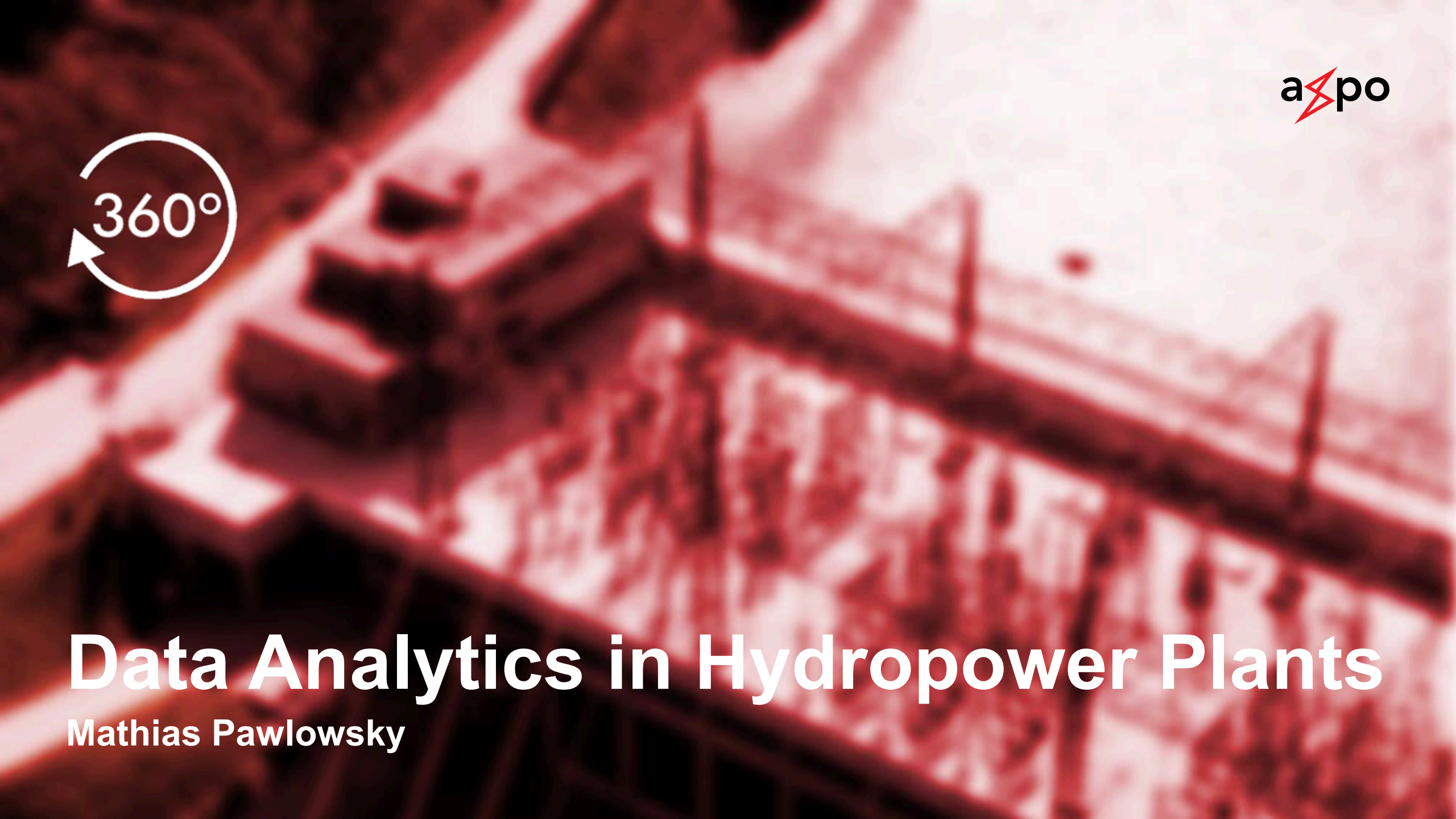
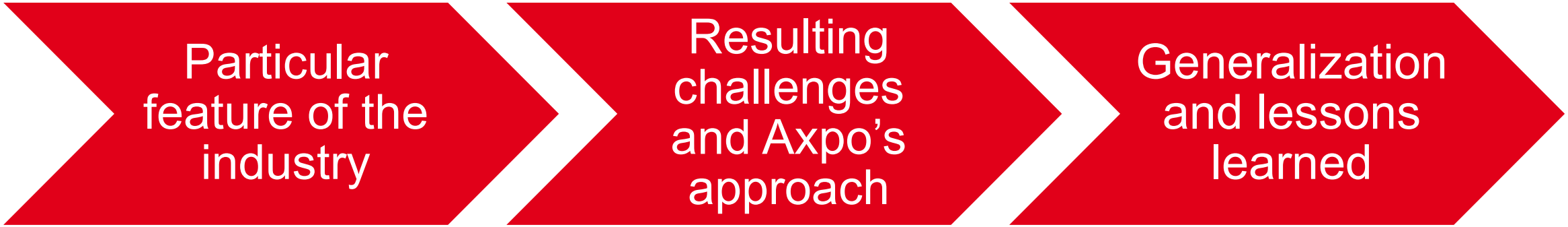


Data Analytics in Hydropower Plants

Mathias Pawlowsky

Case study format



Goals:

- You can recognize a similarly structured problem in your industry and profit from Axpo's experiences
- You already had a similar problem and found a better solution → Let's talk

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Particular features
Water flows, data doesn’t

Situation:

- Sensor data is stored only locally in the plant & aggregated after three months, losing resolution
- Control system is a separate network – nothing in or out
- Software and hardware are easily 10 years old
- Rare protocols used (IEC 60870-5-104)

Challenge
Getting data from the power plant

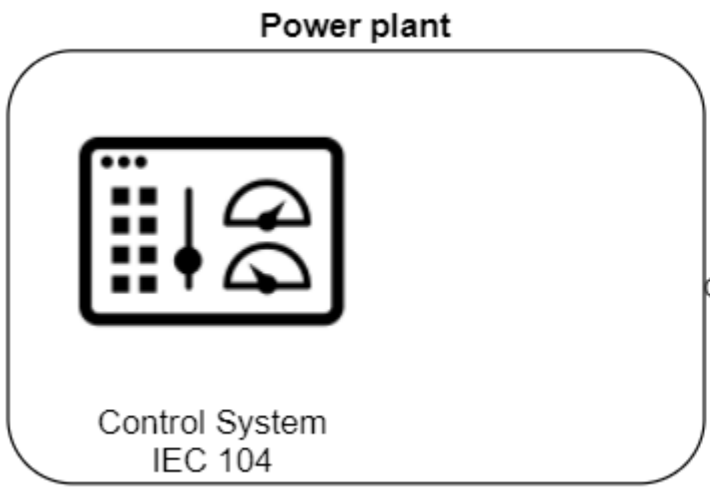
Technical:

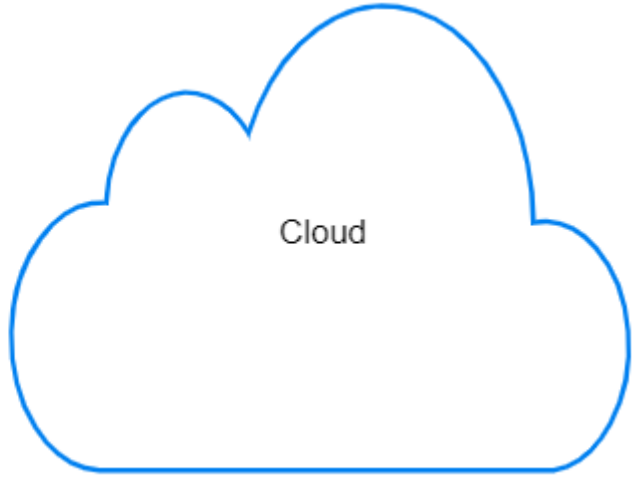
- How to move the data to the cloud?

Cultural:

- How to convince IT Security?
- Recognizing the value of all your data

Axpo’s approach
Data architecture – from power plants to users





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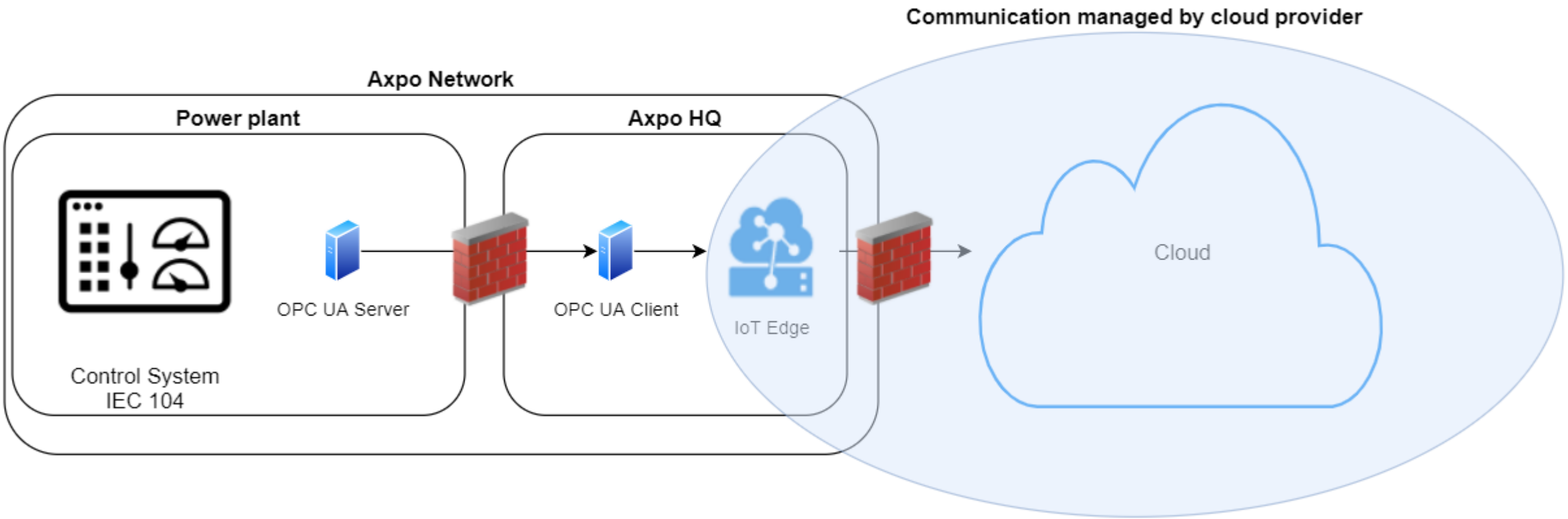
Axpo’s approach
Data architecture – from power plants to users



Axpo's approach
Storing every signal

We store every signal in the highest resolution available:

- We don't know what signals we might need tomorrow
- Storing the signals just in case is not expensive:
  - Maximum is 28'000 signals per plant
  - 2 GB/month/plant
  - Assume storing last ten years 2 GB*12*10=240 GB, @ 0.1 ~ USD/GB/month → 24 USD/month/plant

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Live demo use case 1
Hydro Insights

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Lessons learned
Cloud technology simplifies collecting data from plants

OPC DA and UA are great bridging protocols between control systems and cloud:

- Control systems typically support them
- Major cloud providers have adapters

Edge devices allow to outsource securely connecting your network and the cloud

Storing all surprising amounts of data is financially feasible

Particular features
Every hydropower plant is unique

Situation:

- Each hydropower plant is designed for its specific geographical situation
- Major components are custom made

Implication for predictive maintenance:

- Training data?

Mitigation strategies:

- Get more data: Domain adaptation
- Reduce data dependency: Physics-based models

→ Design know-how? → Collaboration with suppliers necessary

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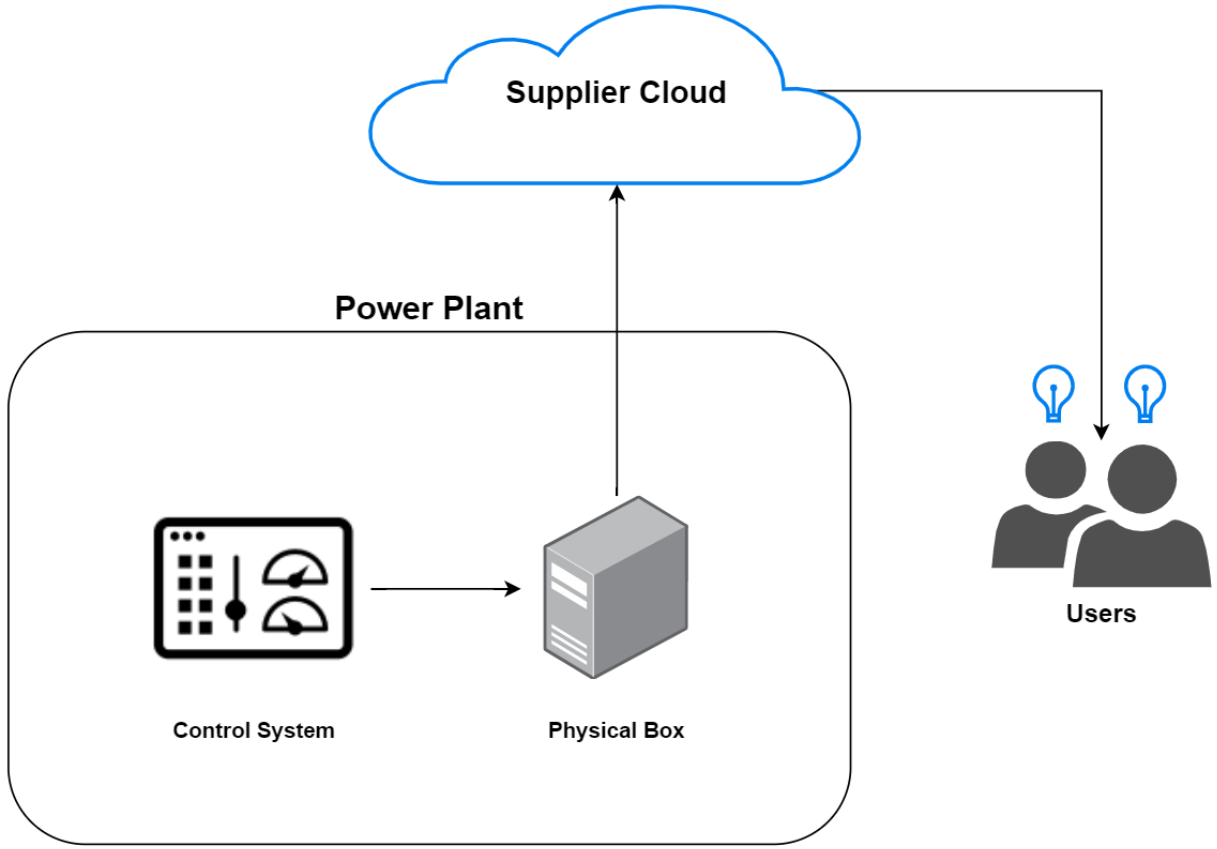
Pictures: Wind farm: https://commons.wikimedia.org/wiki/File:DanishWindTurbines.jpg (cropped), Power Plant: Axpo

Challenge
How to collaborate with suppliers?

Requirements:

- Keeping control over Axpo’s data
- Protecting intellectual property on both sides
- User friendly interface for Axpo’s maintenance and engineering teams

Challenge
Existing products don’t fulfill Axpo’s requirements



Disadvantages:

- Control over data?
- Vendor lock-in?
- X suppliers per plant ⇔ X user interfaces for Axpo’s employees to learn

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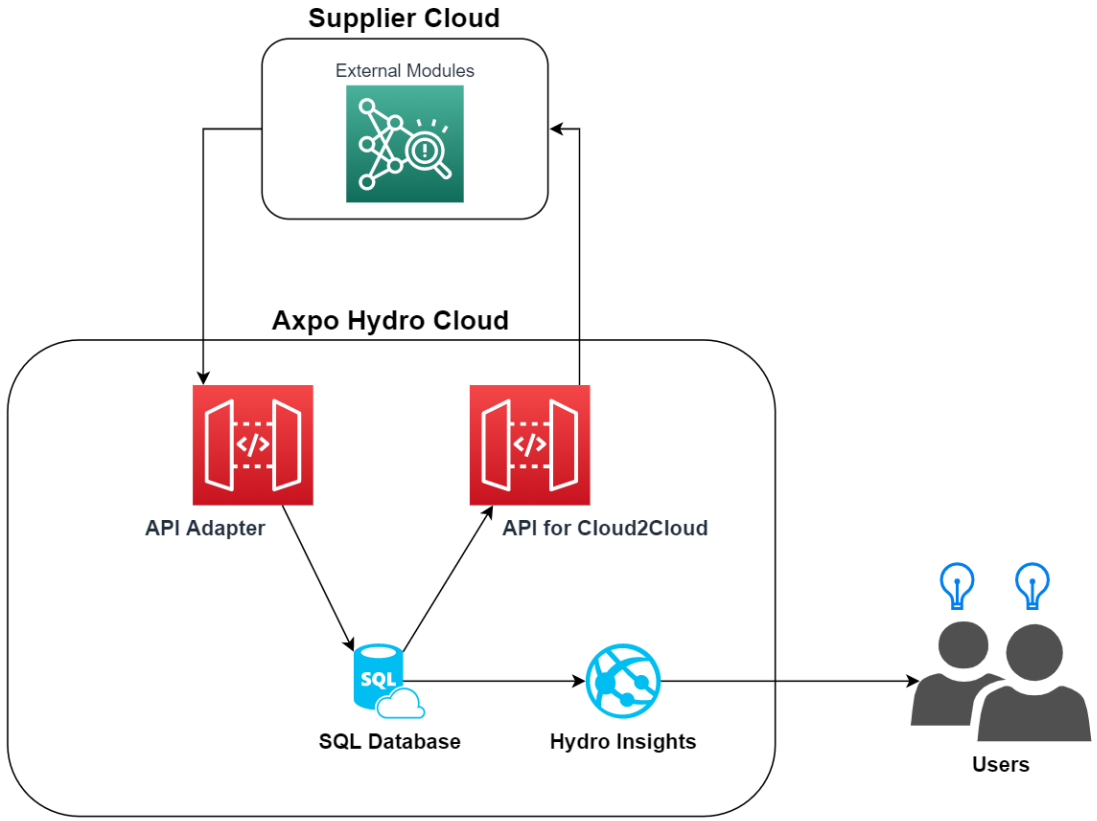
Axpo's approach
Hydro Insights



Advantages:

- Grant access to data selectively
- Easy to onboard new «insight suppliers»
- One UI for Axpo's employees

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Live demo use case 2
Hydro Insights

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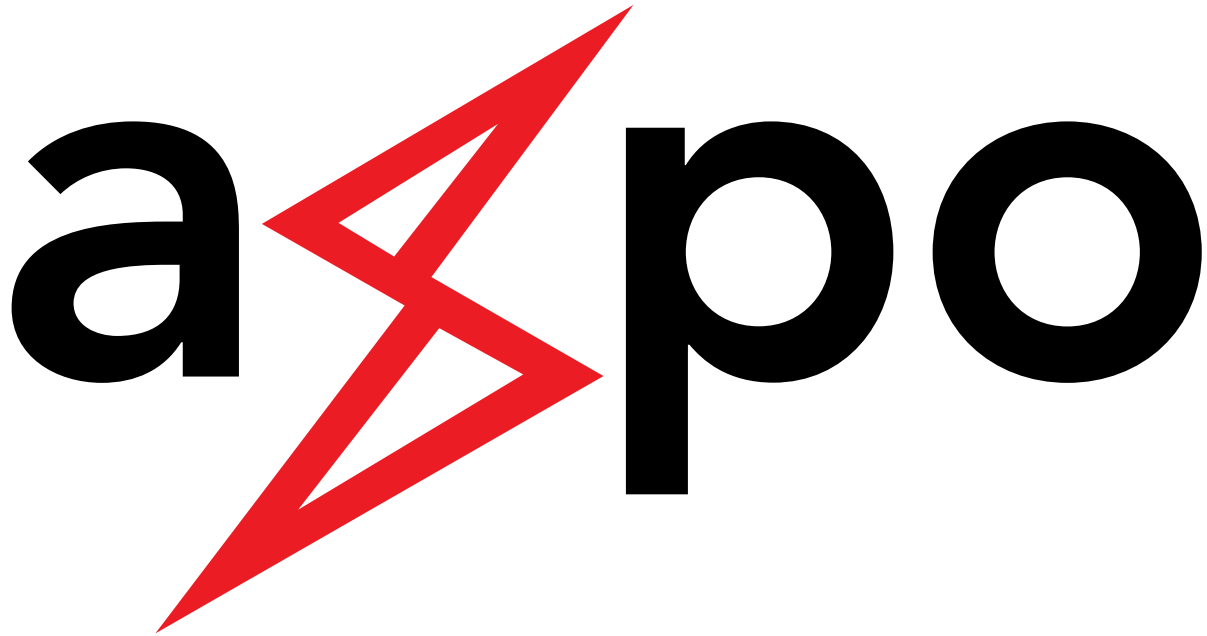
Lessons learned
Collaboration with suppliers

Investment smaller than expected: Cloud2Cloud is fast to implement

Resonance is positive: Two big players exposed an API for the first time

Pricing model and validation: More complex than anticipated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