18/05/2022

Leveraging on AVEVA Edge/Cloud solutions to satisfy Enel’s new data needs

Alessandro Civiero / Alvise Rossi / Daniel Linares

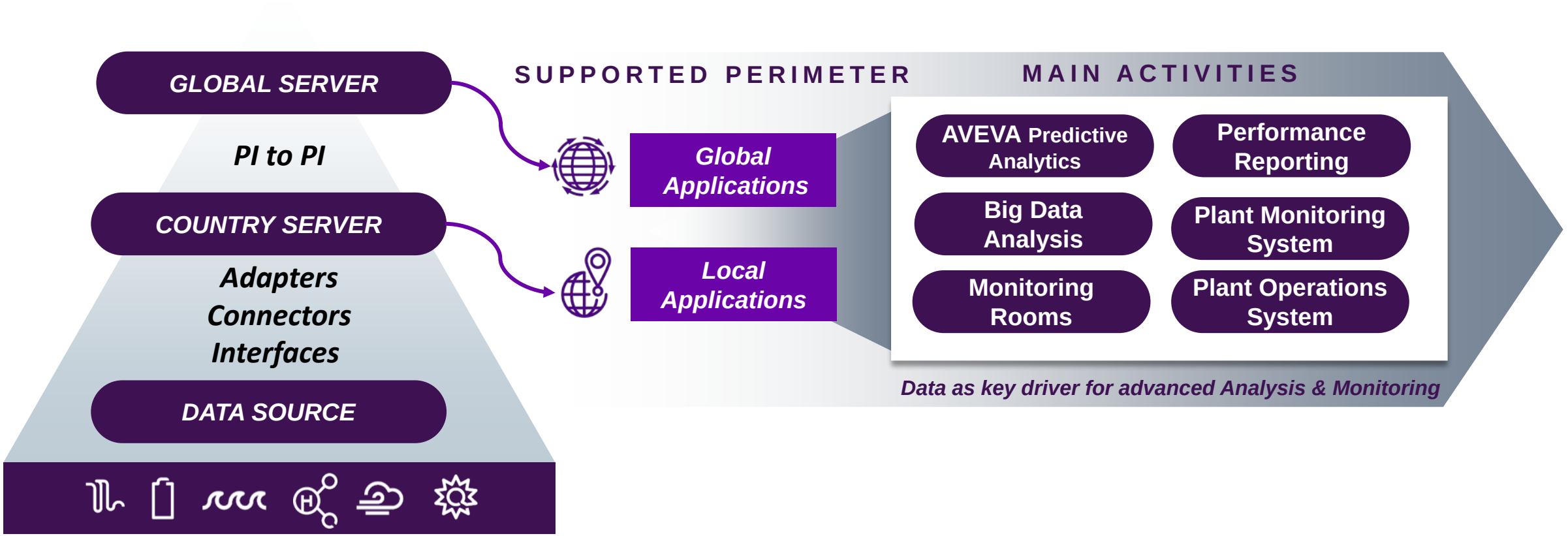
About Enel

Enel leadership in clean energy transition

- World's largest private player in **renewables** operating in 21 countries with more than 1200 power plants
- ~84 GW additional renewable capacity by 2030
- We are part of the Digital Hub of Enel Green Power and Thermal Generation business line
- PI System as cross-technology main platform for data gathering from plant

Plant Data Gathering

Brief summary of our two levels architecture



Agenda

1) How to automatically fill gaps in PI System with SCADA data to ensure the highest data availability
2) How to acquire data from small and distributed sensors / systems using an IoT approach
3) How to aggregate data on-site to reduce bandwidth and hard disk consumption, without deploying a PI data archive
4) How to access PI System data from Microsoft PowerBI dashboards with the goal to cross the PI System data with other sources for reporting and presentation purpose.

Enel designed the solutions to the above needs by experimenting the features offered by new AVEVA solutions, namely PI Adapters, Edge Data Store and OCS

AVEVA

How to automatically fill gaps in PI System with SCADA data to ensure the highest data availability

Data recovery through OPC UA

Challenge

Guarantee the highest data availability on PI Server and permit history recovery as backup strategy in case of real-time data flow unavailability with an on-demand solution

Solution

Deployed a PI Adapter for OPC UA in our infrastructure without changing the real-time configuration and data flow. Installed also a central queue service for data retrieval management

Benefits

Backup strategy available to recover data gaps and possibility to recover data gaps on-demand from a central environment

AVEVA

The challenge for a data driven company

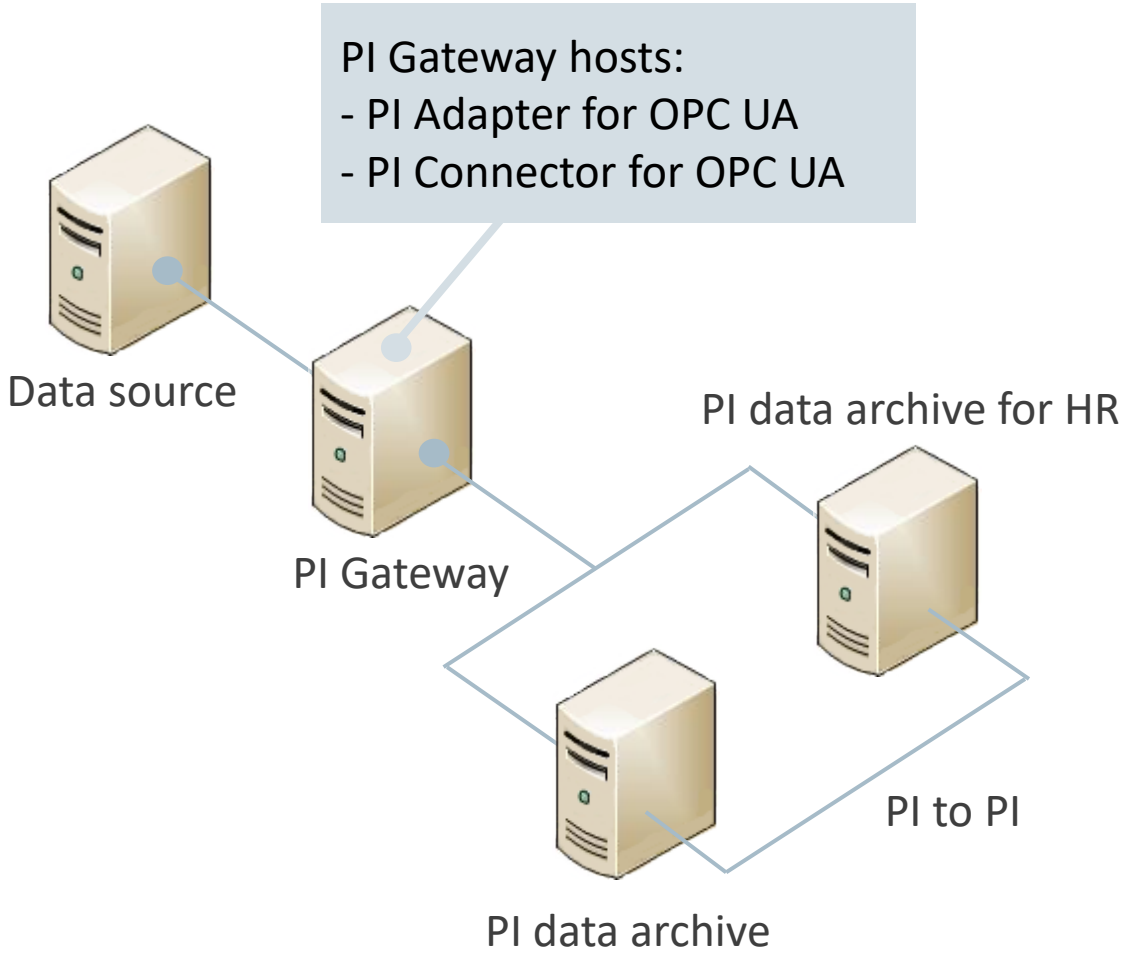
Each event deserves its place in our PI System

- Maintenance activities or failures can affect data flow
- Backup strategy is needed to guarantee a second «road» to acquire data, even at a later stage
- We can’t afford to manually load csv files downloaded from each SCADA. This is too much of an effort for us!

Data recovery through OPC UA

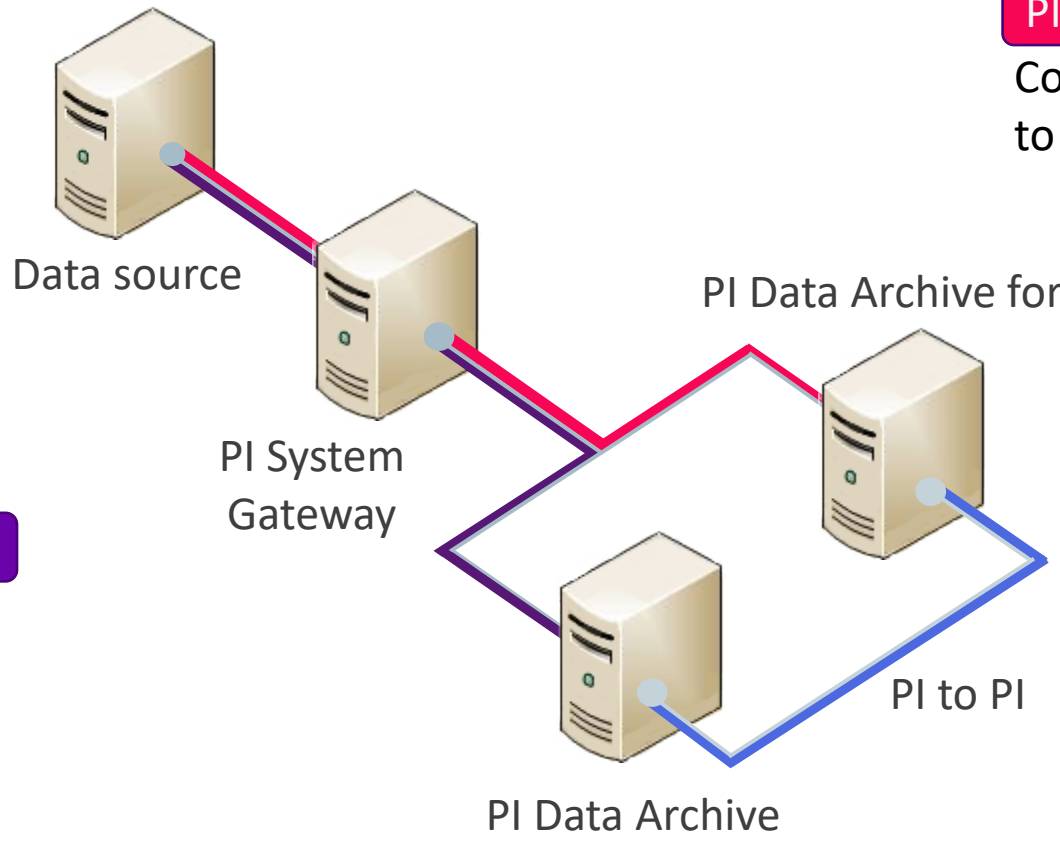
How are we recovering data from the data source

- PI Adapters for OPC UA is our choice as backup strategy for data retrieval
- It’s installed together with PI Connector for OPC UA in the PI Gateway
- PI Adapter is queried through an automatic script that is getting the time interval to be recovered from a central service for queue management



The solution for data recovery

How are we recovering data from the data source



PI Adapter for OPC UA

Collect historical data to be sent to archive for HR

PI Connector for OPC UA

Collect real-time data

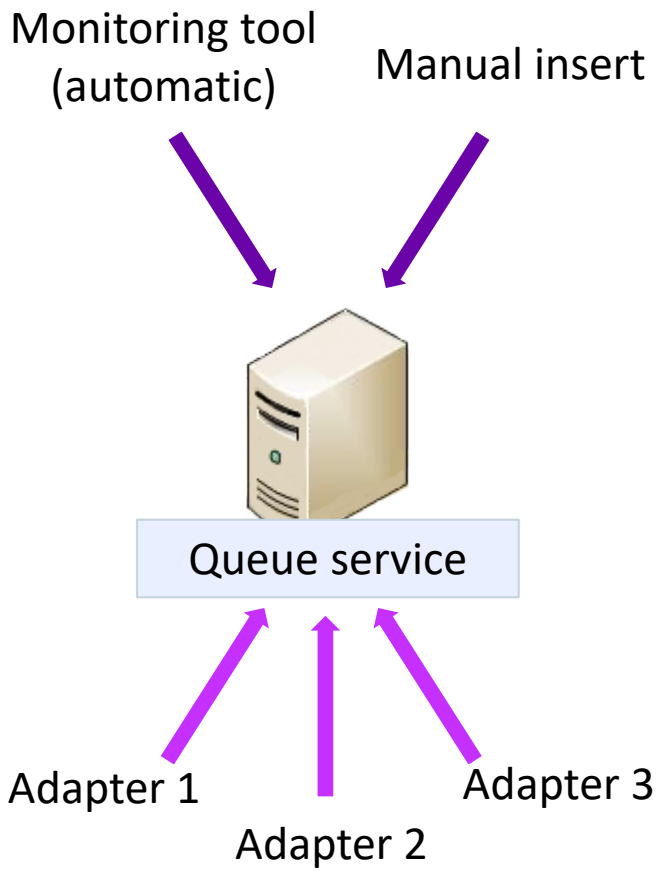
PI to PI

Collect historical data from HR data archive to be sent to main data archive

Data recovery through OPC UA

When do the Adapter should wake-up and ask for historical data from the data source?

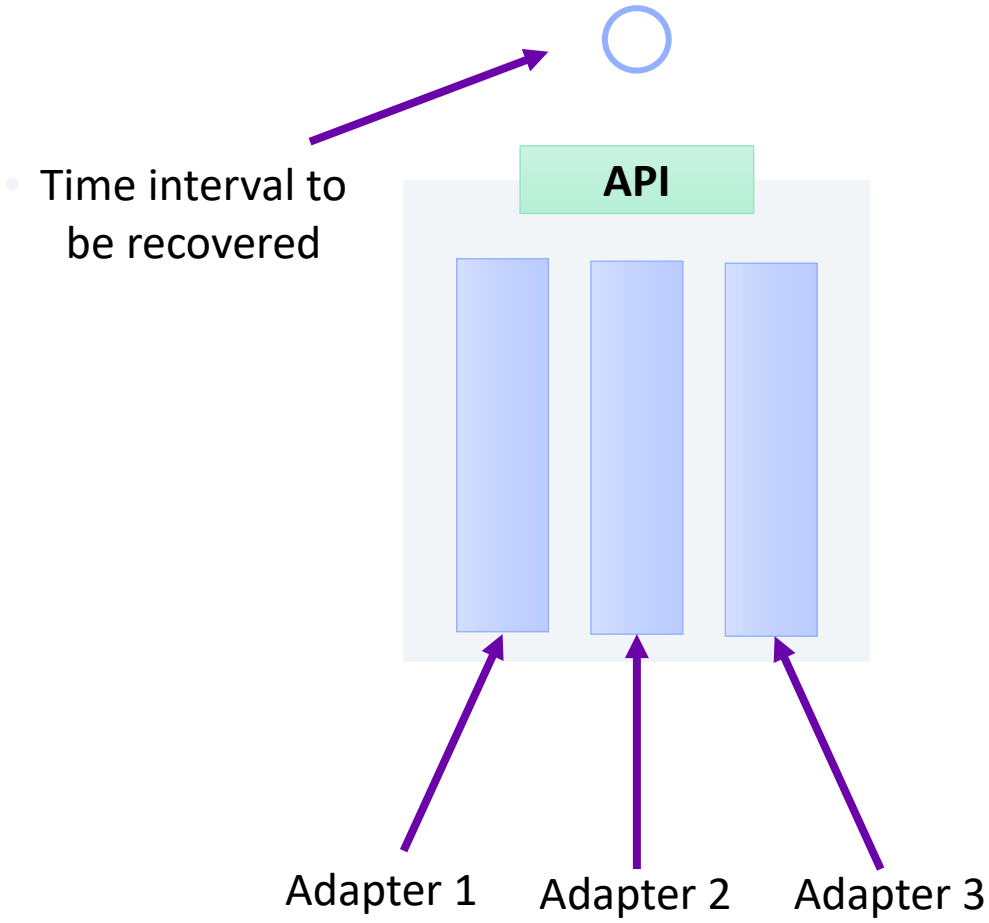
- We have several power plants and data sources, so we can’t rely only on manual activities
- We have planned a microservice to manage queue message to our adapters
- A script installed in the PI System gateway (where the adapter reside) read from the central queue if there are new messages to retrieve



Data recovery through OPC UA

The centralized queue management service

- A data loss event payload is generated and sent to the queue service API
- Queue service store the payload in a dedicated queue based on the routing key associated with the event
- Each queue is dedicated to one adapter (and equally one plant)
- A script installed in the PI System gateway (where the adapter reside) read from the central queue if there are new messages to retrieve and query the adapter with the payload retrieved.



The solution for data recovery

Benefits from this solution

- Data can be recovered from a centralized environment without different VPN, account or connections
- Only outbound network policies are required from PI System gateway located in plant network
- Flexibility of API in Adapters and queue service admits future improvements
- The Adapter is using the existing infrastructure, so there’s no need of new installations

Lighthouse project - PI Adapter for MQTT

Lighthouse project - PI Adapter for MQTT

Challenge

Standardize and increase the operational data egression on the current PI System Infrastructure from small and remote assets.

Solution

Acquire data with a PI Adapter for MQTT using light-weight and cost-effective technologies.

Benefits

Having a standard IoT/Edge off-the-shelf, scalable solution that will increase the availability of data for remote / small assets.

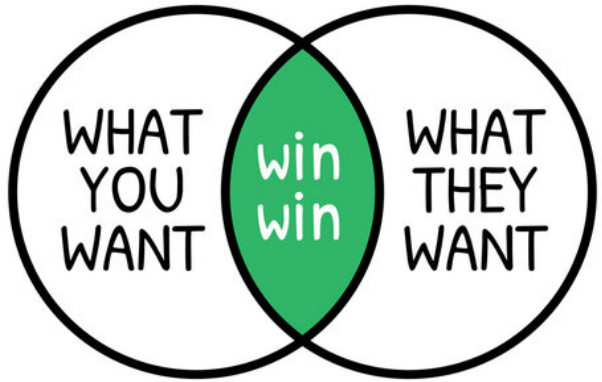
AVEVA

The lighthose project – PI Adapter for MQTT

What is it and which are the reasons behind this lighthouse project?

Enel receives:
- Pre-released software
- Engineering support
- Program management

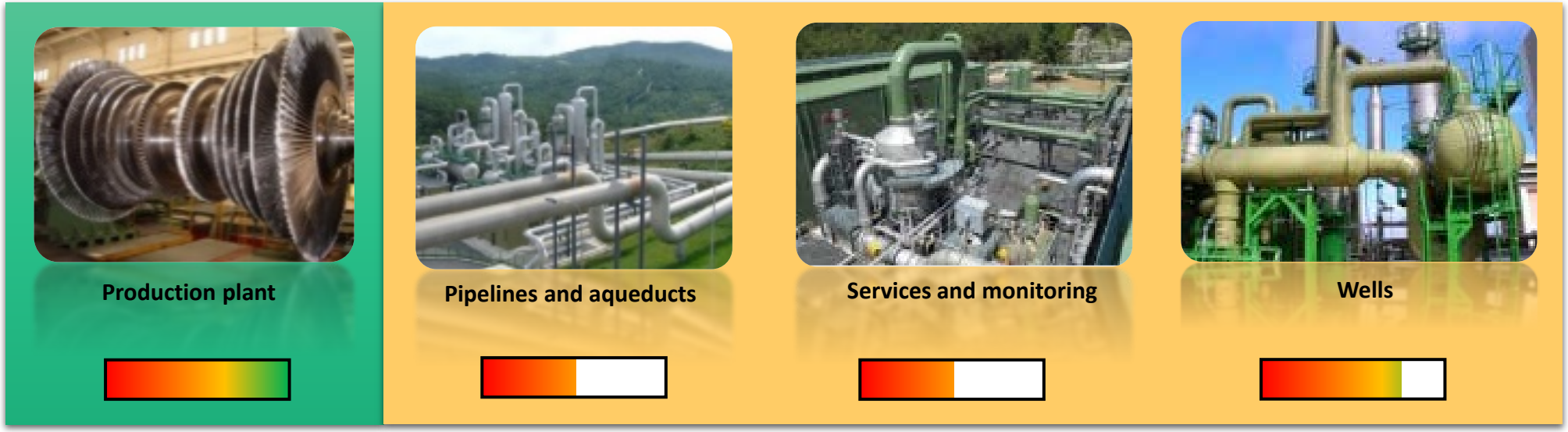
AVEVA receives:
- Feedback



Use Case Geothermal

Why do we need a PI Adapter for MQTT for Geothermal?

- Geothermal Power Generation (Italy)
  - To improve the acquisition of data from pipelines and aqueducts, Service and monitoring and wells

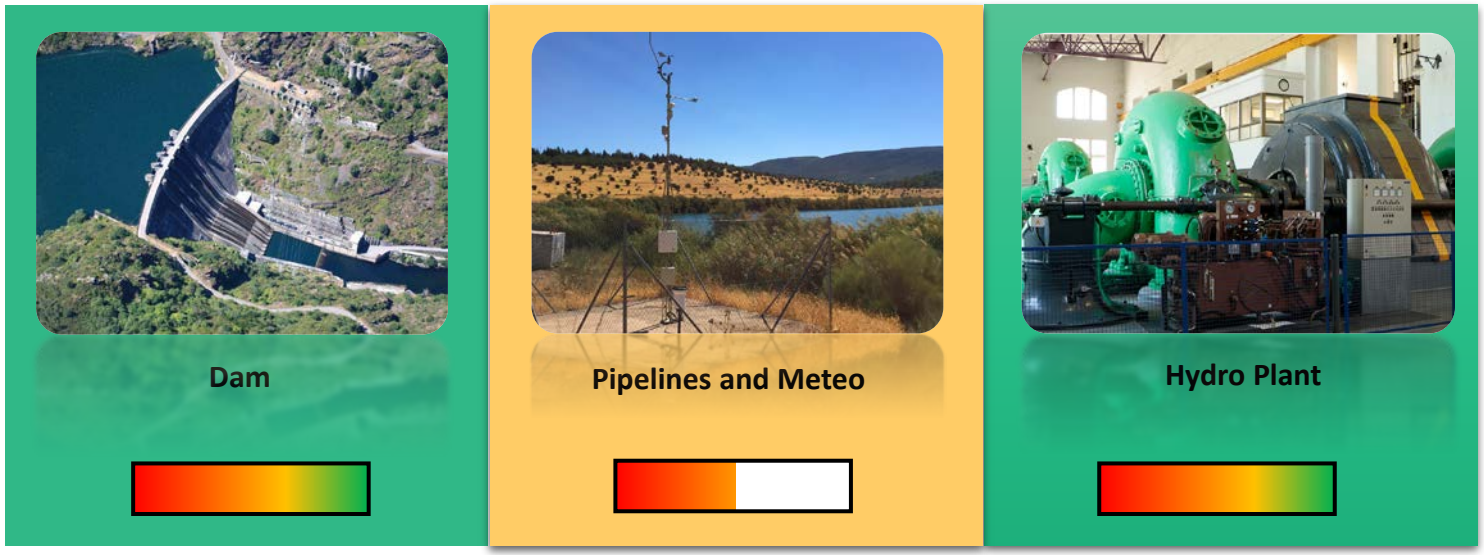


Data Acquisition Level Indicators up to date by asset type in Geothermal technology in Italy

Use Case in Hydro

Why do we need a PI Adapter for MQTT in Hydro?

- Hydro Power Generation (Spain)
  - To Improve the acquisition of data from pipelines and meteo stations
  - To standardize the solution across all the plants as a replacement of individual systems based on dataloggers



Data Acquisition Level Indicators up to date by asset type in Hydro technology in Spain

The lighthose project – PI Adapter for MQTT

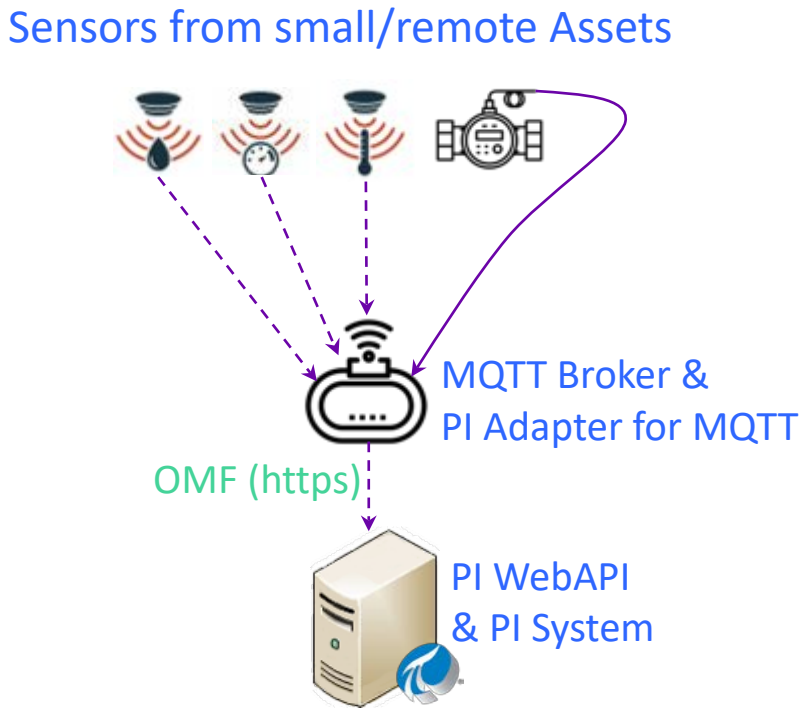
What are the reasons behind this lighthouse project?

- Provide a cost-effective solution to maximize the value to the business.
- Achieve an easily scalable, off-the-shelf solution for consistency across geographies.

Implementation details

Making data ingress from small and remote assets possible.

- Data collection from remote / small assets with IoT sensors or a light device that processes the signals.
- MQTT Broker and PI Adapter for MQTT is installed on the light device.
  - The PI Adapter for MQTT subscribes to the data from the broker and sends it to a PIWebAPI server using OSIsoft Message Format (OMF).
- The PI Web API will act as the entry point to the current PI System infrastructure.



Lighthouse Outcome

Benefits of the PI Adapter for MQTT on theses use cases

- The functionality of the solution has been succesfully proved.
- Cost-effective solution.
- Off-the-shelf solution from AVEVA that can be easily integrated in the existing PI System Infrastructure.
- Scalable solution for existing and new plants.

Local data aggregation through EDS

Local data aggregation through EDS

Challenge

Be able to perform analyses on a large set of homogeneous data, even when they consist of tens of thousand tags for a single plant

Solution

Perform local data aggregation: consider the contribution of all the tags at the source, but send to the central Data Archive only the output of an aggregation

Benefits

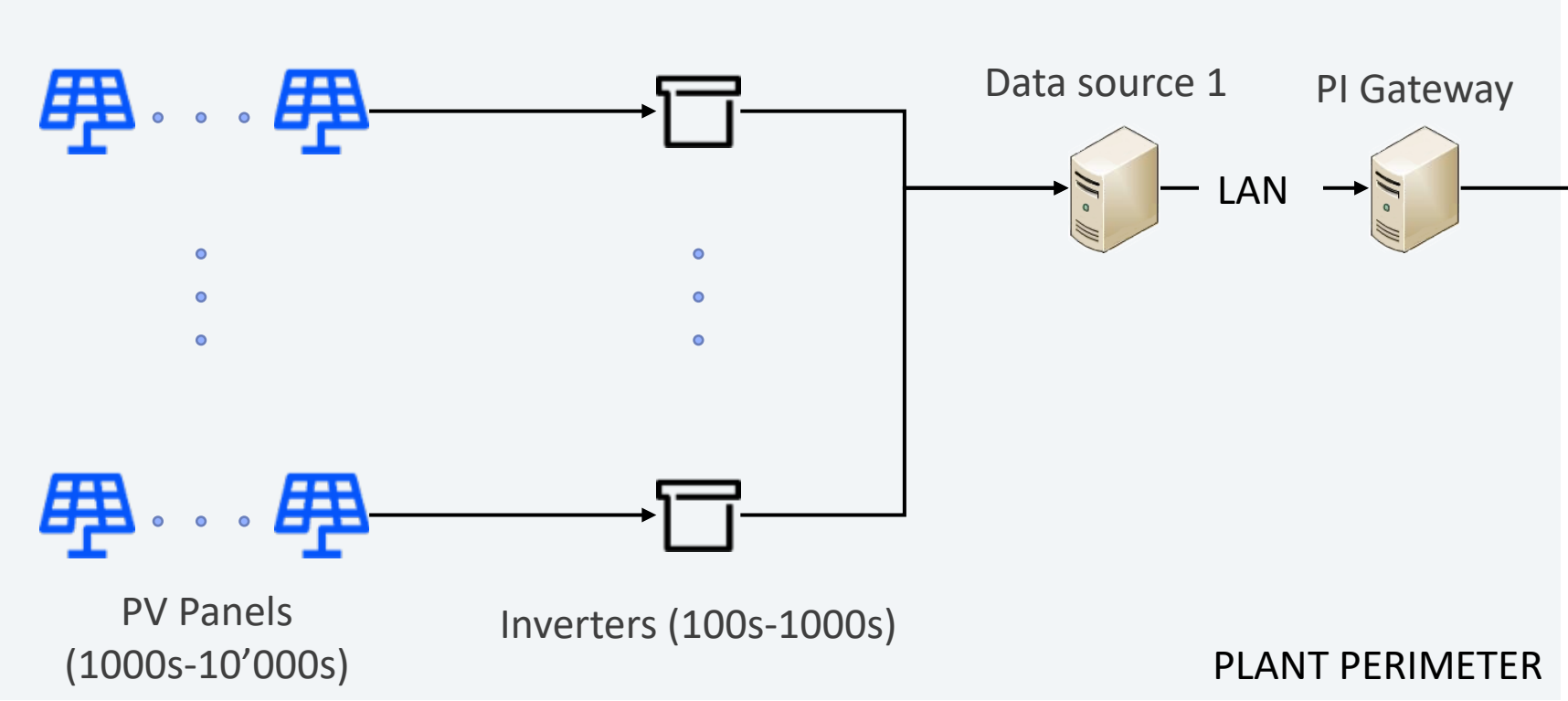
Obtain the same final result, without:

- need for changes in the data source
- overloading of network links
- wasting hard drive space for larger PI Data Archives

Preamble: the existing architecture

The number of PV panels in an Enel plant can be very large!

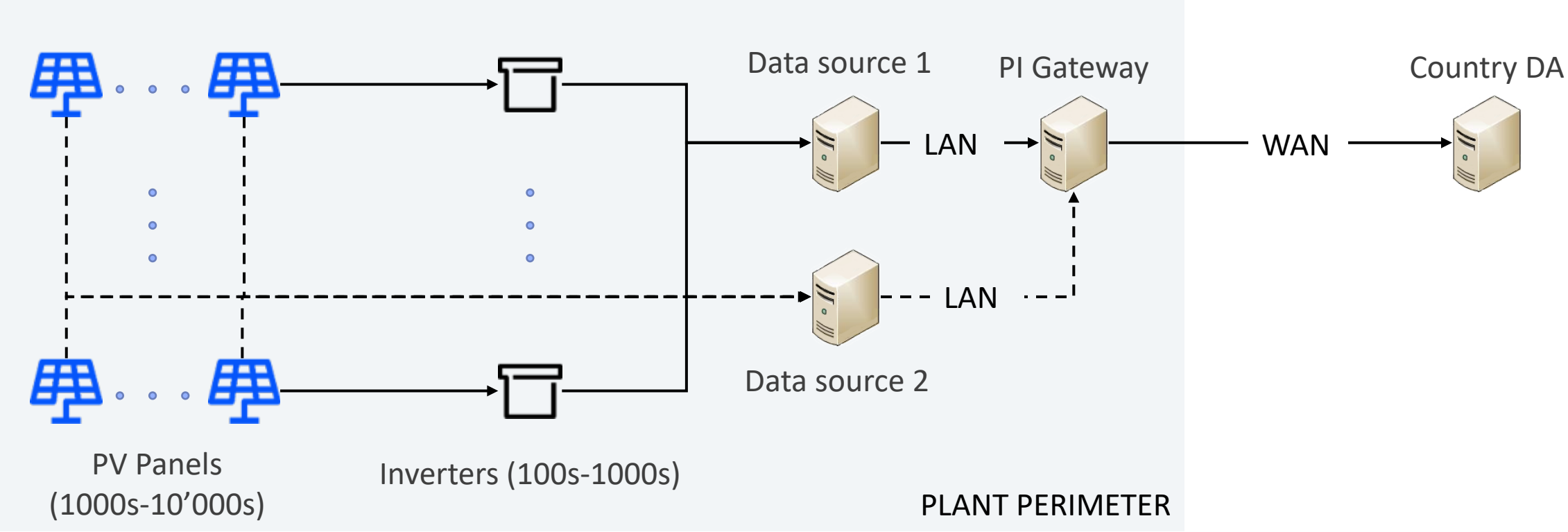
- So far, Enel has acquired data mostly at the inverter level



New need: analyses at the PV panel level

Increasing the granularity of the data acquired

- More recently, our users needed to perform analyses at the PV panel level



Issues with PV Panel data acquisition

The number of variables increases dramatically – especially considering the same activity on multiple plants. This means that:

- WAN network links might not bear the increase in traffic
- Improving the network links is a time-consuming and costly process
- The hard drive space taken by archives on the Country Hub would be significantly increased

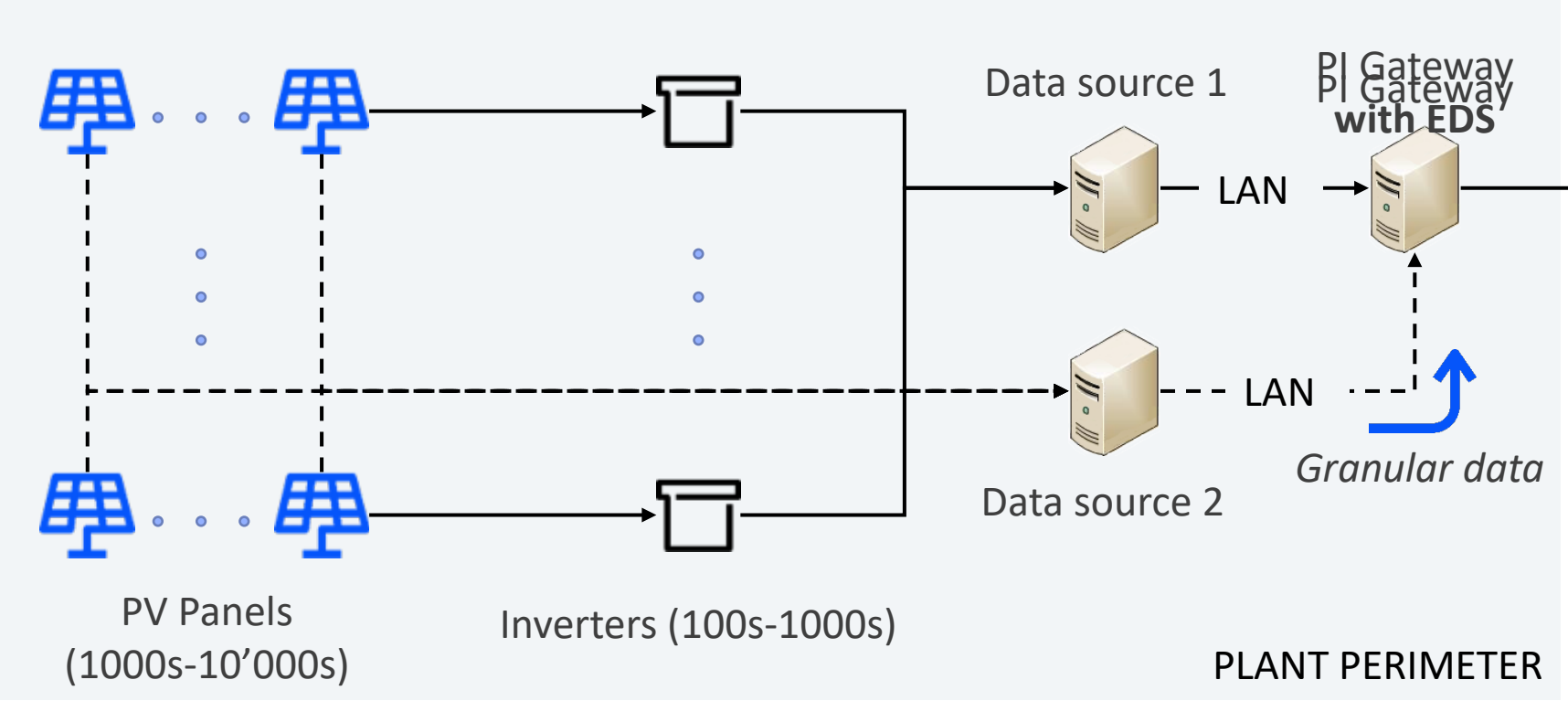
Solution:

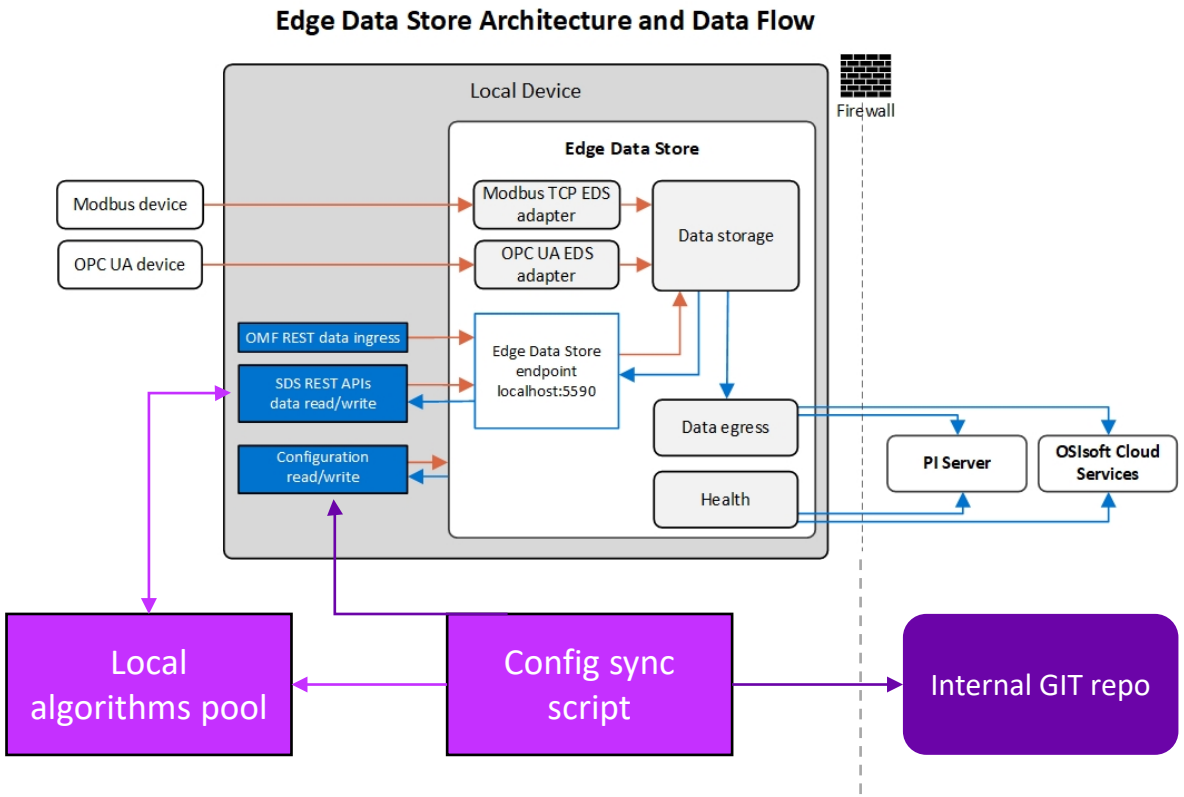
Decentralize the analyses with local data aggregation

Enabler:

EDS!

Installing EDS directly on the PI System Gateway node





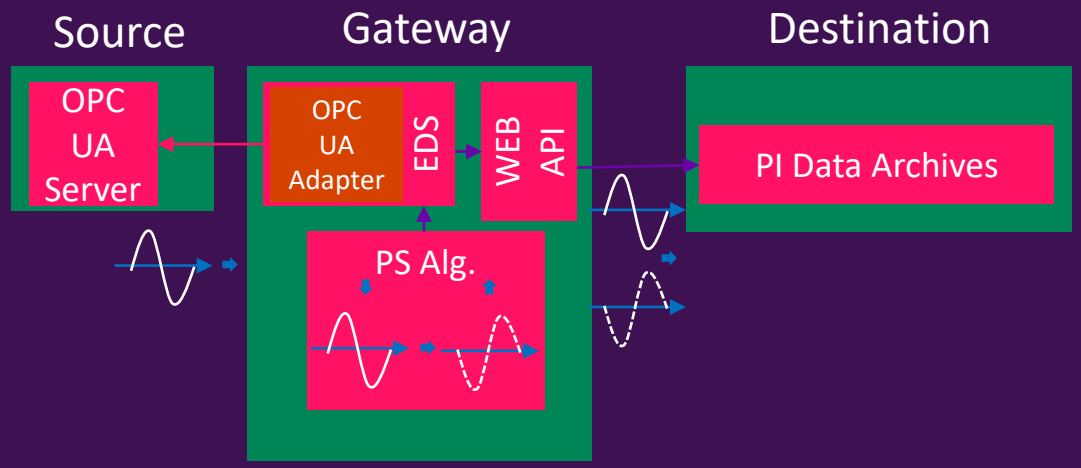
Usage of EDS

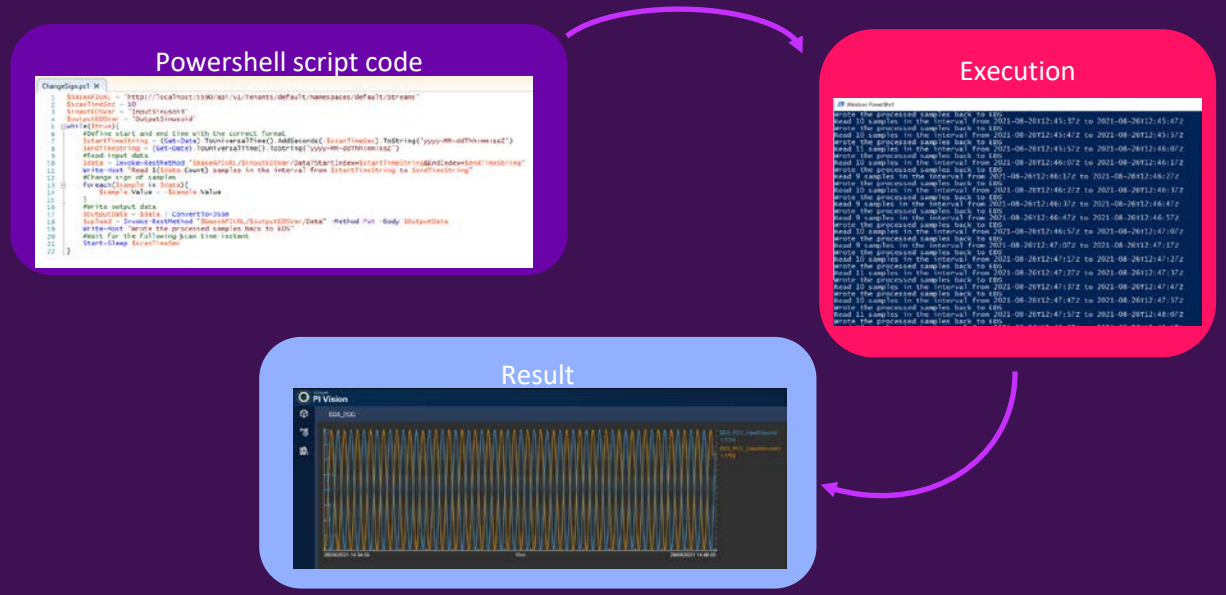
By means of EDS we will be able to:

- Establish a data channel in parallel to the existing one
- Reuse the hardware already available on site
  - Less resources needed w.r.t. a local Data Archive
  - Quicker deployment
- Have a two-level historian:
  - Granular short-term historic data on EDS for debugging
  - Aggregated long-term historic data on the Data Archive
- Aggregate data using common programming languages, using EDS REST API for I/O
- Apply uniform analyses thanks to a central repository of algorithms, containing both the codebases valid for all plants and configuration files specific to each single plant

The proof of concept

- So far we successfully tested the architecture in a development environment, using a simple algorithm that inverts the value of a sinusoid
- We are now in the phase of designing the deployment of a real data aggregation algorithm on a test plant
- We still have to assess the performance boundaries for such an implementation (maximum # of tags and ev/sec that can be managed in our scenario)





Extra: PI Data in PowerBI through OCS

PI Data in PowerBI: a growing demand

- In our company, the usage of PowerBI for creating different kind of reports has **significantly increased** over the last months
- PowerBI can be used to create dashboard that allows to **cross PI System data** with data coming from **other corporate data stores**
- Before OCS, the main option considered for integrations with PowerBI was the usage of the *PI Integrator for Business Analytics*, which **requires an intermediate database to be deployed**
- Enel chose to explore the possibility to use OCS for this kind of integration, both to have a **lighter integration infrastructure** and to **move the first steps into the OCS world**
- So far a PoC about the creation of a dashboard showing the real-time total active power per country has been implemented – more to come!

Value per Country

Wrap-up

Global Renewable energy for a sustainable future

Improve availability of data

Goals

- Improve availability of data
- Acquire more data from field to enable deeper analyses
- Create business-class dashboards including PI data

Challenges

- Real-time data acquisition can be interrupted for different causes
- Avoid the overloads of network links and storage drives on central systems
- Easily connect PI data with Power BI

Results

- Adapters with easy management and installation are the chosen backup-strategy
- The results of the tests made those tools appear very promising

Alessandro Civiero

Plant Information Platform Engineer

- Enel Green Power S.p.A.
- alessandro.civiero@enel.com

Daniel Linares

Plant Information Platform Engineer

- Endesa Medios Y Sistemas, S.L.
- daniel.linares@enel.com

Alvise Rossi

Plant Information Platform Engineer

- Enel Global Thermal Generation S.r.l.
- alvise.rossi@enel.com

Questions?

Please wait for the microphone

- State your name and company

Please remember to…

Complete the survey!

- Navigate to this session in the mobile agenda for the survey

This presentation may include predictions, estimates, intentions, beliefs and other statements that are or may be construed as being forward-looking. While these forward-looking statements represent our current judgment on what the future holds, they are subject to risks and uncertainties that could result in actual outcomes differing materially from those projected in these statements. No statement contained herein constitutes a commitment by AVEVA to perform any particular action or to deliver any particular product or product features. Readers are cautioned not to place undue reliance on these forward-looking statements, which reflect our opinions only as of the date of this presentation.

The Company shall not be obliged to disclose any revision to these forward-looking statements to reflect events or circumstances occurring after the date on which they are made or to reflect the occurrence of future events.

linkedin.com/company/aveva

@avevagroup

ABOUT AVEVA

AVEVA is a global leader in industrial software, driving digital transformation and sustainability. By connecting the power of information and artificial intelligence with human insight, AVEVA enables teams to use their data to unlock new value. We call this Performance Intelligence. AVEVA's comprehensive portfolio enables more than 20,000 industrial enterprises to engineer smarter, operate better and drive sustainable efficiency. AVEVA supports customers through a trusted ecosystem that includes 5,500 partners and 5,700 certified developers around the world. The company is headquartered in Cambridge, UK, with over 6,500 employees and 90 offices in over 40 countries.

Learn more at www.aveva.com

AVEVA