the largest bucket of time that the system considers for slicing the data.

You can configure a measure period, which forces the computation of the measure calculations at the specified period.

For example, a measure object configured with a measure period of one hour stores calculations in the measure table for every hour since the data collection start.

From the Measure Period, you can see smaller time slices with a given hour because of the influence of the contextual time-defining dimensions.

The 'Data collection start' parameter under 'Data Backfill' is the datetime that you would like to compute or to perform a reverse backfill computation that will compute all the calculations.

Typically, measure tables are updated with time, adding records for every time-slice defined by time-slicing dimensions and the measure period. As such, measure tables are updated incrementally,from the time defined by the data collection start-time.

The data collection starts from reverse up to the point of the specified data collection start-time.

So, it starts at the most recent time slices sticking, near real time and then it goes in reverse to reach the specified date.

Once you save the general input, go to the 'Context' tab.

Here, we will add the dimensions to configure for the Measure's calculation context.

Please note, you would have had to create a context link relationship within an asset model dimension and a time-defining dimension prior to this process.

Click the button 'Add Dimension.'

Select the asset model dimension from the context link relationship that you created earlier.

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Click ‘Add Dimension’ once again.

This time, select the time-defining dimension from the same context link relationship.

In this instance, I choose WorkOrder_Dimension.

You can edit the alias as required.

It is recommended to keep the Foreign Key name as simple as possible, like removing the number.

Click the context link toggle button next to your asset model dimension.

Once enabled, this feature restricts the influence of time-defining dimensions on only the asset populated within.

You will not be able to click the toggle button next to your dimension in some certain cases due to dimension configuration missing.

You can create a calculation on your own.

Click ‘Edit Calculations’.

Click the Add + button.

Enter the calculation name and select ‘Aggregate’ as the calculation type; the calculation type is ‘aggregate’ when the calculation belongs to the function that you use for aggregating the data.

So, you have to select a given custom query that provides the right information from the data adapter.

Click the pencil icon next to Source Data Items, to select the custom query that provides the required information from the data adapter.

In this example, I will select the Insight custom query 'EnergyElectricity'.

Click the checkbox and click the toggle button to preview the source data.

Then, fill in the following criteria in this order: Function,

Calculation field, Return type, and Period field.

The next step is to define the context relationship mapping with the calculation result set: Save your calculation.

This brings us to the end of the demo video for the Measures object in the AVEVA BI Gateway Model Builder.

Thank you.

Video tutorial: Configure AVEVA BI Gateway to Power BI

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https://player.vimeo.com/video/894970131?badge=0&autopause=0&player_id=0&app_id=58479

Transcript

Hello. Welcome to this demo video on AVEVA BI Gateway and Power BI.

This tutorial will show you how to configure a BI Gateway model database to the Microsoft Power BI application.

There are some prerequisites that must be in check before configuring your database to Power BI.

You should have created a tenant, assigned groups and roles, and whitelisted your domain.

You can visit the section 'Report a Database Configuration' within the AVEVA BI Gateway Online Help to learn more on each of these prerequisites.

We can now configure our BI Gateway model database to Power BI.

Within your model builder, go to the profile icon.

Select View Datastore Information.

The datastore server name and datastore name appear, which you will use to configure the database to Power BI.

Go to the Power BI Desktop application.

Next, select Get Data from the Home menu tab.

Then, under Azure, select Azure SQL Database OR Azure Synapse Analytical SQL.

Paste or enter the server name and datastore name that you had earlier saved.

Even though it says that the database name is 'optional', it is required to enter that information, as default databases don't exist within Azure SQL databases.

Click to select the Import option. This makes the dashboard design experience through Power BI more responsive because it preloads the data set, and then you can work with the data without having to permanently pull data from the database.

The Navigator opens with a checklist of all the objects in the database.

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Retrieve all the object names that match your model.

Once you have selected the required object names, select Transform Data.

You will automatically be taken to the Power BI Query Editor page.

Here, we extract, transform and load data.

This is also commonly known as Data ETL.

You can rename the fields in the columns based on your requirement.

You can also remove certain fields that are not needed, as they cause visual clutter when you explore your database.

Select the column(s) you do not require, right-click and say Remove Column.

Once you have made the required changes, select Close and Apply.

You are taken back to the Power BI application main page.

Confirm by selecting Apply Changes. The removed objects are no more available in the Data panel.

The next step is important as we are going to link our objects to one another.

Under the Modeling menu tab, select Manage relationships.

Start with the measure; for each measure you have to link the appropriate dimensions.

Ensure that the Cardinality is Many to one. Many records in the measure can point to a single record in the dimension.

Repeat this for all other dimensions.

Once we have configured the data and defined the relationships between measure and dimension, we can visualize our data as required.

Please note, the following demonstration is only one way of data visualization, and it is not necessary to follow the exact steps.

Select Model View.

The visualization in the form of a star schema appears.

The measure is the pillar of the model, surrounded by all the static and time-defining dimensions of the model.

There are some parent-child relationships within the dimensions themselves.

Now, we will look at how to create an additional calculation within the Power BI Desktop itself.

Select Measure and right-click to select New Column.

I will call the new column ‘ProductionTotal’.

Enter the formula: ProductionTotal = ProductionQtyBad + ProductionQtyGood.

A new column is created under the Measure Object.

Please note: any additional calculations created in Power BI will not be reflected in the BI Gateway Model builder.

To look at another example, let's create a KPI.

EnergyIntensity = EnergyElectricity / ProductionTotal.

To save your file, save your file in the .pbix format.

You can publish your file against Power BI Services, which is the Cloud application of Power BI.

This is optional, and by publishing your file, it will be made available for anyone who needs to consume it.

Select Publish from the Home menu.

Select the destination.

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The report and the dataset are both automatically published to the destination.

To connect to a published datasource from Power BI Services, select Get Data from the Home menu tab.

Then, under Microsoft Fabric, select Power BI Datasets.

Select the file from the list provided.

The dataset comes under the Data panel.

This chart is an example of data visualization available in Power BI.

Please note: the example is provided in dark mode.

Power BI can be accessed in light mode and dark mode.

You have the option to define the period start time and period end time and filter the data according to the criteria provided in the list.

Because of the well-defined relationships among the objects, it is easy to select and filter our data, and restrict the measure for more accurate visualization.

With that, we come to the end of the demo video.

Thank you.

Video tutorial: Configure AVEVA BI Gateway to Tableau

https://player.vimeo.com/video/900140253?badge=0&autopause=0&player_id=0&app_id=58479

Transcript

Welcome to this demo video on AVEVA BI Gateway and Tableau.

This tutorial will show you how to configure a BI Gateway model database to the Tableau application.

There are some prerequisites that must be in check before configuring your database to Tableau.

You should have created a tenant, assigned groups and roles, whitelisted your domain, and, whitelisted your IP.

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You can visit the section ‘Report a Database Configuration’ within the

AVEVA BI Gateway Online Help to learn more on each of these prerequisites.

To install Tableau Desktop, visit the official Tableau site www.tableau.com.

Log in with your credentials, or else create an account if you do not have one already.

Once you have created or logged into your account, you can download tableau onto your system.

We can now configure our BI Gateway model database to Tableau.

Within your BI Gateway model builder from AVEVA Connect, go to the profile icon.

Select 'View Datastore Information'.

The datastore server name and datastore name appear, which you will use to configure the database to Tableau.

Have these copied or saved in your system.

Go to the Tableau Desktop application.

From the Connect section, select an option under ‘To the Server’.

You can select Azure Synapse Analytics.

Paste or enter the server name and datastore name that you had earlier saved.

Under Authentication, select Active Directory Password.

Enter your username and password, and then sign in.

The next step is important as we are going to link our objects to one another.

As you can see on the screen, the list of objects is within the Data Table pane.

Start with the Measure; drag the measure object from the table list to the Tableau canvas.

Now, we’ll start to link our dimension objects to the measure.

For example, the asset dimension.

Drag the asset object to the canvas.

You need to link the appropriate foreign key to the Asset. Under this measure dropdown list, select 'FK Asset', and under asset, select 'aaID Asset'.

Search within the list for the objects that exactly match to the objects within your BI Gateway model builder, and repeat this for all other dimensions. Click on 'Update now' to review the data.

To organize the data source, click on Sheet 1.

You will automatically be taken to the Tableau workspace page.

You can rename the fields in the columns based on your requirements.

You can hide certain fields that are not needed, such as system fields, as they cause visual clutter when you explore your database.

You can also group by folder and functionally organize the different fields by domain of expertise with the appropriate operational naming that may differ from the model design naming.

This KPI is an example of a combination of fields to create a calculated field.

You can create calculated fields from existing objects as per your requirements.

Let’s now look at how to save and publish a Tableau Desktop File to Tableau Cloud.

Before publishing the file onto Tableau Cloud, extract the data.

Right-click at the datastore name and select 'Extract Data'.

Save the local .hyper file onto your system.

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Next, go to the Server menu option and select 'Sign in' if you haven't already.

Once you are signed in, you can publish the datasource. Server > Publish Datasource > datastore.

Select the location wherein you want to publish the tableau file.

Edit to allow for refresh access. This means that Tableau Cloud can invoke the datasource, retrieve the data, and regularly refresh the data to keep the datasource within Tableau Cloud up to date.

Click Publish.

You are taken to Tableau Cloud. You can schedule the refresh or close the pop-up based on your requirements.

To connect to a Published Datasource from Tableau Cloud, select 'Tableau Server' from the Connect tab within the desktop application and select the required datasource from the list provided.

Once you have published the datasource against Tableau Cloud, you can launch it on the desktop application and start to design your dashboard.

This dashboard is an example of the Energy Management System.

You can navigate within the dashboard to filter through and analyze the dimension objects.

Because of the well-defined relationships among the objects, it is easy to select and filter out data, and restrict the measure for more accurate visualization.

This brings us to the end of the demo video.

Thank you.

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Data sources

AVEVA BI Gateway retrieves data from external data sources and provides this data to the reporting, analysis, and other visualization tools at the enterprise level.

Data sources are the external source systems to which you can map the dimensions and measures fields in the AVEVA BI Gateway model. At run time, the data from the external source systems populate the dimensions and measures as per the mappings.

Data adapters are plug-in components that provide connectivity and retrieval from the data sources. The available data adapters support data sources such as AVEVA Insight and Microsoft Azure SQL Database.

The AVEVA Insight Data Adapter is used to retrieve data from AVEVA Insight. The AVEVA Insight Data Adapter requires Custom Queries to be defined. The connection information required by the AVEVA Insight Data Adapter to connect to the AVEVA Insight Data Source uses bearer token authentication.

You must configure the Data Source objects to provide connection information to the external data source systems. Only deployed data sources are available at run time to the dependent dimensions and measures for data collection.

Manage data sources

You can manage a data source using the Data Source editor.

The Data Source editor allows you to:

- Add a data source
- Edit a data source
- Deploy and undeploy a data source
- Delete a data source
- Retrieve the schema
- Use custom queries
- Use engineering units
- Time zone for a data source

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Video tutorial: Configure AVEVA BI Gateway data sources

https://player.vimeo.com/video/848800459?badge=0&autopause=0&player_id=0&app_id=58479

Video transcript (Select to expand)

Welcome! This is a short demo of the Data Source object within the AVEVA Insight BI Gateway Model Builder.

BI Gateway retrieves data from external data sources and provides this data to the reporting, analysis, and other visualization tools at the enterprise level.

Data sources are the external source systems to which you can map the dimensions and measure fields in the BI Gateway model at run time.

Let us look at how to add a data source.

We will begin with a data source with a custom query that sustains static dimension population.

The main purpose is to retrieve the asset collection from Insight Asset Model, which is specifically called the Common Intelligent Model (CIM).

In detail, we are looking to retrieve the list of assets configured through the Insight MES User Interface which are used for tracking operational utilization and OEE.

Go to the Floating Action Button (FAB) and click Data Source.

A new data source appears.

Let us call this one 'Generic REST API'.

Select Generic REST API as the Data Adapter type, and Bearer Token as the authentication type.

Fill in the URL and Token fields.

You can retrieve this information from the Insight Solution.

The whole URL is split into two parts called the base URL and the ItemPath.

It is recommended to test the URL from an external tool such as Postman in order to properly address the different query parameters available as per the API endpoint.

Go to the Custom Queries tab and click the pencil icon, and then the + icon to create a custom query, which we will call 'Asset'.

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The query syntax is structured through four parts – the method, itempath, queryparameter, and APIType.

The adapter supports only the ‘get’ method.

Click the toggle button Preview Data to see the result set that the query returns.

As you can see, the data comes as a table result.

Let us now add a data source with a custom query that populates time defining dimension.

The main purpose is to retrieve the utilization recorded as per each asset and subsequently populate the time-defining dimension with the event definition such as Asset ID, and utilization event starttime and endtime.

Once again, go to the Floating Action Button (FAB), and click Data Source.

A new data source appears.

Let us call this one 'Insight'.

Select AVEVA Insight as the Data Adapter type.

Fill in the URL and Key fields.

You can retrieve this information from the Insight Solution.

In the Custom Queries tab, click the pencil icon and then the + icon to create a custom query 'UtilizationEvents'.

The query syntax is structured through few parts. Some parts are optional.

The query name should be configured with the API targeted endpoint.

The SelectColumn filter addresses the data source field that needs to be returned.

The Filter part conditions how to filter out the data.

The two parameters [RequestedStartTime] and [RequestedEndTime] within squared brackets are used as placeholders during execution for leveraging the incremental update mechanism.

It is recommended to filter the data from UtilizationEvents endpoint as per the LastModified datetime field.

Click the toggle button Preview Data to see the result set that the query returns. As you can see, the data comes as a table result.

Let us now add a custom query under the same data source 'Insight'.

This custom query supplies measure calculations.

The main purpose is to compute calculation leveraging Insight advanced retrieval mode, which means that is operated on the API side, such as the quantity of semi-finished goods measured by a flow meter.

The assigned tagnames should have a time-based engineering unit such as kg/h.

Click the pencil icon in the Custom Queries tab, and then the + icon.

Add the custom query ‘AnalogSummary’.

The query syntax is structured through two main parts: the main query and the nested query.

Let’s start with the nested query: It retrieves the eligible collection of tags that match the filter condition.

Upon the Insight tagname configuration change, new configured tags are dynamically considered during the next execution.

The query name should be configured with the API targeted endpoint.

The SelectColumn filter addresses the data source field that needs to be returned.

The SelectColumn also supports field aliasing.

The Filter part conditions how to filter out the data.

The two parameters [RequestedStartTime] and [RequestedEndTime] within squared brackets are used as placeholders during execution for time slicing measure calculations.

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You can preview your data by clicking on the Preview Data toggle button.

The query returns the integral calculation as per the list of tags within the specified StartDateTime and EndDateTime period.

This video focuses on the Data Source object and provides instructions to create different types of data sources.

Configuration workflow

Add a data source
Edit a data source
Deploy and undeploy a data source
Delete a data source
Retrieve the schema
Use custom queries
Use engineering units
Time zone for a data source

Add a data source

You can add a data source that allows you to map the dimensions and measures fields in the AVEVA BI Gateway model.

Add a data source

1. Open the AVEVA BI Gateway Model Builder.
2. Click the **Add** icon in the **Floating Action Buttons** menu and then click the **Data Source** icon. A new data source is added in the AVEVA BI Gateway model with a default name, and the Data Source editor appears in the right pane.
3. Click the **General** tab, and then do the following:
   a. In the **Name** box, type a new name for the data source. The data source name must be unique and can have a maximum length of 32 characters.
   b. In the **Description** box, type a description for the data source. The description must be less than 1024 characters.
4. In the **Data Adapter Service** section, select one of the following in the **Data Adapter Type** list:
   - Select **AVEVA Insight** if you want to use AVEVA Insight as a data source. For more information about AVEVA Insight, refer to the AVEVA Insight Help.
   - Select **Microsoft Azure SQL Database** if you want to use Microsoft Azure SQL Database as a data source.
   - Select **Generic Rest API** if you want to use Generic Rest API as a data source.
5. In the **Data Source Configuration** section, enter the configuration details for AVEVA Insight, Microsoft Azure SQL Database, or Generic REST API.
   - For information on configuring an AVEVA Insight connection, see Configure the AVEVA Insight

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connection.

- For information on configuring a Microsoft Azure SQL Database connection, see Configure the Microsoft Azure SQL database connection.
- For information on configuring a Generic Rest API connection, see Configure the Generic REST API connection.

6. Click **Connect**. If the connection succeeds, the Getting schema notification message appears. It can take a few minutes to validate the datasource connection.
7. Click **Done** and then click **Save**.

Security guidelines for source databases

When configuring a data source in the AVEVA BI Gateway Model Builder, it is a security best practice to use an account that only has read permissions to the data source. If the use of Stored Procedures is required (for example, Custom Queries), you may need to grant that account Execute permissions to these particular stored procedures, on top of the read-only permission. Ensure proper testing during the AVEVA BI Gateway Model design.

Edit a data source

You can edit any deployed or undeployed data source.

Edit a data source

1. Open the AVEVA BI Gateway Model Builder.
2. Under the **Data Sources** column, click the data source that you want to edit. The data source editor appears in the right pane with the selected data source details.
3. Do the required modifications.
4. Click **Save**.

Deploy and undeploy a data source

You deploy the data source to AVEVA BI Gateway. Data from deployed data sources is available to deployed dependent dimensions and measures at run time. Ensure that you have defined the data source with the AVEVA BI Gateway node name before deploying the data source.

Deploy a data source

1. Open the AVEVA BI Gateway Model Builder.
2. Under the **Data Sources** column, click the data source that you want to deploy. The Data source editor appears in the right pane with the selected data source details.
3. On the **Action** menu, click the **Deploy** icon. After the successful deployment, a notification message appears and the deploy status next to the data source name changes from **Yellow** to **Blue**.

Undeploy a data source

1. Open the AVEVA BI Gateway Model Builder.

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2. Under the **Data Sources** column, click the data source that you want to undeploy. The Data source editor appears in the right pane with the selected data source details.
3. On the **Action** menu, click the **Undeploy** icon. After the successful undeployment, a notification message appears and the deploy status next to the data source name changes from **Blue** to **Yellow**.

Delete a data source

You can delete a data source that is not deployed or is not referenced by a dependent dimension or measure.

Delete a data source

1. Open the AVEVA BI Gateway Model Builder.
2. Under the **Data Sources** column, click the data source that you want to delete.
3. On the **Action** menu, click the **Delete** icon. A confirmation message appears.

   NOTE: The **Delete** button in the Data Source editor is available only when the selected data source is undeployed.
4. Click **Delete**.

   The selected data source gets deleted successfully.

Retrieve the schema

You can retrieve the source data items using the data source connection information using the **Connect** button. If you have defined any custom queries, the **Connect** button will re-compute the custom queries source data items.

Retrieval operations in order of execution are:

- Clearing the cached version of the schema within the data source.
- Retrieving the source data item names from the configured source.
- Retrieving schema field(s) one source data item at a time.

Use custom queries

You can add, rename, and build custom query expressions, and delete custom queries in a data source.

You can build custom query expressions to create custom source data items for an external data source system. Custom source data items help you to prepare and optimize the data structure of the external source system for data extraction operations required by the AVEVA BI Gateway model.

Add custom queries to a data source

You can add any number of custom queries to a data source.

Add a custom query to a data source

1. Click the **Custom Queries** tab and then click **Edit**. The **Custom Queries** page appears.

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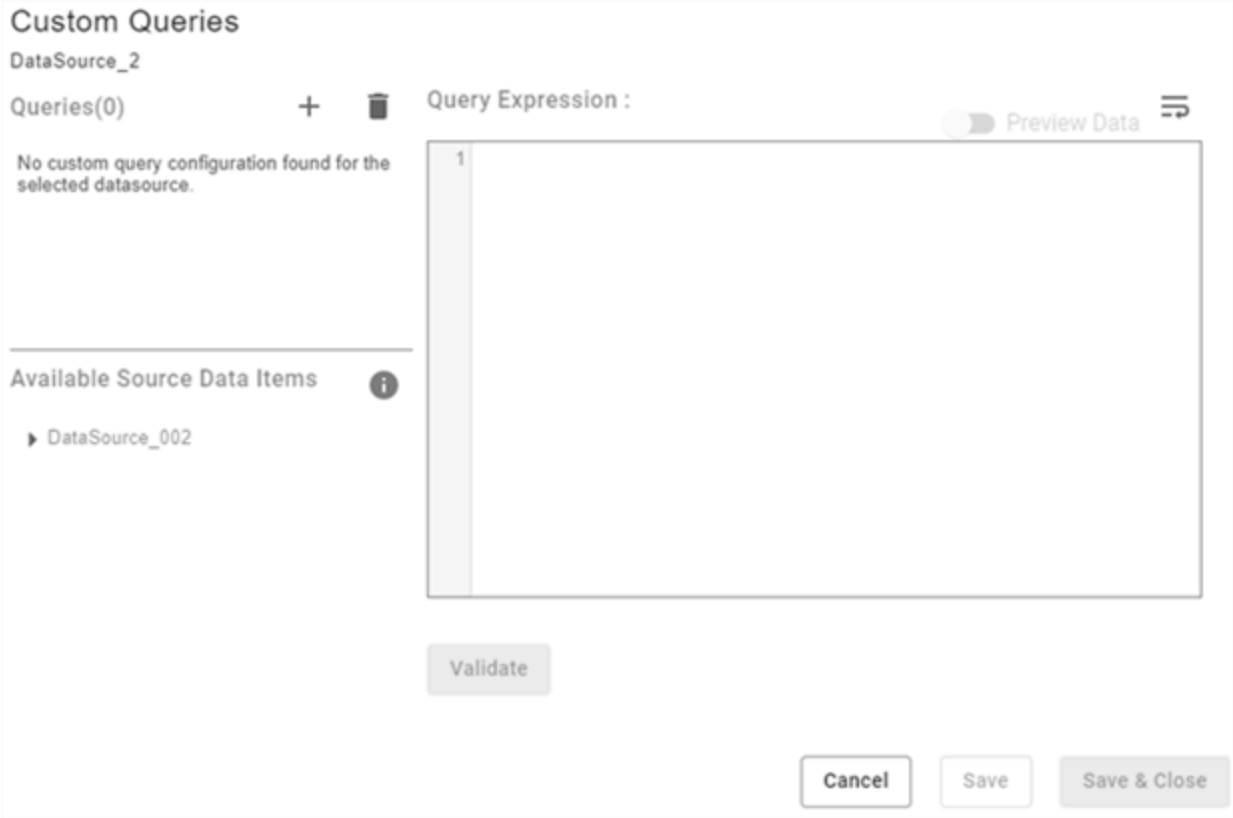

2. In the **Queries** area, click the **Add +** icon to add a custom query. A custom query with a default name is added in the Queries pane. You can update the default query name.

   For more information about renaming a custom query, see Renaming a Custom Query.
3. Click **Save**.

Delete a custom query

You can delete a custom query in the Queries pane. After you save the data source, the system shows a warning message about the dependent dimensions and measures that could be affected by the custom query deletion.

Delete a custom query

1. Under the **Data Sources** column, click the data source of which you want to delete the custom query. The data source editor appears.
2. Click the **Custom Queries** tab and then click the **Edit** icon. The **Custom Queries** page appears.
3. Under the **Queries** area, select the Custom Queries that you want to delete.
4. Click the **Delete** icon. A confirmation message appears.
5. Click **Delete**.

Rename a custom query

The custom query name must be unique within the data source object. The custom query name:

- Can have a maximum length of 100 characters.

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- Follows the Microsoft SQL Server naming conventions.
- Follows the AVEVA BI Gateway database restrictions and should not be a AVEVA BI Gateway database reserved name.
- Is case insensitive.
- Must have a letter or an underscore (_) as the first character.

Rename a custom query

1. In the Data Source editor, click the **Custom Queries** tab and then click the **Edit** icon. The **Custom Queries** page appears.
2. In the **Queries** area, click the custom query that you want to rename, and then type a new name for the custom query.
3. Click **Save**.

Build a custom query expression to create custom source data items

You can build a custom query expression to create custom source data items from AVEVA Insight. Custom source data items help you to prepare and optimize the data structure of the external source system for data extraction operations required by the AVEVA BI Gateway model.

For example, you can build a custom query to combine the information from multiple source data items into a single one, such as merging shift descriptions with the operational schedule.

Build a custom query expression

1. Under the **Data Sources** tab, click the data source for which you want to build a custom query expression. The **data source** editor appears.
2. Click the **Custom Queries** tab and then click the **Edit** icon. The **Custom Queries** page appears. The **Available Source Data Items** pane shows the source data items of the current data source. You can expand the source data items to view the fields, along with the field type, within the source data item.
3. In the **Queries** area, click a custom query for which you want to build a custom query expression.
4. Click **Validate** to manually validate the custom query expression syntax.
5. You can slide to enable the **Preview Data** option. If the query validation succeeds, the data preview area below the **Query Expression** editor shows the top ten data rows from the data source.

   You can use a valid JSON expression to create a custom query.

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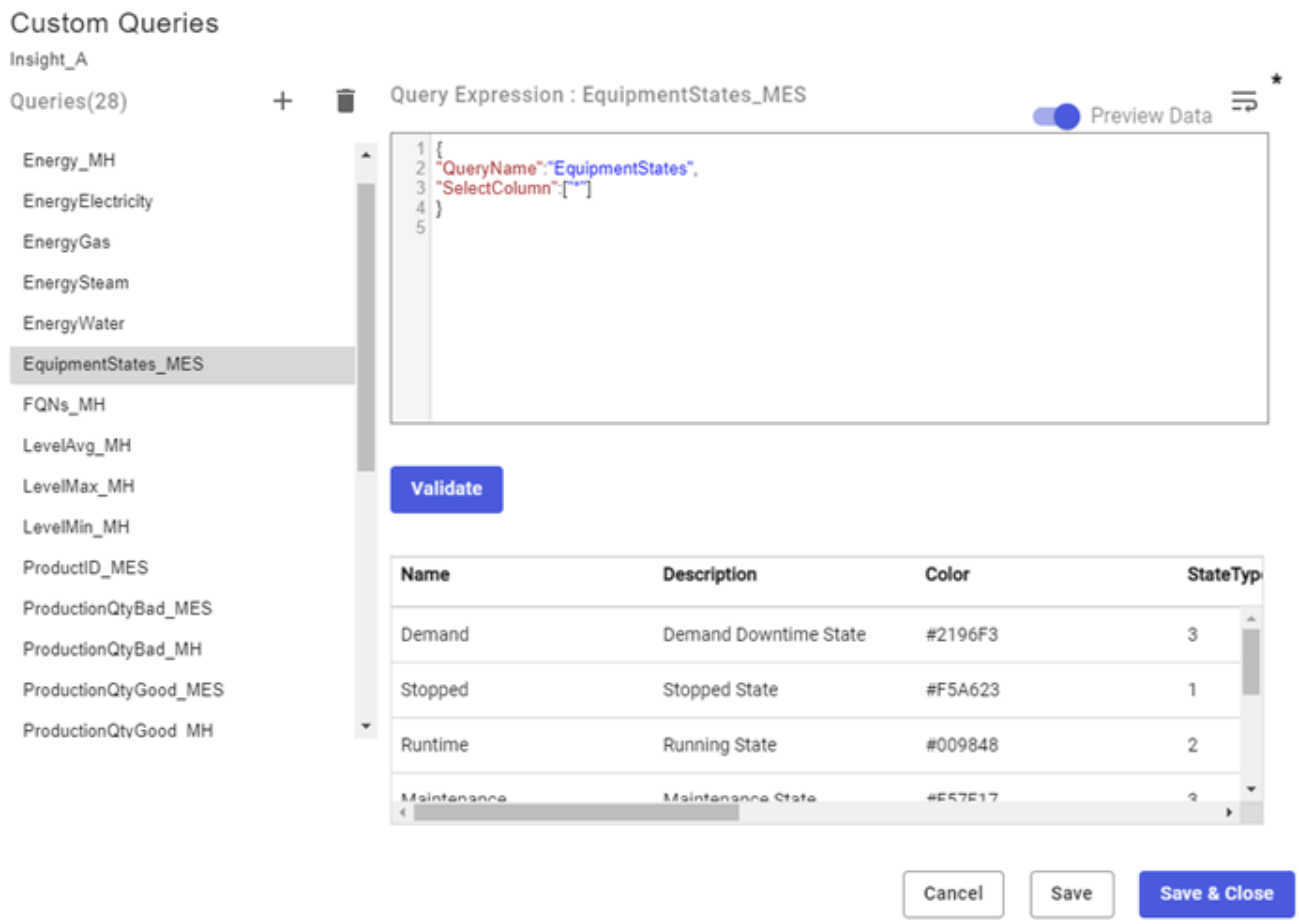

Note:
- A JSON expression must have "QueryName". This is a mandatory parameter name. Query name denotes the name of the custom query defined under the Azure function.
- The other common parameter is "SelectColumn" and is an optional parameter to specify required columns.
- The query returns all the properties (columns) when it is not specified in the query expression or when it is specified, such as SelectColumn: ["*"].
- Apart from the "QueryName" and "SelectColumn" parameter, other parameters are query-specific parameter(s).
- A query expression is case insensitive.

6. Click **Save**. The system automatically validates the custom query syntax after you save the data source.

Use BI Gateway keywords in a custom query

Two special AVEVA BI Gateway keywords are available for you to use in custom queries:

- [[RequestedStartTime]]: This is evaluated by the data adapter based on the requested start time from the AVEVA BI Gateway.
- [[RequestedEndTime]]: This is evaluated by the data adapter based on the requested end time from the AVEVA BI Gateway.

Note: Custom queries built with these keywords are used for measure calculations only. They should not be used for a dimension because they are not translated into a time-slice.

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The AVEVA BI Gateway has a specific requested start and end time based on the time-slicing calculation that is made by using the Measure object's configuration.

Use stored procedures in a custom query

You can use stored procedures in a custom query for a Microsoft Azure SQL Server data source only.

You must use a different syntax to execute stored procedures than you would for regular custom queries. This is due to the different execution paths that occur when the query is executed against the data source. The stored procedure syntax:

- Must start with the EXEC statement. Spaces and line breaks preceding this keyword are allowed, however.
- May take zero or multiple parameters.
- Is case-insensitive unless the database itself is set to be case-sensitive.

The following is a list of examples:

```
EXEC usp_storedProcName
EXEC dbo.usp_storedProcName 1, 'abc'
EXEC myDb.dbo.usp_storedProcName @param1 = 1, @param2 = 'abc'
```

Stored procedures can also use the [[RequestedStartTime]] and [[RequestedEndTime]] keywords in place of their parameter values. This allows the value to be dynamic. Two examples are:

```
EXEC usp_storedProcName @param1 = [[RequestedStartTime]]
EXEC usp_storedProcName @param1 = [[RequestedStartTime]], @param2 = [[RequestedEndTime]]
```

- For more information on these keywords, see "Using BI Gateway Keywords in a Custom Query".

SQL comments, such as ones starting with a double hyphen (-- comment) or within comment blocks (/*…*/), that precede the EXEC statement are not supported. For example, the following query will fail because the query does not start with the EXEC statement:

```
-- Code Comment;
EXEC usp_storedprocName
```

You will get an error or invalid syntax message if you create an invalid query or try to use an EXEC statement with a data adapter other than the SQL Server data adapter. A warning will also be logged to the Application Insight.

If you change a stored procedure used by a deployed data source, you must redeploy the data source.

Required modifications to stored procedures

There are two scenarios that require a slight modification to stored procedures:

- **Stored procedures that use temporary tables**
- **Stored procedures that return a different schema depending on the value of the passed parameter**

For these scenarios, use the SET FMTONLY OFF setting at the top of the stored procedure that your custom query will call.

For example:

```
CREATE PROCEDURE usp_Sample
( @x varchar(10) )
```

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```
AS
SET FMTONLY OFF;
... --body of procedure
```

By adding the SET FMTONLY OFF setting at the top of the stored procedure, temporary tables can be used, and only the schema that is retrieved depending on the parameter value will be returned by the data adapter. For more information, see "Limitations When Using Stored Procedures".

Limitations when using stored procedures

The following limitations apply to stored procedures in custom queries.

- The stored procedure must return at least an empty record set. If the stored procedure does not return anything (not even an empty record set), then the data source preview will be empty and the following message appears: "The Stored Procedure that was used in the custom query did not return any schema information. Try running the stored procedure directly to ensure that it returns at least an empty recordset." At run time, the same message appears in the Application Insight. However, access to the Application Insight Logger is available only to DevOps.
- Stored procedures that use "out" parameters are not supported.
- Stored procedures that return multiple result sets are not supported.
- For the result set data, some SQL Server data types are not supported or a data type conversion is performed by the data adapter. For more information, see "Supported Data Types for Stored Procedures."
- Stored procedures that use temporary tables are supported if they include the SET FMTONLY OFF setting at the top of the stored procedure. For a sample example, see "Required Modifications to Stored Procedures."
- If the SET FMTONLY OFF setting is not included, the AVEVA BI Gateway data adapter will return an error during the preview. If the custom query is executed at run time, the Application Insight will also log an error with a message indicating that the <name of the temporary table> cannot be found.
- Stored procedures that have multiple branches (multiple IF statements)—where one branch returns a different schema than another branch—are not supported unless the stored procedure can be modified or if only the first branch is exercised when the stored procedure executes.

To illustrate an example of a stored procedure that has multiple branches where each branch returns a different schema, examine the code below:

```
IF @X = 'Good'
   SELECT * FROM Production_Good
ELSE
   SELECT * FROM Production_Bad
```

In this case, the data adapter query succeeds if one of the following conditions are true:

- If the custom query passes @x = 'Good'. This query would succeed because passing 'Good' as the value to parameter @x would exercise the first returned result set. If, however, another value would be passed, then the ELSE block would get executed. In this case, you would get an error stating that the Column name or number of supplied values does not match the table definition. This is because the OLEDB data adapter sets the FMTONLY setting to ON, which retrieves all result sets for all branches, and the OLEDB data adapter will only accept the first result set as its returned schema definition. Therefore we recommend that you do not use stored procedures that return different result sets depending on which branch was executed.
- If the SET FMTONLY OFF setting is included at the top of the stored procedure, then either branch can be executed successfully, and this limitation is resolved. For more information, see "Required Modifications to

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Stored Procedures."

- Stored procedures that include the WITH RESULT SETS option are not supported.
- Stored procedures that include the USE clause are not supported.

Supported data types for stored procedures

When a stored procedure returns data through the data adapter, not all SQL Server data types are supported. The following table indicates which data types are supported:

Data Source Data Type	Supported	Converted into
[bigint]	Yes	[bigint]
[binary]	Yes	[nvarchar](4000)
[bit]	Yes	[bit]
[char]	Yes	[nvarchar](4000)
[date]	Yes	[datetime]
[datetime]	Yes	[datetime]
[datetime2]	Yes	[datetime]
[datetimeoffset]	Yes	[nvarchar](4000)
[decimal]	Yes	[decimal](38,15)
[float]	Yes	[float]
[geography]	No	-
[geometry]	No	-
[hierarchyid]	No	-
[image]	No	-
[int]	Yes	[int]
[money]	Yes	[decimal](38,15)
[nchar]	Yes	[nvarchar](4000)
[ntext]	Yes	[nvarchar](4000)
[numeric]	Yes	[decimal](38,15)
[nvarchar]	Yes	[nvarchar](4000)
[nvarchar](max)	Yes	[nvarchar](4000)

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Data Source Data Type	Supported	Converted into
[real]	Yes	[float]
[smalldatetime]	Yes	[datetime]
[smallint]	Yes	[smallint]
[smallmoney]	Yes	[decimal](38,15)
[sql_variant]	No	-
[text]	Yes	[nvarchar](4000)
[time]	Yes	[nvarchar](4000)
[timestamp]	No	-
[tinyint]	Yes	[smallint]
[uniqueidentifier]	Yes	[uniqueidentifier]
[varbinary]	Yes	[nvarchar](4000)
[varbinary](max)	No	-
[varchar]	Yes	[nvarchar](4000)
[varchar](max)	Yes	[nvarchar](4000)
[xml]	No	-

If a data type is supported, the "Converted into" column provides information about whether the data adapter would convert the data into a different type, including the length or precision. Depending on the data type, some supported data types may be truncated to 4000 characters, or an error may occur if 4000 characters are exceeded.

If a data type is not supported, a conversion-type error such as the following may appear: "An error occurred in AdapterBase::GetDataItemData - ...Implicit conversion from data type hierarchyid to nvarchar is not allowed. Use the CONVERT function to run this query."

Supported query expression operators

You can use the following operators in a query filter expression.

Operator	Sample
Equal	"Filter":"FQN eq 'Weather.Los Angeles.Temperature'"
Not equal	"Filter":"FQN ne 'Weather.Los Angeles.Temperature'

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Operator	Sample
Starts with	"Filter":"startswith(FQN, 'Weather')"
Ends with	"Filter":"endswith(FQN, 'Temperature')"
Contains	"Filter":"contains(FQN,'Temperature')"
Or	"Filter":"FQN eq 'Weather.Los Angeles.Temperature' or FQN eq 'Weather.Chicago.Temperature'"
And	"Filter":"FQN eq 'Weather.Los Angeles.Temperature' and Location eq '/Los Angeles'"

Note:
- If you apply the filter on a String column, ensure that you enclose the String value in Single quotes, as mentioned in the examples above. However, if you apply the filter on a non-string column (such as decimal or integer), you can enter the values as-is, without using Single quotes. For example, "Filter": "OpcQuality eq 192"

- AVEVA Insight does not support compound expressions with more than 3 conditions. An example of a compound filter expression is:
"Filter":"(FQN eq 'Weather.Los Angeles.Temperature' and Location eq '/Los Angeles') OR (FQN eq 'Weather.Los Angeles.Temperature' and Location eq '/houston') OR (FQN eq 'Weather.Los Angeles.Temperature' and Location eq '/San Francisco')"

Use engineering units

About engineering unit

Engineering unit is the metric by which data values for a particular tag are measured; for example, RPMs, milliseconds, or degrees. Engineering Units are case-sensitive. (Also called **unit of measure**.)

You have to map the engineering units to the relevant Engineering Unit catalog. For more information on defining custom engineering units, see the **Define custom engineering units** section in the AVEVA Insight Online Help.

Converting engineering units for tags in BI Gateway

For a given tag or a group of tags, a value reported in an engineering unit belonging to the same Engineering Unit catalog dimension (For example, Energy, Mass Flow, Area, Power, Pressure, and so on) as other engineering units available in Insight can be converted using the **Expression** parameter in BI Gateway.

Leveraging the Expression parameter for a group of tags enables you to convert and normalize value of each of the tags in the group to a given output Engineering Unit.

You can use Engineering Units in the AnalogSummary, CQAnalogSummary, CQProcessValues, ProcessValues, and ProcessValues for time defining dimension queries. If you want to convert Engineering Units for the tags defined in any of these queries, ensure that you use the **Tag** parameter in that query.

Consider a scenario where a query contains multiple tags. If the destination Engineering Unit is defined only for

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one tag, the conversion happens only for that tag. The other tags which do not have a destination Engineering Unit assigned return the default Engineering Unit.

For example, the following query contains Temperature and Humidity tags. However, the destination Engineering Unit (°C) is applicable only for the Temperature tag. Therefore, the conversion happens only for the Temperature tag, and the Humidity tag returns the default Engineering Unit.

```
{
   "QueryName": "AnalogSummary",
   "SelectColumn":
   ["FQN","StartDateTime","OpcQuality","Minimum","Maximum","Average","StdDev","Integral","C
   ount"],
   "Tag": {
      "Filter":"FQN eq 'Weather.Los Angeles.Temperature' or FQN eq 'Weather.Los
      Angeles.Humidity'",
      "Select":"FQN"
   },
   "StartDateTime": "[RequestedStartTime]",
   "EndDateTime": "[RequestedEndTime]",
   "Expression":"UOM(°C)"
}
```

Note:
- If you do not pass any value to UOM(), a validation error occurs. To ensure that the validation is successful, you have to pass a valid engineering unit. For example, UOM(ºC) and UOM(t/h)
- If a tag does not have the assigned destination Engineering Unit, then the default Engineering Unit is returned.

Time zone for a data source

Time zone for AVEVA Insight

The time zone for the AVEVA Insight data adapter is always represented using (UTC) Coordinated Universal Time.

Time zone for Microsoft Azure SQL Database

You can define a time zone for a data source to handle the time difference between the BI Gateway application and the database that the external data source system is referencing. By default, the time zone for the Microsoft Azure SQL Database data adapter is represented using (UTC) Coordinated Universal Time. However, you can edit the time zone if required.

For example, a dimension named "DimensionShift" that has DateTime fields defined as "ShiftStartTime" and "ShiftEndTime" has the following columns:

- ShiftStartTime
- ShiftStartTime_UTC
- ShiftStartTime_Offset
- ShiftEndTime
- ShiftEndTime_UTC
- ShiftEndTime_Offset

The measure table stores the measure calculation period start and end time in UTC, offset time, and the time of the external data source system database.

For example, a measure has the following fields:

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- "aaValuePeriodStartTime"
- "aaValuePeriodStartTime_UTC"
- "aaValuePeriodStartTime_Offset"
- "aaValuePeriodEndTime"
- "aaValuePeriodEndTime_UTC"
- "aaValuePeriodEndTime_Offset"

Data adapters

AVEVA Insight data adapter
SQL Azure database data adapter
Generic REST API data adapter

AVEVA Insight data adapter

An Azure function is used to transform the data from AVEVA Insight to BI Gateway. By default, the following common custom queries defined in the Azure function are available for use in the Custom Query expression editor.

Insight Historian API

- AnalogSummary
  - AnalogSummary
  - CQAnalogSummary (This custom query is supported to ensure backward compatibility.)
- News
  - News
  - NewsAlgorithm
  - NewsComment
  - NewsDatasourceFlatline
  - NewsEntropyHigh
  - NewsEntropyLow
  - NewsHigh
  - NewsLow
  - NewsTagFlatline
  - NewsTTanomaly
- ProcessValues
  - CQProcessValues (This custom query is supported to ensure backward compatibility.)
  - CQProcessValuesSameDataSet (This custom query is supported to ensure backward compatibility.)
  - CQProcessValuesTagTypes (This custom query is supported to ensure backward compatibility.)
  - ProcessValues

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- ProcessValues for time defining dimension
- Retrieval modes supported by ProcessValues endpoints
- TagMetaData

Insight MES API

- ContextEvents
  - ContextEvents
  - ContextEvents for time defining dimension
- DispositionReasons
- Equipment
- EquipmentStates
- OEECalculations
- ProductionEvents
- UtilizationEvents
- UtilizationReasonGroups
- UtilizationReasons

Configure the AVEVA Insight connection

You can provide connection information for the AVEVA Insight external data source system.

The AVEVA Insight data adapter allows AVEVA BI Gateway data source to use AVEVA Insight as a source to which you can map the dimensions and measures fields in the AVEVA BI Gateway model.

Configuring the AVEVA Insight data adapter helps you interact with the Azure functions available within the AVEVA Insight source. By default, the AVEVA Insight data adapter points to the Azure function available in the production environment.

Configure the AVEVA Insight connection

1. In the **Data Adapter Type** list, select **AVEVA Insight**.

   The **Data Source Configuration** section appears as follows.

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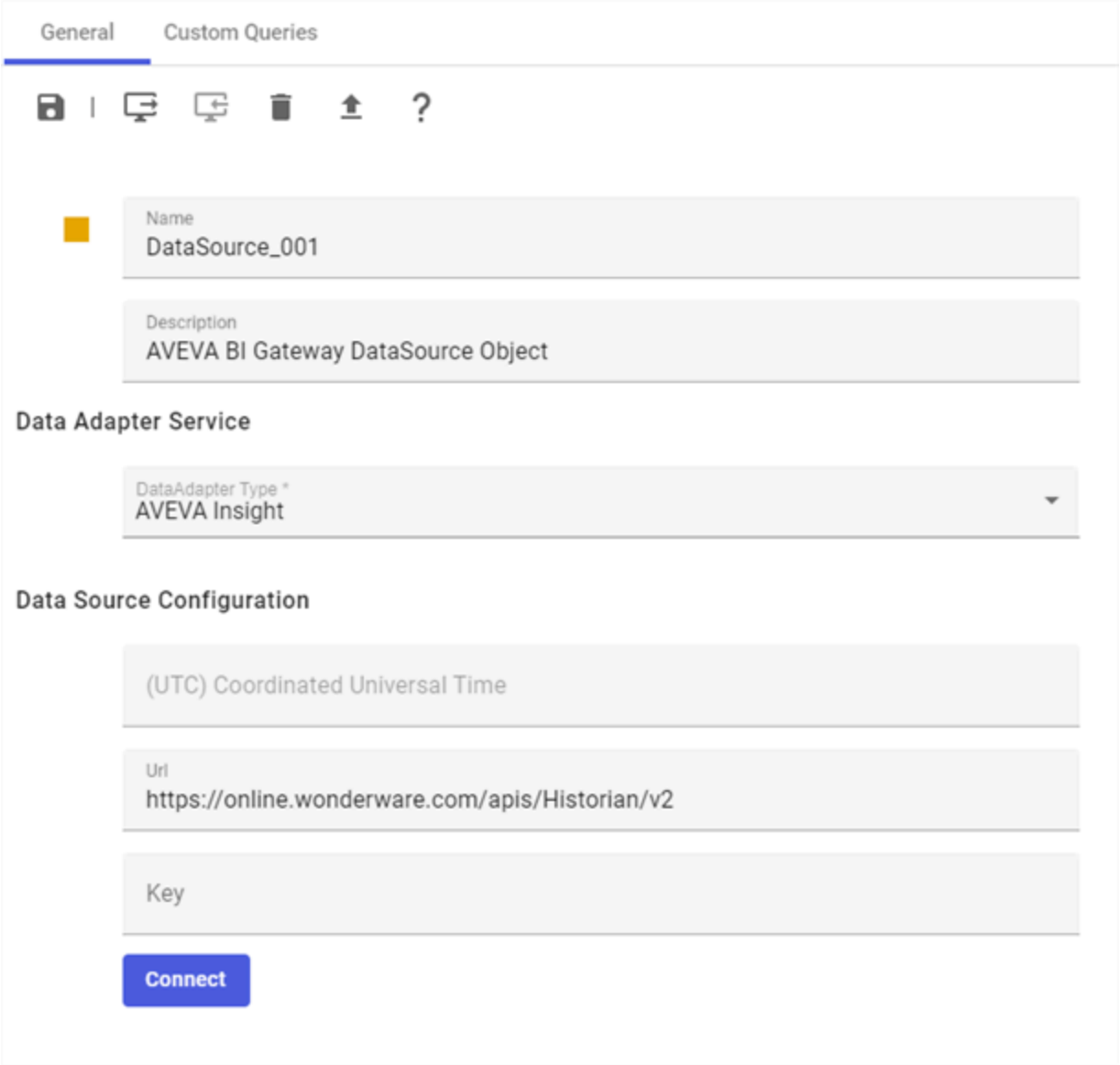

2. In the **Data Source Configuration** section, do the following:
   a. In the **Data Source time zone** list, the Coordinated Universal Time (UTC) option is by default selected. You cannot edit the time zone for the AVEVA Insight data adapter.
   b. In the **URL** text box, specify the AVEVA Insight source URL. The default URL is "https://online.wonderware.com/apis/Historian/v2".
   c. In the **Key** box, specify the authentication key for the registered AVEVA Insight URL.
3. Click **Connect**. A confirmation message appears.
4. Click **Done** and then click **Save**.

Note: The AVEVA Insight adapter supports only custom queries. You can add or modify custom queries using the Custom Query Expression editor. For more information, see Use custom queries.

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Insight Historian API

- AnalogSummary
  - AnalogSummary
  - CQAnalogSummary (This custom query is supported to ensure backward compatibility.)
- News
  - News
  - NewsAlgorithm
  - NewsComment
  - NewsDatasourceFlatline
  - NewsEntropyHigh
  - NewsEntropyLow
  - NewsHigh
  - NewsLow
  - NewsTagFlatline
  - NewsTTanomaly
- ProcessValues
  - CQProcessValues (This custom query is supported to ensure backward compatibility.)
  - CQProcessValuesSameDataSet (This custom query is supported to ensure backward compatibility.)
  - CQProcessValuesTagTypes (This custom query is supported to ensure backward compatibility.)
  - ProcessValues
  - ProcessValues for time defining dimension
  - Retrieval modes supported by ProcessValues endpoints
- TagMetaData

AnalogSummary

- AnalogSummary
- CQAnalogSummary (This custom query is supported to ensure backward compatibility.)

AnalogSummary

This Azure custom query returns summary values for analog tags based on search criteria. The custom query expression supports the following parameters.

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Parameter Name	Parameter Choice	Example	Description
QueryName	Required	Analogsummary	Azure function query name
SelectColumn	Optional	["*"] Or ["FQN","StartDateTime", "Minimum", "Maximum", "Average", "StdDev", "Integral", "Count"]	Option to pick required properties from AVEVA Insight

Tag	Optional	{
		"Filter": "endswith(FQN, '.Temperature')",
		"Select": ["FQN"]
		}
			The Tag expression is used to apply a filter on the tags.
			The Filter parameter is used to apply a filter on the tags.
			The Select parameter is used to specify the property name that could be used in the tag filter. If extended property is used in the filter, then it is must to specify in the select.

StartDateTime	Optional	"[RequestedStartTime]"	Any valid UTC date time value. To leverage [RequestedStartTime] parameter for populating a time defining dimension, you must enable incremental update feature for the dimension. For more information, see Configure an incremental update for a dimension.
EndDateTime	Optional	"[RequestedEndTime]"	Any valid UTC date time value. This datetime value should be greater than "StartDateTime". To leverage [RequestedEndTime] parameter for populating a time defining

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Parameter Name	Parameter Choice	Example	Description
			dimension, you must enable incremental update feature for the dimension. For more information, see Configure an incremental update for a dimension.
Expression	Optional	"UOM(hl/min)" Or "UOM(t/h)"	Any valid Engineering Unit. This is used to convert the destination Engineering Unit. Ensure that you use the **Tag** parameter in the query to support the Engineering Unit conversion. For more information about Engineering Units, see the AVEVA Insight Online Help.

The following properties are returned from the Azure function query for "Analogsummary".

Property Name	Datatype	Description
FQN	string	The fully qualified name for the tag. A fully qualified name uses the format: **datasource.tagname**.
OPCQuality	Int32	Defines the OPC quality for the data.
PercentGood	Double	The ratio of the number of rows that have "good" quality to the total number of rows in the retrieval cycle, expressed as a percentage in the range 0 to 100.
First	Double	If at least one non-NULL point exists for the tag in question within the retrieval cycle, then the value returned is the first point stored with a time stamp within the retrieval cycle. If no points exist within the retrieval cycle, then the

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Property Name	Datatype	Description
		value returned is the current value at the cycle start time. If no non-NULL points can be found, then NULL is returned.
FirstDateTime	DateTimeOffset	Timestamp associated with first value. This might be earlier than StartDateTime if this is the initial value for the retrieval cycle.
Last	Double	If at least one non-NULL point exists for the tag in question within the retrieval cycle, then the value returned is the last point stored with a time stamp within the retrieval cycle. If no points exist within the retrieval cycle, then the value returned is the current value at the cycle start time. If no non-NULL points can be found, then NULL is returned.
LastDateTime	DateTimeOffset	Timestamp associated with last value. This might be earlier than StartDateTime if this is the initial value for the retrieval cycle.
Minimum	Double	If at least one non-NULL point exists for the tag in question within the retrieval cycle, then the value returned is the minimum point stored with a time stamp within the retrieval cycle. If no points exist within the retrieval cycle, then the value returned is the current value at the cycle start time. If no non-NULL points can be found, then NULL is returned.
MinDateTime	DateTimeOffset	Timestamp associated with Min value. NULL if Min is NULL.
Maximum	Double	If at least one non-NULL point exists for the tag in question within the retrieval cycle, then the value returned is the maximum point stored with a time stamp within the

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Property Name	Datatype	Description
		retrieval cycle. If no points exist within the retrieval cycle, then the value returned is the current value at the cycle start time. If no non-NULL points can be found, then NULL is returned.
MaxDateTime	DateTimeOffset	Timestamp associated with Max value. NULL if Max is NULL.
Average	Double	Time weighted average value of retrieval cycle. This is calculated by using the individual summary averages. The calculation is "Sum(average * delta t) / Total time of average in all cycles" - delta t is prorated for any partially contained storage cycles. For analog tags, the calculation is "Sum(value * delta t) / Total time.
StdDev	Double	Time weighted standard deviation value of the retrieval cycle. The value is calculated using time weighted sums (Integrals) and time weighted sums of squares (IntegralOfSquares) values.
Integral	Double	Area under value curve of retrieval cycle. The calculation is "Sum(value * delta t) / Total time of integral in all cycles" - delta t is prorated for any partially contained storage cycles. For analog tags, the calculation is "Sum(value * delta t) / Total time.
Count	Double	Number of values in a particular cycle.

CQAnalogSummary

This Azure custom query returns summary values for analog tags based on the query expression.

Note: This custom query is supported to ensure backward compatibility.

The custom query expression supports the following parameters.

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Parameter Name	Parameter Choice	Example	Description
QueryName	Required	CQAnalogsummary	Azure function query name
SelectColumn	Optional	["*"] Or ["FQN","StartDateTime", "Minimum", "Maximum", "Average", "StdDev", "Integral", "Count"]	Option to select required properties from AVEVA Insight.

Tag	Optional	{
		"Filter": "startswith(FQN,'Temperature.Los Angeles')",
		"Select": ["FQN"]
		}
			The Tag expression is used to apply a filter on the tags.
			The Filter parameter is used to apply a filter on the tags.
			The Select parameter is used to specify the property name that could be used in the tag filter. If extended property is used in the filter, then it is must to specify in the select.

RetrievalMode	Optional	• Average • Cyclic • Integral • Delta • Counter • Full	AVEVA Insight query retrieval mode.
Resolution	Optional	3000	A valid numeric value in milliseconds
Expression	Optional	"UOM(hl/min)" or "UOM(t/h)"	Any valid Engineering Unit. This is used to convert the destination Engineering Unit. Ensure that you use the **Tag** parameter in the

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Parameter Name	Parameter Choice	Example	Description
			query to support the Engineering Unit conversion. For more information about Engineering Units, see the AVEVA Insight Online Help.

For more information about the supported Filter expressions, see the "Query Expression Operator" section.

The following properties are returned from the Azure function query for "CQAnalogsummary".

Property Name	Datatype	Description
FQN	string	The fully qualified name for the tag. A fully qualified name uses the format: **datasource.tagname**.
OPCQuality	Int32	Defines the OPC quality for the data.
PercentGood	Double	The ratio of the number of rows that have "good" quality to the total number of rows in the retrieval cycle, expressed as a percentage in the range 0 to 100.
First	Double	If at least one non-NULL point exists for the tag in question within the retrieval cycle, then the value returned is the first point stored with a time stamp within the retrieval cycle. If no points exist within the retrieval cycle, then the value returned is the current value at the cycle start time. If no non-NULL points can be found, then NULL is returned.
FirstDateTime	DateTimeOffset	Timestamp associated with first value. This might be earlier than StartDateTime if this is the initial value for the retrieval cycle.
Last	Double	If at least one non-NULL point exists for the tag in question within the retrieval cycle, then the value

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Property Name	Datatype	Description
		returned is the last point stored with a time stamp within the retrieval cycle. If no points exist within the retrieval cycle, then the value returned is the current value at the cycle start time. If no non-NULL points can be found, then NULL is returned.
LastDateTime	DateTimeOffset	Timestamp associated with last value. This might be earlier than StartDateTime if this is the initial value for the retrieval cycle.
Minimum	Double	If at least one non-NULL point exists for the tag in question within the retrieval cycle, then the value returned is the minimum point stored with a time stamp within the retrieval cycle. If no points exist within the retrieval cycle, then the value returned is the current value at the cycle start time. If no non-NULL points can be found, then NULL is returned.
MinDateTime	DateTimeOffset	Timestamp associated with Min value. NULL if Min is NULL.
Maximum	Double	If at least one non-NULL point exists for the tag in question within the retrieval cycle, then the value returned is the maximum point stored with a time stamp within the retrieval cycle. If no points exist within the retrieval cycle, then the value returned is the current value at the cycle start time. If no non-NULL points can be found, then NULL is returned.
MaxDateTime	DateTimeOffset	Timestamp associated with Max value. NULL if Max is NULL.
Average	Double	Time weighted average value of retrieval cycle. This is calculated by using the individual summary

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Property Name	Datatype	Description
		averages. The calculation is "Sum(average * delta t) / Total time of average in all cycles" - delta t is prorated for any partially contained storage cycles. For analog tags, the calculation is "Sum(value * delta t) / Total time.
StdDev	Double	Time weighted standard deviation value of the retrieval cycle. The value is calculated using time weighted sums (Integrals) and time weighted sums of squares (IntegralOfSquares) values.
Integral	Double	Area under value curve of retrieval cycle. The calculation is "Sum(value * delta t) / Total time of integral in all cycles" - delta t is prorated for any partially contained storage cycles. For analog tags, the calculation is "Sum(value * delta t) / Total time.
Count	Double	Number of values in a particular cycle.

Sample query expressions for AnalogSummary

AnalogSummary

```
{
   "QueryName": "AnalogSummary",
   "SelectColumn":
   ["FQN","StartDateTime","OpcQuality","Minimum","Maximum","Average","StdDev"],
   "Tag": {
      "Filter": "endswith(FQN,'.Temperature')",
      "Select": ["FQN"]
   },
   "StartDateTime": "[RequestedStartTime]",
   "EndDateTime": "[RequestedEndTime]",
   "Expression":"UOM(°C)"
}
```

CQAnalogSummary

```
{
   "QueryName": "CQAnalogsummary",
```

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```
   "SelectColumn": ["FQN","StartDateTime","Integral"],
   "Tag": {
      "Filter": "endswith(FQN,'.flowrate')",
      "Select": ["FQN"]
},
   "StartDateTime": "[RequestedStartTime]",
   "EndDateTime": "[RequestedEndTime]",
   "Expression":"UOM(t/h)"
}
```

News

- News
- NewsAlgorithm
- NewsComment
- NewsDatasourceFlatline
- NewsEntropyHigh
- NewsEntropyLow
- NewsHigh
- NewsLow
- NewsTagFlatline
- NewsTTanomaly

News

This Azure function custom query returns the news events for all the algorithms. The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	News	Azure function query name
StartDateTime	Optional	"[RequestedStartTime]"	Any valid UTC date time value. To leverage [RequestedStartTime] parameter for populating a time defining dimension, you must enable incremental update feature for the dimension. For more information, see Configure an incremental update for a dimension.

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Parameter Name	Parameter Choice	Example	Description
EndDateTime	Optional	"[RequestedEndTime]"	Any valid UTC date time value. To leverage [RequestedEndTime] parameter for populating a time defining dimension, you must enable incremental update feature for dimension. For more information, see Configure an incremental update for a dimension.

The following properties are returned from the Azure function query for "News".

Property Name	Datatype	Description
Score	Double	Score of the news story
Algorithm	String	The algorithm to which the news story belongs
DateTime	DateTime	The time after which the news anomaly is inserted into the endpoint.
StartTime	DateTime	The start time (in UTC format) of the news events.
TimeOfOccurrence	DateTime	The time at which the news anomaly is detected.
Source	String	Source of the news story
FQN	String	The fully qualified name for the tag. A fully qualified name uses the format: **datasource.tagname**.
Units	String	The engineering units of the FQN
Author	String	Author of the news story
Tenant	String	Name of the tenant of the news story
Location	String	Location
ID	String	Globally unique identifier for the

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Property Name	Datatype	Description
		event.

NewsAlgorithm

This Azure function custom query returns the list of algorithms for the news events. The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	NewsAlgorithm	Azure function query name

The following properties are returned from the Azure function query for "NewsAlgorithm".

Property Name	Datatype	Description
Algorithm	String	The algorithm to which the news story belongs

NewsComment

This Azure function custom query returns the comments for the news events for the **comment** algorithm. The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	NewsComment	Azure function query name
StartDateTime	Optional	"[RequestedStartTime]"	Any valid UTC date time value. To leverage [RequestedStartTime] parameter for populating a time defining dimension, you must enable incremental update feature for the dimension. For more information, see Configure an incremental update for a dimension.
EndDateTime	Optional	"[RequestedEndTime]"	Any valid UTC date time value. To leverage

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Parameter Name	Parameter Choice	Example	Description
			[RequestedEndTime] parameter for populating a time defining dimension, you must enable incremental update feature for dimension. For more information, see Configure an incremental update for a dimension.

The following properties are returned from the Azure function query for "NewsComment".

Property Name	Datatype	Description
Score	Double	Score of the news story
Algorithm	String	The algorithm to which the story belongs
PrimaryFQN	String	A fully qualified name for the tag that acts as a base reference.
User_Comment	String	Additional comment provided by the user.
TimeOfOccurrence	DateTime	The time at which the news anomaly is detected.
Source	String	Source of the news story
User	String	The name of the user who is adding the comment.
Author	String	Author of the news story
Tenant	String	Name of the tenant of the news story
ID	String	Globally unique identifier for the event.

NewsDatasourceFlatline

This Azure function custom query returns the news events for the **xtfg** algorithm. The custom query expression supports the following parameters:

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Parameter Name	Parameter Choice	Example	Description
QueryName	Required	NewsDatasourceFlatline	Azure function query name
StartDateTime	Optional	"[RequestedStartTime]"	Any valid UTC date time value. To leverage [RequestedStartTime] parameter for populating a time defining dimension, you must enable incremental update feature for the dimension. For more information, see Configure an incremental update for a dimension.
EndDateTime	Optional	"[RequestedEndTime]"	Any valid UTC date time value. To leverage [RequestedEndTime] parameter for populating a time defining dimension, you must enable incremental update feature for dimension. For more information, see Configure an incremental update for a dimension.

The following properties are returned from the Azure function query for "NewsDatasourceFlatline".

Note: The fields with the prefix **LP** are the parameters exposed to the Insight News Feed component.

Property Name	Datatype	Description
Score	Double	Score of the news story
Algorithm	String	The algorithm to which the news story belongs
DateTime	DateTime	The time after which the news anomaly is inserted into the endpoint.
LP_Lapse	Double	The lapse time. This is the time difference (in

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Property Name	Datatype	Description
		minutes) between the TimeOfOccurrence and DateTime parameters.
LP_Since	DateTime	The **since** field is a duplicate of TimeOfOccurrence.
LP_Source	String	Source of the news story
LP_TagCount	Double	The number of tags contributing to the news story.
TimeOfOccurrence	DateTime	The time at which the news anomaly is detected.
Source	String	Source of the news story
TimeZone	String	The name of the timezone of the news story
User	String	The system user.
TZ	String	Time zone offset of the news story
Location	String	Location
Author	String	Author of the news story
Tenant	String	Name of the tenant of the news story
ID	String	Globally unique identifier for the event.

NewsEntropyHigh

This Azure function custom query returns the news events for the **enth** algorithm. The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	NewsEntropyHigh	Azure function query name
StartDateTime	Optional	"[RequestedStartTime]"	Any valid UTC date time value. To leverage [RequestedStartTime]

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Parameter Name	Parameter Choice	Example	Description
			parameter for populating a time defining dimension, you must enable incremental update feature for the dimension. For more information, see Configure an incremental update for a dimension.
EndDateTime	Optional	"[RequestedEndTime]"	Any valid UTC date time value. To leverage [RequestedEndTime] parameter for populating a time defining dimension, you must enable incremental update feature for dimension. For more information, see Configure an incremental update for a dimension.

The following properties are returned from the Azure function query for "NewsEntropyHigh".

Property Name	Datatype	Description
Score	Double	Score of the news story
Algorithm	String	The algorithm to which the story belongs
DateTime	DateTime	The time after which the news anomaly is inserted into the endpoint.
StartTime	DateTime	The start time (in UTC format) of the news events.
EndTime	DateTime	The end time (in UTC format) of the news events.
TimeOfOccurrence	DateTime	The time at which the news anomaly is detected.
Source	String	Source of the news story

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Property Name	Datatype	Description
FQN	String	The fully qualified name for the tag. A fully qualified name uses the format: **datasource.tagname**.
Units	String	The engineering units of the FQN
TimeZone	String	The name of the timezone of the news story
User	String	The system user
TZ	String	Time zone offset of the news story
Location	String	Location
Author	String	Author of the news story
Tenant	String	Name of the tenant of the news story
ID	String	Globally unique identifier for the event.

NewsEntropyLow

This Azure function custom query returns the news events for the **entl** algorithm. The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	NewsEntropyLow	Azure function query name
StartDateTime	Optional	"[RequestedStartTime]"	Any valid UTC date time value. To leverage [RequestedStartTime] parameter for populating a time defining dimension, you must enable incremental update feature for the dimension. For more information, see Configure an incremental update for a dimension.

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Parameter Name	Parameter Choice	Example	Description
EndDateTime	Optional	"[RequestedEndTime]"	Any valid UTC date time value. To leverage [RequestedEndTime] parameter for populating a time defining dimension, you must enable incremental update feature for dimension. For more information, see Configure an incremental update for a dimension.

The following properties are returned from the Azure function query for "NewsEntropyLow".

Property Name	Datatype	Description
Score	Double	Score of the news story
Algorithm	String	The algorithm to which the story belongs
DateTime	DateTime	The time after which the news anomaly is inserted into the endpoint.
StartTime	DateTime	The start time (in UTC format) of the news events.
EndTime	DateTime	The end time (in UTC format) of the news events.
TimeOfOccurrence	DateTime	The time at which the news anomaly is detected.
Source	String	Source of the news story
FQN	String	The fully qualified name for the tag. A fully qualified name uses the format: **datasource.tagname**.
Units	String	The engineering units of the FQN
TimeZone	String	The name of the timezone of the news story
User	String	The system user

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Property Name	Datatype	Description
TZ	String	Time zone offset of the news story
Location	String	Location
Author	String	Author of the news story
Tenant	String	Name of the tenant of the news story
ID	String	Globally unique identifier for the event.

NewsHigh

This Azure function custom query returns the news events for the **xtch** algorithm. The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	NewsHigh	Azure function query name
StartDateTime	Optional	"[RequestedStartTime]"	Any valid UTC date time value. To leverage [RequestedStartTime] parameter for populating a time defining dimension, you must enable incremental update feature for the dimension. For more information, see Configure an incremental update for a dimension.
EndDateTime	Optional	"[RequestedEndTime]"	Any valid UTC date time value. To leverage [RequestedEndTime] parameter for populating a time defining dimension, you must enable incremental update feature for dimension. For more information, see

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Parameter Name	Parameter Choice	Example	Description
			Configure an incremental update for a dimension.

The following properties are returned from the Azure function query for "NewsHigh".

Note: The fields with the prefix **LP** are the parameters exposed to the Insight News Feed component.

Property Name	Datatype	Description
Score	Double	Score of the news story
Algorithm	String	The algorithm to which the news story belongs
DateTime	DateTime	The time after which the news anomaly is inserted into the endpoint.
StartTime	DateTime	The start time (in UTC format) of the news events.
EndTime	DateTime	The end time (in UTC format) of the news events.
TimeOfOccurrence	DateTime	The time at which the news anomaly is detected.
Source	String	Source of the news story
FQN	String	The fully qualified name for the tag. A fully qualified name uses the format: **datasource.tagname**.
LP_Tag	String	Tag name
Units	String	The engineering units of the FQN
TimeZone	String	The name of the timezone of the news story
User	String	The system user
TZ	String	Time zone offset of the news story
Location	String	Location
Author	String	Author of the news story
Tenant	String	Name of the tenant of the news story

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Property Name	Datatype	Description
ID	String	Globally unique identifier for the event.

NewsLow

This Azure function custom query returns the news events for the **xtcl** algorithm. The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	NewsLow	Azure function query name
StartDateTime	Optional	"[RequestedStartTime]"	Any valid UTC date time value. To leverage [RequestedStartTime] parameter for populating a time defining dimension, you must enable incremental update feature for the dimension. For more information, see Configure an incremental update for a dimension.
EndDateTime	Optional	"[RequestedEndTime]"	Any valid UTC date time value. To leverage [RequestedEndTime] parameter for populating a time defining dimension, you must enable incremental update feature for dimension. For more information, see Configure an incremental update for a dimension.

The following properties are returned from the Azure function query for "NewsLow".

Note: The fields with the prefix **LP** are the parameters exposed to the Insight News Feed component.

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Property Name	Datatype	Description
Score	Double	Score of the news story
Algorithm	String	The algorithm to which the news story belongs
DateTime	DateTime	The time after which the news anomaly is inserted into the endpoint.
StartTime	DateTime	The start time (in UTC format) of the news events.
EndTime	DateTime	The end time (in UTC format) of the news events.
TimeOfOccurrence	DateTime	The time at which the news anomaly is detected.
Source	String	Source of the news story
FQN	String	The fully qualified name for the tag. A fully qualified name uses the format: **datasource.tagname**.
LP_Tag	String	Tag name
Units	String	The engineering units of the FQN
TimeZone	String	The name of the timezone of the news story
User	String	The system user
TZ	String	Time zone offset of the news story
Location	String	Location
Author	String	Author of the news story
Tenant	String	Name of the tenant of the news story
ID	String	Globally unique identifier for the event.

NewsTagFlatline

This Azure function custom query returns the news events for the **xtfh** algorithm. The custom query expression supports the following parameters:

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Parameter Name	Parameter Choice	Example	Description
QueryName	Required	NewsTagFlatline	Azure function query name
StartDateTime	Optional	"[RequestedStartTime]"	Any valid UTC date time value. To leverage [RequestedStartTime] parameter for populating a time defining dimension, you must enable incremental update feature for the dimension. For more information, see Configure an incremental update for a dimension.
EndDateTime	Optional	"[RequestedEndTime]"	Any valid UTC date time value. To leverage [RequestedEndTime] parameter for populating a time defining dimension, you must enable incremental update feature for dimension. For more information, see Configure an incremental update for a dimension.

The following properties are returned from the Azure function query for "NewsTagFlatline".

Note: The fields with the prefix **LP** are the parameters exposed to the Insight News Feed component.

Property Name	Datatype	Description
Score	Double	Score of the news story
Algorithm	String	The algorithm to which the news story belongs
DateTime	DateTime	The time after which the news anomaly is inserted into the endpoint.
EndDateTime	DateTime	The end time (in UTC format) of the news events.

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Property Name	Datatype	Description
FQN	String	The fully qualified name for the tag. A fully qualified name uses the format: **datasource.tagname**.
LP_Tag	String	Tag name
StartTime	DateTime	The start time (in UTC format) of the news events.
TimeOfOccurrence	DateTime	The time at which the news anomaly is detected.
Source	String	Source of the news story
Units	String	The engineering units of the FQN
TimeZone	String	The name of the timezone of the news story
User	String	The system user
TZ	String	Time zone offset of the news story
Location	String	Location
Author	String	Author of the news story
Tenant	String	Name of the tenant of the news story
ID	String	Globally unique identifier for the event.

NewsTTanomaly

This Azure function custom query returns the news events for the **ttanomaly – TwinThread Anomaly** algorithm. The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	NewsTTanomaly	Azure function query name
StartDateTime	Optional	"[RequestedStartTime]"	Any valid UTC date time value. To leverage [RequestedStartTime] parameter for populating

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Parameter Name	Parameter Choice	Example	Description
			a time defining dimension, you must enable incremental update feature for the dimension. For more information, see Configure an incremental update for a dimension.
EndDateTime	Optional	"[RequestedEndTime]"	Any valid UTC date time value. To leverage [RequestedEndTime] parameter for populating a time defining dimension, you must enable incremental update feature for dimension. For more information, see Configure an incremental update for a dimension.

The following properties are returned from the Azure function query for "NewsTTanomaly".

Note:
- This news story returns the top 3 contributors namely Fqn1, Fqn2, and Fqn3.
- The fields with the prefix **LP** are the parameters exposed to the Insight News Feed component.

Property Name	DataType	Description
Score	Double	Score of the news story
Algorithm	String	The algorithm to which the news story belongs
DateTime	DateTime	The time after which the news anomaly is inserted into the endpoint.
StartTime	DateTime	The start time (in UTC format) of the news events.
TimeOfOccurrence	DateTime	The time at which the news anomaly is detected.
LP_Asset	String	Asset
LP_DateTime	DateTime	Datetime

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Property Name	DataType	Description
LP_AssetAnomalyScore	Double	Asset anomaly score
LP_Modelname	String	Model name
LP_ModelId	String	Model ID
LP_Fqn1	String	The first contributor FQN to the news story
LP_Transform1	String	The transformation type for the first FQN
LP_OriginalTransform1	String	The transformation type for the first FQN
LP_MlName1	String	Internal name of the first FQN
LP_Value1	Double	Value of the first FQN
LP_OldScore1	Double	Old score of the first FQN
LP_AnomalyScore1	Double	Anomaly score of the first FQN
LP_RawScore1	Double	Raw score of the first FQN
LP_RangeMin1	Double	Minimum range of the first FQN
LP_RangeMax1	Double	Maximum range of the first FQN
LP_Fqn2	String	The second contributor FQN to the news story
LP_Transform2	String	The transformation type for the second FQN
LP_OriginalTransform2	String	The transformation type for the second FQN
LP_MlName2	String	Internal name of the second FQN
LP_Value2	Double	Value of the second FQN
LP_OldScore2	Double	Old score of the second FQN
LP_AnomalyScore2	Double	Anomaly score of the second FQN
LP_RawScore2	Double	Raw score of the second FQN
LP_RangeMin2	Double	Minimum range of the second FQN

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Property Name	DataType	Description
LP_RangeMax2	Double	Maximum range of the second FQN
LP_Fqn3	String	The third contributor FQN to the news story
LP_Transform3	String	The transformation type for the third FQN
LP_OriginalTransform3	String	The transformation type for the third FQN
LP_MlName3	String	Internal name of the third FQN
LP_Value3	Double	Value of the third FQN
LP_OldScore3	Double	Old score of the third FQN
LP_AnomalyScore3	Double	Anomaly score of the third FQN
LP_RawScore3	Double	Raw score of the third FQN
LP_RangeMin3	Double	Minimum range of the third FQN
LP_RangeMax3	Double	Maximum range of the third FQN
Units	String	The engineering units of the FQN
TimeZone	String	The name of the timezone of the news story
User	String	The system user
AssetID	String	Asset ID of the news story
Location	String	Location
Author	String	Author of the news story
Tenant	String	Name of the tenant of the news story
ID	String	Globally unique identifier for the event.
FQN	String	The fully qualified name for the tag. A fully qualified name uses the format: **datasource.tagname**.

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Sample query expressions for News

News

```
{
"QueryName":"News",
"StartDateTime": "[RequestedStartTime]",
"EndDateTime": "[RequestedEndTime]"
}
```

NewsAlgorithm

```
{
"QueryName":"NewsAlgorithm"
}
```

NewsComment

```
{
"QueryName":"NewsComment",
"StartDateTime": "[RequestedStartTime]",
"EndDateTime": "[RequestedEndTime]"
}
```

NewsDataSourceFlatline

```
{
"QueryName":"NewsDatasourceFlatline",
"StartDateTime": "[RequestedStartTime]",
"EndDateTime": "[RequestedEndTime]"
}
```

NewsEntropyHigh

```
{
"QueryName":"NewsEntropyHigh",
"StartDateTime": "[RequestedStartTime]",
"EndDateTime": "[RequestedEndTime]"
}
```

NewsEntropyLow

```
{
"QueryName":"NewsEntropyLow",
"StartDateTime": "[RequestedStartTime]",
"EndDateTime": "[RequestedEndTime]"
}
```

NewsHigh

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```
{
"QueryName":"NewsHigh",
"StartDateTime": "[RequestedStartTime]",
"EndDateTime": "[RequestedEndTime]"
}
```

NewsLow

```
{
"QueryName":"NewsLow",
"StartDateTime": "[RequestedStartTime]",
"EndDateTime": "[RequestedEndTime]"
}
```

NewsTagFlatline

```
{
"QueryName":"NewsTagFlatline",
"StartDateTime": "[RequestedStartTime]",
"EndDateTime": "[RequestedEndTime]"
}
```

NewsTTanomaly

```
{
"QueryName":"NewsTTanomaly",
"StartDateTime" : "[RequestedStartTime]",
"EndDateTime": "[RequestedEndTime]"
}
```

Measure calculation functions supported for News endpoints

- **Average** and **Sum** calculations support Numerical values (Double and Integer). Return type can either be Double or Integer.
- **Count** calculation supports Numerical values (Double and Integer) and String values. Return type can either be Double or Integer.
- **Min** and **Max** calculations support Numerical values (Double and Integer) and String values. The **Return type** value should be the same as the **Calculation field** datatype.

ProcessValues

- CQProcessValues (This custom query is supported to ensure backward compatibility.)
- CQProcessValuesSameDataSet (This custom query is supported to ensure backward compatibility.)
- CQProcessValuesTagTypes (This custom query is supported to ensure backward compatibility.)
- ProcessValues
- ProcessValues for time defining dimension
- Retrieval modes supported by ProcessValues endpoints

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ProcessValues

This Azure function custom query returns the process values for the given tags. The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	ProcessValues	Azure function query name
SelectColumn	Optional	["*"] Or ["FQN", "DateTime", "OpcQuality", "Text", "Value"]	Option to pick required properties from AVEVA Insight.

Tag	Optional	{
		"Filter": "startswith(Location,'/Lake')",
		"Select": ["FQN"]
		}
			The Tag expression is used to apply a filter on the tags.
			The Filter parameter is used to apply a filter on the tags.
			The Select parameter is used to specify the property name that could be used in the tag filter. If extended property is used in the filter, then it is must to specify in the select.

StartDateTime	Optional	"[RequestedStartTime]"	Any valid UTC date time value. To leverage [RequestedStartTime] parameter for populating a time defining dimension, you must enable incremental update feature for the dimension. For more information, see Configure an incremental update for a dimension.

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Parameter Name	Parameter Choice	Example	Description
EndDateTime	Optional	"[RequestedEndTime]"	Any valid UTC date time value. This datetime value should be greater than "StartDateTime". To leverage [RequestedEndTime] parameter for populating a time defining dimension, you must enable incremental update feature for dimension. For more information, see Configure an incremental update for a dimension.
RetrievalMode	Optional	• Average • Cyclic • Integral • Delta • Counter • Full	Retrieval mode of the query. For more information about retrieval modes, see the AVEVA Insight Online Help.
Expression	Optional	"UOM(hl/min)" or "UOM(t/h)"	Any valid Engineering Unit. This is used to convert the destination Engineering Unit. Ensure that you use the **Tag** parameter in the query to support the Engineering Unit conversion. For more information about Engineering Units, see the AVEVA Insight Online Help.

The following properties are returned from the Azure function query for "ProcessValues".

Property Name	Datatype	Description
FQN	String	Fully qualified name. A fully qualified name uses the format:

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Property Name	Datatype	Description
		datasource.tagname.
DateTime	DateTime	Value recorded date time.
OpcQuality	Int32	Tag quality.
Text	String	Text value of the tag.
Value	Double	Value of the tag.
Unit	String	Engineering Unit

CQProcessValues

This Azure custom query returns the process value of the tags based on the query expression.

Note: This custom query is supported to ensure backward compatibility.

The custom query expression supports the following parameters.

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	CQProcessValues	Azure function query name
SelectColumn	Optional	["*"] Or ["FQN","DateTime","Opc Quality", "Text","Value"]	Option to pick required properties from AVEVA Insight

Tag	Optional	{
		"Filter": "startswith(Location,'/Lake')",
		"Select": ["FQN"]
		}
			The Tag expression is used to apply a filter on the tags.
			The Filter parameter is used to apply a filter on the tags.
			The Select parameter is used to specify the property name that could be used in the tag filter. If extended property is used in the filter, then it is must to specify in the select.

StartDateTime	Optional	"[RequestedStartTime]"	Any valid UTC date time value. To leverage [RequestedStartTime]

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Parameter Name	Parameter Choice	Example	Description
			parameter for populating a time defining dimension, you must enable incremental update feature for dimension. For more information, see Configure an incremental update for a dimension.
EndDateTime	Optional	"[RequestedEndTime]"	Any valid UTC date time value. This datetime value should be greater than "StartDateTime". To leverage [RequestedEndTime] parameter for populating a time defining dimension, you must enable incremental update feature for dimension. For more information, see Configure an incremental update for a dimension.
RetrievalMode	Optional	• Average • Cyclic • Integral • Delta • Counter • Full	Retrieval mode of the query.
Resolution	Optional	3000	A valid numeric value in milliseconds
Expression	Optional	"UOM(hl/min)" Or "UOM(t/h)"	Any valid Engineering Unit. This is used to convert the destination Engineering Unit. Ensure that you use the **Tag** parameter in the query to support the

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Parameter Name	Parameter Choice	Example	Description
			Engineering Unit conversion. For more information about Engineering Units, see the AVEVA Insight Online Help.

For more information about the supported Filter expressions, see the "Query Expression Operator" section.

The following properties are returned from the Azure function query for "CQProcessValues".

Property Name	Datatype	Description
FQN	String	Fully qualified name. A fully qualified name uses the format: **datasource.tagname**.
DateTime	DateTime	Value recorded date time.
OpcQuality	Int32	Tag quality.
Text	String	Text value of the tag.
Value	Double	Value of the tag.

CQProcessValuesSameDataSet

This Azure custom query returns the process value of the tags that belong to a given source.

Note: This custom query is supported to ensure backward compatibility.

The custom query expression supports the following parameters.

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	CQProcessValuesSameDataSet	Azure function query name.
SelectColumn	Optional	["*"] Or ["FQN","DateTime","OpcQuality","Text","Value"]	Option to pick required properties from AVEVA Insight.
Source	Optional	AVEVA Insight Datasource Name	The tag source.

The following properties are returned from the Azure function query for "CQProcessValuesSameDataSet".

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Property Name	Datatype	Description
FQN	String	Fully qualified name. A fully qualified name uses the format: **datasource.tagname**.
DateTime	DateTime	Value recorded date time.
OpcQuality	Int32	Tag quality.
Text	String	Text value of the tag.
Value	Double	Value of the tag.

CQProcessValuesTagTypes

This Azure custom query returns the process value of the tags based on the given tag type.

Note: This custom query is supported to ensure backward compatibility.

The custom query expression supports the following parameters.

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	CQProcessValuesTagTypes	Azure function query name
SelectColumn	Optional	["*"] Or ["FQN","DateTime","Opc Quality", "Text","Value"]	Option to select required properties from AVEVA Insight
TagType	Optional	Analog or Discrete or String	Type of tag.

The following properties are returned from the Azure function query for "CQProcessValuesTagTypes".

Property Name	Datatype	Description
FQN	String	Fully qualified name. A fully qualified name uses the format: **datasource.tagname**.
DateTime	DateTime	Value recorded date time.
OpcQuality	Int32	Tag quality.
Text	String	Text value of the tag.
Value	Double	Value of the tag.

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ProcessValues for time defining dimension

This Azure function custom query returns the process values for the time defining definitions (TDD). The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	TDDProcessValues	Azure function query name
SelectColumn	Optional	["*"] Or ["FQN","OpcQuality","Text","Value", “DateTime AS StartTime","DateTime AS EndTime"]	Option to pick required properties from AVEVA Insight. **Note:** The previous record of same FQN’s DateTime is considered as current record StartTime, and current record DateTime is considered as Endtime.
DistinctColumn	Required	["FQN","OpcQuality","Text","Value","StartTime","EndTime"]	Option to pick distinct properties from AVEVA Insight

Tag	Optional	{
		"Filter": "startswith(Location,'/Lake')",
		"Select": ["FQN"]
		}
			The Tag expression is used to apply a filter on the tags.
			The Filter parameter is used to apply a filter on the tags.
			The Select parameter is used to specify the property name that could be used in the tag filter. If extended property is used in the filter, then it is must to specify in the select.

StartDateTime	Optional	"[RequestedStartTime]"	Any valid UTC date time value. To leverage [RequestedStartTime] parameter for populating a time defining dimension, you must enable incremental update feature for the dimension. For more

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Parameter Name	Parameter Choice	Example	Description
			information, see Configure an incremental update for a dimension.
EndDateTime	Optional	"[RequestedEndTime]"	Any valid UTC date time value. To leverage [RequestedEndTime] parameter for populating a time defining dimension, you must enable incremental update feature for dimension. For more information, see Configure an incremental update for a dimension.
RetrievalMode	Optional	• Average • Cyclic • Integral • Delta • Counter • Full	Retrieval mode of the query **Note:** For Deadband queries, use the Delta retrieval mode.
Resolution	Required*	3000	A valid numeric value in milliseconds. This value is required for Cyclic Retrieval mode.
TimeDeadband**	Optional	5000	A time deadband for retrieval controls the time resolution of data returned in delta mode. Any value changes that occur within the time deadband are not returned. Value is in milliseconds. For more information about TimeDeadband, see the AVEVA Historian Retrieval Guide. You can

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Parameter Name	Parameter Choice	Example	Description
			download the guide from AVEVA Knowledge & Support Center.
ValueDeadband**	Optional	10	A value deadband for retrieval controls the value resolution of data returned in delta mode. Any data values that change less than the specified value deadband are not returned. The value deadband is a percentage of a tag's full scale in engineering units. For more information about ValueDeadband, see the AVEVA Historian Retrieval Guide. You can download the guide from AVEVA Knowledge & Support Center.
Expression	Optional	"UOM(hl/min)" or "UOM([t/h])"	Any valid Engineering Unit. This is used to convert the destination Engineering Unit. Ensure that you use the **Tag** parameter in the query to support the Engineering Unit conversion. For more information about Engineering Units, see the AVEVA Insight Online Help.

*The **Resolution** parameter is not required for the Deadband queries.

**Only the TDDProcessValues query supports the TimeDeadband and ValueDeadband parameters.

Note: If you use the Tag Extended Property (TEP) in the **Filter** expression, you must use the same in the **SelectColumn** list. The Tag Extended Property is applicable for only Online Insight queries. For more information about the Tag Extended Property, see the AVEVA Insight Help.

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Data Transformation for TDDProcessValues

The TDD Dimension requires StartDateTime and EndDateTime. However, the AVEVA Insight ProcessValues endpoint returns the following data, which does not comprise of the pre-defined StartDateTime and EndDateTime.

FQN	DateTime	OpcQuality	Value	Text
Weather.Los Angeles.Temperature	2020-01-06T07:25:19.216486Z	192	104	104
Weather.Los Angeles.Temperature	2020-01-06T07:45:00.010240Z	192	105	105
Weather.Los Angeles.Temperature	2020-01-06T08:00:01.087106Z	0	105.2	105.2
Weather.Los Angeles.Humidity	2020-01-06T08:00:01.087106Z	192	70	70
Weather.Los Angeles.Temperature	2020-01-06T08:05:36.228415Z	192	105.5	105.5
Weather.Los Angeles.Temperature	2020-01-06T08:10:11.864521Z	0	105.6	105.6
Weather.Los Angeles.Temperature	2020-01-06T08:25:45.341932Z	192	106	106
Weather.Los Angeles.Humidity	2020-01-06T08:25:45.341932Z	192	72	72

The AVEVA Insight Adapter processes the data returned by the ProcessValues endpoint. The processing is based on the rule that the timestamp of the current record of the same FQN is considered as the previous record's end time (**EndDateTime** field from the table below), and the previous record's timestamp is considered as the current record's start time (**StartDateTime** field from the table below). For example, the data shown in the above table is processed by the AVEVA Insight Adapter and is returned as follows.

FQN	StartDateTime	EndDateTime	OpcQuality	Value	Text
Weather.Los Angeles.Tempera	2020-01-06T07:25:19.216486Z	2020-01-06T07:45:00.010240Z	192	104	104

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FQN	StartDateTime	EndDateTime	OpcQuality	Value	Text
ture					
Weather.Los Angeles.Temperature	2020-01-06T07:45:00.010240Z	2020-01-06T08:05:36.228415Z	192	105	105
Weather.Los Angeles.Temperature	2020-01-06T08:00:01.087106Z		0	105.2	105.2
Weather.Los Angeles.Temperature	2020-01-06T08:05:36.228415Z	2020-01-06T08:25:45.341932Z	192	105.5	105.5
Weather.Los Angeles.Temperature	2020-01-06T08:10:11.864521Z		0	105.6	105.6
Weather.Los Angeles.Temperature	2020-01-06T08:25:45.341932Z	9998-12-31 23:59:59.00	192	106	106
Weather.Los Angeles.Humidity	2020-01-06T08:00:01.087106Z	2020-01-06T08:25:45.341932Z	192	70	70
Weather.Los Angeles.Humidity	2020-01-06T08:25:45.341932Z	9998-12-31 23:59:59.00	192	72	72

Note:
- Only the records with the "OpcQuality" value as "192" are considered for processing.
- AVEVA Insight Azure function considers “9998-12-31 23:59:59.00” as the value for the future EndDateTime. This record reflects the current value/state of the tagname.

Sample query expressions for ProcessValues

CQProcessValues

```
{
   "QueryName": "CQProcessValues",
   "SelectColumn": ["FQN","DateTime","OpcQuality","Text","Value"],
   "Tag": {
      "Filter": "startswith(Location,'/Lake')",
      "Select": ["FQN"]
   },
   "StartDateTime":"[RequestedStartTime]",
   "EndDateTime":"[RequestedEndTime]",
```

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```
   "RetrievalMode":"Full"
}
```

CQProcessValuesSameDataSet

```
{
"QueryName":"CQProcessValuesSameDataSet",
"SelectColumn": ["FQN","DateTime","OpcQuality","Text","Value"],
"Source":"Weather"
}
```

CQProcessValuesTagTypes

```
{
"QueryName": "CQProcessValuesTagTypes",
"SelectColumn": ["FQN","DateTime","OpcQuality","Text","Value"],
"TagType":"Discrete,String"
}
```

ProcessValues

```
{
   "QueryName":"ProcessValues",
   "Select":"DateTime, FQN, Value",
   "Tag": {
      "Filter": "startswith(Location,'/Lake') AND endswith(FQNS,'.temperature')",
      "Select": ["FQN"]
   },
   "RetrievalMode":"Average",
   "StartDateTime":"[RequestedStartTime]",
   "EndDateTime":"[RequestedEndTime]",
   "Expression":"UOM(°C)"
}
```

ProcessValues for Time Defining Dimension

TimeDeadband

```
{
   "QueryName":"TDDProcessValues",
   "SelectColumn": ["FQN","TagName","Source","Location","Text", "DateTime AS
   StartTime","DateTime AS EndTime"],
   "DistinctColumn": ["FQN","TagName","Source","Location","Text", "DateTime AS
   StartTime","DateTime AS EndTime"],
   "Tag": {
      "Filter":"startswith(FQN,'DataSource1')"
   },
   "StartDateTime":"[RequestedStartTime]",
   "EndDateTime":"[RequestedEndTime]",
   "TimeDeadband":5000,
   "RetrievalMode":"Delta"
}
```

ValueDeadband

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```
{
   "QueryName":"TDDProcessValues",
   "SelectColumn": ["FQN","TagName","Source","Location","Text", "DateTime AS
   StartTime","DateTime AS EndTime"],
   "DistinctColumn": ["FQN","TagName","Source","Location","Text", "DateTime AS
   StartTime","DateTime AS EndTime"],
   "Tag": {
      "Filter":"startswith(FQN,'DataSource1')"
   },
   "StartDateTime":"[RequestedStartTime]",
   "EndDateTime":"[RequestedEndTime]",
   "ValueDeadband":"20",
   "RetrievalMode":"Delta"
}
```

TimeDeadband and ValueDeadband

```
{
   "QueryName":"TDDProcessValues",
   "SelectColumn": ["FQN","TagName","Source","Location","Text", "DateTime AS
   StartTime","DateTime AS EndTime"],
   "DistinctColumn": ["FQN","TagName","Source","Location","Text", "DateTime AS
   StartTime","DateTime AS EndTime"],
   "Tag": {
      "Filter":"startswith(FQN,'DataSource1')"
   },
   "StartDateTime":"[RequestedStartTime]",
   "EndDateTime":"[RequestedEndTime]",
   "TimeDeadband":5000,
   "ValueDeadband":"20",
   "RetrievalMode":"Delta"
}
```

Retrieval modes supported by ProcessValues endpoints

The details of retrieval modes listed in this topic are taken from the AVEVA Historian Client User Guide. For more information about retrieval modes, refer to AVEVA Historian Client User Guide.

Average retrieval

For the time-weighted average (in short: "average") retrieval mode, a time-weighted average algorithm is used to calculate the value to be returned for each retrieval cycle.

For a statistical average, the actual data values are used to calculate the average. The average is the sum of the data values divided by the number of data values. For the following data values, the statistical average is computed as :

(P1 + P2 + P3 + P4) / 4) = Average

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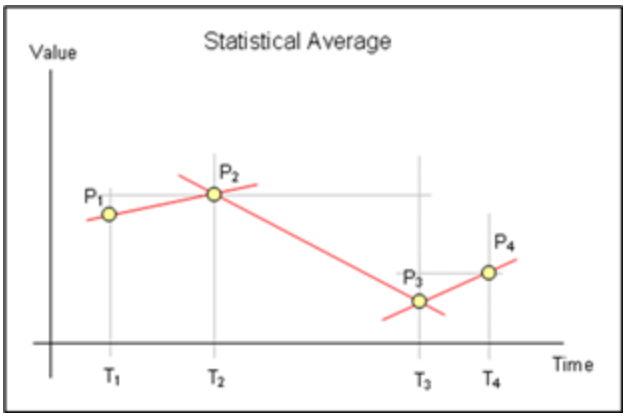
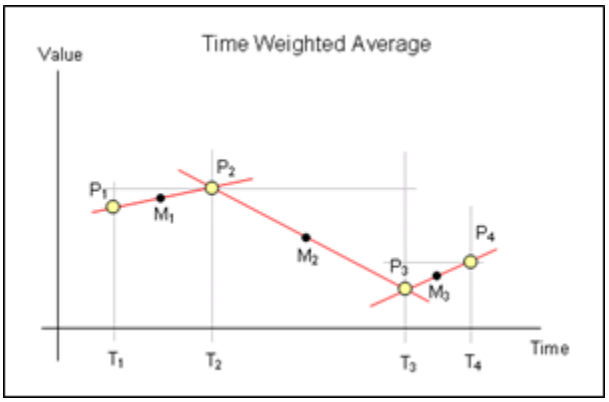


For a time-weighted average, values are multiplied by the time difference between the points to determine the time-weighted value. Therefore, the longer a tag had a particular value, the more weight that value holds in the overall average. The overall average is determined by adding all of the time-weighted values and then dividing that number by the total amount of time.

Which values are weighted depends on the interpolation setting of the tag. For a tag that uses linear interpolation, the midpoints between values are weighted. For a tag that uses stair-step interpolation, the earlier of two values is weighted.

For the following data values of a tag that uses linear interpolation, the time-weighted average is computed as:

(((P1 + P2) / 2) x (T2 - T1)) + (((P2 + P3) / 2) x (T3 - T2)) + (((P3 + P4) / 2) x (T4 - T3)) / (T4 - T1) = Average



If the same tag uses stair-step interpolation, the time-weighted average is:

((P1 x (T2 - T1)) + (P2 x (T3 - T2)) + (P3 x (T4 - T3))) / (T4 - T1) = Average

The SQL Server AVG aggregate is a simple statistical average. Using the average retrieval mode with a cycle count of 1 returns data much faster than the AVG aggregate, and usually more accurately due to the time weighting. The event subsystem also returns a simple statistical average.

Average retrieval returns one row for each tag in the query for each cycle. The number of cycles is based on the specified resolution or cycle count.

The time-weighted average algorithm is only applied to analog and analog summary tags. If you use average retrieval with other tags, the results are the same as when using regular cyclic retrieval.

For more information on Average Retrieval, refer to the AVEVA Historian Client User Guide.

Counter retrieval

Counter retrieval allows you to accurately retrieve the delta change of a tag's value over a period of time even

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for tags that are reset upon reaching a "rollover value." The rollover value is defined in the Wonderware Historian for each tag.

This retrieval mode is useful for determining how much of an item was produced during a particular time period. For example, you might have an integer counter that keeps track of how many cartons were produced.

The next value after the highest value that can be physically shown by the counter is called the rollover value. In this example, the rollover value is 10,000. When the counter reaches the 9,999th value, the counter rolls back to 0. Therefore, a counter value of 9,900 at one time and a value of 100 at a later time means that you have produced 200 units during that period, even though the counter value has dropped by 9,800 (9,900 minus 100). Counter retrieval allows you to handle this situation and receive the correct value. For each cycle, the counter retrieval mode shows the increase in that counter during the cycle, including rollovers.

Counter retrieval also works with floating point counters, which is useful for flow meter data. Similar to the carton counter, some flow meters "roll over" after a certain amount of flow accumulates. For both examples, the need is to convert the accumulating measure to a "delta change" value over a given period.

Counter retrieval is a true cyclic mode. It returns one row for each tag in the query for each cycle. The number of cycles is based on the specified resolution or cycle count.

The counter algorithm is only applied to analog tags and to discrete tags. For integer analog tags, the result will be an integer returned as a float data type For a real analog tag, the rollover value and the result may be real values and can include fractional values. If a query contains tags of other types, then no rows are returned for those tags. For discrete tags, the rollover value is assumed to be 2.

The rules used to determine the OPCQuality returned with a counter value are the same as for a time weighted average query. When a rollover has occurred in the calculation cycle, a special quality detail of 212 is returned in all non-NULL cases .

For more information on Counter Retrieval, refer to the AVEVA Historian Client User Guide.

Cyclic retrieval

Cyclic retrieval is the retrieval of stored data for the given time period based on a specified cyclic retrieval resolution, regardless of whether or not the value of the tag(s) has changed. It works with all types of tags. Cyclic retrieval produces a virtual rowset, which may or may not correspond to the actual data rows stored on the Wonderware Historian.

In cyclic retrieval, one row is returned for each "cycle boundary." You specify the number of cycles either directly or by means of a time resolution, that is, the spacing of cycle boundaries in time. If you specify a number of cycles, the Wonderware Historian returns that number of rows, evenly spaced in time over the requested period. The cyclic resolution is calculated by dividing the requested time period by the number of cycle boundaries. If you specify a resolution, the number of cycles is calculated by dividing the time period by the resolution.

If no data value is actually stored at a cycle boundary, the last value before the boundary is returned.

Cyclic retrieval is fast and therefore consumes little server resources. However, it may not correctly reflect the stored data because important process values (such as gaps and spikes) might fall between cycle boundaries.

For more information on Cyclic Retrieval, refer to the AVEVA Historian Client User Guide.

Delta retrieval

Delta retrieval, or retrieval based on exception, is the retrieval of only the changed values for a tag(s) for the given time interval. That is, duplicate values are not returned. It works with all types of tags.

Delta retrieval always produces a rowset comprised of only rows that are actually stored on the Historian; that is,

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a delta query returns all of the physical rows in history for the specified tags, over the specified period, minus any duplicate values. If there is no actual data point at the start time, the last data point before the start time is returned.

For more information on Delta Retrieval, refer to the AVEVA Historian Client User Guide.

Full retrieval

In full retrieval mode, all stored data points are returned, regardless of whether a value or quality has changed since the last value. This mode allows the same value and quality pair (or NULL value) to be returned consecutively with their actual timestamps. It works with all types of tags.

By using full retrieval in conjunction with storage without filtering (that is, no delta or cyclic storage mode is applied at the historian), you can retrieve all values that originated from the plant floor data source or from another application.

For more information on Full Retrieval, refer to the AVEVA Historian Client User Guide.

Integral retrieval

Integral retrieval calculates the values at retrieval cycle boundaries by integrating the graph described by the points stored for the tag. Therefore, it works much like average retrieval, but it additionally applies a scaling factor. This retrieval mode is useful for calculating volume for a particular tag. For example, if one of your tags represents product flow in gallons per second, integral retrieval allows you to retrieve the total product flow in gallons during a certain time period. It additionally applies the scaling factor called IntegralDivisor. For more information about IntegralDivisor, see **View the engineering unit catalog and the properties of catalog units** in the AVEVA Insight Online Help.

Integral retrieval is a true cyclic mode. It returns one row for each tag in the query for each cycle. The number of cycles is based on the specified resolution or cycle count.

Integral retrieval only works with analog tags. For all other tags, normal cyclic results are returned.

For more information on Integral Retrieval, refer to the AVEVA Historian Client User Guide.

TagMetaData

This Azure custom query returns the tags based on the query expression. The custom query expression supports the following parameters.

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Parameter Name	Parameter Choice	Example	Description
QueryName	Required	TagMetaData	Azure function query name
SelectColumn	Optional	["*","Location"], Or ["FQN", "Source", "Description", "EngUnit", "EngUnitMax", "EngUnitMin", "InterpolationType", "MessageOff", "MessageOn", "TagName", "TagType", "SourceTag", "Namespace", "Alias","Location"]	Option to pick required properties from AVEVA Insight.
*Filter**	Optional	"startswith(FQN,'Weather. Los Angeles')"	Expression to apply filter on the tags.

For more information about the supported Filter expressions, see the "Query Expression Operator" section.

The following properties are returned from the Azure function query for "TagMetadata".

Property Name	Datatype	Description
FQN	string	The fully qualified name for the tag. A fully qualified name uses the format: **datasource.tagname**.
TagName	string	The unique name of the tag within the Wonderware Historian system.
Source	string	The data source.
Description	string	The description of the tag.
EngUnit	string	The engineering units used for the tag's recorded values.
EngUnitMax	Double	The maximum value of the tag, measured in engineering units.
EngUnitMin	Double	The minimum value of the tag, measured in engineering units.
MessageOff	string	The message associated with the FALSE state of the discrete tag.

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Property Name	Datatype	Description
MessageOn	string	The message associated with the TRUE state of the discrete tag.
TagType	string	The type of tag. 1 = Analog; 2 = Discrete; 3 = String; 5 = Event, 7 = Summary tag (analog or state)

Sample query expression of TagMetaData

```
{
"QueryName": "TagMetaData",
"SelectColumn": ["*","Location"],
"Filter": "startswith(FQN,'Weather.Los Angeles')"
}
```

Insight MES API

- ContextEvents
  - ContextEvents
  - ContextEvents for time defining dimension
- DispositionReasons
- Equipment
- EquipmentStates
- OEECalculations
- ProductionEvents
- UtilizationEvents
- UtilizationReasonGroups
- UtilizationReasons

ContextEvents

- ContextEvents
- ContextEvents for time defining dimension

ContextEvents

This Azure function custom query returns the context events. The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	ContextEvents	Azure function query

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Parameter Name	Parameter Choice	Example	Description
			name
SelectColumn	Required	["*"]	Option to pick required properties from MES
Filter	Required	"endswith (myFilter,'')"	Expression to apply filter on the Context events.
StartDateTime	Optional	"[RequestedStartTime]"	Any valid UTC date time value. To leverage [RequestedStartTime] parameter for populating a time defining dimension, you must enable incremental update feature for the dimension. For more information, see Configure an incremental update for a dimension.

The following properties are returned from the Azure function query for "ContextEvents".

Property Name	Datatype	Description
Namespace	String	The equipment namespace.
Equipment	String	The equipment name.
StartTime	DateTime	The start time (in UTC format) of the context events.
PropertyName	String	The name of the property.
PropertyValue	String	The value of the property.
AutomationSource	String	This parameter is for internal use.

ContextEvents for time defining dimension

This Azure function custom query returns the TDD context events. The custom query expression supports the following parameters:

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Parameter Name	Parameter Choice	Example	Description
QueryName	Required	TDDContextEvents	Azure function query name
SelectColumn	Required	["*"] Or ["Namespace","Equipment","PropertyName","Start Time as StartTime","StartTime as EndTime"]	Option to pick required properties from MES
Filter	Required	"endswith (myFilter,'')"	Expression to apply filter on the TDD Context events.
StartDateTime	Optional	"[RequestedStartTime]"	Any valid UTC date time value. To leverage [RequestedStartTime] parameter for populating a time defining dimension, you must enable incremental update feature for the dimension. For more information, see Configure an incremental update for a dimension.
EndDateTime	Optional	"[RequestedEndTime]"	Any valid UTC date time value. To leverage [RequestedEndTime] parameter for populating a time defining dimension, you must enable incremental update feature for dimension. For more information, see Configure an incremental update for a dimension.

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Data transformation for TDDContextEvents

The TDD Dimension requires StartTime and EndTime. However, the AVEVA Insight ContextEvents endpoint returns the following data, which does not comprise of the pre-defined EndTime.

Namespace	Equipment	StartTime	PropertyName
New York Plant	BottleLine001	2020-08-01T00:00:00Z	Shift
New York Plant	BottleLine001	2020-08-01T08:00:00Z	Shift
New York Plant	BottleLine001	2020-08-02T00:00:00Z	Shift
New York Plant	BottleLine001	2020-08-02T08:00:00Z	Shift
New York Plant	BottleLine001	2020-08-03T00:00:00Z	Shift
New York Plant	BottleLine001	2020-08-03T08:00:00Z	Shift

The AVEVA Insight Adapter processes the data returned by the ContextEvents endpoint. The processing is based on the rule that the timestamp of the current record of the same **Namespace/Equipment/PropertyName** is considered as the previous record's end time (**EndTime** field from the table below). For example, the data shown in the above table is processed by the AVEVA Insight Adapter and is returned as follows.

Namespace	Equipment	StartTime	EndTime	PropertyName
New York Plant	BottleLine001	2020-08-01T00:00:00Z	2020-08-01T08:00:00Z	Shift
New York Plant	BottleLine001	2020-08-01T08:00:00Z	2020-08-02T00:00:00Z	Shift
New York Plant	BottleLine001	2020-08-02T00:00:00Z	2020-08-02T08:00:00Z	Shift
New York Plant	BottleLine001	2020-08-02T08:00:00Z	2020-08-03T00:00:00Z	Shift
New York Plant	BottleLine001	2020-08-03T00:00:00Z	2020-08-03T08:00:00Z	Shift
New York Plant	BottleLine001	2020-08-03T08:00:00Z	9998-12-31T23:59:59Z	Shift

Sample query expressions for ContextEvents

ContextEvents

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```
{
"QueryName": "ContextEvents",
"SelectColumn": ["*"],
"Filter":"endswith(myfilter,'')",
"StartDateTime":"[RequestedStartTime]"
}
```

ContextEvents for Time Defining Dimension

```
{
   "QueryName": "TDDContextEvents",
   "SelectColumn": ["Namespace","Equipment","PropertyName","StartTime as
   StartTime","StartTime as EndTime"],
   "Filter":"endswith(myfilter,'')",
   "StartDateTime":"[RequestedStartTime]",
   "EndDateTime":"[RequestedEndTime]"
}
```

DispositionReasons

This Azure function custom query returns the disposition reasons. The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	DispositionReasons	Azure function query name
SelectColumn	Optional	["*"] Or ["Name","Description","AutomationValue","DispositionType", "DisableDate","Id", "LastModified","_etag"]	Option to pick required properties from AVEVA Insight

The following properties are returned from the Azure function query for "DispositionReasons".

Property Name	Datatype	Description
Name	String	The disposition reason name. This is unique across all disposition reasons.
Description	String	The disposition reason description.

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Property Name	Datatype	Description
AutomationValue	Int32	The disposition reason automation value.
DispositionType	Int32	A read-only property, which is ignored if passed. It is set internally based on the DispositionReason.
DisableDate	DateTime	The disabled date. If this has a value, then the state is considered deleted.
Id	String	The DispositionReason ID.
LastModified	DateTime	The UTC time when the disposition was modified.
_etag	String	This an optimistic concurrency tag which prevents overlapping updates to an entity.

Sample query expression for DispositionReasons

```
{
"QueryName": "DispositionReasons",
"SelectColumn": ["*"]
}
```

Equipment

This Azure function custom query returns all the equipment present in AVEVA Insight. The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	Equipment	Azure function query name
SelectColumn	Optional	["*"] Or ["Name", "Namespace", "Description", "Location", "Id", "_etag"]	Option to pick required properties from AVEVA Insight

The following properties are returned from the Azure function query for "Equipment".

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Property Name	Datatype	Description
Name	String	The description of an equipment. Equipment are unique by Name combined with Namespace. Also by Name combined with Location.
Namespace	String	The namespace of an equipment
Description	String	The description of an equipment
Location	String	The location of an equipment
Id	String	The ID that identifies the equipment. The ID can be a typical equipment ID or the equipment's asset ID, indicated by the *useAssetId* parameter.
_etag	String	This an optimistic concurrency tag which prevents overlapping updates to an entity

Sample query expression for Equipment

```
{
"QueryName":"Equipment",
"SelectColumn":["*"]
}
```

EquipmentStates

This Azure function custom query returns all the equipment states present in AVEVA Insight. The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	EquipmentStates	Azure function query name
SelectColumn	Optional	["*"] Or ["Name", "Description", "Color", "StateType", "DisableDate", "Id", "_etag"]	Option to pick required properties from AVEVA Insight

The following properties are returned from the Azure function query for "EquipmentStates".

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Property Name	Datatype	Description
Name	String	An equipment state name. This is unique across all equipment states.
Description	String	An equipment state description.
Color	String	Represents an equipment state color in the RGB format (#DC0A0A).
StateType	Number	Represents an equipment state type (1=Idle, 2=Runtime, 3=Downtime).
DisableDate	DateTime	The disabled date. If this has a value, then the state is considered deleted.
Id	String	The EquipmentState ID.
_etag	String	This an optimistic concurrency tag which prevents overlapping updates to an entity.

Sample query expression for EquipmentStates

```
{
"QueryName":"EquipmentStates",
"SelectColumn":["*"]
}
```

OEECalculations

This Azure function custom query returns the OEE Calculations. The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	OEECalculations	Azure function query name

The following properties are returned from the Azure function query for "OEECalculations".

Property Name	Datatype	Description
Namespace	String	The namespace for the piece of equipment to which this OEE calculation definition applies.
Name	String	The name for the equipment.

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Property Name	Datatype	Description
DefaultRate	Int32	The default quantity of items being produced on this piece of equipment.
DefaultRate.UOM	String	The UOM (unit of measure) for the default production rate.
DefaultRate.Time	String	The default amount of time that is required to produce the default rate quantity of items on this piece of equipment.
TargetAvailability	Int32	The target setpoints for Availability for the equipment.
TargetQuality	Int32	The target setpoints for Quality for the equipment.
TargetPerformance	Int32	The target setpoints for Performance for the equipment.
TargetOEE	Int32	The target setpoints for KPI OEE for the equipment.
StartUtilizationReason	String	If a valid utilization reason is provided in this column, a utilization event with this utilization reason will be added when a production run is started.
CompleteUtilizationReason	String	If a valid utilization reason is provided in this column, a utilization event with this utilization reason will be added when a production run is completed.

For more information, see the **OEE calculation definition columns** section in the AVEVA Insight Online Help.

Sample query expression for OEECalculations

```
{
"QueryName":"OEECalculations"
}
```

ProductionEvents

This Azure function custom query returns the production events. The custom query expression supports the following parameters:

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Parameter Name	Parameter Choice	Example	Description
QueryName	Required	ProductionEvents	Azure function query name
SelectColumn	Required	["*"]	Option to pick required properties from MES
Filter	Required	"endswith (myFilter,'')"	Expression to apply filter on the production events.
StartDateTime	Optional	"[RequestedStartTime]"	Any valid UTC date time value. To leverage [RequestedStartTime] parameter for populating a time defining dimension, you must enable incremental update feature for the dimension. For more information, see Configure an incremental update for a dimension.

The following properties are returned from the Azure function query for "ProductionEvents".

Property Name	Datatype	Description
ProducedTime	DateTime	The UTC time when the production was added. The default is the current time.
Equipment	String	The equipment name.
Namespace	String	The equipment namespace.
DispositionReason	String	The disposition reason or automation value for the production that is being added. The reason must exist in the efficiency model.
DispositionType	Int32	A read-only property, which is ignored if passed. It is set internally based on the DispositionReason.
Quantity	Double	The quantity of items that were produced. Quantity can be positive or negative value. A negative

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Property Name	Datatype	Description
		quantity results in reducing existing event quantities with the same disposition reason. Negative quantities also result in an Http 204 (No Content) being returned. However, an error is returned if the negative quantity is greater than the produced quantity for the active production run.
OriginalQuantity	Double	A read-only property, which is ignored if passed. If a production event is ever adjusted due to an Edit or Reclassify, this property holds the original value before it was adjusted. Typically for internal use only.
Comment	String	A comment about the production that is being added.
AutomationSource	String	This parameter is for internal use.
Id	String	The ProductionEvent ID.
LastModified	DateTime	The UTC time when the production was modified.
_etag	String	This an optimistic concurrency tag which prevents overlapping updates to an entity.

Sample query expression for ProductionEvents

```
{
"QueryName": "ProductionEvents",
"SelectColumn": ["*"],
"Filter":"endswith(myFilter,'')",
"StartDateTime":"[RequestedStartTime]"
}
```

UtilizationEvents

This Azure function custom query returns the utilization events.

Note: For the UtilizationEvents custom query expression, the best practice is to use the **LastModified** parameter in the incremental update feature, instead of **StartTime** or **EndTime** parameters. When Incremental update timeframe observes StartTime field, then it considers only events where StartTime matches the incremental

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update timeframe. Subsequently it excludes all the events that are out of the timeframe, but which have been modified within the same timeframe. Meanwhile, **LastModified** parameter considers any and all changes with every incremental update. For more information, refer to Configure an Incremental Update for a Dimension.

The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	UtilizationEvents	Azure function query name
SelectColumn	Optional	["*"] Or ["Equipment AS EquipmentName", "Namespace AS Namespace", "Location AS Location", "EquipmentState AS State", "UtilizationReason AS Reason", "StartTime", "EndTime"]	Option to pick required properties from AVEVA Insight

Equipment	Required	{
		"Filter": "contains(Location,'Lake Forest')"
		}
			Equipment expression is used to apply a filter on the equipment to be used to retrieve utilization events.

LastModified	Optional	"[RequestedStartTime]" "[RequestedEndTime]"	Any valid UTC date time value. To fully leverage the LastModified datetime field from MES API resultset, you must subsequently enable the incremental update feature for a dimension by configuring the LastModified field in it. For more information, see Configure an incremental update for a dimension. **Note:** LastModified is

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Parameter Name	Parameter Choice	Example	Description
			available only for the UtilizationEvents custom query.
Top	Optional	"50000"	Number of records to be retrieved from AVEVA Insight

The following properties are returned from the Azure function query for "UtilizationEvents".

Property Name	Datatype	Description
StartTime	DateTime	The start time of the utilization event.
Equipment	String	The equipment name.
Namespace	String	The equipment namespace.
Location	String	The equipment location.
StateType	Number	The equipment state type (1=Idle, 2=Runtime, 3=Downtime).
EquipmentState	String	The equipment state name.
UtilizationReason	String	The utilization reason name.
Comment	String	An event comment.
EndTime	DateTime	The end time of the utilization event.
AutomationSource	String	The Tag FQN when the utilization event is from data collection (Internal use).
Id	String	The UtilizationEvent ID.
_etag	String	This an optimistic concurrency tag which prevents overlapping updates to an entity.
LastModified	DateTime	The time of modification of the utilization event.

Sample query expression for UtilizationEvents

```
{
```

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```
"QueryName": "UtilizationEvents",
"SelectColumn": ["*"],
"Filter":"endswith(Location,'')",
"LastModified":"[RequestedStartTime]",
"LastModified":"[RequestedEndTime]"
}
```

UtilizationReasonGroups

This Azure function custom query returns the utilization reason groups. The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	UtilizationReasonGroups	Azure function query name
SelectColumn	Optional	["*"] Or ["GroupName", "Description", "ParentGroupName", "Id", "_etag"]	Option to pick required properties from AVEVA Insight

The following properties are returned from the Azure function query for "UtilizationReasonGroups".

Property Name	Datatype	Description
GroupName	String	The utilization reason group name. This is unique across all utilization reasons.
Description	String	The utilization reason group description.
ParentGroupName	String	Name of a parent group. If blank, this is a top-level group.
Id	String	The UtilizationReasonGroup ID.
_etag	String	This an optimistic concurrency tag which prevents overlapping updates to an entity

Sample query expression for UtilizationReasonGroups

```
{
"QueryName":"UtilizationReasonGroups",
"SelectColumn":["*"]
}
```

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UtilizationReasons

This Azure function custom query returns the utilization reasons. The custom query expression supports the following parameters:

Parameter Name	Parameter Choice	Example	Description
QueryName	Required	UtilizationReasons	Azure function query name
SelectColumn	Optional	["*"] Or ["Name", "Description", "AutomationValue", "EquipmentStateId", "ReasonGroupNames", "DisableDate", "Id", "_etag"]	Option to pick required properties from AVEVA Insight

The following properties are returned from the Azure function query for "UtilizationReasons".

Property Name	Datatype	Description
Name	String	The utilization reason name. This is unique across all utilization reasons.
Description	String	The utilization reason description.
AutomationValue	Int32	The utilization reason automation value.
EquipmentStateId	String	The ID of the associated equipment state.
ReasonGroupNames	String	Reason groups to which this reason belongs.
DisableDate	DateTime	The disabled date. If this has a value, then the state is considered deleted.
Id	String	The UtilizationReason ID.
_etag	String	This an optimistic concurrency tag which prevents overlapping updates to an entity.

Sample query expression for UtilizationReasons

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```
{
"QueryName":"UtilizationReasons",
"SelectColumn":["*"]
}
```

SQL Azure database data adapter

Configure the Microsoft Azure SQL database connection

Configure the Microsoft Azure SQL database connection

You can configure the Microsoft Azure SQL database name to connect to a Microsoft Azure SQL Server database and retrieve the database details.

Configure the Microsoft Azure SQL database connection

1. In the **Data Adapter Type** list, select **Microsoft Azure SQL Database**.

   The **Data Source Configuration** section appears as follows.

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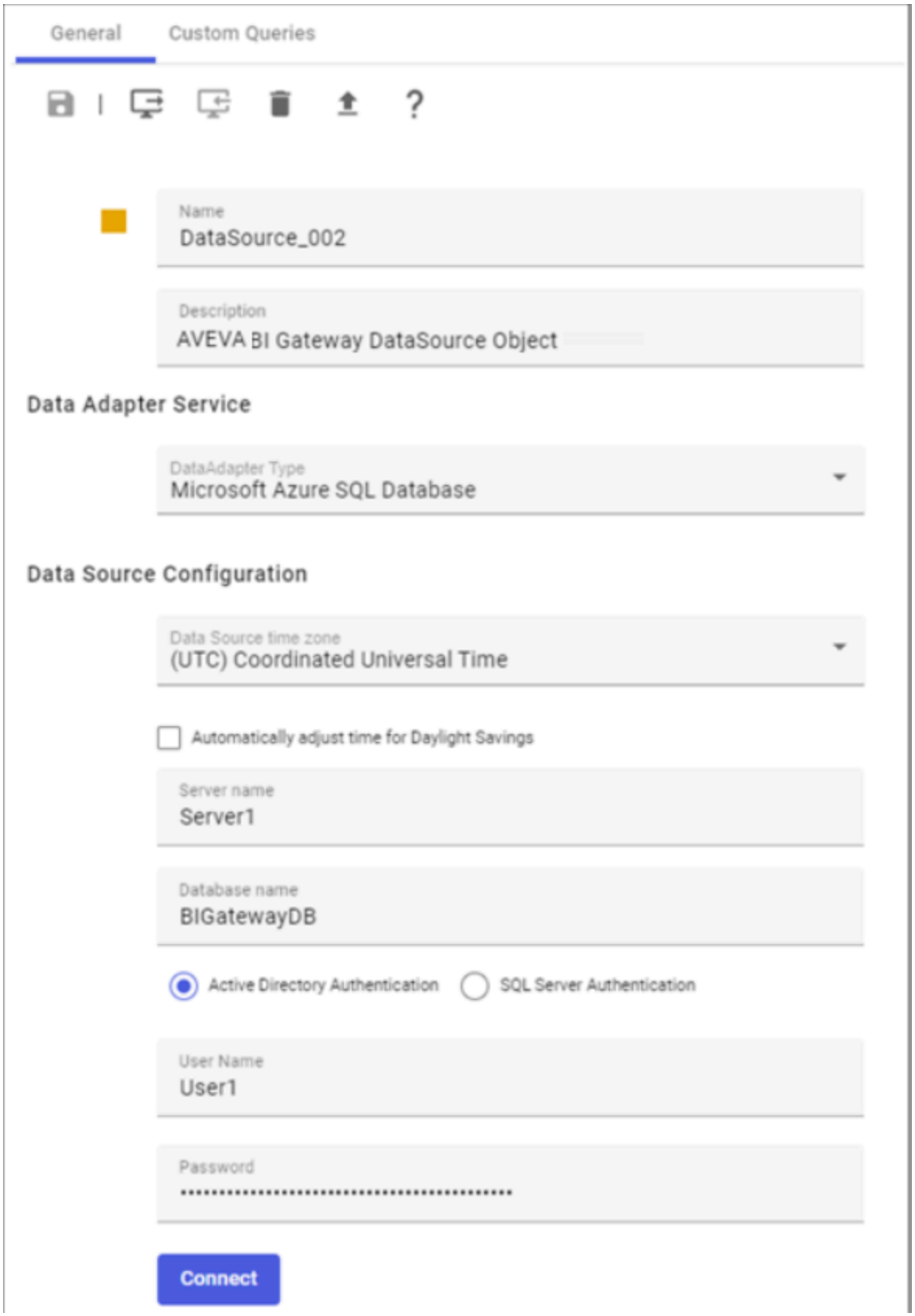

2. In the **Data Source Configuration** section, do the following:

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a. In the **Data Source time zone** list, click the time zone of the database that the external data source system is referencing.

   You can click the **Automatically adjust time for Daylight Savings** check box if the time zone that you select is affected by daylight saving time (DST).

   For more information, see Time zone for a data source.

In the **Server name** box, type the URL of the Microsoft Azure SQL server.

a. In the **Database name** box, type the database name that you want to connect to.
b. Select the authentication mode and then enter the user name and password.
   a. Select the **Active Directory Authentication** mode if you want to connect using the Active Directory credentials. You must specify the user name and password for authentication.
   b. Select the **SQL Server Authentication** mode if you want to connect using the SQL Server credentials. You must specify the user name and password for authentication.

3. Click **Connect**. If the connection succeeds, the Getting schema notification message appears. It can take a few minutes to retrieve the schema from the data source. For more information about retrieving the schema, see Retrieve the schema.
4. Click **Done** and then click **Save**.

Generic REST API data adapter

Configure the Generic REST API connection
Use custom queries for Generic REST API
Sample query expressions that support Generic REST API

Configure the Generic REST API connection

You can provide connection information for the generic REST API to retrieve the data from shared data sources.

The generic REST API data source allows you to query private or public data such as weather, government agencies information, and so on.

Configure the Generic REST API Connection

1. In the **Data Adapter Type** list under **Data Adapter Service**, select **Generic Rest API**.

   The **Data Source Configuration** section appears.
2. In the **Data Source time zone** list, the Coordinated Universal Time (UTC) option is by default selected. You cannot edit the time zone for Generic Rest API.
3. In the **URL** text box, specify the base URL for the required Rest API.

   For example, if the URL is *https://api.openweathermap.org/data/2.5/weather?lat=46.91945109973637&lon=6.2763601429257125&appid=142170e30e9f2a4fd492e3b7581*, then:

   - the base URL is *https://api.openweathermap.org/*

     Note: It is mandatory for a base URL to end with the forward slash **/** symbol.
     Note: Base URL for DataHub datasource is tenant-based (see the Client Credentials section below.)

   - the ItemPath is *data/2.5/weather*

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- the Query expression is
  ?lat=46.91945109973637&lon=6.2763601429257125&appid=142170e30e9f2a4fd492e3b7581
- Under the Custom Queries tab, ItemPath and QueryExpression are configurable with the ItemPath and QueryParameter within a data source object.

Note: It is mandatory for a Query expression to begin with the question mark **?** symbol.

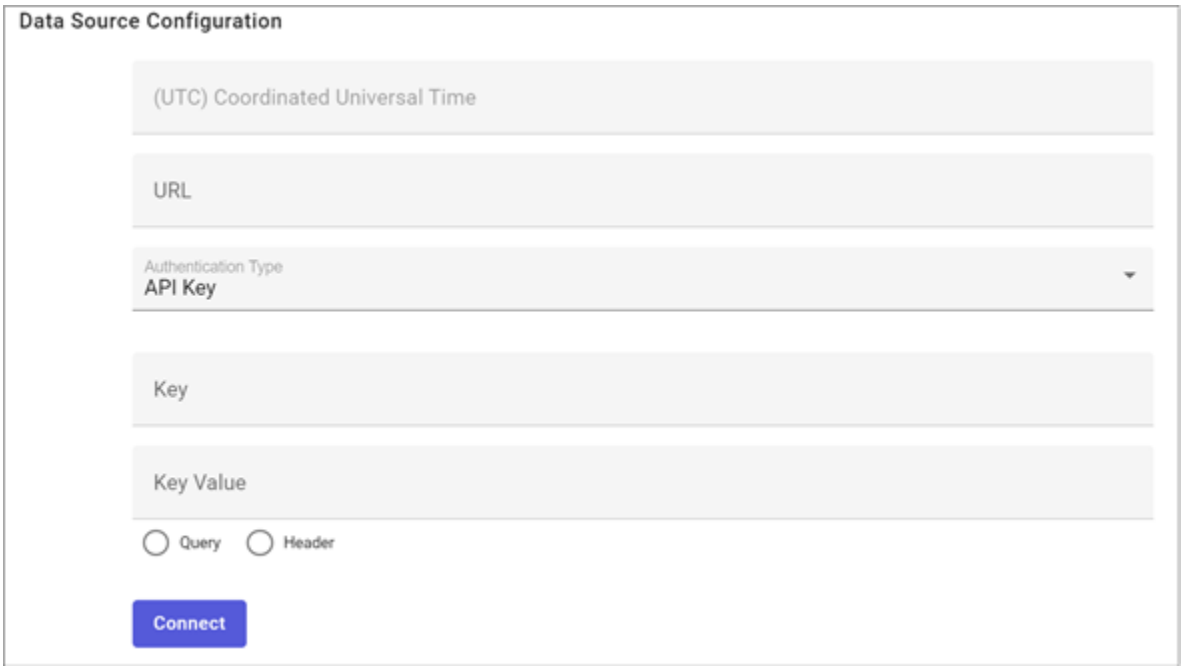
4. In the **Authentication Type** dropdown list, select either of the following authentication types to authenticate the API call:
   - **API key**

     Select the **API Key** type to authenticate using the REST API key, and then perform the following:

     a. In the **Key** box, specify the authentication key for the required Rest API.

     b. In the **Key Value** box, specify the key value for the required Rest API.

     c. Select either **Query** or **Header** for the retrieval request. The API documentation mentions whether to use Query or Header. For example, OpenWeather API supports Header.



   - **Bearer token**

     Select the **Bearer Token** type to authenticate using the bearer token of the required API. In the **Token** box, enter the bearer token of the required API. For example, Insight APIs such as Historian, MES, or CIM.

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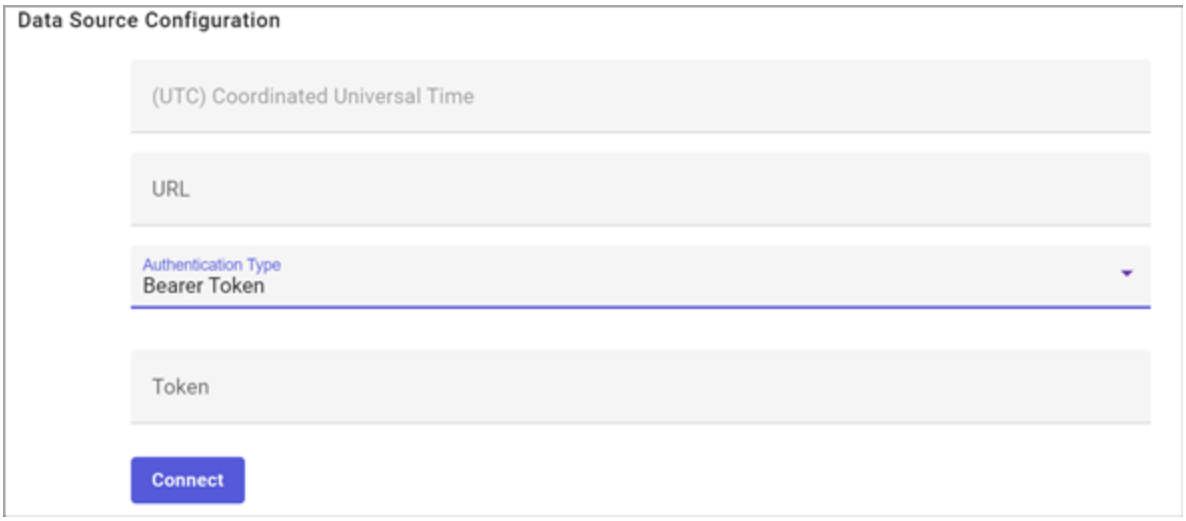

- **Client credentials**

  Select the **Client Credentials** type to authenticate Insight ADH API. The **URL** is tenant based. Enter the **Token Url**, **Client Id**, and **Client Secret**. The token Url differs according to regions:

  - West US (primary): https://uswe.datahub.connect.aveva.com/identity/connect/token
  - Northern Europe: https://euno.datahub.connect.aveva.com/identity/connect/token
  - East Australia: https://auea.datahub.connect.aveva.com/identity/connect/token

  The example below shows the North Europe token Url.

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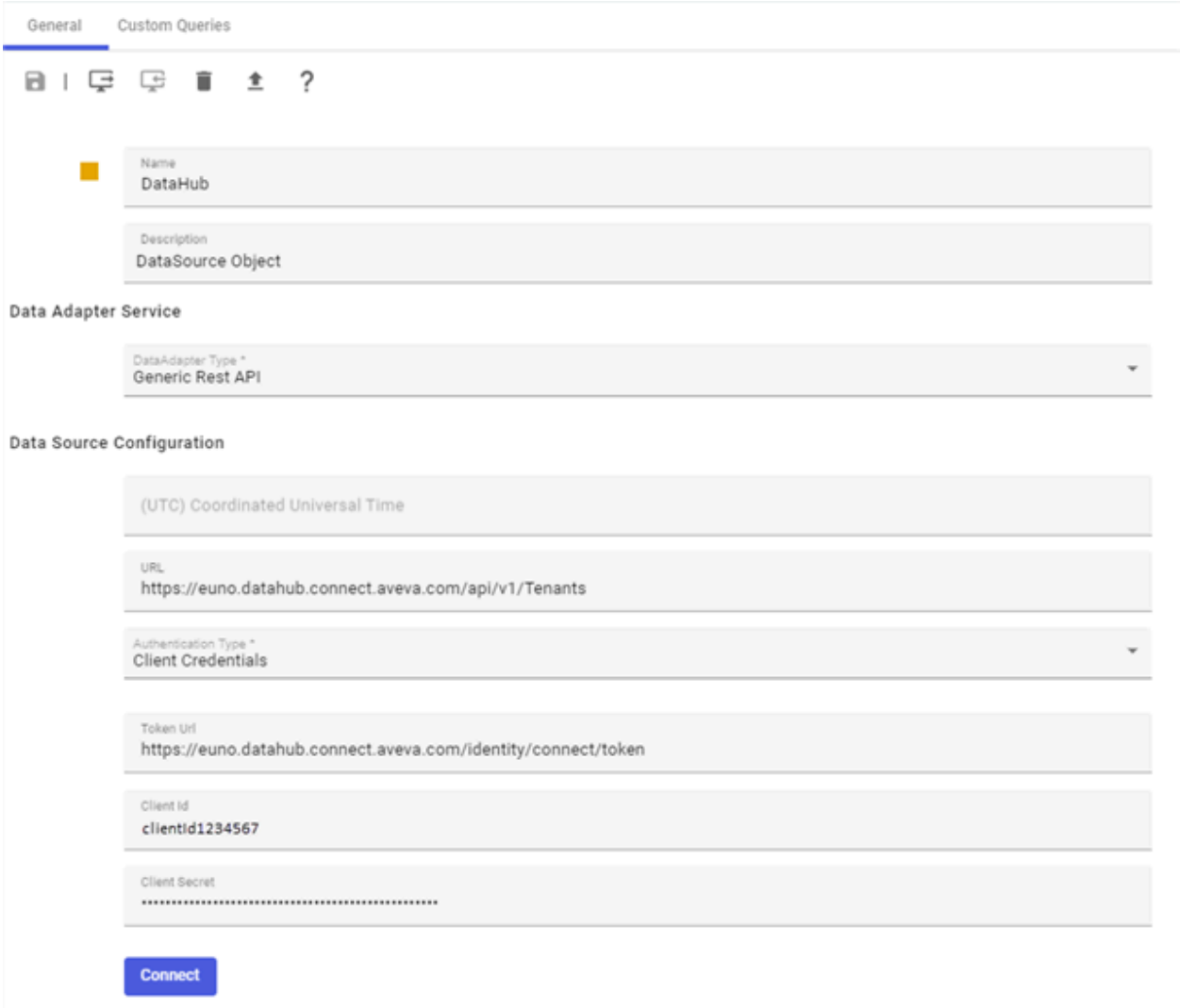

Create client credentials for Insight ADH API:

a. Log into your AVEVA account with your credentials.
b. Click on the Data Hub tenant.
c. From the menu tab, select **Security a**nd then **Clients**.
d. Click **Add Client**.
e. Type in or select the **name, tenant roles,** and **token lifetime** (or keep the default token lifetime value).
f. Click **Continue**.
g. You may add a Secret description. It is optional but recommended.
h. Select or deselect the **Never Expires** checkbox based on your requirements.

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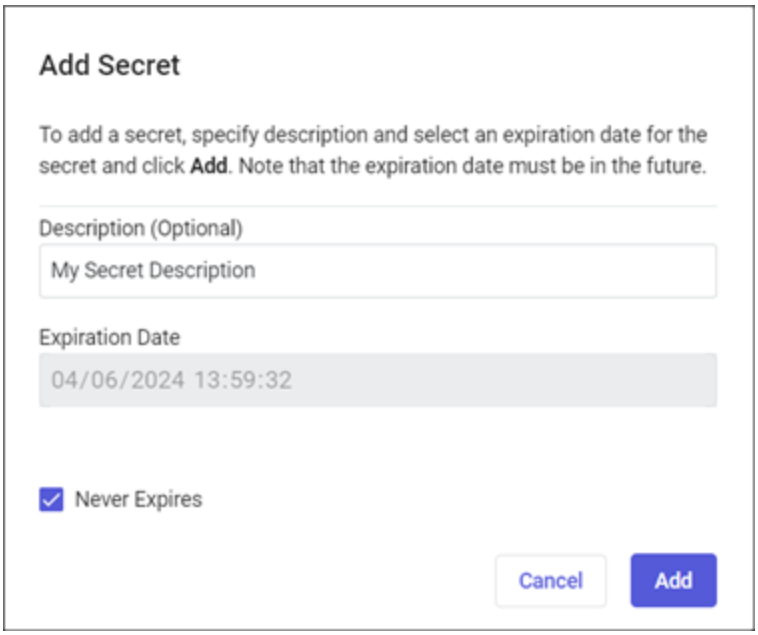

i. Click **Add**.

The Client is successfully created, and the required credentials appear. Make sure to copy or save the credentials, especially because **Client Secret** appears only once.

After selecting a Client from the list, a right-hand-side pane appears and provides the required Client details. The pane also provides **Connection Information,** which contains the **Tenant ID** and **Namespaces** of different regions. The URL must contain the tenant ID and namespace.

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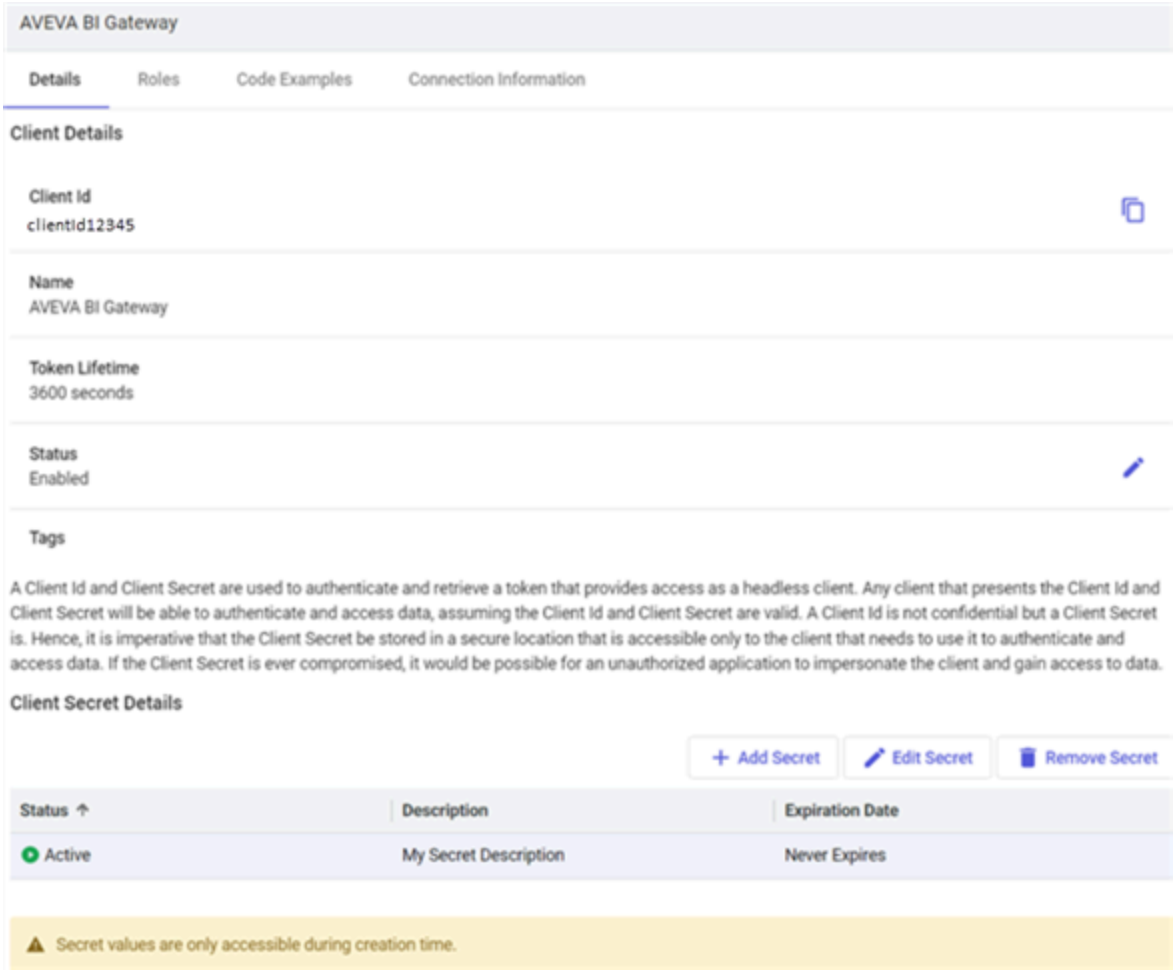

j. Choose the correct tenant ID and namespace details based on the region.

5. Click **Connect**. If the connection succeeds, the Getting schema notification message appears. It can take a few minutes to retrieve the schema from the data source. For more information about retrieving the schema, see Retrieve the schema.
6. Click **Done** and then click **Save**.

Use custom queries for Generic REST API

An Azure function is used to flatten the data from Generic Rest API data source for data transformation in BI Gateway. The following custom queries are available for use in the Custom Query expression editor.

The custom query expression supports the following parameters.

Parameter Name	**Parameter Choice**	**Example (using common Insight REST API queries)**	**Description**
QueryName	Required	WeatherTags	BI Gateway data source query name You can define the

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Parameter Name	Parameter Choice	Example (using common Insight REST API queries)	Description
			QueryName as per your requirements.
Method	Required	Get	Method used to perform action on the http request. Generic REST API data adapter currently supports only the Get method.
ItemPath	Required	For example, if the generic Rest API URL is *https://online.wonderware.com/ apis/Historian/v2/Tags*, then the ItemPath is *apis/Historian/v2/Tags*.	The ItemPath is added to the base URL. The combination of base URL and Item Path represent the REST API end point.
QueryParameter	Optional	"$filter=startswith(FQN, 'Weather.Los Angeles ')"	A defined set of parameters attached to the end of a URL. To add multiple parameters, add an '&' between each parameter. **Note:** QueryParameter may be optional for some endpoints. In such cases, the URL may only have the base URL and the ItemPath.
NextPage	If the REST API has pagination, specify this parameter.	JSON Output with Pagination to be specified	Used to apply pagination if the data retrieved spans more than 1 page.

The following are the sample query expressions which support Generic REST API.

Note: The value **@odata.nextLink** used for the **NextPage** parameter is applicable only for Insight APIs which support pagination.
The value **CIMv3** for the **APIType** parameter is applicable only for Insight CIM API.
The value **ADH** for the **APIType** parameter is applicable only for Insight ADH API.

Sample query expressions that support Generic REST API

Insight Historian API

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Insight MES API
Insight CIM API
DataHub API
External API

Insight Historian API

Tags

This custom query returns the tags based on the query expression.

Sample query expression

```
{
   "QueryName": "WeatherTags",
   "Service":{
      "Method": "Get",
      "ItemPath":"apis/Historian/v2/Tags",
      "QueryParameter": "$filter=startswith(FQN, ‘Weather.Los Angeles’)",
      "NextPage": "@odata.nextLink"
   }
}
```

ProcessValues

This custom query returns the process values for the given tags.

Sample query expression

```
{
   "QueryName": "ProcessValues",
   "Service":
   {
      "Method": "Get",
      "ItemPath":"apis/Historian/v2/ProcessValues",
      "QueryParameter": "TagFilter=startswith(FQN,
      'London.Mash200.temperature_PV')&StartDateTime=\"[RequestedStartTime]\"&EndDateTime=\
      "[RequestedEndTime]\"&RetrievalMode=Full",
      "NextPage": "@odata.nextLink"
   }
}
```

Insight MES API

ProductionEvents

This custom query returns the production events for the given tags.

Sample query expression

```
{
   "QueryName":"ProductionEvents",
   "Service":{
      "Method":"Get",
      "ItemPath":"apis/MES/odata/ProductionEvents",
      "QueryParameter":"$filter=ProducedTime ge [RequestedStartTime] AND ProducedTime le
      [RequestedEndTime] AND DispositionType eq 1&$orderby=ProducedTime&$top=10000",
      "NextPage":"@odata.nextLink"
```

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```
    }
}
```

ContextEvents

This custom query returns the context events for the given tags.

Sample query expression

```
{
    "QueryName":"ContextEvents",
    "Service":
    {
        "Method":"Get",
        "ItemPath":"apis/MES/odata/ContextEvents",
        "QueryParameter":"$filter=StartTime ge [RequestedStartTime] AND StartTime le
        [RequestedEndTime] AND PropertyName eq 'ProductID' &$orderby=StartTime&$top=10000",
        "NextPage":"@odata.nextLink"
    }
}
```

ProductionRuns

This custom query returns the production runs for the given tags.

Sample query expression

```
{
    "QueryName":"ProductionRuns",
    "Service":
    {
        "Method":"Get",
        "ItemPath":"apis/MES/odata/ProductionRuns",
        "QueryParameter":"$filter=StartTime ge [RequestedStartTime] AND EndTime le
        [RequestedEndTime] &$orderby=StartTime&$top=200000",
        "NextPage":"@odata.nextLink"
        }
}
```

Insight CIM API

CIMv3

This custom query returns the CIMv3 MES asset list.

This query sample is only applicable to version 3 of CIM.

Sample query expression

```
{
    "QueryName": "CIMV3",
    "Service":
    {
        "Method": "Get",
        "ItemPath":"apis/cim/v3/entities",
        "QueryParameter": "query={\"@entityDefinitionId\":\"a2560e20-fe5b-
        ee15-ed2b-39f79ccab75c\",\"namespace\": \"London
        Plant\"}&IncludeData=true&IncludeTraits=false&includePaths=false&IncludeLinks=false",
        "APIType":"CIMv3"
    }
}
```

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DataHub API

ADH

This custom query returns the appropriate response for the given API.

Sample query expression

```
{
   "QueryName":"Try",
   "Service":
{
   "Method":"Get",
   "ItemPath":"/Namespaces/63a7020f-e047-4279-8dea-c71d36df747d/DataViews/WindFarm/Data/
   Interpolated",
   "QueryParameter":
   "startIndex=2023-04-10T00:00:00.000Z&endIndex=2024-04-12T00:00:00.000Z&interval=02.00:00
   :00&form=default",
   "APIType":"ADH"
}
}
```

External API

This custom query returns the appropriate response for the given API.

Sample query expression

```
{
   "QueryName":"openweather",
   "Service":
   {
      "Method":"Get",
      "ItemPath":"data/2.5/weather",
      "QueryParameter":"&lat=46.91945109973637&lon=6.2763601429257125",
      "NextPage":"@odata.nextLink"
   }
}
```

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Dimensions

A dimension provides contextual information to measures in the AVEVA BI Gateway model. Each dimension typically stores related information. For example, a product dimension can store the product ID, product name, and product description. Product ID, product name, and product description are the fields of the product dimension. Dimension fields are represented by columns of the dimension table in the AVEVA BI Gateway datastore. You can map the dimension fields to source data item fields.

In the AVEVA BI Gateway model, you must provide at least one dimension key for each dimension. The dimension key is a field or a group of fields that uniquely identifies each record of a dimension. You can include a maximum of eight fields in a given dimension key. It is critical to ensure that your dimension key combination will generate unique records. If a duplicable row is found during execution, the complete dimension will be invalidated.

You must specify a refresh rate for a dimension. The AVEVA BI Gateway services extract data from the data sources, transform it, and populate the respective dimension table. Thereafter, the dimension is periodically refreshed as per the refresh rate. You can build a filter expression to filter the required transformed data from external data sources and populate the dimension table in the datastore.

You can add and configure dimension links in a dimension. Dimension links help you relate dimensions between each other. When defining a measure, you can add linked dimensions to the measure context even if the measure source data has no direct reference to the linked dimension. Measure source data will be inferred from the dimension that defined the dimension link.

You can also configure a dimension as time-slicing. Such dimensions define the time periods for which measure calculations will be computed. For example, a shift schedule or Work Order dimension can be configured as a time-slicing dimension through the fields that identify the start and end times of the period they represent.

The first record in the dimension table represents an unknown record. The unknown record is created automatically. It consists of a primary key field equal to 0 and null values in all the associated source data item fields. The unknown record is used in the following scenarios:

- At run time, the system looks up for each dimension link and measure relationship with the values of the source field(s) used in the link or relationship. These values are then associated with a dimension key value. When the source field value is "Null" or does not exist in the dimension, then the corresponding record or aggregate will reference the unknown dimension record.
- When you relate a constant value to the dimension key ("Null" is also a constant), then the constant value is attached to all of the aggregates from the source system after the calculation of the aggregates. The resulting dimension key in the measure table points to the relevant dimension record. If the constant value does not exist in the dimension or is "Null", then the corresponding record will reference the unknown dimension record.

Manage dimensions

After you add and configure data sources, you can add and manage dimensions.

The Dimension editor allows you to:

- Add a dimension

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- Edit a Dimension
- Deploy and undeploy a dimension
- Delete a dimension
- Manage dimension fields
- Manage dimension links
- Configure Refresh Rate of a Dimension
- Configure an incremental update for a dimension
- Configure time-slicing for a dimension
- Configure a filter for a dimension

Quick dimension tutorial videos

Video tutorial: Create a regular dimension object in AVEVA BI Gateway

https://player.vimeo.com/video/848800426?badge=0&autopause=0&player_id=0&app_id=58479

Video transcript (Select to expand)

Welcome! This is a short demo of the Dimensions object within the AVEVA BI Gateway Model Builder.

A dimension provides contextual information to measures in the model.

Each dimension typically stores related information.

In this video, we will look at how to create a basic or a static dimension.

Let us look at how to create a basic dimension.

Go to the Floating Action Button (FAB) and click Dimension.

A new dimension appears.

Enter the name and description.

Next, go to Fields and select the pencil icon.

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This step is important as we are now adding a data source to the dimension.

Select the data source icon.

Search for the data source and click the checkbox.

The search result includes the custom queries within data sources and SQL table as well.

Select the required data source.

For this example, let us choose the Asset data source.

Click to select the Preview Source Data button.

The table set of the custom query appears.

Click OK.

The next step is to add fields to the dimension.

You can map the dimension fields to source data item fields.

You have to design the dimension by defining field name and map to the field name returned by the custom query selected.

As a best practice but still optional, it is recommended to keep the field name the same as the name provided from the custom query.

Define the fields that will become the primary key or contribute to a composite key, by clicking the toggle button.

The combination of the fields should contribute to the uniqueness of the record.

A combination of keys is called a composite key.

Once this is over, our Basic Dimension ‘Asset’ is created.

Since it is a basic dimension and there is no time-related information to the asset, you can select the appropriate refresh rate.

The options under the Advanced section are used for time-defining dimensions.

While you can use the Filter Expression option under the Filter section, it is less time-consuming to filter out data from the level of the data source into the custom query itself, rather than applying the filter on top of the whole result set returned by the data source, which subsequently eliminates more data.

The next step is to deploy the dimension.

The dimension has now changed from yellow to green which indicates that it is well configured, deployed and executed.

This video demonstrates how to create a regular dimension object.

Note: 'Regular dimension' is the new term for 'static dimension' as of August 2023.

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Video tutorial: Create a time-defining dimension object in AVEVA BI Gateway

https://player.vimeo.com/video/848800410?badge=0&autopause=0&player_id=0&app_id=58479

Video transcript (Select to expand)

In this video, we will look at how to create a time-defining dimension, and then how to link two dimensions in a measure.

The initial dimension-creating process is the same as basic settings of the dimension:

Go to the Floating Action Button (FAB) and click Dimension.

Enter the name and description.

Go to Fields and select the pencil icon.

Then, select the data source icon.

Search for the data source and click the checkbox.

Select the required data source.

For this example, let us choose the Work Order data source.

Click to select the Preview Source Data button.

The table set of the custom query appears.

Click OK.

The next step is to add fields to the time-defining dimension.

The WorkOrderID custom query retrieves and returns records in an organized and timely manner, based on the StartTime and EndTime specified.

Hence, you will have to the make Plant, Asset, and also StartTime to contribute to the uniqueness of the composite keys.

Go to the Advanced section of the dimension and select the Time Slicing checkbox.

This is important, as the dimension is a time-contextual contributor to the measure and enforces the measure calculation to be time-sliced as per the work order events.

The Incremental Update is optional but recommended for a large data set.

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You can backfill the dimension from a specified date called Data Collection Start.

In BI Gateway, you have to define the relationship between the time defining dimension and the Asset dimension under the Links section, if they have a common field that needs to be mapped from each other.

This step is particularly important to enable the ContextLink feature in a measure object.

To create a new link, go to the Links section of the dimension selected.

In this video, we are still at the WorkOrder_TimeDefiningDimension.

Click the plus icon and rename as required.

The default name contains 'FK' which means foreign key, which is the opposite of the primary key.

The Foreign key points to the destination dimension, which in this case is the Asset_Dimension.

Choose and verify the dimension fields.

The link should be well configured when you have to define the context of a measure.

Create a measure and go to the Context section.

Select the dimensions to define the measure context.

Click the toggle button to enable the link.

It is crucial to have earlier defined the dimension link before, as we did in this video.

This brings us to the end of our dimensions object demo video.

Thank you.

This video demonstrates how to create a time-defining dimension object, and how to link two dimensions.

Add a dimension

You can add a dimension to the AVEVA BI Gateway Model.

Add a dimension

1. Open the AVEVA BI Gateway Model Builder.
2. Click the **Add** icon in the **Floating Action Buttons** menu and then click the **Dimension** icon. A new dimension is added in the AVEVA BI Gateway model with a default name and the Dimension editor appears in the right pane.

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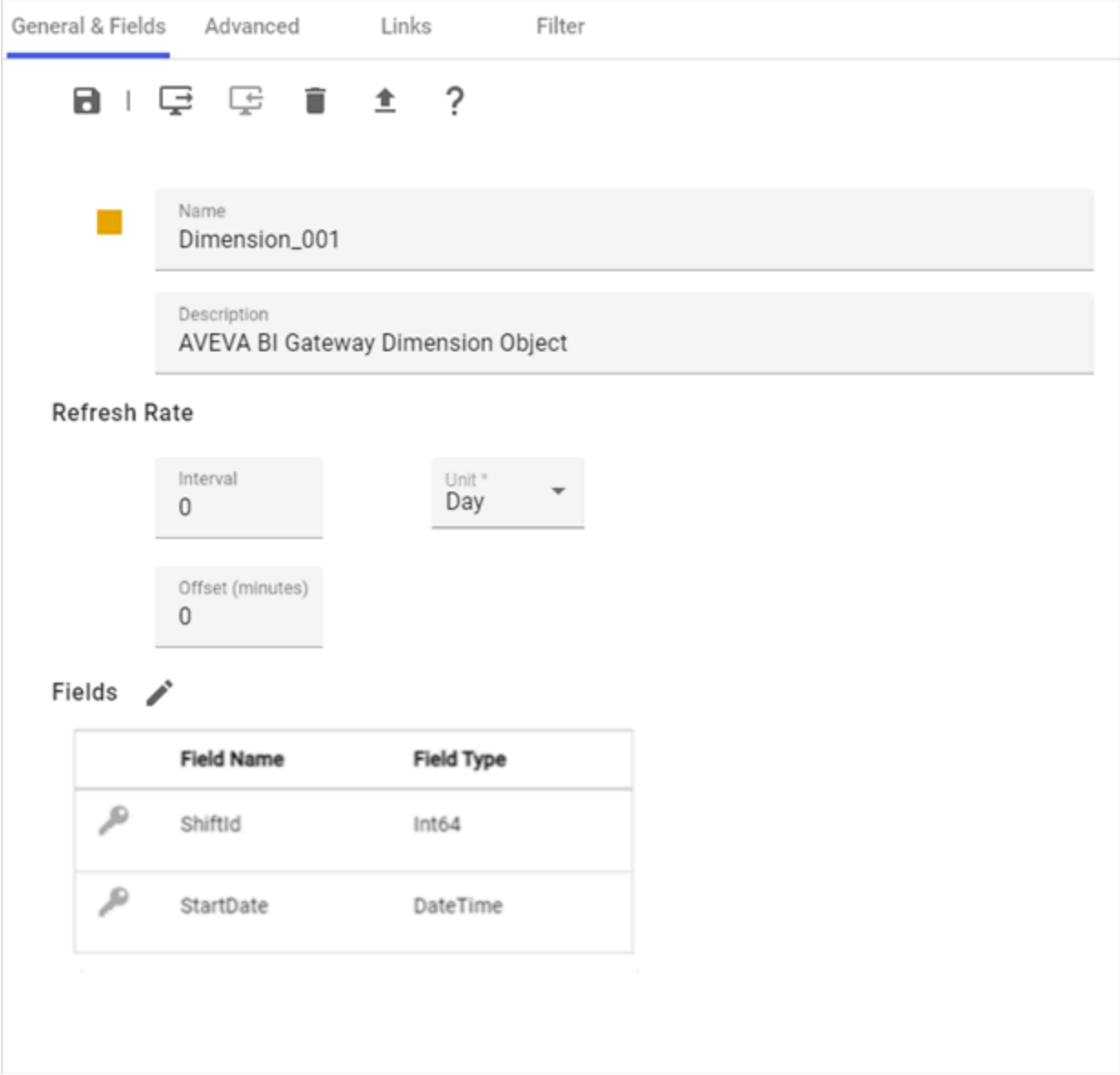

3. In the **General & Fields** section, do the following:
   a. In the **Name** box, type a new name for the dimension. The dimension name must be unique and can have a maximum length of 32 characters.
   b. In the **Description** box, type a description for the dimension. The description can contain a maximum of 1024 characters.
4. In the **Refresh Rate** area, configure how often the dimension is refreshed with data.
   a. In the **Interval** list, select the time interval for the refresh and then click a time unit in the **Units** list. The default refresh rate is One (1) day.

      The Interval field units' value must comply with the following conventions:

      a. If the Refresh Rate **Unit** type is **Day**, then the number must be between 0 and 366.
      b. If the Refresh Rate **Unit** type is **Hour**, then the number must be between 0 and 8784.
      c. If the Refresh Rate **Unit** type is **Minute**, then the number must be between 0 and 527040.
   b. In the **Offset (minutes)** list, select an offset time in minutes. The offset time is used to delay the

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scheduled data refresh. You can provide a maximum offset time of 59 minutes. The default offset time is zero minutes.

5. In the **Fields** section, click the **Edit** icon to add, edit, or delete dimension fields. For more information, refer to Manage dimension fields.
6. Click **Save**.

Edit a Dimension

When editing a dimension, you can:

- Modify the dimension field names and mappings.
- Add or delete dimension fields.
- Modify fields data type.
- Modify the refresh rate.
- Re-configure time-slicing.
- Re-configure dimension links.
- Re-configure the filter expression.

If you edit a deployed dimension, then the state of the dimension changes to "Deployed with pending changes". After you edit the dimension, the system shows a message warning about the dependent measures that can be affected by the modifications.

You can modify the dimension field data type only if the existing data type is implicitly convertible to the new data type. If the data type is not convertible, then you can delete the existing dimension field and add a new field.

The following table lists the convertible data types:

Existing field data type	Convertible to
Boolean	String
Byte	String, Int16, Int32, Int64, Decimal, Double
DateTime	String
DateTime2	String
Decimal	String, Double
Double	String
Int16	String, Int32, Int64, Decimal, Double
Int32	String, Int64, Decimal, Double

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Existing field data type	Convertible to
Int64	String, Decimal, Double
Guid	String
String	String
Other	N/A

Edit a dimension

1. Open the AVEVA BI Gateway Model Builder.
2. Under the **Dimensions** section, click the dimension that you want to edit. The Dimension editor appears with the selected dimension details.
3. Do the required modifications.
4. Click **Save**.
5. If the dimension was deployed and changes were saved, it will be marked in the Explorer with a Black tag indicating that redeployment is required. This may affect the dependent measures, which will also be marked for redeployment.

   Important: If you delete a dimension field, then a confirmation message appears. The system deletes the column and data of the deleted dimension field from the dimension table.

Deploy and undeploy a dimension

You deploy the dimension to the AVEVA BI Gateway.

Deploy a dimension

1. Open the AVEVA BI Gateway Model Builder.
2. Under the **Dimension** column, click the dimension that you want to deploy. The Dimension editor appears in the right pane with the selected dimension details.
3. On the **Action** menu, click the **Deploy** icon. A confirmation message appears.
4. Click **Yes.** After the successful deployment, the deploy status next to the dimension name changes from **Yellow** to **Blue**.

   NOTE: By default, when you deploy a dimension, it deploys the parent objects too if the objects are undeployed.

Undeploy a dimension

1. Open the AVEVA BI Gateway Model Builder.
2. Under the **Dimension** column, click the dimension that you want to undeploy. The Dimension editor appears in the right pane with the selected dimension details.
3. On the **Action** menu, click the **Undeploy** icon. A confirmation message appears.
4. Click **Yes.** After the successful undeployment, the deploy status next to the dimension name changes from

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Blue to **Yellow**.

Delete a dimension

You can delete a dimension that is not deployed or is not referenced by a dependent measure.

Delete a dimension

1. Open the AVEVA BI Gateway Model Builder.
2. Under the **Dimension** column, click the dimension that you want to delete.
3. On the **Action** menu, click the **Delete** icon. A confirmation message appears.

   NOTE: The **Delete** button in the Dimension editor is available only when the selected dimension is undeployed.
4. Click **Delete**.

   NOTE: The model integrity validation will first check for dependency relationship and block the deletion if the dimension is referenced in other objects.

Manage dimension fields

You can add, rename, and delete fields in a dimension.

Add a dimension field

A dimension can have a maximum of 190 dimension fields. You must provide at least one dimension key field per dimension. A dimension key is a field that uniquely identities each record in the dimension. You can provide a maximum of eight keys fields per dimension. When a dimension key contains more than one field, it is called a composite key.

Add a dimension field

1. Open the AVEVA BI Gateway Model Builder.
2. Under the **Dimensions** column, click the dimension to which you want to add a dimension field.
3. In the Dimension editor in the right pane, click the **Edit** icon next to **Fields**. The **Fields** editor appears.

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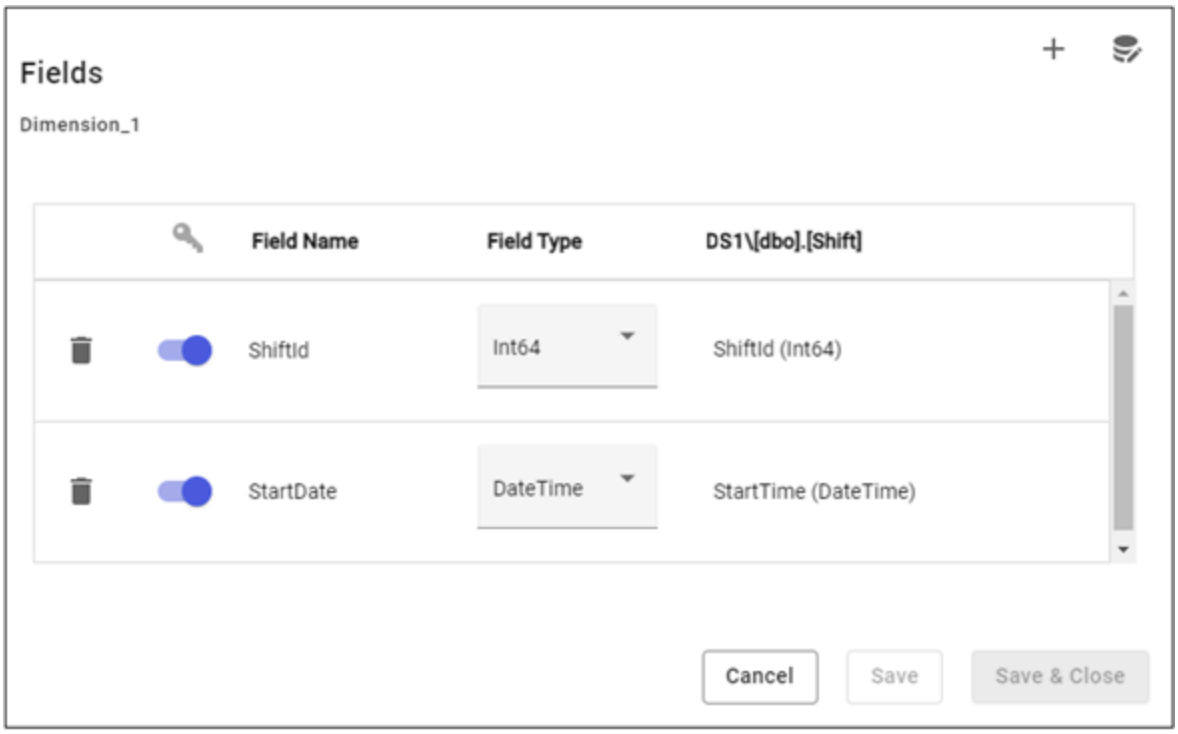

4. Click the **Add** + icon. A new row is added in the grid.
5. Under the **Key** column, slide to enable the dimension key for the corresponding dimension field. You must provide at least one dimension key. You can include a maximum of eight fields for the dimension key.
6. Under the **Field Name** column, type a name for the dimension field.

   The dimension field name must comply with the following conventions:

   - The dimension field name is case insensitive and the maximum length is 100 characters.
   - The dimension field name must be unique and can contain characters that are valid in Microsoft SQL Server for regular column identifiers except that the first character of the name must be a letter as defined by the latest Unicode Standard, or an underscore (_). The subsequent characters can be letters or numbers as defined by the latest Unicode Standard, underscore (_), dollar ($), blank space, and hash (#) characters.
   - You cannot use the word "TimeStamp" for the dimension field name.
7. Under the **Field Type** column, click a data type for the corresponding dimension field. The default data type is Boolean. For more information about the data type conversions, see Data type mapping.
8. Click **Save**.

Rename a dimension field

If you rename a dimension field, the configurations, mappings, and relationships of the dimension field are not modified.

Rename a dimension field

1. Open the AVEVA BI Gateway Model Builder.
2. Under the **Dimensions** column, click the dimension to which you want to add a dimension field.

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3. In the Dimension editor in the right pane, click the **Edit** icon next to **Fields**. The **Fields** editor appears.
4. Under the **Field name** column, click the dimension field that you want to rename.
5. Type a new name for the dimension field and then press **Enter.**

   For more information, see Add a dimension field.

Delete a dimension field

If you delete a dimension field, then the configurations, mappings, relationships, and data of the dimension field are deleted.

Delete a dimension field

1. Open the AVEVA BI Gateway Model Builder.
2. Under the **Dimensions** column, click the dimension to which you want to add a dimension field.
3. In the Dimension editor in the right pane, click the **Edit** icon next to **Fields**. The **Fields** editor appears.
4. Select the dimension field row that you want to delete, and then click **Delete** . A confirmation message appears.
5. Click **Yes** and then click **Save**.

   Important: If deployed, the indicator will show as "Deployed with pending changes" (black) and that changes may trigger measures to be updated too.

Select source data items for a dimension

You can select data items from any of the configured data sources to later map to your dimension fields.

The source data items shown in the **Select source data items** dialog box are retrieved from the saved schema. You can use the **Connect** option in the data source editor (**Connection** tab) to refresh the data source schema.

Select source data items for a dimension

1. Open the AVEVA BI Gateway Model Builder.
2. Under the **Dimensions** column, click the dimension to which you want to add a dimension field.
3. In the Dimension editor, click the **Edit** icon next to **Fields**. The **Fields** editor appears.
4. Click the **Data Source Item Picker** icon. The **Data Source Item Picker** dialog box appears.

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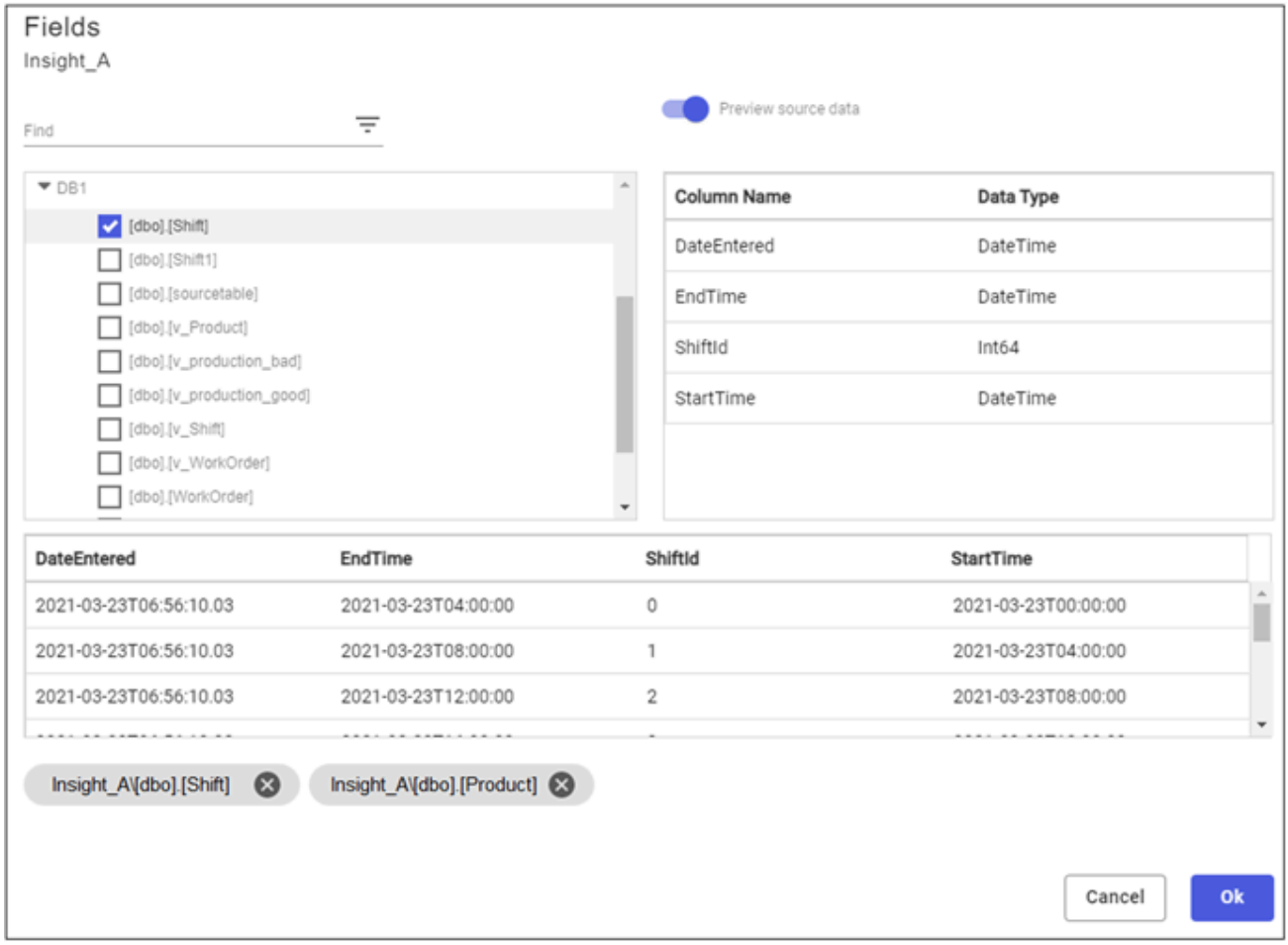

The **Data Source items** pane shows the available schema of the data sources.

5. Click the Expand icon to expand the data source and view the source data items within the data source.

   NOTE: You can use the **Find** box to search a source data item. The search behaves as a 'Contain' query.

6. Select a source data item from which you want to expose the fields to add the data source item. Deselect a source data item to move an item back to the **Data Source items** pane.

   The names in a data source table should not contain the special character, semicolon (;). The names that contain special characters like semicolon (;) and (#) do not appear in data source items pane.

   The right pane of the dialog box shows the fields of the source data item that you select in the **Data Source items** pane. The first source (from the top of the list) providing a value for the field will be used in the resulting dimension table.

7. Slide to enable the **Preview source data** option to view sample data from the data source.
8. Click **Ok**.

   Selected data source items become available for mapping to the dimension fields.

   For more information, see Map dimension fields to data item fields.

Map dimension fields to data item fields

You can map dimension fields in the AVEVA BI Gateway model to data source item fields. At run time, the data

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from the data source item fields populate the dimension fields according to these mappings.

For more information about data type compatibility, see Data type mapping.

Map dimension fields to fields from a single source data item

You can map dimension fields to source data item fields from a single source data item.

Map dimension fields to fields from single source data item

1. Open the AVEVA BI Gateway Model Builder.
2. Under the **Dimensions** column, click the dimension to which you want to add a dimension field.
3. In the Dimension editor in the right pane, click the **Edit** icon next to **Fields**. The **Fields** editor appears.

   The **Field name** column shows the name of the dimension fields.

   The **Field type** column shows the data type of the corresponding dimension fields.

   For more information on Managing Dimension Fields, see Manage dimension fields.

   The column to the right of **Field Type** shows the source data item that you have selected for the dimension.

   For more information, see Select source data items for a dimension.
4. Under the source data item column, select the source data item fields to map to the corresponding dimension fields.

   You can provide a constant value in the source data item field. After check in the system verifies whether the dimension field type is compatible with the constant type.

   You can map a dimension key field that is part of a composite key to a "Null" or constant value only if at least one of the key fields of the composite key is mapped to a source data item field. You cannot map a dimension key field that is part of a composite key to "Skip".
5. Click **Save**.

Map one dimension field to fields from multiple data items

You can map one dimension field to fields from multiple source data items.

Map one dimension field to fields from multiple source data items

1. Open the AVEVA BI Gateway Model Builder.
2. Under the **Dimensions** column, click the dimension to which you want to add a dimension field.
3. In the Dimension editor in the right pane, click the **Edit** icon next to **Fields**. The **Fields** editor appears.

   The **Field name** column shows the name of the dimension fields.

   The **Field type** column shows the data type of the corresponding dimension fields.

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The corresponding columns show the source data items with the source data item fields that you have exposed to the dimension.

For more information, see Select source data items for a dimension.

4. Under the source data item columns, click the source data item fields to map to the corresponding dimension field.

   The left-most source data item column is of the highest priority. For more information about setting the source data item priority, see Select source data items for a dimension.

   For each of the dimension fields, you can:

   - Provide a constant value in the source data item field. During the object save and check in, the system verifies whether the dimension field type is compatible with the constant type.
   - Specify the value "Skip" in the source data item field. The system skips the source data item for that field and takes the next highest priority of source data item. If the next highest priority of source data item does not contain a record for the dimension key, then the value is set to "Null". You cannot map a dimension key field that is part of a composite key to "Skip".
   - Map a dimension key field that is part of a composite key to a "Null" or constant value only if at least one of the key fields of the composite key is mapped to a source data item field. You cannot map a dimension key field that is part of a composite key to "Skip".

5. Click **Save**.

Manage dimension links

You can add, rename, configure, and delete dimension links. Dimension links allow you to create links between dimensions. When defining a measure, you can add linked dimensions to the measure context even if the measure source data has no direct reference to the linked dimension and it will be inferred from the dimension that defined the dimension link.

For more information, see Define relationships for a measure

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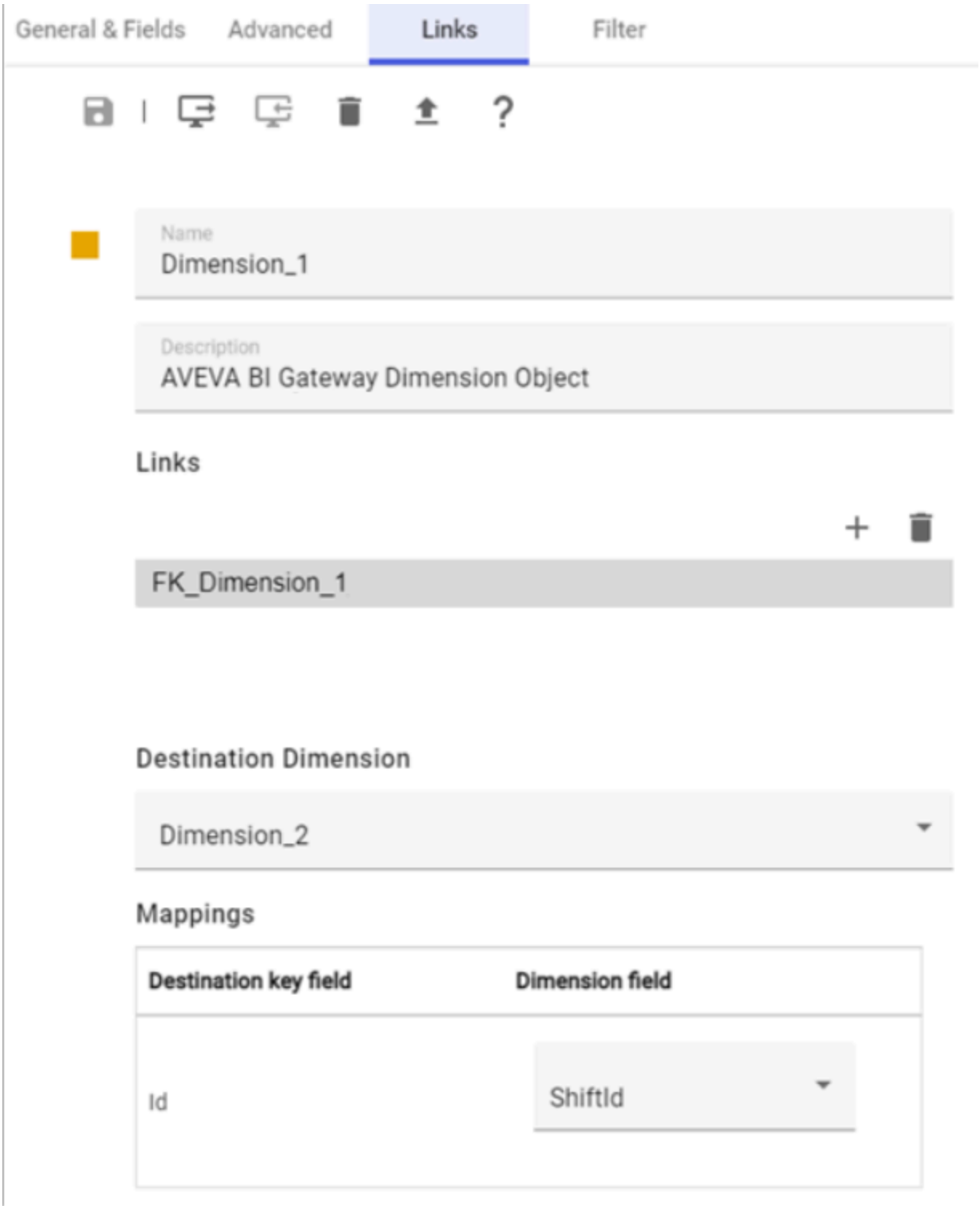

Add a dimension link

You can add a maximum of 30 dimension links in a dimension.

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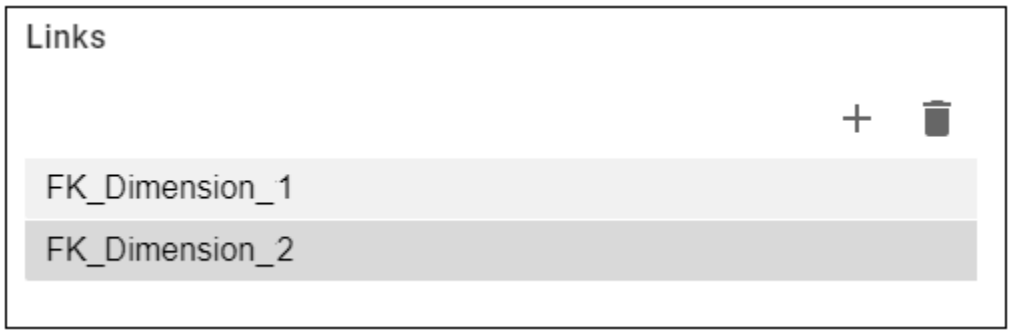
Add a dimension link

1. Under the **Dimensions** column, click the dimension for which you want to add a dimension link. The Dimension Editor appears.
2. Click the **Links** tab.
3. In the **Links** section, click the **Add** + icon to add a dimension link. A dimension link with a default name is added.

   For more information about renaming a dimension link, see Rename a dimension link.

4. Click **Save**.

   NOTE: You can select a dimension link in the **Links** area and select **Delete** to delete the dimension link. After you save the dimension, the associated measure(s) show as "Deployed with pending changes" (black indicator) and need to be reconfigured.

Rename a dimension link

Dimension link names must be unique within each dimension. A dimension link name can have a maximum length of 100 characters.

Rename a dimension link

1. Under the **Dimensions** column, click the dimension of which you want to rename the dimension link. The dimension editor appears.
2. Click the **Links** tab.
3. In the **Links** section, click a dimension link that you want to rename.
4. In the **Link name** box, type a new name for the dimension link. The Link name can contain only a-z, A-Z, 0-9, underscore (_), dollar ($), and hash (#) characters.
5. Click **Save**.

Configure a dimension link

Dimension links allow you to create links between dimensions. When defining a measure, you can add linked dimensions to the measure context even if the measure source data has no direct reference to the linked dimension. The measure source data will be inferred from the dimension that defined the dimension link.

When you configure a link in a dimension and deploy the dimension, the system adds a column in the dimension table of the current dimension for each of the linked dimensions. This column contains the foreign key ID of the

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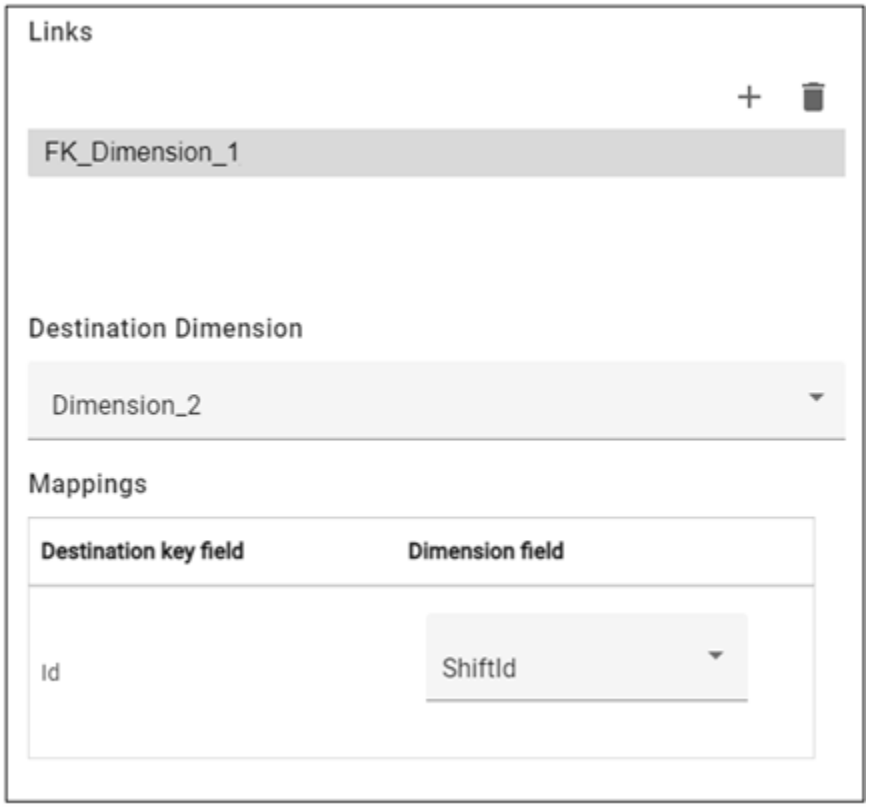
linked dimension. The column name is the same as the link name.

Configure a dimension link

1. Under the **Dimensions** column, click the dimension for which you want to configure a dimension link. The Dimension Editor appears.
2. Click the **Links** tab.



3. In the **Links** section, click a dimension link that you want to configure.

   The Link name box shows the dimension link that you select.

   The **Destination dimension** list shows all dimensions but the current dimension of the AVEVA BI Gateway model.
4. In the **Destination Dimension** drop-down list, click a dimension that you want to link to the current dimension.

   The **Destination key field** column in the **Mappings** grid shows all the key fields of the linked dimension.

   The **Dimension field** column in the **Mappings** grid shows the fields of the current dimension.
5. In the **Dimension field** column, select a dimension field that you want to map to the corresponding dimension key field. You must provide a mapping for all the corresponding key fields of the linked dimension. Be sure that the field data type of the current dimension is compatible with the key field data type of the linked dimension. For more information, see Implicitly convertible data types.

   NOTE: When deploying dimensions referring to 'linked dimensions', ensure that the linked dimensions are deployed before the dimension using those links so that the relationships can be found. In the same way, the linked dimensions should be refreshed at a faster rate than the dimensions using those references.
6. Click **Save**.

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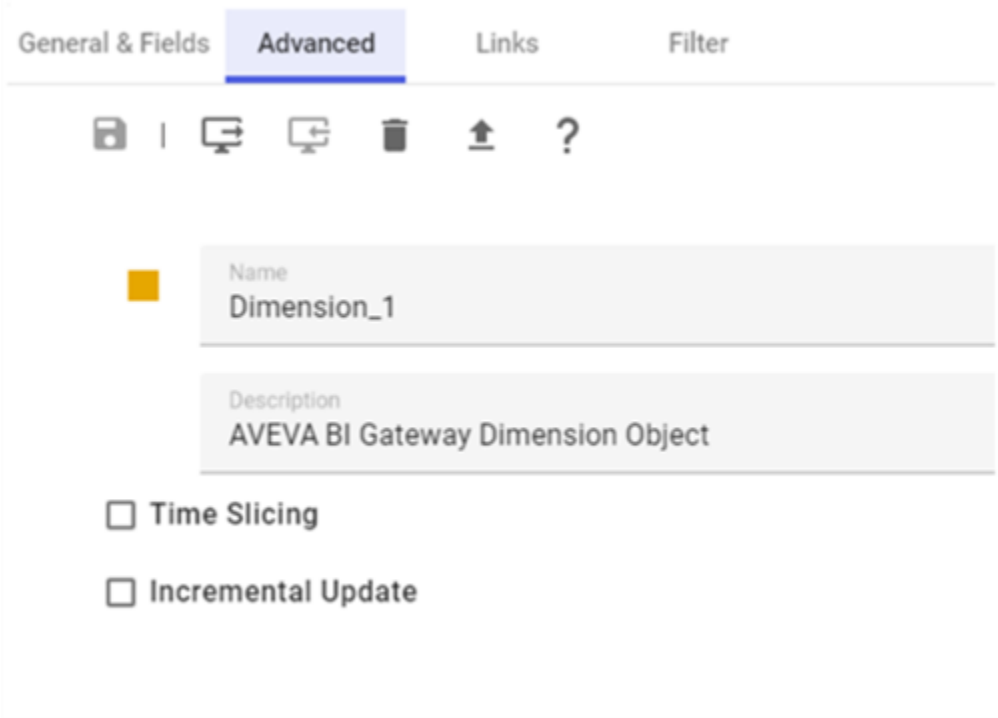
Configure time-slicing for a dimension

You can enable time-slicing for a dimension. Time-slicing defines the time periods for which measure calculations are aggregated. A measure can be time-sliced by more than one time-slicing dimension. To configure time-slicing for a dimension, you must define which fields represent the start and end time or start time and duration for time-slices.

If you have a time-defining dimension that produces time slices that are overlapping, and you are using a time-based relationship, aggregate calculation results are produced for the time overlaps. There is an aggregate calculation for each time slice. Be aware that reports based on these aggregate calculations may include the overlap results and therefore, include duplicated data. This behavior does not occur for key-based relationships.

Configure time-slicing for a dimension

1. Open the AVEVA BI Gateway Model Builder.
2. Click the **Add** icon in the **Floating Action Buttons** menu and then click the **Dimension** icon. A new dimension is added in the AVEVA BI Gateway model with a default name and the Dimension editor appears in the right pane.
3. Click the **Advanced** tab.



4. Select the **Time slicing** check box to enable time-slicing for the dimension.

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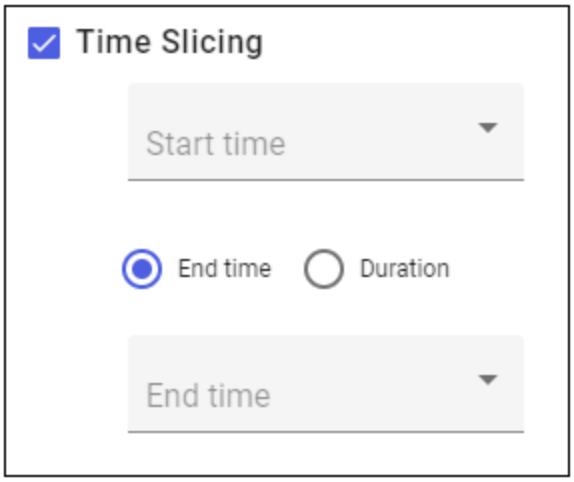
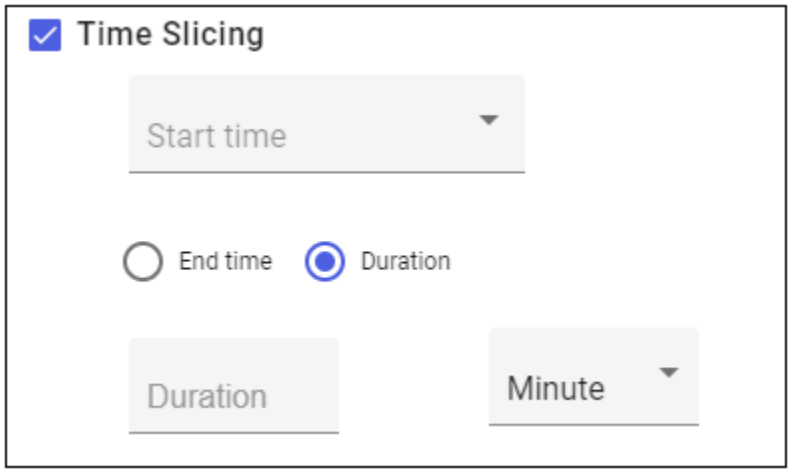


5. In the **Start time** list, click a field representing the start time of each time-slice of the dimension. The **Start time** list shows the DateTime fields of the dimension.
6. Configure the end time field for time-slices by doing one of the following:
   - In the **End time** list, click a field representing the end time of each time-slice of the dimension. The **End time** list shows the DateTime fields of the dimension.
   - In the **Duration** list, click a field or type a number representing the duration of each time-slice of the dimension. The **Duration** list shows the numeric fields (Int16, Int32, and Int64) of the dimension. Then, in the **Unit** list, select a unit of time for the duration. You can provide a minimum period of one millisecond and a maximum period of 366 days.



7. Click **Save**.

Configure an incremental update for a dimension

By default, all records of a dimension are updated at each refresh execution. However, for dimensions with large row counts, you may configure the dimension to update incrementally. Incremental updates are based on the DateTime field of the dimension. The initial population of the dimension only considers records from the data collection start time and then, at each refresh, from records corresponding to the update period. This limits the number of records to be processed at each refresh.

For example, if you configure a dimension with a refresh rate of 15 minutes and an update period of 1 hour, then

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every 15 minutes, the system will query the past hour of data and update the dimension table accordingly.

Alternatively, when you cannot use an incremental update, you may consider a dimension filter expression to limit the number of records handled at each refresh.

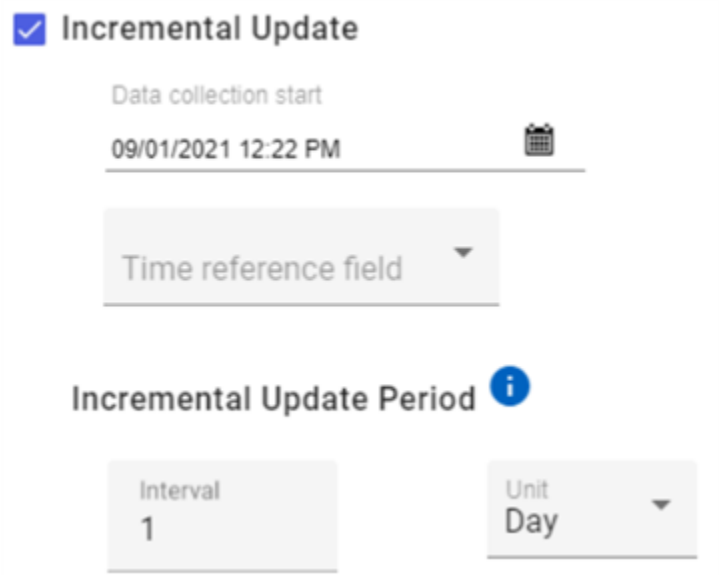
Note: In case you want to leverage Insight Data Source, you must use the [RequestedStartTime] and [RequestedEndTime] parameters in the custom query expressions. If you have not enabled the incremental update feature, then the parameters only return the default value, which is the last round hour.

Note: For the UtilizationEvents custom query expression, the best practice is to use the **LastModified** parameter in the incremental update feature, instead of **StartTime** or **EndTime** parameters. When Incremental update timeframe observes StartTime field, then it considers only events where StartTime matches the incremental update timeframe. Subsequently it excludes all the events that are out of the timeframe, but which have been modified within the same timeframe. Meanwhile, **LastModified** parameter considers any and all changes with every incremental update. For more information, refer to UtilizationEvents.

Configure an incremental update for a dimension

1. Open the AVEVA BI Gateway Model Builder.

2. Click the **Add** icon in the **Floating Action Buttons** menu and then click the **Dimension** icon. A new dimension is added in the AVEVA BI Gateway model with a default name and the Dimension editor appears in the right pane.
3. Click the **Advanced** tab.
4. Select the **Incremental Update** checkbox.



5. In the **Data collection start** list, click and select the data collection start date and time.

   Note: The StartDateTime specified in the custom query expression takes a higher precedence than the datetime value defined in the **Data collection start** field. For more information about custom query expression, see Use custom queries.

6. In the **Time reference field** list, click a dimension DateTime reference field for the update period.

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Note: This is the field on which the **Data collection start** time will be applied. The **Time reference field** list shows the DateTime fields of the current dimension.

7. In the **Incremental Update Period** area, do the following:
   a. In the **Interval** list, click the required update period for the dimension.
   b. In the **Unit** list, click the required unit of time for the update period. You can provide a minimum update period of one minute and a maximum update period of 366 days. The default update period is one day.

      Ensure that the update period is equal to or more than the refresh rate for the dimension.
8. Click **Save**.

Configure a filter for a dimension

You can build a filter expression to select a subset of the transformed data from external data sources and populate the dimension table in the datastore. You build a filter expression by using dimension fields and/or expression operators.

Configure a filter for a dimension

1. Open the AVEVA BI Gateway Model Builder.
2. Click the **Add** icon in the **Floating Action Buttons** menu and then click the **Dimension** icon. A new dimension is added in the AVEVA BI Gateway model with a default name and the Dimension editor appears in the right pane.
3. Click the **Filter** tab.

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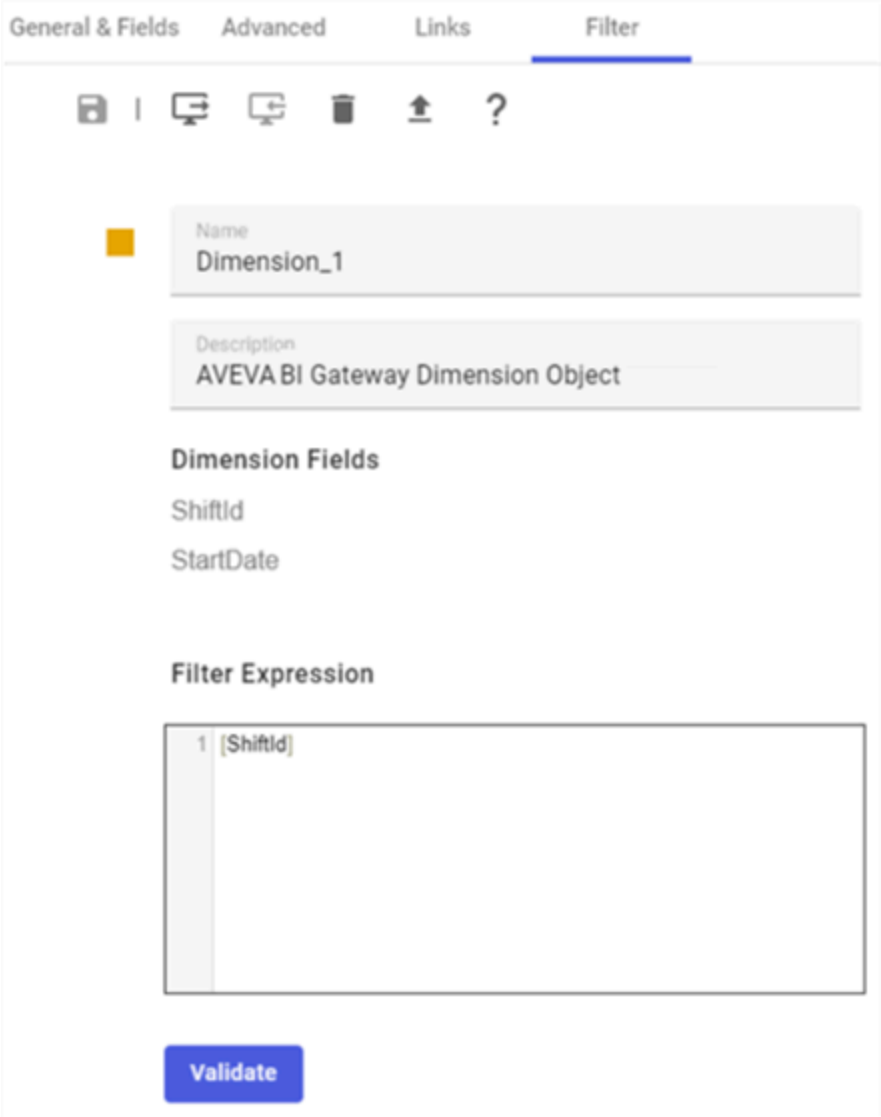

4. Build a filter expression. Do the following:
   a. In the **Dimension Fields** section, double-click the dimension field to add the dimension field to the **Filter Expression** editor.
   b. Specify an operator to add to the **Filter Expression** editor.

      You can use the open and close parenthesis () to define sub-comparison expressions and single quotes '...' as string delimiters. The filter expression needs to be a valid SQL Server WHERE clause.

      For more information about WHERE clauses, see the Microsoft SQL Server documentation.
5. Click **Validate** to manually validate the expression syntax.

   Note: Alternatively, the system automatically validates the expression syntax after you save the dimension.
6. Click **Save**.

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Measures

A measure is a group of calculations that shares the same context. A measure consists of calculations for each source system, time period, and for each unique combination of dimension value.

Measures are typically numerical values computed from source systems and put into context with dimensions. You can configure measures by defining which calculations need to be computed, along with the context (dimensions) to which the calculations are related. Upon deployment, a measure is represented by a table in the datastore, which contains the calculated values along with references to the related dimensions. Each record in the measure table represents a time-slice (period) for which the calculated values are computed.

Typically measure tables are updated with time, adding records for every time-slice defined by time-slicing dimensions and the measure period. As such, measure tables are updated incrementally, from the time defined by the data collection start time.

Because measure records are described by a time-slice, a measure object must at least have one time context defined either by a measure period, and/or time-slicing dimensions.

You can configure a measure period, which allows the computation of the measure calculations at the specified period. For example, a measure object configured with a measure period of one hour stores calculations in the measure table for every hour since the data collection start.

You can also add one or more time-slicing dimensions to the context of a measure. These time-slicing can be used instead of a measure period. At run time, time periods defined by all time-slicing dimensions and by the measure period are all combined together to create smaller, contiguous time-slices by which measure calculations are computed.

For more information about specifying a measure period, see "Configuring a Measure Period".

You have to provide a refresh rate for the measure. The refresh rate recomputes calculations for the current time-slice and also verifies whether a new time-slice must be defined. The following are three scenarios when considering the refresh rate and the measure period:

- The refresh rate is smaller than the measure period or the time-slice.

  The measure is updated until a new measure period or time-slice is identified. Thereafter, a new measure value is calculated.
- The refresh rate is bigger than the measure period or the time-slice.

  The refresh rate verifies whether a new measure period or a time-slice is identified since the last refresh period. New measure values are calculated for the identified measure period and time-slices.
- The refresh rate is equal to the measure period or the time-slice.

  A new measure value is calculated at the identified measure period and time-slice.

  Note: The refresh rate just defines how often the calculation is executed. The above scenarios are only the result of the refresh execution and are not explicitly triggered.

In addition to the refresh rate, the Update Period defines how much data is updated in the measure table. For example, if you configure a Measure object with a refresh rate of 15 minutes and an update period of 1 hour, every 15 minutes, the AVEVA BI Gateway services update the last hour of data in the measure table.

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Manage measures

The Measure editor allows you to:

- Add a measure
- Edit a measure
- Deploy and undeploy a measure
- Delete a measure
- Manage measure calculations
- Define relationships for a measure
- Configure a measure filter

Video tutorial: Introduction to AVEVA BI Gateway measures

https://player.vimeo.com/video/852660200?badge=0&autopause=0&player_id=0&app_id=58479

Video transcript (Select to expand)

Hello.

Welcome to the demo of the Measures object within the AVEVA BI Gateway Model Builder.

A measure is a group of calculations that shares the same context.

It consists of calculations for each source system, time period, and for each unique combination of dimension value.

Measures are typically numerical values computed from source systems and put into context with dimensions.

You can configure measures by defining which calculations need to be computed, along with the context (dimensions) to which the calculations are related.

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Go to the Floating Action Button (FAB) and click 'Measure.'

Enter the name and description as required.

Under 'Refresh Rate,' define how the measure instance will be executed.

The refresh rate recomputes calculations for the current time-slice and also verifies whether a new time-slice must be defined.

For this example, I will set the refresh rate as one hour with 15-minute offset.

This means that from the top of the hour, the dimension objects are refreshed every 1 hour and 15 minutes, and the measure is refreshed after the completion of all the dimensions refresh.

It is important to delay the refresh by 15 or 20 minutes, otherwise the dimension execution refresh will overlap with the measure refresh, and may cause temporary issues within the data consistency standpoint.

Next, define the 'Update Period' as required.

In addition to the Refresh Rate, the Update Period defines how much data is updated in the measure table.

For example, if you configure a Measure object with a refresh rate of 15 minutes and an update period of 1 hour, every 15 minutes the BI Gateway services update the last hour of data in the measure table.

The Measure Period is the largest bucket of time that the system considers for slicing the data.

You can configure a measure period, which forces the computation of the measure calculations at the specified period.

For example, a measure object configured with a measure period of one hour stores calculations in the measure table for every hour since the data collection start.

From the Measure Period, you can see smaller time slices with a given hour because of the influence of the contextual time-defining dimensions.

The 'Data collection start' parameter under 'Data Backfill' is the datetime that you would like to compute or to perform a reverse backfill computation that will compute all the calculations.

Typically, measure tables are updated with time, adding records for every time-slice defined by time-slicing dimensions and the measure period. As such, measure tables are updated incrementally,from the time defined by the data collection start-time.

The data collection starts from reverse up to the point of the specified data collection start-time.

So, it starts at the most recent time slices sticking, near real time and then it goes in reverse to reach the specified date.

Once you save the general input, go to the 'Context' tab.

Here, we will add the dimensions to configure for the Measure's calculation context.

Please note, you would have had to create a context link relationship within an asset model dimension and a time-defining dimension prior to this process.

Click the button 'Add Dimension.'

Select the asset model dimension from the context link relationship that you created earlier.

Click 'Add Dimension' once again.

This time, select the time-defining dimension from the same context link relationship.

In this instance, I choose WorkOrder_Dimension.

You can edit the alias as required.

It is recommended to keep the Foreign Key name as simple as possible, like removing the number.

Click the context link toggle button next to your asset model dimension.

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Once enabled, this feature restricts the influence of time-defining dimensions on only the asset populated within.

You will not be able to click the toggle button next to your dimension in some certain cases due to dimension configuration missing.

You can create a calculation on your own.

Click ‘Edit Calculations’.

Click the Add + button.

Enter the calculation name and select ‘Aggregate’ as the calculation type; the calculation type is ‘aggregate’ when the calculation belongs to the function that you use for aggregating the data.

So, you have to select a given custom query that provides the right information from the data adapter.

Click the pencil icon next to Source Data Items, to select the custom query that provides the required information from the data adapter.

In this example, I will select the Insight custom query 'EnergyElectricity'.

Click the checkbox and click the toggle button to preview the source data.

Then, fill in the following criteria in this order: Function,

Calculation field, Return type, and Period field.

The next step is to define the context relationship mapping with the calculation result set: Save your calculation.

This brings us to the end of the demo video for the Measures object in the AVEVA BI Gateway Model Builder.

Thank you.

This video provides a brief overview of measure objects.

Add a measure

You can create a measure by using the FAB button.

Add a measure

1. Open the AVEVA BI Gateway Model Builder.
2. Click the **Add** icon in the **Fast Action Buttons** menu and then click the Measure icon. A new measure is added in the AVEVA BI Gateway model with a default name and the Measure editor appears in the right pane.
3. Click the **General** tab and do the following:
   a. In the **Name** box, type a new name for the measure**.** The measure name must be unique and can have a maximum length of 32 characters. The measure name can contain only a-z, A-Z, 0-9, underscore (_), dollar ($), and hash (#) characters. The first character must not be a dollar sign ($). The measure name must contain at least one letter.
   b. In the **Description** box, type a description for the measure. The description can contain a maximum of 256 characters.
4. Click **Save**.

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Configure data collection details for a measure

You have to provide a data collection start date and time and optionally an offset time for a measure. You must provide a refresh rate and update period for the measure. The measure is first populated on the start date and time that you specify. Thereafter, the measure data is refreshed as per the configured refresh rate and the update period.

You must provide an update period to define a time interval for which measure data has to be refreshed during the measure refresh.

For example, if you specify a refresh rate of one hour and an update period of one day, then the system refreshes the measure data for the past day after every one hour.

The system also triggers a check on the configured refresh rate to verify if there is a measure period or dimension time-slices identified since the last refresh. New measure values are calculated for each time-slice defined by measure period and time-slicing dimensions and the values are stored in the measure table.

For more information about measure period and dimension time-slicing, see Configure a Measure Period and "Configuring Time-Slicing for a Dimension".

You have to provide a measure data collection start date and time that is before or equal to the measure deployment date. Upon deployment, the process of computing measure calculations for each time-slice between the data collection start time and the current time is called measure backfilling. Thereafter, new measure values are calculated as per the configured refresh rate and update period.

You can also provide an offset time to delay the refresh execution. Using an offset time can be useful to ensure that transactions at the data source have completed prior to the extraction of data for the measure.

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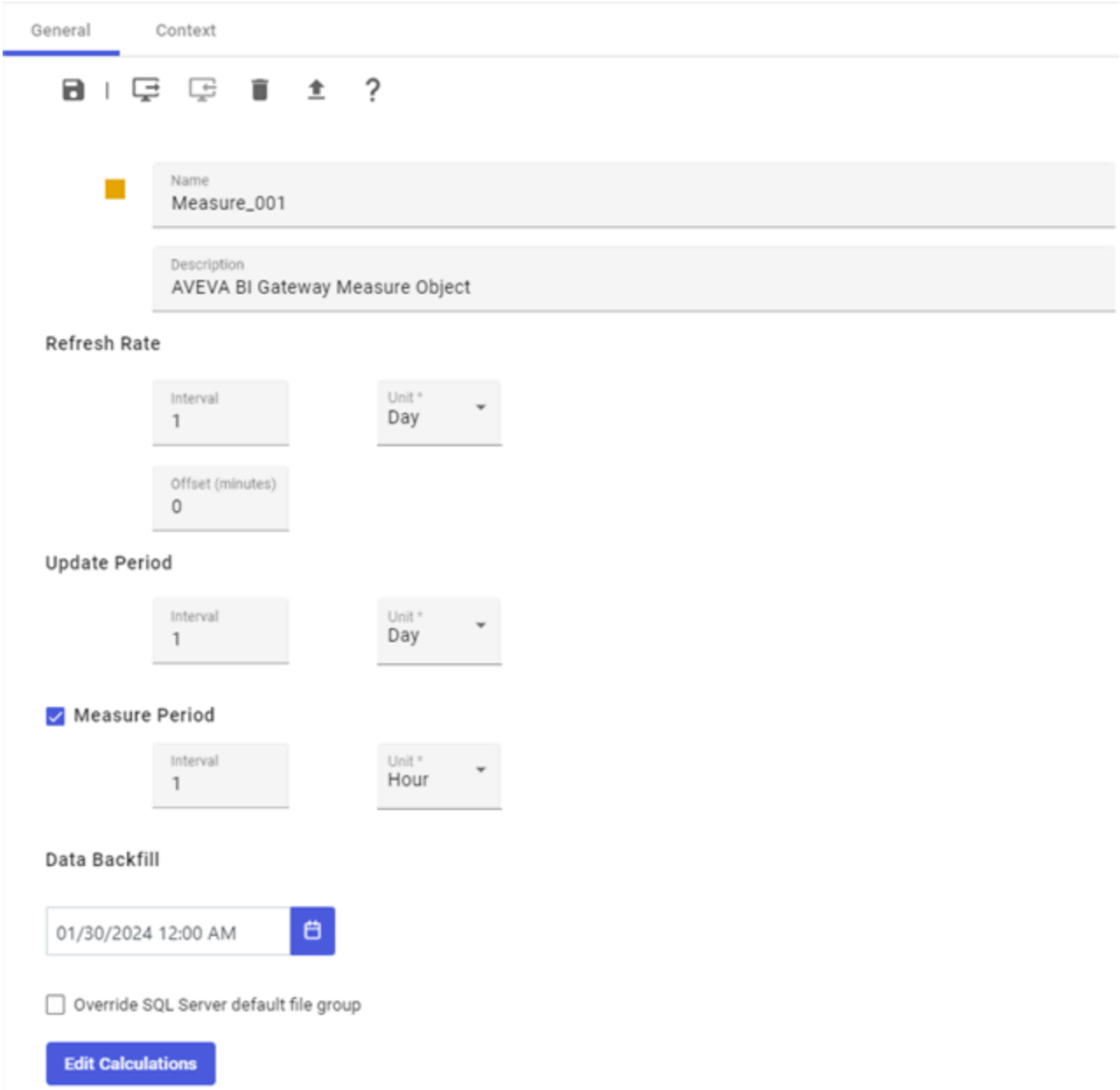

Configure a data collection start date, refresh rate, update period, and offset time for a measure

1. In the **Refresh rate** area, specify a refresh rate and offset time for the measure. Do the following:

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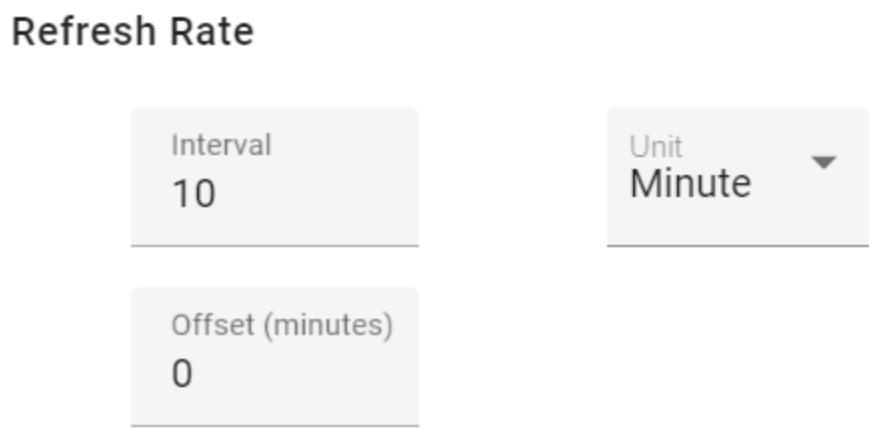
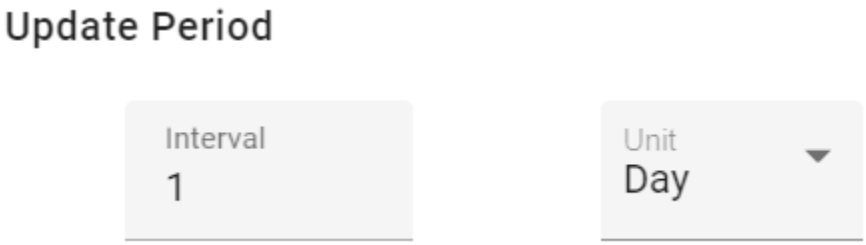


a. In the **Interval** list, click a refresh rate for the measure.
b. In the **Unit** list, click a unit of time for the refresh rate. You can provide a minimum refresh rate of one minute and a maximum refresh rate of 366 days. The default refresh rate is one day.
c. In the **Offset (minutes)** list, click an offset time in minutes. The offset time is used to delay the scheduled refresh of the measure. You can provide an offset time of maximum 59 minutes. The default offset time is zero minutes.

2. In the **Update period** area, do the following:



a. In the **Interval** list, click the required update period for the measure.
b. In the **Unit** list, click the required unit of time for the update period. You can provide a minimum update period of one millisecond and a maximum update period of 366 days. The default update period is one day.Be sure that the update period is equal to or more than the refresh rate.

3. In the **Data backfill** area, specify a data collection start date and time. In the **Data collection start** list, click the start date and time to collect data from the data sources and populate the measure. You must provide a start date and time prior to the measure deployment date. The default start date and time is 12:00:000 A.M. on the date of measure creation.
4. Click **Save**.

Configure a measure period

You can configure a measure period, which will force the computation of the measure calculations at the specified period. For example, a Measure object configured with a measure period of one hour stores calculations in the measure table for every hour since the data collection start time.

For each measure calculation, you must provide a source data item field mapping that is used to calculate period for measure calculation.

Because measure records are described by a time-slice, a Measure object must at least have one time context defined either by a measure period, and/or time-slicing dimensions. If you do not provide a measure period or

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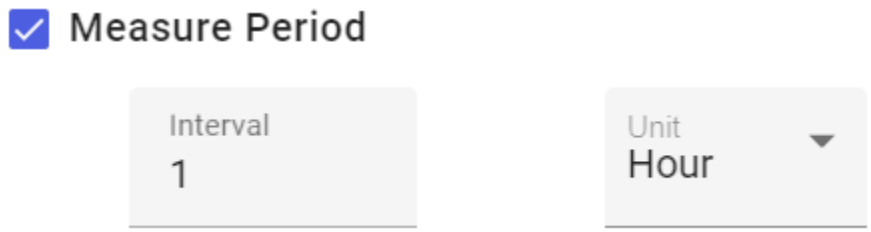
do not relate the measure to a time-slicing dimension, then after saving the measure the state of the measure changes to "Warning" and measure values are not calculated.

Configure a measure period

1. Select the **Measure period** check box.



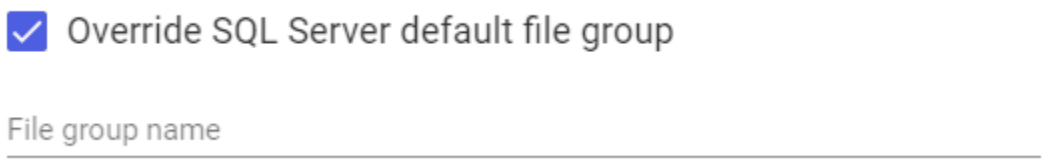
2. In the **Interval** list, type or click a period for measure calculation.
3. In the **Unit** list, click the unit of time for the period.

   You can provide a minimum period of one millisecond and a maximum period of 366 days. The default measure period is one hour.
4. Click **Save**.

Assign measure to a file group

Assign the measure to a pre-configured file group, do the following:

1. Select the **Override SQL Server default file group** check box.



2. In the **File group name** box, type the name of the pre-configured file group to which you want to associate the measure. The file group name can contain a maximum of 128 characters.
   - File groups help support database growth and performance by storing data in different files.
   - You can associate a measure to a SQL Server file group. The measure table is created and the measure data is stored on the server file group that you specify.
   - Before associating a measure to a file group, you must create and configure the file group in the SQL Server where the data store resides.
   - If you do not associate a measure to a file group, then the measure table is created and the measure data is stored in the default file group called "Primary".
   - Associating measures to different file groups helps distribute the data, thereby enhancing the performance.

     For more information about creating file groups, see the Microsoft SQL Server documentation.

     Note: If the file group that you specify is not available in the SQL Server, then the system assigns the measure to the default file group.
3. To associate the measure to the default file group, clear the **Override SQL Server default file group** check

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box.

Manage measure calculations

You can add, clone, rename, configure, and delete measure calculations.

There are two types of measure calculations:

- Aggregates

  You can configure aggregate calculations to execute a single operation on a single field. Aggregate calculations serve as the base variables within a measure. You can use aggregate calculations as input for expressions.

  An aggregate calculates a summary function, such as average, minimum, and sum on the data set retrieved from the source.
- Expression

  You can build an arithmetic expression using the configured aggregates.

  An example for a simple calculation created from an expression is (AggregateA + AggregateB)/AggregateC.

Measure calculations are each represented by separate columns in the resulting measure table.

The column names are the same as the calculation names defined in the measure object.

You must define at least one measure calculation in a measure.

Add a measure calculation

You can add a maximum of 75 calculations in a measure.

Add a measure calculation

1. Open the AVEVA BI Gateway Model Builder.
2. Click the **Add** icon in the **Fast Action Buttons** menu and then click the Measure icon. A new measure is added in the AVEVA BI Gateway model with a default name and the Measure editor appears in the right pane.
3. Click the **Edit Calculations** button. The **Context** & **Calculations** page appears.

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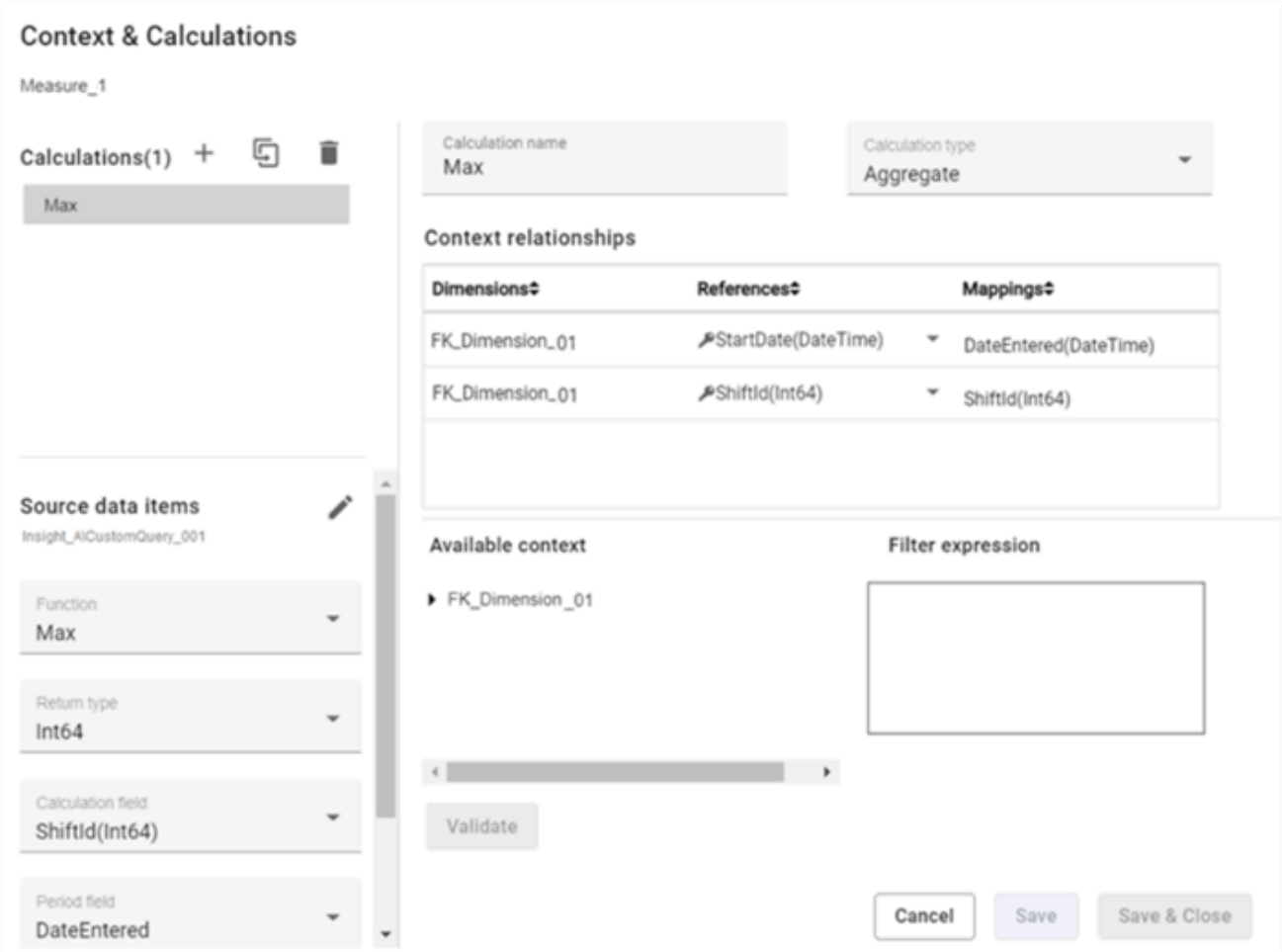

4. Click the **Add** (**+**) icon to add a measure calculation. A measure calculation with a default name is added in the **Calculations** pane.
5. Type a new name for the measure calculation.
6. Click **Save**.

Note: To delete a measure calculation, select the measure calculation in the **Calculations** pane, and then click **Delete**.

Configure an aggregate calculation

The AVEVA BI Gateway service extracts data from data sources, determines time-slicing, computes aggregates, adds the associated context, and stores this data in the datastore.

You can configure an aggregate calculation by providing a function, return data type, and source data item mapping for calculating the time period and values (using the function).

You can set a refresh rate to specify the frequency at which the measure data will be refreshed at run time. You can also define the update period that allows you to define the time period for which data will be retrieved every time the measure refreshes. The minimal update period you can select is 1 minute, and the maximum is 366 days.

For example, you have a measure configured with an update period of 1 hour, and a refresh rate of 5 minutes. Every 5 minutes, the AVEVA BI Gateway services will query the last hour of data from the source and update the

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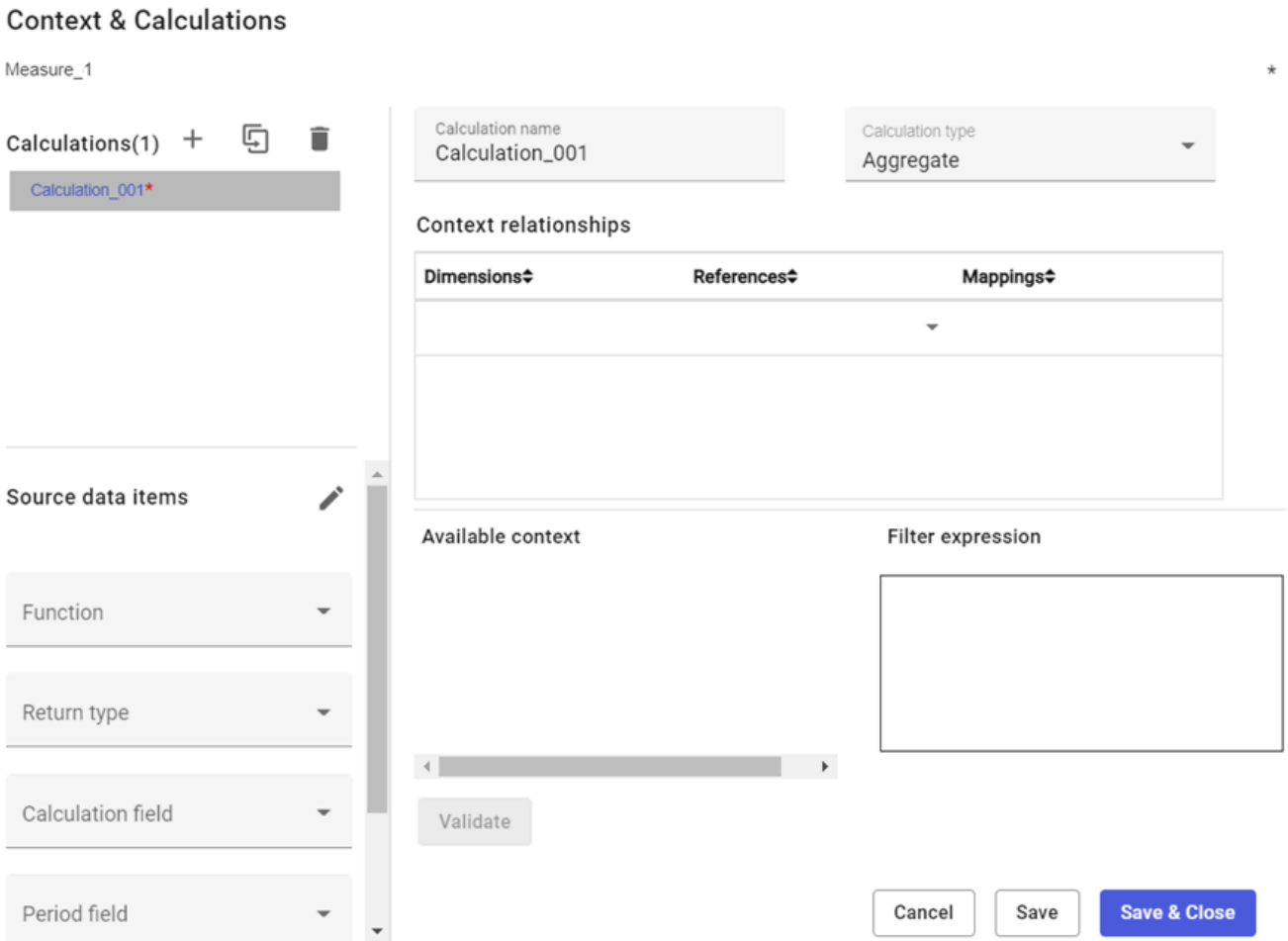
target records in the datastore.

However, if a source record from the previous day is modified, it is not captured by the update period of 1 hour. If the data source records the date or time at which records are modified, you can use the modification period function. When you configure the **Modification Period**, the AVEVA BI Gateway services will handle the records at the source that have been modified since the last measure refresh, in addition to the records handled by the update period.

Configure an aggregate calculation

1. Click the **Edit Calculations** button. The **Context** & **Calculations** page appears.



2. In the **Calculations** pane, click a calculation that you want to configure.
3. In the **Calculation type** list, click **Aggregate**.
4. Configure the aggregate calculation. In the **Aggregate calculation** area, do the following:
   a. Click **Source data items** to select a source data item in the **Source data item** box. The **Select source data items** dialog box appears. Select a source data item that you want to use in the calculation. The **Calculation field** and **Period field** boxes show the source data item fields of the source data item that you select.
   b. In the **Function** list, click a function for the calculation.

      The functions **Min**, **Max**, **Sum**, and **Avg** can be used with AnalogSummary query. The **Count** function can only be used with ProcessValues query.

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c. In the **Return type** list, click a return data type for the function. The default return data type is Double.

d. In the **Calculation field** list, click the source data item field that you want to use for the measure calculation based on the function. This is the field that will be used for the data Aggregation.

e. In the **Period field** list, click the source data item field that will be used to select the source records for a time-slice. For example, the source system stores data values with a timestamp. The Time Stamp field would be used here to query the appropriate records for each of the time-slices.

f. In the **Modification field** list, click the source data item field that you want to use for the calculation. The default value is set as "None". This default value indicates that the measure data update using a record modification date function is disabled.

   The **Modification field**, selected from the available fields of the source data item, is used as an indication for the source record modification date or time. When the **Modification field** is specified, the AVEVA BI Gateway service retrieves the measure source records that have been modified since the last update, in addition to the records already covered by the update period interval. The default value (set as "None") indicates that the measure data update using a record modification date feature is disabled.

   i. In the **Interval** list, click the required time interval of the Modification period.

      You can enter a time interval value only if you specify a **Modification field**. You cannot enter a decimal value for the time interval. You can use the modification interval to limit the number of source records that are scanned for record modification dates. This function is useful when there is no index on the record modification date in the source database but only on the **Period field**. The AVEVA BI Gateway service scans only the source records that have the **Period field** within the modification interval period. The modification interval is not used if the source database has an index on the **Modification field**. When the modification interval is not used, you can set its value to zero.

   ii. In the **Unit** list, click the required unit of time for the Modification period.

      The default value for Unit is Minute. You can select a time interval unit after the Modification field is populated.

5. Define relationships for the measure in the **Context Relationships** grid.
6. Click **Save**.

Configure an expression calculation

An expression allows you to create a simple calculation for which you must use aggregates.

An example of a simple calculation created from an expression is (AggregateA + AggregateB)/AggregateC.

You can build an expression calculation by using the SQL arithmetic operators and aggregate calculations.

When you create an expression, you must ensure that the execution of the expression will not trigger SQL exceptions. For example, the expression should include logic to catch a potential division by zero. If such exceptions occur, the object reports an error at each scheduled execution and record insertion will stop at the time of the error.

Configure an expression calculation

1. Click **Edit Calculations**.
2. In the **Context & Calculations** pane, click a calculation that you want to configure.
3. In the **Calculation type** list, click **Expression**.

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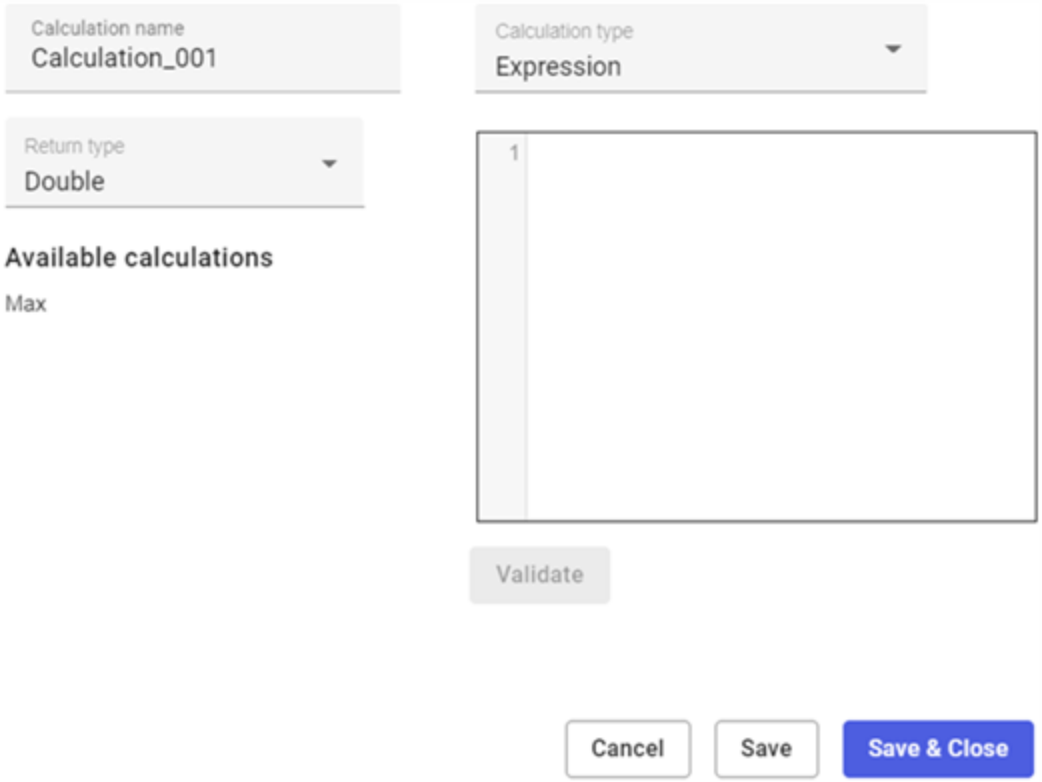

4. In the **Return type** list, click a return data type for the expression. The default return data type is Double.
5. In the **Expression** area, build an expression calculation. Do the following:
   a. In the **Available calculations** area, double-click an aggregate calculation that you want to use in expression calculation. The **Available calculations** area shows the aggregate calculations of the current measure that have a numeric return type.
   b. In the **Operators** area, click an operator to use in expression calculation.

      The expression built in the **SQL Expression** editor must be a valid Microsoft SQL Server expression.
6. Click **Save**.

Retrieve data using the counter retrieval mode

If you want to enable the **Counter** retrieval mode, you need to do it at the Measure Calculations level.

This retrieval mode is supported for the following queries:

- CQProcessValues
- CQProcessValuesSameDataSet
- CQProcessValuesTagTypes
- ProcessValues

Use the counter retrieval mode:

1. Select a measure object.
2. Click the **Context** tab.

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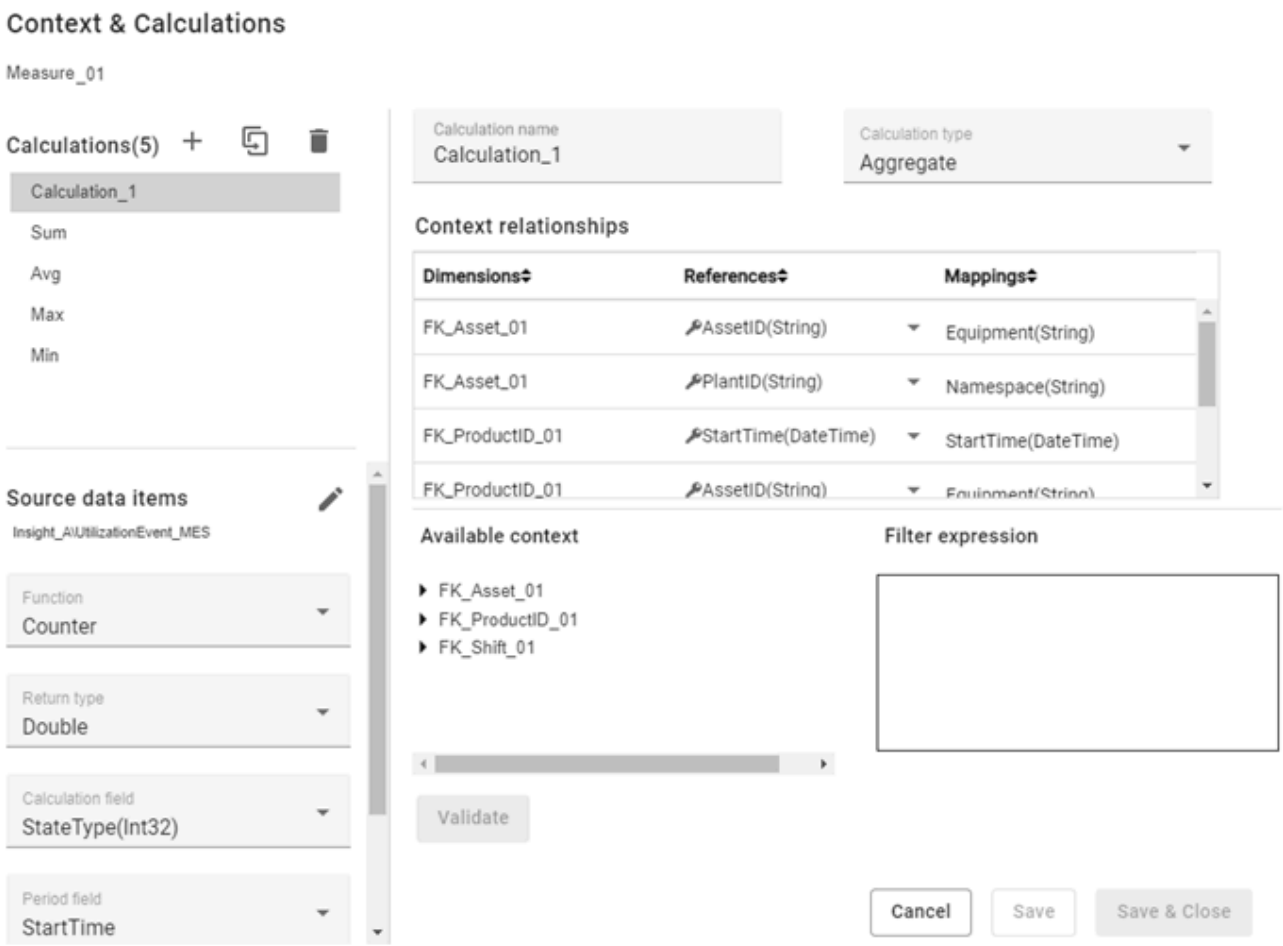
3. Click **Edit Calculations**.

   The screen appears as follows.



4. In the **Function** drop-down list, select **Counter**. When you select the **Counter** retrieval mode from the this list, it is **implicitly** passed to the queries.
5. Save the measure object.

Custom Queries for counter retrieval mode

ProcessValues

```
{
   "QueryName":"ProcessValues",
   "SelectColumn": ["FQN","DateTime", "Value","OpcQuality","Text"],
   "FQNS":["WonderBrew.Filler.Counter", "WonderBrew.Paletizer.Counter"],
   "StartDateTime" : "[RequestedStartTime]",
   "EndDateTime": "[RequestedEndTime]"
}
```

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CQProcessValues

```
{
   "QueryName": "CQProcessValues",
   "SelectColumn": ["FQN","DateTime", "Value","OpcQuality","Text"],
   "Tag": {
      "Filter": "startswith(FQN, 'WonderBrew')"
   },
   "StartDateTime" : "[RequestedStartTime]",
   "EndDateTime": "[RequestedEndTime]"
}
```

CQProcessValuesSameDataSet

```
{
   "QueryName":"CQProcessValuesSameDataSet",
   "SelectColumn": ["FQN","DateTime", "Value","OpcQuality","Text"],
   "Source":"WonderBrew",
   "StartDateTime" : "[RequestedStartTime]",
   "EndDateTime": "[RequestedEndTime]"
}
```

CQProcessValuesTagTypes

```
{
   "QueryName": "CQProcessValuesTagTypes",
   "SelectColumn": ["FQN","DateTime","OpcQuality","Text","Value"],
   "TagType":"Analog",
   "StartDateTime" : "[RequestedStartTime]",
   "EndDateTime": "[RequestedEndTime]"
}
```

Select dimensions to define the context for a measure

A measure is an aggregated value. You often need to provide a context to the aggregated value. To do this, you relate a measure to a dimension.

You can select dimensions that define the context of the measure. For example, you can select the Product and Shift dimensions and relate them to a Production measure. The Product and Shift dimensions define the context for the Production measure and allow reporting production by Product and Shift.

You can select the same dimension more than once. For example, you can select a Material dimension twice to define the Material Input and Material Output context for a measure.

By default, the system adds an alias name to the dimension that you select. Aliases must be unique within the context definition of a measure. For more information, see Define relationships for a measure.

The measure table contains a column for the reference value for each dimension that the measure relates to. The column name is the defined alias for the dimension.

Select dimensions for a measure

1. Under the **Measures** column, click the measure for which you want to select the dimensions. The measure editor appears.

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2. Click the **Context** tab.
3. Click **Add Dimensions**. You can select a maximum of 30 dimensions.
4. In the **Changing dimensions** area, select a dimension that you want to map to the measure. An alias with a default name is added in the **Changing dimensions** pane under the **Alias** column. The **Link** option appears unselected by default. For more information about renaming a dimension alias, see Rename a dimension alias. For more information about configuring a context link for a dimension, see Select a context link dimension.

   Note: You can click the **Delete** icon to remove a dimension. If you remove the dimension, the system deletes all the relationships that reference the dimension alias in calculations within the measure. For more information about measure calculations, see Manage measure calculations.

Rename a dimension alias

You can rename a dimension alias. The alias name:

- Must be unique within the measure.
- Can contain a maximum of 100 characters and cannot start with the "aa" character.

Rename a dimension alias

1. Under the **Measures** column, click the measure for which you want to rename the dimension alias. The measure editor appears.
2. Click the **Context** tab.
3. In the **Changing dimensions** area, under the **Alias** column, double-click an alias, and type a new alias name.
4. Click **Add Dimensions**.

Select a context link dimension

A context is established by relating a measure to a dimension. Some of these dimensions can be defined as time defining, and as such, contribute to the definition of the time periods for which measures are aggregated. Time-slices obtained from time defining dimensions can have an associated context. This enables you to reduce the total number of time intervals for measure records.

A context link identifies a dimension by which time-slicing will be computed. For example, if the equipment is selected as the context link dimension, time-slices identified by the time defining dimension will be grouped by equipment and stored as such in the measure table. A time-slice for equipment A will not be considered when calculating the aggregates for equipment B.

For example, a measure has two selected dimensions in the context pane. The two selected dimensions are the time defining dimension called Work Order and the Equipment dimension. The Equipment dimension link can be used to provide context-based time-slicing. To enable this, drag the **Link** option for the Equipment dimension. The Work Order dimension must have a dimension link to the Equipment dimension since it is the context-link dimension. Any other time defining dimension used in the context of the measure and having a dimension link to Equipment will also be sliced according to equipment at run time.

For more information about time-slicing dimensions, see Configure time-slicing for a dimension.

You can select only one dimension as a context link dimension.

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Select a context link dimension

1. Under the **Measures** column, click the measure for which you want to select the dimensions. The measure editor appears.
2. Click the **Context** tab.
3. In the **Changing dimensions** area, under the **Link** column, drag the **Link** option to enable.
4. Click **Add Dimensions**.

Define relationships for a measure

After you select dimensions for a measure, you must define relationships. Relationships help define context for the measure.

There are three types of relationships:

- Key relationship - You can relate to a dimension key field using a source data item field. This establishes the relationship between the measure record and the selected dimension.
- Dimension link relationship - You can relate a dimension using a linked dimension. This adds the linked dimension reference in the measure table. For example, your source data defines values with respect to equipment. However, you want to have the Site definition with your measure data. The Equipment dimension contains a dimension link to Site. This allows you to add the Site dimension to the measure data and use the linked dimension for site defined in the Equipment dimension.
- Time-based relationship - You can provide a time-based relation for a dimension that has a time-slice configured. The system automatically maps to the dimension using the data source DateTime field that you define for aggregate calculation.

For example, you want to have Shift context on a Historian aggregate value. If Shift is defined as a time-slicing dimension, you can use a time relationship to relate the timestamp of the Historian data to the time-slices defined by the Shift dimension.

You can either provide a dimension link relationship or you must provide a relationship for all the key fields of a dimension. For example, if you select a dimension that has four key fields that form a composite key, then you must provide a relationship for all the four key fields. However, you can provide only one time-based relationship for a key field out of the four key fields.

If you are providing a dimension link relationship, then you do not need to provide a mapping for all the other key fields of the dimension.

Define a relationship for a measure

1. Open the AVEVA BI Gateway Model Builder.
2. Click the **Add** icon in the **Fast Action Buttons** menu and then click the Measure icon. A new measure is added in the AVEVA BI Gateway model with a default name and the Measure editor appears in the right pane.
3. Click the **Edit Calculations** button. The **Context** & **Calculations** page appears.
4. In the **Context & Calculations** page, click a required aggregate calculation.
5. Click the **Context Relationships** button. The **Context** page appears.

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6. In the **Relationships** grid, do the following:

   The **Dimensions** column shows the alias names of dimensions that you select in the **Context** tab. One row is added for each key field of a dimension.

   The **References** column shows:

   - All the key fields (represented by a Key icon) of the current dimension.
   - Dimension links (represented by a Link icon) of the dimensions that you select in the **Context** tab, that reference the current dimension. If you select the dimension link option for a dimension, then all other rows for the dimension are unavailable.
   - If the corresponding dimension has time-slicing configured, then the dimension column also shows the "TIME" option (represented by a Clock icon).

     a. Under the **References** column, click the required option.

     b. The **Mappings** column shows any one of the following depending on the option you select under the **References** column:

        a. If you select a dimension key, then it shows the fields of the source data item that is used for measure calculation. You must select the field from the source data item which maps to the selected key field of the dimension.

        b. If you select a dimension link, then it shows the dimension of the selected dimension link.

        c. If you select the TIME option, then the **Mappings** field is unavailable. The system automatically maps the dimension to the data source DateTime field that you define for aggregate calculation.

        d. Click the required option.

   Note: If you select a dimension key field under the **References** column, then you can map the dimension key field to a constant value. Ensure that the dimension key field type is compatible with the constant type.

7. Click **Save**.

Clone a measure calculation

You can create a new calculation by copying or cloning the attributes of an existing one. For example, if you want to copy the attributes of a maximum value calculation to create a minimum value calculation, select the maximum calculation in the calculations list and click the clone calculation button. You can then modify the required attributes of the maximum calculation to define it as a minimum calculation. You can clone attributes for aggregate, expression, and advanced calculations.

Clone a measure calculation

1. Click the **Calculations** tab.
2. In the **Calculations** pane, click the calculation that you want to clone.
3. Click **Clone Calculation** to copy the attributes of the measure calculation that you have selected.

   A duplicate calculation is created and displayed under the original calculation in the **Calculations** pane.
4. Click **Save**.

   Note: To delete a measure calculation, select the measure calculation in the **Calculations** pane, and then click **Delete**.

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Select multiple source data items for a measure calculation

You can select multiple source data items from any of the configured data sources to configure measure calculations.

Select multiple source data items for a measure calculation

1. Click the **Edit Calculations** button.
2. In the **Context & Calculations** editor, click the required aggregate calculation.
3. Click **Select source**. The **Select source data items** dialog box appears.

   The **Source data items** area shows the available filtered schema of the data sources.
4. Click **Expand** to expand the data source and view the source data items within the data source.

   Note: You can use the **Find** box to search for a source data item.
5. Select a source data item from which you want to expose the fields to add the source data item. Deselect a source data item to move an item back to the **Source data items** area.

   The names in a data source table should not contain the special character, semicolon (;). The names that contain special characters like semicolon (;) and (#) do not appear in Source data items pane.

   The bottom grid of the dialog box shows the fields of the source data item that you select in the **Source data items** pane. The first source (from the top of the list) providing a value for the field will be used in the resulting dimension table.
6. Drag to enable the **Preview source data** option to view sample data from the data source.
7. Click **OK**.

   The source data items and source data item fields are exposed to the measure. You can use the exposed source data items and source data item fields to configure measure calculations.

   For more information, see Add a measure calculation.

Configure a measure filter

You can build a filter expression for the aggregate calculations to select a subset of the transformed data from external data sources and populate the measure table in the datastore. You can configure only one filter per aggregate calculation.

For more information about aggregate calculations, see Configure an aggregate calculation.

You can build a filter expression by using the dimension fields and the expression operators.

Configure a measure filter

1. Open the AVEVA BI Gateway Model Builder.
2. Click the **Add** icon in the **Fast Action Buttons** menu and then click the Measure icon. A new measure is added in the AVEVA BI Gateway model with a default name and the Measure editor appears in the right pane.
3. Click the **Edit Calculations** button. The **Context** & **Calculations** page appears.
4. In the **Context & Calculations** page, click a required aggregate calculation.

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5. In the **Calculations** area, click the required aggregate calculation.
6. Click **Expand** to expand the **Filter expression** editor.

   Note: You can click **Collapse** to collapse the **Filter expression** editor.
7. In the **Available aggregates** area, click the aggregate calculation for which you want to configure a filter.
8. Build a filter expression. Do the following:
   - In the **Available context Filter Expression,** specify an expression operator to add to the **Filter Expression** editor.

     You can use the open and close parenthesis () to define sub-comparison expressions and single quotes 'abc' as string delimiters. The filter expression must be a valid SQL WHERE clause.

     For more information about SQL WHERE clauses, see the Microsoft SQL Server documentation.
9. Click the **Validate** button to manually validate the expression syntax.

   Note: Alternatively, the system automatically validates the expression syntax after you save the measure.
10. Click **Save**.

Edit a measure

You can modify the measure configuration. If you edit and check in a deployed measure, then the state of the measure changes to "Pending Changes". Editing a measure does not impact other AVEVA BI Gateway objects.

Edit a measure

1. Open the AVEVA BI Gateway Model Builder.
2. Under the **Measures** column, click the measure that you want to edit. The Measure editor appears with the selected measure details.
3. Do the required modifications.
4. Click **Save**.

Delete a measure

If you delete a measure, then the configuration, mappings, and relationships of the measure are deleted. However, the measure table and data are not removed from the datastore.

Delete a measure

1. Open the AVEVA BI Gateway Model Builder.
2. Under the **Measures** column, click the measure that you want to delete.
3. On the **Action** menu, click the **Delete** icon. A confirmation message appears.

   Note: The **Delete** button in the Measures editor is available only when the selected measure is undeployed.
4. Click **Delete**.

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Deploy and undeploy a measure

You deploy the measure to the AVEVA BI Gateway.

Deploy a measure

1. Open the AVEVA BI Gateway Model Builder.
2. Under the **Measures** column, click the measure that you want to deploy. The Measures editor appears in the right pane with the selected measure details.
3. On the **Action** menu, click the **Deploy** icon. A notification message appears in the green color.
4. Click **Yes.** After the successful deployment, the deploy status next to the measure name changes from **Yellow** to **Blue**.

Undeploy a measure

1. Open the AVEVA BI Gateway Model Builder.
2. Under the **Measures** column, click the dimension that you want to undeploy. The Measures editor appears in the right pane with the selected measure details.
3. On the **Action** menu, click the **Undeploy** icon. A notification message appears in the green color.
4. Click **Yes.** After the successful undeployment, the deploy status next to the measure name changes from **Blue** to **Yellow**.

Measure modification and redeployment

You can redeploy a measure, whose calculations have been modified or the configurations are altered but not necessarily repopulated. The following table specifies the rule which follows Measure redeployment:

Modification	Measure Table and Data Deleted	Action Taken	Notes
Measure Calculation Added	No	A new column is added to the measure table corresponding to a new calculation.	For one or more added calculations
Measure calculation deleted	No	The column corresponding to the deleted calculation is removed from the measure table	For one or more deleted calculations; deletion of the measure table column does not release the physical data and requires rebuilding the table's clustered index

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Modification	Measure Table and Data Deleted	Action Taken	Notes
Measure calculation modified but the data type remains unchanged* *Will affect expressions based on this calculation	No	None	For one or more modified calculations
Measure calculation modified to use a different data type	No	The column is dropped and recreated based on the new configuration. All existing data for this calculation is lost and backfilled with Nulls.	Only one calculation data type change is required to trigger the action
Calculation Type is changed (for example, from Aggregate to Expression)	No	The column is dropped and recreated based on the new configuration. All existing data for this calculation is lost and backfilled with Nulls.	Only one calculation data type change is required to trigger the action
Measure calculation is renamed	No	The renamed calculation will appear to be a new calculation and will be treated as such. The formerly named calculation will appear to have been deleted and will be treated as such.	For one or more renamed calculations
Renaming the measure	No	There will be no data loss, but the measure table is dropped and repopulated.	Data loss could occur if the source data is not available anymore.

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Modification	Measure Table and Data Deleted	Action Taken	Notes
Measure data collection start date modified to a later date (moved up)	Yes	The measure table is dropped and recreated based on the new configuration. All data is lost, and backfilling will be required.	
Measure data collection start date modified to an earlier date (backfill)	Yes	The measure table is dropped and recreated based on the new configuration. All data is lost, and backfilling will be required.	

Implicitly convertible data types

The following table lists the implicitly convertible data types:

Field type	SQL type (From)	To										
Bit	**Small Int**	**Int**	**Big Int**	**Decimal (18,4)**	**Unique Identifier**	**Float**	**nVarchar (4000)**	**Date Time**	**Tiny Int**	**SQL_Variant**		
Boolean	Bit			Y	Y	Y	N	Y	Y	N	Y	Y
Int16	Small Int	Y		Y	Y	Y	N	Y	Y	N	Y	Y
Int32	Int	Y	Y		Y	Y	N	Y	Y	N	Y	Y
Int64	BigInt	Y	Y	Y		Y	N	Y	Y	N	Y	Y
Decimal	Decimal (26,9)	Y	Y	Y	Y		N	Y	Y	N	Y	Y

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Field type	SQL type (From)	To										
Guid	Unique Identifier	N	N	N	N	N		N	Y	N	N	Y
Double	Float	Y	Y	Y	Y	Y	N		Y	N	Y	Y
String	nVarchar (4000)	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y
Date Time	Date Time	N	N	N	N	N	N	N	Y		N	Y
Byte	TinyInt	Y	Y	Y	Y	Y	N	Y	Y	N		Y
Other	SQL_Variant	N	N	N	N	N	N	N	N	N	N	

Y indicates that the field type can be implicitly converted. When data is not convertible, NULL value is inserted. For example, a Float value of 23.5678 cannot be converted to an Int, but a Float value of 567.0 can be converted to an Int.

N indicates that the field type cannot be implicitly converted.

Data type mapping

The following table lists the conversion of AVEVA BI Gateway model field types into .NET data types and from .NET data types into SQL data types in the datastore.

Field type in BI Gateway model	.NET data type	SQL data type
Boolean	System.Boolean	[bit]
Int16	System.Int16	[smallint]
Int32	System.Int32	[int]
Decimal	System.Decimal	[decimal](18, 0)
Int64	System.Int64	[bigint]
	Float (not supported)	[real]

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Field type in BI Gateway model	.NET data type	SQL data type
Guid	System.Guid	[uniqueidentifier]
Double	System.Double	[float]
String	System.String	[nvarchar](4000)
DateTime	System.DateTime	[datetime2] (7)
Byte	System.Byte	[tinyint]
	System.Byte[]	[varbinary](max)
Other		SQLVariant

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Models

Export and import models
Deploy, Undeploy, and Delete Models

Export and import models

To help you create and manage items more efficiently, you can export AVEVA BI Gateway Models from an existing system to a .json file and then import the .json file when you create a new AVEVA BI Gateway Model at a later date. You can also use the import functionality to update an existing model.

Export a BI Gateway model
Import a BI Gateway model

Export a BI Gateway model

You can export an existing AVEVA BI Gateway Model to a .json file. The export considers the latest version of objects.

Export a BI Gateway model

1. From the AVEVA BI Gateway Model Builder Home page, click the **Export All** icon from the main menu. A confirmation message appears.
2. Click **Done** to finish exporting the Model. The Exported Model is saved at the default location with a file name Data.json.

Note: You can also export an individual model object using the Export icon available in the Object editor.

Edit the .JSON file

You can edit the exported file in any notepad editor to modify the AVEVA BI Gateway Model as per the requirement before importing it into a new setup and create a fresh AVEVA BI Gateway Model. However, it is recommended that you should avoid editing the .json file.

Sample exported model file format

```
{
   "Settings": [
      {
      "SettingUID": 1,
      "Name": "Schema.Version",
      "Value": "3.5.0",
      "DateEntered_UTC": "2020-07-07T12:34:41.6338496"
      },
      {
      "SettingUID": 2,
      "Name": "PurgeEventLogRefreshIntervalInMinutes",
```

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```
      "Value": "1440",
      "DateEntered_UTC": "2020-07-07T12:34:44.6494679"
      },
      {
      "SettingUID": 3,
      "Name": "EventLogRetentionPeriodInDays",
      "Value": "7",
      "DateEntered_UTC": "2020-07-07T12:34:44.6494679"
      },
      {
      "SettingUID": 4,
      "Name": "ErrorEventLogEnabled",
      "Value": "1",
      "DateEntered_UTC": "2020-07-07T12:34:44.6494679"
      },
      {
      "SettingUID": 5,
      "Name": "WarningEventLogEnabled",
      "Value": "1",
      "DateEntered_UTC": "2020-07-07T12:34:44.6494679"
      },
      {
      "SettingUID": 6,
      "Name": "TraceEventLogEnabled",
      "Value": "0",
      "DateEntered_UTC": "2020-07-07T12:34:44.6651191"
      },
      {
      "SettingUID": 7,
      "Name": "InfoEventLogEnabled",
      "Value": "1",
      "DateEntered_UTC": "2020-07-07T12:34:44.6651191"
      },
      {
      "SettingUID": 8,
      "Name": "CustomEventLogEnabled",
      "Value": "0",
      "DateEntered_UTC": "2020-07-07T12:34:44.6651191"
      },
      {
      "SettingUID": 9,
      "Name": "Current Version",
      "Value": "2021.4.0",
      "DateEntered_UTC": "2021-07-05T09:03:43.0804354"
      }
      ],
      "Calculations": [
      {
      "CalculationUID": 177,
      "Id": "a1917775-f65c-4ac9-a2f6-8eceed75e145",
      "MeasureDataItemUID": 4,
      "MeasureDataItemVersion": 1,
      "Name": "Max",
      "Function": "Max",
      "FunctionFieldMapping_MappingTypeUID": 0,
      "FunctionFieldMapping_SourceFieldName": "Value",
```


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```
"PeriodFieldMapping_MappingTypeUID": 0,
"PeriodFieldMapping_SourceFieldName": "DateTime",
"ModificationPeriodFieldMapping_MappingTypeUID": 0,
"ModificationPeriodFieldMapping_SourceFieldName": "<None>",
"ModificationPeriodInterval": null,
"ModificationPeriodUnit": null,
"ReturnDataTypeUID": 4,
"FilterExpression": null
}
],
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{
"CalculationSourceDataItemMappingUID": 177,
"CalculationUID": 177,
"SourceDataItemUID": 178,
"Priority": 0
}
],
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{
"DataItemTypeUID": 1,
"Name": "DataSource"
},
{
"DataItemTypeUID": 2,
"Name": "Dimension"
},
{
"DataItemTypeUID": 3,
"Name": "Measure"
}
],
"DataSources": [
{
"DataSourceUID": 8,
"Version": 1,
"DeployStateUID": 0,
"IsDirty": false,
"Id": "9e6f1dab-e543-4382-943f-84279c4e8dde",
"Name": "InsightDatasource",
"NodeName": "localhost",
"Port": 8732,
"ConnectionInfo": "",
"DataSourceType": "Online Insight",
"LastUpdate_UTC": "2021-09-02T12:47:23.075327",
"Description": "Insight BI Gateway DataSource Object",
"SerializedTimeZone": "UTC;0;(UTC) Coordinated Universal Time;Coordinated Universal
Time;Coordinated Universal Time;;",
"UseDaylightSavingTime": false
}
],
"DataType": [
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"DataTypeUID": 0,
"Name": "Boolean"
},
```


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```
      {
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      "Name": "Byte"
      },
      {
      "DataTypeUID": 2,
      "Name": "DateTime"
      },
      {
      "DataTypeUID": 3,
      "Name": "Decimal"
      },
      {
      "DataTypeUID": 4,
      "Name": "Double"
      },
      {
      "DataTypeUID": 5,
      "Name": "Guid"
      },
      {
      "DataTypeUID": 6,
      "Name": "Int16"
      },
      {
      "DataTypeUID": 7,
      "Name": "Int32"
      },
      {
      "DataTypeUID": 8,
      "Name": "Int64"
      },
      {
      "DataTypeUID": 9,
      "Name": "Other"
      },
      {
      "DataTypeUID": 10,
      "Name": "String"
      }
      ],
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      {
      "DeployStateUID": 0,
      "Name": "NotDeployed"
      },
      {
      "DeployStateUID": 1,
      "Name": "Deployed"
      }
      ],
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      {
      "DimensionAliasUID": 19,
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      "MeasureDataItemUID": 4,
```


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```
"MeasureDataItemVersion": 1,
"Alias": "FK_Tags_01",
"DimensionDataItemUID": 17,
"DimensionDataItemVersion": 1,
"ContextLink": false
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],
"DimensionDataItems": [
{
"DimensionDataItemUID": 17,
"Version": 1,
"DeployStateUID": 0,
"IsDirty": false,
"Id": "aeafaae5-b1ed-4d15-ae59-893a97351ed3",
"Name": "Tags",
"Description": "Insight BI Gateway Dimension Object",
"RefreshRateInterval": 1,
"RefreshRateOffset": 0,
"RefreshRateUnit": "Day",
"TimeDefiningEnabled": false,
"TimeDefiningType": null,
"TimeDefiningStart_DimensionFieldUID": null,
"TimeDefiningEnd_DimensionFieldUID": null,
"TimeDefiningDuration_DimensionFieldUID": null,
"TimeDefiningDuration_Constant": null,
"TimeDefiningDuration_MappingTypeUID": null,
"TimeDefiningDurationUnit": null,
"FilterExpression": "",
"UpdatePeriodEnabled": false,
"UpdatePeriodStartDate": null,
"UpdatePeriodTime_DimensionFieldUID": null,
"UpdatePeriodInterval": null,
"UpdatePeriodUnit": null,
"DeploymentTimestamp_UTC": null,
"LastUpdate_UTC": "2021-09-02T10:20:51.5122759"
}
],
"DimensionDataItemFields": [
{
"DimensionDataItemFieldUID": 122,
"Id": "6beeb6bb-00ee-4688-980a-54a2c72776d2",
"DimensionDataItemUID": 17,
"DimensionDataItemVersion": 1,
"Name": "FQN",
"FieldDataTypeUID": 10,
"Active": true,
"KeyField": true
}
],
"DimensionDataItemFieldMappings": [
{
"DimensionDataItemFieldMappingUID": 392,
"DimensionDataItemFieldUID": 122,
"DimensionDataItemMappingUID": 71,
"FieldMappingTypeUID": 0,
"Constant": null,
```


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```
      "DimensionFieldName": "FQN",
      "SourceDataItemFieldUID": 1156
      }
      ],
      "DimensionDataItemLinks": [],
      "DimensionDataItemLinkMappings": [],
      "DimensionDataItemMappings": [
      {
      "DimensionDataItemMappingUID": 71,
      "DimensionDataItemUID": 17,
      "DimensionDataItemVersion": 1,
      "SourceDataItemUID": 179,
      "Priority": 1
      }
      ],
      "ExpressionCalculations": [],
      "MappingType": [
      {
      "MappingTypeUID": 0,
      "Name": "SourceField"
      },
      {
      "MappingTypeUID": 1,
      "Name": "Constant"
      },
      {
      "MappingTypeUID": 2,
      "Name": "NULL"
      },
      {
      "MappingTypeUID": 3,
      "Name": "Skip"
      },
      {
      "MappingTypeUID": 4,
      "Name": "DimensionField"
      }
      ],
      "MeasureDataItems": [
      {
      "MeasureDataItemUID": 4,
      "Version": 1,
      "DeployStateUID": 0,
      "IsDirty": false,
      "Id": "d0f70b62-f544-4749-9635-37918522962c",
      "Name": "Measure1",
      "Description": "Insight BI Gateway Measure Object",
      "RefreshRateOffset": 0,
      "RefreshRateInterval": 1,
      "RefreshRateStartDateTime": "2021-01-01T00:00:00",
      "UsePeriodValues": true,
      "Period": 1,
      "PeriodUnit": "Hour",
      "RefreshRateUnit": "Day",
      "UpdatePeriod": 1,
      "UpdatePeriodUnit": "Day",
```


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```
      "ServerFileGroupEnabled": false,
      "ServerFileGroupName": null,
      "LastUpdate_UTC": "2021-09-02T10:51:42.8978179"
      }
      ],
      "Relationships": [
      {
      "RelationshipUID": 2977,
      "CalculationUID": 177,
      "DimensionAliasUID": 19,
      "RelationshipDimensionReferenceUID": 2113,
      "RelationshipSourceMappingUID": 2113,
      "MapType": "Key"
      }
      ],
      "RelationshipDimensionReferences": [
      {
      "RelationshipDimensionReferenceUID": 2113,
      "DimensionDataItemFieldUID": 122,
      "DimensionDataItemLinkUID": null
      }
      ],
      "RelationshipSourceMappings": [
      {
      "RelationshipSourceMappingUID": 2113,
      "SourceDataItemFieldUID": 1151,
      "SourceDimensionAliasUID": null,
      "Constant": null
      }
      ],
      "SourceDataItems": [
      {
      "SourceDataItemUID": 178,
      "DataSourceUID": 8,
      "DataSourceVersion": 1,
      "Id": "db223916-91d8-47c6-9a7d-87534e1bc503",
      "Name": "ProcessValue",
      "Description": null,
      "Namespace": null,
      "ObjectName": null,
      "IsCustomQuery": true,
      "CustomQuery": "{\n \"QueryName\":\"ProcessValues\",\n \"SelectColumn\": [\"*\"],\n
      \"Tag\": {\n \"Filter\":\"startswith(FQN,'PLP')\",\n \"Select\":\"FQN\"\n },\n
      \"StartDateTime\":\"[RequestedSartTime]\",\n \"EndDateTime\":\"[RequestedEndTime]\"\n
      }\n",
      "DateEntered": "2021-08-09T06:08:30.6437897",
      "DateModified": "2021-09-02T12:48:49.3064322"
      },
      {
      "SourceDataItemUID": 179,
      "DataSourceUID": 8,
      "DataSourceVersion": 1,
      "Id": "b81440e7-1a0c-4abb-aef4-120afe6e0ba5",
      "Name": "TagMetadata",
      "Description": null,
      "Namespace": null,
```


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```
"ObjectName": null,
"IsCustomQuery": true,
"CustomQuery": "{\n\"QueryName\": \"TagMetaData\",\n\"SelectColumn\":
[\"*\"],\n\"DistinctColumn\":[\"BIGateway_PlantID\",\"BIGateway_AssetID\",\"BIGateway
_Dimension\",\"BIGateway_MeasureCalculation\",\"FQN\",\"Description\",\"EngUnit\",\"E
ngUnitMin\",\"EngUnitMax\",\"GeoLocation\"],\n \"Filter\":
\"startswith(FQN,'PLP')\"\n}",
"DateEntered": "2021-08-09T06:08:30.6437897",
"DateModified": "2021-08-09T06:08:30.6437897"
}
],
"SourceDataItemFields": [
{
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"SourceDataItemUID": 178,
"Id": "fc0f23f9-d85b-4540-a275-14b5544b276d",
"Name": "Value",
"FieldDataTypeUID": 4,
"Active": true,
"KeyField": false
},
{
"SourceDataItemFieldUID": 1148,
"SourceDataItemUID": 178,
"Id": "1e1fb708-19a7-43ff-b5bd-3e3afbc14ebb",
"Name": "Unit",
"FieldDataTypeUID": 10,
"Active": true,
"KeyField": false
},
{
"SourceDataItemFieldUID": 1149,
"SourceDataItemUID": 178,
"Id": "934725cf-2158-4cda-8394-7ccfdfc63e5a",
"Name": "DateTime",
"FieldDataTypeUID": 2,
"Active": true,
"KeyField": false
},
{
"SourceDataItemFieldUID": 1150,
"SourceDataItemUID": 178,
"Id": "0626b750-395b-48c1-be2c-95a11be1090b",
"Name": "Text",
"FieldDataTypeUID": 10,
"Active": true,
"KeyField": false
},
{
"SourceDataItemFieldUID": 1151,
"SourceDataItemUID": 178,
"Id": "ab4d5f22-3ccd-4b5f-a0b2-c030ed93edc3",
"Name": "FQN",
"FieldDataTypeUID": 10,
"Active": true,
"KeyField": false
```


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```
      },
      {
      "SourceDataItemFieldUID": 1152,
      "SourceDataItemUID": 178,
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      "Name": "OpcQuality",
      "FieldDataTypeUID": 7,
      "Active": true,
      "KeyField": false
      },
      {
      "SourceDataItemFieldUID": 1153,
      "SourceDataItemUID": 179,
      "Id": "498f51ab-1907-4c74-beb5-08168169e776",
      "Name": "EngUnitMax",
      "FieldDataTypeUID": 4,
      "Active": true,
      "KeyField": false
      },
      {
      "SourceDataItemFieldUID": 1154,
      "SourceDataItemUID": 179,
      "Id": "bb582691-bf02-4880-921d-0d8a885d2747",
      "Name": "EngUnit",
      "FieldDataTypeUID": 10,
      "Active": true,
      "KeyField": false
      },
      {
      "SourceDataItemFieldUID": 1155,
      "SourceDataItemUID": 179,
      "Id": "d735bfdd-2e90-45dd-9cbc-24e4a4a78711",
      "Name": "InterpolationType",
      "FieldDataTypeUID": 10,
      "Active": true,
      "KeyField": false
      },
      {
      "SourceDataItemFieldUID": 1156,
      "SourceDataItemUID": 179,
      "Id": "13836cfe-7afe-4505-8a1b-2b4c49ab1508",
      "Name": "FQN",
      "FieldDataTypeUID": 10,
      "Active": true,
      "KeyField": false
      },
      {
      "SourceDataItemFieldUID": 1157,
      "SourceDataItemUID": 179,
      "Id": "048ecf0f-d277-4f1b-9045-4c89dcb95d01",
      "Name": "Description",
      "FieldDataTypeUID": 10,
      "Active": true,
      "KeyField": false
      },
      {
```


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```
      "SourceDataItemFieldUID": 1158,
      "SourceDataItemUID": 179,
      "Id": "70abde39-e8aa-483d-9642-52dfb1c89071",
      "Name": "EngUnitMin",
      "FieldDataTypeUID": 4,
      "Active": true,
      "KeyField": false
      },
      {
      "SourceDataItemFieldUID": 1159,
      "SourceDataItemUID": 179,
      "Id": "e2366b41-79a4-4014-85ea-5bede5e1ebfe",
      "Name": "MessageOn",
      "FieldDataTypeUID": 10,
      "Active": true,
      "KeyField": false
      },
      {
      "SourceDataItemFieldUID": 1160,
      "SourceDataItemUID": 179,
      "Id": "7c852221-4878-40b2-8749-893e93c9754b",
      "Name": "TagName",
      "FieldDataTypeUID": 10,
      "Active": true,
      "KeyField": false
      },
      {
      "SourceDataItemFieldUID": 1161,
      "SourceDataItemUID": 179,
      "Id": "c2e2528d-1540-474d-b102-9522d5d43b9e",
      "Name": "TagType",
      "FieldDataTypeUID": 10,
      "Active": true,
      "KeyField": false
      },
      {
      "SourceDataItemFieldUID": 1162,
      "SourceDataItemUID": 179,
      "Id": "845bfff2-f658-497b-960c-b26d5554b30a",
      "Name": "Source",
      "FieldDataTypeUID": 10,
      "Active": true,
      "KeyField": false
      },
      {
      "SourceDataItemFieldUID": 1163,
      "SourceDataItemUID": 179,
      "Id": "ce22184c-5eca-40b9-8b6c-efab70b268a2",
      "Name": "MessageOff",
      "FieldDataTypeUID": 10,
      "Active": true,
      "KeyField": false
      }
      ],
  "UserDefinedFunctionCalculations": [],
  "UserDefinedFunctionParameters": []
```


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```
}
```

Import a BI Gateway model

You can import an existing AVEVA BI Gateway Model of the same version using the exported Data.json file.

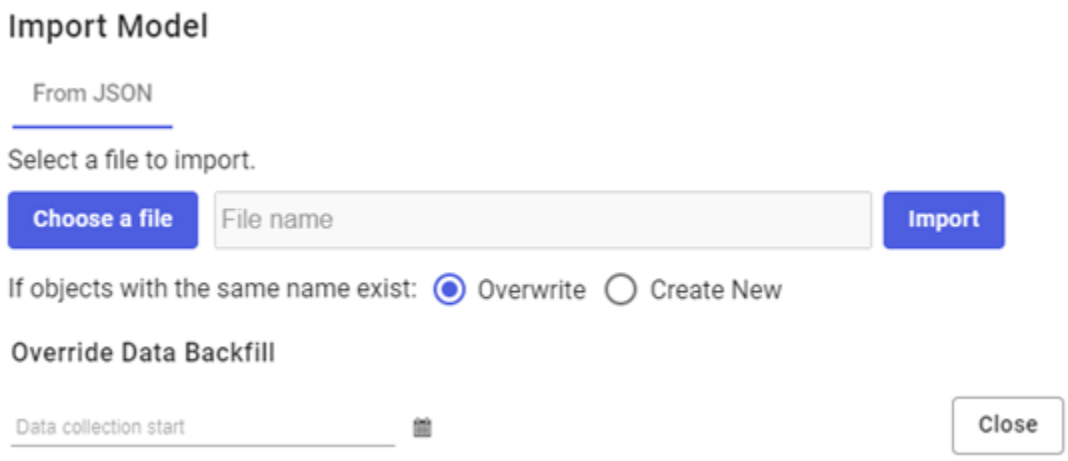
The following import rules are followed while performing the import of AVEVA BI Gateway Model:

- All the objects are imported from Export File.
- If any objects are existing, you can choose to either 'Overwrite' or 'Create New' objects.
- After import, all newly created objects are in undeployed state, irrelevant of the state they were in at export time.
- If any objects are existing and are in deployed state, they are in 'Deployed with pending changes' state (a new version is created).
- If any objects are existing and are in undeployed state, they are overwritten.
- If any objects are existing, and are in 'Deployed with pending changes' state, this version is overwritten.
- All relationships between objects are preserved.

Note: In case of migration from Intelligence 2017 U1 on-premises, you must get the JSON file, and then import the JSON file to Cloud. It is applicable only for the AVEVA Insight data source.

Import a BI Gateway model

1. From the AVEVA BI Gateway Home page, click **Import** from the main menu. The **Import Model** dialog box appears.



2. In the **Import Model** dialog box, click **Choose a file**. The **Open** dialog box appears.
3. Select the file that you want to import and then click **Open**.
4. In the **Import Model dialog** box, select any of the following
   - **Overwrite**: If you want to overwrite an existing object or AVEVA BI Gateway Model.
   - **Create New**: If you want to create a new object or AVEVA BI Gateway Model.
5. Specify the **Override Data Backfill** date if you want to set the data collection date which the system would consider for pulling the data for measure or dimension during the import process.

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6. Click **Import**. The import process starts importing the model and a successful import message appears.
7. Click **Done**.

Deploy, Undeploy, and Delete Models

About BI Gateway model deployment
Deploy the BI Gateway model
Undeploy the BI Gateway model
Delete the BI Gateway model

About BI Gateway model deployment

You deploy the AVEVA BI Gateway model, which includes the DataSource, Dimension, and Measure objects to the AVEVA BI Gateway. The deployment provides the AVEVA BI Gateway model to the AVEVA BI Gateway.

AVEVA BI Gateway objects with invalid configurations are not deployed. An AVEVA BI Gateway object configuration is considered invalid if the configuration has changed from a previously deployed state, or if the representation is not created in the datastore during run time.

The Explorer view shows an icon indicating the deployment status of the AVEVA BI Gateway objects. When a new AVEVA BI Gateway object is created, it is shown as "not deployed" and is updated to "deployed" after deployment.

Once an Object is deployed to the Runtime, you cannot make changes to the deployed object. A copy of the object is created if it detects any requested changes to allow users to continue working with the object, even though it is deployed.

When you open an object in the AVEVA BI Gateway, it references and displays as applicable, the latest version of all of its dependee objects, regardless of the deployment state.

Dependent Object	Dependee Object
Data Source	None
Dimension	Data Source, Dimension
Measure	Data Source, Dimension

This is based on the assumption that only one Object can be loaded at a time by the AVEVA BI Gateway. When a dependee object that is deployed is further modified and saved, and a dependent object is opened, the dependent object will automatically load the dependencies based on the latest version of the dependee object and not the deployed version. This implies that there is not a way to view the dependent object along with its dependencies from a version of the dependee object that is not the latest.

Any saved modifications done to the dependee object, as seen from within a dependent object, will need to be reconciled with a dependent object as required. Further, a dependent object cannot be deployed when a corresponding dependee object is in an undeployed state or is in "Deployed with pending changes" state. A message is shown to the user indicating the dependee objects that should be in the deployed state. Similarly, an object cannot be deleted if it has one or more dependent objects. The dependencies will first need to be removed to delete the object.

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Even if a dependee object has a change that is not directly related to changes done in a dependent object, a dependee object cannot be in an undeployed or deployed with pending changes state when a dependent object is deployed.

Deploy the BI Gateway model

You deploy an AVEVA BI Gateway model, or AVEVA BI Gateway objects to AVEVA BI Gateway. You can:

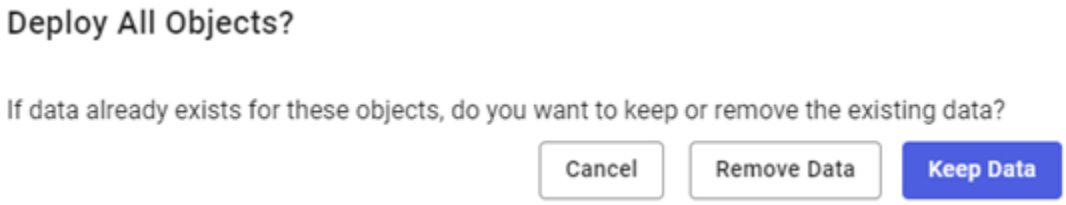
- Deploy the entire AVEVA BI Gateway model.
- Deploy individual AVEVA BI Gateway objects or deploy AVEVA BI Gateway objects with their parent dependents. Measure to Dimensions (and Dimension links) and Measure / Dimensions to Data Sources together.

  Note: To deploy from an individual object, click the **Deploy** icon.
- Deploy AVEVA BI Gateway objects of the same group together.

Data from deployed data sources is available to the deployed dependent dimensions and measures at run time. If you deploy objects of different groups together, then the order of deployment is: Data Sources, Dimensions, and then Measures. If you deploy the parent objects, all the dependent objects will also be updated.

Deploy the BI Gateway model

1. Open the AVEVA BI Gateway Model Builder Home page.
2. Click **Deploy All** from the main menu to deploy the entire AVEVA BI Gateway model. The **Deploy All Objects** dialog box appears.



3. Click any of the following:
   - **Cancel**
   - **Remove Data**: if you want to remove the existing data in the datastore. You must rename and redeploy the new dimension or measure.
   - **Keep Data**: if you want to retain the existing data in the datastore. You must rename and redeploy the new dimension or measure.

     Note: 'Keep Data' may still result in a complete drop of the relevant dimension or measure data if the structure changed.

Undeploy the BI Gateway model

You undeploy a AVEVA BI Gateway model from AVEVA BI Gateway. You can:

- Undeploy the AVEVA BI Gateway model.

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- Undeploy individual AVEVA BI Gateway objects.

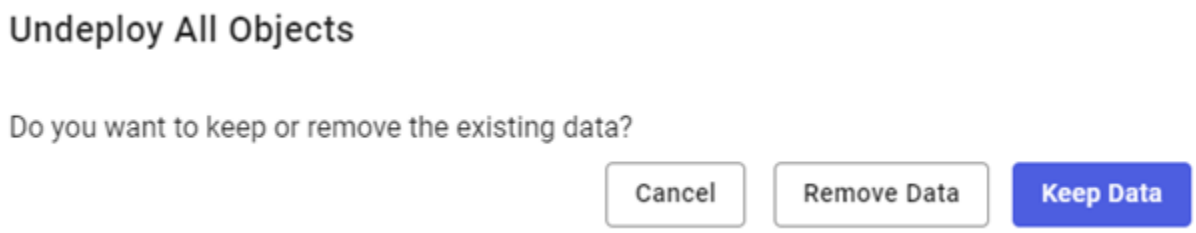
  Note: To undeploy individual objects, click the **Undeploy** icon in the Object Editor pane.

If you undeploy:

- Multiple objects together, then the order of undeployment is: measures, dimensions, and then data sources.
- A data source only, then the dimensions and measures cannot access the data source. The on-going data collection process from the data source fails and reports errors in the logger.
- A dimension or measure, then the on-going data collection process for the dimension or measure is terminated.
- A dimension or measure, then the system prompts you to retain or remove the dimension or measure table in the datastore. If you choose to retain the table on undeployment, then the table is retained but not refreshed. If you choose to delete the table from the datastore, then the table is deleted from the datastore.

Undeploy BI Gateway model

1. Open the AVEVA BI Gateway Home page.
2. Click **Undeploy All** from the main menu to deploy the entire AVEVA Insight BI Gateway model. The **Undeploy All Objects** dialog box appears.



3. Click any of the following:
   - **Cancel**
   - **Remove Data**: if you want to delete the dimension or measure data from the datastore on undeployment.
   - **Keep Data**: if you want to retain the dimension or measure data in the datastore on undeployment.

Delete the BI Gateway model

1. If the model that you want to delete has been deployed, then undeploy the model. For more information about undeploying a model, see Undeploy the Intelligence Model.
2. Delete objects based on the object dependencies.
   a. To delete a dimension with a dependent measure, delete the measure first and then delete the dimension. For more information about deleting measures and dimensions, see Delete a measure and Delete a dimension, respectively.
   b. To delete a data source with a dependent dimension or measure, delete the measure first, then the dimension, and finally delete the data source. For more information about deleting measures, dimensions, and data sources, see Delete a measure, Delete a dimension, and Delete a data source, respectively.

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Datastores

Manage the datastore
Connect to the Azure SQL datastore

Manage the datastore

The AVEVA BI Gateway datastore contains dimension and measure data that is stored based on the deployed AVEVA BI Gateway Model configuration.

Before you connect to the BI Gateway datastore, ensure that:

- The corporate domain is whitelisted. For more information, see Whitelist corporate domain.
- The user IP address is whitelisted. For more information, see Whitelist IP addresses.
- BI Gateway roles are assigned to the required user groups. For more information, see Assign roles.
- The MFA is set up within 14 days of the user being added to the Azure AD. For more information, see Enroll to multifactor authentication.

View datastore connection information

You can view datastore connection information, such as the datastore server name and datastore name.

View datastore connection information

1. From the AVEVA BI Gateway Model Builder Home Page, click the profile icon .
   A list with options appears. The current account is displayed.

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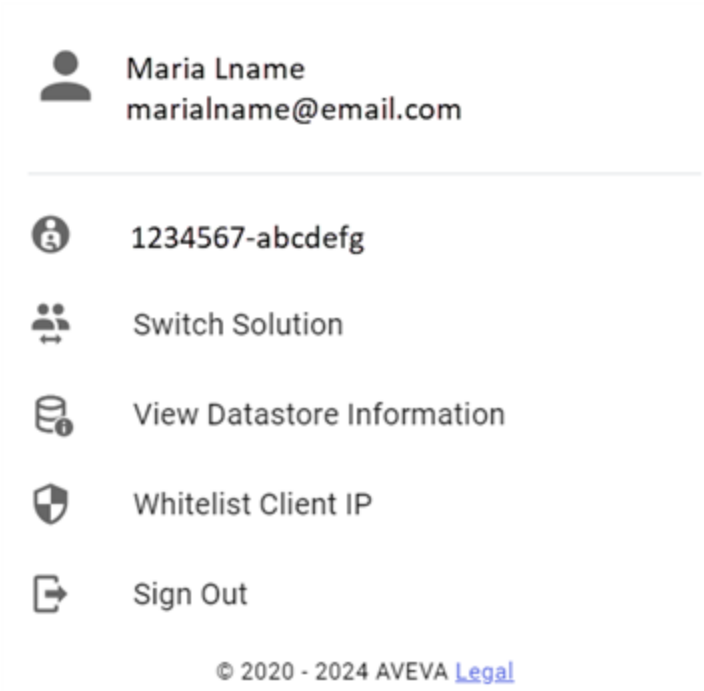

2. Click **View Datastore Information**.

   The **Datastore Connection Information** dialog box appears.

   The following details are displayed.

   - The **Datastore server name** field displays the name of the AVEVA BI Gateway datastore server.
   - The **Datastore name** field displays the name of the AVEVA BI Gateway database.

3. Click the copy icon adjacent to the **Datastore server name** and **Datastore name** fields to copy the respective details.
4. Click **OK**.

How is the datastore updated at runtime?

The datastore is updated at run time if you modify the configuration and redeployed a dimension or measure.

If you redeploy a dimension after modifying the dimension configuration and the modified configuration affects the dependent measures, then the dimension triggers an alert to the dependent measure.

Similarly, if you redeploy a measure after modifying the measure configuration, then the measure values are recalculated if required.

Datastore updates resulting from modifications to deployed dimensions

The following table lists the scenarios when data in the datastore is updated after a dimension has been modified and redeployed.

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Modification done to a deployed dimension	Run time handling of the datastore
A dimension is undeployed and the option to delete the dimension table in the datastore is selected. Thereafter, the dimension configuration is modified and the dimension is redeployed.	Deletes the existing dimension table and creates a new dimension table based on the new configuration.
A dimension is renamed.	Renames the dimension table in the datastore. Updates the dependent measures for dimension name related dependencies.
A new dimension key field is selected.	Deletes existing rows, starts dimension processing afresh. Deletes the data in the measure tables of the dependent measures and starts measure processing afresh.
The time-defining fields in a dimension are modified, inserted, or deleted. Thereafter, the dimension is redeployed.	Reprocesses and updates the dependent measure records.

Datastore updates resulting from modifications to deployed measures

The following table lists the scenarios when data in the datastore is updated after a measure has been modified and redeployed.

Modification done to a deployed measure	Run time handling of the datastore
A measure is undeployed and the option to delete the measure table in the datastore is selected. Thereafter, the measure configuration is modified and the measure is redeployed.	Deletes the existing measure table and creates a new measure table based on the new configuration.

Run time handling of deployed BI Gateway objects

The following table lists the run time handling of any on-going process if the configuration of a deployed object is modified and the object is redeployed.

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Configuration modifications	Run time handling
Data Sources	
Modified the configuration of a deployed data source and redeployed the data source.	Completes the on-going data collection process before executing the new configuration. If there is an on-going back-filling process, then: • Validates the back-filling process. If the schema update in the data source affects the dependent objects, then the system displays an error message. You must redeploy the dependent objects. • Validates the back-filling process. If the schema update in the data source does not affect the dependent objects, then the system executes the new configuration and finishes the back-filling process.
Dimensions	
Modified the configuration of a deployed dimension and redeployed the dimension.	Finishes the on-going data collection process before executing the new configuration.
Measures	
Modified the configuration of a deployed measure and redeployed the measure.	Finishes the on-going data collection process before executing the new configuration.
Modified the configuration other than the schedule of a deployed measure and redeployed the measure.	Initiates the measure update process.

Connect to the Azure SQL datastore

You can get connected to the BI Gateway datastore hosted as an Azure SQL database.

To get started with this feature, you must first install SQL Server Management Studio (SSMS), Microsoft Power BI, or Tableau. You can also use any analytics tool supporting SQL Azure connection instead.

Connect SQL Server Management Studio

You can connect SQL Server Management Studio (SSMS) to Azure SQL Database.

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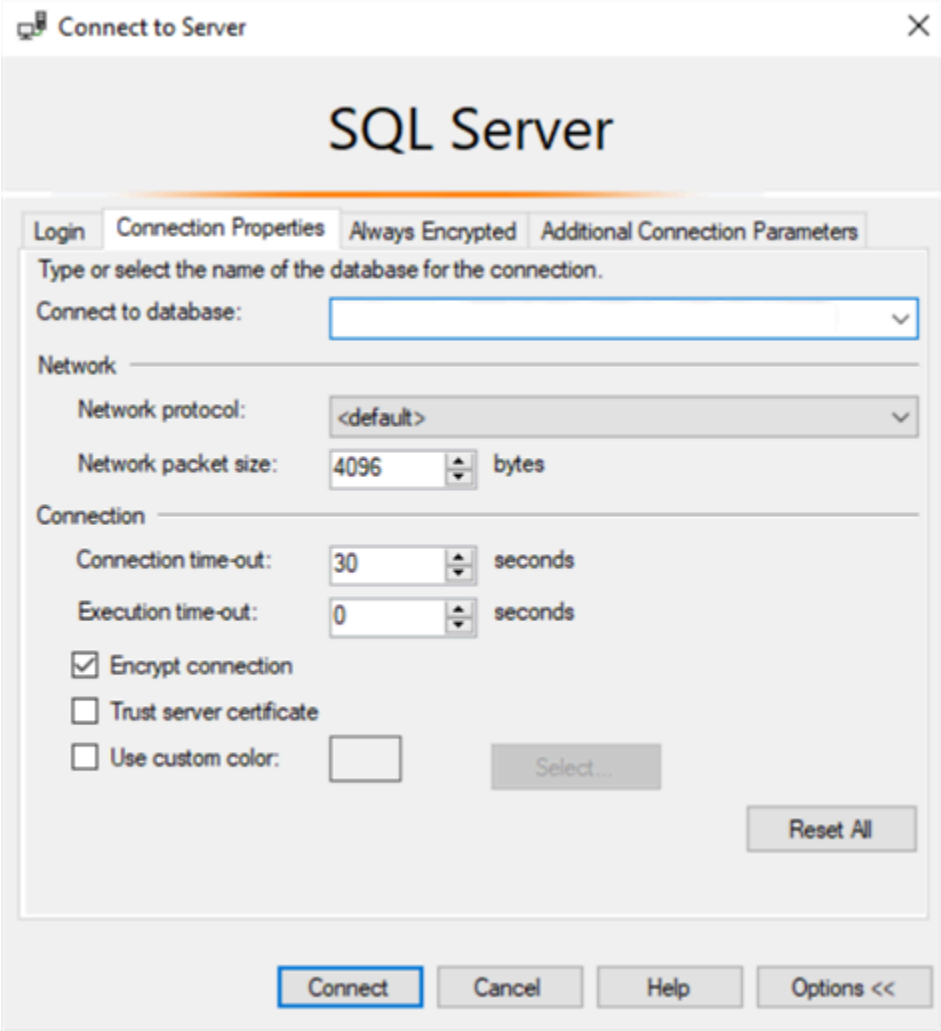
Connect SSMS

1. Open SQL Server Management Studio.

   The **Connect to Server** dialog box appears.
2. In the **Server name** box, enter the Datastore Server name. Ensure that this value matches the Datastore Server name displayed in the **Datastore Connection Information** dialog box. For more information, see View datastore connection information.
3. In the **Authentication** drop-down list, select the **Azure Active Directory - Password** option.

   The dialog box appears.
4. In the **User name** and **Password** boxes, enter the user name and password to connect to SSMS.
5. Click **Options**.
6. Click the **Connection Properties** tab.

   The dialog box appears as follows.



7. In the **Connect to database** box, enter the name of the datastore name. Ensure that this value matches the Datastore name displayed in the Datastore Connection Information dialog box. For more information, see View datastore connection information.
8. Click **Connect**.

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The connection between SSMS and Azure SQL database is established successfully.

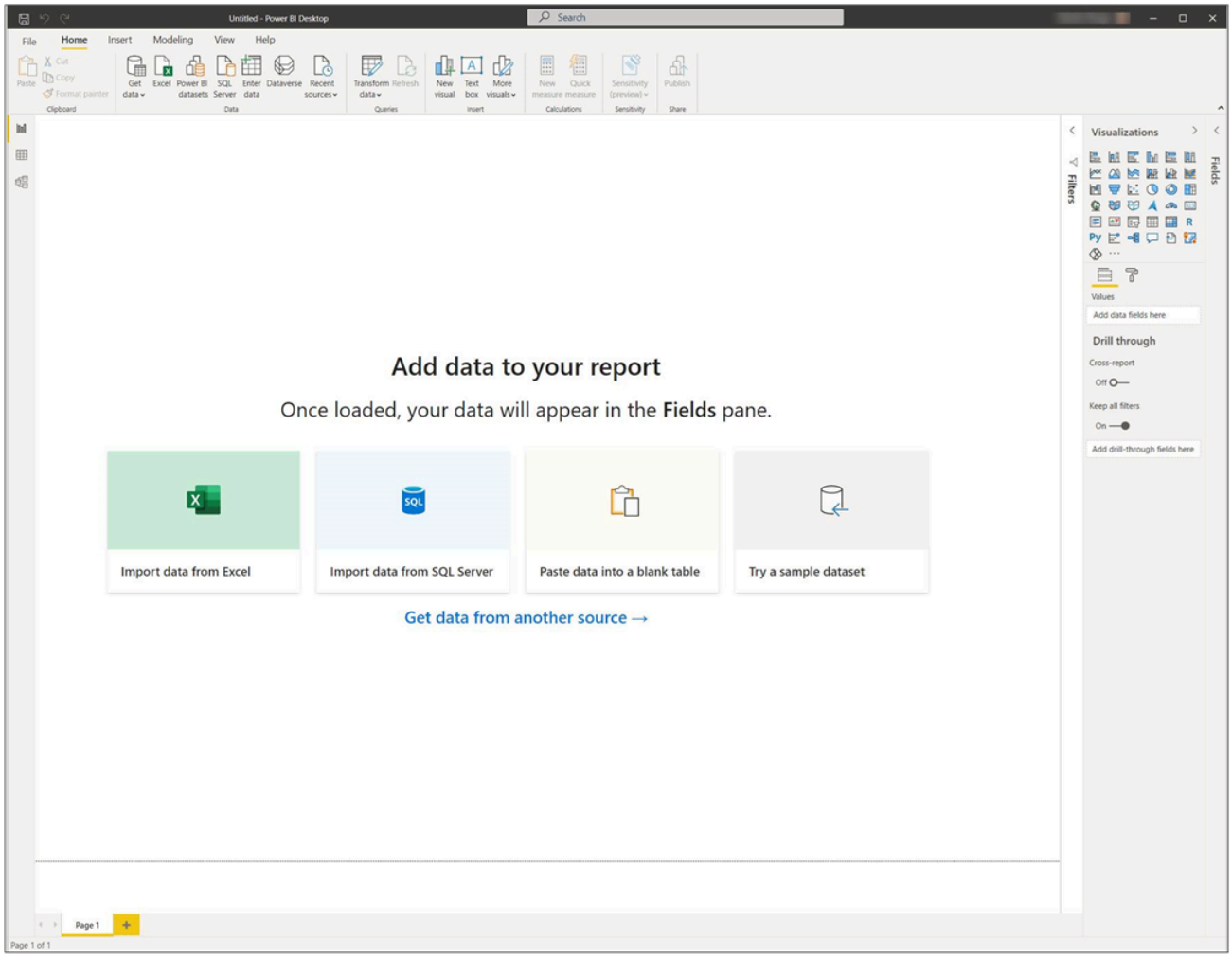
Connect Power BI

You can connect Power BI Desktop to Azure SQL Database.

Connect Power BI

1. Open Power BI Desktop.

   The following window appears.



2. Click **Get Data**.

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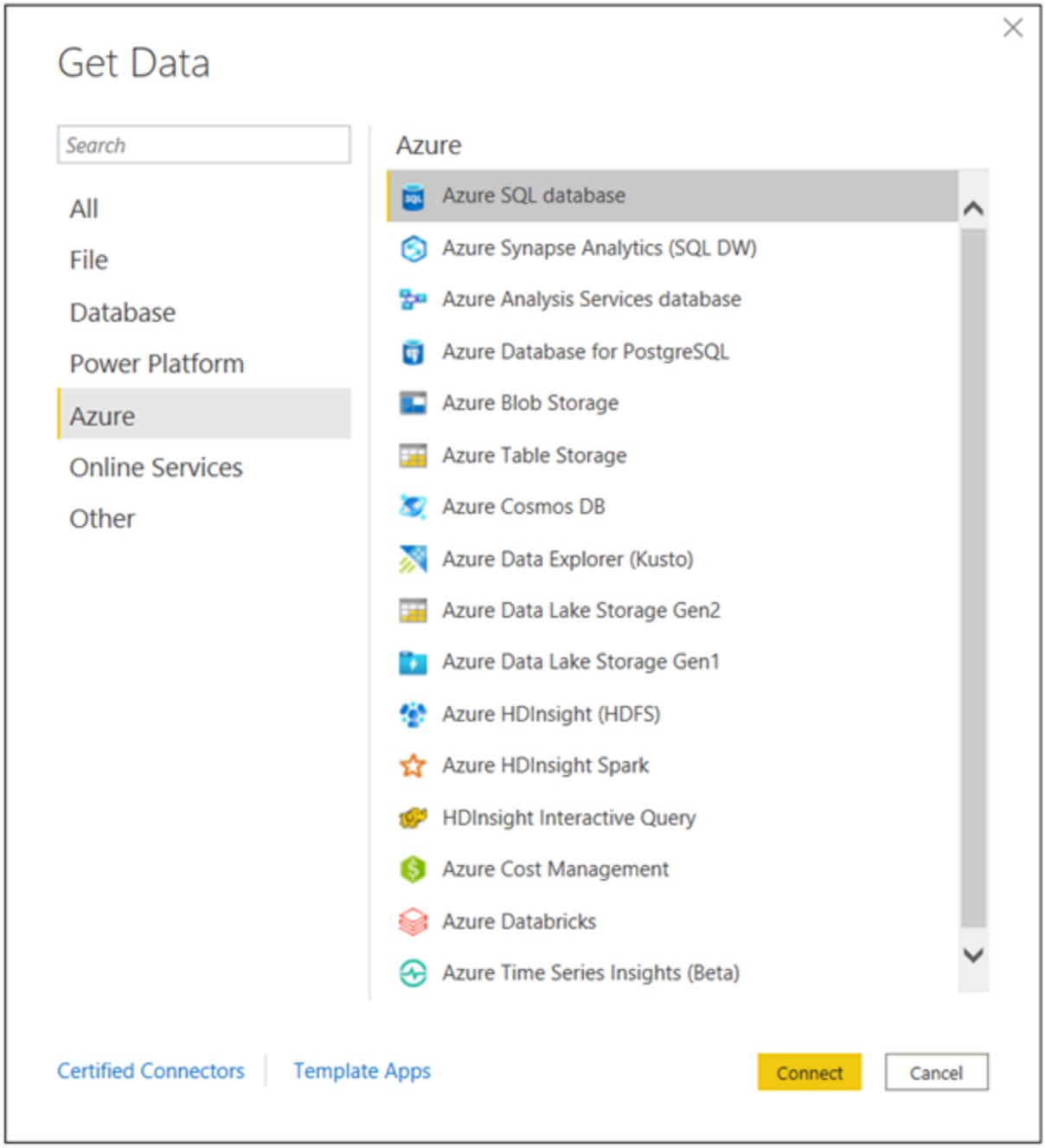

3. Select **Azure** on the left pane, and then select **Azure SQL database**.
4. Click **Connect**.

   A dialog box appears.
5. In the **Server** box, enter the Datastore Server name. Ensure that this value matches the Datastore Server name displayed in the Datastore Connection Information dialog box. For more information, see View datastore connection information.
6. In the **Database** box, enter the name of the datastore name. Ensure that this value matches the Datastore name displayed in the Datastore Connection Information dialog box. For more information, see View datastore connection information.
7. Click **OK**.

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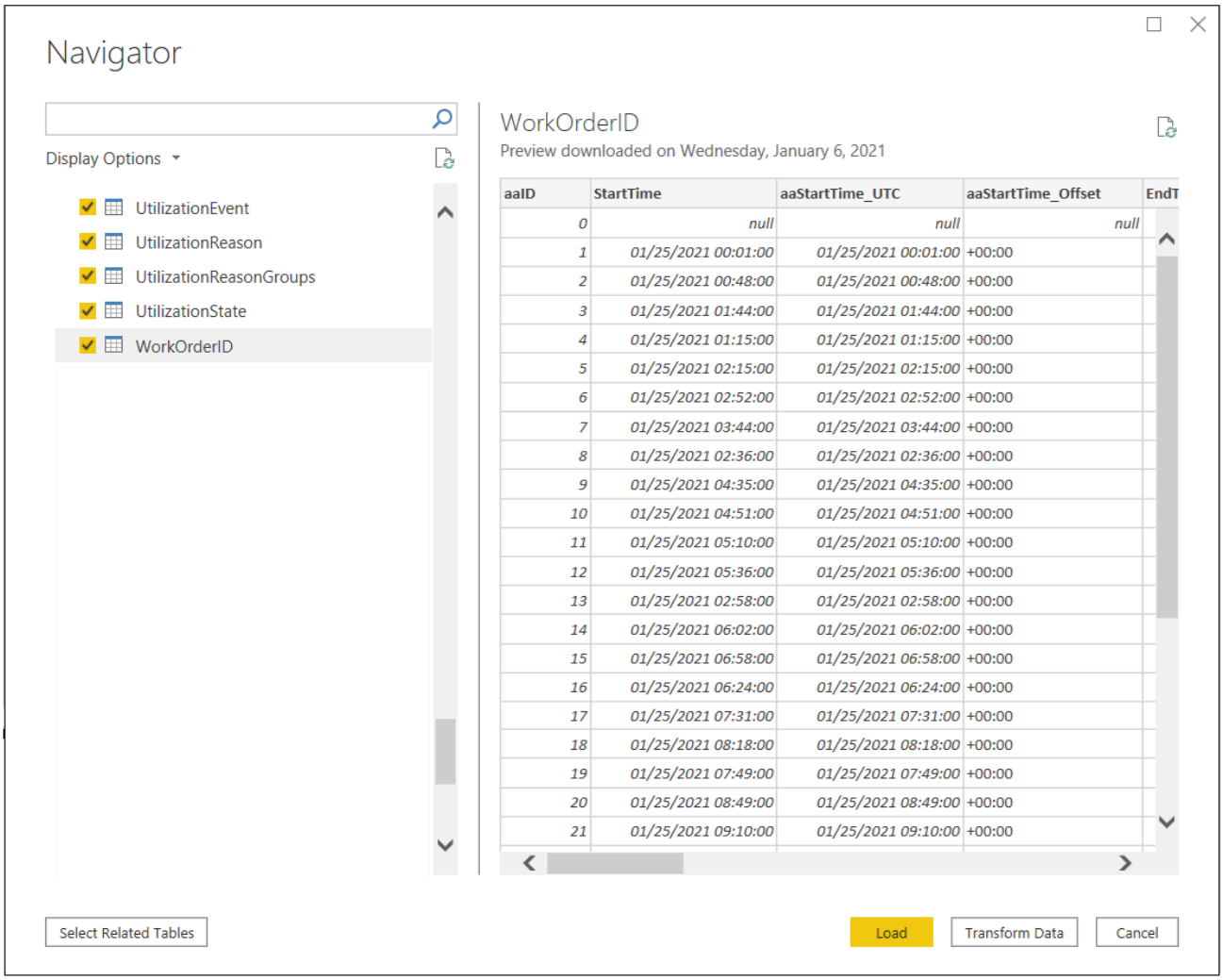
A dialog box appears.

8. Click **Connect**.

   The connection between Power BI and Azure SQL Database is established successfully.



9. Select the object on the left pane, and then preview the data on the right pane.
10. Click **Load** to load the data into Power BI Desktop.

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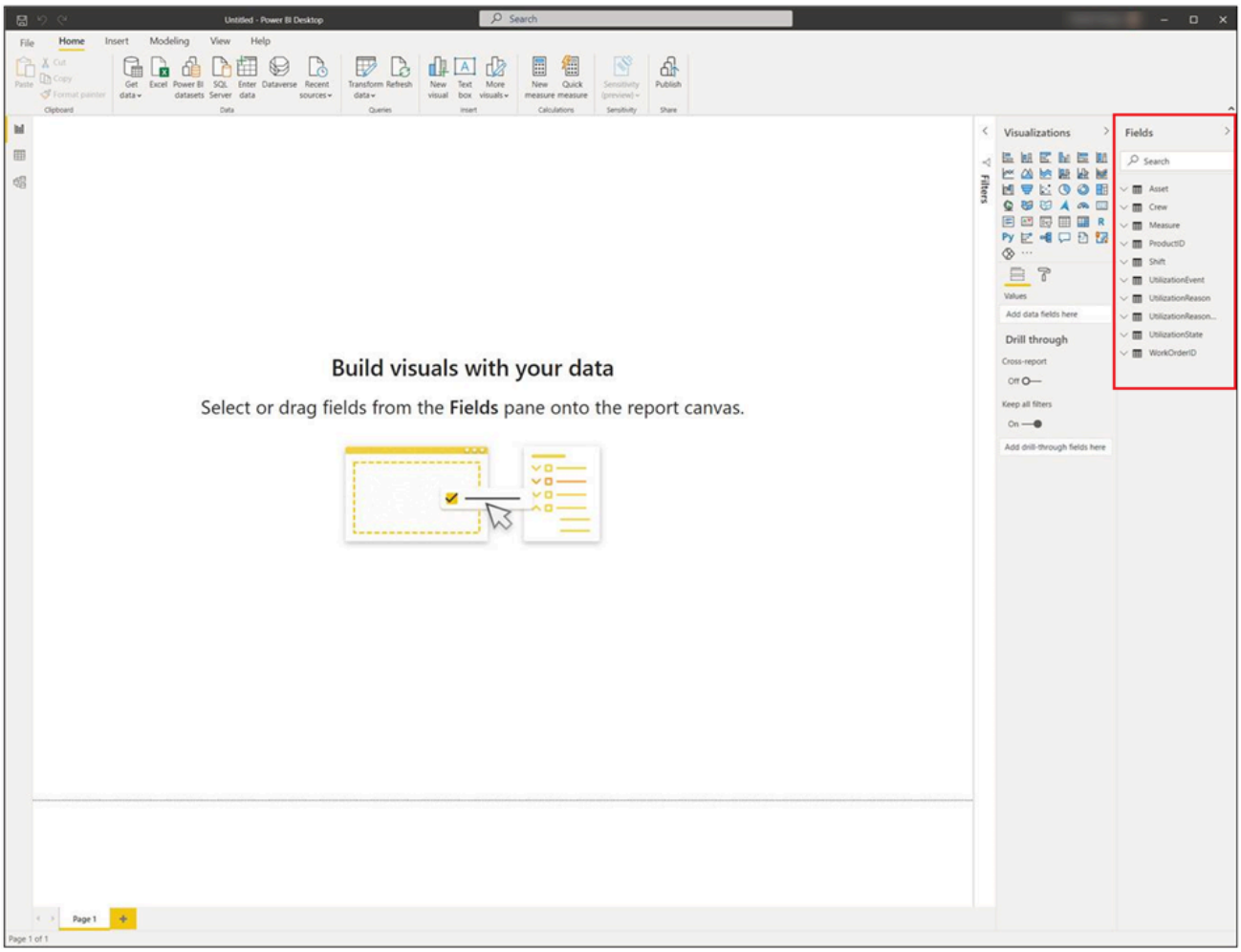

Once loaded, the imported objects are listed under the **Fields** section on the right pane.

Connect Tableau Desktop

You can connect Tableau Desktop leveraging the Azure Synapse Analytics Connector.

Connect Tableau Desktop

1. Open Tableau Desktop.

   Note:
   - Microsoft SQL Azure Connector (Azure Synapse Analytics) is available for BI Gateway Analytics Client (OEM version of Tableau Desktop).
   - BI Gateway Analytics Client is shipped with AVEVA BI Gateway.
   - BI Gateway Dashboard Server can be downloaded from AVEVA Knowledge and Support Center website. For more information on the installation process, refer to https://help.tableau.com/current/server/en-us/install.htm.

   The following window appears.

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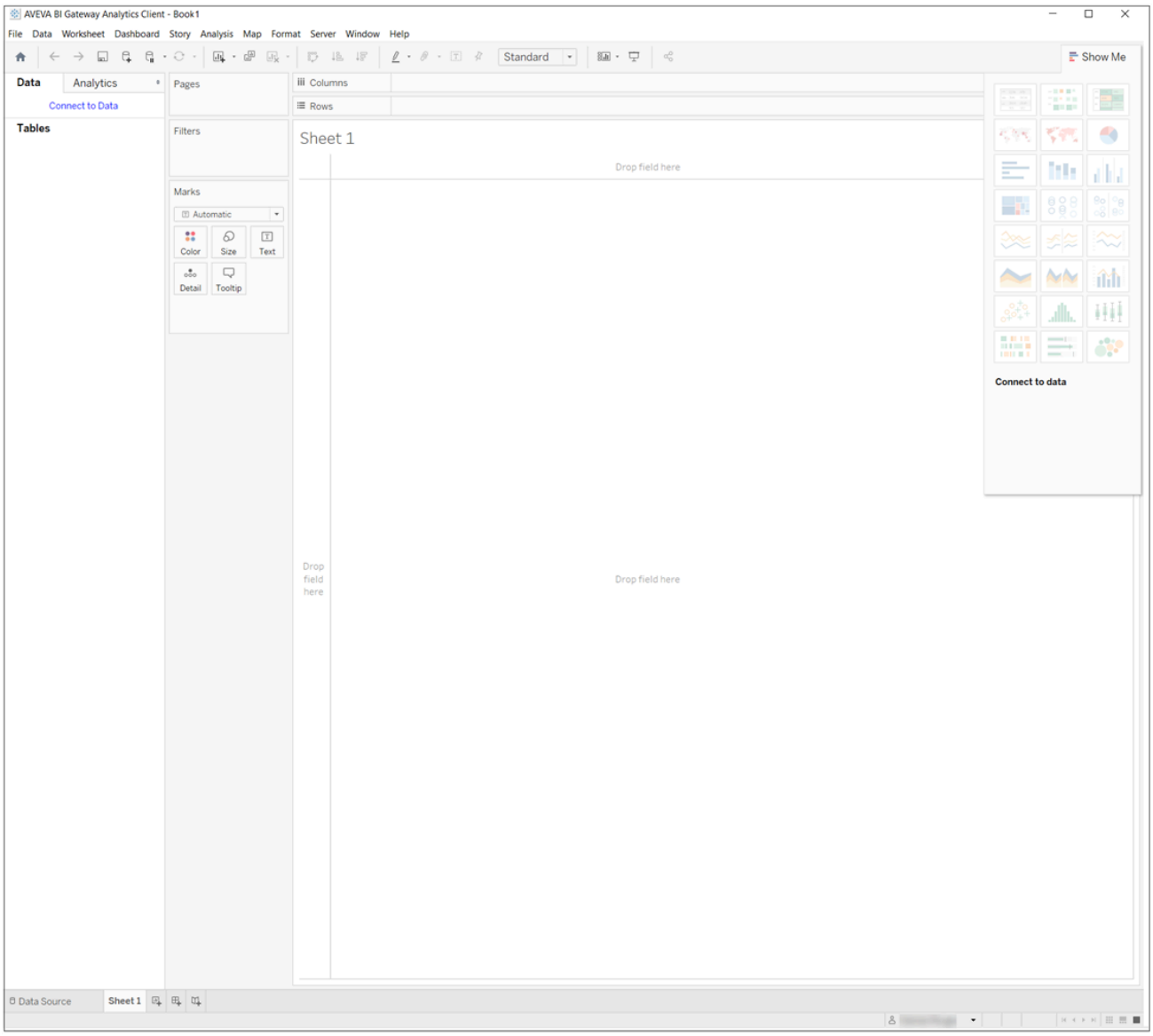

2. Click **Connect**.

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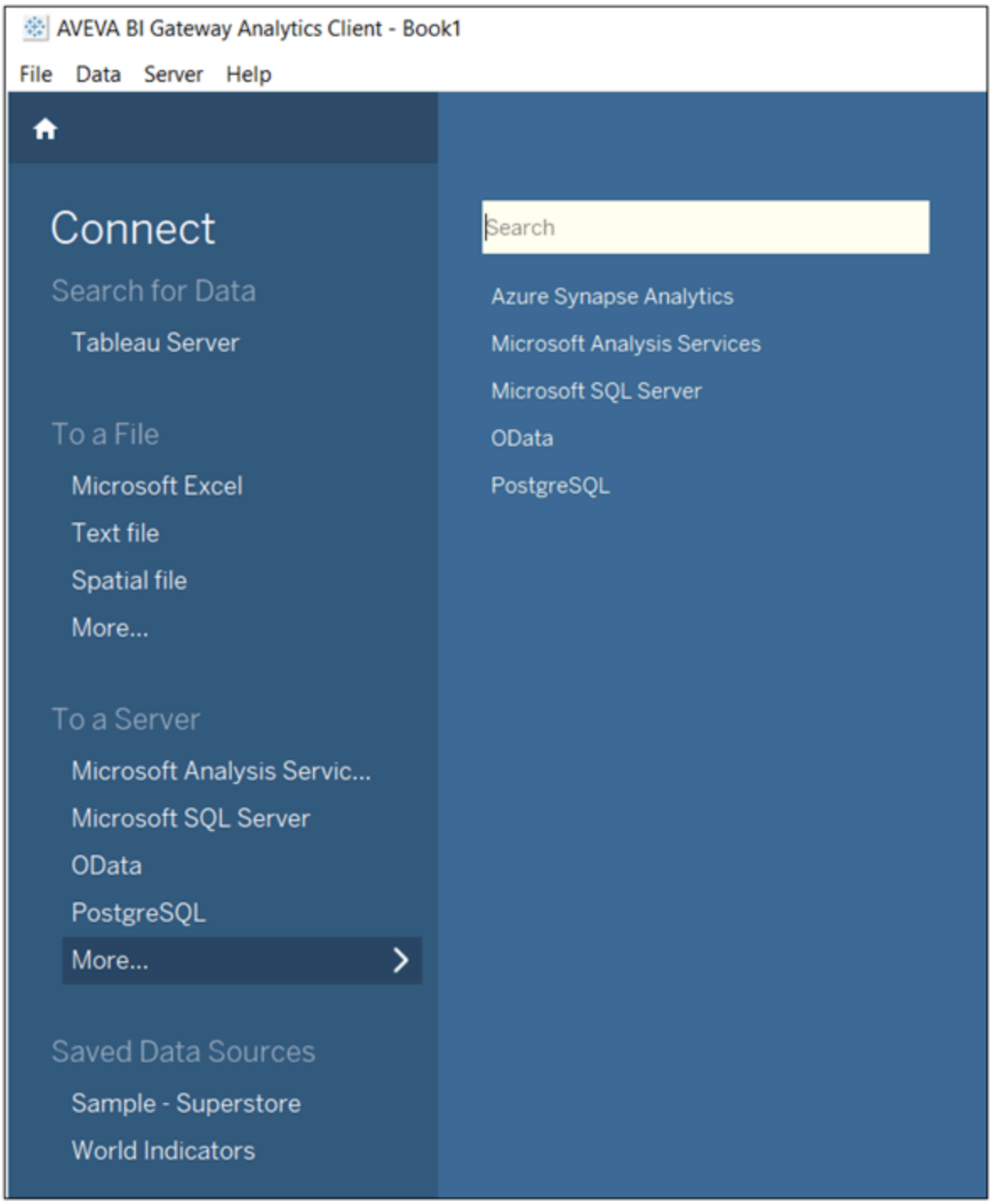

3. Under **Connect to a Server** on the left pane, select **Azure Synapse Analytics**. Alternatively, you can type **Azure Synapse Analytics** in the **Search** field and click the link.
4. Click **Connect**.

   The **New Connection** dialog box appears.
5. In the **Server** box, enter the Datastore Server name. Ensure that this value matches the Datastore Server name displayed in the Datastore Connection Information dialog box. For more information, see View datastore connection information.
6. In the **Database** box, enter the name of the datastore name. Ensure that this value matches the Datastore

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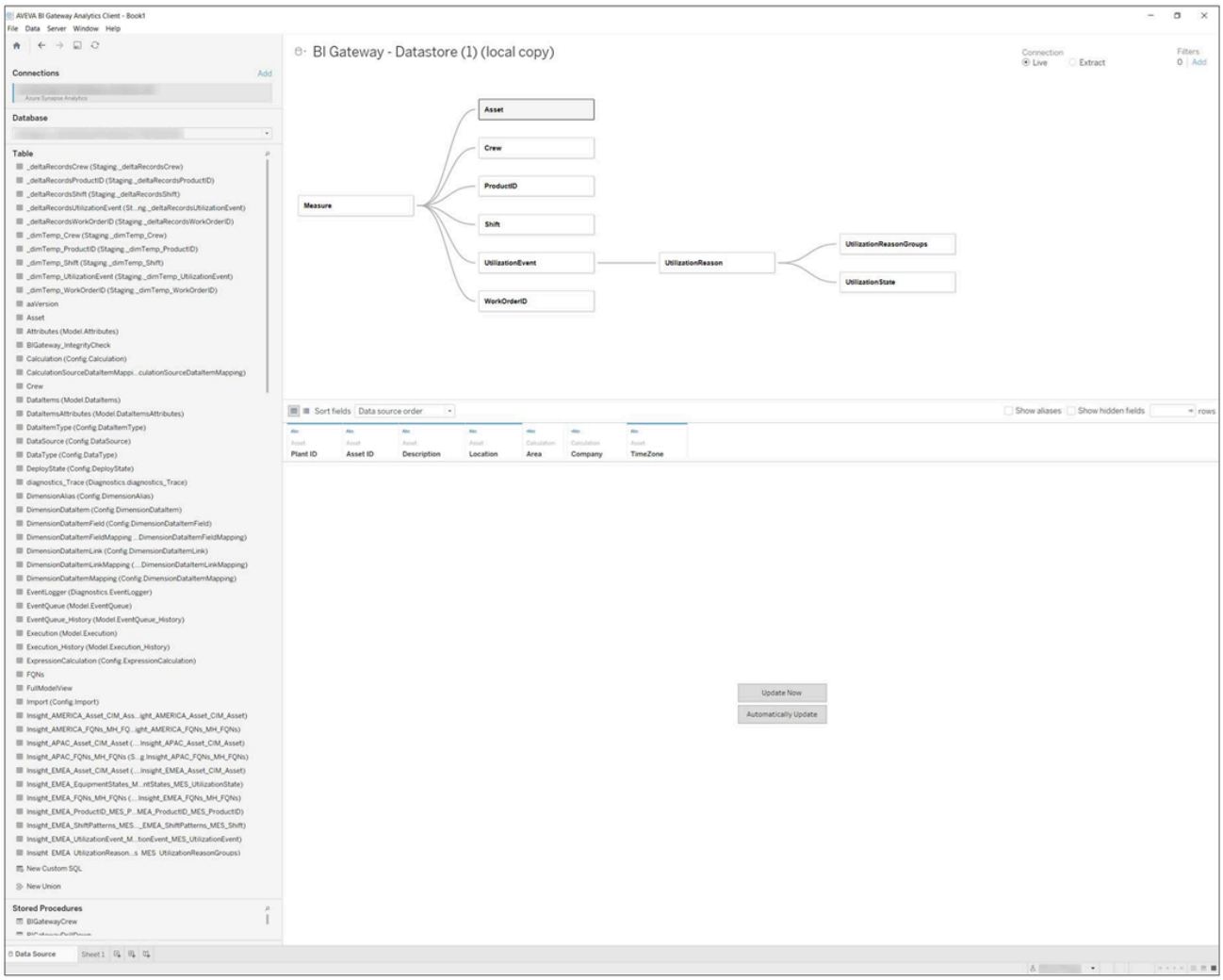
name displayed in the Datastore Connection Information dialog box. For more information, see View datastore connection information.

7. In the **Authentication** drop-down list, select **Active Directory Password**.
8. In the **Username** and **Password** boxes, type the user name and password respectively to connect to the database.
9. Click **Sign In**.

   The connection between Tableau Desktop and Azure Synapse Analytics is established successfully.



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Event API

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About Event API

The BI Gateway Event API is used to programmatically inject requests to reprocess dimensions and measures.

For dimensions and measures, you can request to reprocess a specific time-range or a simple refresh.

Note: When you deploy a Measure without a schedule and driving its execution based on Time-Defining Dimension changes, it is recommended that the Measure is refreshed periodically using Events API.

Get started with Event API

The Event API service is used by client applications to add events to a first-in, first out execution queue.

In this architecture, the REST- based API service is used to expose "Event API" methods to external applications.

Event API methods

The Intelligence Event Interface Service exposes the following methods:

- AddDimensionDateRangeEvent() method
- AddMeasureDateRangeEvent() method
- AddRefreshEvent() method

These methods, in turn, call the Event Manager methods for adding Events to the queue.

AddDimensionDateRangeEvent() method

The AddDimensionDateRangeEvent() method adds events to reprocess a date range of a dimension. The date range consists of a start and an end date (including time). This will trigger the service to reprocess the time slices of the date range.

URL: *https://<BI Gateway URL>/eventapi/odata/Event/AddDimensionDateRangeEvent*

For example: *https://eu.v2.bigateway.connect.aveva.com/eventapi/odata/Event/AddDimensionDateRangeEvent*

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Important Note: You are required to add the TenantID as a header. For example, **'x-wwTenantID'**.

For more information on how to identify the tenant ID, see Identify the tenant ID.

Request

Parameter Type	Parameter Name	Description	Data Type
Input Request	jsonstring	The Data Transfer Object which holds three attributes: Object name, StartDate, EndDate.	DTO (valid JSON format)

Important: Make sure that the Start DateTime and End DateTime parameter are in UTC date and time format.

Return value

A GUID is returned corresponding to the event created in the database. If the AddDimensionDateRangeEvent() method fails, an error is logged in the Application Insight and a value of zero is returned.

Postman example

The following Postman code snippet shows the example for the query.

Note: Replace the values for ObjectName, Dimension, StartDate, and EndDate according to your requirement.

```
{"ObjectName":"Dimension_001","StartDate":"2021-01-02 08:00:00Z","EndDate":"2021-01-03
23:59:59Z"}
```

If the query is successful, the relevant GUID is displayed as a response.

For more information about Postman installation and configuration, see Configuring Postman Settings.

Delete aaIDs in Postman

Within a Postman query, you can delete aaIDs before an entry process. The aaID is presented in the dimension column.

The following is an example query used in Postman to delete aaIDs:

```
{
"ObjectName": "Dimension_001",
"aaIDs": [
"4",
"5"
],
"StartDate": "2023-03-18 23:24:00.000",
"EndDate": "2023-03-19 02:12:00.000"
}
```

Note: The option to delete aaIDs is **optional**.

Deletion of the aaID will **not** be processed if:

- the aaID does not fall within the date range specified in the query.
- the aaID provided is irrelevant or does not exist.

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- you provide multiple aaIDs and only some fall in the specified date range.

Deprecated - AddDimensionDateRangeEvent() method

The AddDimensionDateRangeEvent() method adds events to reprocess a date range of a dimension. The date range consists of a start and an end date (including time). This will trigger the service to reprocess the time slices of the date range.

URL: *https://<BI Gateway URL>/modelapi/<Tenant ID>/odata/Event/AddDimensionDateRangeEvent*

For example: *https://eu.bigateway.connect.aveva.com/modelapi/0bc81b25-a433-4a82-b6c4-1746090d41f8/odata/Event/AddDimensionDateRangeEvent*

For more information on how to identify the tenant ID, see Identify the tenant ID.

AddMeasureDateRangeEvent() method

The AddMeasureDateRangeEvent() method adds events for a Measure object having particular given calculation or a set of calculations and a given dimension or a set of dimensions for a specific date time range. The date time range consists of a start date time and an end date time.

For dimension, any dimension field could contribute as a processing criteria to the measure execution.

URL: *https://<BI Gateway URL>/eventapi/odata/Event/AddMeasureDateRangeEvent*

For example: *https://eu.v2.bigateway.connect.aveva.com/eventapi/odata/Event/AddMeasureDateRangeEvent*

Important Note: You are required to add the TenantID as a header. For example, **'x-wwTenantID'**.

For more information on how to identify the tenant ID, see Identify the tenant ID.

Refresh measure objects for a date range

Request

Parameter Type	Parameter Name	Description	Data Type
Input Request	ObjectName	The Data Transfer Object which holds three attributes: ObjectName, Calculation list, Dimensions list, StartDate, and EndDate.	DTO (valid JSON format)

Return value:

A GUID (for example: 00000000-0000-0000-0000-000000000000) is returned corresponding to the event created in the database. If the AddMeasureDateRangeEvent() method fails, an error is logged in the Application Insight and the API returns a value of zero.

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Postman example

The following Postman code snippet shows the example for the query.

Note: Replace the values for ObjectName, Measure, StartDate, and EndDate according to your requirement.

```
{"ObjectName":"Measure_001","StartDate":"2021-01-02 08:00:00Z","EndDate":"2021-01-03
23:59:59Z"}
```

If the query is successful, the relevant GUID is displayed as a response.

For more information about Postman installation and configuration, see Configuring Postman Settings.

Refresh measure objects for specific calculations and dimensions for a date range

Request

Parameter Type	Parameter Name	Description	Data Type
Input Request	jsonstring	The Data Transfer Object which holds three attributes: Object name, StartDate, EndDate.	DTO (valid JSON format)

Important: Make sure that the Start DateTime and End DateTime parameter is in UTC date and time format.

Return value:

A GUID is returned corresponding to the event created in the database. If the AddMeasureDateRangeEvent() method fails, an error is logged in the Application Insight and a value of zero is returned.

Postman examples

The following Postman code snippets show the examples for the query.

Note: Replace the values for ObjectName, Calculation list, Dimensions list, StartDate, and EndDate according to your requirement.

Process a single calculation for a single dimension field

```
{
   "ObjectName": "Measure_001",
   "Calculations": [
      "Count"
   ],
   "Dimensions": [
   {
      "Dimension_001": [
         {
```

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```
            "ShiftName": "Morning"
            }
            ]
        }
    ],
    "StartDate": "2021-03-13 06:30:00.00Z",
    "EndDate": "2021-03-13 07:30:00.00Z"
}
```

If the query is successful, the relevant GUID is displayed as a response.

Process a single calculation for multiple fields of a single dimension

```
{
    "ObjectName": "Measure_001",
    "Calculations": [
        "Count"
    ],
    "Dimensions": [
    {
        "Dimension_001": [
            {
            "ShiftName": "Morning"
            },
            {
            "ShiftName": "Night"
            }
        ]
        }
    ],
    "StartDate": "2021-03-13 06:00:00.00Z",
    "EndDate": "2021-03-14 06:00:00.00Z"
}
```

If the query is successful, the relevant GUID is displayed as a response.

Process a set of calculations for a set of fields of dimensions

```
{
    "ObjectName": "Measure_001",
    "Calculations": [
    "Count",
    "Sum"
    ],
    "Dimensions": [
    {
        "Dimension_001": [
            {
            "ShiftId": "2249"
            }
            ],
        "Dimension_002": [
            {
            "WorkOrderId": "PO_20210313_7701"
            }
            ]
```

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```
      }
   ],
   "StartDate": "2021-03-13 06:30:00.00Z",
   "EndDate": "2021-03-13 07:30:00.00Z"
}
```

If the query is successful, the relevant GUID is displayed as a response.

Process an expression calculation for a set of dimension fields

Mention all the primary calculations used in the expression calculation.

```
{
   "ObjectName": "Measure",
   "Calculations": [
   "TotalEnergy",
   "QuantityProduced",
   "QuantityRejected",
   "AverageSpeed"
   ],
   "Dimensions": [
   {
      "Asset": [
         {
         "AssetName": "Filler01"
         },
         {
         "AssetName": "Filler02"
         }
      ],
      "Shift": [
      {
         "ShiftId": "Night"
         }
      ]
      }
   ],
   "StartDate": "2021-03-09 22:00:00.00Z",
   "EndDate": "2021-03-15 06:00:00.00Z"
}
```

If the query is successful, the relevant GUID is displayed as a response.

For more information about Postman installation and configuration, see Configuring Postman Settings.

Deprecated - AddMeasureDateRangeEvent() method

The AddMeasureDateRangeEvent() method adds events for a Measure object having particular given calculation or a set of calculations and a given dimension or a set of dimensions for a specific date time range. The date time range consists of a start date time and an end date time.

For dimension, any dimension field could contribute as a processing criteria to the measure execution.

URL: *https://<BI Gateway URL>/modelapi/<Tenant ID>/odata/Event/AddMeasureDateRangeEvent*

For example: *https://eu.bigateway.connect.aveva.com/modelapi/0bc81b25-a433-4a82-b6c4-1746090d41f8/odata/Event/AddMeasureDateRangeEvent*

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For more information on how to identify the tenant ID, see Identify the tenant ID.

AddRefreshEvent() method

The AddRefreshEvent() method adds events for a Dimension object or Measure object (without the date range).

Note: When you invoke this method to a measure object, the whole backfill processing gets invoked.

URL: *https://<BI Gateway URL>/eventapi/odata/Event/AddRefreshEvent*

For example: *https://eu.v2.bigateway.connect.aveva.com/eventapi/odata/Event/AddRefreshEvent*

Important Note: You are required to add the TenantID as a header. For example, **'x-wwTenantID'.**

For more information on how to identify the tenant ID, see Identify the tenant ID.

Request

Parameter Type	Parameter Name	Description	Data Type
Input Request	ObjectName	The Dimension or Measure object name. For example : Dimension_001	String

Return value:

A GUID (for example: 00000000-0000-0000-0000-000000000000) is returned corresponding to the event created in the database. If the **AddRefreshEvent**() method fails, an error is logged in the Application Insight and the API returns a value of zero.

Postman example

The following Postman code snippets show the examples for the query.

Note: Replace the value for Dimension or Measure according to your requirement.

```
"Dimension_001"
```

Or

```
"Measure_001"
```

If the query is successful, the relevant GUID is displayed as a response.

For more information about Postman installation and configuration, see Configuring Postman Settings.

Deprecated - AddRefreshEvent() method

The AddRefreshEvent() method adds events for a Dimension object or Measure object (without the date range).

Note: When you invoke this method to a measure object, the whole backfill processing gets invoked.

URL: *https://<BI Gateway URL>/modelapi/<Tenant ID>/odata/Event/AddRefreshEvent*

For example: *https://eu.bigateway.connect.aveva.com/modelapi/0bc81b25-a433-4a82-b6c4-1746090d41f8/odata/Event/AddRefreshEvent*

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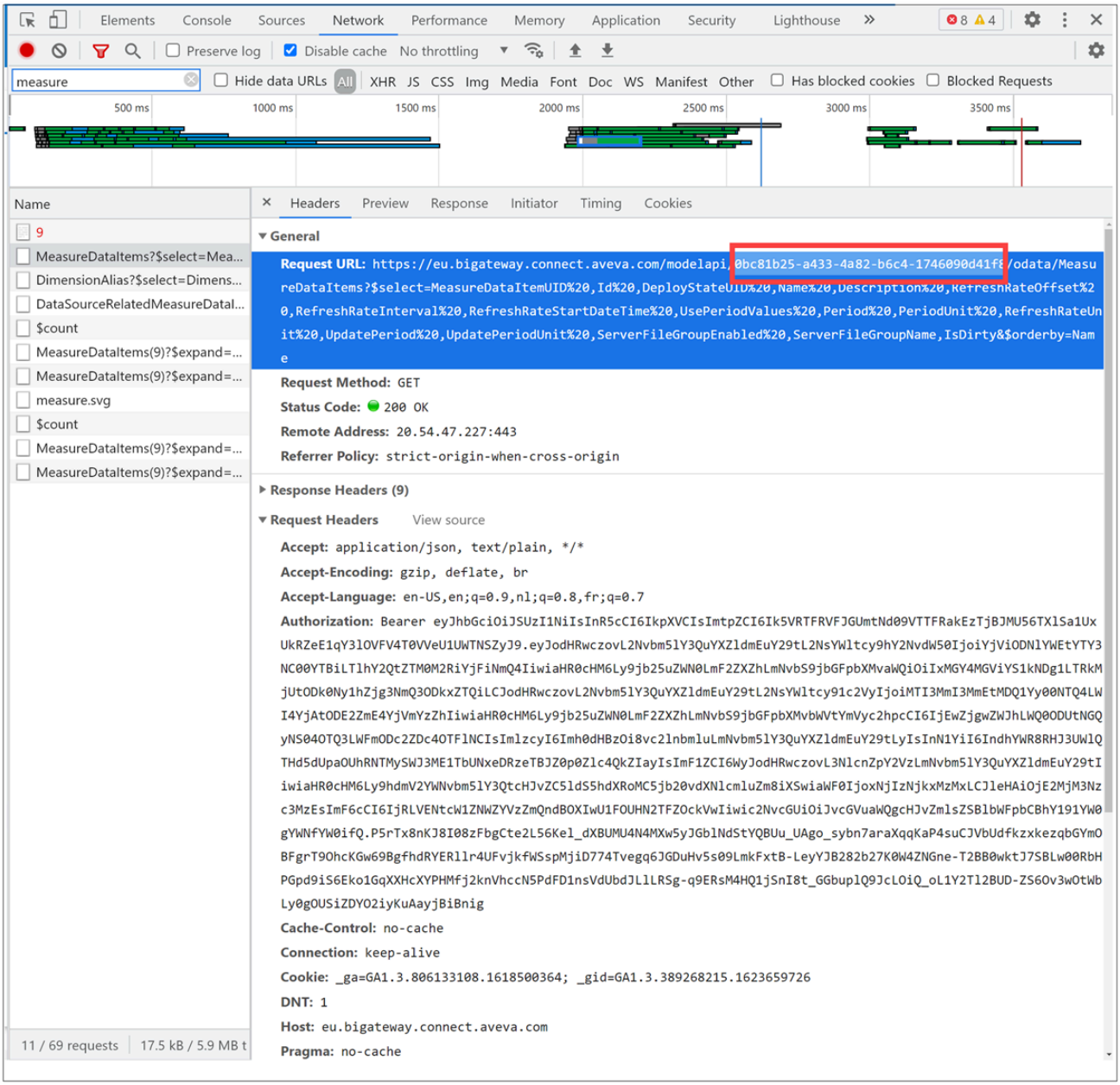
For more information on how to identify the tenant ID, see Identify the tenant ID.

Identify the tenant ID

1. Open AVEVA BI Gateway Model Builder.
2. Open **Developer Tools** by pressing the **Ctrl+Shift+I** or **F12** keys.
3. Click the **Network** tab.
4. In the **Name** column, filter the name based on the "measure" or "dimension" keywords.

   Note: If the right pane appears blank, then refresh the browser page.

   The page appears as follows.



5. Under **General**, note down the value mentioned in the **Request URL** field as shown in the above figure.

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You can use this tenant ID value while consuming BI Gateway APIs or while connecting to databases.

For example, if you replace the value of "BI Gateway URL" and "Tenant ID" in the **https://<BI Gateway URL>/modelapi/<Tenant ID>**, the output appears as **https://eu.bigateway.connect.aveva.com/modelapi/0bc81b25-a433-4a82-b6c4-1746090d41f8**.

Configure Postman settings

Install Postman

You can post queries to and retrieve responses from Postman. Ensure that you download and install Postman. Alternatively, you can also access Postman from the web by signing in with your account. For more information about installing Postman or using Postman on the web, see the Postman documentation.

Configure bearer token authentication

You must configure the bearer token authentication. After authentication, you can post queries to and retrieve the response from Postman.

Configure bearer token authentication:

1. Open AVEVA BI Gateway Model Builder.
2. Open **Developer Tools** by pressing the **Ctrl+Shift+I** or **F12** keys.
3. Click the **Network** tab.
4. In the **Name** column, filter the name based on the "measure" or "dimension" keywords.

   Note: If the right pane appears blank, then refresh the browser page.

   The section appears as follows.

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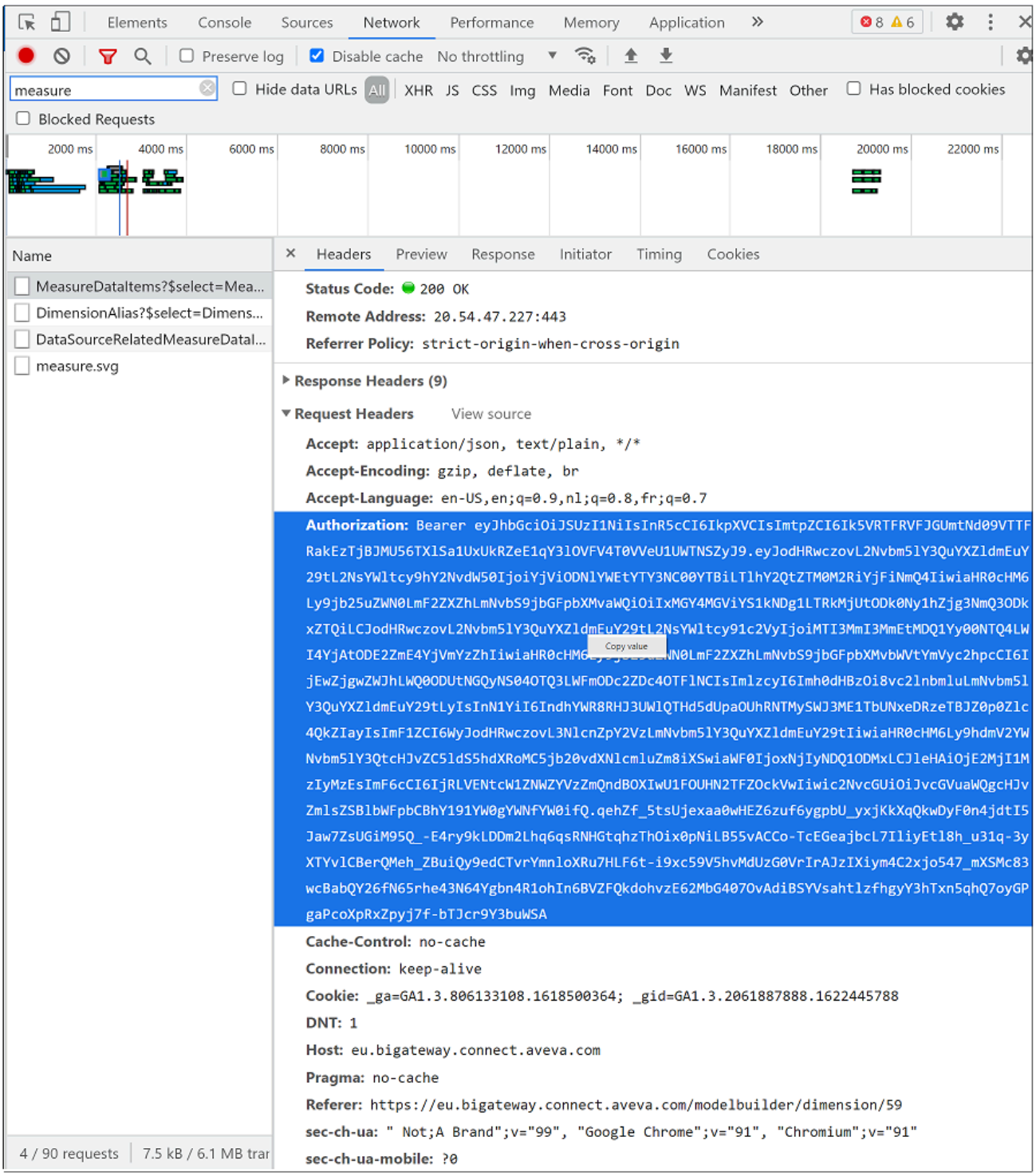

5. Under **Request Headers**, note down the value mentioned in the **Authorization Bearer** field. You have to enter this value in Postman.
6. Open Postman.
7. Create a new request or open an existing request.
8. Click the **Authorization** tab.

   A screen appears.

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9. In the **Type** drop-down list on the left pane, select **Bearer Token**.
10. In the **Token** box, type the bearer authorization token.
11. Click **Send**.

    The bearer token details are saved successfully.

Post queries

You can post queries and receive responses.

Post queries:

1. Open Postman.

   The Postman screen appears.
2. Click **New** and then create a new request.
3. Add a name for the request.
4. In the drop-down list, select the required method. For example, POST or GET
5. In the adjacent box, type the link with the AVEVA BI Gateway URL and the Tenant ID details as follows:

   http://<BIGateway URL>/modelapi/<Tenant ID>/odata/Event/<Event>

   For example, https://bigateway.connect.aveva.com/modelapi/<Tenant ID>/odata/Event/AddDimensionDateRangeEvent
6. Click **Body**.
7. Click **raw**.
8. From the drop-down list, click **JSON**.
9. In the **Body** field, type the required query.

   For example, {"object name":"Dimension_001","StartDate":"2021-01-02 08:00:00Z","EndDate":"2021-01-03 23:59:59Z"}
10. Click **Send**.

    A relevant GUID is displayed as a response.

Event API exceptions

The following is a list of exceptions that you might encounter while working with the AVEVA BI Gateway Event API. The table also gives you an insight into the possible cause of the exception and the solutions to resolve these exceptions:

Error: Invalid or un-deployed {object name}.

Cause:

The measure or dimension is not deployed or does not exist in the model.

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Solution:

Specify the correctly deployed measure or dimension.

Error: Unable to add the event. {object name} does not exist.

Cause:

The name of the object that you provided in the API call does not exist in the model or is not deployed.

Solution:

Make sure that you are using an object name (Measure or Dimension) that exists in the model and is deployed.

Error: Event not added to the database.

Cause:

The input parameters of the date range (start and end date) are invalid. The date range is either in the future or the end date is less than the start date.

Solution:

Make sure that you use an event with a valid start and end date.

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Asset model

You can leverage the asset model capability of AVEVA Insight™ having the following objectives, such as:

- AVEVA BI Gateway operates as an abstraction layer by processing the dimensional model regardless of the distinct assets and FQN/Tagnames to consider.
- AVEVA BI Gateway needs to resolve
  - “what to do” (for example: populates a dimension, compute a measure calculation, execute backfill processing,and run a scheduled refreshed) from the dimensional model and its internal mechanism (custom queries, and scheduler).
  - “How to do” (for example: which FQN to consider for populating batch dimension, which retrieval mode to consider, does it require dataset manipulation, and which asset and asset’s behavior to consider) from the asset model capability of AVEVA Insight.

Asset model structure

The asset model concept can be configured through different AVEVA Insight layers such as:

- Managed Historian – Tagname Dictionary (built-in and extended properties)
- MES - Equipment Efficiency Model
- CIM – Common Intelligent Model

It can be combined in such a way as:

1. Basic asset model
   - Managed Historian only
2. Intermediate asset model
   - Managed Historian
   - MES Efficiency
3. Advanced asset model (Future Release)
   - Common Intelligent Model

REST APIs

AVEVA Insight contents are mainly exposed through three REST APIs which allow interacting with the solution such as:

- Historian Data REST API (Managed Historian API)
- Equipment Efficiency REST API (MES API)
- Common Intelligent Model REST API (CIM API)

For more information about available API endpoints, see the Custom Query section.

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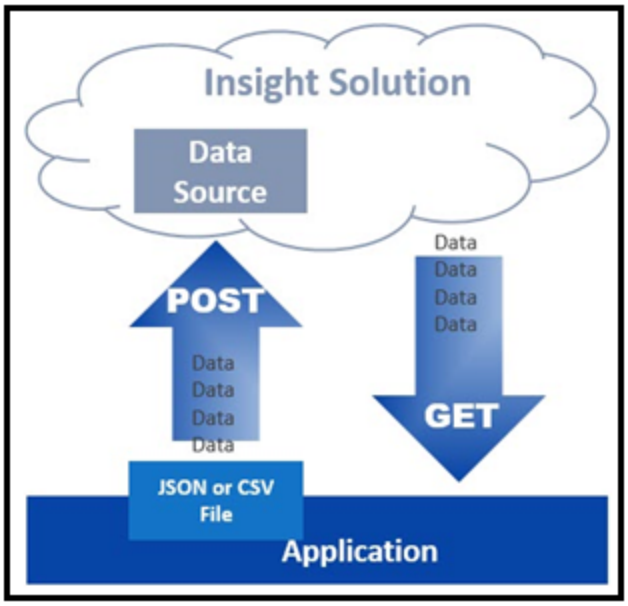

Each of the above APIs allows upload or retrieval requests using a web browser or a client-side applications such as:

- Microsoft Excel (2013, 2016, or Office 365)
- Business Intelligence (BI) systems
  - Tableau
  - Microsoft Power BI
- Postman

Basic asset model

The basic asset model only leverages Tagname Dictionary of Managed Historian (Historian API) and its capability of configuring extended properties for grouping Tagname per a field value expected by BI Gateway model objects.

Scenario

Scope of this scenario is to define 2 dimensions and 1 measure calculation such as:

- The asset dimension reflects all **assets** and **plants** available as part of the Tagname Dictionary.
- **Batch** dimension as a type of Time Defining Dimension reflects all batches that have been operated against existing assets. This dimension retrieves tagname historical data and returns all batches (batch ID, Start Time,and End Time) per the key fields **Asset** and **Plant**.
- Power measure's calculation computes the energy spent by the context of Asset, Plant, and Batch.

The **Asset** dimension is populated by retrieving all distinct value of the custom extended properties named "BIGateway_Asset" and "BIGateway_Plant" across the whole Tagname Dictionary.

The **Batch** dimension retrieves all tagnames matching the criteria BIGateway_Dimension eq 'Batch' and

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subsequently returns all historical events associated to.

The **Power** calculation retrieves all tagnames matching the criteria BIGateway_MeasureCalculation eq 'Power' and subsequently returns aggregated historical data associated to per requested time slice.

Note: AVEVA BI Gateway datasource object uses Custom Query expression, which facilitates the configuration of the query statement (See the Query Expression section) for retrieving and manipulating result set accordingly to the expected output schema.

Configure Tagname Extended Property

Following is an example of a JSON file, which is used to create Tagname Extended Properties leveraging the basic asset model concept.

Sample:

```
{
"metadata": [
{
"TagName": "Asset0001.Batch",
"BIGateway_Asset": {"DataType":"String", "Value":"Asset0001"},
"BIGateway_Dimension": {"DataType":"String", "Value":"Batch"},
"BIGateway_MeasureCalculation": {"DataType":"String", "Value":""}
},
{
"TagName": "Asset0001.Power",
"BIGateway_Asset": {"DataType":"String", "Value":"Asset0001"},
"BIGateway_Dimension": {"DataType":"String", "Value":""},
"BIGateway_MeasureCalculation": {"DataType":"String", "Value":"Power"}
}
]
}
```

For more information about defining extended tag properties, see the **Define extended tag properties** section in the AVEVA Insight Online Help.

Intermediate asset model

The intermediate asset model leverages both Tagname Dictionary (Historian API) and MES Efficiency (MES API) parts and their capabilities of configuring and hosting asset model information.

For more information, see the **Manage the efficiency model** section in the AVEVA Insight Online Help.

Scenario

Scope of this scenario is to define 3 dimensions and 1 measure calculation such as:

- The **asset** dimension reflects all **Assets** and **Plants** available as part of the Equipment Efficiency Model.
- **Batch** dimension as a type of Time Defining Dimension reflects all batches that have been operated against existing assets. This dimension returns all batches (batch ID, Start Time, and End Time) per the key fields **Asset** and **Plant**.
- **UtilizationEvent** dimension as a type of Time Defining Dimension reflects all utilization event and their reason that assets have been exposed to. This dimension returns all utilization events (Event ID, Start

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Time,and End Time) per the key fields **Asset** and **Plant**.

- **Power** measure's calculation computes the energy spent by the context of **Asset**, **Plant**, **Batch**, and **UtilizationEvent**.

The **Asset** dimension is populated by retrieving all equipment and location (hierarchy) from the Equipment Efficiency Model (MES API).

The **Batch** dimension retrieves all tagnames matching the criteria BIGateway_Dimension eq 'Batch' and subsequently returns all historical events associated to.

The **UtilizationEvent** dimension retrieves all utilization event (MES API)

The **Power** calculation retrieves all tagnames matching the criteria BIGateway_MeasureCalculation eq 'Power' and subsequently returns aggregated historical data associated to per requested time slice.

Configure Tagname Extended Property

Here is an example of JSON file for creating Tagname Extended Properties leveraging Intermediate asset model concept.

Sample:

```
{
"metadata": [
{
"TagName": "Asset0001.Batch",
"BIGateway_Asset": {"DataType":"String", "Value":"Asset0001"},
"BIGateway_Dimension": {"DataType":"String", "Value":"Batch"},
"BIGateway_MeasureCalculation": {"DataType":"String", "Value":""}
},
{
"TagName": "Asset0001.Power",
"BIGateway_Asset": {"DataType":"String", "Value":"Asset0001"},
"BIGateway_Dimension": {"DataType":"String", "Value":""},
"BIGateway_MeasureCalculation": {"DataType":"String", "Value":"Power"}
}
]
}
```

For more information about defining extended tag properties, see the **Define extended tag properties** section in the AVEVA Insight Online Help.

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Third party integration

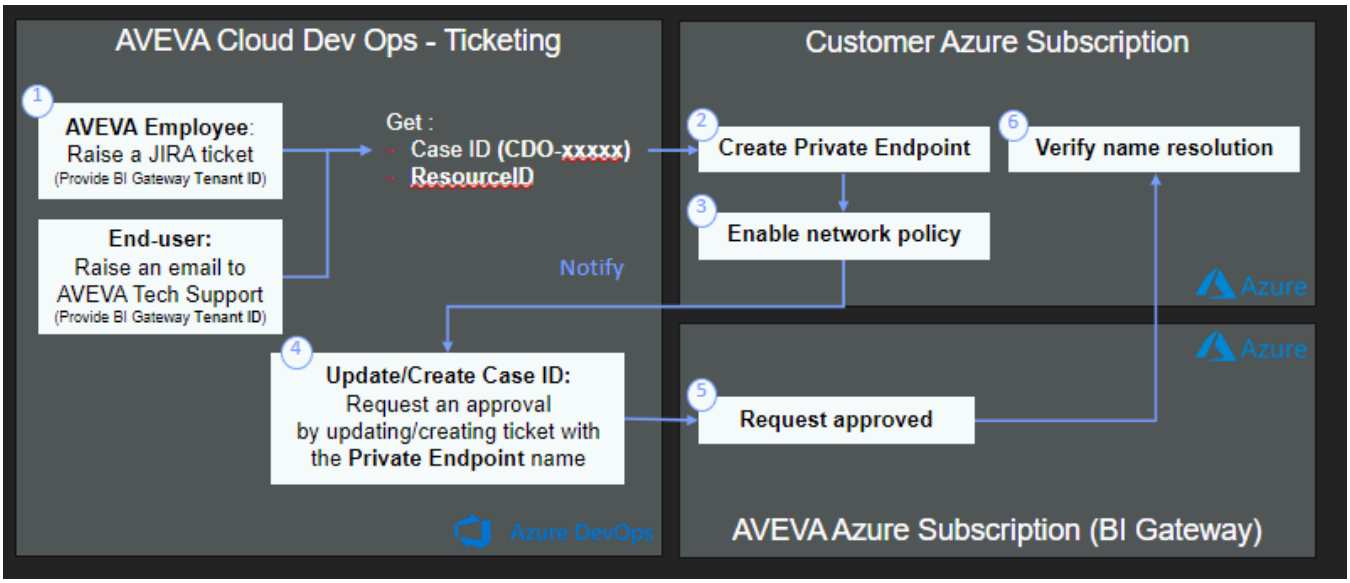
This section focuses on the integration of third party products with AVEVA BI Gateway.

Private endpoint configuration

Private endpoint configuration

This sub-section focuses on the configuration of private endpoint from the Microsoft Azure Portal, and its integration within AVEVA BI Gateway.

Private endpoint configuration workflow



Prerequisites
Step 1: Raise a ticket with AVEVA Cloud DevOps team to get the resource ID
Step 2: Create a private endpoint
Step 3: Enable network policy
Steps 4 and 5: Notify the AVEVA Cloud DevOps team
Step 6: Verify name resolution of the private endpoint

Prerequisites

- An Azure subscription
- Access to the required Azure subscription resources

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Step 1: Raise a ticket with AVEVA Cloud DevOps team to get the resource ID

To get the resource ID or alias, raise a ticket request with AVEVA Cloud DevOps team.

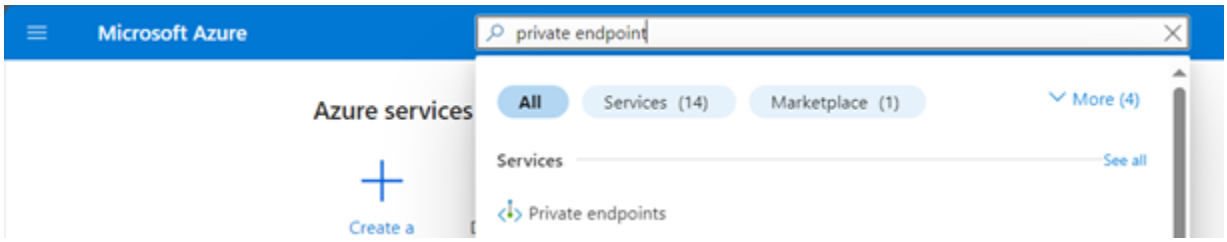
- If you are an AVEVA employee, raise a ticket through the JIRA ticketing system.
- If you are an external user, raise a request through AVEVA Tech support. Provide the tenant ID or datastore information from your AVEVA BI Gateway model.

  To view the tenant ID and datastore, refer to the tutorial video AVEVA BI Gateway UI Tour, or the topic View datastore connection information.

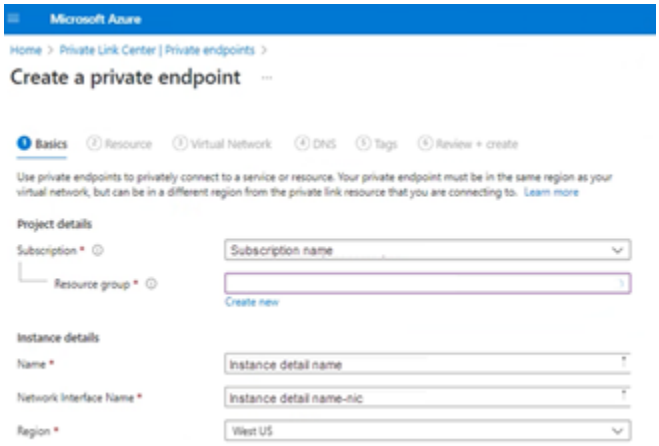
Step 2: Create a private endpoint

Create a private endpoint

1. Log in to the Microsoft Azure portal with your credentials.
2. In the search bar, enter **'private endpoints'.** The option appears in the dropdown list.



   The **Private endpoints** page appears.
3. Select **Create**. The **Create a private endpoint** page appears, with the first section called **Basics**.
4. Under **Project details**, enter the name of the required resource group.



5. Under **Instance details**, create and enter the name of the private endpoint. The **Network Interface Name** takes the name previously entered.
6. Select the correct region.

   Note: Select the same region as the AVEVA BI Gateway tenant exists to avoid network latency. The region should be the same region as the Azure SQL databases. Please note that the region refers to capacity region,

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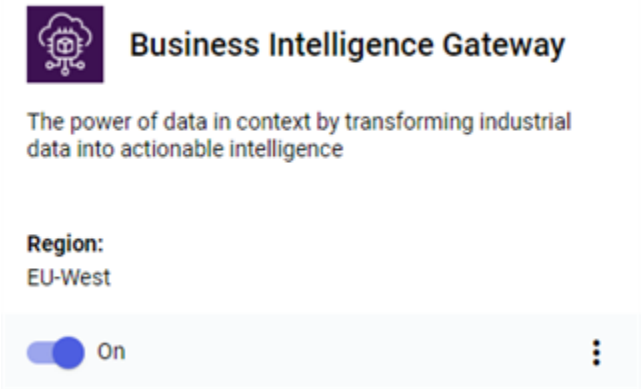
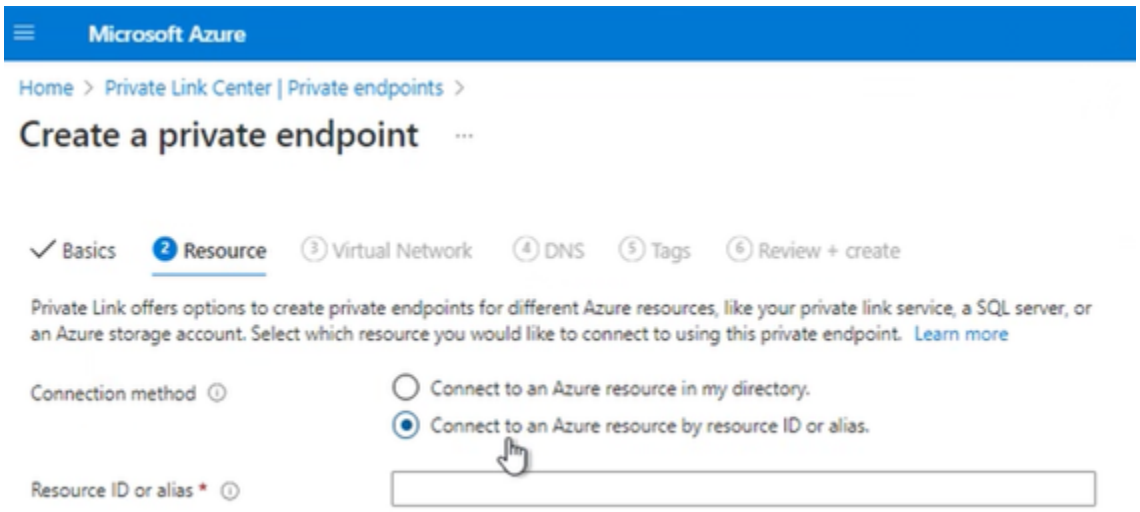
and **not** the Connect/Folder region. For example:



7. Click the **Next : Resource** button to advance to the next section.
8. Under the **Resource** section, select the option **'connect to an Azure resource by resource ID of alias'** as the preferred connection method.



9. Manually type in **'Azure SQL Databases**' as the target sub-resource.
10. Even though it is not mandatory, it is recommended to add a request message.
11. Under the **DNS** section, select **Yes** to integrate with private DNS zone.
12. Leave the default private **DNS zone of privatelink.database.windows.net**.

Step 3: Enable network policy

To enable the network policy for private endpoints under the **Virtual Network** section, select **edit**. The **Edit subnet network policy** page appears.

1. Under the dropdown list, click to select both the checkboxes **Network security groups** and **Route table**. Save the changes.

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2. The network policy is enabled.
3. Under the **Review + create** section, click **Next.**
4. The private endpoint is created.

Note: It is best practice to delete the whitelist client IP addresses within the BI Gateway model, as they are not required since you have enabled the private endpoint. To learn how to delete IP addresses, go to Whitelist client IP addresses.

Steps 4 and 5: Notify the AVEVA Cloud DevOps team

To notify the AVEVA Cloud DevOps (CDO) team to approve the private endpoint;

1. Return to the ticket case ID. Reopen the ticket if it is closed.
   - You can also create a new ticket.
2. Update the case ID by adding a comment that mentions the **private endpoint name.**

   The comment is forwarded to a CDO member to approve the private endpoint.

Step 5 is receiving the approval from the CDO team. Once approved, you can verify name resolution of the private endpoint.

Step 6: Verify name resolution of the private endpoint

To verify name resolution of the private endpoint;

1. In the search box at the top of the portal, enter **Virtual machine**. Select **Virtual machines** from the search results.
2. Select the available or required virtual machine.
3. Log in with your username and password.
4. Enter the command **'nslookup sql-server-1.database.windows.net.'** in the command prompt window.

The results are as follows:

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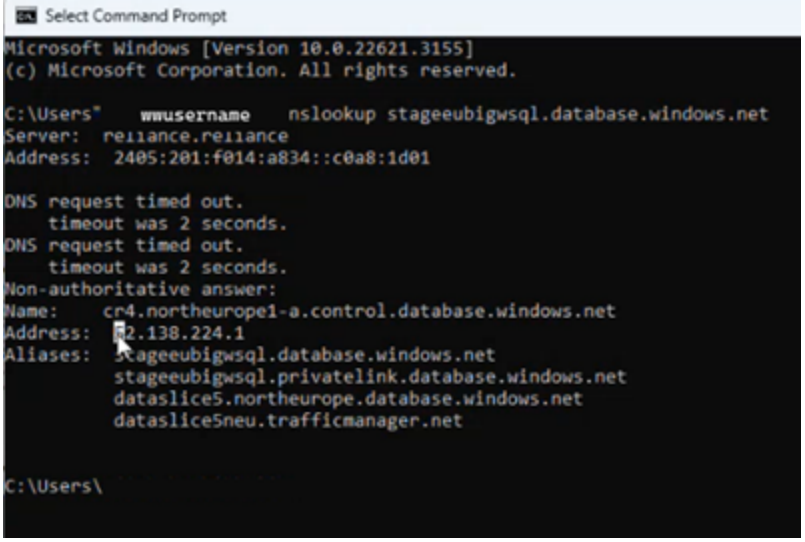

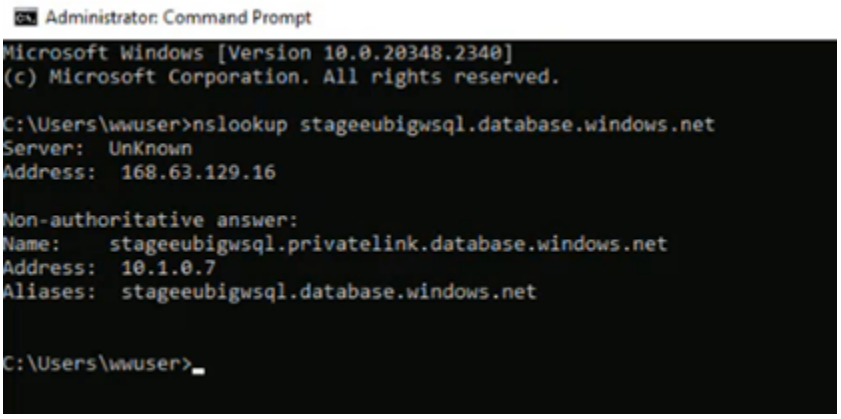

Important: To get approval for private endpoint, raise a ticket request with AVEVA Cloud DevOps.

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Best practices

Base Practices
Context Link

Base pactices

This section lists the best practices and recommendations for creating and maintaining BI Gateway Models.

Data sources

Following are the recommendations for Custom Queries:

- In the queries used for time series data, include **[RequestedStartTime]** and **[RequestedEndTime]** parameters. For more information, see Configure an incremental update for a dimension.
- Use Stored Procedures if you want to implement custom/complex logic for Azure SQL Adapters. For more information, see Use custom queries.

Dimensions

Following are the recommendations for dimensions:

- Enable incremental update for all the time series data.
- For linked dimensions, configure adequate Dimension Refresh Offset. This ensure that the linked dimensions are refreshed at a faster rate than the dimensions using those references. For more information, see Configure a dimension link.

Measures

Following is the recommendation for measures:

- Enable Context Link for measures to reduce the number of time slices for each refresh. Do the following:
  1. Enable Context Link for non-TDD Dimension. For more information, see Add a dimension link.
  2. Ensure that this non TDD Dimension is linked to a TDD Dimension.

     The non-TDD Dimension and TDD Dimension will be available in the Measure Context.
  3. Enable the context link for the non-TDD Dimension. For more information, see Select a context link dimension.

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Context link

About context link

A context link provides a context for time-slicing. Time-slices obtained from time defining dimensions can have an associated context.

You can use context link to optimize the outcome data, resulting from the data processing.

Context link enables you to:

- Retain only relevant time-slices
- Maintain the datastore to an optimized size
- Retrieve context-specific data from data sources

This approach requires you to identify or define a context dimension (usually **Asset** dimension), which acts as a “pillar” for computing the measure calculation in context.

The Measure execution considers all context related to the dimension used as context link and ensures that the execution is performed in an optimized and accurate way.

Note: We recommend that you enable context link.

Configuration workflow

The following diagram represents the workflow for configuring context link.

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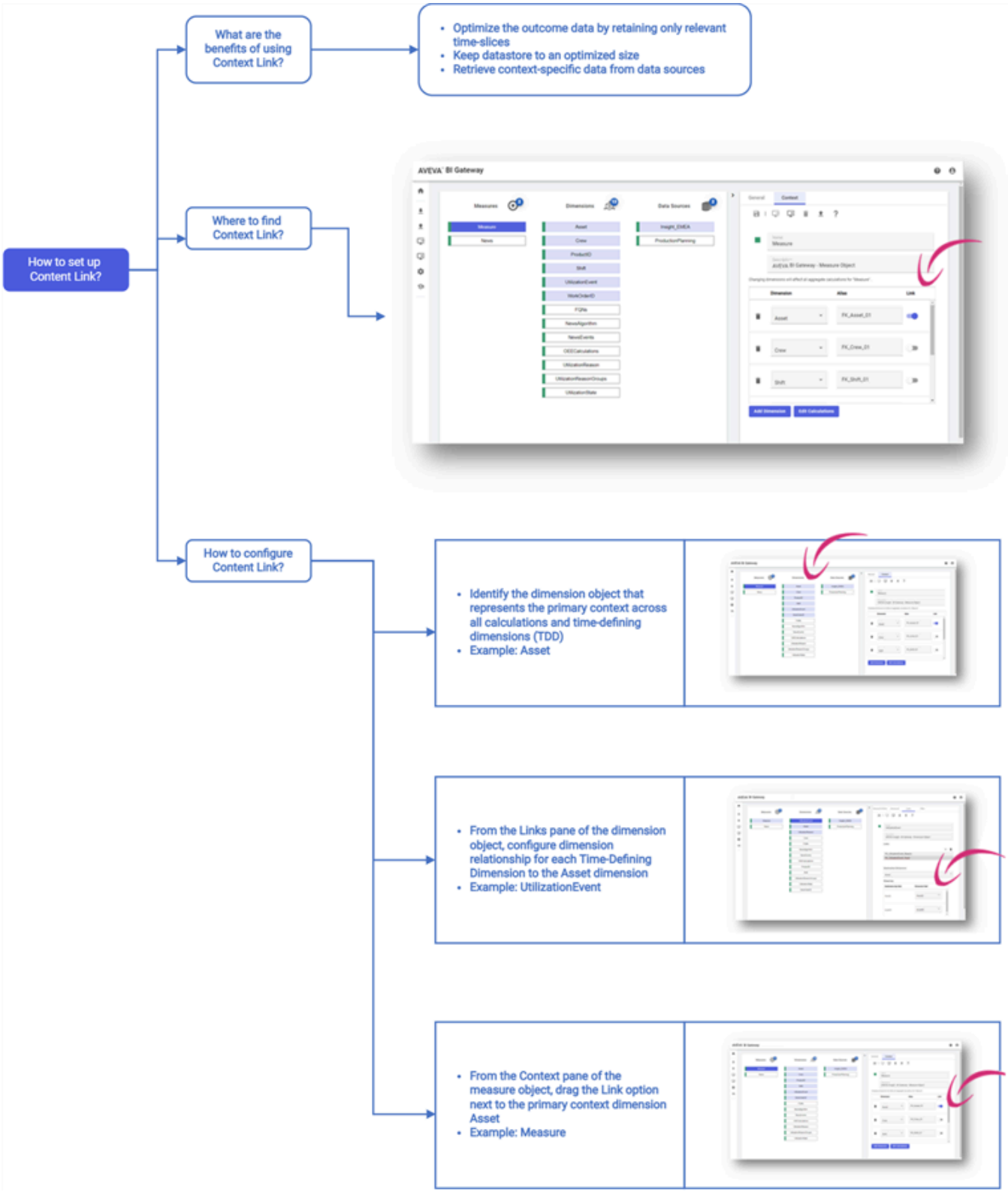

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Troubleshooting

Log flags
Diagnostic views
Troubleshooting errors

Log flags

AVEVA BI Gateway logs messages under different categories identified as custom log flags.

You can search for logs based on log flags.

Note: The user who has access to the Model Builder can also access the Azure SQL Database. However, access to the Application Insight Logger is available only to DevOps.

Available Log Flags	Description
Data Source Manager Entry	Displays the executed method against the data source
DimensionDataChangedDetector	Displays the data changes detected during the dimension refresh
DimensionExecutionTrace	Displays the traceability of the dimension execution
Intelligence.QueryTrace	Displays the executed SQL statements
Intelligence.TimeSliceTrace	Displays the measure execution plans, time slices
Intelligence.MeasureExecution	Trace of all measure executions.
MeasureBackfill	Displays the measure backfill process flow
MeasureBackfillProgress	Displays the time slices executed during measure backfill
MeasureBackfillHealthMonitor	Displays the health monitoring backfills information
OnDemandRequestManager	Displays the messages related to the queue data item, which is triggered by the TDD (time defining dimension).
Performance	Displays the execution time in various areas. For example, Time to retrieve the data from data source.

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Available Log Flags	Description
Scheduler	Displays the next scheduled execution time for all deployed objects
TDDMeasureUpdate	Measure execution triggered by TDD update.
TransformManager	Displays the traceability of the object execution including both dimension and measure.

View logs

You can view logs using the Azure SQL Database.

The available log types are:

- Trace
- Info
- Warning
- Error
- Custom events

View logs using Azure SQL Database

- In the Azure SQL Database, query the **Diagnostics.EventLogger** table.

Configure event log settings

You can configure the event log settings such as Auto Purge and Log Types.

- The **Auto Purge** settings consist of the purge interval and the retention period for event logs. The purge interval is the interval at which AVEVA BI Gateway checks the **Diagnostics.EventLogger** table to identify any data that needs to be purged. Any data that is older than the retention period gets purged.
- The **Log Types** setting allows you to configure the type of log messages that must be displayed in the Logs.

Configure event log settings

1. From the AVEVA BI Gateway Model Builder Home Page, click **Settings** from the main menu.

   The **Settings** dialog box appears.

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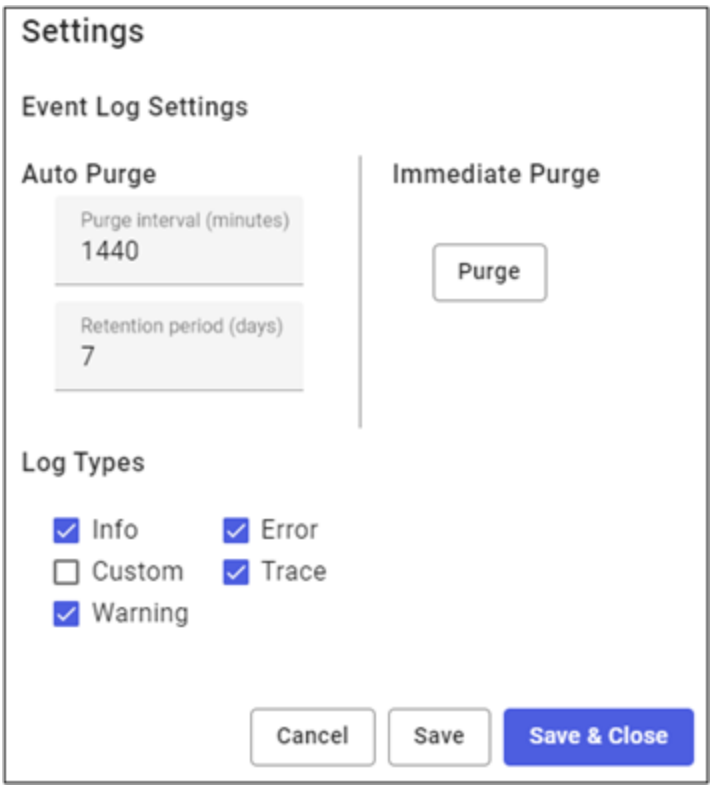

2. Under **Auto Purge**, perform the following.
   a. In the **Purge Interval (minutes)** box, type the interval at which the **Diagnostics.EventLogger** table must identify any data that needs to be purged. The default value is 1440 minutes.
   b. In the **Retention period (days)** box, type the number of days for which you want to retain the Event Logs. The default value is 7 days.
3. Under **Log Types,** select the required check boxes:
   - **Info:** (Default) Logs all the information messages.
   - **Error:** (Default) Logs all the error messages.
   - **Warning:** (Default) Logs all the warnings.
   - **Trace:** Logs all the traces.
   - **Custom:** Logs all the custom messages. For more information about custom log message types, see Log flags.

     Note: Trace and Custom log types are database intensive and may impact overall system performance. Therefore, we recommend that you use these log types judiciously.
4. Click **Save & Close**.

   A message appears indicating that the event log settings are successfully configured.

Purge event log data

You can purge the **Diagnostics.EventLogger** table data. However, the data cannot be restored after it is purged. Therefore, ensure that you save a copy of the data so that you can access it later.

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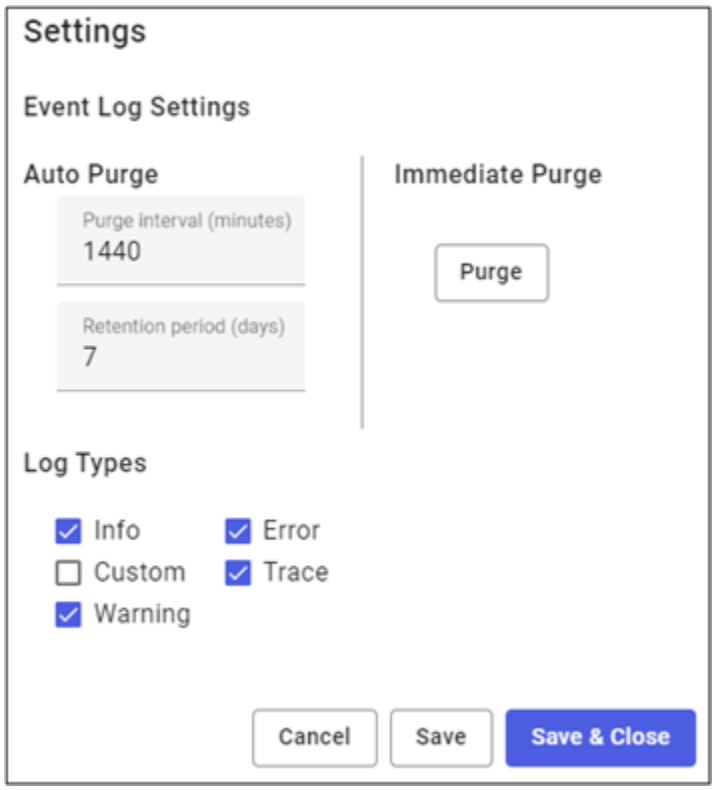
Purge event log data

1. From the AVEVA BI Gateway Model Builder Home Page, click **Settings** from the main menu.

   The **Settings** dialog box appears.



2. Click **Purge**.

   The **Purge Event Log** dialog box appears indicating that the **Diagnostics.EventLogger** table data will be purged, and this action cannot be restored.

   Note: Log Types are not applicable to immediate purge. All the data is considered for the immediate purge.

3. Click **Purge**.

   A message appears indicating that the event log data is successfully purged.

Diagnostic views

Diagnostic Views allows you to improve monitoring and supportability of the event execution. You can execute views using the SQL Server query editor.

The following list of views are available in the AVEVA BI Gateway Datastore.

- viewExecution
- viewExecutionHistory
- viewMeasureBackfillStatus
- viewTddQueue
- viewTddQueueHistory

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viewExecution

This view returns a record-set of any data items (Dimensions or Measures) that are currently being executed (or processed) by the Runtime. Any data items that have already finished being executed by the Runtime are not returned. A large record-set, therefore, means that the Runtime is currently processing many data items.

Column	**Description**
ExecutionId	The autogenerated Execution-ID
DataItem	The name of the Data Item (Dimension or Measure)
DataItem Guid	The Guid of the Data Item (Dimension or Measure)
Execution Source	The Source of execution (SCHEDULER, EVENT, TDD)
Runtime Thread Id	The runtime service internal Thread Id
Start-time (UTC)	The start date and time for execution
End-time (UTC)	The end date and time for execution
Total Number of Execution Plans	The calculated total number of execution plans for the time range of start and end-time.
Current Plan Start-time (UTC)	The last execution plan's start time
Current Plan End-time (UTC)	The last execution plan's end time
Execution Status	The current execution status
Execution TimeStamp	The date and time when the execution request was added
Last Modified Time	The last time that the row was modified by the runtime service.

Example:

Select * from [dbo].[viewExecution]

viewExecutionHistory

This view returns a record-set of any data items (Dimensions or Measures) that have finished execution (or processing) by the Runtime. It also includes those data items that have started processing.

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Note: The data population for **viewExecutionHistory** is disabled by default. To enable the data population, send an email to Customer First Support (custfirstsupport@aveva.com).

Column	Description
ExecutionId	The autogenerated Execution-ID
DataItem	The name of the Data Item (Dimension or Measure)
DataItem Guid	The Guid of the Data Item (Dimension or Measure)
Source	The Source of execution (SCHEDULER, EVENT, TDD)
Last Modified	The last time that the row was modified by the runtime service.
Thread Id	The runtime service internal Thread Id
Start-time (UTC)	The start date and time for execution
End-time (UTC)	The end date and time for execution
Total Number of Execution Plans	The calculated total number of execution plans for the time range of start and end-time.
Current Plan Start-time (UTC)	The last execution plan's start time
Current Plan End-time (UTC)	The last execution plan's end time
Execution Status	The current execution status
Execution TimeStamp	The date and time when the execution request was added
History TimeStamp	The last time that the row was modified by the runtime service.

Example:

Select * from [dbo].[viewExecutionHistory]

viewMeasureBackfillStatus

This view returns a record-set of any deployed measures. It includes the start and end of the entire backfill time-range, which consists of a list of execution "plans". It also includes the start and end of the individual plan that has last completed. Once the Backfill Status is set to 'Completed', the Measure has finished its backfill

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successfully.

Column	Description
Measure	The name of the DataItem Measure
DataItem Guid	The Guid of the Data Item (Measure)
Backfill Start-time (UTC)	The start date and time of the total backfill
Backfill End-time (UTC)	The end date and time of the total backfill
Total Number of Execution Plans	The calculated total number of execution plans for the time range of start and end-time.
Current Plan Start-time (UTC)	The last execution plan's start time
Current Plan End-time (UTC)	The last execution plan's end time
Backfill Status	The current status of the Backfill (Pending, Completed, Suspended). If an error occurred during the backfill, then the status is suspended.
Backfill TimeStamp	The last time that the row was modified by the runtime service.

Example:

Select * from [dbo].[viewMeasureBackfillStatus]

viewTddQueue

When a Time-Defining Dimension has been updated, the dimension subsequently requests any of its associated measures to be updated for the same time-range. This view returns a record-set of any pending requests. Once the Runtime receives the request and starts updating its time-slices, the status changes to "Processing". After the measure has completed its update, the request is removed and is no longer included in this data-set.

Column	Description
TDD Queue-Id	The auto-generated Queue ID
(Target) Measure	The name of the DataItem Measure which is targeted to be updated
(Target) Measure DataItem Guid	The Guid of the DataItem Measure which is targeted to be updated

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Column	Description
(Source) Dimension	The name of the DataItem Dimension which is the TDD source that requested the Measure update.
(Source) Dimension DataItem Guid	The Guid of the DataItem Dimension which is the TDD source that requested the Measure update.
TDD Start-time (UTC)	The earliest calculated start date and time of the update to the target
TDD End-time (UTC)	The earliest calculated end date and time of the update to the target
Processing Status	The current status (Pending, Processing)
TDD Queue TimeStamp	The date and time when the TDD measure update was requested

Example:

Select * from [dbo].[viewTddQueue]

viewTddQueueHistory

This view returns a record-set of any requests that have finished processing. It also includes those requests that have started processing.

Note: The data population for **viewTddQueueHistory** is disabled by default. To enable the data population, send an email to Customer First Support (custfirstsupport@aveva.com).

Column	Description
ID	The autogenerated History-ID
TDD Queue-Id	The auto-generated Queue ID
(Target) Measure	The Guid of the Data Item (Measure)
(Target) Measure DataItem Guid	The name of the DataItem Measure which is targeted to be updated
(Source) Dimension	The Guid of the DataItem Measure which is targeted to be updated
(Source) Dimension	The name of the DataItem Dimension which is the TDD source that requested the Measure update.

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Column	Description
DataItem Guid	The Guid of the DataItem Dimension which is the TDD source that requested the Measure update.
TDD Start-time (UTC)	The earliest calculated start date and time of the update to the target
TDD End-time (UTC)	The earliest calculated end date and time of the update to the target
Processing Status	The current status (Pending)
TDD Queue TimeStamp	The date and time when the TDD measure update was requested
History TimeStamp	The date and time when the row was added to the History table

Example:

Select * from [dbo].[viewTddQueueHistory]

Troubleshooting errors

If you encounter any of the given error messages when you configure the AVEVA BI Gateway model, follow the solution described in the table below:

Error type	Possible cause	Solution
Unable to rename a data source, dimension, or measure.	The new name does not comply with the naming convention for the data source, dimension, or measure.	Provide a name that complies with the naming convention for the respective objects.
	The respective editors are open.	Close the respective editors.
	The data source, dimension, or measure is in a deployed state.	Undeploy the data source, dimension, or measure.
Unable to delete a data source, dimension, or measure.	The respective editors are open.	Close the respective editors.
	The data source, dimension, or measure is in a deployed state.	Undeploy the data source, dimension, or measure.

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Error type	Possible cause	Solution
Data collection from a data source has stopped.	Data source is undeployed.	Deploy the data source.
	The data source server is unavailable due to connection failure, or the data source server is not running.	Be sure that the data source connection information is correct, and the data source server is running.
The dimension or measure is renamed in the AVEVA BI Gateway model, but not in the datastore.	The dimension or measure is not redeployed.	Redeploy the dimension or measure. The dimension or measure name is renamed in the datastore only after redeploying.
The state of a dimension is changed to "Warning" or "Pending Changes."	The schema of an associated data source is refreshed and changed.	Redeploy the dimension.
	An associated data source is deleted.	Redeploy the dimension.
	The dimension configuration is modified.	Redeploy the dimension.
The state of a measure is changed to "Warning" or "Pending Changes."	The schema of an associated data source is refreshed and changed.	Redeploy the measure.
	An associated data source is deleted.	Redeploy the measure.
	An associated dimension is renamed or deleted, or the dimension configuration is modified.	Redeploy the measure.
	The measure configuration is modified.	Redeploy the measure.
Unable to test the connection or retrieve schema from a data source.	The data source server is unavailable due to incorrect connection information, or the data source server is not running.	Be sure that the data source connection information is correct, and the data source server is running.

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Error type	Possible cause	Solution
Not received an invitation email from BI Gateway Azure AD.	The corporate domain is not whitelisted.	1. Contact AVEVA Knowledge & Support Center to whitelist your corporate domain. 2. Unassign the BI Gateway roles from the required user groups. 3. Reassign the BI Gateway roles to the required user groups.
Unable to connect to BI Gateway SQL Azure database from Analytics Clients (Power BI, Tableau, and SSMS).	Customer domain (For example, @<mycorporatedomain>.com) is not whitelisted in the BI Gateway Azure Active Directory.	Contact AVEVA Knowledge & Support Center to whitelist your corporate domain.
	Multifactor authentication is not set up for the user in the AVEVA Intelligence Domain.	To connect to BI Gateway SQL Azure database with Power BI: 1. If you are not an existing user in the Active Directory (AD), contact AVEVA Support for an invitation email. Accept the invite from the AVEVA Intelligence Azure AD to the AVEVA Intelligence domain. This is the domain where the BI Gateway database is hosted. 2. Whitelist the IP Address of the Client Server in BI Gateway Configuration. For more information about whitelisting, see Whitelist client IP addresses. 3. Set up multifactor authentication for the AVEVA Intelligence Domain within 14 days of being added to the Azure AD. For more information about setting up multifactor authentication, see Enable Multifactor Authentication. **Note:** If multifactor authentication has expired, contact AVEVA

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Error type	Possible cause	Solution
		Knowledge & Support Center. 1. Ensure that your email domain is whitelisted by AVEVA. Contact AVEVA Support to whitelist your email domain.

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