

AVEVA PI WORLD

Remote Operations Monitoring in OCS

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AVEVA

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



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 separate repositories based on their technology.

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

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



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

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

Architecture

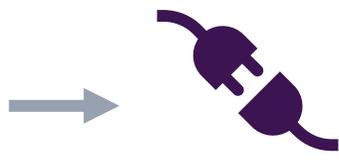


Device Twin

1



Weather Forecast Service

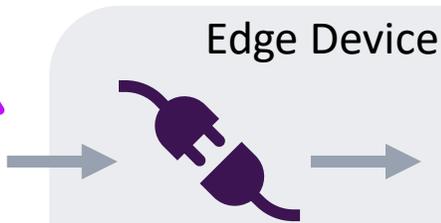


Structured File Adapter

2



Wind Data Sources



DNP3 Adapter

Edge Device



Edge Data Store

3



Edge Data Store



Environmental Data



MQTT Adapter

Edge Device

Edge Devices



MQTT Devices



Forecasted Weather Data

The Structured File Adapter and EdgeCmd



Architecture



1



Weather
Forecast Service



Structured File
Adapter



PI Adapters

PI Adapters



Cross Platform



Lightweight Footprint



Ready Off-The-Shelf

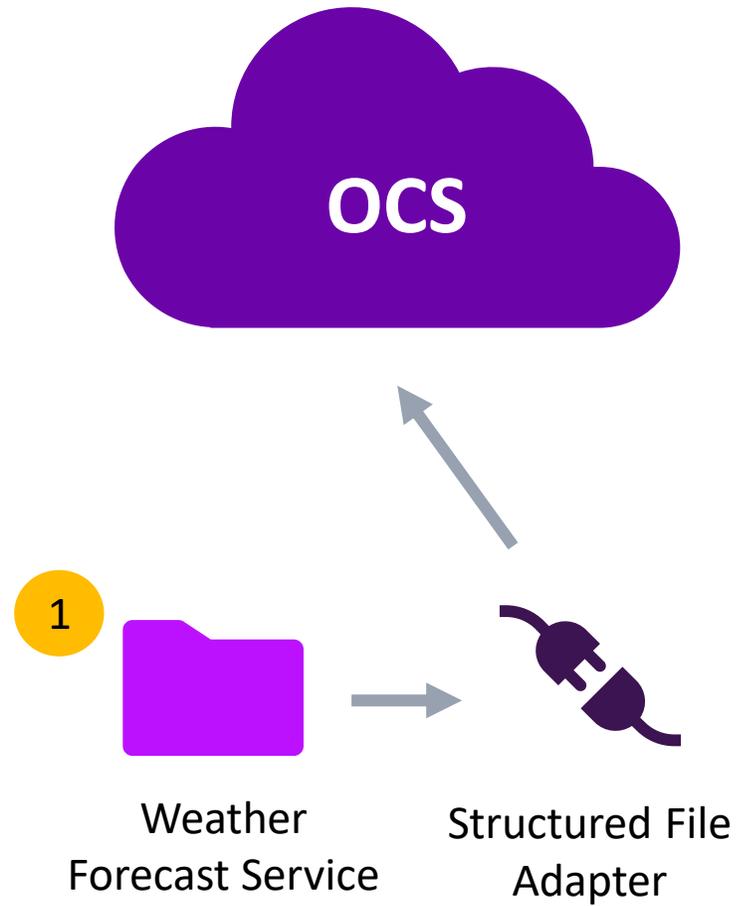
- Extending data collection capabilities to harsh, remote environments
- Cross-platform (Windows, Linux), lightweight, and resilient
- Write to PI System, EDS, and OCS with options to optimize bandwidth

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!



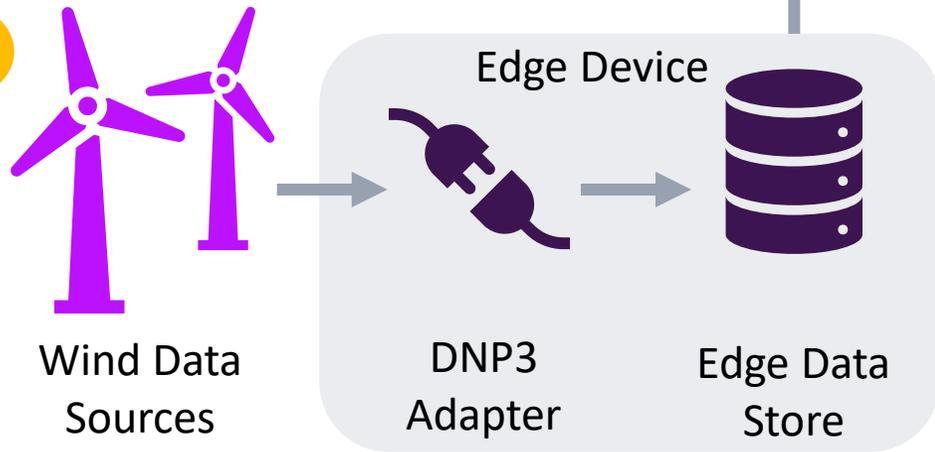


Wind Turbine Data

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



Architecture



2

Edge Data Store



Persistent Storage



Self-Healing Capabilities

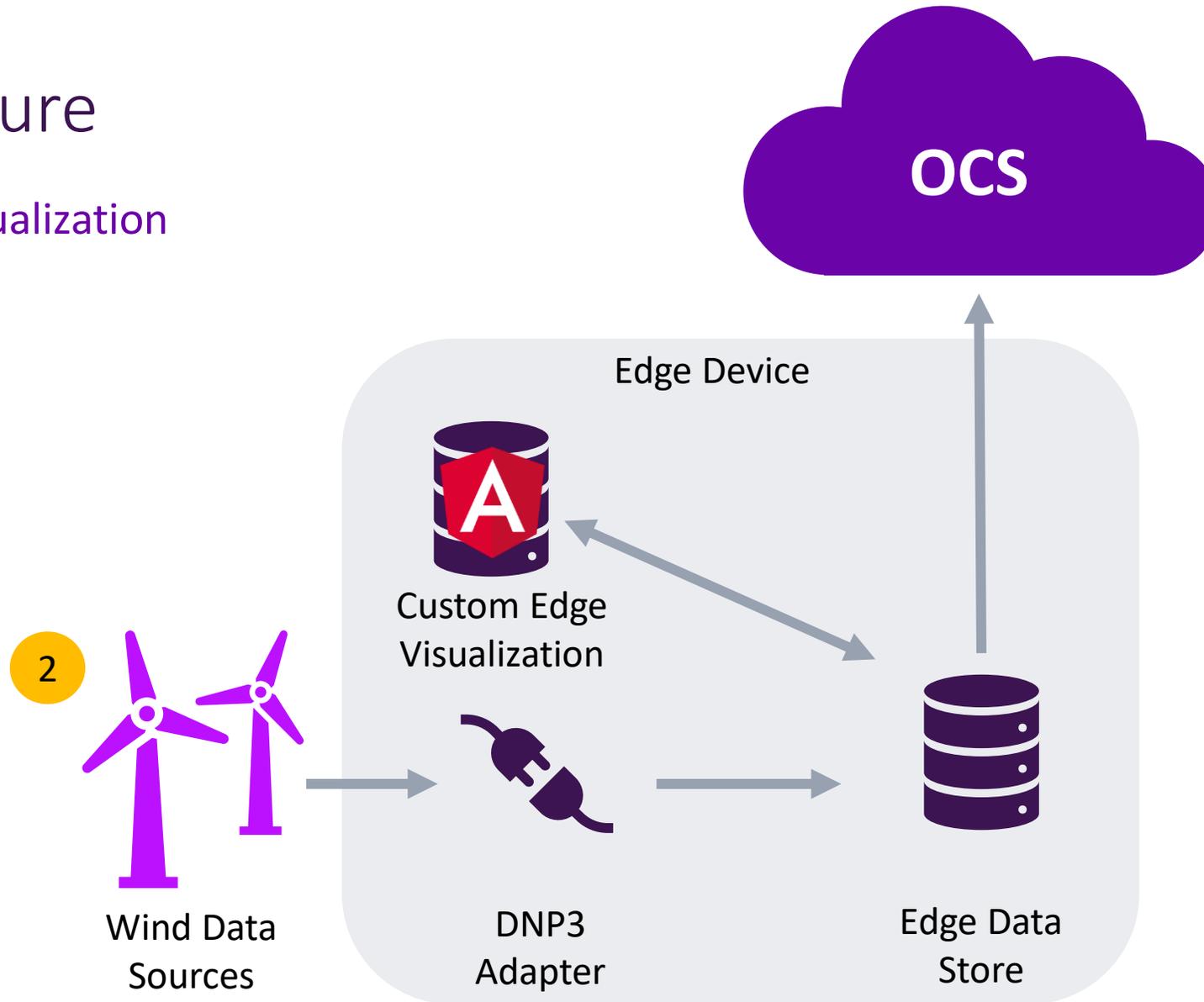


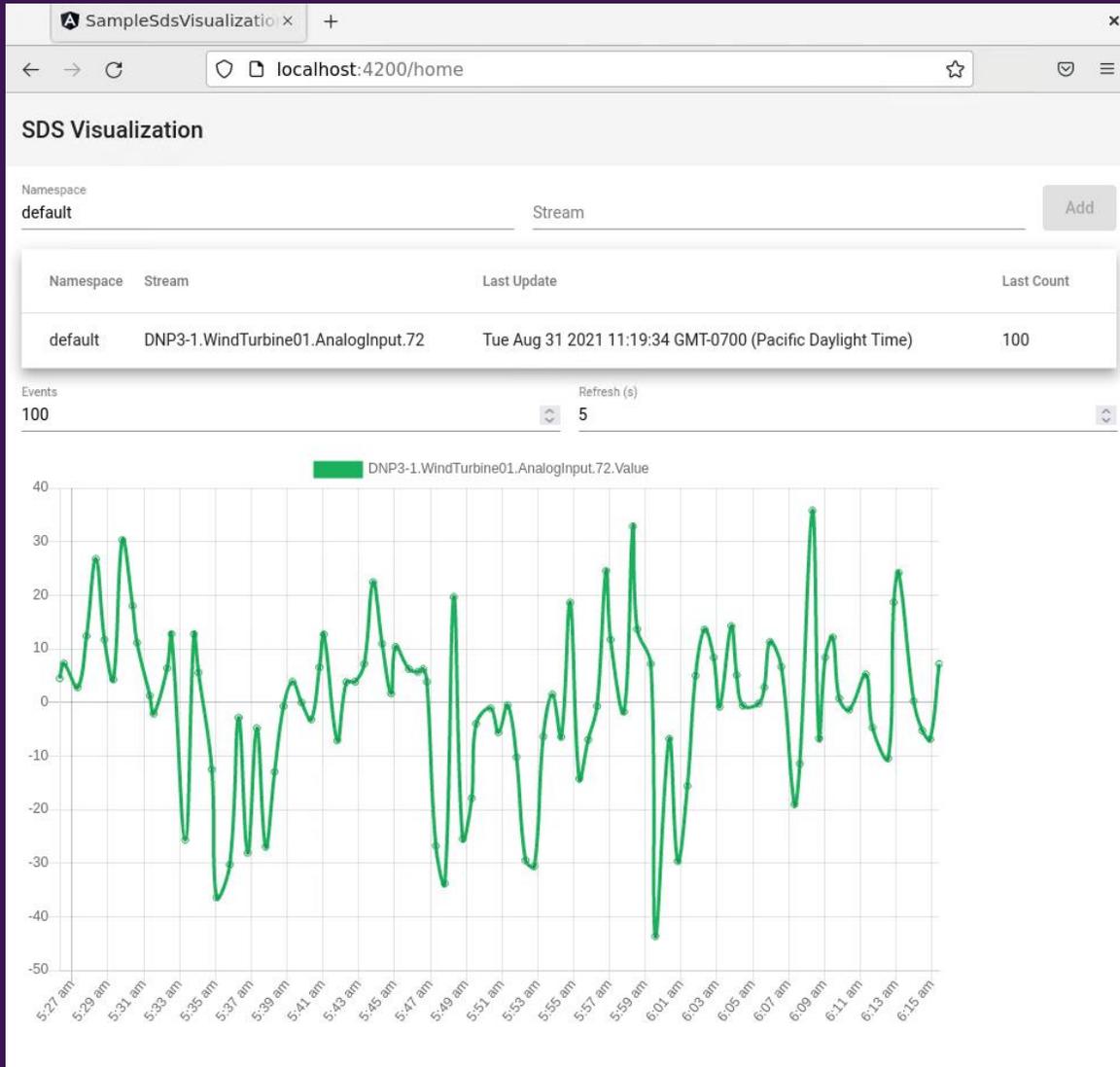
Application Platform

- 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

Architecture

With Edge Visualization



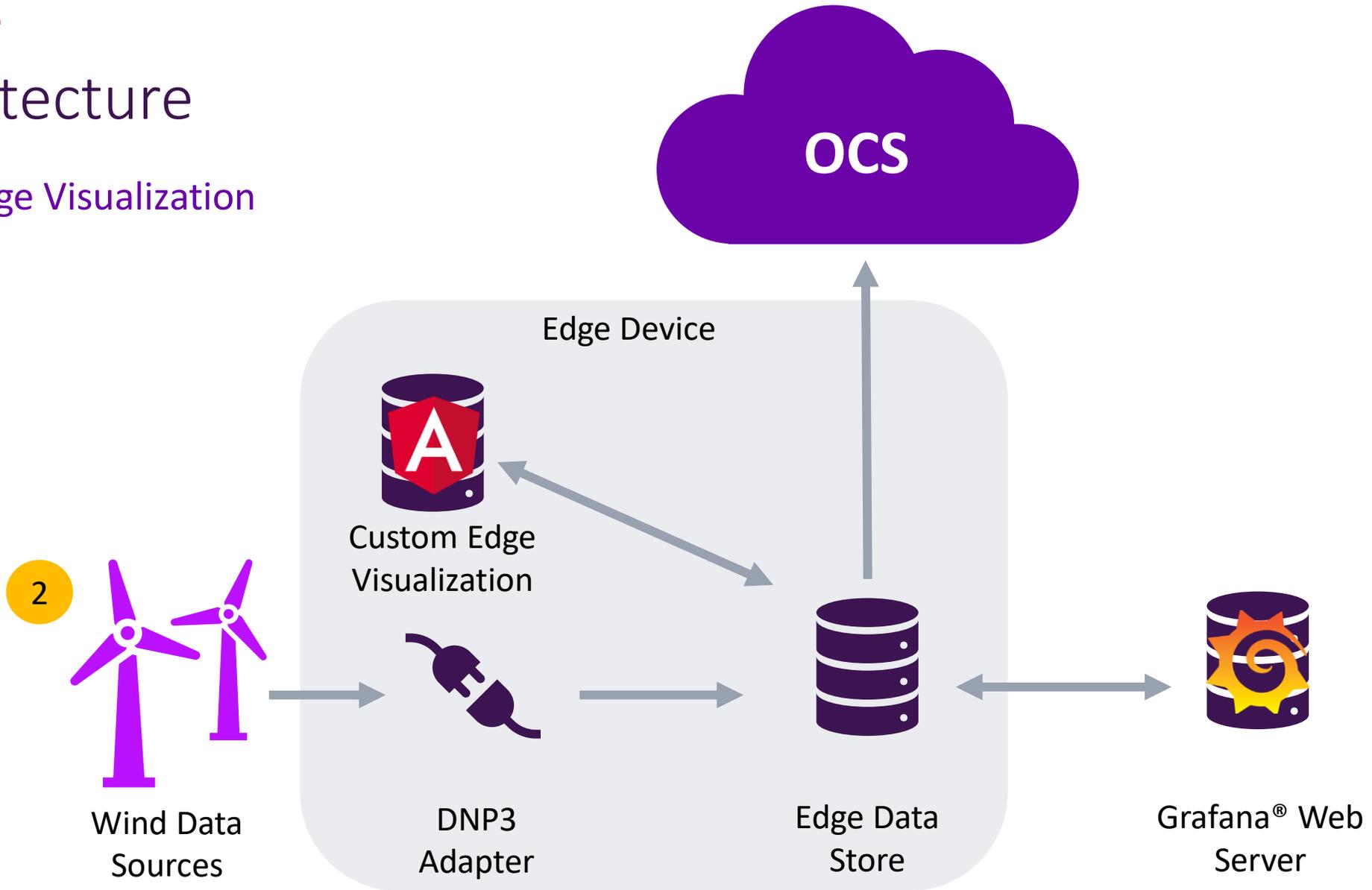


SDS Angular Visualization

- 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

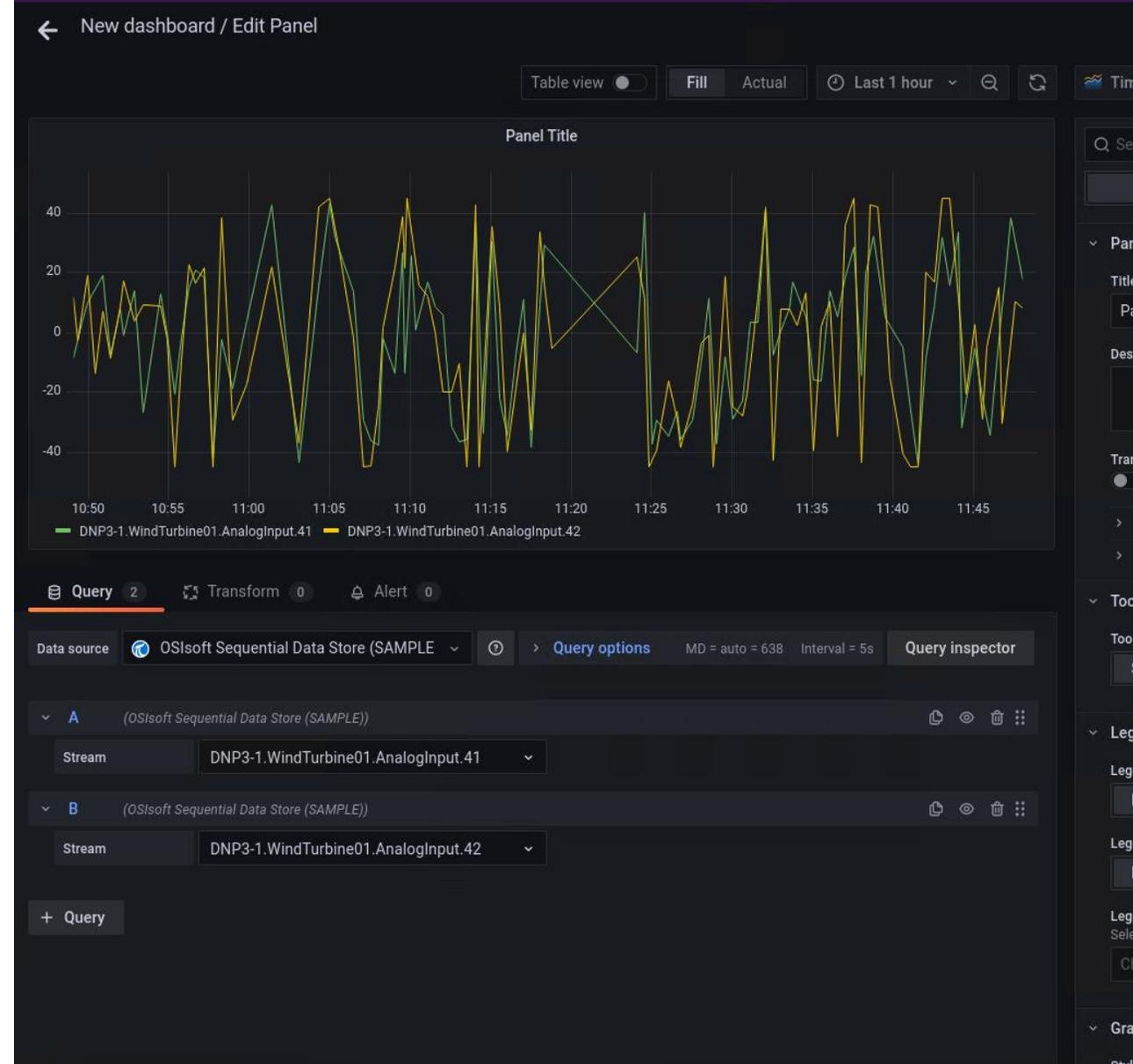
Architecture

With Edge Visualization

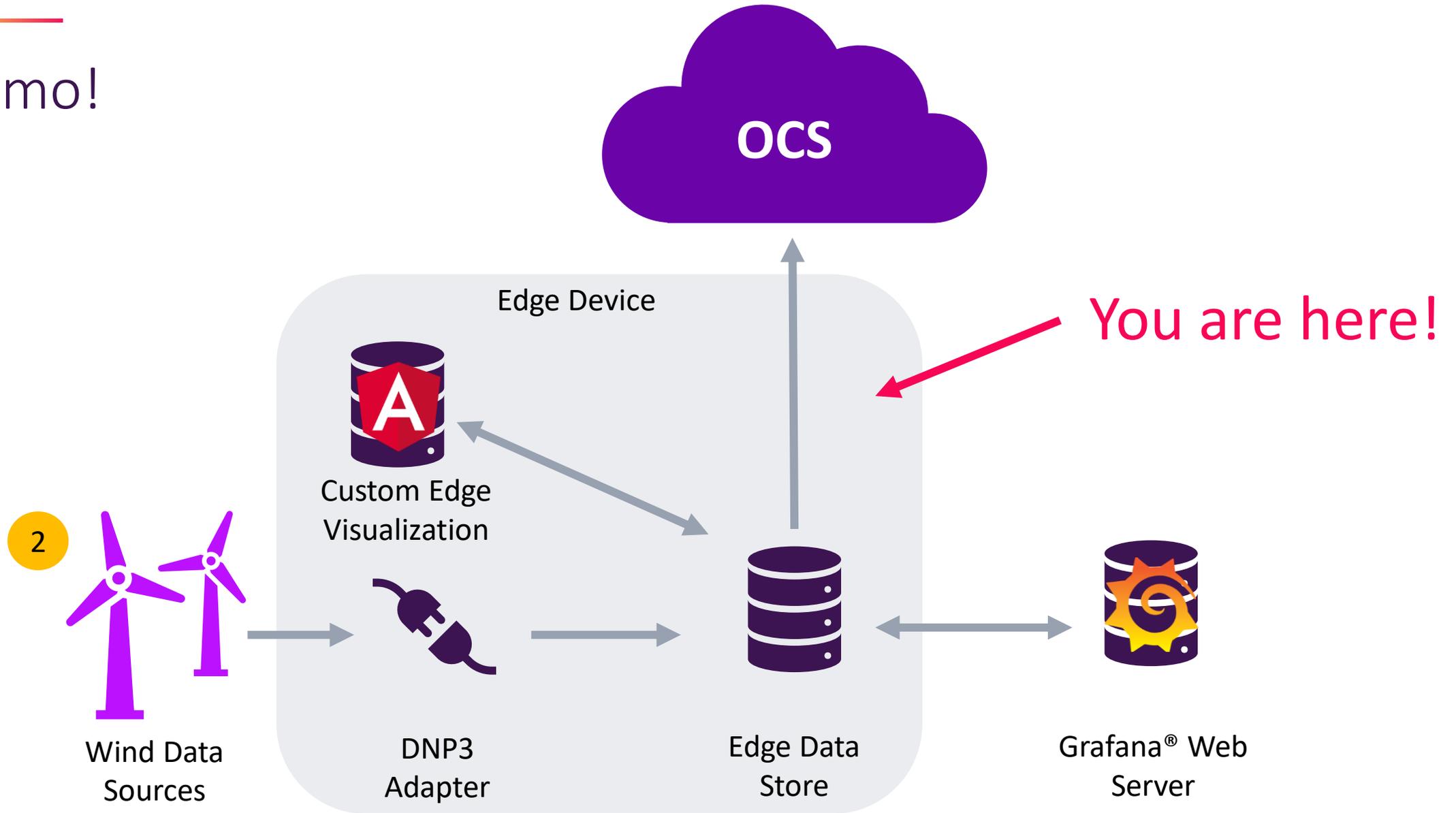


SDS Grafana® Visualization

- 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!

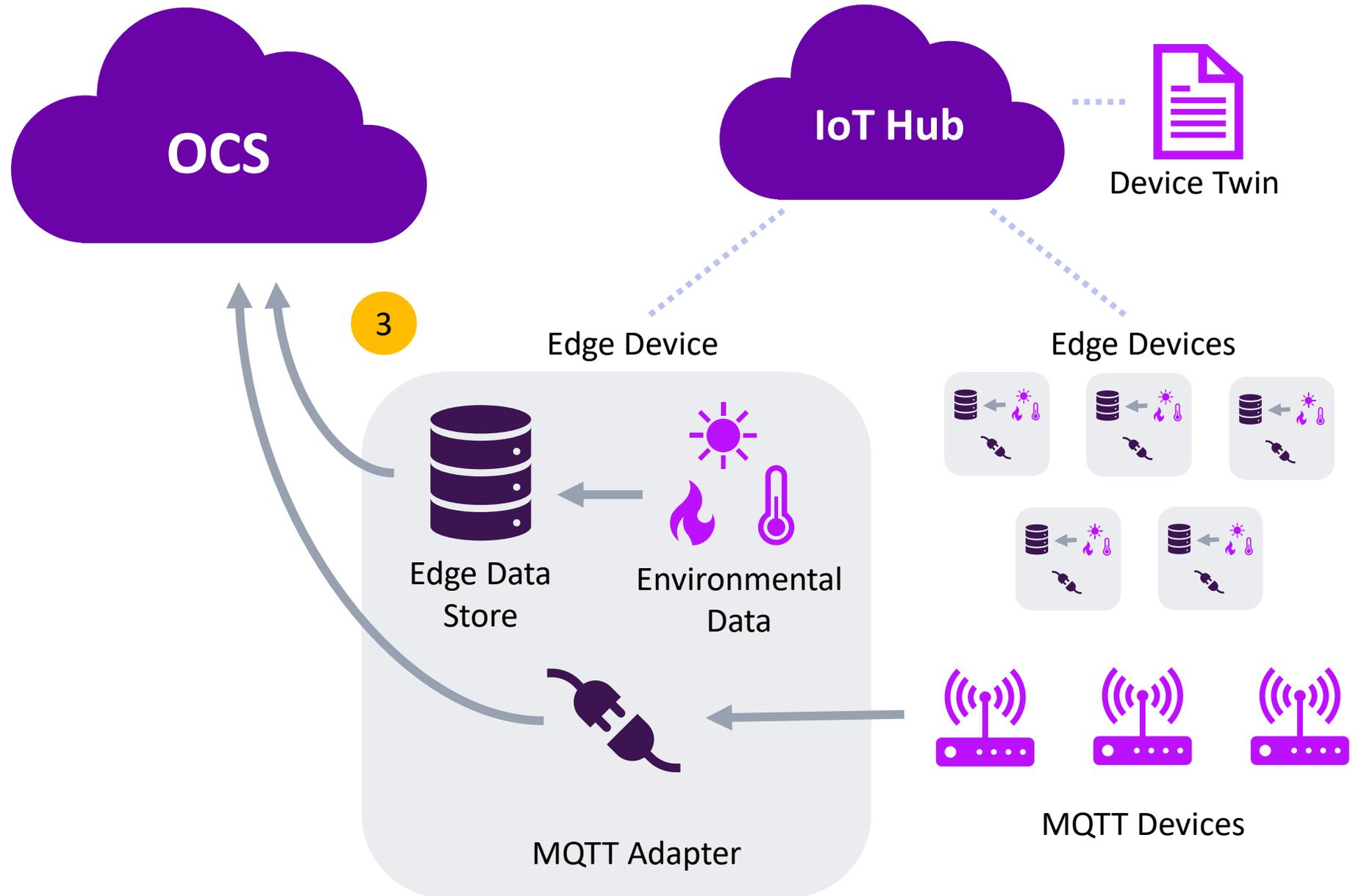


Environmental Sensor Data

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

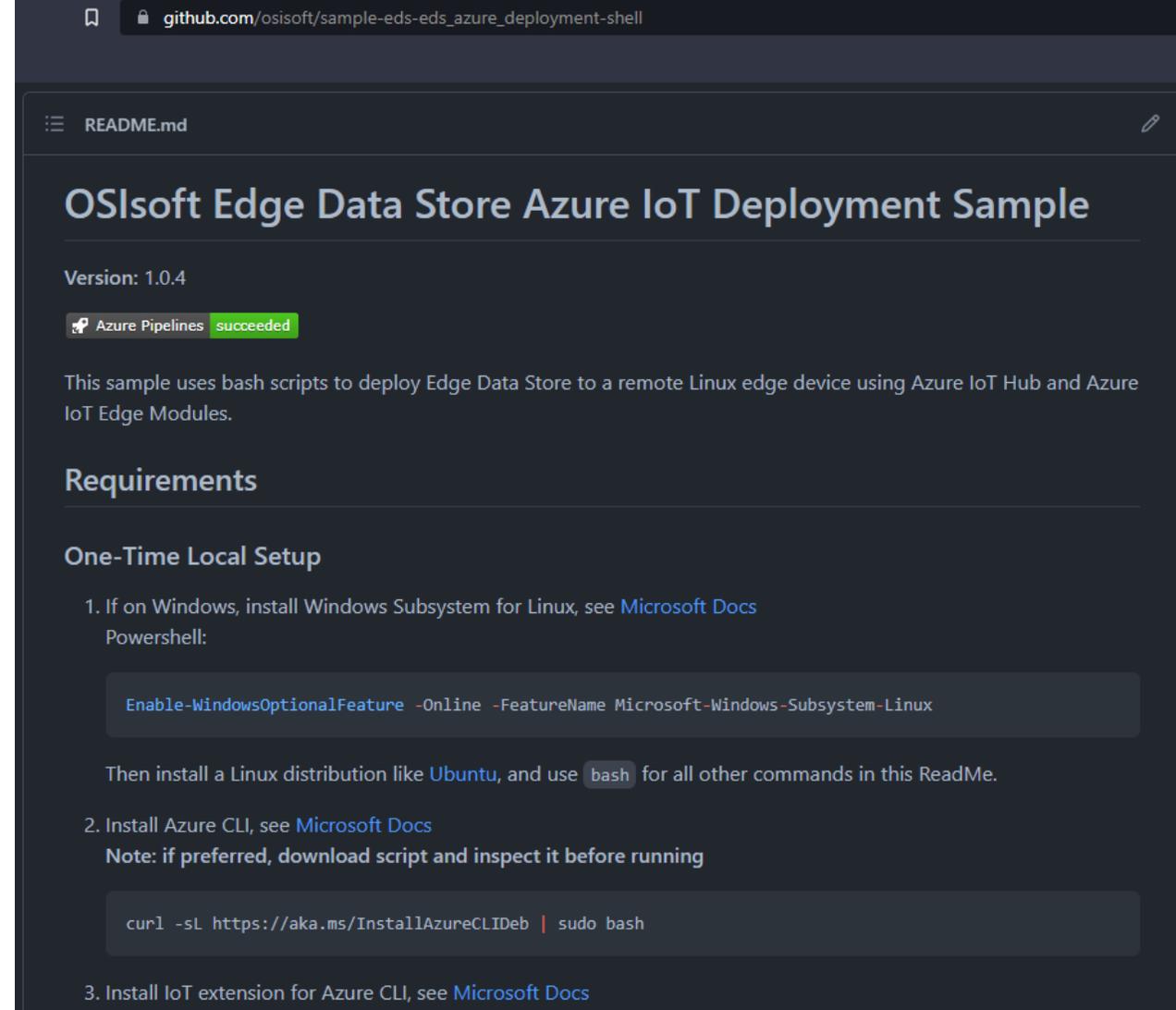
AVEVA

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



The screenshot shows a GitHub repository page for 'OSIsoft Edge Data Store Azure IoT Deployment Sample'. The page title is 'OSIsoft Edge Data Store Azure IoT Deployment Sample' and the version is '1.0.4'. A green badge indicates 'Azure Pipelines succeeded'. The page content includes a description: 'This sample uses bash scripts to deploy Edge Data Store to a remote Linux edge device using Azure IoT Hub and Azure IoT Edge Modules.' Below this, there are sections for 'Requirements' and 'One-Time Local Setup'. The 'One-Time Local Setup' section contains three numbered steps: 1. Install Windows Subsystem for Linux (with a PowerShell command: `Enable-WindowsOptionalFeature -Online -FeatureName Microsoft-Windows-Subsystem-Linux`), 2. Install Azure CLI (with a note to download and inspect the script before running, and a command: `curl -sL https://aka.ms/InstallAzureCLIDeb | sudo bash`), and 3. Install IoT extension for Azure CLI.

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

The screenshot shows the configuration page for a device named 'ConferenceRoomEDS' in the Azure IoT Hub. The page is titled 'ConferenceRoomEDS' and is under the 'SLTC-EDGE' namespace. The configuration fields are as follows:

- Device ID: ConferenceRoomEDS
- Primary Key: [Redacted]
- Secondary Key: [Redacted]
- Primary Connection String: [Redacted]
- Secondary Connection String: [Redacted]
- Enable connection to IoT Hub: Enable Disable
- Parent device: No parent device (with a gear icon for configuration)

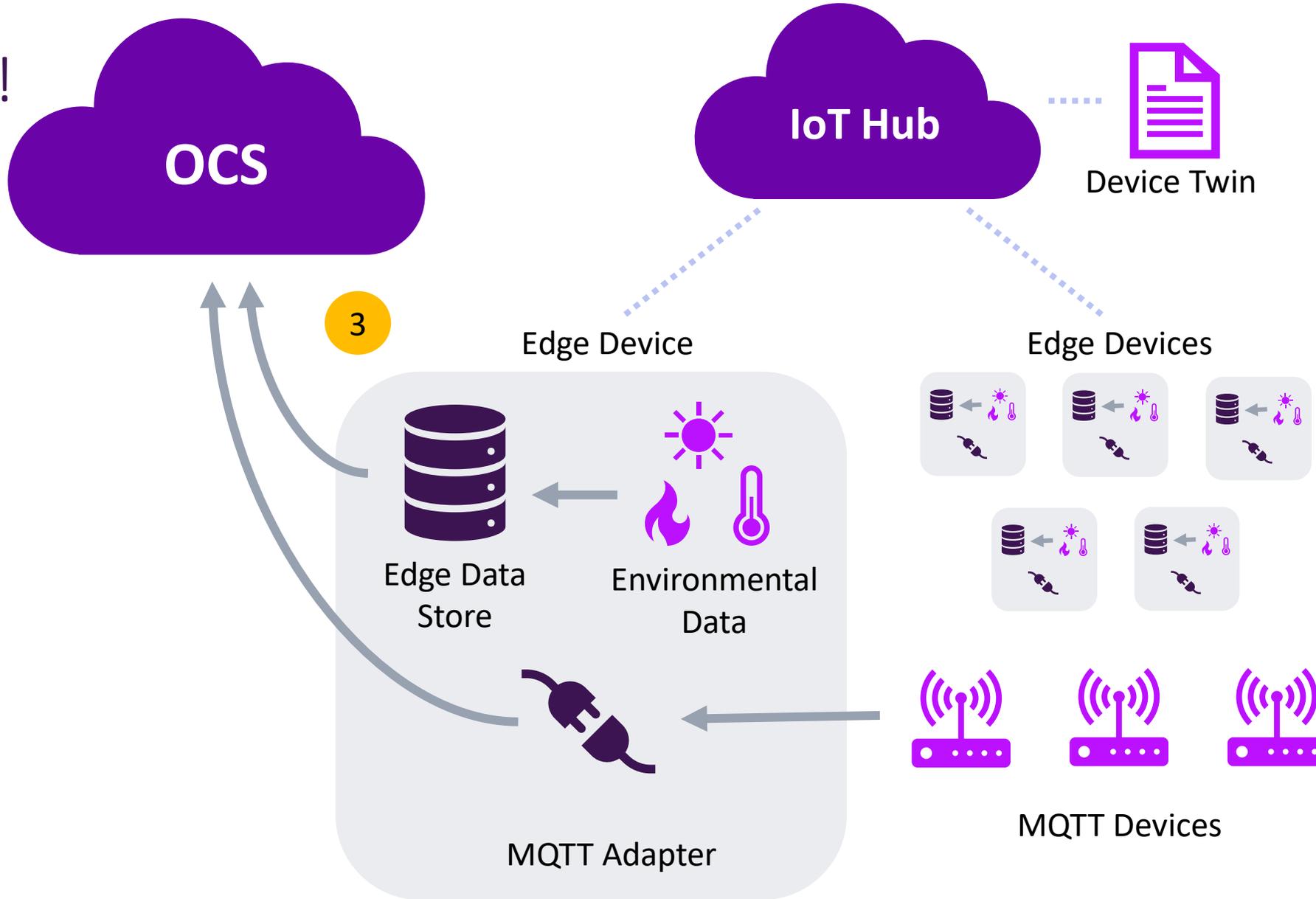
Below the configuration fields, there are two tabs: 'Module Identities' (selected) and 'Configurations'. The 'Module Identities' tab shows a table with the following columns: 'Module ID', 'Connection State', 'Connection State Last Updated ...', and 'Last Activity Time (UTC)'. The table is currently empty, with a message stating 'There are no module identities for this device.'

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

Demo!



OSIsoft Message Format (OMF)

OMF



Maximum Developer Flexibility



Lightweight Footprint



Environment Agnostic

- 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

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"
}
```

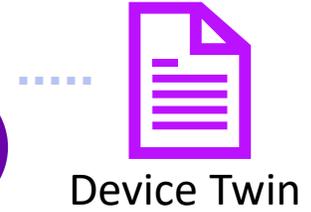
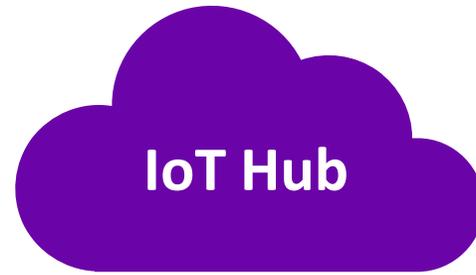
Data Messages:

```
{
  "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
    }
  ]
}
```

Demo!

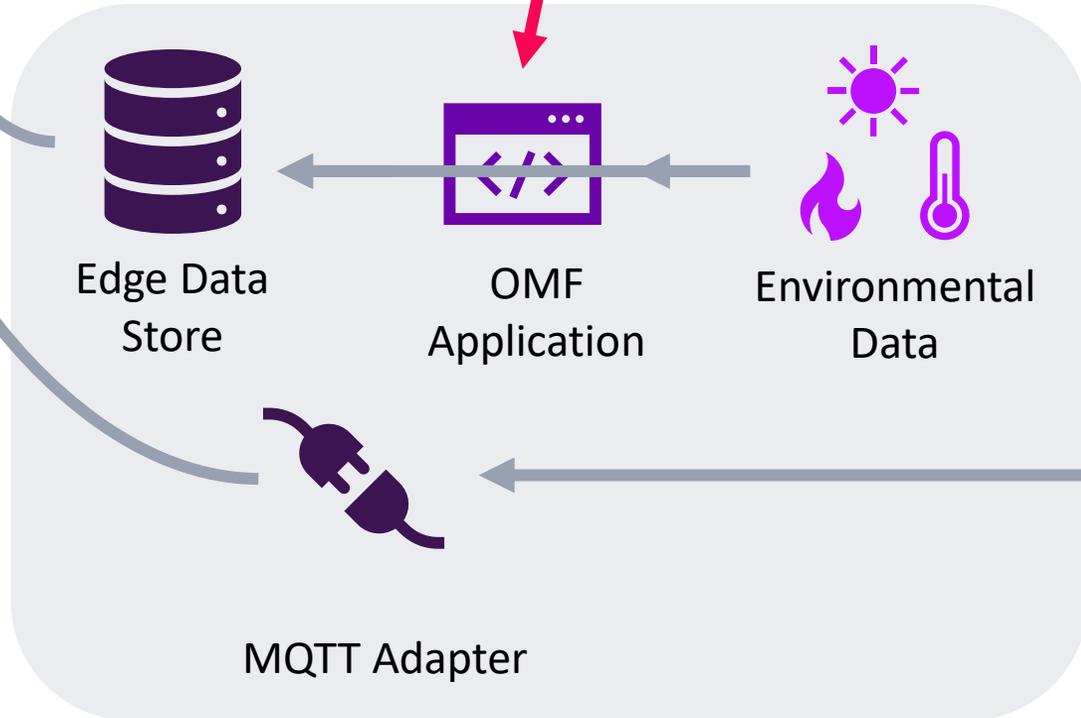


You are here!



3

Edge Device



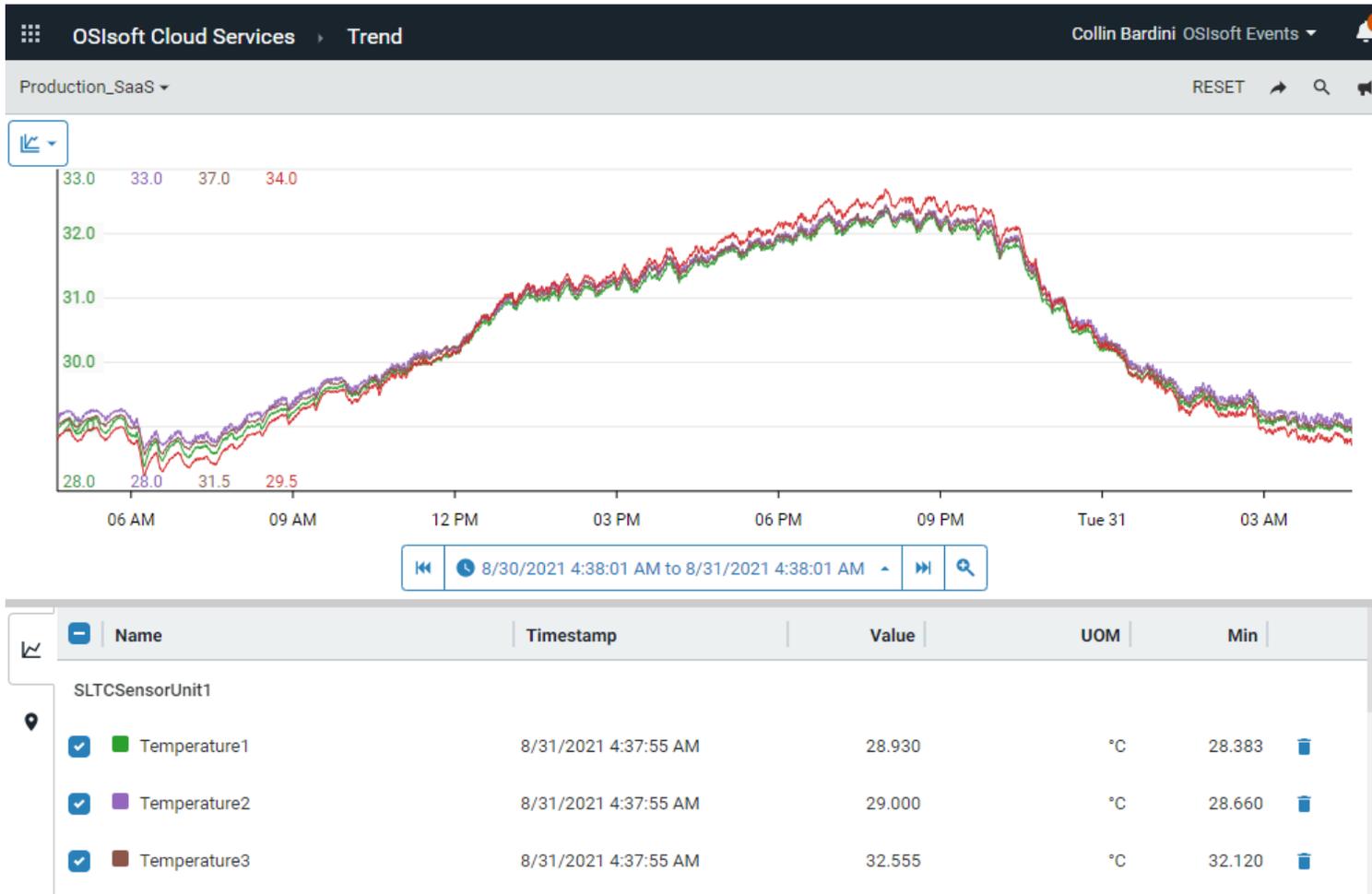
Edge Devices



MQTT Devices



Edge Analytics



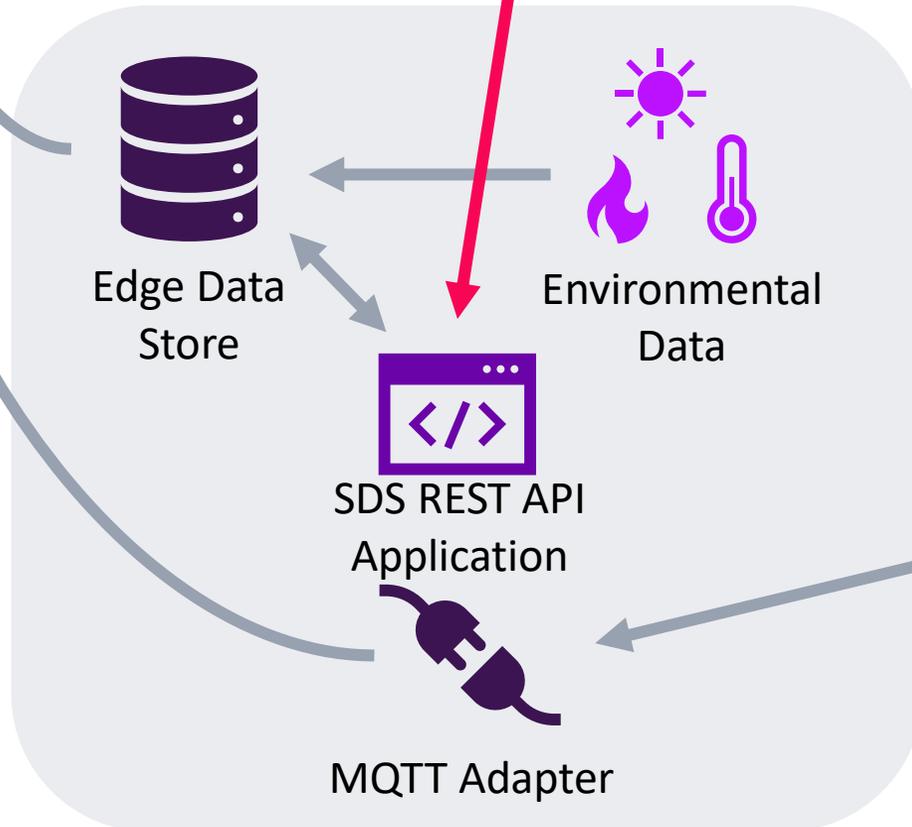
- Each sensor unit has three temperature sensors
- The users at Windtopia that consume this data prefer to use an average of three temperatures
- Edge analytics are used to calculate the average temperature on the sensor unit, making use of existing computing power

Demo!



You are here!

3 Edge Device



Edge Devices



MQTT Devices

Remote Operations Monitoring from OCS

Creating, monitoring, and visualizing OCS Assets



Cloud native platform designed for real-time operations

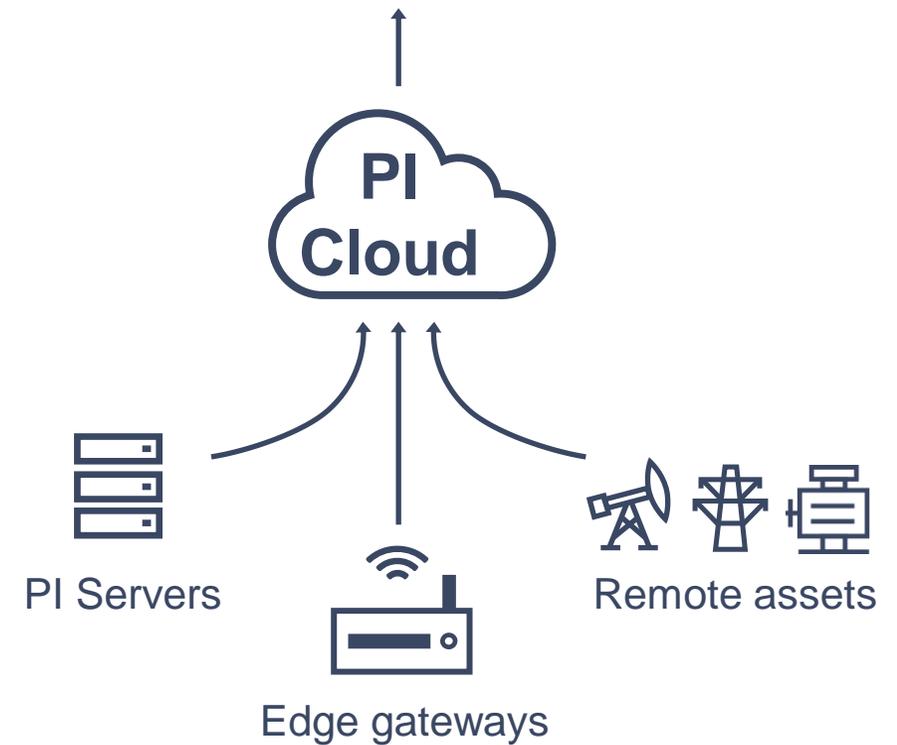
Managed, secure, multi-tenant platform

Operated & maintained by AVEVA

High speed, scalable, elastic, & resilient

Modern, secure REST APIs

Built & deployed on Microsoft Azure



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



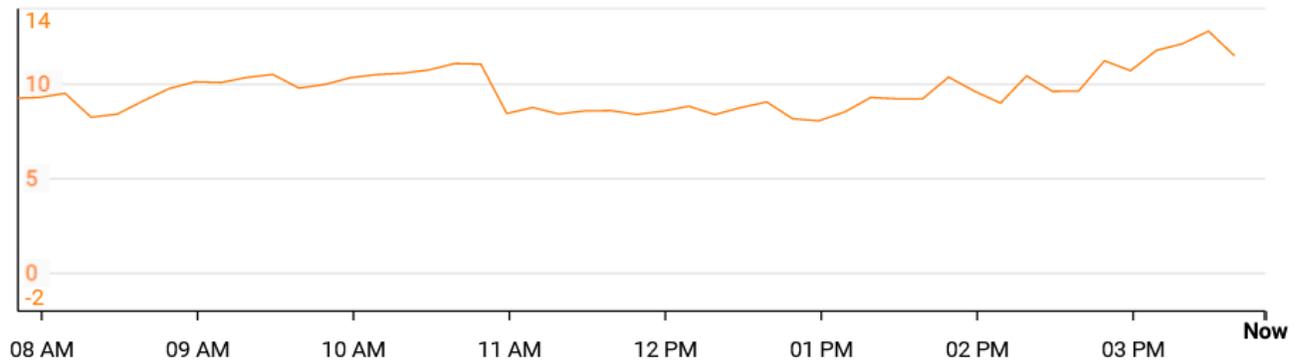
This is a Wind Turbine at Big Buffalo

Asset Type: [GE Wind Turbine](#)

Metadata **Properties** Status

	Property	Last Value	UOM	Timestamp
<input type="checkbox"/>	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
<input type="checkbox"/>	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

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

Token Sources

Stream Name Pattern

Stream Metadata

Change Stream

Stream Name Pattern

BBWF_WT_GE01_Active Power

1. Match letters preceding the delimiter “_”

{Site} - BBWF

2. Match the delimiter “_”

3. Match letters preceding the delimiter “_”

{AssetType} - WT

4. Match the delimiter “_”

Cancel

Undo Capture

Next

Tokens

{Site} - BBWF

{AssetType} - WT

{Manufacturer} - GE

{AssetID} - 01

{Measurement} - Active Power

Demo!

You are here!



Device Twin

1



Weather Forecast Service

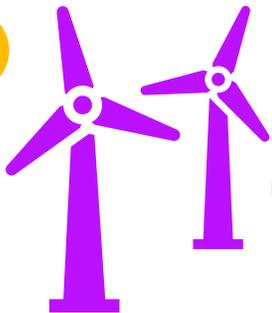


Structured File Adapter



3

2



Wind Data Sources

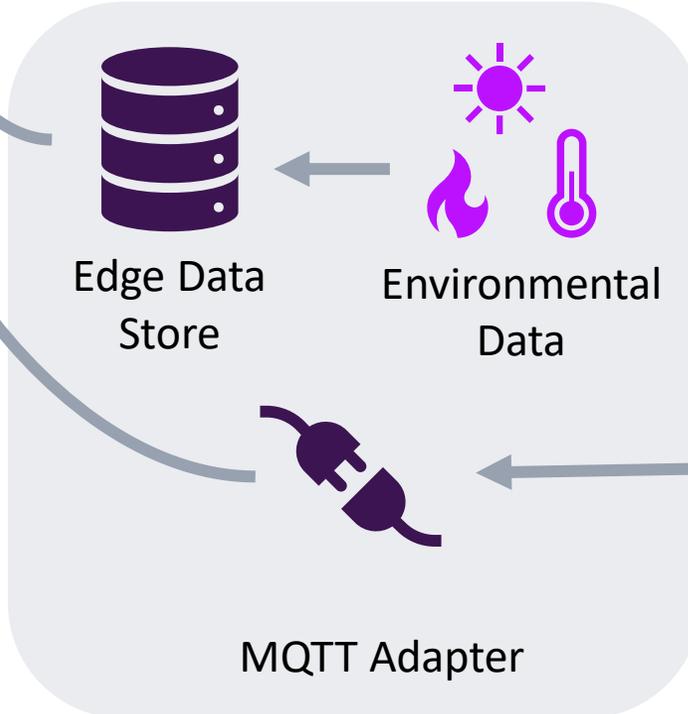


DNP3 Adapter

Edge Device



Edge Data Store



Edge Device

Edge Data Store

Environmental Data

MQTT Adapter

Edge Devices



MQTT Devices



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THANK YOU

謝謝

DZIĘKUJĘ CI

NGIYABONGA

TEŞEKKÜR EDERİM

DANKIE

TERIMA KASIH

GRACIES

WHAKAWHETAI KOE

DANKON

TANK

TAPADH LEAT

SALAMAT

SPASIBO

GRAZIE

MATUR NUWUN

ХВАЛА ВАМ

MULŢUMESC

PAKMET CIZGE

고맙습니다

GRAZIE

شكرا

FAAFETAI

ESKERRIK ASKO

GO RAIBH MAITH AGAT

HVALA

HVALA

БЛАГОДАРЯ

GRACIAS

MAHADSANID

TEŞEKKÜR EDERİM

ТИ БЛАГОДАРАМ

DANKJE

EΥΧΑΡΙΣΤΩ

GRATIAS TIBI

OBRIGADO

TAK DANKE

AČIŪ

SALAMAT

MAHALO IĀ 'ŌE

TAKK SKALDU HA

МЕРЦИ

RAHMAT

MERCI

GRAZZI

PAKKA PÉR

ありがとうございました

DI OU MÈSI

ĐAKUJEM

HATUR NUHUN

PAXMAT CAĠA

SIPAS JI WERE

TERIMA KASIH

CẢM ƠN BẠN

UA TSAUG RAU KOJ

ТИ БЛАГОДАРАМ

СИПОС

WAZVIITA

FALEMINDERIT

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