OCTOBER 25, 2023

Platform Developers: Putting it all together with a demo + Q&A with experts!

AVEVA

Derek Endres & Yuki Kimura

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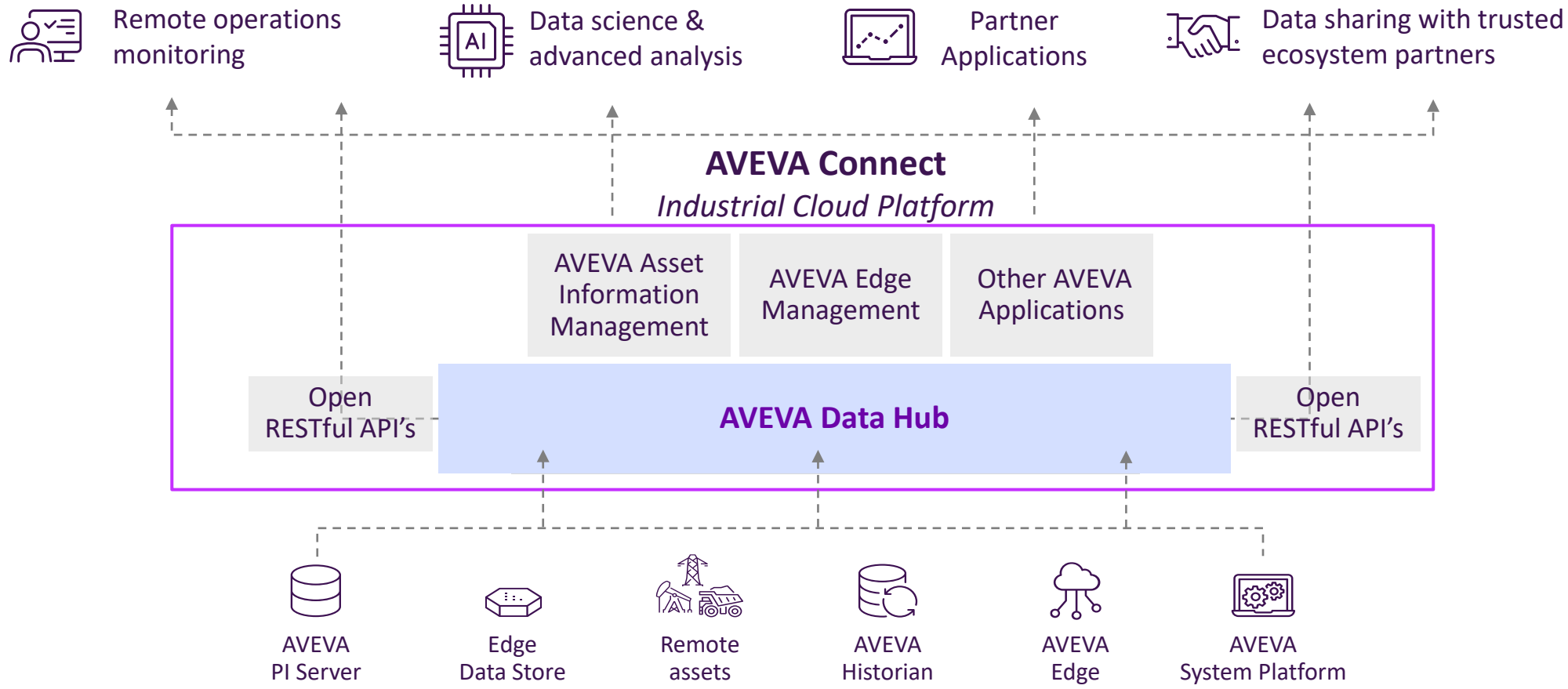
- Yuki.Kimura@aveva.com

AGENDA

- Data Ingress
  - SDS Type Definition
  - SDS API vs OMF
  - Best Practices
  - DEMO!!!!
- Data Egress
  - Streams vs Assets vs Data views
  - DEMO!!!!

The Power of AVEVA™ Connect

AVEVA Connect enables a hybrid data architecture through cloud offerings



AVEVA Data Hub

Remote monitoring

Data science & AI/ML platforms

3rd party analytic tools

Data sharing with business partners

Custom & partner applications

Reporting & Dashboards

OMF Apps & Remote assets

AVEVA Adapters

Edge Data Store

AVEVA PI Server

AVEVA Historian

AVEVA System Platform

Cloud apps & silos

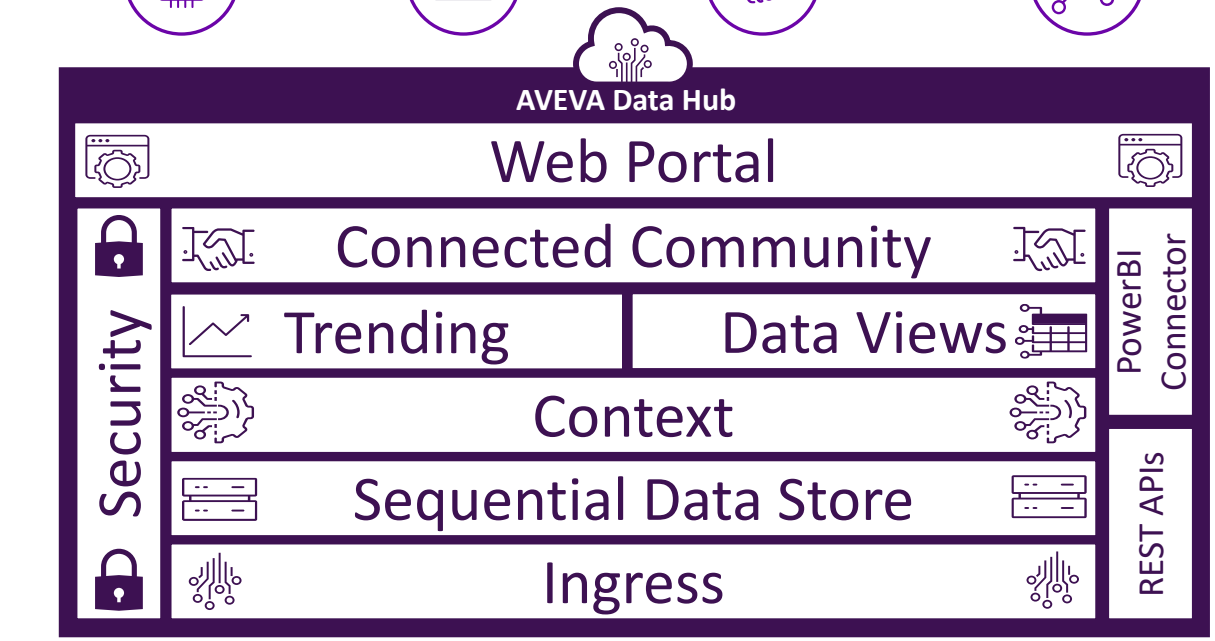
A cloud-native industrial platform designed for aggregating, storing, enriching, accessing, analyzing, and securely sharing real-time operations data from historians, edge devices, and more

- Managed, secure, multi-tenant platform
- Operated & maintained by AVEVA
- High speed, scalable, elastic, & resilient
- Modern, secure REST APIs
- Built & deployed on Microsoft Azure

AVEVA

AVEVA Data Hub

Remote monitoring | Data science & AI/ML platforms | 3rd party analytic tools | Data sharing with business partners | Custom & partner applications | Reporting & Dashboards



OMF Apps & Remote assets | AVEVA Adapters | Edge Data Store | AVEVA PI Server | AVEVA Historian | AVEVA System Platform | Cloud apps & silos

A cloud-native industrial platform designed for aggregating, storing, enriching, accessing, analyzing, and securely sharing real-time operations data from historians, edge devices, and more

- Managed, secure, multi-tenant platform
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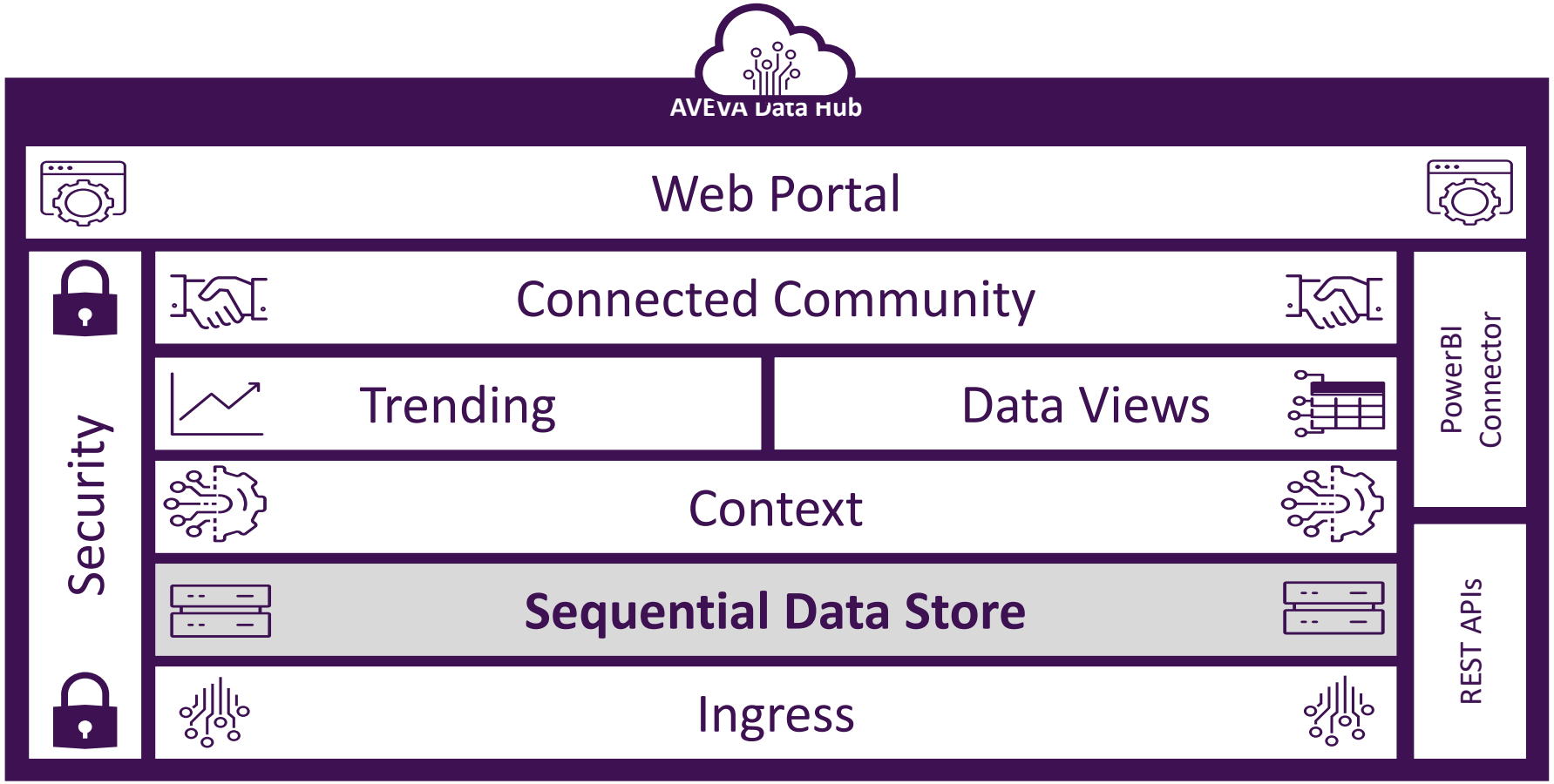
- Modern, secure REST APIs
- Built & deployed on Microsoft Azure

Supported Regions
West US (California)
North Europe (Ireland)
Australia East (New South Wales)

AVEVA

Sequential Data Store



Flexible *Sequential Data Store* that keeps related data together

Sequential Data Store

Stream types & streams

Timestamp
Depth
Pressure
Speed
Latitude
Longitude
Quality information

Timestamp
Temp
Quality

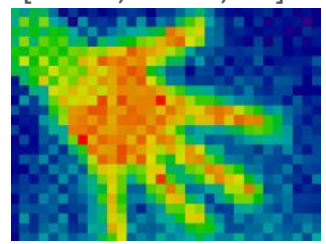
Timestamp
Flow
Quality

Timestamp
Level
Quality information

STREAM PROPERTIES

Timestamp

IR Camera
[24.56, 24.58, ...]



Limited functionality / custom consumer application required for this functionality

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Complex vs Simple Types

What is a simple type?

- Key-Value pair
- Often Timestamp Value
- Adapters
- PI Server
- AVEVA Historian

```
{
    "Timestamp": "2023-07-17T21:12:08.1915788Z",
    “Temperature": 0
}
```

```
{
  "Timestamp": "2023-02-08T02:51:58.707077Z",
  "Value": 0,
  "IsQuestionable": false,
  "IsSubstituted": false,
  "IsAnnotated": false,
  "SystemStateCode": null,
  "DigitalStateName": null
}
```

```
{
  "Timestamp": "2022-02-03T16:13:09.27763Z",
  "ParticleCount0.3": 408,
  "ParticleCount0.5": 134,
  "ParticleCount1.0": 17,
  "ParticleCount2.5": 4,
  "ParticleCount5.0": 2,
  "ParticleCount10.0": 2,
  "PM1.0S": 2,
  "PM1.0E": 2,
  "PM2.5S": 2,
  "PM2.5E": 2,
  "PM10S": 5,
  "PM10E": 5
}
```


Complex vs Simple Types

What is a complex type?

- Key with multiple properties
- Compound indices
- Nested types

AVEVA

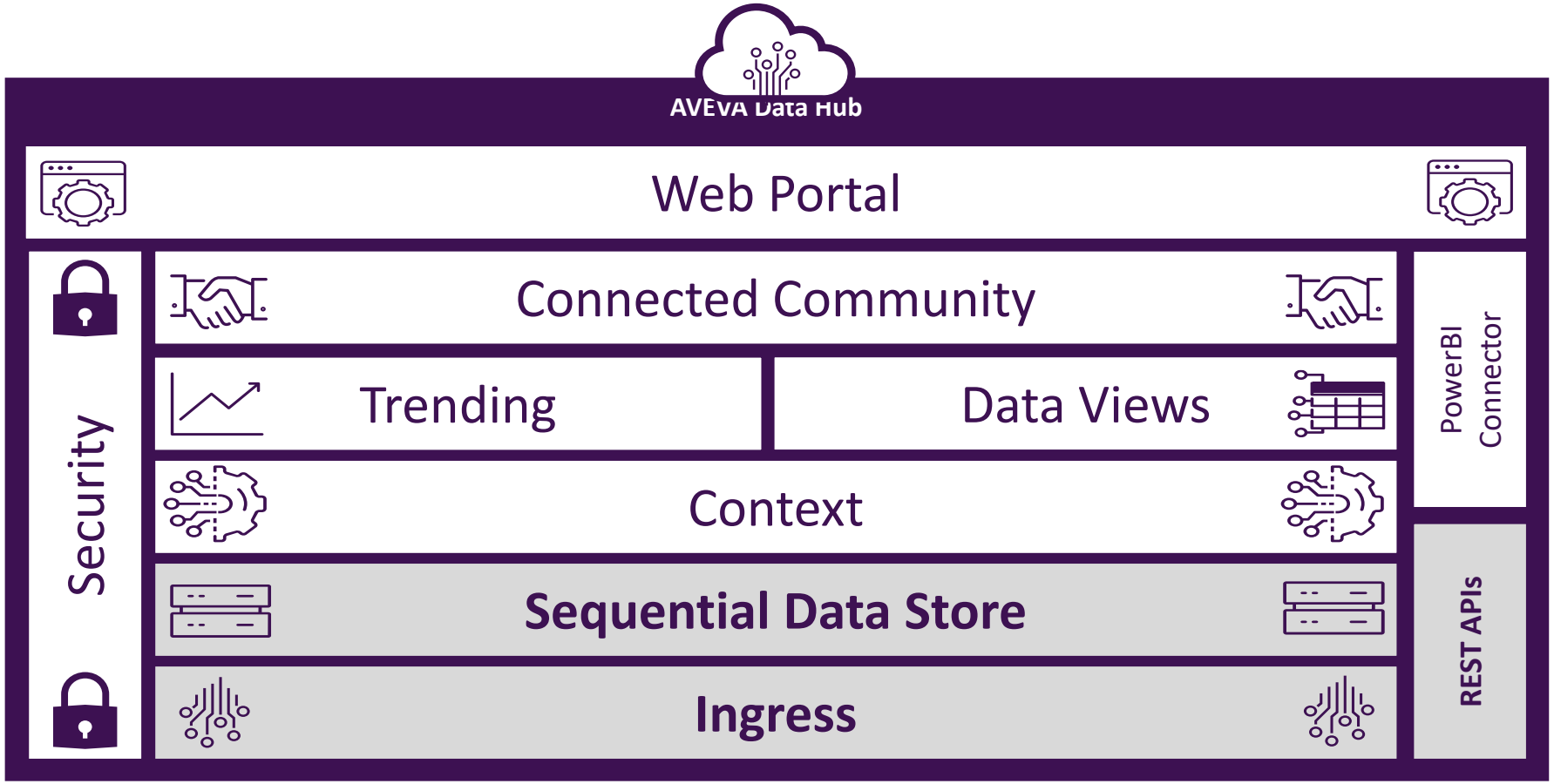
Complex vs Simple Types

Which should I choose?

- All types should have a value for each property on each event
  - If an event can and will occur without every property it should be broken apart or interpolation will not be valid

- Stream views can be used to view a type in a different way or to permanently retype a stream

Ingress and REST APIs



SDS API vs OMF

What is SDS API?

- Sequential Data Store
  - Purpose-built sequential data storage for AVEVA Data Hub and Edge Data Store
- Terminology
  - Types
  - Streams
  - Events
- Send multiple events to a stream

```
[
    {
        "Timestamp": "2023-07-17T21:12:08.1915788Z",
        "Value": 0
    },
    {
        "Timestamp": "2023-07-17T21:15:00.6197394Z",
        "Value": 10
    },
    {
        "Timestamp": "2023-07-17T21:20:00.7899553Z",
        "Value": 30
    }
]
```

```
[{
   "containerid": "Tank1_PressureMeasurements",
   "values": [{
      "Timestamp": "2019-09-11T22:23:23.430Z",
      "Pressure": 12.0
   }, {
      "Timestamp": "2019-09-11T22:24:23.430Z",
      "Pressure": 11.5
   }]
}, {
   "containerid": "Tank2_PressureMeasurements",
   "values": [{
      "Timestamp": "2019-09-11T22:23:23.430Z",
      "Pressure": 14.0
   }, {
      "Timestamp": "2019-09-11T22:24:23.430Z",
      "Pressure": 15.1
   }]
}]
```


SDS API vs OMF

What is OMF?

- Open Message Format
  - Generic format that can be interpreted by PI, ADH and EDS
- Terminology
  - Types
  - Containers
  - Data values
- Send multiple data values to multiple containers

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SDS API vs OMF

Similarities and differences

- SDS
  - Single Stream
  - Immediate response/validation
  - EDS and ADH only
- OMF
  - Multiple containers
  - Minimal validation
  - Can send to PI, EDS and ADH

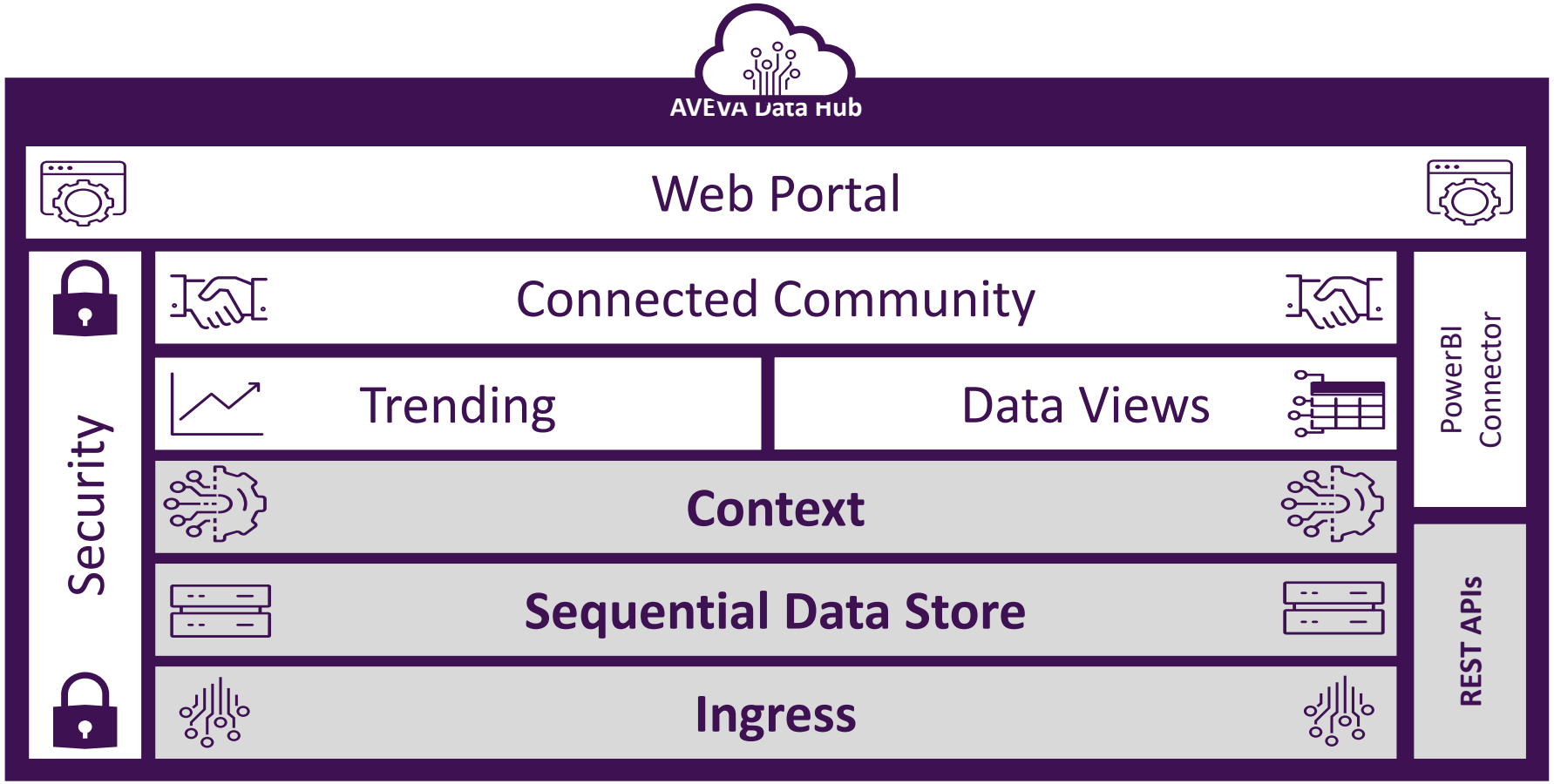
- Simple and Complex stream definitions *
- Non-time series and compound indices*

SDS API vs OMF

What data ingress do I choose?

- Adapter, PI Server, AVEVA Historian, AVEVA System Platform, Edge Data Store
- OMF for ingress applications
- SDS for situations where you are reading SDS data and writing it back into a few streams

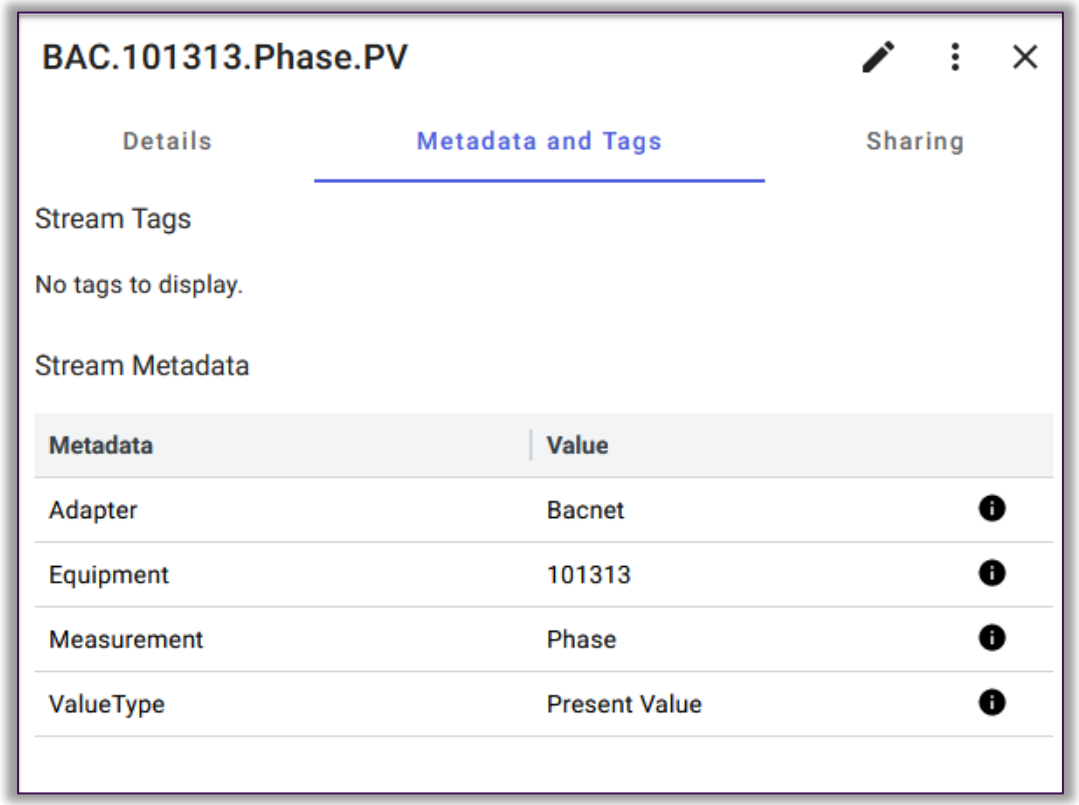
Ingress and REST APIs



Data Ingestion Best Practices

- In-order data (increasing, for the stream)
- SDS Type reuse
- UOMs can be set on type and/or streams
- Naming patterns

Create Metadata from Stream name patterns with Metadata Rules



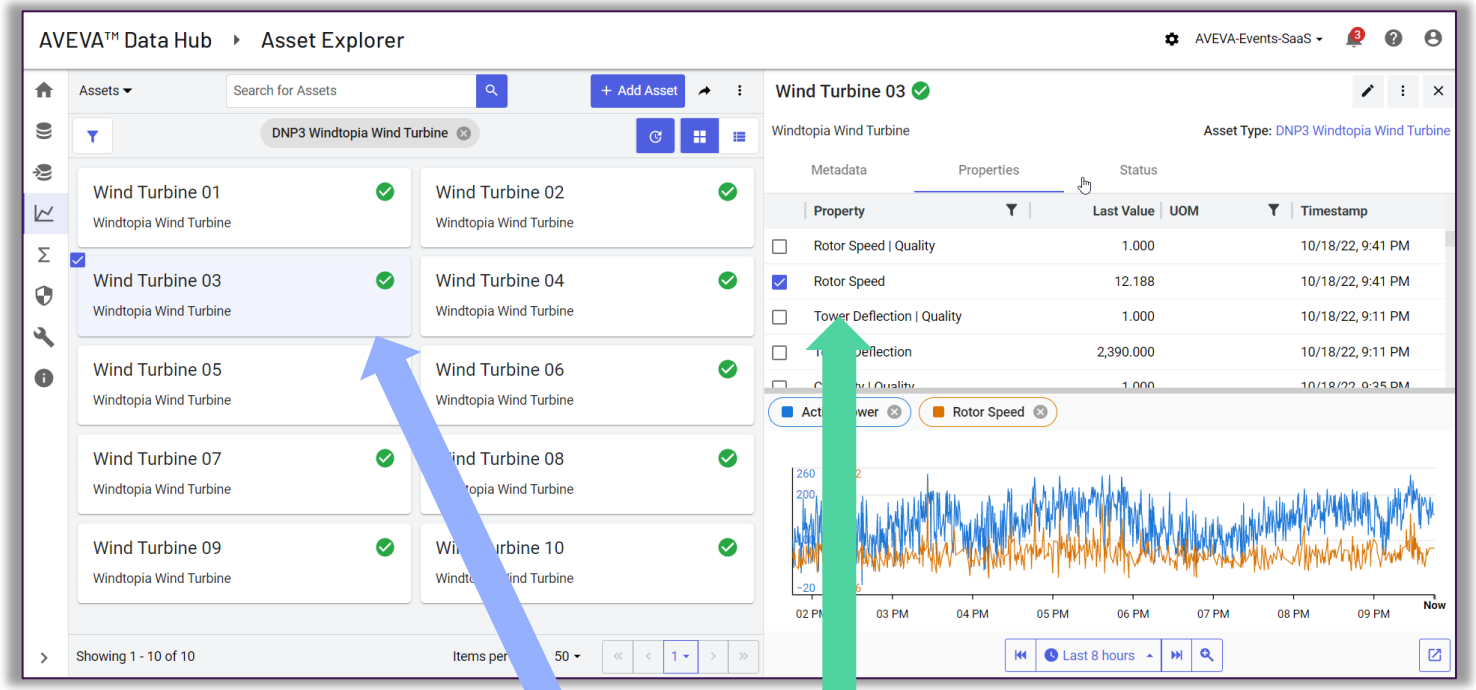
Metadata RULES

BAC identifies the **adapter name**	**101313** identifies the **equipment number**	**Phase** identifies the **measurement**	**PV** identifies the **value**

STREAM NAME **BAC.101313.Phase.PV**

BAC.101413.Phase.PV

Create Assets from Stream name patterns with Asset Rules



Asset RULES

WindTurbine03 identifies the **asset name**

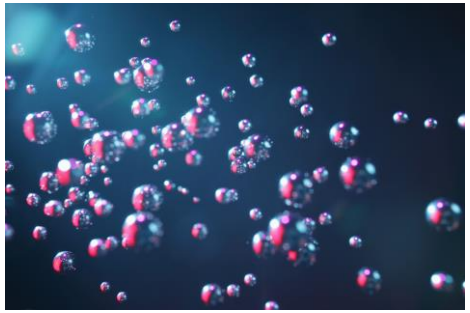
RotorSpd identifies the **Rotor Speed** property

STREAM NAME **DNP3-1.WindTurbine03.RotorSpd.0**

DNP3-1.WindTurbine03.RotorDeflection.0

DNP3-1.WindTurbine04.RotorSpd.0

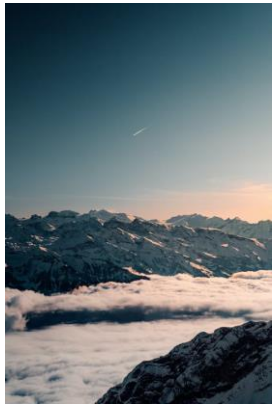
Use Case – define problem



Ingressing data from particle sensors

- Small IoT devices running on Linux
- Multiple devices in multiple locations
- Need custom code to read the values, send to AVEVA Data Hub (Sequential Data Store) as streams
- Preference to develop in .NET Core

DEMO – Ingress



Steps

- Start with Github sample: https://github.com/AVEVA/sample-adh-omf_ingress-dotnet
  - Simplify by deleting OMF connection creation logic
    - Assume OMF connections and clients have been created
  - Delete logic to clean up OMF connections, SDS types and streams

- Replace Main() method as follows:
  - Read constants from appsettings.json to configure app
  - Send OMF type and container messages
  - Setup timer loops for collecting and sending data
  - Add sensor-specific code to collect the data and add to a queue
  - Send data from queue

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README.md

❗ This organization is under construction ❗

AVEVA Samples

AVEVA is a proven leader in enabling operation intelligence. In this GitHub repo, we provide navigatoin to sample repos which will help you get started with using AVEVA technology. The samples are intended to help you get started and are not production applications and libraries.

The official AVEVA samples are organized by technology and accessible through the following table, note you can always utilize GitHub search to find a repo too:

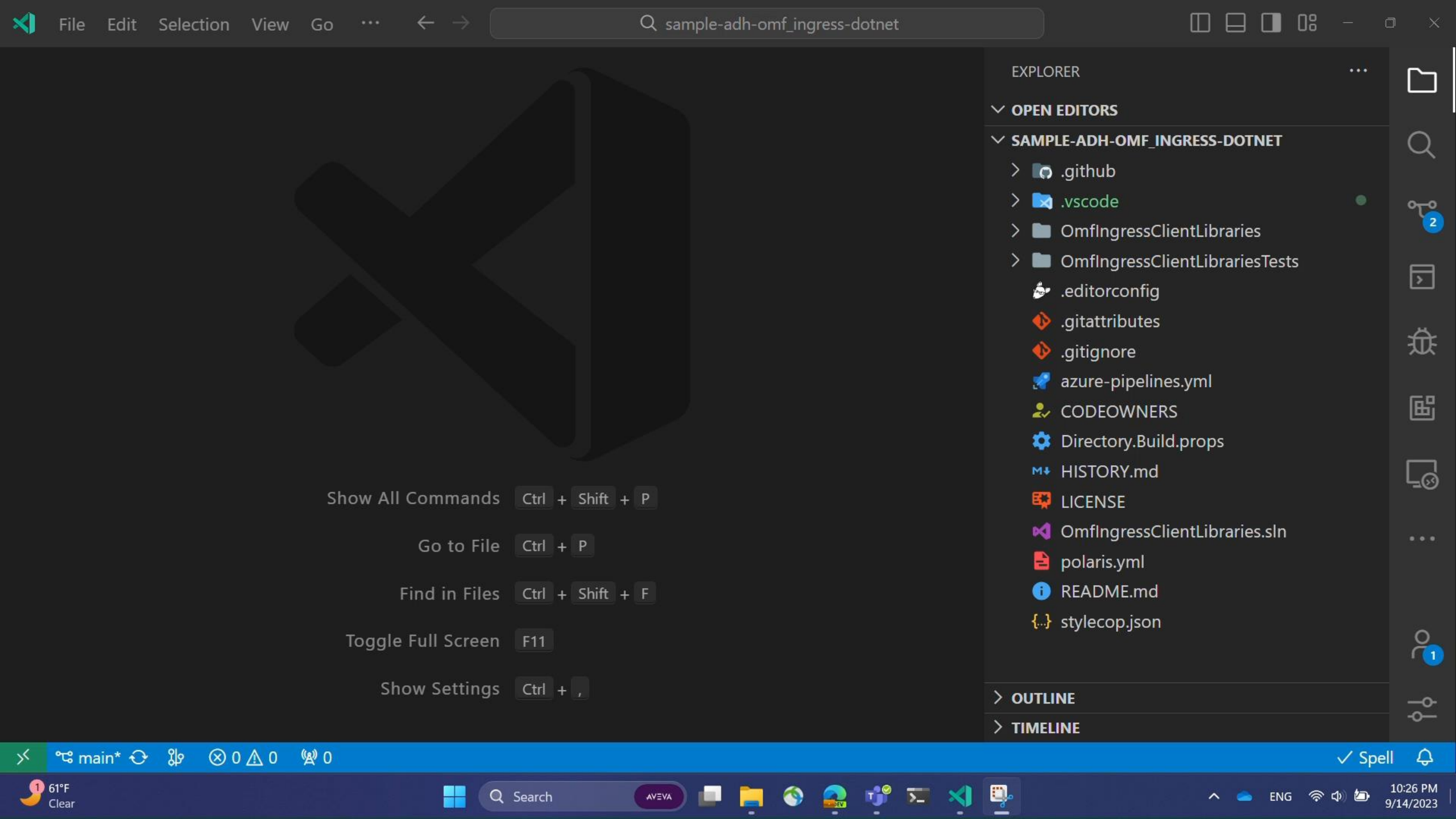
View as: Public

You are viewing the README and pinned repositories as a public user.

People

Top languages

C# Python JavaScript PowerShell Java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.github
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OmfIngressClientLibrariesTests
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Directory.Build.props
HISTORY.md
LICENSE
OmfIngressClientLibraries.sln
polaris.yml
README.md
stylecop.json
OUTLINE
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Show All Commands Ctrl + Shift + P
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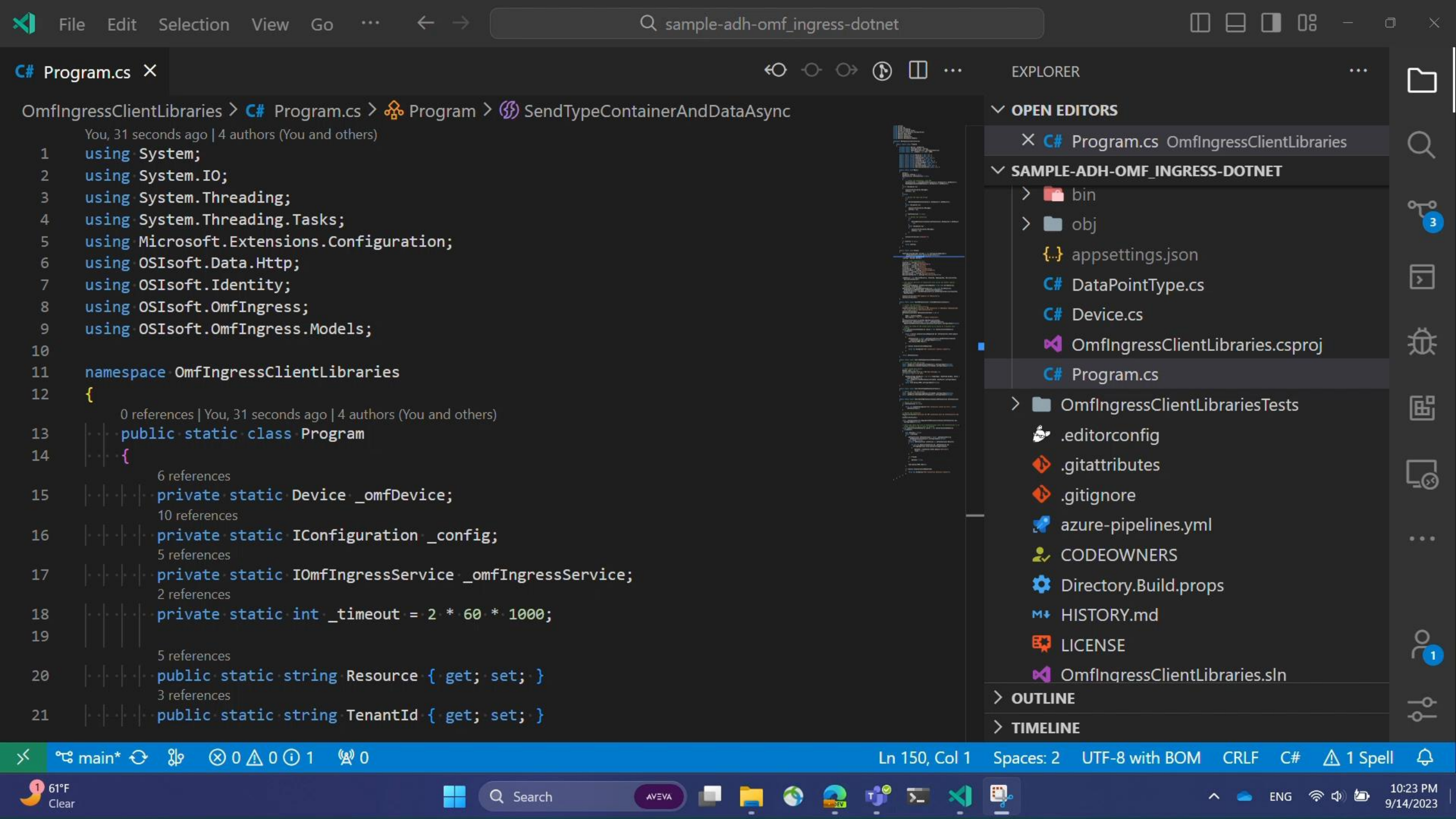
File Edit Selection View Go
sample-adh-omf_ingress-dotnet
Program.cs
OmfIngressClientLibraries > Program.cs > Program > SendTypeContainerAndDataAsync
You, 31 seconds ago | 4 authors (You and others)
using System;
using System.IO;
using System.Threading;
using System.Threading.Tasks;
using Microsoft.Extensions.Configuration;
using OSIsoft.Data.Http;
using OSIsoft.Identity;
using OSIsoft.OmfIngress;
using OSIsoft.OmfIngress.Models;
namespace OmfIngressClientLibraries
{
0 references | You, 31 seconds ago | 4 authors (You and others)
public static class Program
{
6 references
private static Device _omfDevice;
10 references
private static IConfiguration _config;
5 references
private static IOmfIngressService _omfIngressService;
2 references
private static int _timeout = 2 * 60 * 1000;
5 references
public static string Resource { get; set; }
3 references
public static string TenantId { get; set; }
EXPLORER
OPEN EDITORS
Program.cs OmfIngressClientLibraries
SAMPLE-ADH-OMF_INGRESS-DOTNET
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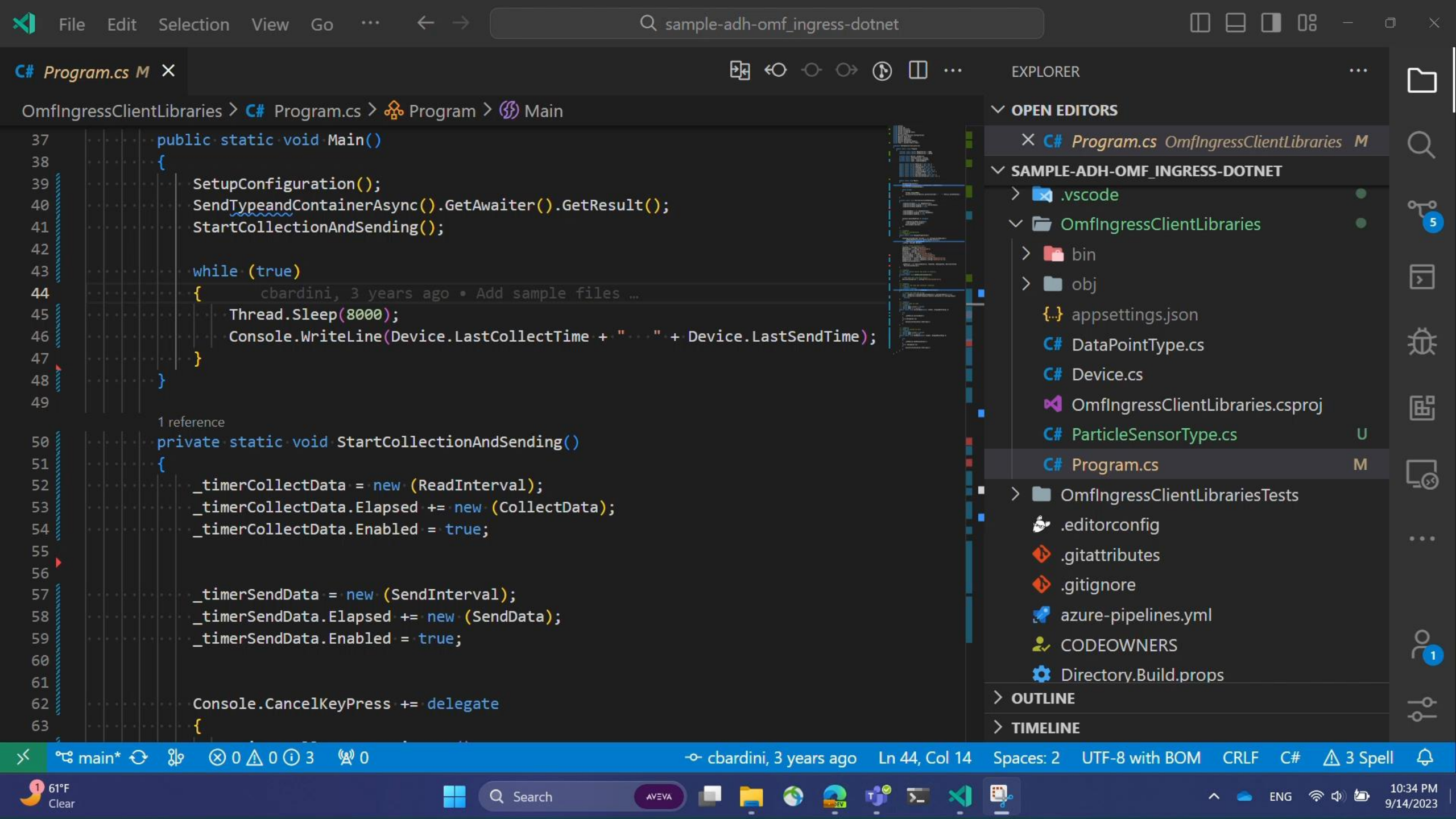
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sample-adh-omf_ingress-dotnet
Program.cs M
OmfIngressClientLibraries > Program.cs > Program > Main
public static void Main()
{
SetupConfiguration();
SendTypeandContainerAsync().GetAwaiter().GetResult();
StartCollectionAndSending();
while (true)
{ cbardini, 3 years ago • Add sample files …
Thread.Sleep(8000);
Console.WriteLine(Device.LastCollectTime + " " + Device.LastSendTime);
}
}
1 reference
private static void StartCollectionAndSending()
{
_timerCollectData = new (ReadInterval);
_timerCollectData.Elapsed += new (CollectData);
_timerCollectData.Enabled = true;
_timerSendData = new (SendInterval);
_timerSendData.Elapsed += new (SendData);
_timerSendData.Enabled = true;
Console.CancelKeyPress += delegate
{
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AVEVA™ Data Hub ▸ Sequential Data Store

Development

Types

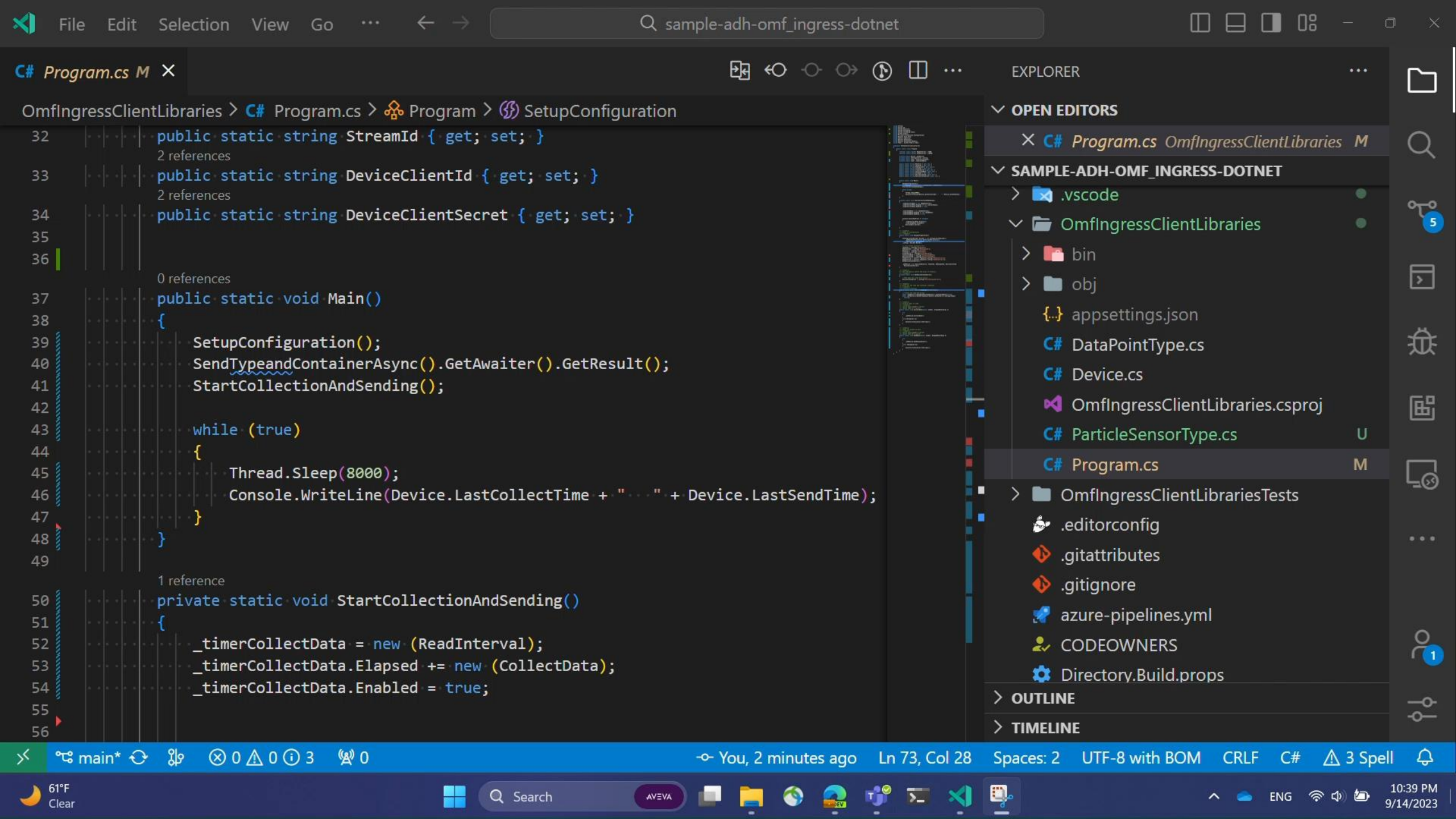
Search for Types
particle*

+ Add Type

Name	Id ↑	Description
ParticleSensorType	ParticleSensorType	

Items per page: 50

1 – 1 of 1


File Edit Selection View Go
sample-adh-omf_ingress-dotnet
Program.cs M
OmfIngressClientLibraries > Program.cs > Program > SetupConfiguration
public static string StreamId { get; set; }
2 references
public static string DeviceClientId { get; set; }
2 references
public static string DeviceClientSecret { get; set; }
0 references
public static void Main()
{
SetupConfiguration();
SendTypeandContainerAsync().GetAwaiter().GetResult();
StartCollectionAndSending();
while (true)
{
Thread.Sleep(8000);
Console.WriteLine(Device.LastCollectTime + " " + Device.LastSendTime);
}
}
1 reference
private static void StartCollectionAndSending()
{
_timerCollectData = new (ReadInterval);
_timerCollectData.Elapsed += new (CollectData);
_timerCollectData.Enabled = true;
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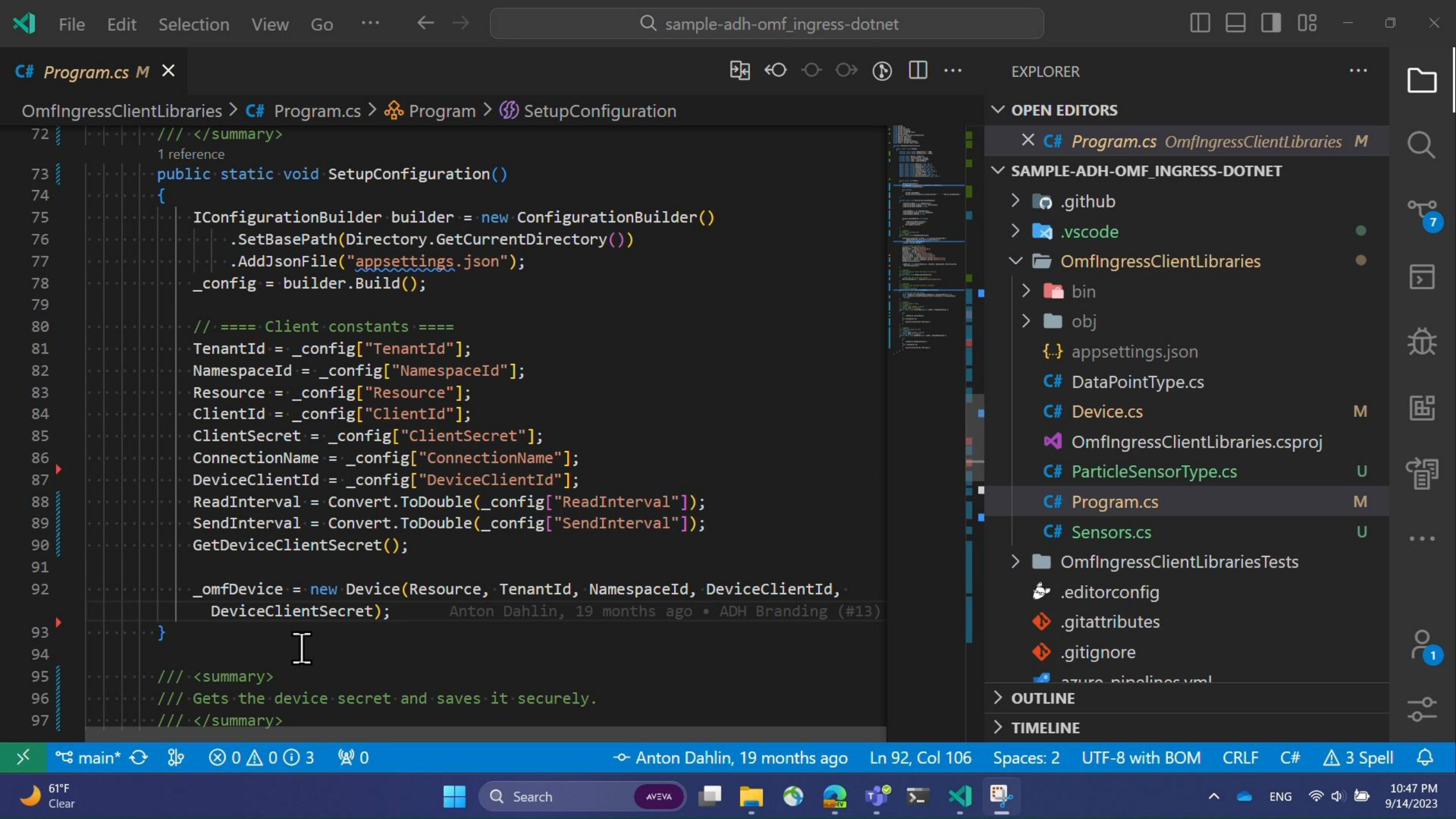
File Edit Selection View Go
sample-adh-omf_ingress-dotnet
Program.cs M
OmfIngressClientLibraries > Program.cs > Program > SetupConfiguration
/// </summary>
1 reference
public static void SetupConfiguration()
{
IConfigurationBuilder builder = new ConfigurationBuilder()
.SetBasePath(Directory.GetCurrentDirectory())
.AddJsonFile("appsettings.json");
_config = builder.Build();
// ==== Client constants ====
TenantId = _config["TenantId"];
NamespaceId = _config["NamespaceId"];
Resource = _config["Resource"];
ClientId = _config["ClientId"];
ClientSecret = _config["ClientSecret"];
ConnectionName = _config["ConnectionName"];
DeviceClientId = _config["DeviceClientId"];
ReadInterval = Convert.ToDouble(_config["ReadInterval"]);
SendInterval = Convert.ToDouble(_config["SendInterval"]);
GetDeviceClientSecret();
_omfDevice = new Device(Resource, TenantId, NamespaceId, DeviceClientId,
DeviceClientSecret);
Anton Dahlin, 19 months ago • ADH Branding (#13)
}
/// <summary>
/// Gets the device secret and saves it securely.
/// </summary>
EXPLORER
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Program.cs OmfIngressClientLibraries M
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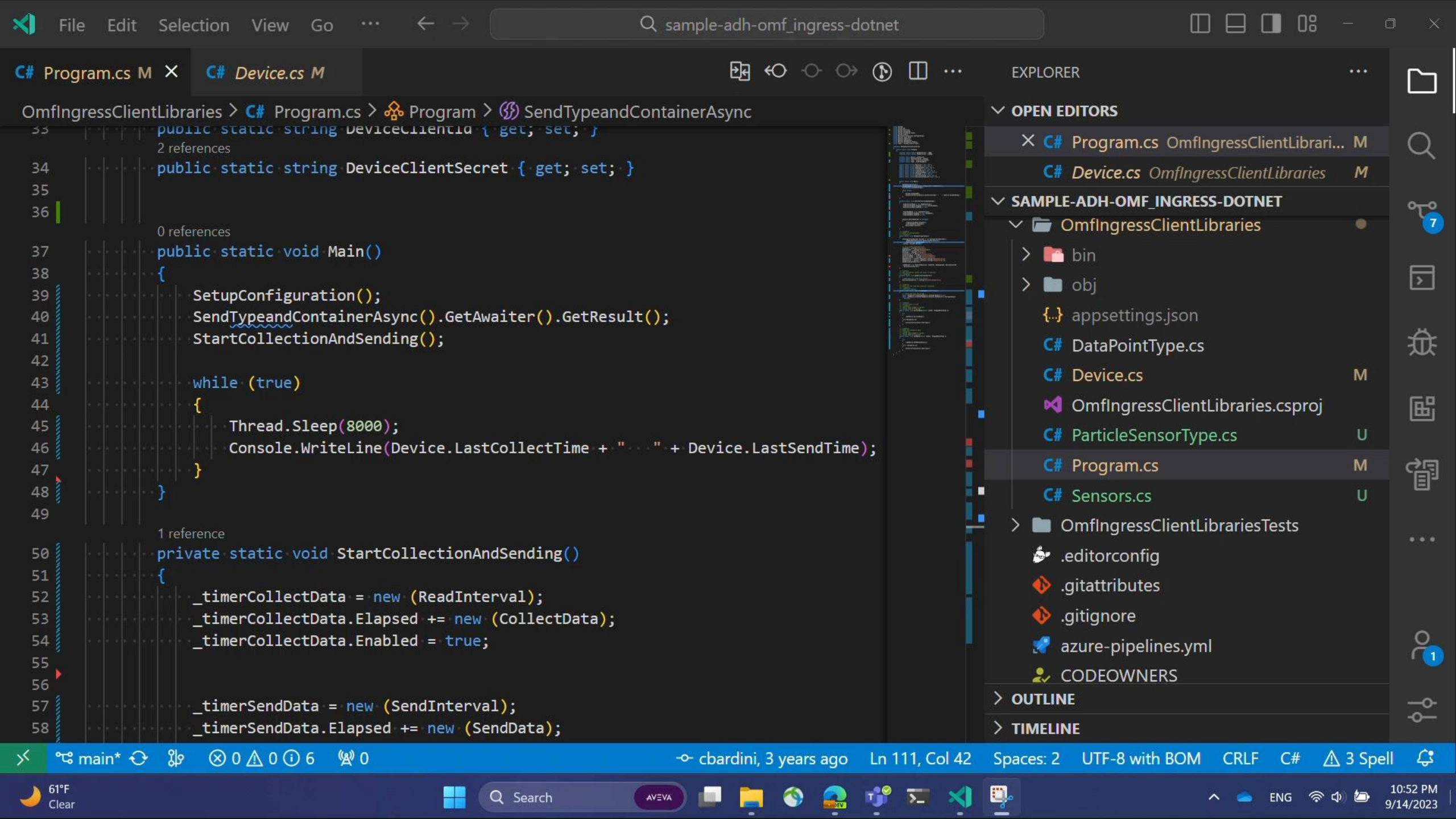
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sample-adh-omf_ingress-dotnet
Program.cs M
Device.cs M
OmfIngressClientLibraries > Program.cs > Program > SendTypeandContainerAsync
2 references
public static string DeviceClientSecret { get; set; }
0 references
public static void Main()
{
SetupConfiguration();
SendTypeandContainerAsync().GetAwaiter().GetResult();
StartCollectionAndSending();
while (true)
{
Thread.Sleep(8000);
Console.WriteLine(Device.LastCollectTime + " " + Device.LastSendTime);
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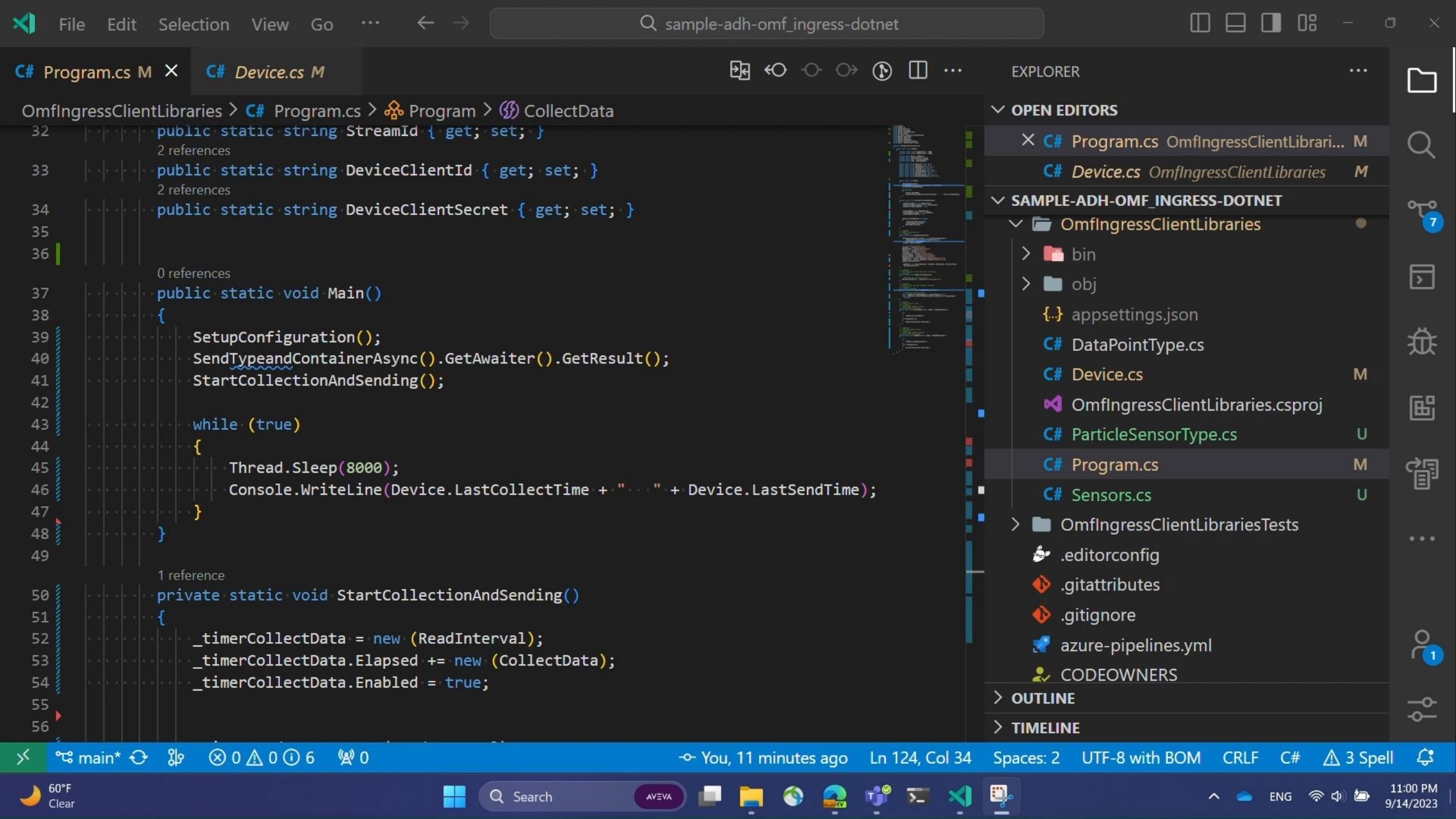
File Edit Selection View Go
sample-adh-omf_ingress-dotnet
Program.cs M
Device.cs M
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public static string StreamId { get; set; }
2 references
public static string DeviceClientId { get; set; }
2 references
public static string DeviceClientSecret { get; set; }
0 references
public static void Main()
{
SetupConfiguration();
SendTypeandContainerAsync().GetAwaiter().GetResult();
StartCollectionAndSending();
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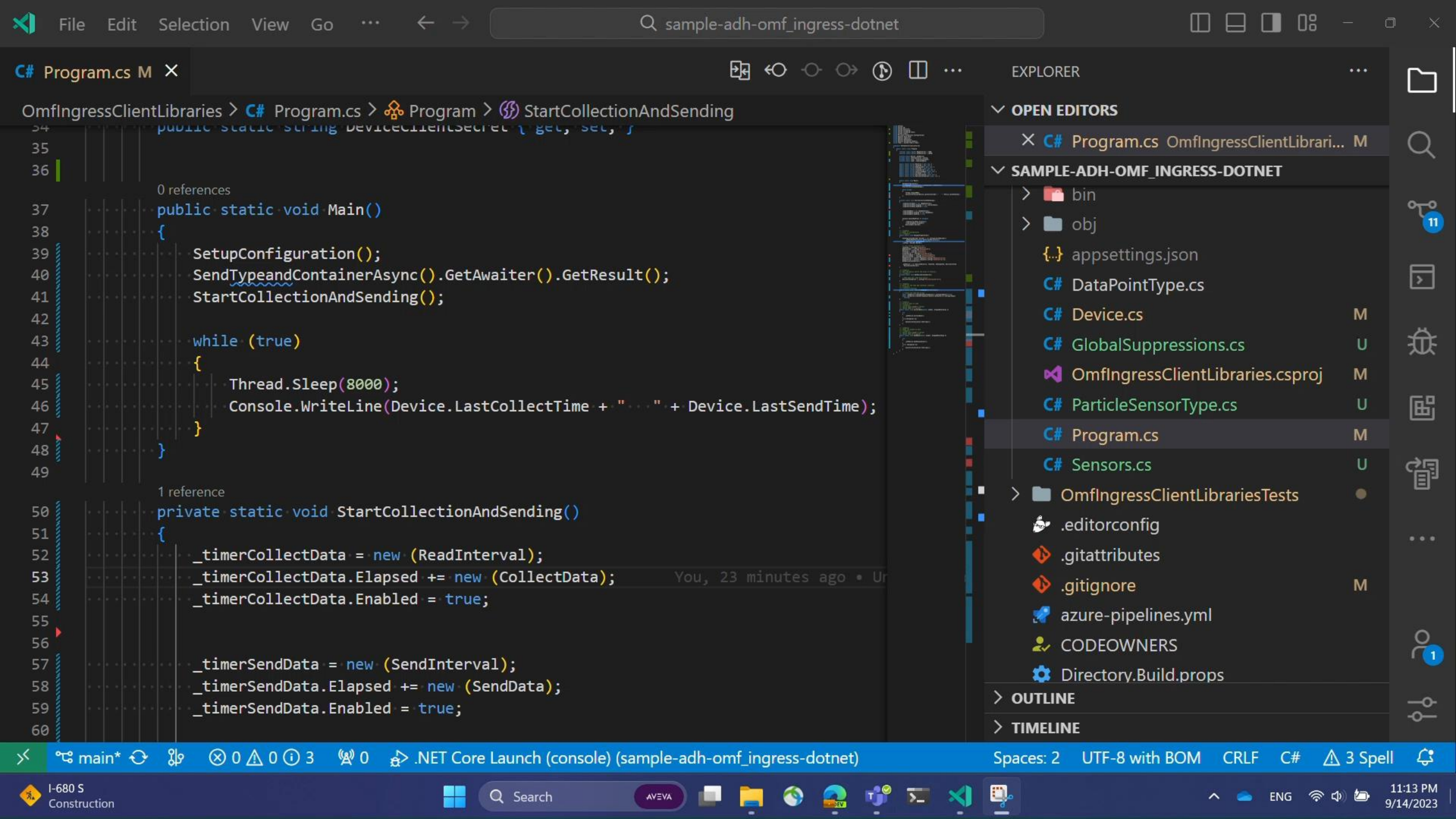
File Edit Selection View Go
sample-adh-omf_ingress-dotnet
Program.cs M
OmfIngressClientLibraries > Program.cs > Program > StartCollectionAndSending
0 references
public static void Main()
{
SetupConfiguration();
SendTypeandContainerAsync().GetAwaiter().GetResult();
StartCollectionAndSending();
while (true)
{
Thread.Sleep(8000);
Console.WriteLine(Device.LastCollectTime + " " + Device.LastSendTime);
}
}
1 reference
private static void StartCollectionAndSending()
{
_timerCollectData = new (ReadInterval);
_timerCollectData.Elapsed += new (CollectData);
You, 23 minutes ago
_timerCollectData.Enabled = true;
_timerSendData = new (SendInterval);
_timerSendData.Elapsed += new (SendData);
_timerSendData.Enabled = true;
EXPLORER
OPEN EDITORS
Program.cs OmfIngressClientLibrari... M
SAMPLE-ADH-OMF_INGRESS-DOTNET
bin
obj
appsettings.json
DataPointType.cs
Device.cs M
GlobalSuppressions.cs U
OmfIngressClientLibraries.csproj M
ParticleSensorType.cs U
Program.cs M
Sensors.cs U
OmfIngressClientLibrariesTests
.editorconfig
.gitattributes
.gitignore M
azure-pipelines.yml
CODEOWNERS
Directory.Build.props
OUTLINE
TIMELINE
main*
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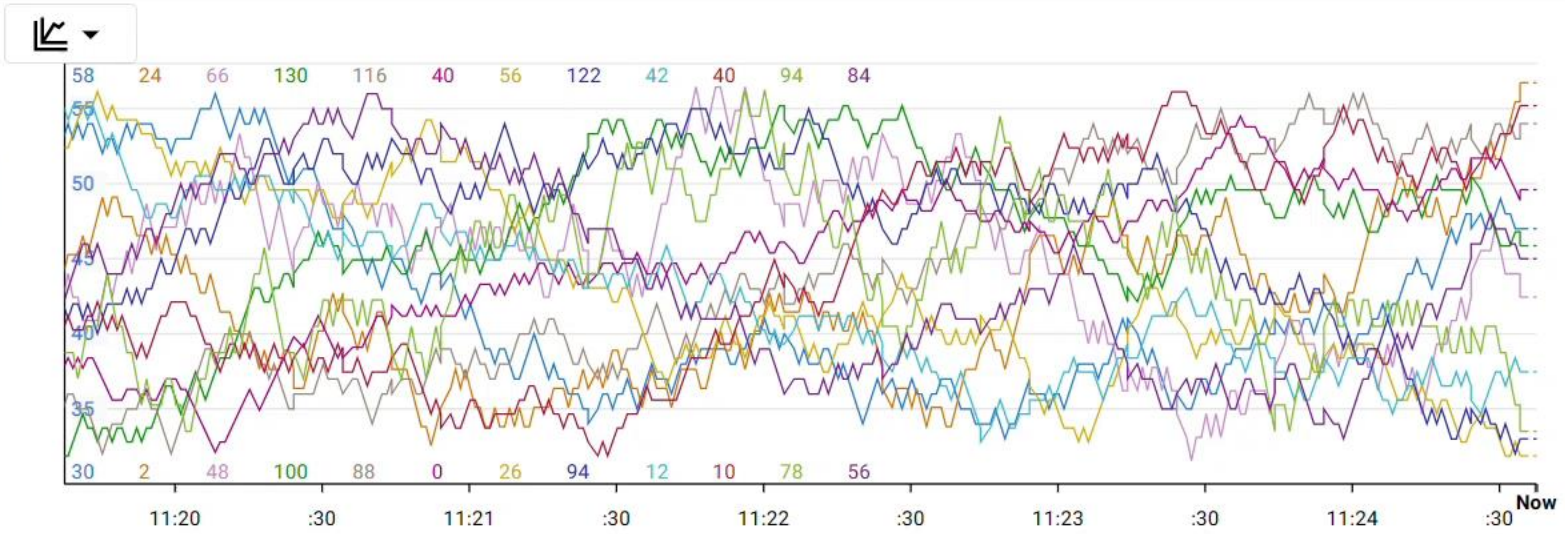
11:13 PM
9/14/2023

Download CSV RESET



Last 5 minutes

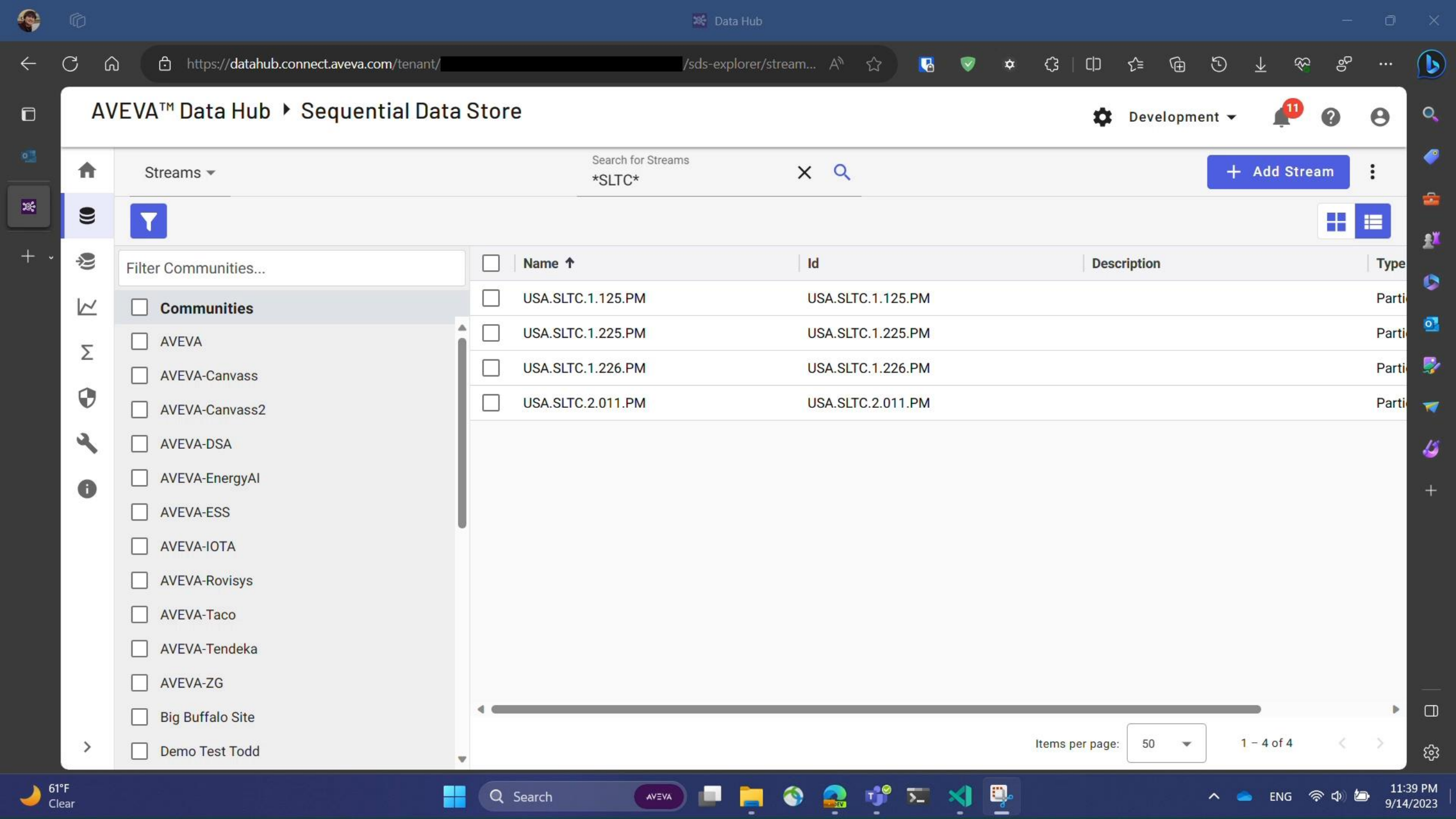
Name	Timestamp	Value	UOM
USA.SLTC.1.125.PM Development			
Count0.3	Sep 14, 2023, 11:24:34 PM	47	count
Count0.5	Sep 14, 2023, 11:24:34 PM	23	count
Count1.0	Sep 14, 2023, 11:24:34 PM	56	count

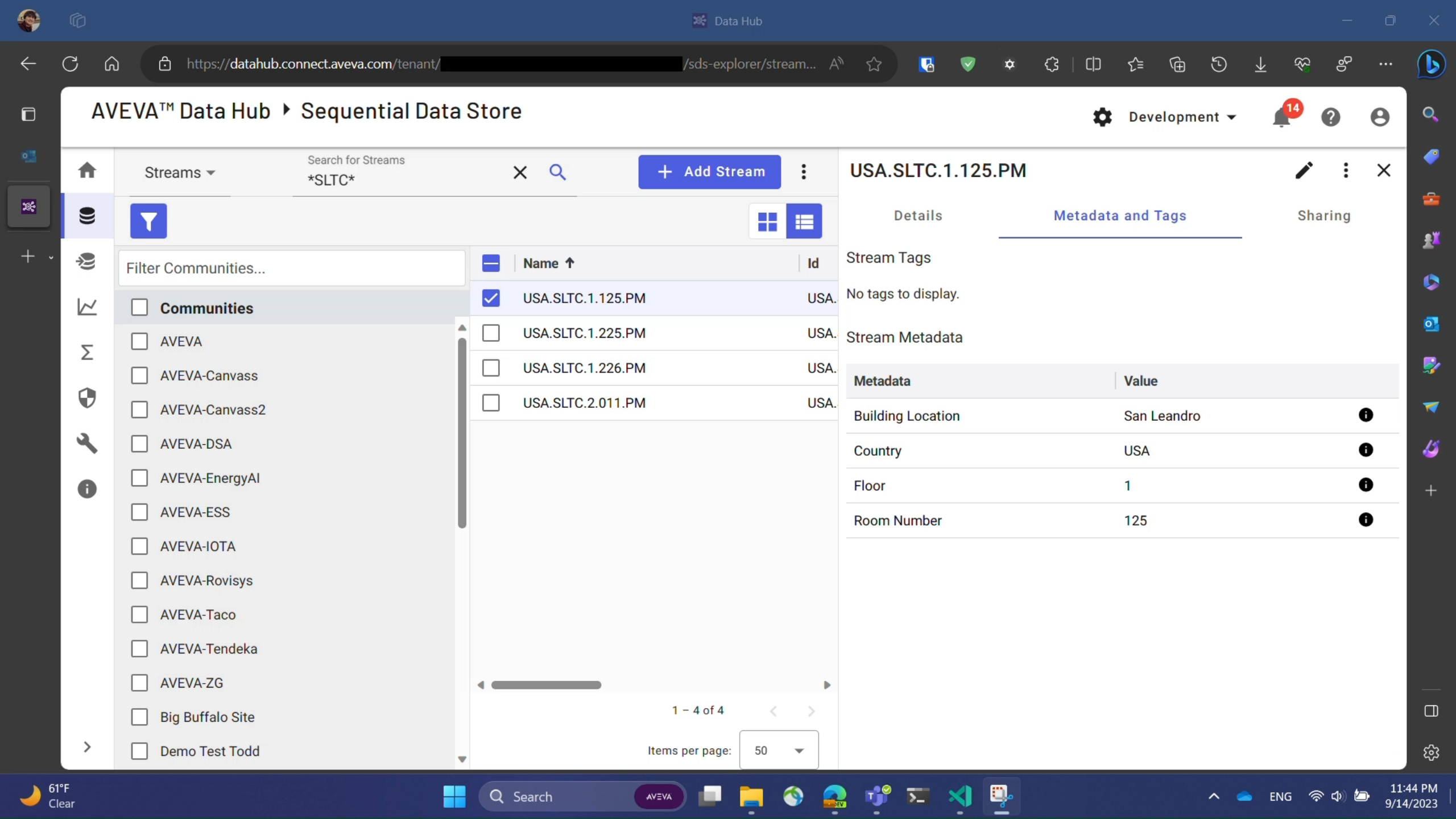
Add Traces

Assets | Streams

Search: USA.SLTC.1.125.PM

- USA.SLTC.1.125.PM | Count0.3
- USA.SLTC.1.125.PM | Count0.5
- USA.SLTC.1.125.PM | Count1.0
- USA.SLTC.1.125.PM | Count2.5
- USA.SLTC.1.125.PM | Count5.0
- USA.SLTC.1.125.PM | Count1...
- USA.SLTC.1.125.PM | PM1.0S
- USA.SLTC.1.125.PM | PM1.0F


Data Hub
https://datahub.connect.aveva.com/tenant/[redacted]/sds-explorer/stream...
AVEVA™ Data Hub ▸ Sequential Data Store
Development
11
Streams
Search for Streams
SLTC
Add Stream
Filter Communities...
Communities
AVEVA
AVEVA-Canvass
AVEVA-Canvass2
AVEVA-DSA
AVEVA-EnergyAI
AVEVA-ESS
AVEVA-IOTA
AVEVA-Rovisys
AVEVA-Taco
AVEVA-Tendeka
AVEVA-ZG
Big Buffalo Site
Demo Test Todd
Name
Id
Description
Type
USA.SLTC.1.125.PM
USA.SLTC.1.225.PM
USA.SLTC.1.226.PM
USA.SLTC.2.011.PM
Items per page:
50
1 – 4 of 4
61°F
Clear
Search
ENG
11:39 PM
9/14/2023


Data Hub
https://datahub.connect.aveva.com/tenant/[redacted]/sds-explorer/stream...
AVEVA™ Data Hub ▸ Sequential Data Store
Development
14
Streams
Search for Streams
SLTC
Add Stream
Filter Communities...
Communities
AVEVA
AVEVA-Canvass
AVEVA-Canvass2
AVEVA-DSA
AVEVA-EnergyAI
AVEVA-ESS
AVEVA-IOTA
AVEVA-Rovisys
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1 – 4 of 4
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Details
Metadata and Tags
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Stream Metadata
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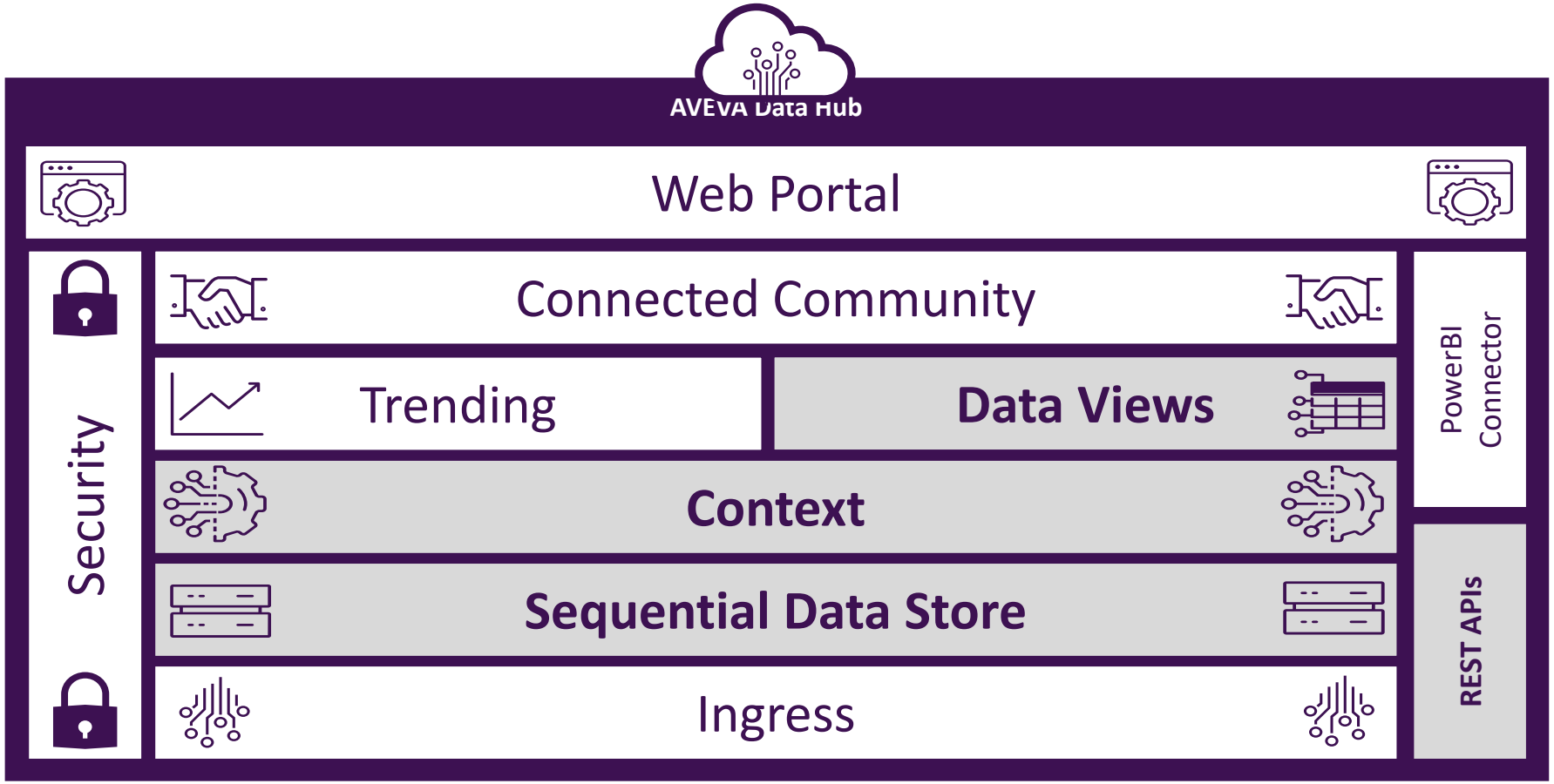
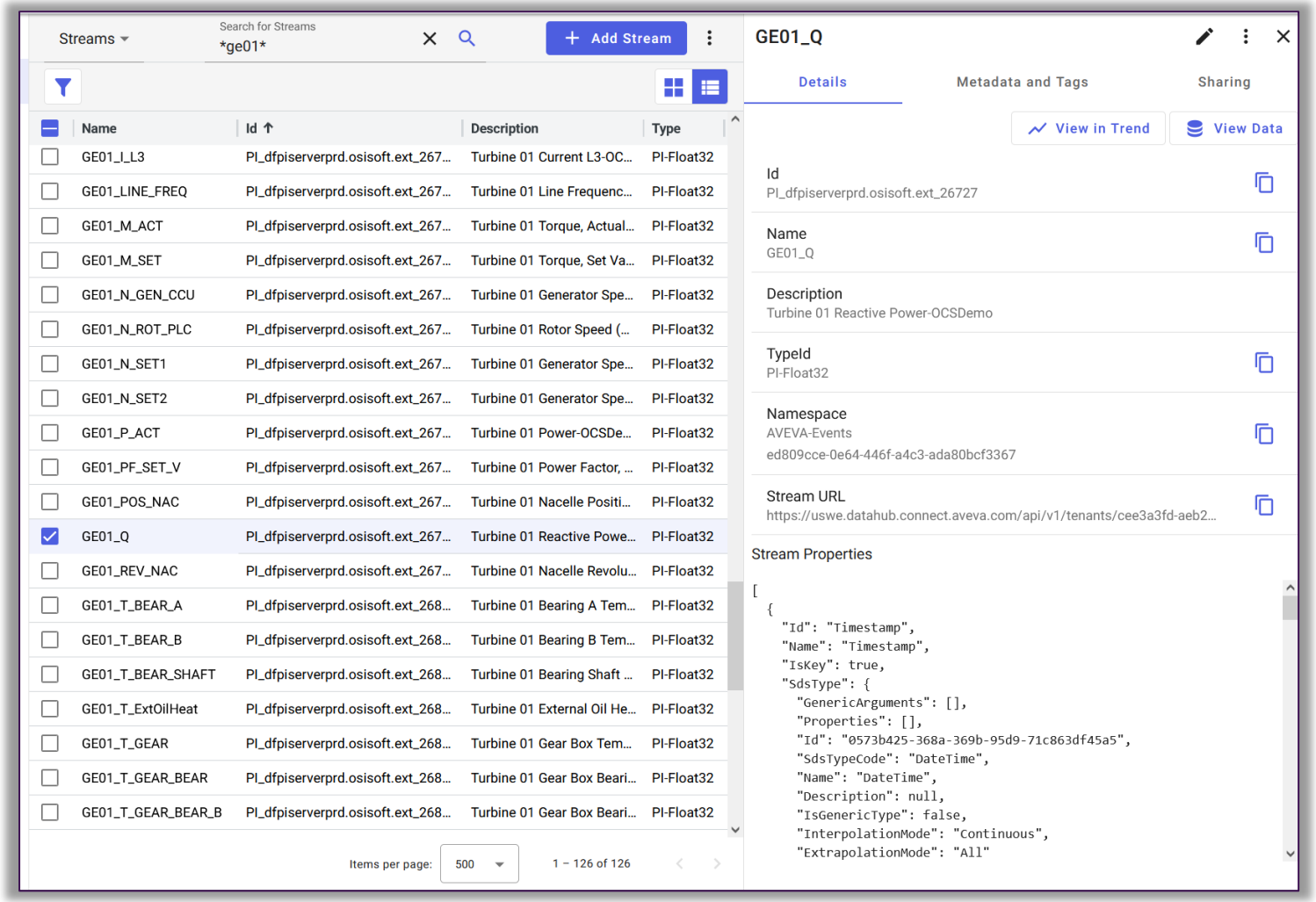
Egress



How to best read data out?

What are streams?

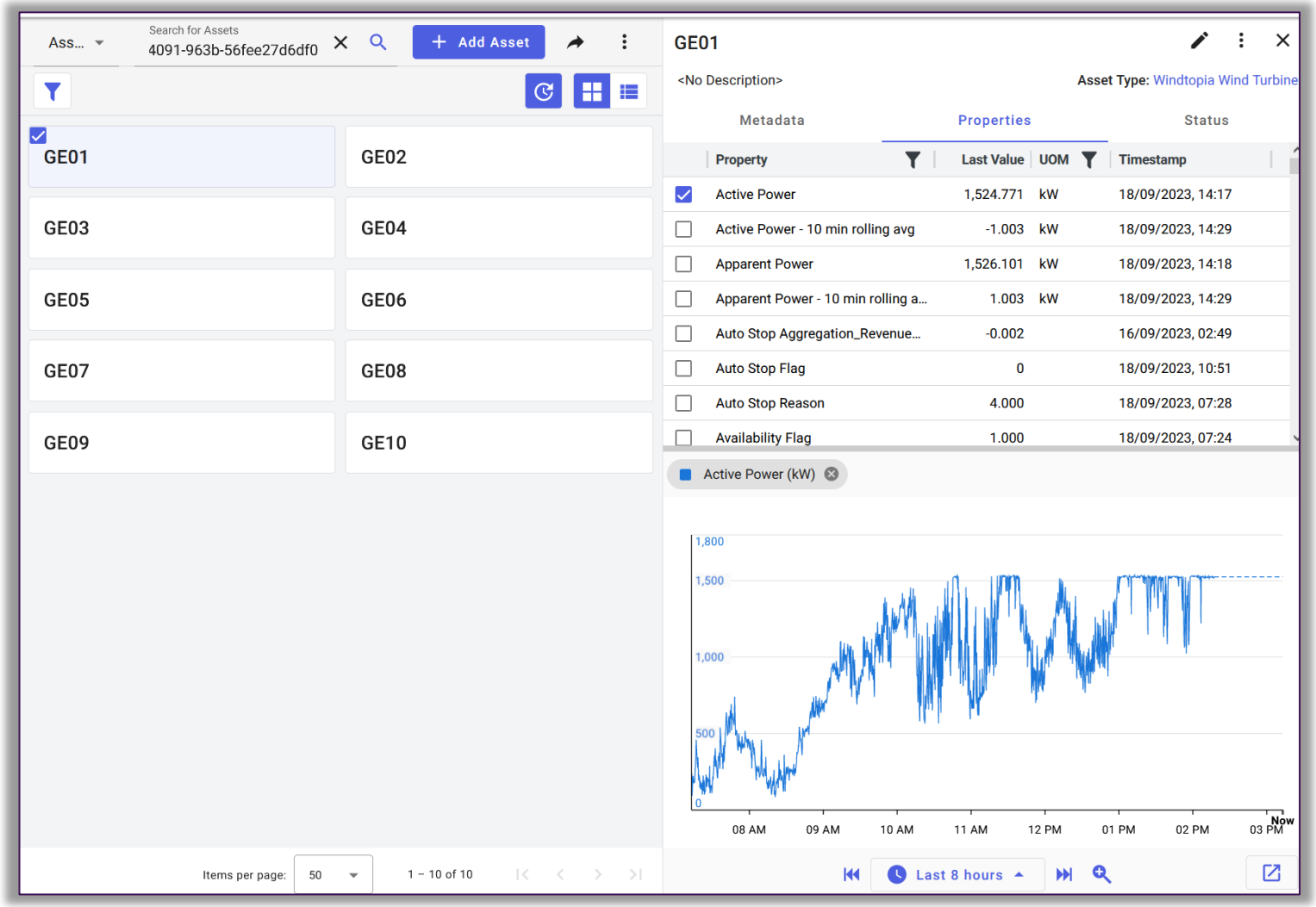
- Fundamental block of SDS
  - An instantiated object of an SDS type
- Can have UOMs, interpolation, extrapolation defined on each property at the stream or type
- Metadata and tags
- Can be shared to a community
- Summary data calls
- Stream views
  - Remove or rename properties
  - Change UOM



How to best read data out?

What are assets?

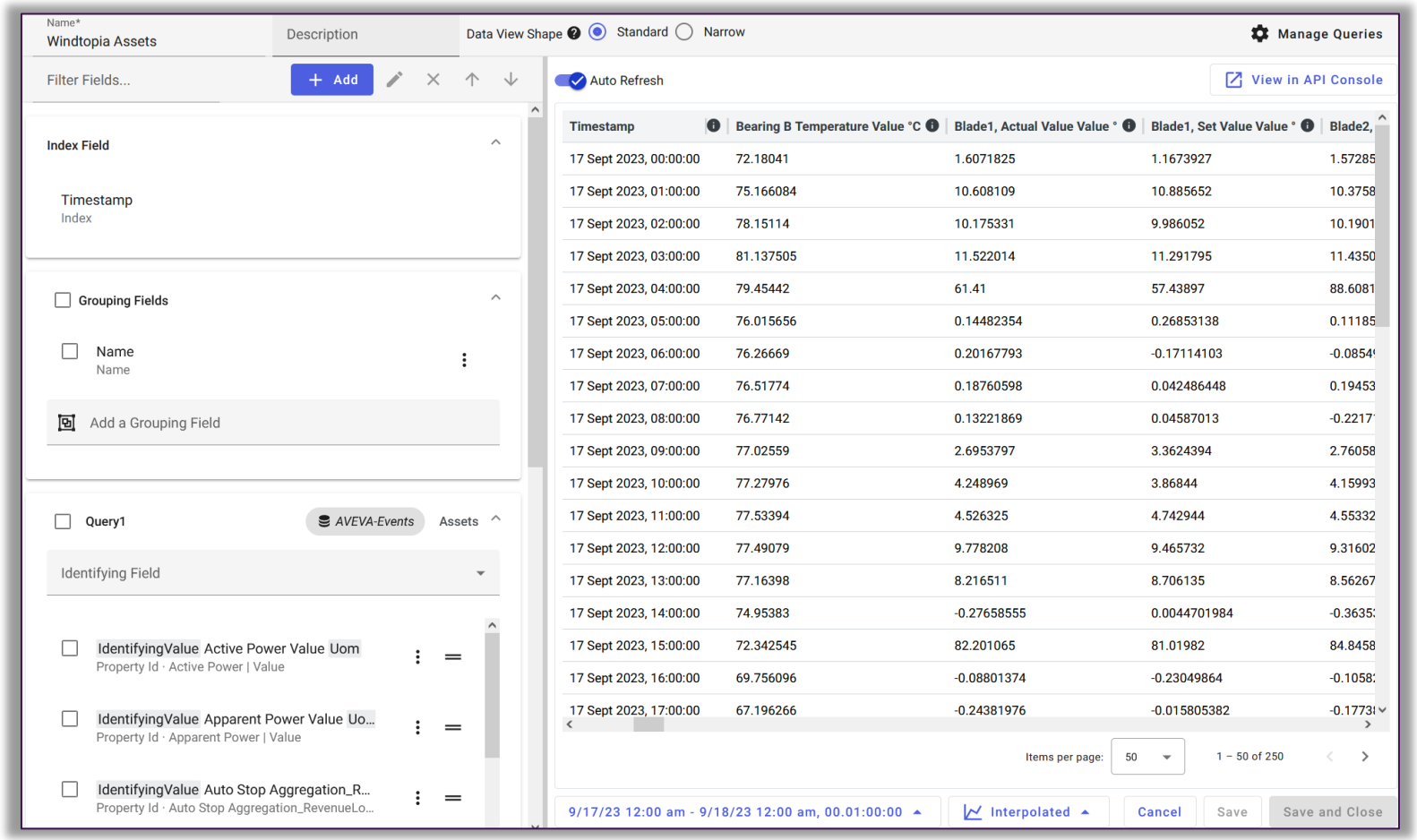
- Fundamental block in ADH
  - Can be based on an asset type
- Collection of streams
  - Can read just some properties(streams)
- Metadata
- Asset status



How to best read data out?

What are data views?

- Based on a query against assets or streams
  - Can query other namespaces and communities
- Pre-defined (time range is variable)
- Re-name columns
- Summary values
- Different output forms
  - JSON
  - CSV
  - Table
  - Parquet



How to best read data out?

Things to consider

- Repeated pre-defined query vs ad-hoc investigation
- Interpolated vs stored (note all support both…)
- Tabular data?
- Default value
- Separating query into smaller ranges on different threads
- Paging
- UOMs
- Summary Calculations

DEMO Use Case

Wind farm operator

- Operating fleet of wind turbines
- Need one year’s worth of 5 second data for 10 assets with ~50 streams each
- Need to make the data available for machine learning project
  => would like the data in a centralized data lakehouse in **Microsoft Fabric** to perform ML analytics at scale

- Use Data Views in AVEVA Data Hub to transform data from assets to a more structured tabular form, and determine the API and query parameters to egress in Apache Parquet format
- Use Data Pipelines to ingest this data as efficiently as possible into Fabric using pagination and parallelization

- AVEVA collaborated with Microsoft in designing such a pipeline

AVEVA™ Data Hub

Development

2

Customize

Latest Service Updates

PI to Data Hub 2.2 is released

Jul 17, 2023, 2:33:09 PM

AVEVA is pleased to announce a new release for PI to AVEVA Data Hub. With this release, PI to Data Hub now enables usage reporting for AVEVA PI Data Infrastructure – aggregate tag licensing model. This licensing option allows customers to purchase PI Tags in aggregate (with a minimum committed number of tags) across any number of deployed PI Servers rather than having to specify a fixed number of PI Tags for a specific PI Data Archive server.

New! AVEVA PI Data Infrastructure – aggregate tag support

Quick Links

- View API documentation
- Explore working code samples provided in multiple programming languages
- View service blog
- Manage Users And User Access For Your Organization
- Manage clients and secrets for securely accessing your data
- Experiment with the REST API console

Yesterday's Resource Usage

Oct 9, 2023

Streams Stored	Streams Accessed	Shared Streams Accessed
70,513	1,478	0

System Health

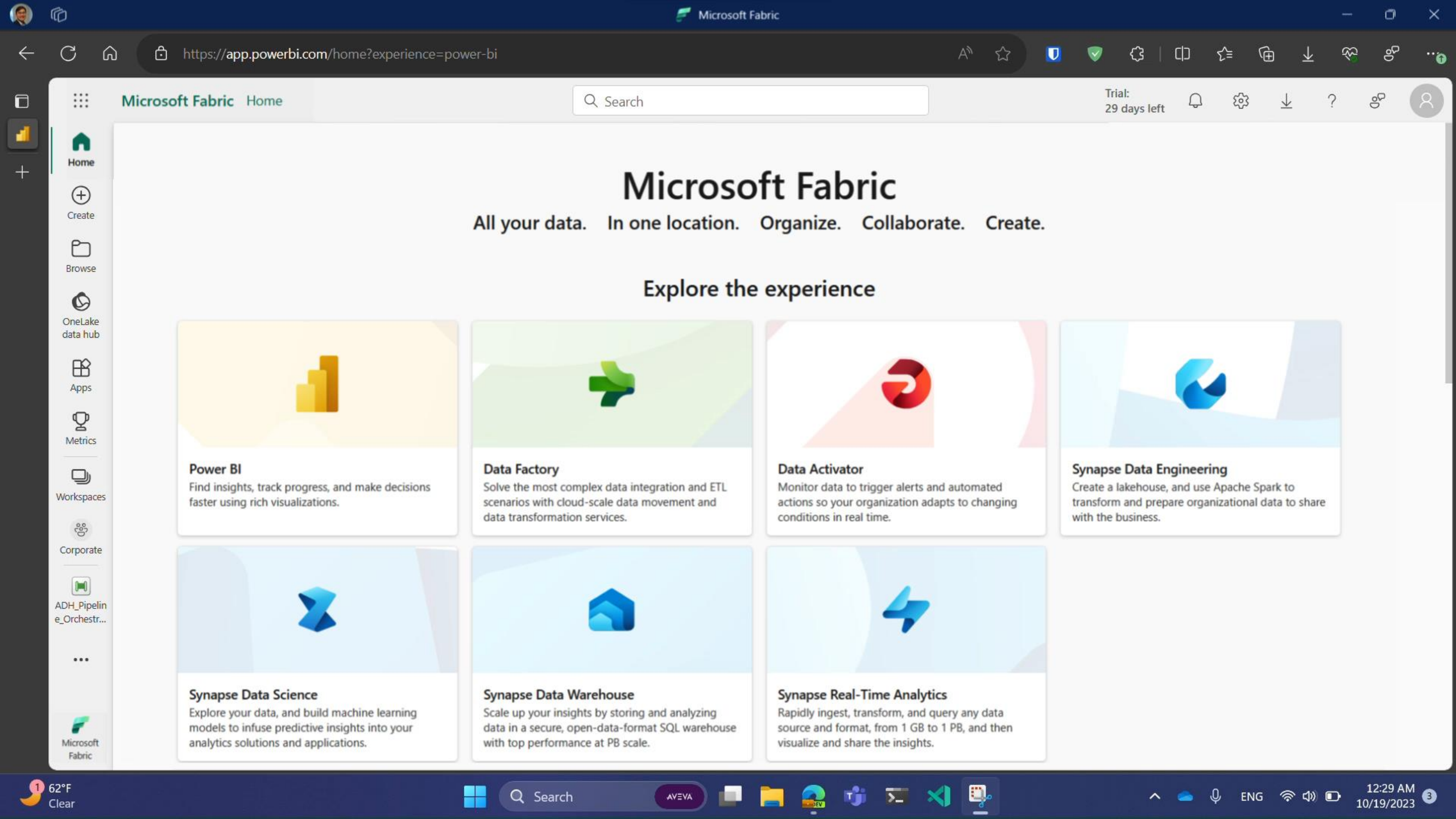
Ok

PI to Data Hub Agents

14
Total Agents

7	2	5	0
Good	Warning	Bad	Stopped

Systems


Microsoft Fabric
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Microsoft Fabric Home
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Trial:
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Home
Create
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OneLake data hub
Apps
Metrics
Workspaces
Corporate
ADH_Pipeline_Orchestr...
Microsoft Fabric
Microsoft Fabric
All your data. In one location. Organize. Collaborate. Create.
Explore the experience
Power BI
Find insights, track progress, and make decisions faster using rich visualizations.
Data Factory
Solve the most complex data integration and ETL scenarios with cloud-scale data movement and data transformation services.
Data Activator
Monitor data to trigger alerts and automated actions so your organization adapts to changing conditions in real time.
Synapse Data Engineering
Create a lakehouse, and use Apache Spark to transform and prepare organizational data to share with the business.
Synapse Data Science
Explore your data, and build machine learning models to infuse predictive insights into your analytics solutions and applications.
Synapse Data Warehouse
Scale up your insights by storing and analyzing data in a secure, open-data-format SQL warehouse with top performance at PB scale.
Synapse Real-Time Analytics
Rapidly ingest, transform, and query any data source and format, from 1 GB to 1 PB, and then visualize and share the insights.
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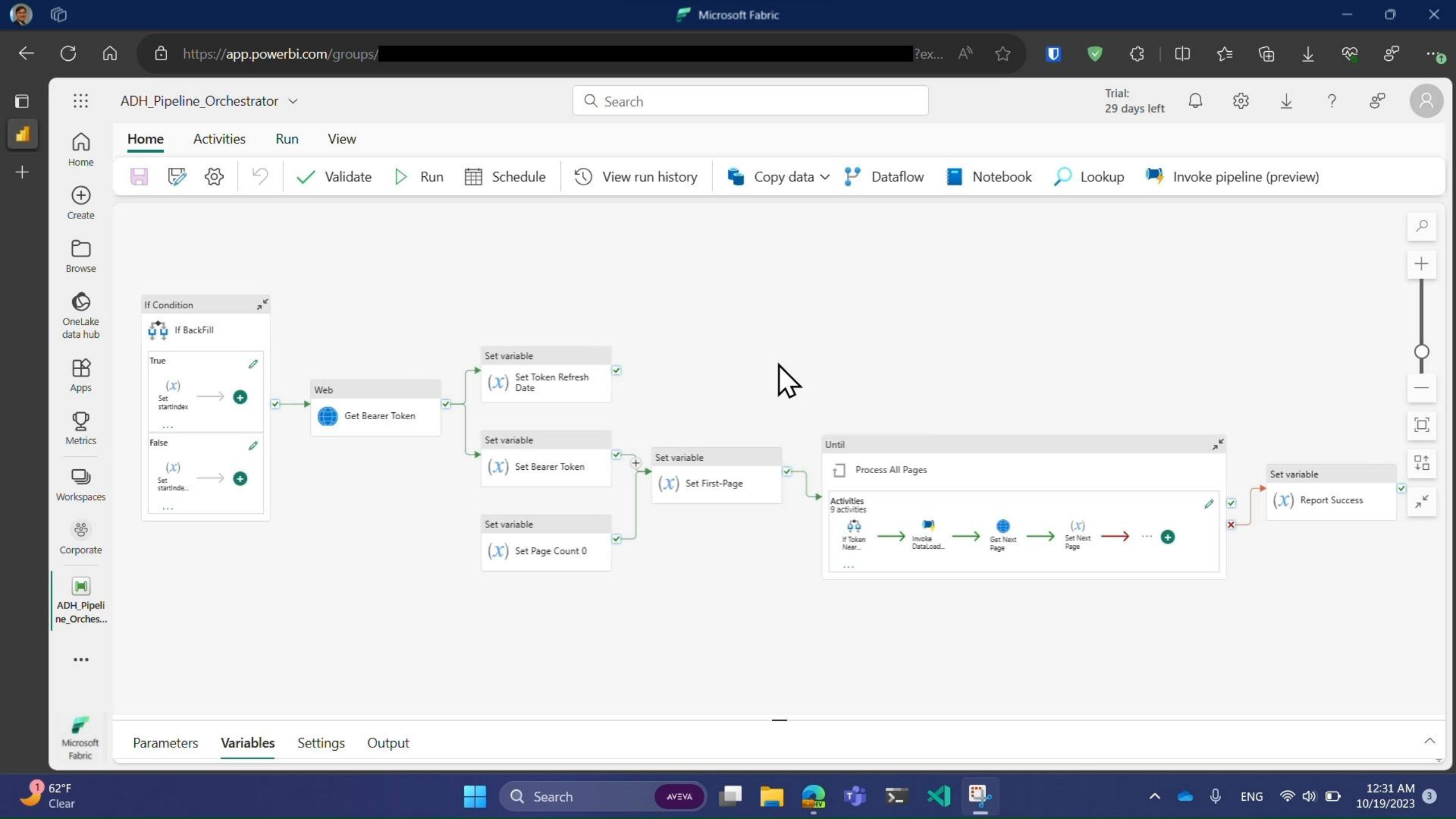
Microsoft Fabric
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ADH_Pipeline_Orchestrator
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Home
Activities
Run
View
Validate
Run
Schedule
View run history
Copy data
Dataflow
Notebook
Lookup
Invoke pipeline (preview)
Create
Browse
OneLake data hub
Apps
Metrics
Workspaces
Corporate
ADH_Pipeline_Orches...
Microsoft Fabric
If Condition
If BackFill
True
Set startIndex
False
Set startInde...
Web
Get Bearer Token
Set variable
Set Token Refresh Date
Set variable
Set Bearer Token
Set variable
Set Page Count 0
Set variable
Set First-Page
Until
Process All Pages
Activities
9 activities
If Token Near...
Invoke DataLoad...
Get Next Page
Set Next Page
Set variable
Report Success
Parameters
Variables
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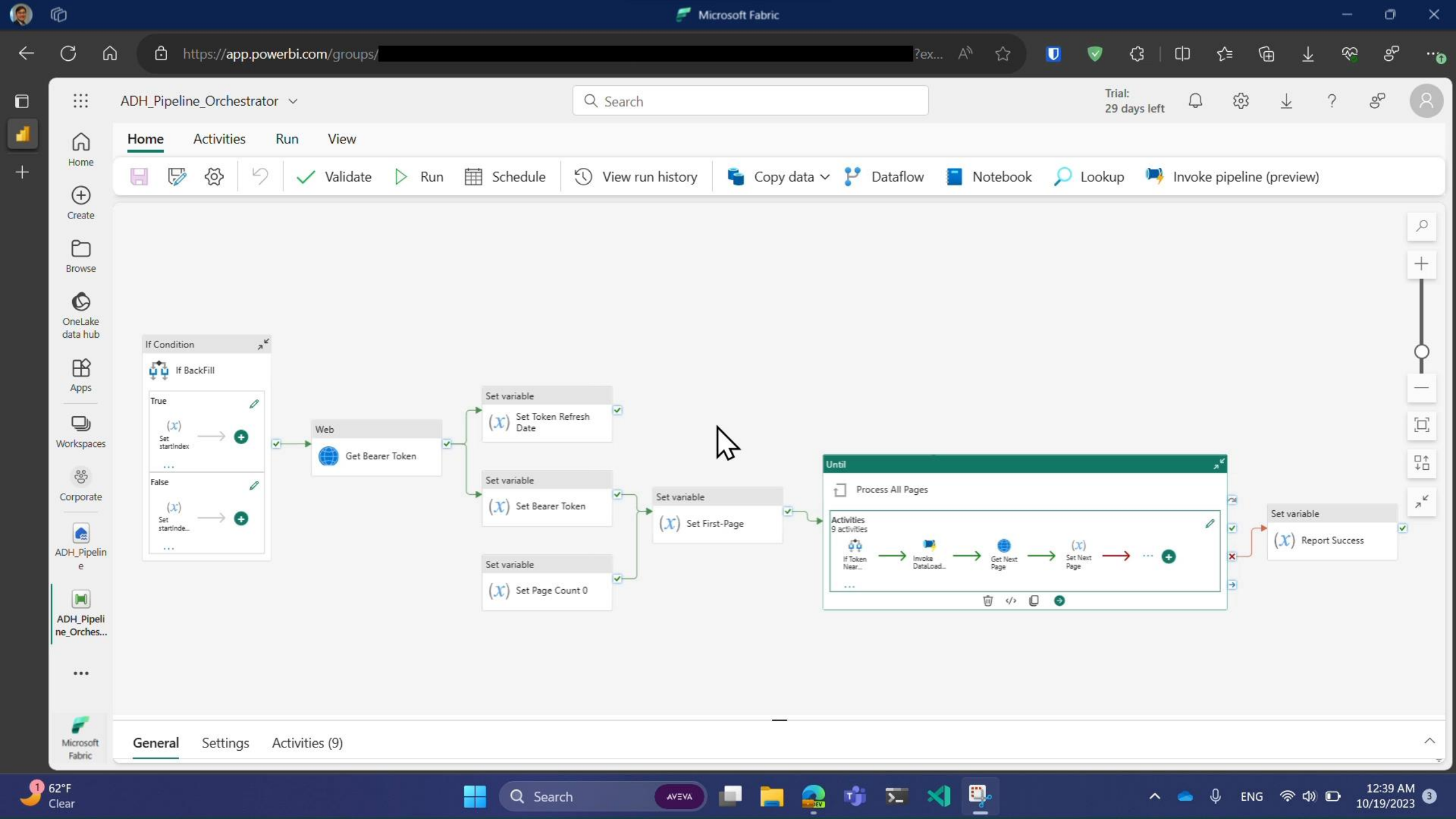
Microsoft Fabric
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ADH_Pipeline_Orchestrator
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Set variable
Set Token Refresh Date
Set variable
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Set variable
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Set variable
Set First-Page
Until
Process All Pages
Activities
9 activities
If Token Near...
Invoke DataLoad...
Get Next Page
Set Next Page
Set variable
Report Success
General
Settings
Activities (9)
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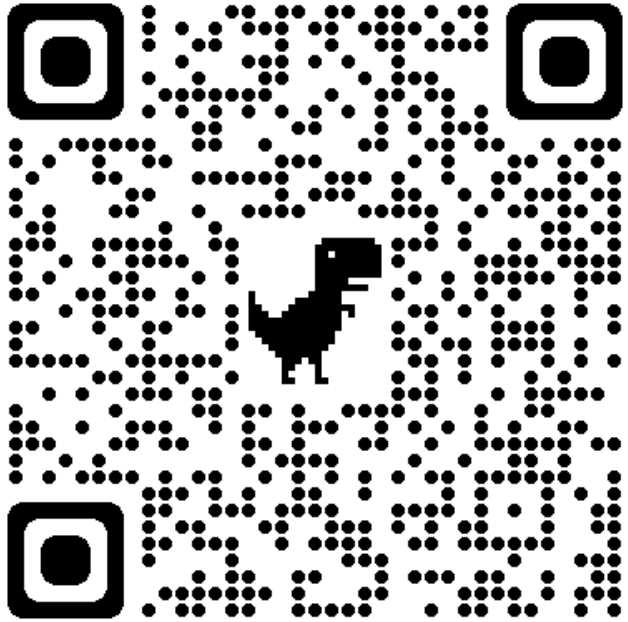
Link to Tutorial Blog

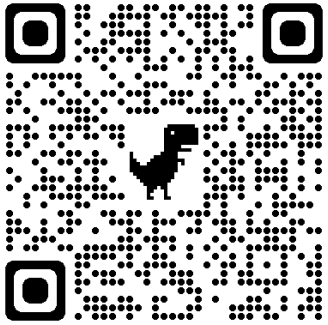
- Data Pipelines Tutorial: Ingest files into a Lakehouse from a REST API with pagination ft. AVEVA Data Hub | Microsoft Fabric Blog | Microsoft Fabric



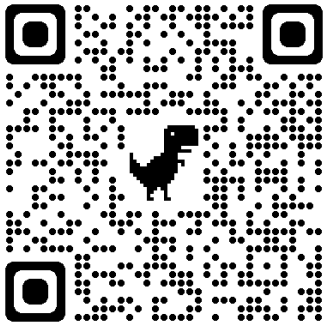
https://bit.ly/3PUy2Vq

Additional Useful Links

- AVEVA and OSIsoft Github Samples
  - AWC Demo Code – https://github.com/AVEVA/demos-aveva_world_2023
  - ADH OMF Ingress .NET Sample – https://bit.ly/48JpN7b



- OMF Documentation
  - Introduction to OMF – https://bit.ly/45Zdu54
  - OMF Application Development – https://bit.ly/3PGFBjF



- AVEVA Data Hub Documentation
  - ADH Portal Overview – https://bit.ly/3LSVBg2
  - Data Views API Overview – https://bit.ly/3Zkxs7H

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Principal Software Developer

- AVEVA
- Yuki.Kimura@aveva.com

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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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