
Building Apps & Solutions with AVEVA's Industrial Cloud Platform

Ecosystem Track – Geek Talk for Developers

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AVEVA

Agenda

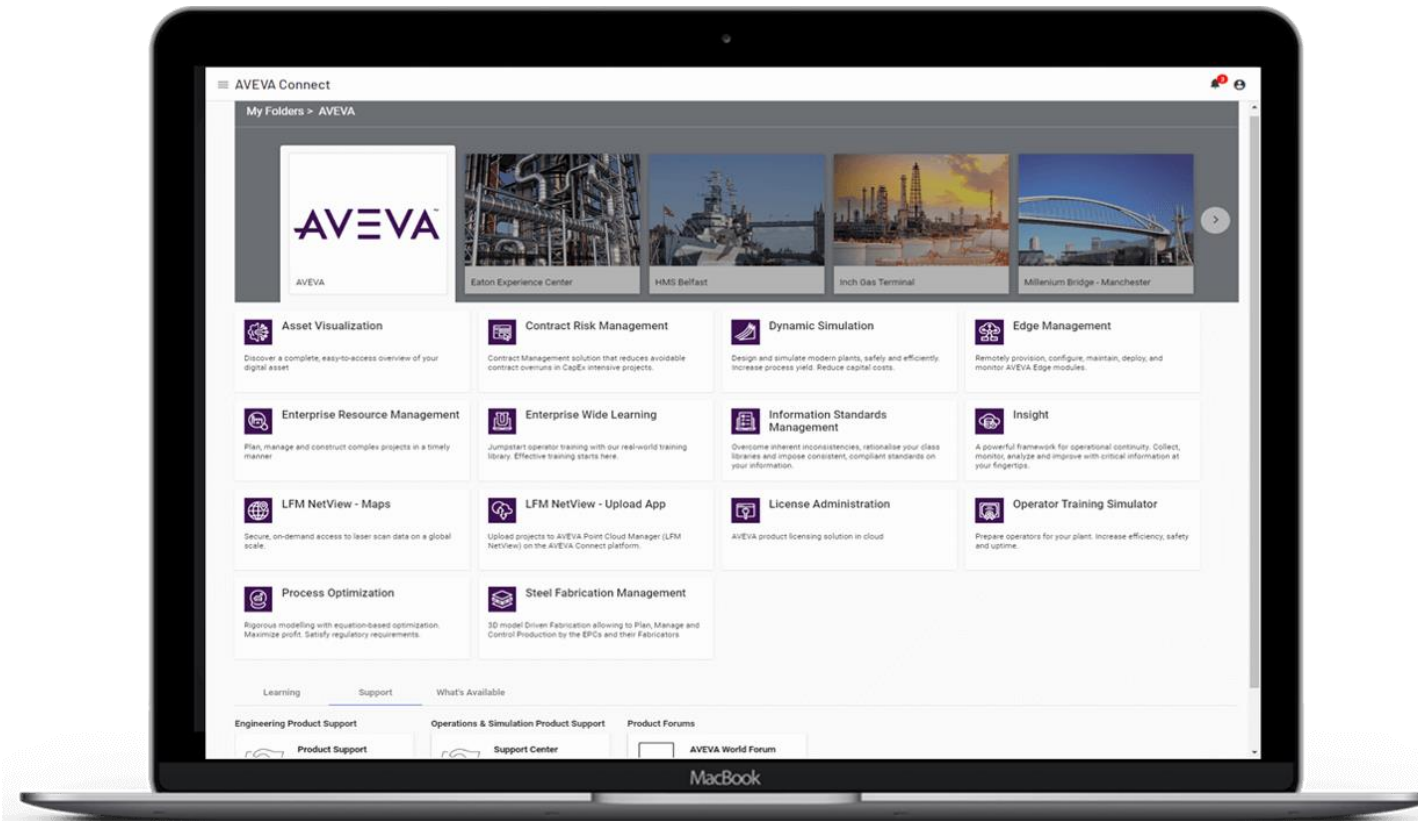
- AVEVA Connect – Infrastructure
- Types of Application
- Types & Scope of Integration
- AVEVA Data Hub – Data Services
- AVEVA Data Hub – Developer's Tools
- Wrap-up

AVEVA Connect Infrastructure



AVEVA CONNECT

AVEVA's cloud platform and customer portal



Advantages of moving to cloud:

- ✓ Faster time to Availability
- ✓ Lower dependency on IT
- ✓ Scalability
- ✓ Flexibility
- ✓ Move from CapEx to OpEx
- ✓ Always the latest and greatest features
- ✓ One single source of truth and one platform to allow collaboration
- ✓ Opportunity to connect and collaborate with partners/ the ecosystem on one single platform

NEUTRAL PLATFORM

Our strategic roadmap:
Accelerate value creation from AVEVA and partner applications with a neutral industrial platform



Partner apps

AVEVA apps

Your apps

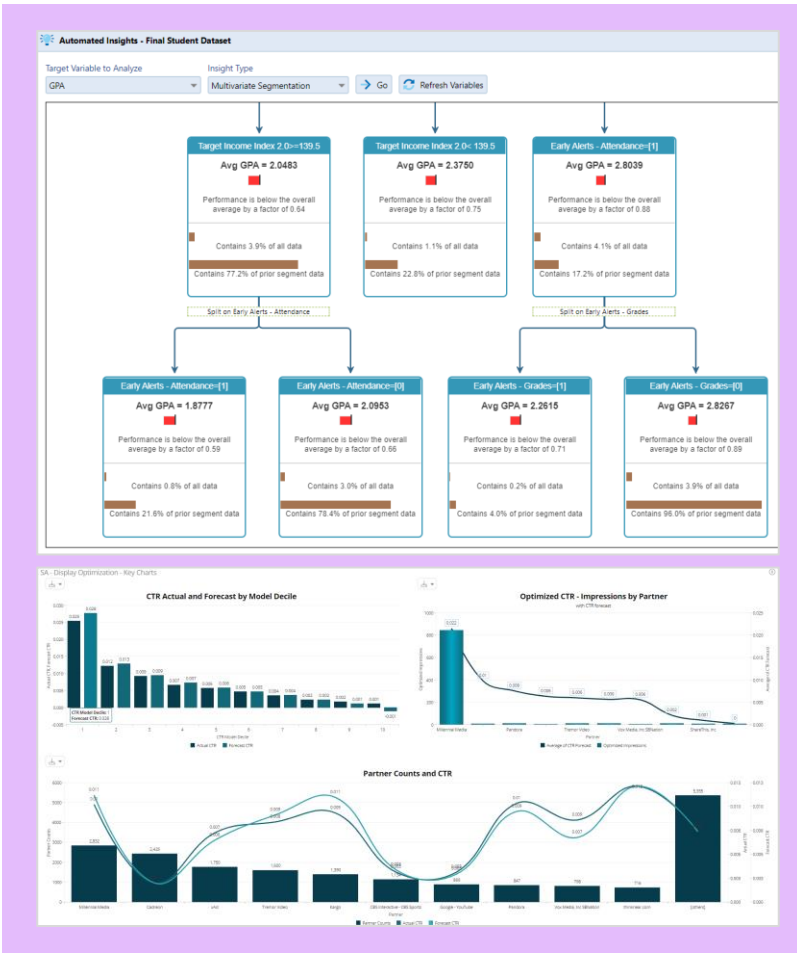


Connect
platform services

- Data services
- Visualization
- Modeling & Analytics
- ... & more to come

CONNECT Industrial Intelligence-as-a-Service

Taking advantage of AVEVA Data Hub **today** sets up success for the future



e.g., LITYX

CONNECT

Partner apps

AVEVA apps

Your apps

Data services via AVEVA Data Hub

↑ All apps / scenarios will pull **FROM** AVEVA Data Hub

↑ All sources send **TO** AVEVA Data Hub

AVEVA PI Server

AVEVA Historian

AVEVA Edge Data Store

AVEVA Mobile Operator

AVEVA Production Accounting

AVEVA Process Optimization

Coming soon

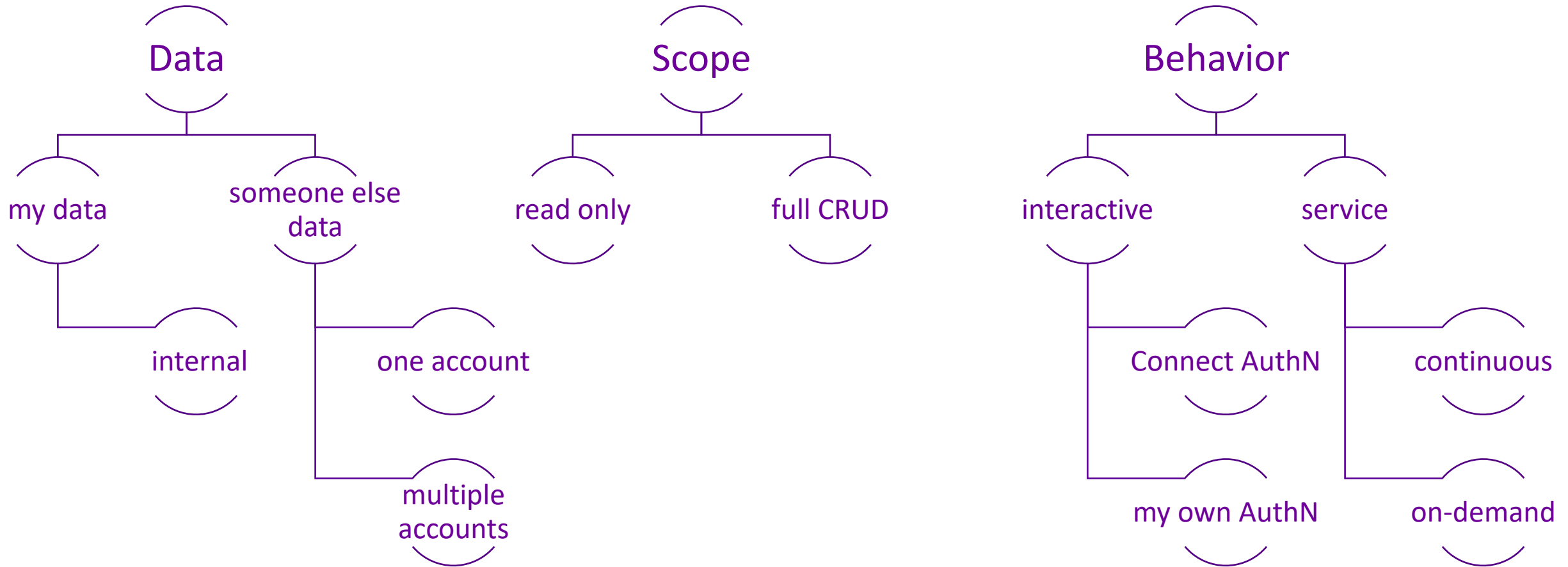
AVEVA MES & AVEVA Production Management Followed by Engineering content

AVEVA

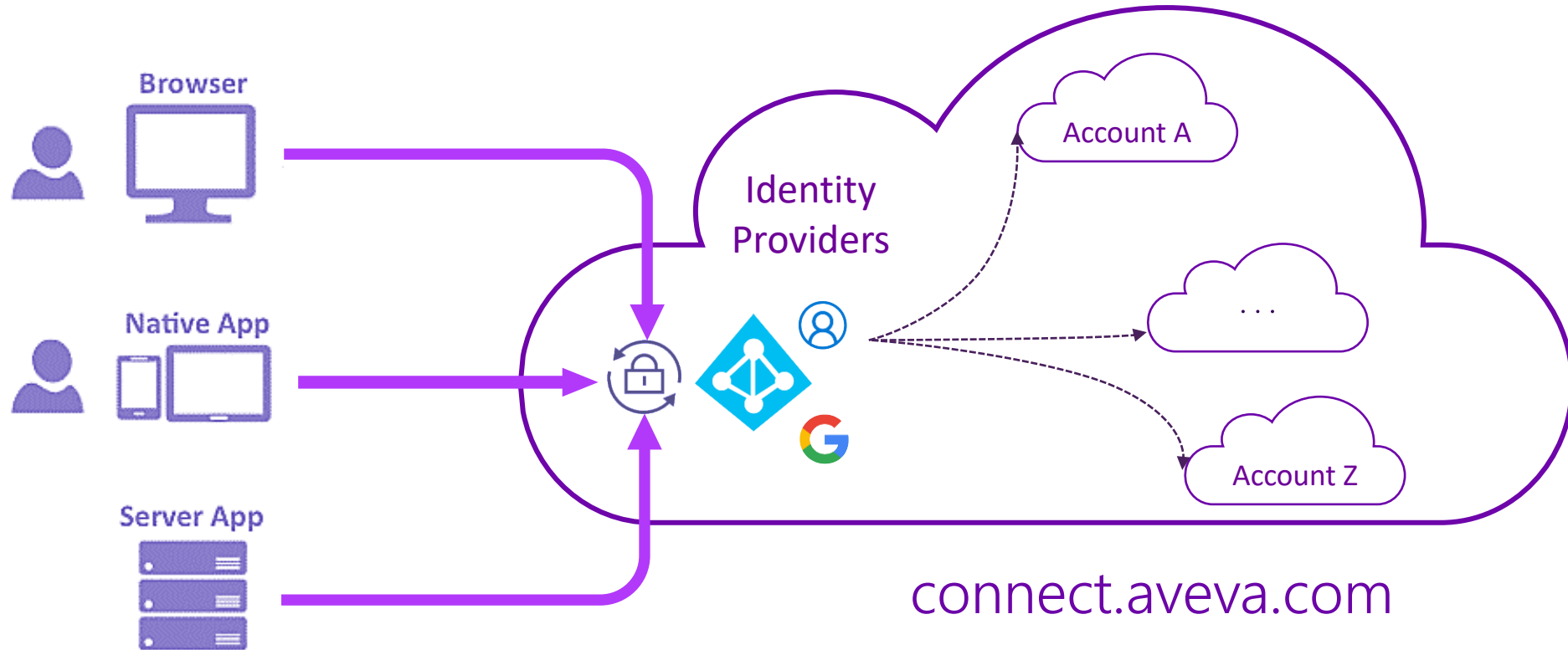
Different Types of Applications & Solutions



What does **the app** do and how is **the app** used?



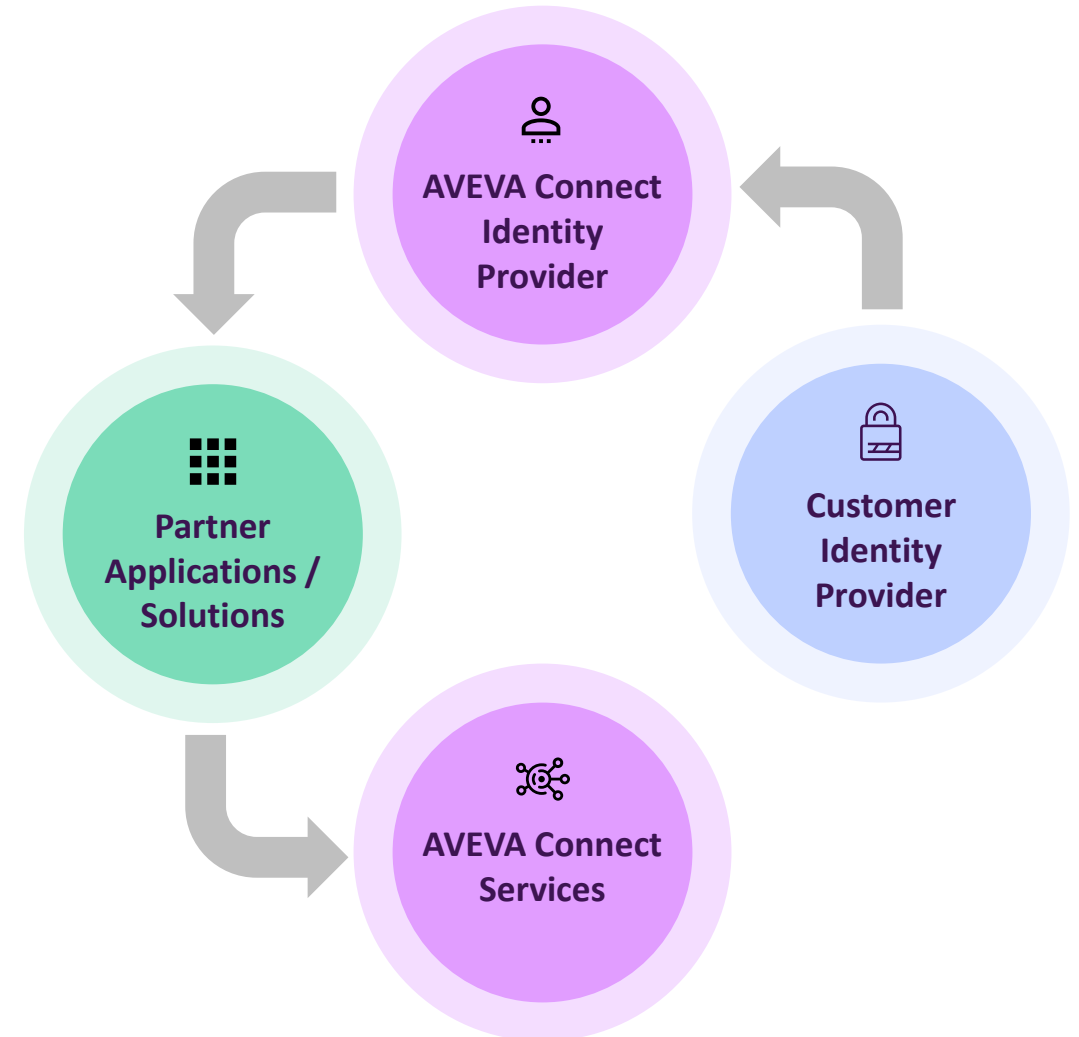
AVEVA Connect Authentication



AVEVA Connect Authentication

OpenID Connect (OIDC)

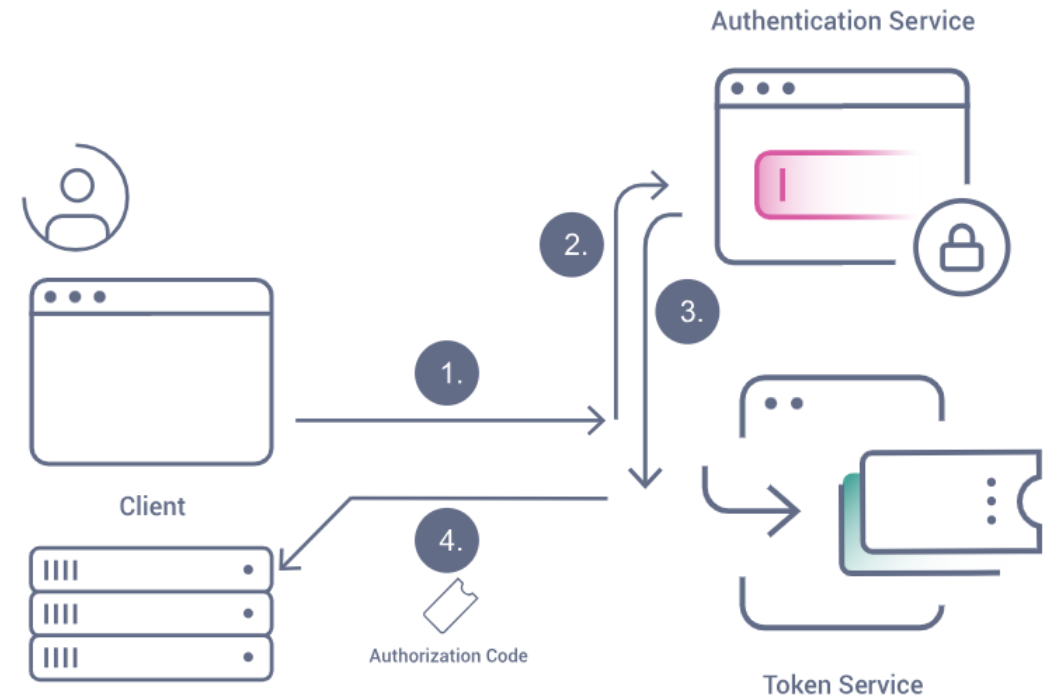
- OIDC is an interoperable authentication protocol.
- Through federation, it allows authenticating users without receiving or storing the user credentials.
- AVEVA Connect is its own Identity Provider (IdP) that can federate with customers' Identity Providers.
- Custom applications can leverage AVEVA Connect IdP. User credentials are never exposed to applications, which receive access tokens to allow access to data services.



Type 1 – Authorization Code Flow (with PKCE – Proof Key of Code Exchange)

Native Apps and Web Apps

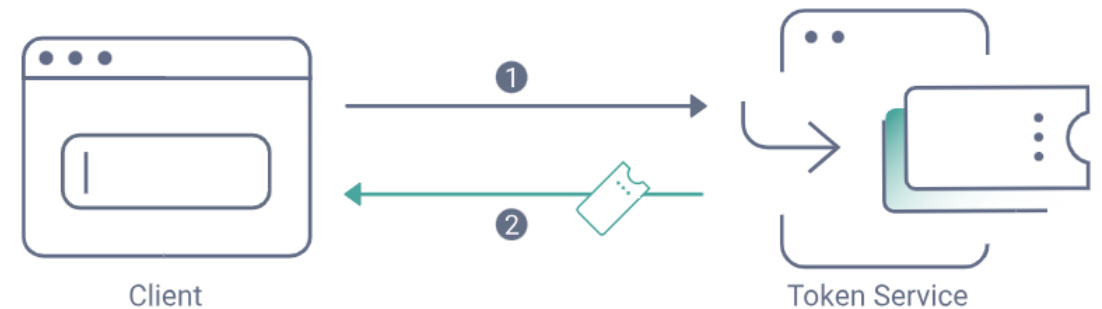
- Solution for applications that need to Authenticate and make calls On Behalf of a User.
- User credentials are never shared with the application, instead they only get an access token.
- The client application use AVEVA Connect credentials to sign in.



Type 2 – Client Credentials

Machine to Machine connection

- Solution for applications that running background, such as AI or analytic tools.
- You can create client credentials and assign them to specific / dedicated Roles.
- With Role assignment you can limit the resources exposed.
- Client Credentials are part of the OIDC Standard and created in ADH.



Demo 1 – Custom Application for Datahub Customers



- **Angular** (source: angular.io)

Angular is a development platform, built on [TypeScript](#). As a platform, Angular includes:

- A component-based framework for building scalable web applications
- A collection of well-integrated libraries that cover a wide variety of features, including routing, forms management, client-server communication, and more
- A suite of developer tools to help you develop, build, test, and update your code



- **Just an example**

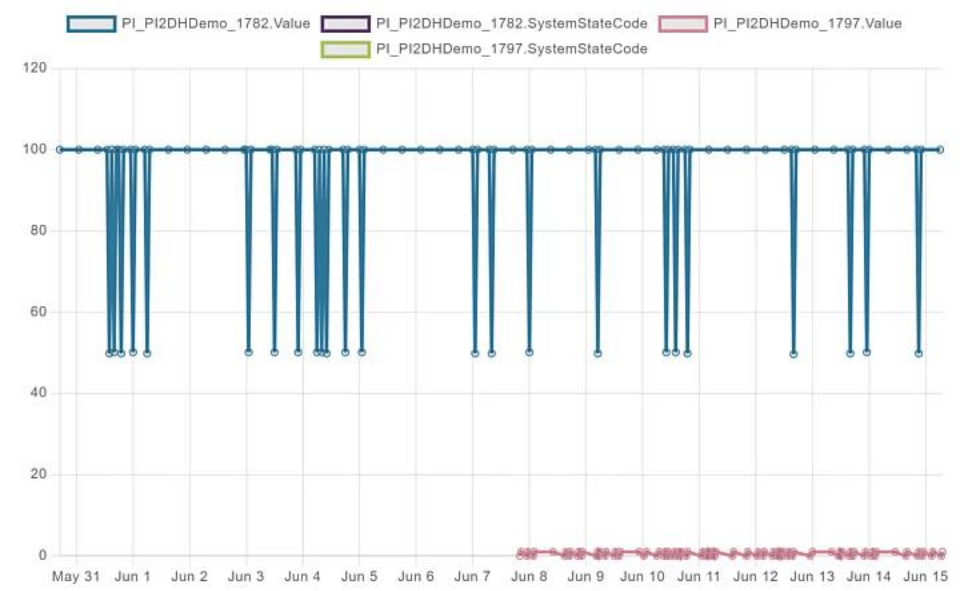
- Open platform based on security standards can work with any web Framework
- Other examples would be React, Vue, Blazor, and more...



SDS Visualization

AVEVA-Events-SaaS Stream Add

Namespace/Community	Stream	Last Update	Last Count
AVEVA-Events-SaaS Namespace	PI_PI2DHDemo_1782	Tue Sep 26 2023 16:18:05 GMT-0500 (Central Daylight Time)	100
AVEVA-Events-SaaS Namespace	PI_PI2DHDemo_1797	Tue Sep 26 2023 16:18:05 GMT-0500 (Central Daylight Time)	100

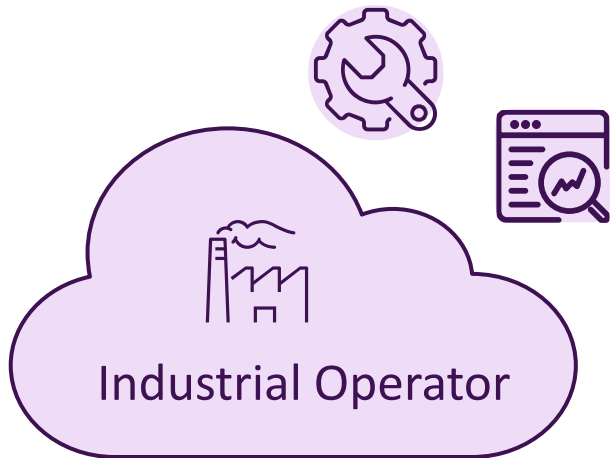


Different Types & Scope of Integration with AVEVA Data Hub

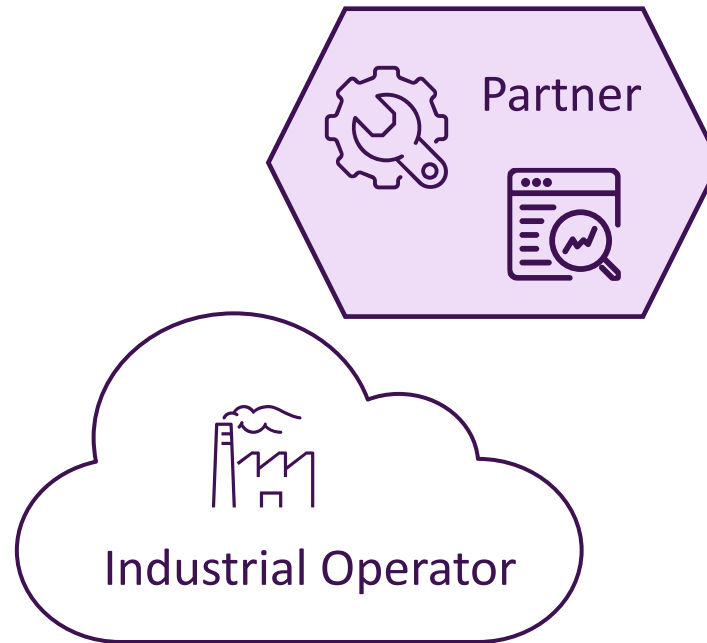


Three main Integration Categories

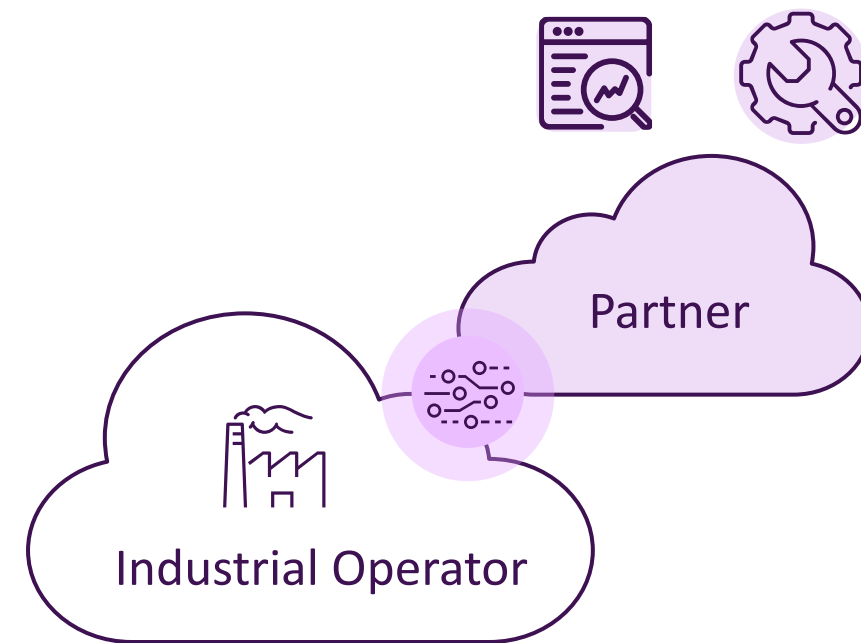
Internal

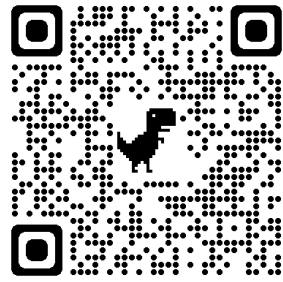


External



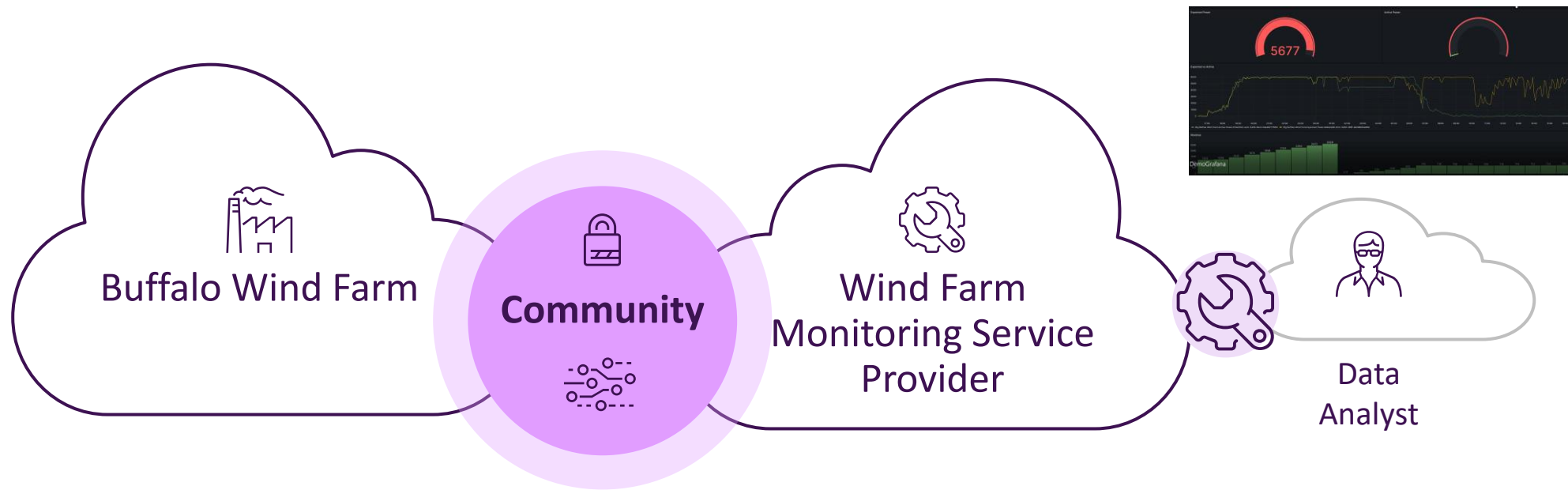
External via Communities





Demo 2 – Service Provider using Grafana

- Grafana is a multi-platform open source analytics and interactive visualization web application. It provides charts, graphs, and alerts for the web when connected to supported data sources.
- We have a sample (open-source) data source for Grafana. You can download and use it here: <https://github.com/osisoft/sample-adh-grafana-nodejs>
- The demo will show how a Partner can use Grafana to access community data from their customers





AVEVA Data Hub – Data Services

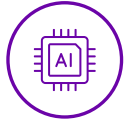


AVEVA Data Hub – Overview

Remote monitoring



Data science & AI/ML platforms



3rd party analytic tools



Custom & partner applications



Data sharing with business partners



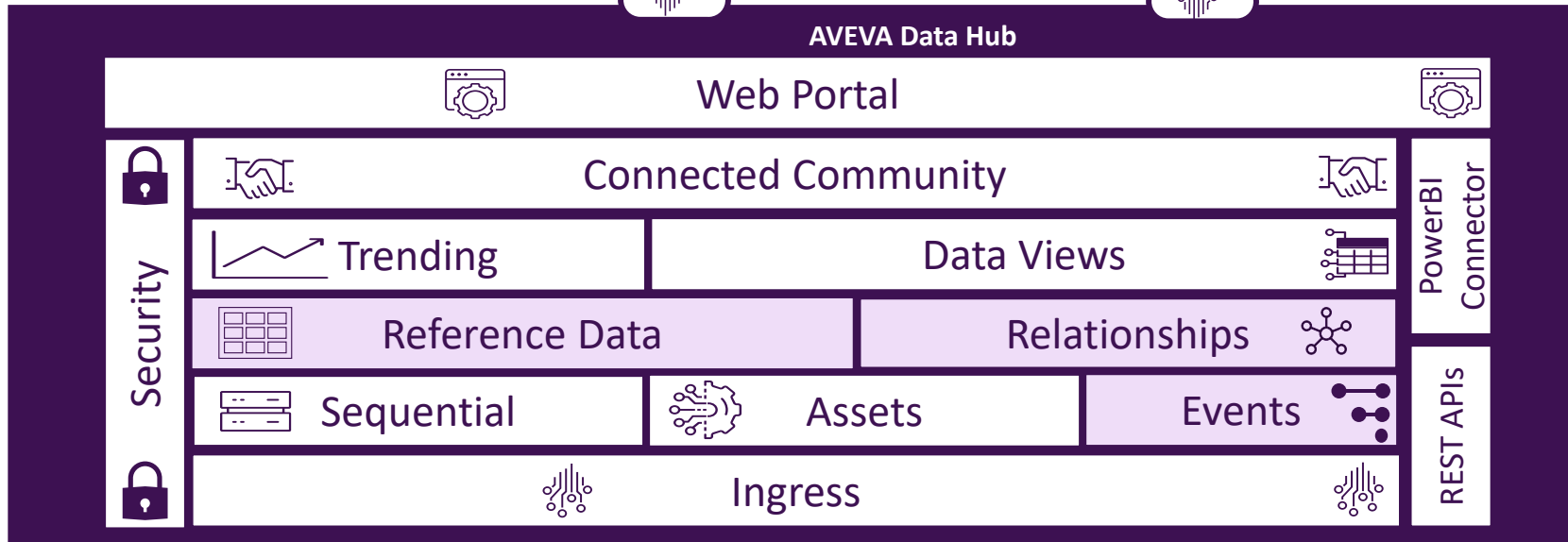
Reporting & Dashboards



Production Performance



Enterprise Visualization



OMF Apps & Remote assets

AVEVA Adapters

Edge Data Store

AVEVA PI Server

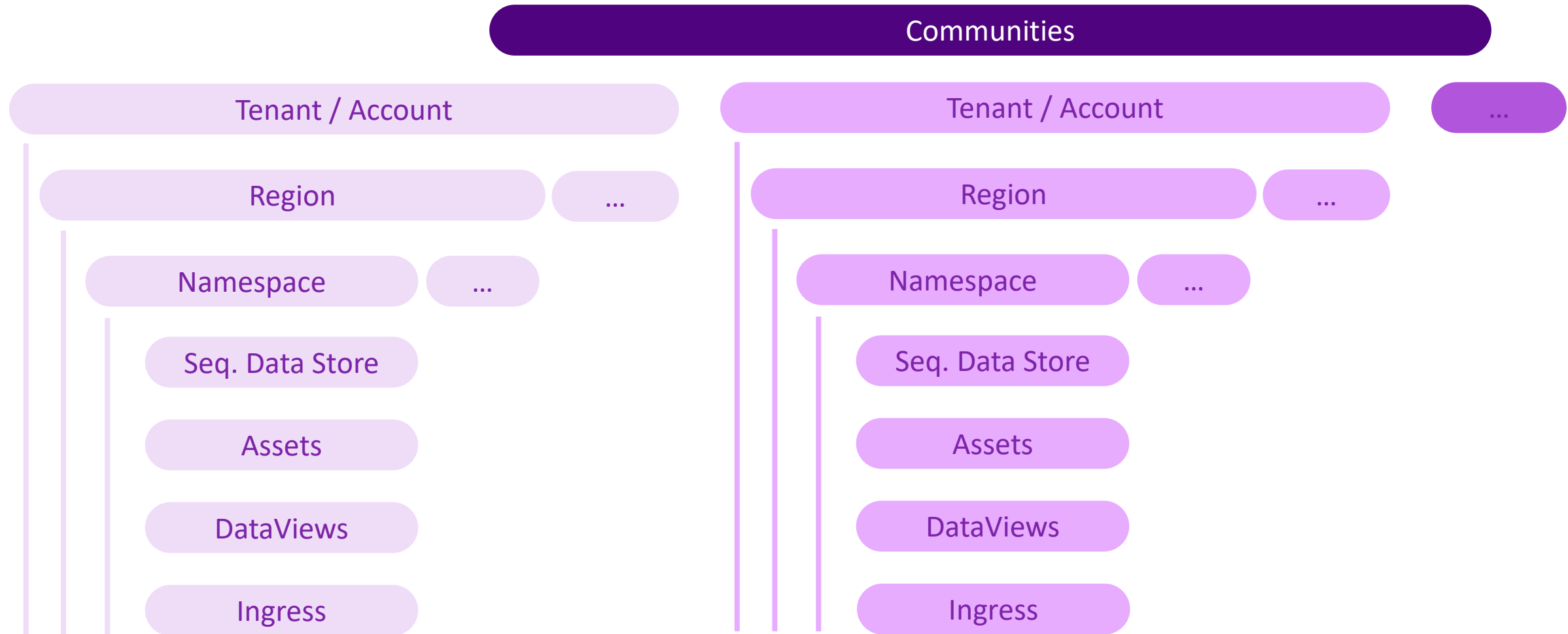
AVEVA Historian

Cloud apps & silos

AVEVA System Platform

AVEVA MES

AVEVA Data Hub – Data Services Structure



AVEVA Data Hub – Namespaces

region.datahub.connect.aveva.com/api/version/Tenants/tenantID

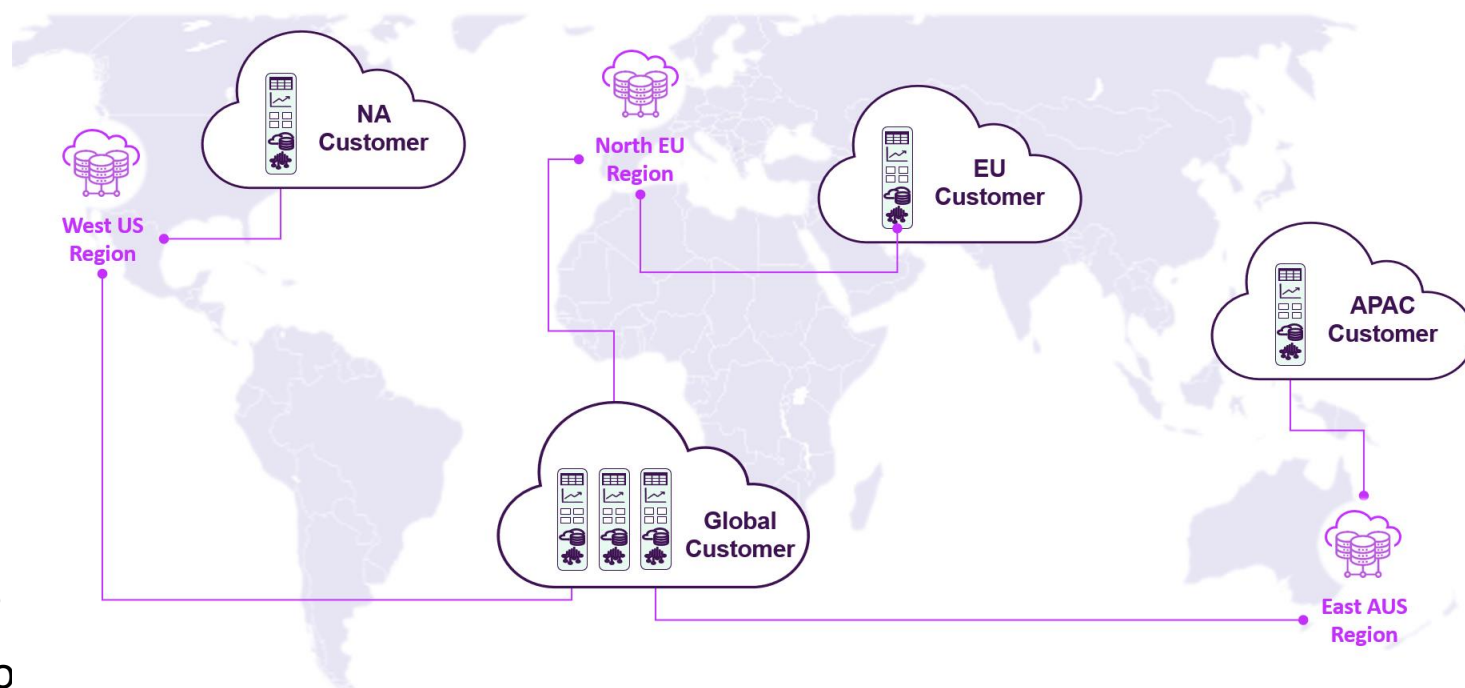
Three Regions:

- US-West (uswe)
- EU-West (euno)
- AUS-East (auea)

GET .../Namespaces/*namespaceId*

GET .../Namespaces/*namespaceId*/AccessRights

GET .../Namespaces/*namespaceId*/AccessContro





AVEVA Data Hub – Sequential Data Store (SDS)

region.datahub.connect.aveva.com/api/version/Tenants/tenantID/Namespace/namespaceId

GET .../Types/*typeId*

GET .../Streams/*streamId*/Data/First/

GET .../Streams/*streamId*/Data/Last/

GET .../Streams/*streamId*/Data/Sampled/

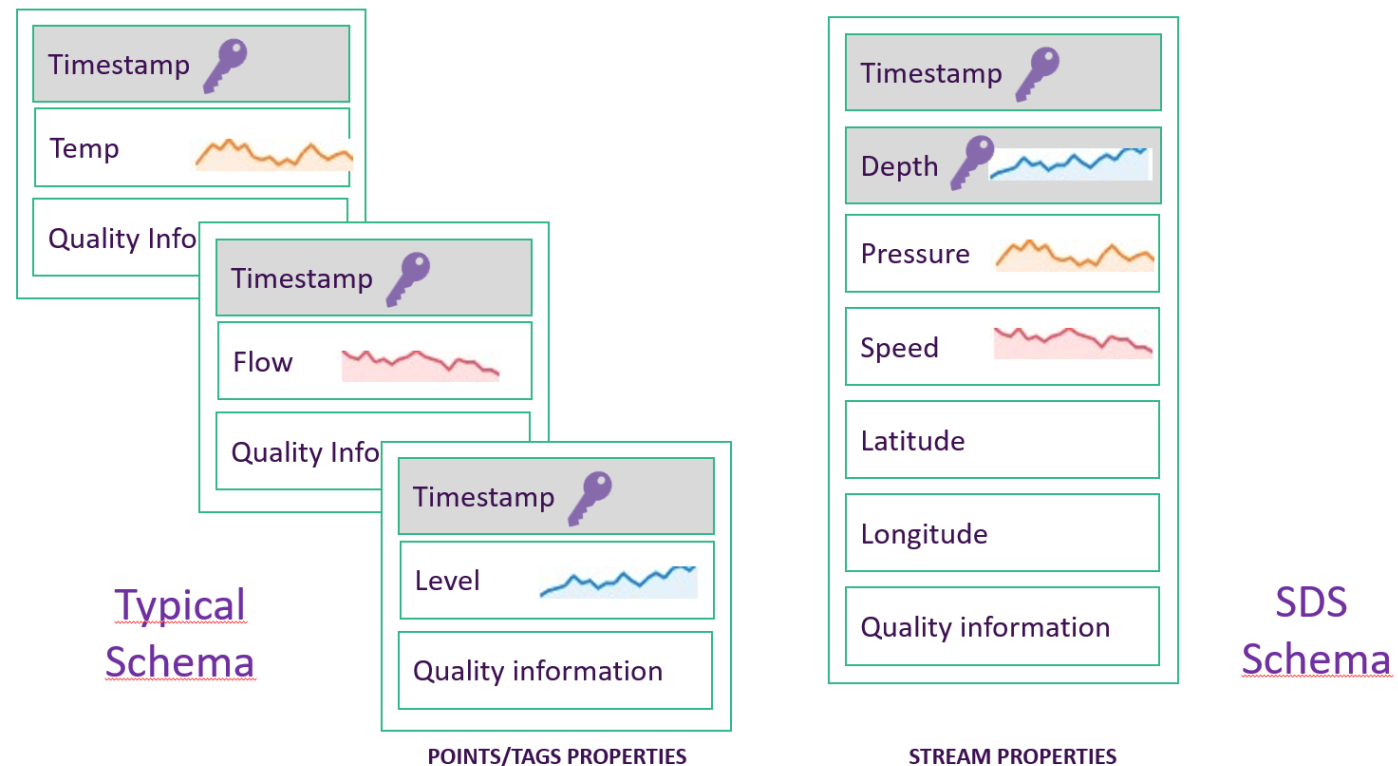
GET .../Streams/*streamId*/Data/Interpolated/

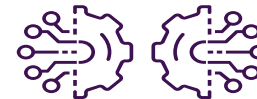
GET .../Streams/*streamId*/Data/Summaries/

GET .../Streams/*streamId*/Metadata/

GET .../Streams/*streamId*/Tags/

GET .../MetadataRule/*ruleId*





AVEVA Data Hub – Assets store

region.datahub.connect.aveva.com/api/version/Tenants/tenantID/Namespace/namespaceid

GET .../AssetTypes/*assettypeid*

GET .../Assets/*assetid*/Data/... (same as Streams)

GET .../Assets/*assetid*/Status/

GET .../AssetRule/*ruleid*

Metadata	Value	UOM
__ParentId	e3d4a3d0-38e8-11ec-94b5-001ddcb76b...	
__ParentName	Big Buffalo Wind Farm	
__Path	\\PI2DHDemo\Windtopia\Windtopia\Big...	
Adjusted Wind Speed Adjustment Coefficient Dr...	103	
Air Density Nominal Air Denisty	1.2466	
Altitude	1,000	
BatchWindBinFilter	WTG01_*	
Bearing A Temperature Limit	60	
Bearing B Temperature Limit	25	
Caculated Ambient Pressure at Altitude g	0.00980665	
Caculated Ambient Pressure at Altitude L	0.0065	
Caculated Ambient Pressure at Altitude M	0.0289644	
Caculated Ambient Pressure at Altitude p0	101.325	
Caculated Ambient Pressure at Altitude R	8.31447	
Caculated Ambient Pressure at Altitude T0	288.15	
Combined Power Forecast	0	

Property	Last Value	UOM	Timestamp
<input type="checkbox"/> Active Power	48.468	kW	6/15/23, 7:03 AM
<input checked="" type="checkbox"/> Active Power - 10 min rolling avg	50.639	kW	6/15/23, 7:04 AM
<input checked="" type="checkbox"/> Ambient Temperature	15.091	°C	6/15/23, 7:02 AM
<input type="checkbox"/> Apparent Power	50.245	kW	6/15/23, 7:04 AM
<input type="checkbox"/> Apparent Power - 10 min rolling a...	49.024	kW	6/15/23, 7:04 AM
<input type="checkbox"/> Auto Stop Aggregation_Revenue...	50.189		6/15/23, 7:04 AM
<input type="checkbox"/> Auto Stop Flag			
<input type="checkbox"/> Auto Stop Reason	0		6/12/23, 12:19 PM
<input type="checkbox"/> Availability Flag	0		6/15/23, 6:59 AM



AVEVA Data Hub – DataViews

region.datahub.connect.aveva.com/api/version/Tenants/tenantID/Namespace/namespaceid

GET .../DataViews/*dataviewId*

GET .../DataViews/*dataviewId*/Data/

GET .../DataViews/*dataviewId*/Data/Stored/

GET .../DataViews/*dataviewId*/Data/Interpolated/

Name	Id	Enum. Id
JSON	default	0
Table	table	1
Table with header	tableh	2
CSV	csv	3
CSV with header	csvh	4
Apache Parquet	parquet	5

The screenshot displays the AVEVA Data Hub interface for a data view named "Wind Turbine Analysis". The interface includes a configuration panel on the left and a data table on the right.

Configuration Panel:

- Name:** Wind Turbine Analysis
- Description:** (empty)
- Data View Shape:** Standard (selected), Narrow
- Filter Fields:** (empty)
- Index Field:** Timestamp
- Grouping Fields:** Name
- Identifying Field:** IdentifyingValue | Turbine Name | Uom

Data Table:

Timestamp	Name	Turbine Name	Rotor Speed Value	Turbine State Value	Nacelle Position Value
Oct 19, 2022, 12:00:00 AM	Wind Turbine 01	WTG	12.02395718191326	15	249.23068748390344
Oct 19, 2022, 1:00:00 AM	Wind Turbine 01	WTG	11.9745087317159	15.89478129771275	257.78282894577916
Oct 19, 2022, 2:00:00 AM	Wind Turbine 01	WTG	19.840414847322762	15	248.66765807474533
Oct 19, 2022, 3:00:00 AM	Wind Turbine 01	WTG	19.897287002948726	15	237.81143537199176
Oct 19, 2022, 4:00:00 AM	Wind Turbine 01	WTG	19.856572760764696	15	237.77723357261442
Oct 19, 2022, 5:00:00 AM	Wind Turbine 01	WTG	18.267031509218096	15	236.78482579251406
Oct 19, 2022, 6:00:00 AM	Wind Turbine 01	WTG	19.850873831183613	15	233.7246888191826
Oct 19, 2022, 7:00:00 AM	Wind Turbine 01	WTG	19.504595273659536	15	238.3036347279759
Oct 19, 2022, 8:00:00 AM	Wind Turbine 01	WTG	19.91404333739064	15	241.11165985103005
Oct 19, 2022, 9:00:00 AM	Wind Turbine 01	WTG	17.37703408061496	15	241.39956382829325
Oct 19, 2022, 10:00:00 AM	Wind Turbine 01	WTG	16.588538703844296	15	250.173249907546
Oct 19, 2022, 11:00:00 AM	Wind Turbine 01	WTG	17.699301989738625	15	260.5750333082171
Oct 19, 2022, 12:00:00 PM	Wind Turbine 01	WTG	17.283550503071254	15	276.0290764040727
Oct 19, 2022, 1:00:00 PM	Wind Turbine 01	WTG	12.209936348298722	15	285.7937339254047
Oct 19, 2022, 2:00:00 PM	Wind Turbine 01	WTG	12.109931081643497	15	265.4840761058815
Oct 19, 2022, 3:00:00 PM	Wind Turbine 01	WTG	12.127603	15	244.2084108419273
Oct 19, 2022, 4:00:00 PM	Wind Turbine 01	WTG	12.159249749506293	15	244.17059962871207
Oct 19, 2022, 5:00:00 PM	Wind Turbine 01	WTG	12.093177454278923	15	237.41092956258828
Oct 19, 2022, 6:00:00 PM	Wind Turbine 01	WTG	12.593478291502821	15	230.28586948411538
Oct 19, 2022, 7:00:00 PM	Wind Turbine 01	WTG	12.522906892649848	15	218.60469537310306



AVEVA Data Hub – Communities

region.datahub.connect.aveva.com/api/version/Communities

GET .../*communityId*/summary

GET .../*communityId*/Tenants

GET .../*communityId*/Invitations

GET .../Search/Communities/*communityId*/Streams

AVEVA™ Data Hub ▶ Communities

Home | Filter communities...

Data Management >

Data Collection >

Visualization >

Analytics >

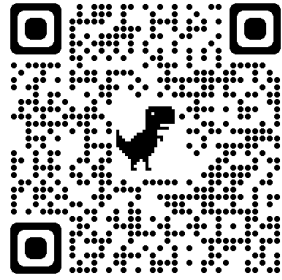
Security >

Developer Tools >

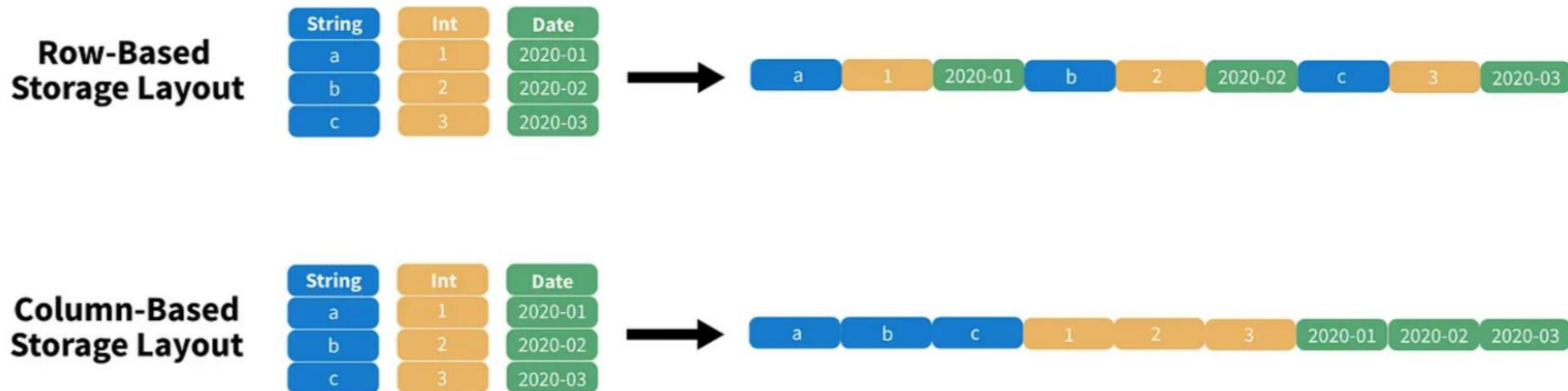
Support >

Community Name	Tenants	Sharing Status	Member Status
Data Sharing Community 1	1	✓ All Tenants Active	ⓘ Cannot view shared data
OEM-Global	1	✓ All Tenants Active	ⓘ Cannot view shared data
FabioTestCommunity	1	✓ All Tenants Active	
HVAC	1	✓ All Tenants Active	

Demo 3 – Parquet Format



- Why Parquet?
 - Parquet is column oriented format vs conventional CSV, which is row based
 - Queries specific column data requires less reads
 - Grouping the data by columns allows for higher compression rates
 - Converting conventional CSV to parquet lowers overall cost and improves performance



Source: [Demystifying the Parquet File Format | by Michael Berk | Towards Data Science](#)

Sample SQL query: `SELECT * FROM cp.`employee.json` LIMIT 20`



Query type: SQL Physical Logical

Query

Hint: Use *Ctrl+Enter* to submit

```
1 SELECT * FROM dfs.`/mnt/c/tmp/data` WHERE `Ambient Temperature Maximum °F` > 60.229 LIMIT 20
```

I

Submit

Reset

Limit results to rows

Default schema:

AVEVA Data Hub – Developer's Tools



AVEVA Data Hub – API Console

- Root/Tenant path
- API Versioning
- Auto-complete
 - Parameters fields
- Full CRUD
- Save to Favorites
- Response formatting
- Copy/download responses

The screenshot displays the AVEVA Data Hub API Console interface. The top navigation bar includes the title 'AVEVA™ Data Hub API Console', a settings icon, and the user 'AVEVA-Events'. The left sidebar contains a navigation menu with items: Home, Data Management, Data Collection, Visualization, Analytics, Security, Developer Tools (highlighted), and Support. The main content area shows a REST client interface for a GET request to the URI '/Namespaces' under version 'v1'. A dropdown menu is open, showing the selected 'GET' method. Below the request configuration, there are buttons for 'Copy Request URI' and 'GET'. The response body is displayed in a code editor, showing a JSON array of namespace objects. The response is formatted with line numbers on the left.

```
1 [{"Id": "056b0838-a392-4693-9524-21a81669a505",
2   "Region": "westus",
3   "Self": "https://uswe.datahub.connect.aveva.com/api/v1/tenant/056b0838-a392-4693-9524-21a81669a505",
4   "Description": "SLTC",
5   "State": 1,
6   "RegionId": "westus",
7   "InstanceId": "4f980591-a732-491a-93d8-0816a9ff9563",
8   "Name": "SLTC",
9   "AllowCrossRegionProcessing": true
10  },
11  {
12    "Id": "250ba352-e3f3-4eb0-a50f-21bde8d301bc",
13    "Region": "westus",
14    "Self": "https://uswe.datahub.connect.aveva.com/api/v1/tenant/250ba352-e3f3-4eb0-a50f-21bde8d301bc",
15    "Description": "AVEVA-Events-SaaS",
16    "State": 1,
17    "RegionId": "westus",
18    "InstanceId": "fbcabc7f-ad67-47a9-929a-1b82541bb950",
19    "Name": "AVEVA-Events-SaaS",
20    "AllowCrossRegionProcessing": true
21  },
22  {
23    "Id": "3a508c99-e2b4-4e02-9e55-b315ed791152",
24    "Region": "westus",
25    "Self": "https://uswe.datahub.connect.aveva.com/api/v1/tenant/3a508c99-e2b4-4e02-9e55-b315ed791152",
26    "Description": "POC",
27    "State": 1,
28    "RegionId": "westus",
29    "InstanceId": "1b7cb5c3-0d30-4c6a-9995-1ef4a16404d4",
30    "Name": "POC",
31    "AllowCrossRegionProcessing": true
32  },
33  }
34  ],
35  }
```

AVEVA Data Hub – Code Samples

- Use case/service oriented
- In context of your tenant
- Multiple languages
 - C#, .Net Libraries
 - Python, Java, Angular, Node JS
- Github repo



AVEVA™ Data Hub ▶ Code Samples

Home
Data Management >
Data Collection >
Visualization >
Analytics >
Security >
Developer Tools >
Support >

Authentication
Authenticating to Aveva Data Hub using all client types in various languages

SDS
SDS common actions written in various languages

Data Ingress
Samples highlighting some possible data ingress options in C#

Visualization
Sample visualization applications in various languages

Analytics
Data view samples in various languages

Other
UOM sample, data copying, and sample libraries

The following are placeholder values that are required for the provided code samples. See the readme file on GitHub for more information on each sample. Some of the placeholder values require a client key. To view or create clients, use the [Clients](#) page.

PLACEHOLDER_REPLACE_WITH_SERVER_URL
uswe.datahub.connect.aveva.com

PLACEHOLDER_REPLACE_WITH_TENANT_ID
cee3a3fd-aeb2-4950-80f5-4b72c77322b1

PLACEHOLDER_REPLACE_WITH_AUTHORITY
uswe.datahub.connect.aveva.com/identity/connect/token

PLACEHOLDER_REPLACE_WITH_CLIENTID
Requires Client Key

PLACEHOLDER_REPLACE_WITH_CLIENT_SECRET
Requires Client Key

AVEVA Data Hub – Online documentation

docs.aveva.com

- Get started section for ‘beginners’
- Full Developer guide
- Full API Reference guide

The screenshot displays the AVEVA Data Hub documentation interface. On the left is a 'TABLE OF CONTENTS' sidebar with categories like 'AVEVA™ Data Hub', 'Get started', 'Data management', 'Data collection', 'Visualization', 'Analytics', 'Security', and 'Developer tools'. The main content area features a breadcrumb trail: 'Home > AVEVA™ Data Hub > Take a tour of the AVEVA Data Hub portal'. The title is 'Take a tour of the AVEVA Data Hub portal', last updated on Jul 14, 2023. Below the title, it states 'Access and interact with AVEVA Data Hub through the web-based portal.' and 'AVEVA Data Hub home page'. A screenshot of the AVEVA Data Hub home page is shown, featuring a navigation menu, 'Latest Service Updates', 'Quick Links', 'Yesterday's Resource Usage' (with a table of Streams, Shared Streams, and Alerts), 'System Health', 'PI to Data Hub Agents', and 'Edge Data Store & Adapters'. The bottom of the page begins with the text 'The AVEVA Data Hub home page displays the following:'.

AVEVA Data Hub – ‘How To’ Videos

<p>Video</p> <h3>AVEVA™ Data Hub Set Up and User Access for Administrators</h3> <p>AVEVA™ Data Hub - set up activities (administrator) Activate your AVEVA™ Data Hub service and configure your user access.</p>	<p>Video</p> <h3>AVEVA™ Data Hub Creating a Data Transfer for Administrators</h3> <p>AVEVA™ Data Hub - creating a PI Server data transfer (administrator) Transfer data from an AVEVA™ PI Server data archive, to your AVEVA™ Data Hub service.</p>	<p>Video</p> <h3>Communities in AVEVA™ Data Hub for Administrators</h3> <p>AVEVA™ Data Hub - Communities (administrator) Creating a Community to share selected data, using AVEVA™ Data Hub</p>	<p>Video</p> <h3>Creating a Data View in AVEVA™ Data Hub for All Users</h3> <p>Creating a Data View in AVEVA™ Data Hub (All users) Creating a Data View for efficient data collaboration.</p>
<p>Video</p> <h3>Using AVEVA™ Data Hub with Power BI Desktop For Data Users</h3> <p>Using AVEVA™ Data Hub data with Power BI Desktop (all users) Make use of data from AVEVA™ Data Hub in Microsoft's Power BI Desktop.</p>	<p>Video</p> <h3>Using Data in AVEVA™ Data Hub for All Users</h3> <p>Using Data in AVEVA™ Data Hub Learn to make use of data, including streams, assets and types, in AVEVA Data Hub.</p>	<p>Video</p> <h3>APIs and Code Samples in AVEVA™ Data Hub for All Users</h3> <p>APIs and Code Samples in AVEVA™ Data Hub How to use the API Console for API requests and access code library samples.</p>	

[Software Services \(aveva.com\)](https://www.aveva.com/software-services)

Technical Documentation

For process guides and answers to technical questions on AVEVA services, visit the documentation site:

[Docs.AVEVA.com](https://docs.aveva.com)

Wrap-Up

AVEVA Industrial Cloud Platform moving forward



1

EXPANDING AVEVA CONNECT & DATA HUB VALUE

2

SUPPORTING FROM EDGE TO COMMUNITY

3

BRIDGE ENGINEERING & OPERATIONS DIGITAL TWIN

4

EXPANDING THE ECOSYSTEM



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 [@avevagroup](https://twitter.com/avevagroup)

ABOUT AVEVA

AVEVA is a world leader in industrial software, providing engineering and operational solutions across multiple industries, including oil and gas, chemical, pharmaceutical, power and utilities, marine, renewables, and food and beverage. Our agnostic and open architecture helps organizations design, build, operate, maintain and optimize the complete lifecycle of complex industrial assets, from production plants and offshore platforms to manufactured consumer goods.

Over 20,000 enterprises in over 100 countries rely on AVEVA to help them deliver life's essentials: safe and reliable energy, food, medicines, infrastructure and more. By connecting people with trusted information and AI-enriched insights, AVEVA enables teams to engineer efficiently and optimize operations, driving growth and sustainability.

Named as one of the world's most innovative companies, AVEVA supports customers with open solutions and the expertise of more than 6,400 employees, 5,000 partners and 5,700 certified developers. The company is headquartered in Cambridge, UK.

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