AVEVA PI WORLD

Remote Operations Monitoring in OCS

Presented By: Doug Broad and Collin Bardini

REMOTE OPERATIONS MONITORING

Topics & Tools

1. PI Adapters
   - Structured Files, DNP3, MQTT
2. Edge Command / EdgeCmd
3. Edge Data Store / EDS
4. OSIsoft Message Format / OMF
5. OSIsoft Cloud Services / OCS
   - Assets, Asset Types, Asset Rules, Trend
6. GitHub Code Samples

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https://github.com/osisoft/OSI-Samples

README.md

OSIsoft Samples

(OSIsoft) is a proven leader in enabling operation intelligence. In this GitHub repo, we provide samples which will help you get started with using OSIsoft technology. The repo includes samples against the PI Server via PI Web API, samples using OSIsoft Cloud Services (OCS) via the OCS API directly and using libraries, and samples creating OSIsoft Message Format (OMF) messages and sending them. The samples are intended to help you get started and are not production applications and libraries.

The official OSIsoft samples are organized by technology and accessible through the following table:

Note: these samples have transitioned to be hosted in seperate repositories based on their technology.

Technologies	
OCS These samples cover programming against OCS. Samples include basic samples to more advanced. Details	**OMF** These samples highlight forming and sending OMF messages for PI and OCS. Details
PI System These samples cover topics related to the PI System. Details	**Edge** These samples cover topics related to OSIsoft Edge technologies. Details

Note: The OMF samples work against both the on-prem PI System and OCS.

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About Windtopia

- Windtopia is a power generation company that specializes in wind energy
- With widespread shifts to renewable energy, Windtopia is growing quickly and needs sustainable solutions
- Windtopia is investing in an integrated operations center to monitor their assets, mostly wind turbines and wind farms
- 100% real

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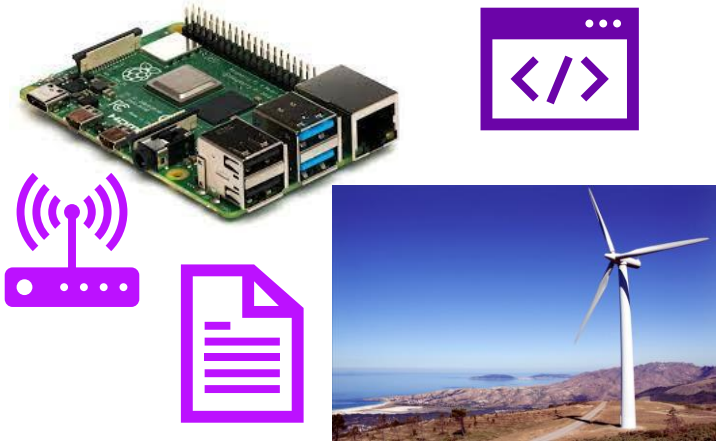
Challenges



- Wide range of data sources:
  - Wind turbines → DNP3
  - Sensor units → MQTT
  - Forecasted weather → Json text file
  - Custom applications
- There are thousands of remote devices and assets to manage
- Need to be able to visualize information on asset-specific edge devices in the field
- Need to aggregate data from all sources in one place
- Monitoring of assets from the cloud needs to be simple and intuitive for non-technical users

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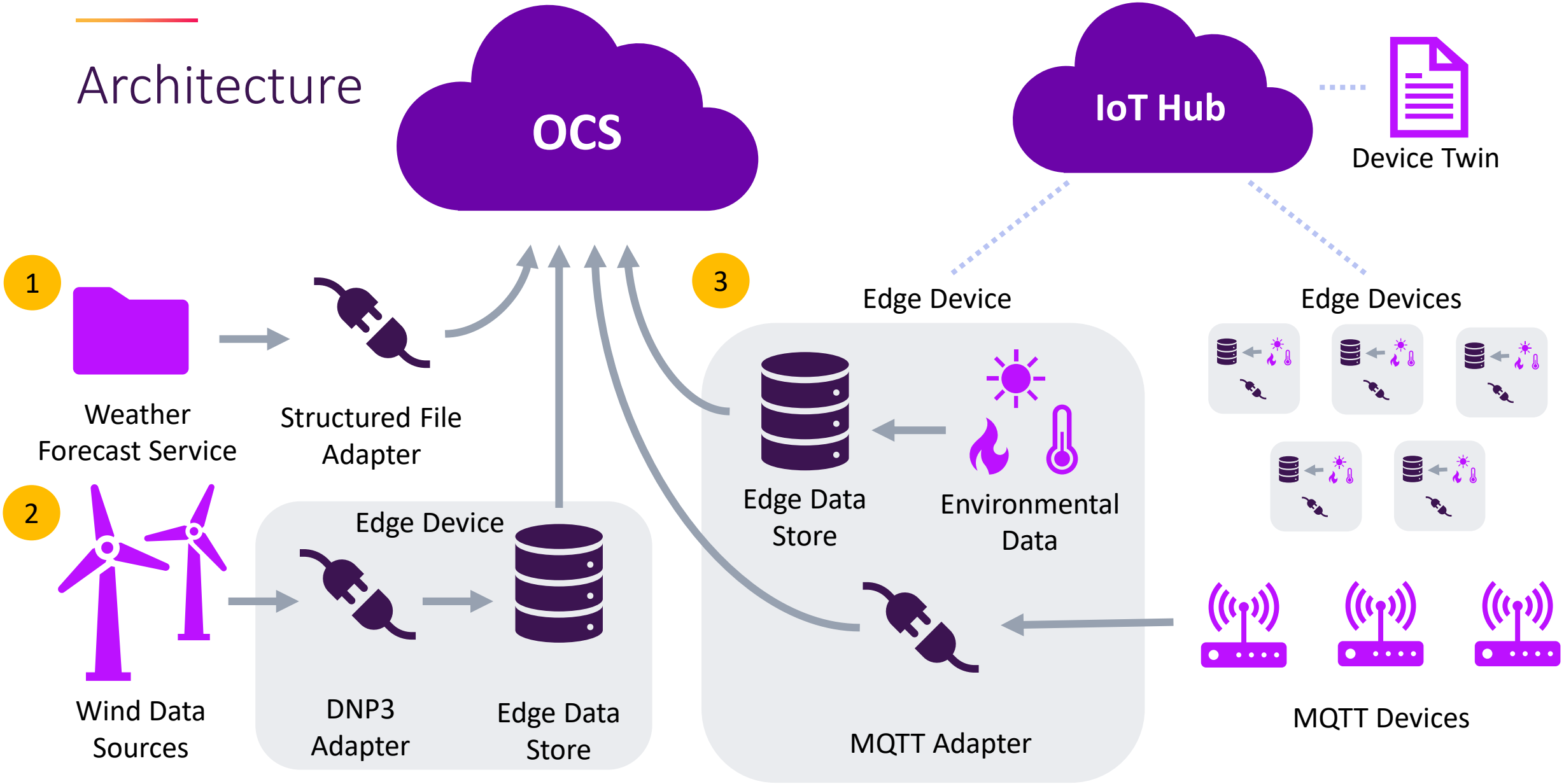
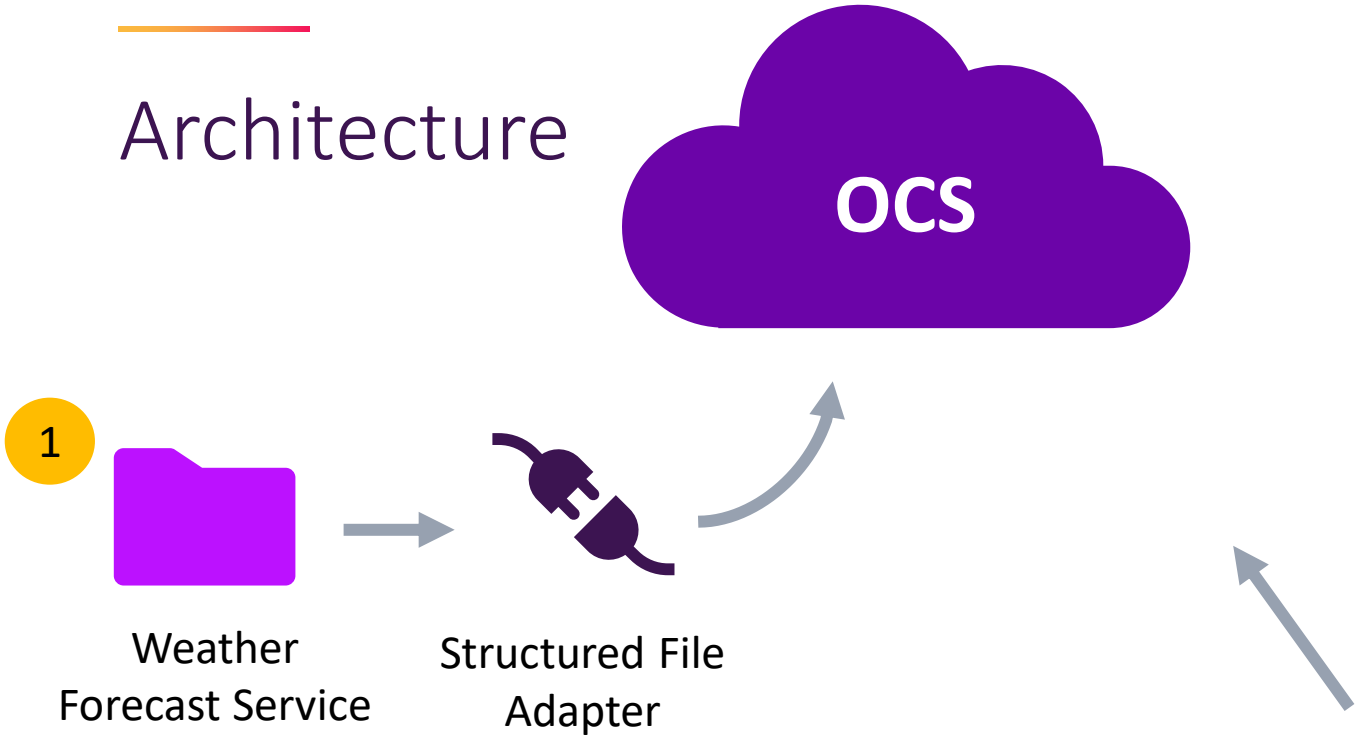
Architecture



Forecasted Weather Data

The Structured File Adapter and EdgeCmd

Architecture



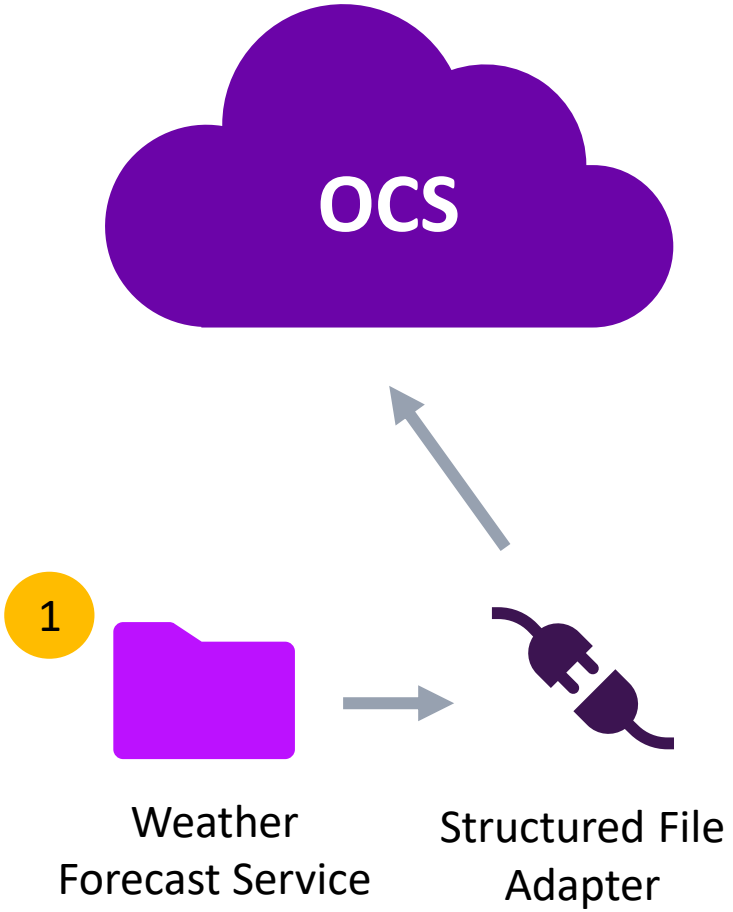
PI Adapters

- Extending data collection capabilities to harsh, remote environments
- Cross-platform (Windows, Linux), lightweight, and resilient
- Write to PI System, EDS, and OCS with options to optimize bandwidth

EdgeCmd

- EdgeCmd utility can be used to configure and administer PI adapters and Edge Data Stores using command line arguments.
- If you prefer, you can perform all tasks available in EdgeCmd utility using REST APIs.
- Use EdgeCmd utility to make one-off changes; use REST APIs to configure multiple systems the same way programmatically.

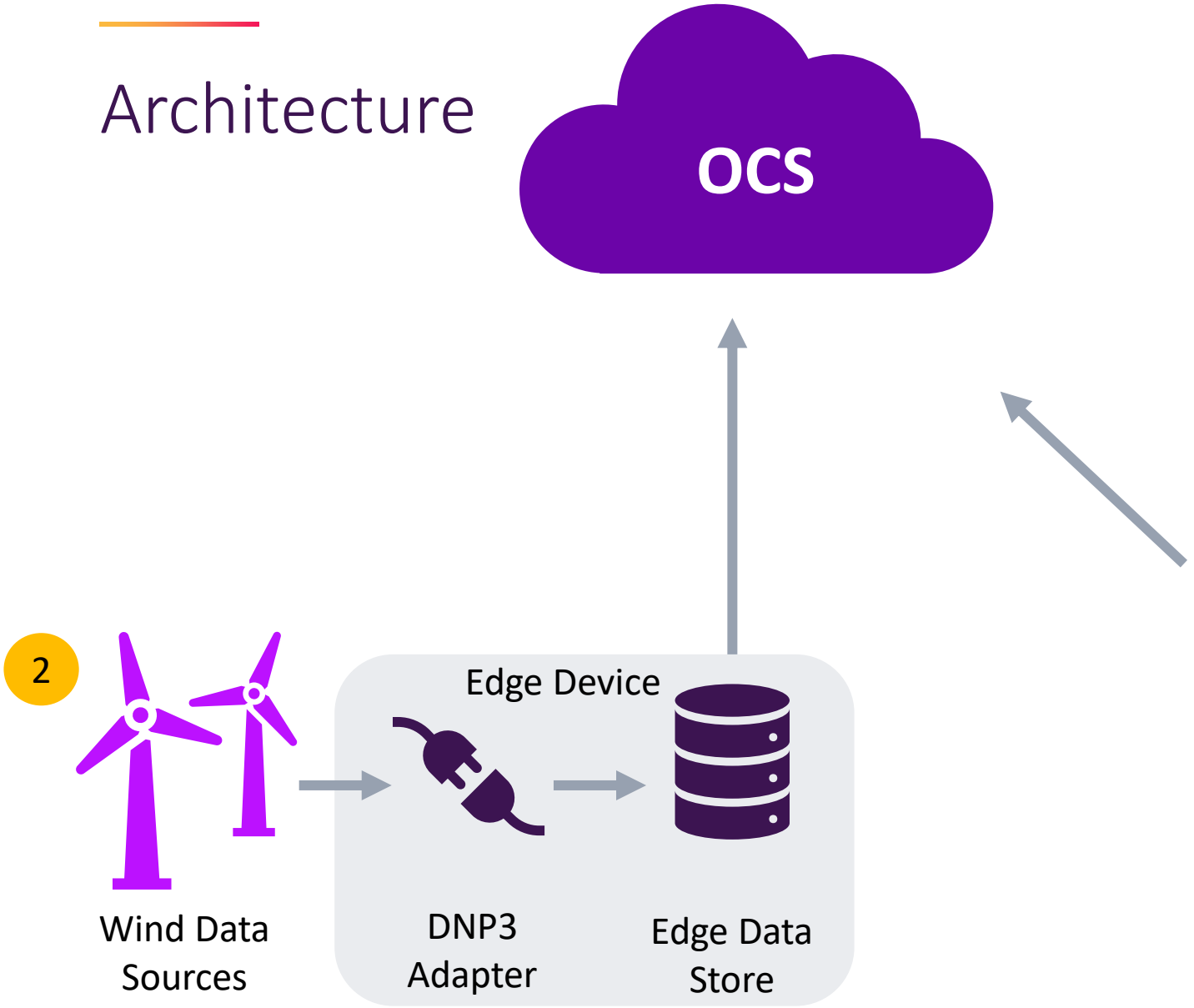
Demo!



Wind Turbine Data

PI Adapter for DNP3, Edge Data Store, and Edge Visualization

Architecture



Edge Data Store

- Persistent data available for visualization and analytics at the edge
- Cross-platform (Windows, Linux), lightweight, and resilient
- Multiple data ingress options (off-the-shelf or custom)
- Write to PI System and OCS with options to optimize bandwidth

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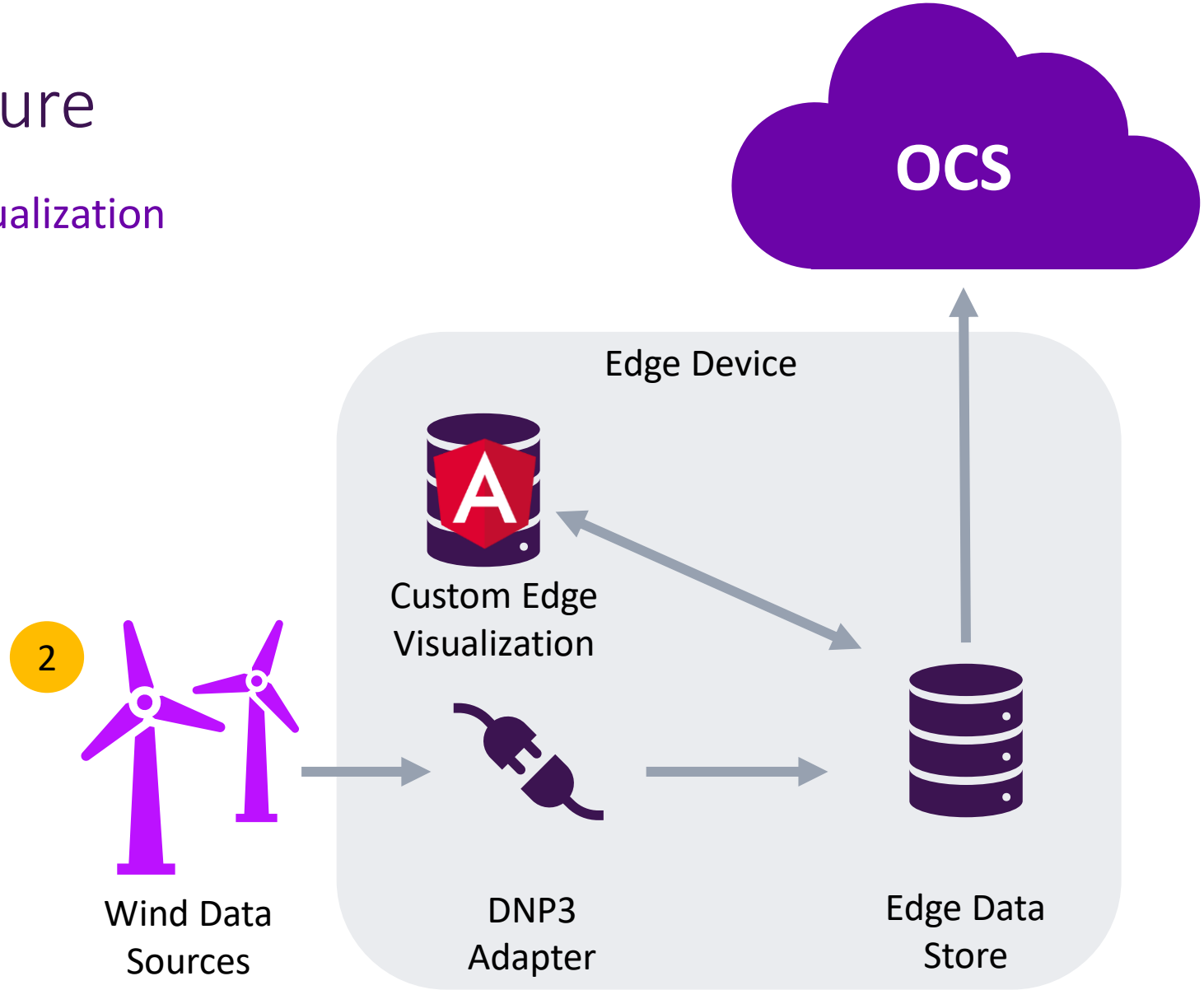
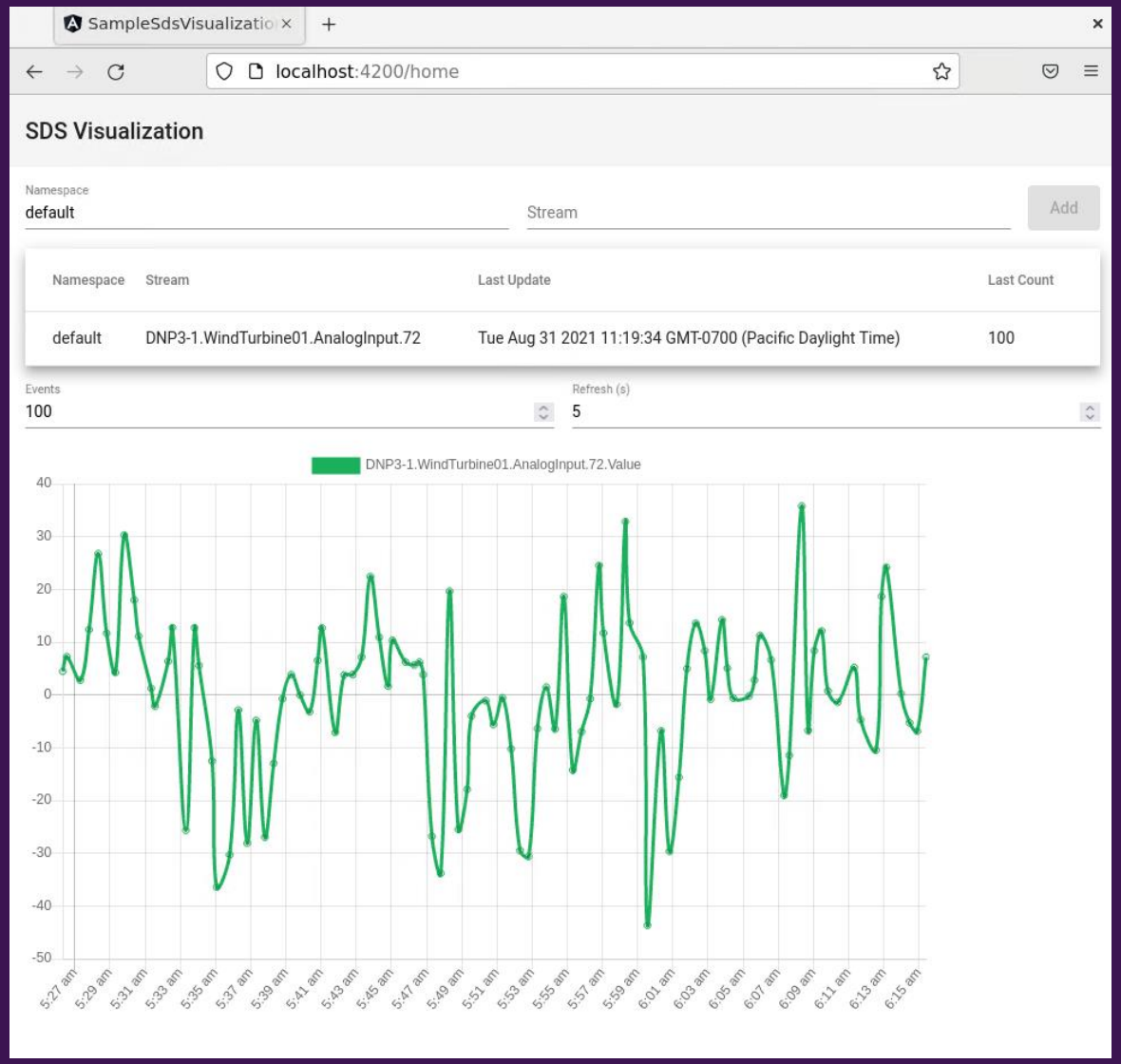
Architecture

With Edge Visualization



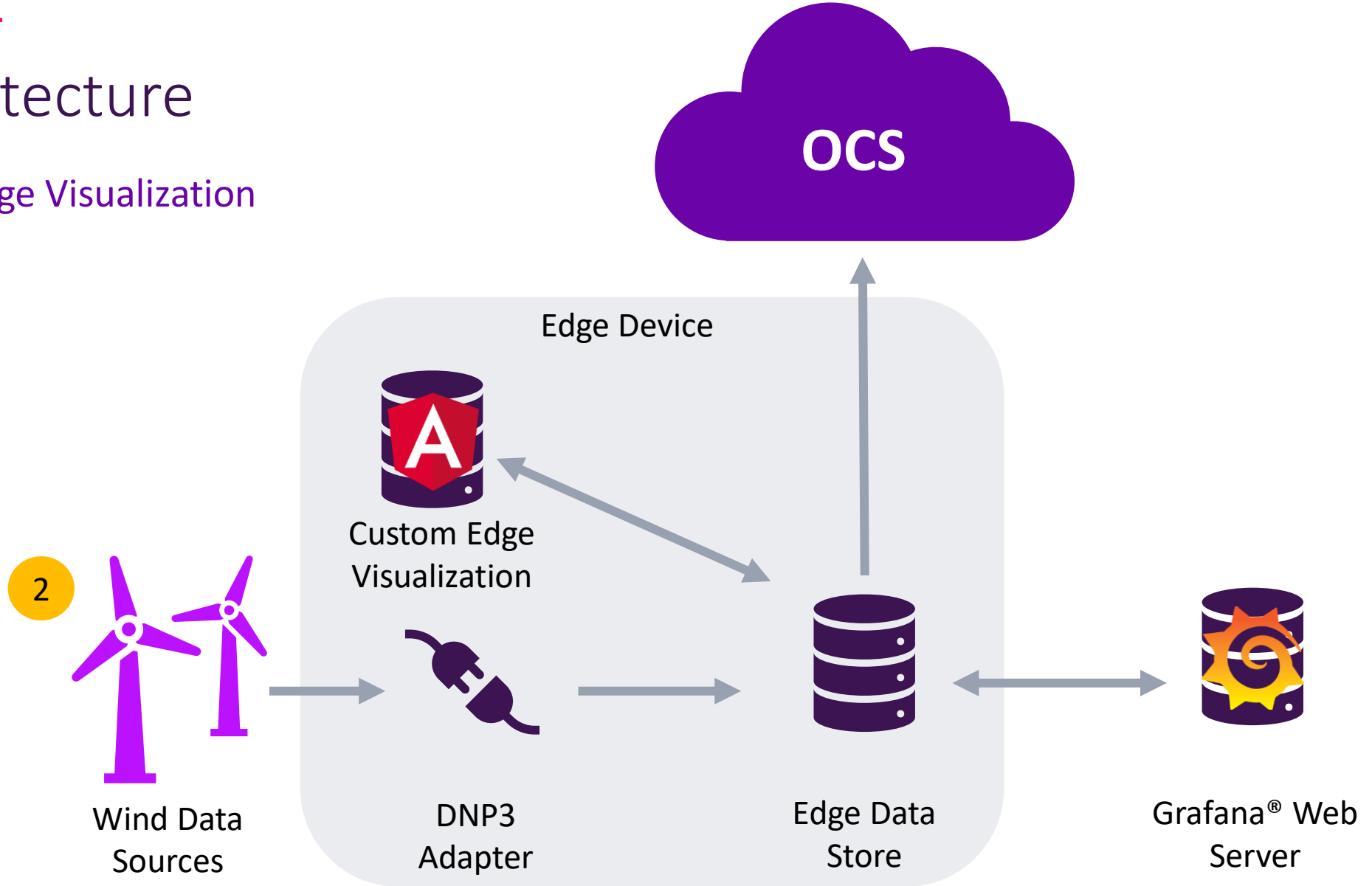


SDS Angular Visualization

- Trend streams from Edge Data Store directly in a browser on the edge device
- Platform-agnostic sample built on NodeJS
- Plot multiple streams, using X number of events for each stream, default 100
- Auto-refresh all trends with latest data
- Can also be configured to connect to OCS
- Open source in GitHub, extensible

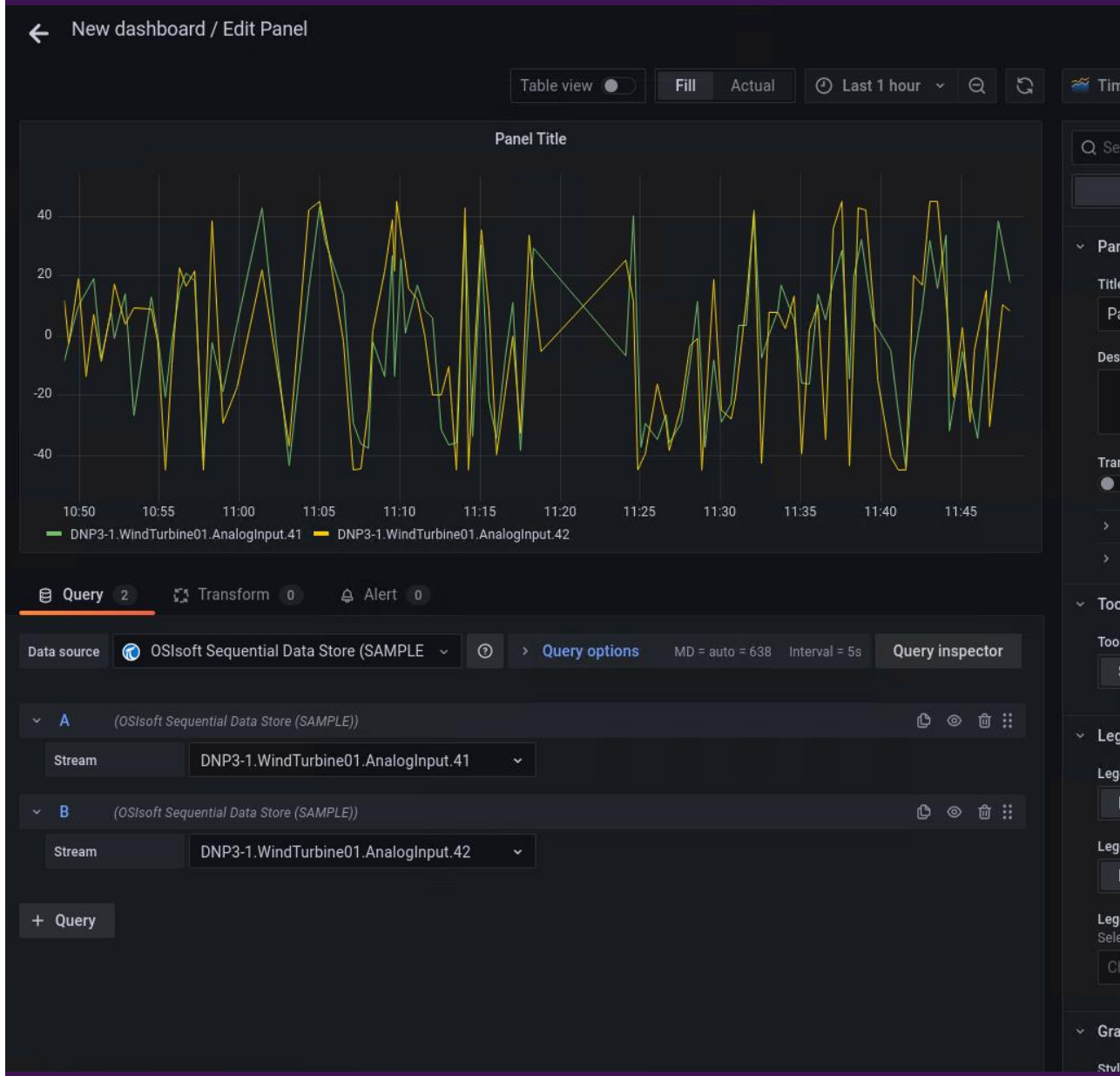
Architecture

With Edge Visualization

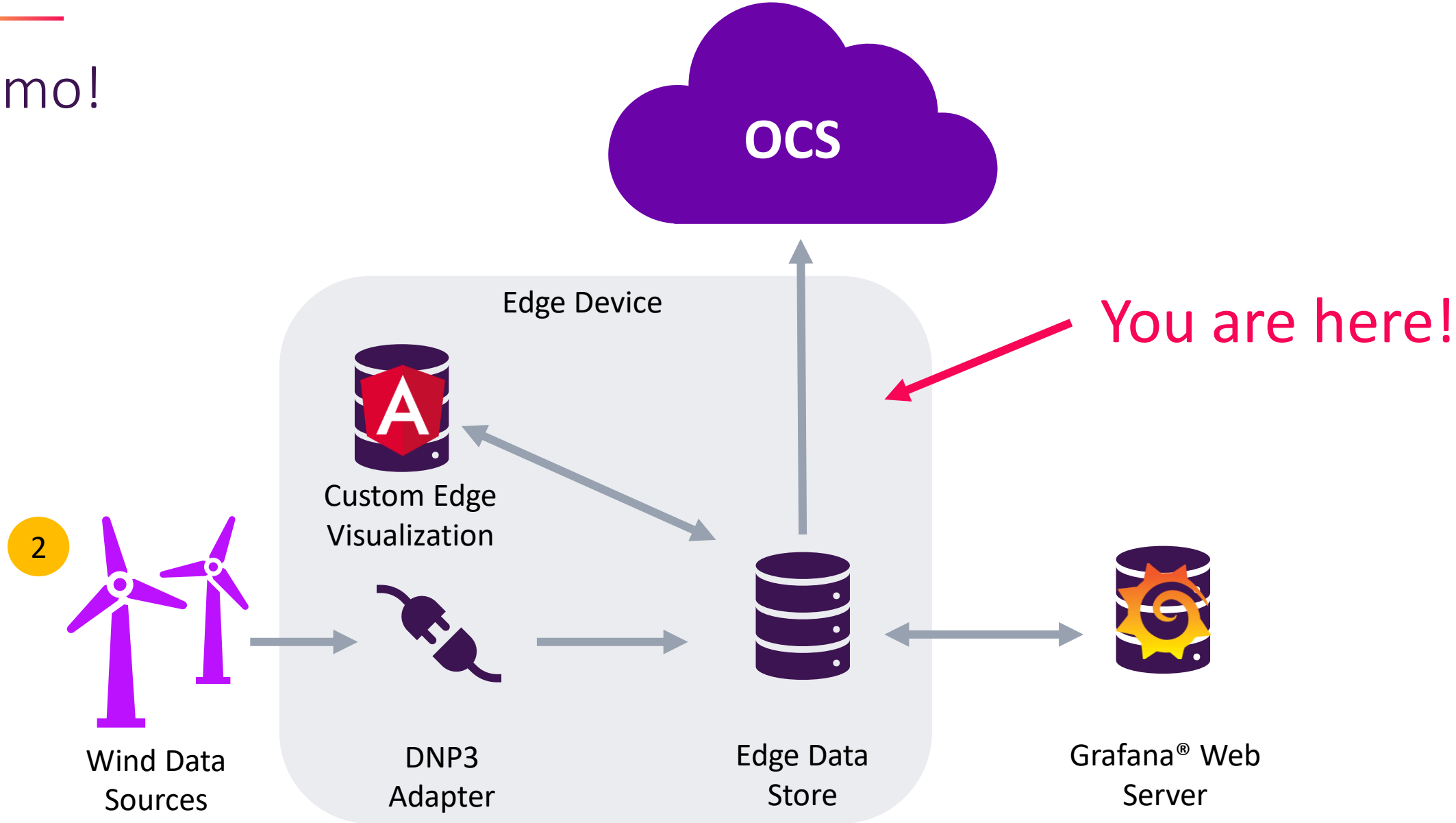


SDS Grafana® Visualization

- Same as Angular, trend streams from Edge Data Store directly in a browser on the edge device
- Platform-agnostic sample built on NodeJS
- Web server can run on a remote machine
- Full-fledged visualization suite from Grafana
- Can also be configured to connect to OCS
- Open source in GitHub, extensible



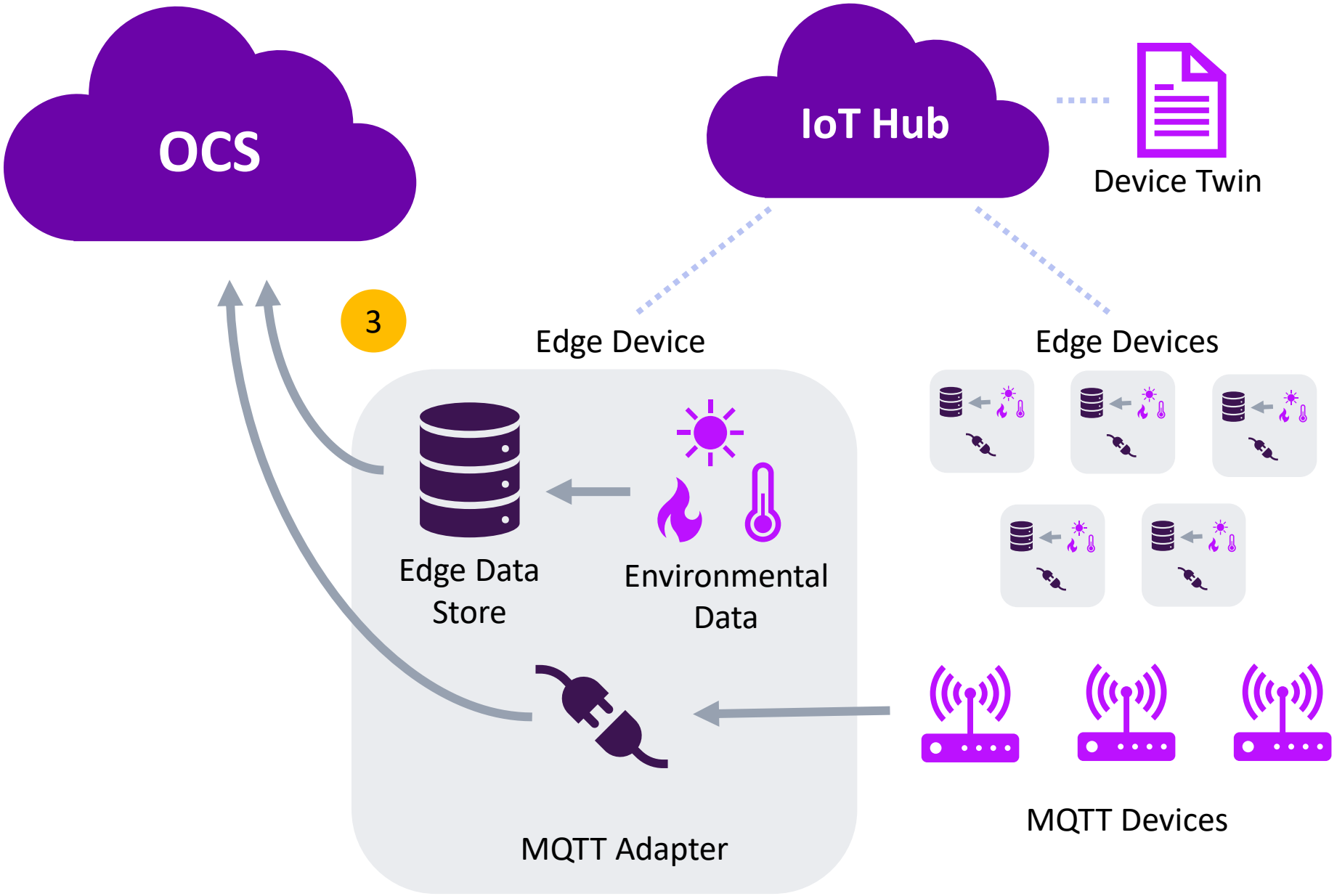
Demo!



Environmental Sensor Data

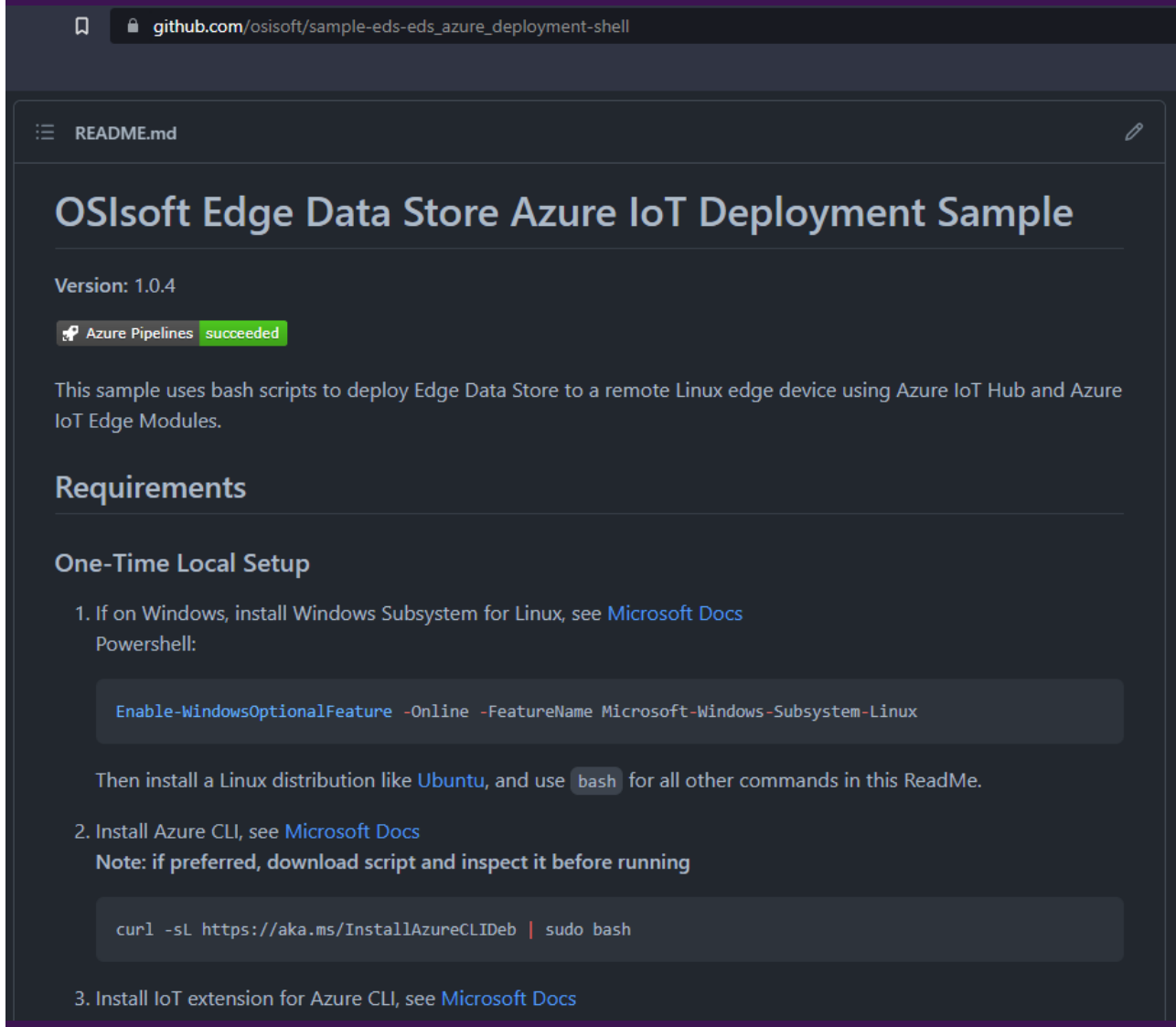
Remote deployment of containers, Azure digital twin,
OSIsoft Message Format, and edge analytics

Architecture



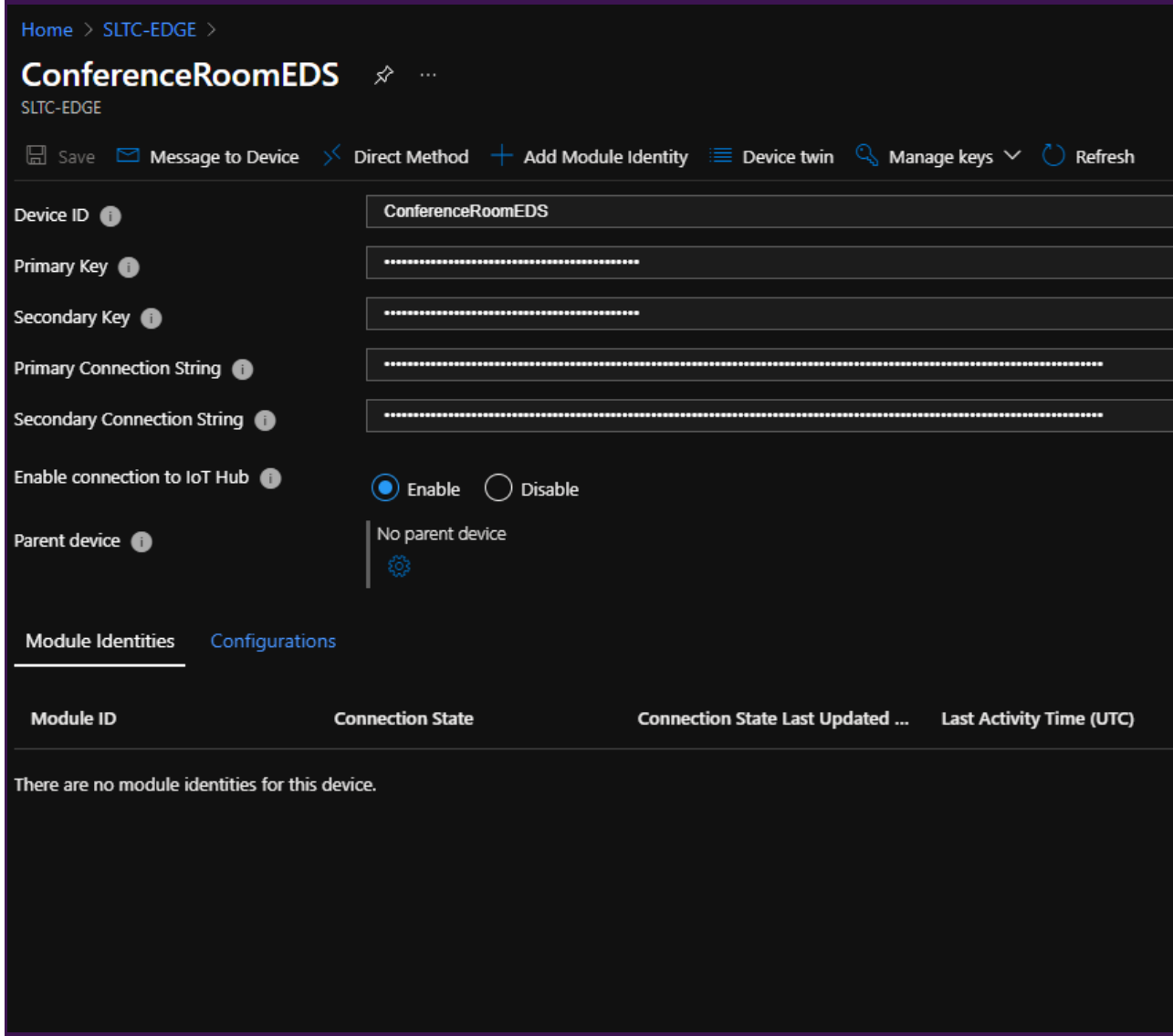
Remote Deployment

- Remote deployment of containers is used for easy setup and maintenance
- Containers are pushed to an Azure Container Registry
- The state of the containers is managed from Azure



Remote Management

- OSIsoft software can be configured remotely using Azure's IoT hub through a custom application using:
  - MQTT
  - Device SDKs
- Functionality includes:
  - Message to Device
  - Direct Method
  - Device twin



Device Twin

- Device twins are JSON documents that store device state information
- Devices can receive notifications when their device twin has changed, allowing devices to be remotely configured and updated from Azure
- Because the Edge Data Store and PI Adapters use JSON for their configurations, it is easy to store their configurations in a Device Twin

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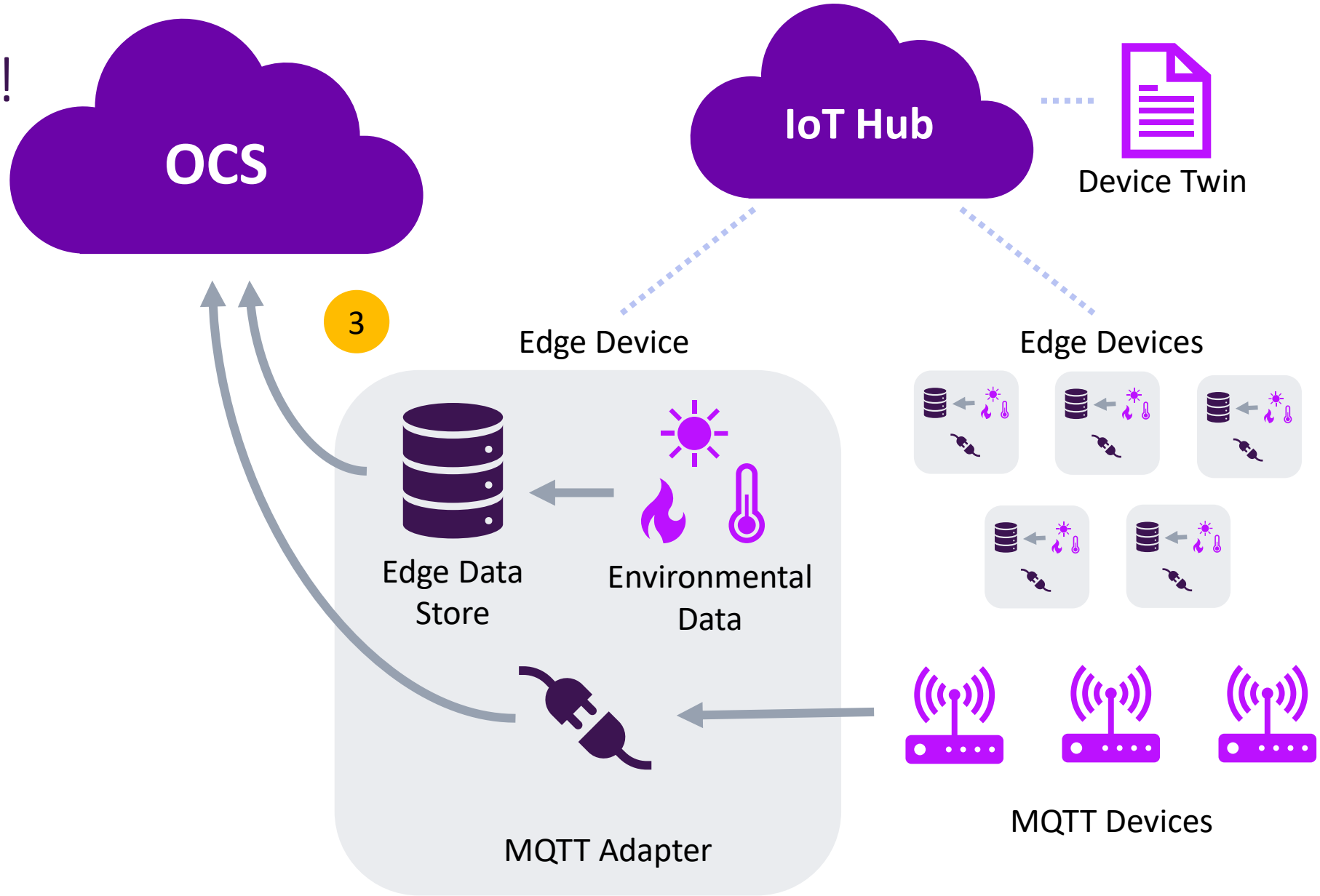
Demo!



OSIsoft Message Format (OMF)

- OSIsoft specification that supports streaming data and metadata
- Enables custom application development for data ingress
- Independent of operating system and programming language
- Write to PI System, EDS, and OCS

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Type Messages:

```
{
  "id": "TankMeasurement",
  "version": "1.0.0.0",
  "type": "object",
  "classification": "dynamic",
  "properties": {
    "Time": {
      "format": "date-time",
      "type": "string",
      "isindex": true
    },
    "Pressure": {
      "type": "number",
      "name": "Tank Pressure",
      "description": "Tank Pressure in Pa",
      "uom": "pascal"
    },
    "Temperature": {
      "type": "number",
      "name": "Tank Temperature",
      "description": "Tank Temperature in K",
      "uom": "K"
    }
  }
}
```

Container Messages:

```
{
  "id": "Tank1Measurements",
  "typeid": "TankMeasurement",
  "typeVersion": "1.0.0.0"
}
```

Data Messages:

```
{
  "containerid": "Tank1Measurements",
  "values": [
    {
      "Time": "2017-01-11T22:23:23.430Z",
      "Pressure": 12.0,
      "Temperature": 100.1
    },
    {
      "Time": "2017-01-11T22:24:23.430Z",
      "Pressure": 11.5,
      "Temperature": 101.2
    }
  ]
}
```


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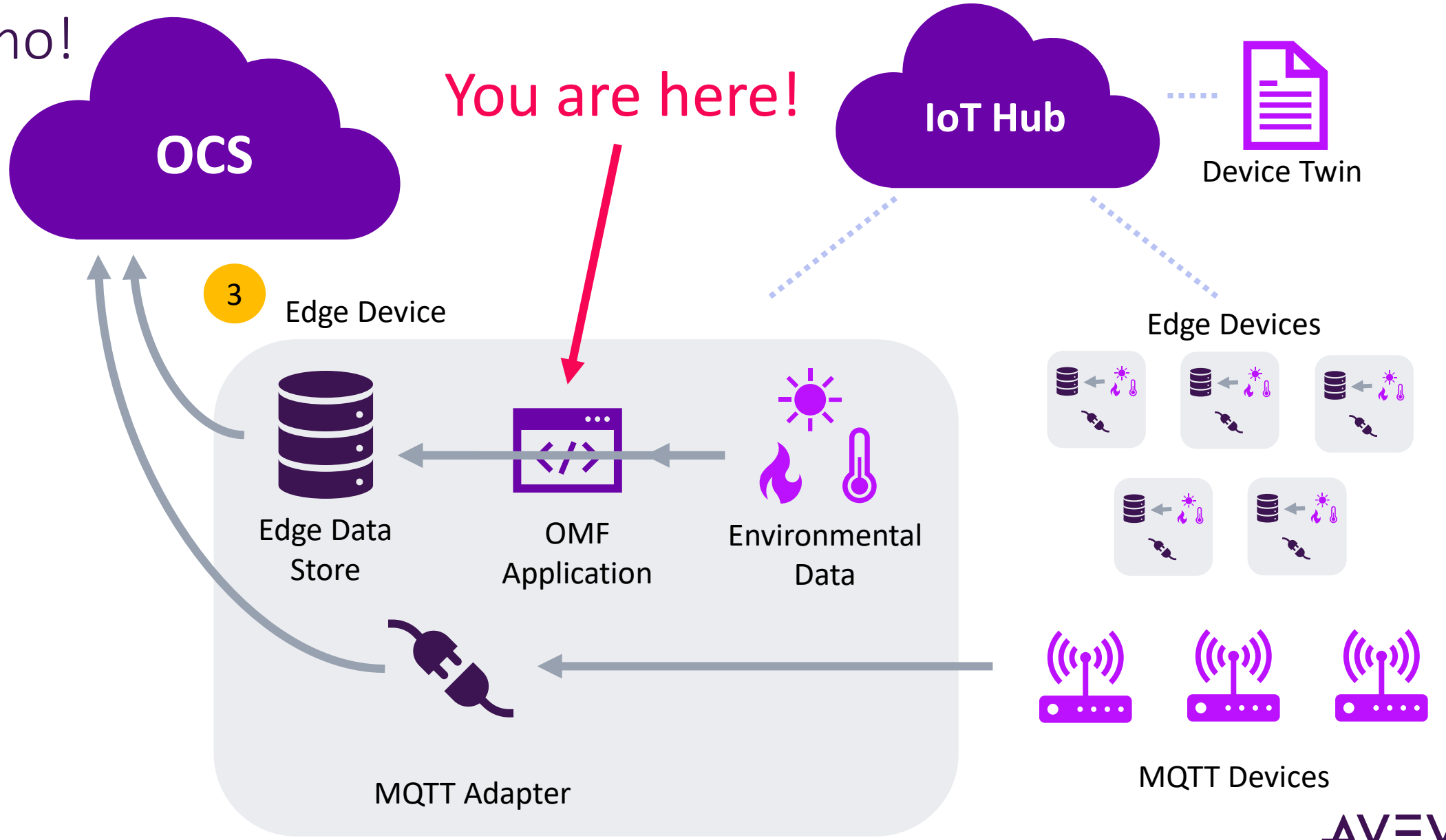
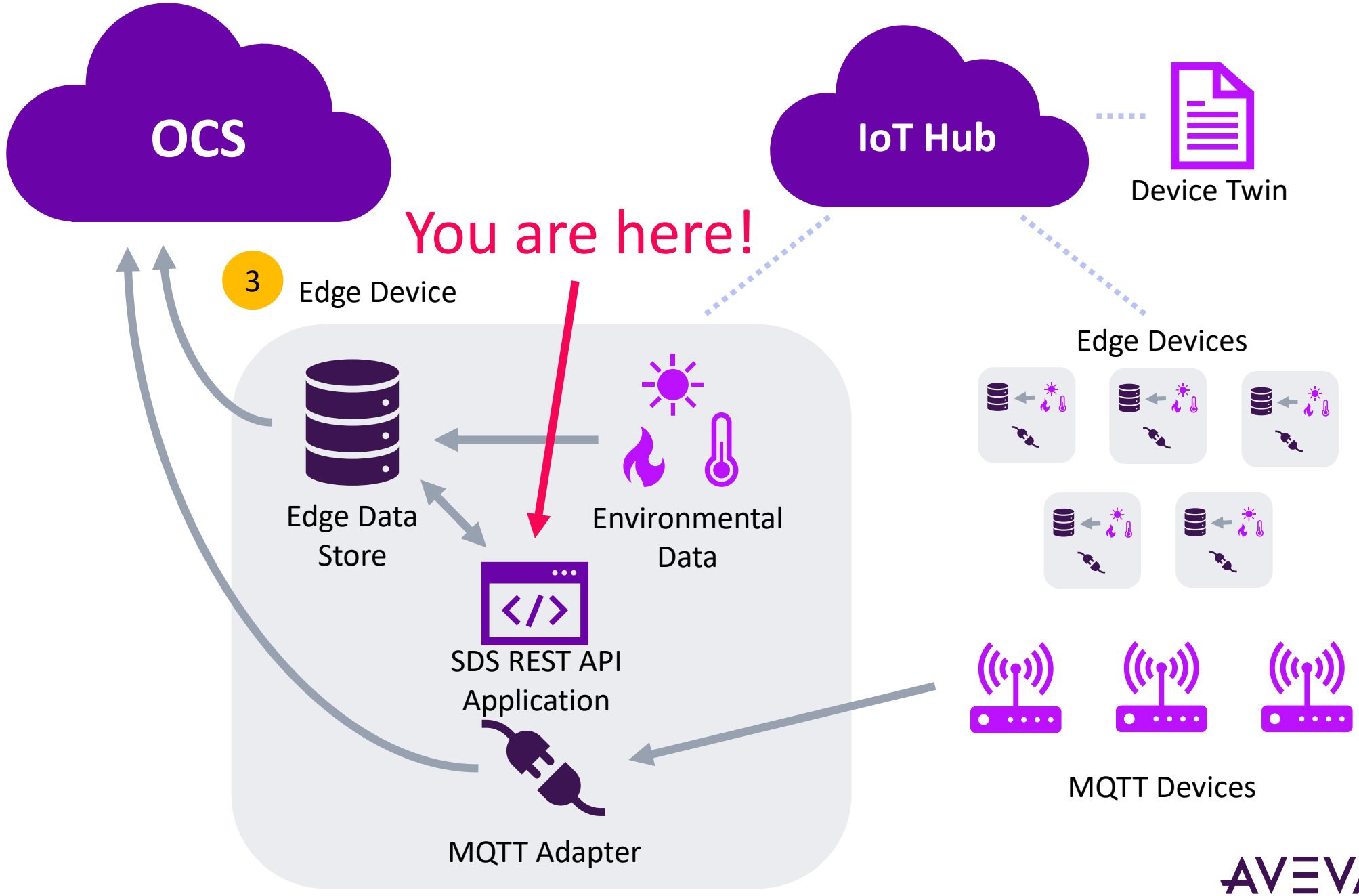
Demo!


OCS
You are here!
IoT Hub
Device Twin
3
Edge Device
Edge Devices
Edge Data Store
OMF Application
Environmental Data
MQTT Adapter
MQTT Devices

Edge Analytics

- Each sensor unit has three temperature sensors
- The users at Windtopia that consume this data prefer to use an average of three temperatures
- Edge analytics are used to calculate the average temperature on the sensor unit, making use of existing computing power

Demo!


OCS
IoT Hub
Device Twin
You are here!
3
Edge Device
Edge Devices
Edge Data Store
Environmental Data
SDS REST API Application
MQTT Adapter
MQTT Devices

Remote Operations Monitoring from OCS

Creating, monitoring, and visualizing OCS Assets

Cloud native platform designed for real-time operations

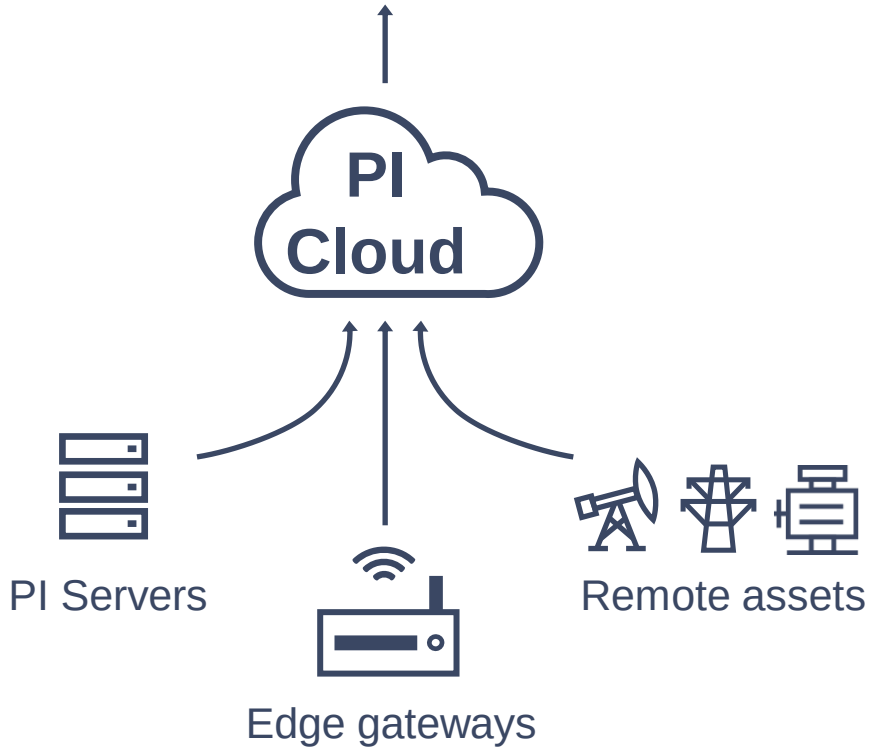
Managed, secure, multi-tenant platform

Operated & maintained by AVEVA

High speed, scalable, elastic, & resilient

Modern, secure REST APIs

Built & deployed on Microsoft Azure



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OCS Assets

- Containers for data streams associated with a particular device or object
- Comparable to Elements in PI Asset Framework
- Typically represent devices with multiple data streams, but you can create an asset with only one stream if necessary
- Also contain metadata, or static information, about the asset (such as location or company)
- Can specify a status rule that is calculated based on associated data stream values

GE Wind Turbine 01

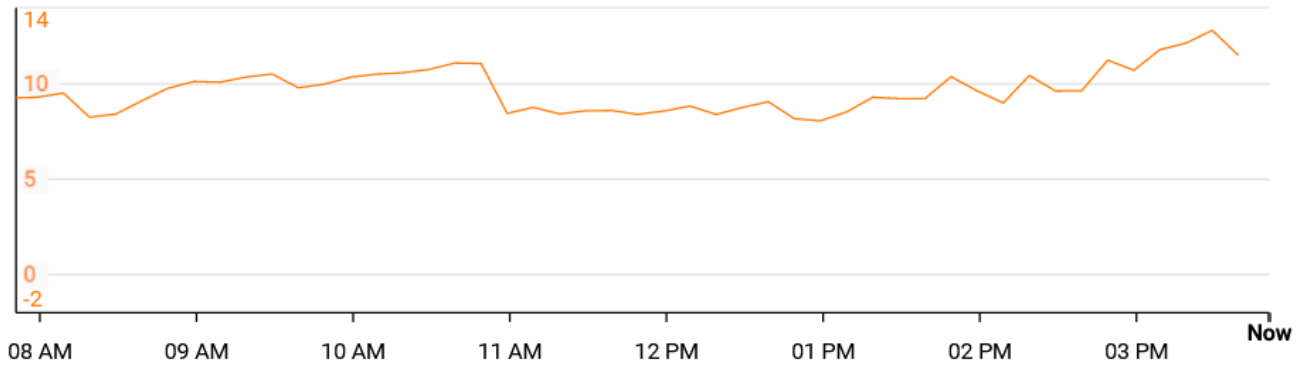
This is a Wind Turbine at Big Buffalo

Asset Type: GE Wind Turbine

Metadata | Properties | Status

Property	Last Value	UOM	Timestamp
EAF MTD | Value	92.690		8/31/2021 3:50:00 PM
EAF MTD | IsQuestionable	false		8/31/2021 3:50:00 PM
EAF MTD | IsSubstituted	false		8/31/2021 3:50:00 PM
EAF MTD | IsAnnotated	false		8/31/2021 3:50:00 PM
EAF MTD | SystemStateCode			8/31/2021 3:50:00 PM

Wind Speed - 10 min rolling avg | Value



Last 8 hours

OCS Asset Types

- Templates for creating assets that share a common structure or type
- Comparable to Element Templates in PI Asset Framework
- Type defines the expected metadata, stream references, and status configuration for assets created from the type
- Asset types can be created based on existing assets, or can be created from scratch as new asset types

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GE Wind Turbine

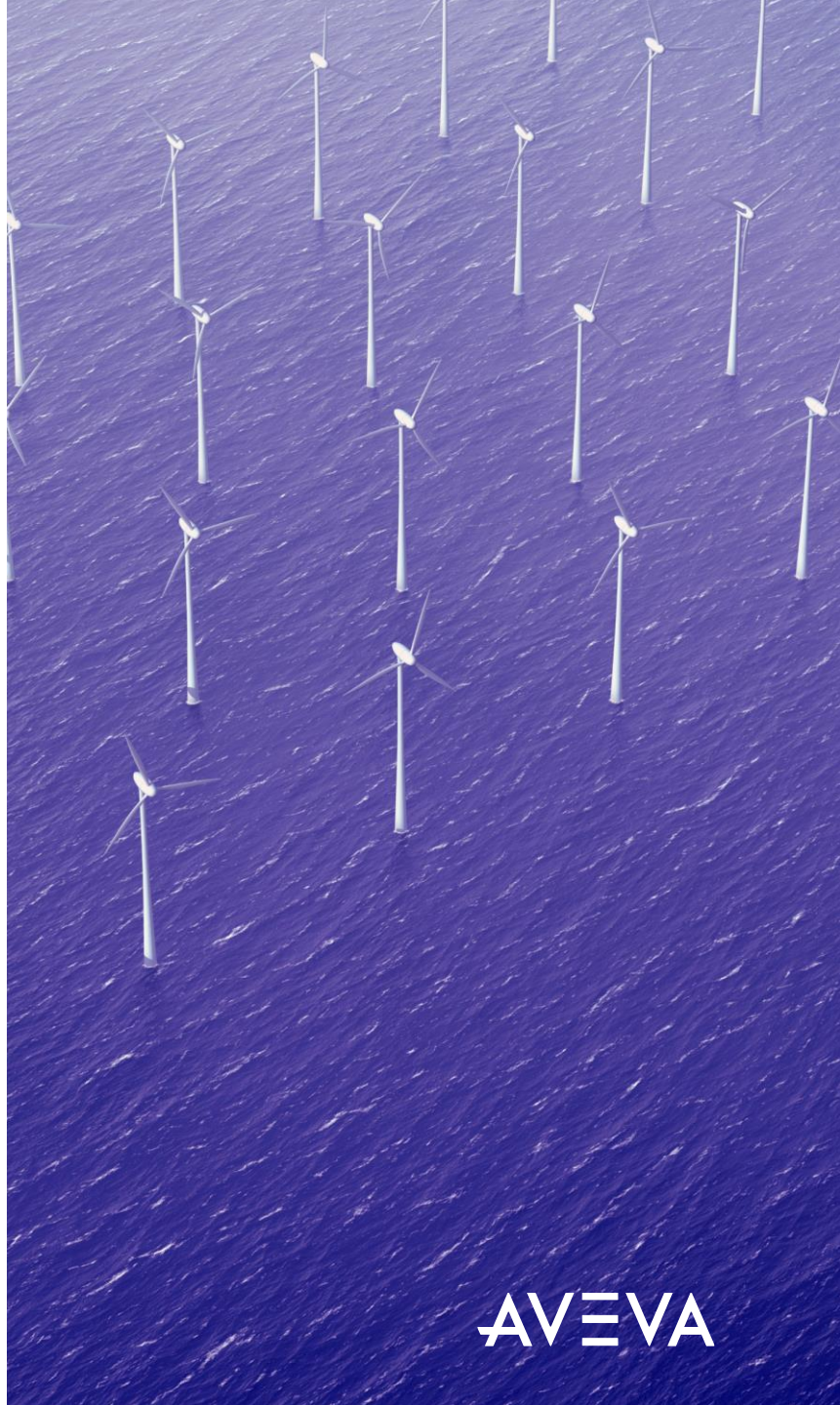
A wind turbine!

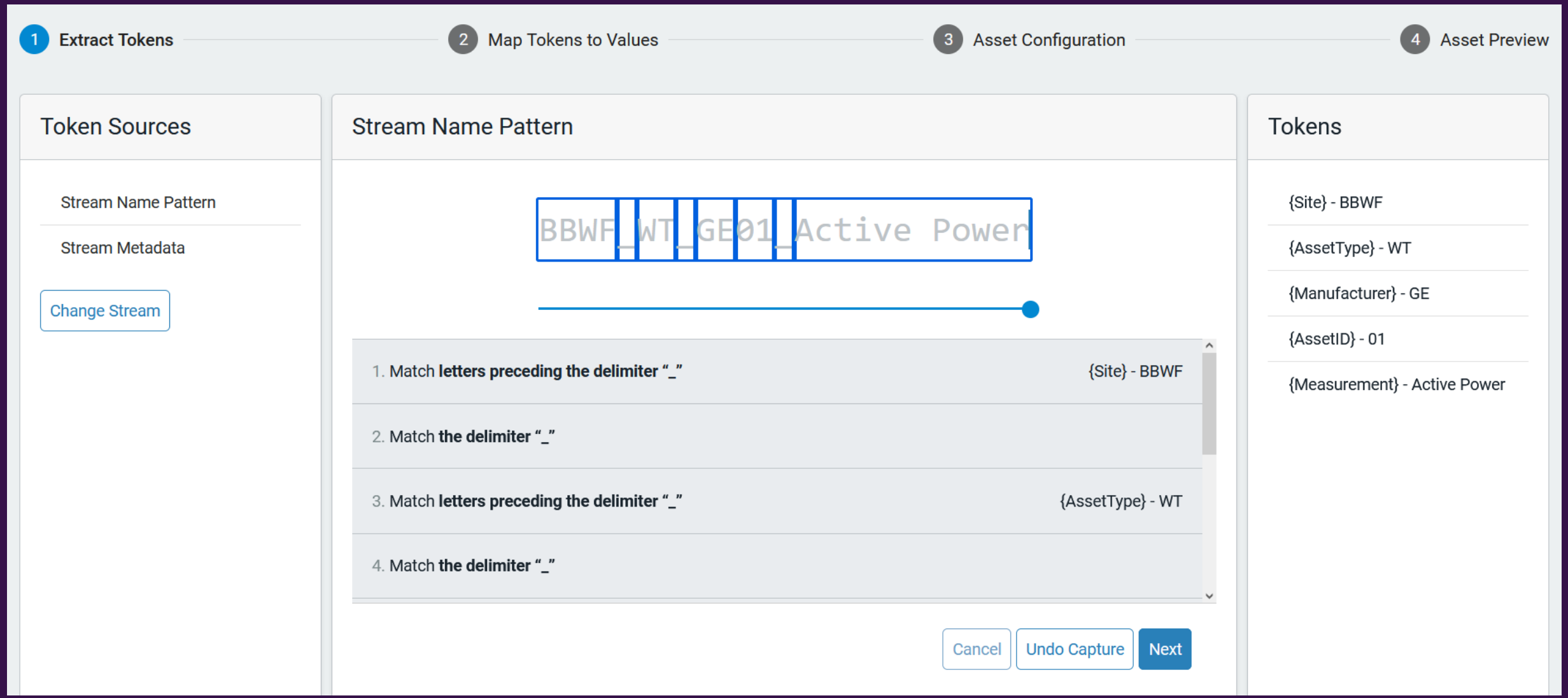
Metadata | Properties | Status

Metadata	Value	UOM
Altitude	1000	m
Gearbox Serial Number	4800000-0000-0	
Latitude	44.563149	°
Longitude	-109.25416	°
Manufacturer	Truvale	
Model	T95-2MW	
Overheating delta limit	60	°C
Power Rated	1500	kW
Region	NA	
Serial Number	M000000	

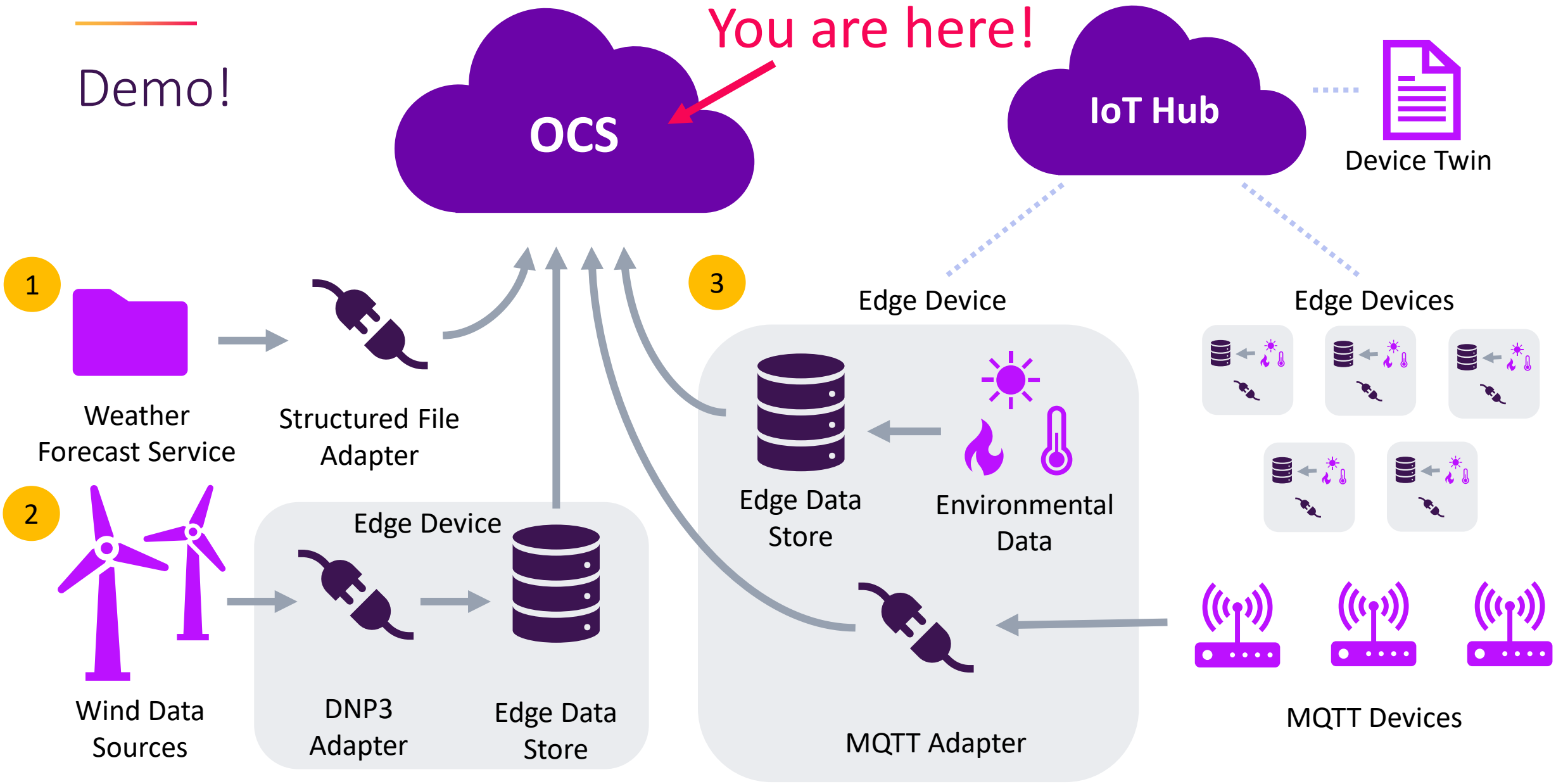
OCS Asset Rules

- Create assets automatically based on stream properties
  - ID, Name, Description, and stream metadata
- Follows a pattern to map values from stream name into specific tags that can be used to define each asset
- Can be executed on demand or unattended





Demo!



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