Haeolus Summer School
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Industrial Internet of Things software platforms for energy management

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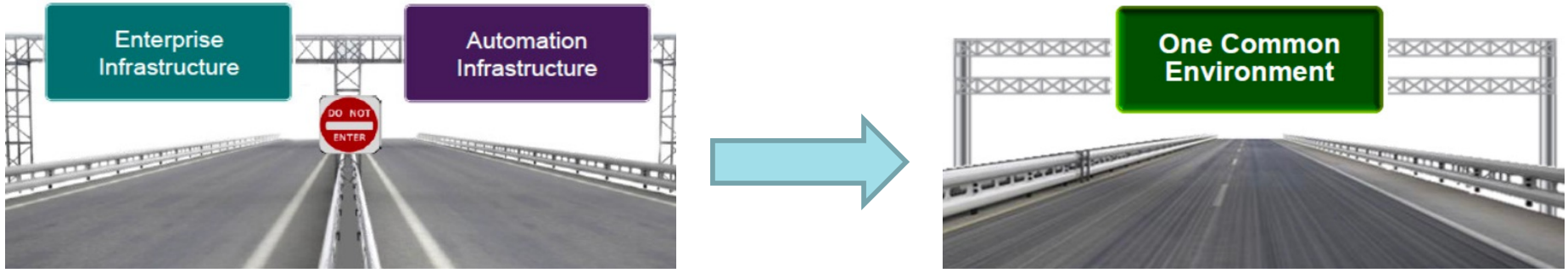
Industry 4.0

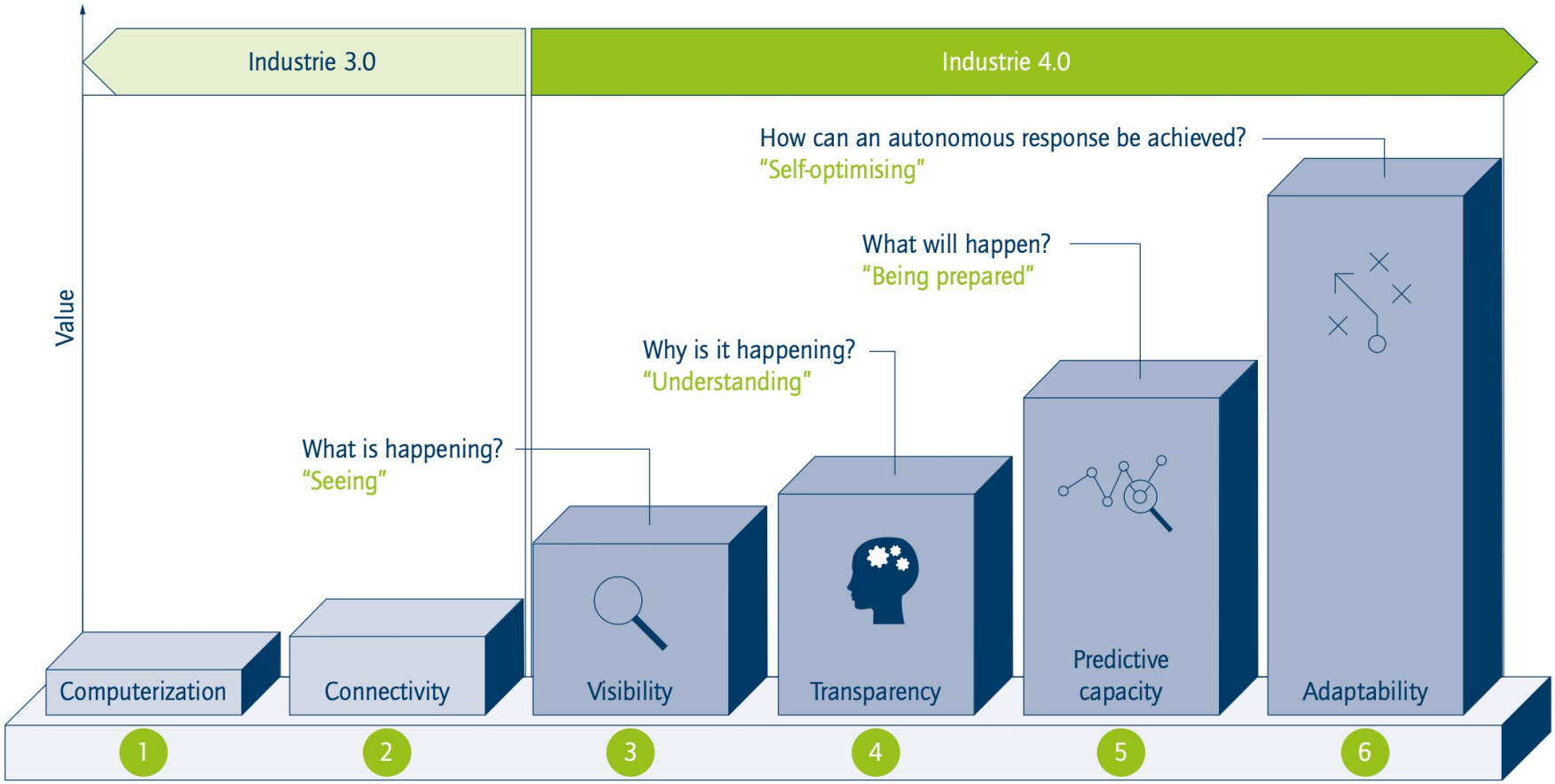
The term Industry 4.0 has been used since 2011 to describe the widespread integration of information and communication technology in industrial manufacturing.

However, it is not enough to address the developments associated with the fourth industrial revolution from a purely technological perspective. Digitalisation also requires companies to transform their organisation and culture so that they can become as flexible and adaptable as possible.

The ultimate goal is to become a learning, agile company capable of adapting continuously and dynamically to a disruptive environment.



Industry 4.0 compared to the third revolution



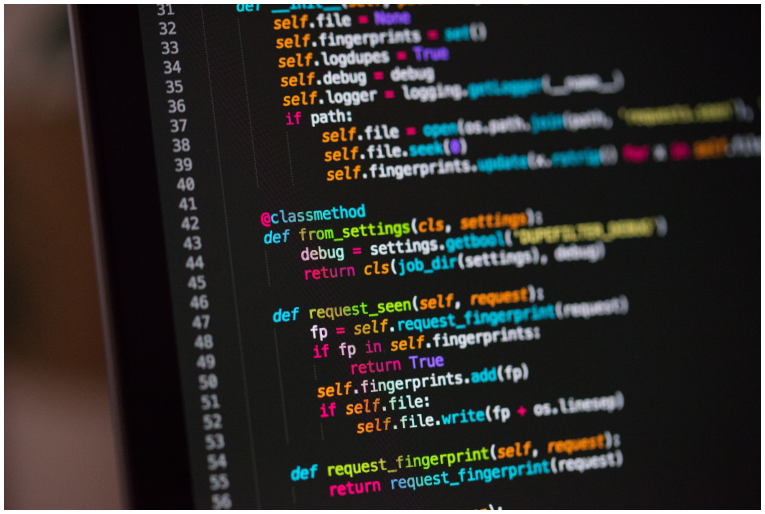
Source: G. Schuh, R. Anderl, R. Dumitrescu, A. Krüger, M. ten Hompel
'Industrie 4.0 Maturity Index' Accatec 2020

Industrial internet of things (IIoT)

The industrial internet of things (IIoT) refers to the extension and use of the internet of things (IoT) in industrial sectors and applications.

With a strong focus on machine-to-machine (M2M) communication, big data, and machine learning, the IIoT enables industries and enterprises to have better efficiency and reliability in their operations.

The IIoT encompasses industrial applications, including robotics, medical devices, software-defined production processes and energy production management.



Before IIoT

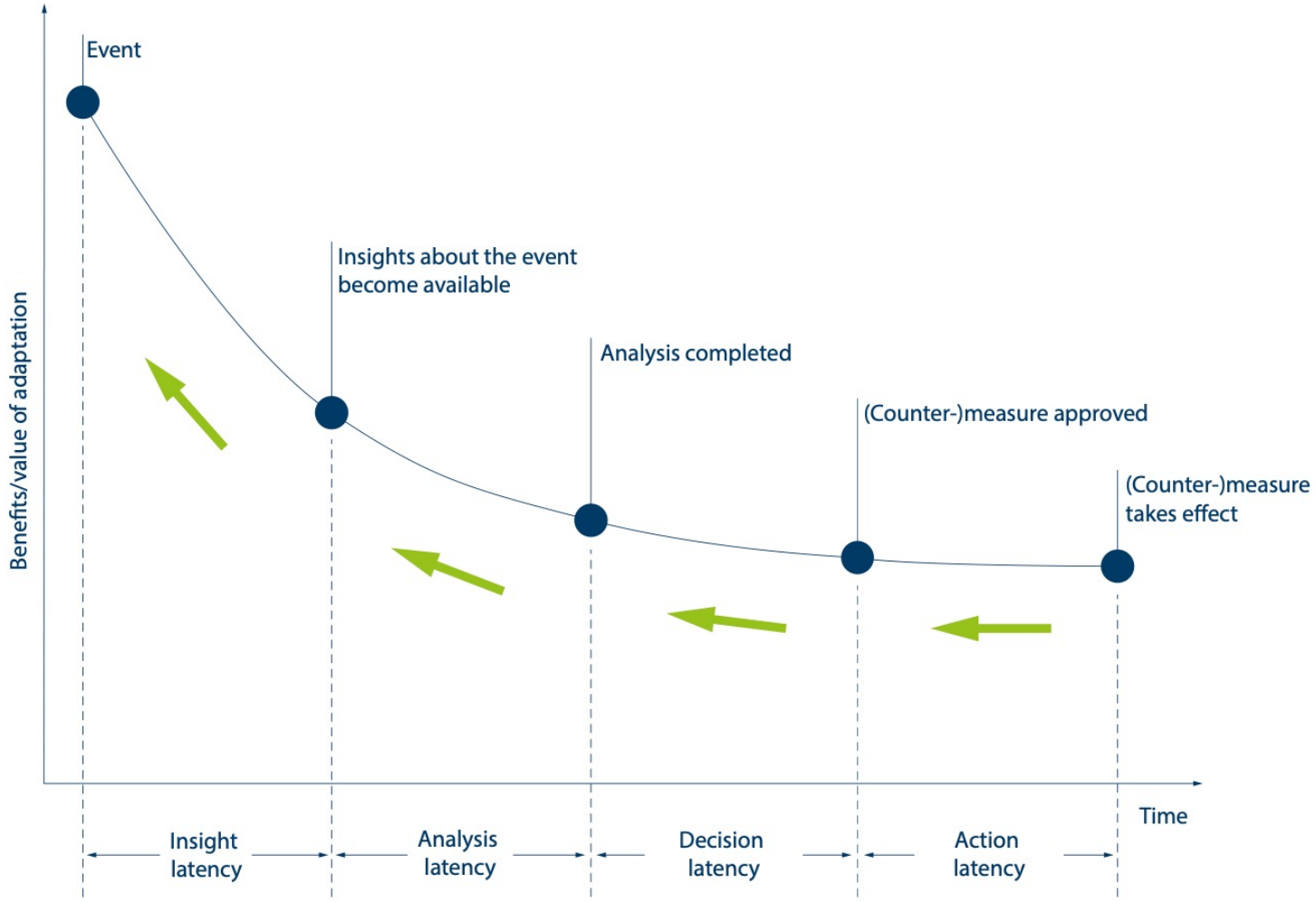
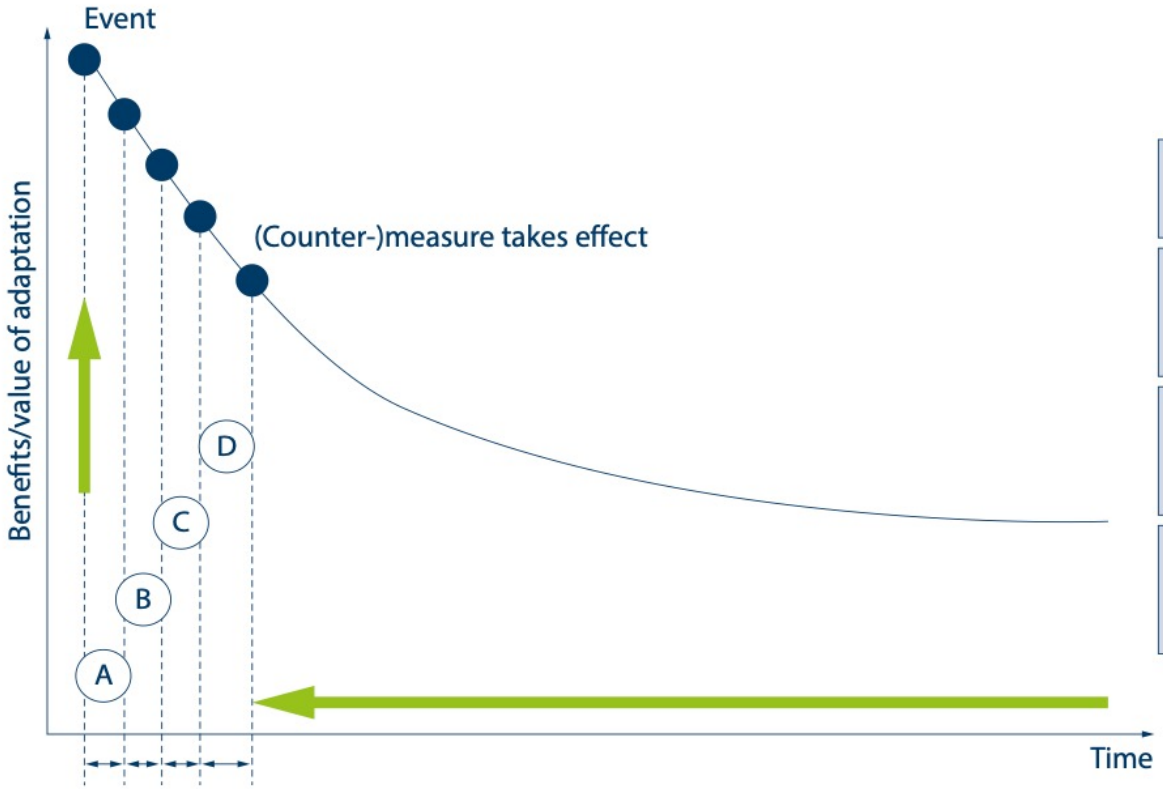


Figure 2: Corporate adaptation processes (source: based on Hackathom 2002; Muehlen/Shapiro 2010)

Applying the IIoT paradadigm



Technological elements of Industrie 4.0

A	▪ Real-time capability ▪ Systems integration
B	▪ Big Data Analytics (known hypotheses) ▪ Machine Learning and Artificial Intelligenc (new contexts)
C	▪ Decision support systems (visualisation) ▪ Automated decision making
D	▪ Vertical and horizontal process and systems integration ▪ Cyber-physical systems

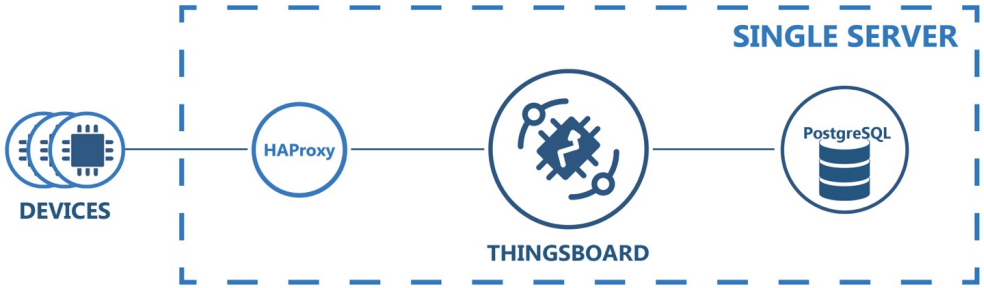
(source: FIR e. V. at RWTH Aachen University)

KES IIoT platform for Haeolus

Main goal:

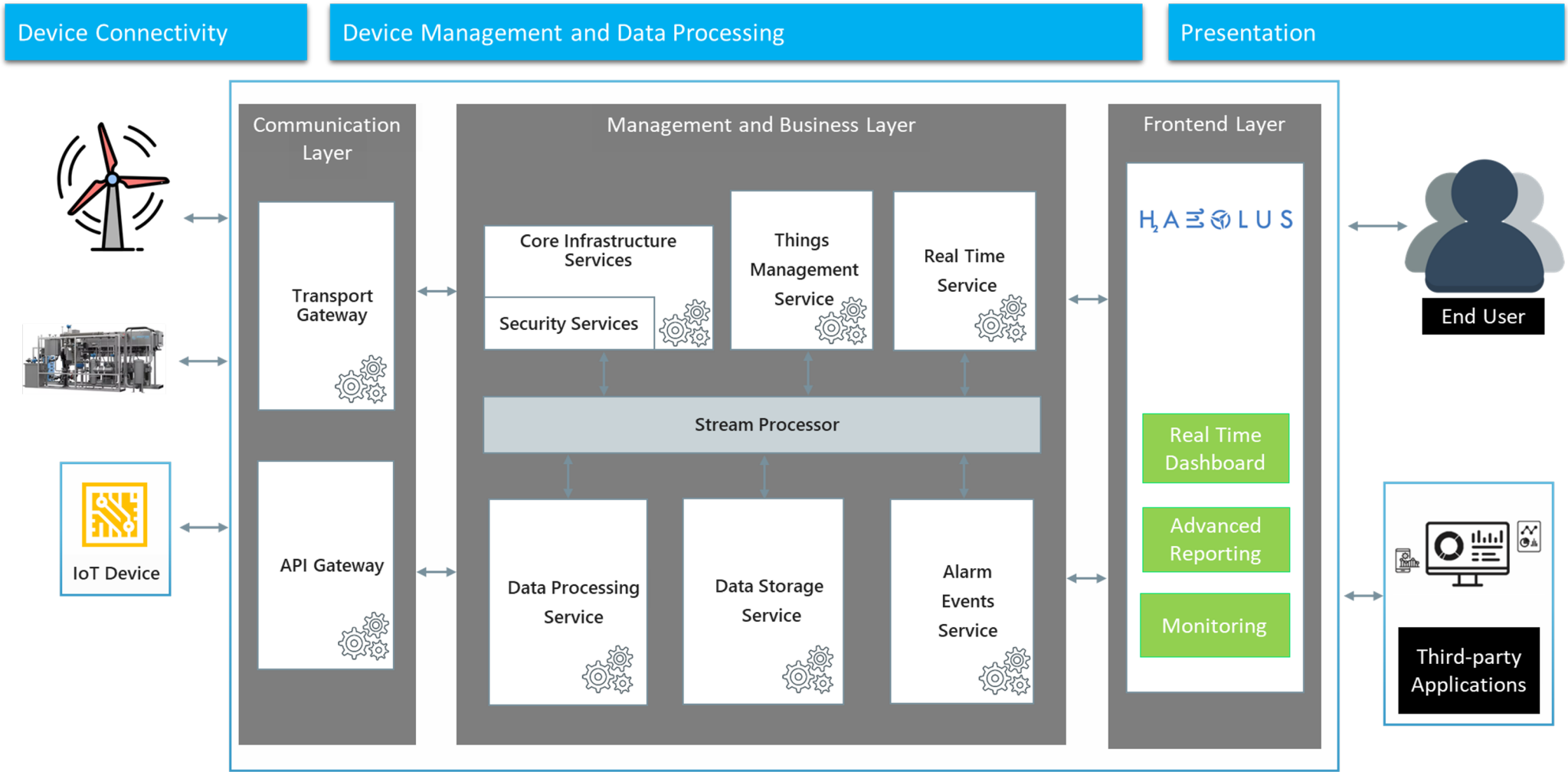
Deploy a IIoT platform in the cloud with the following features:

- Collect data from the Ragovidda wind farm (VK)
- Collect data from the electrolyzer and fuell cell controllers (HYG)
- Run algorithms developed by Haeolus project partners (UBFC and Unisannio) as Python scripts
- Present results on a web GUI

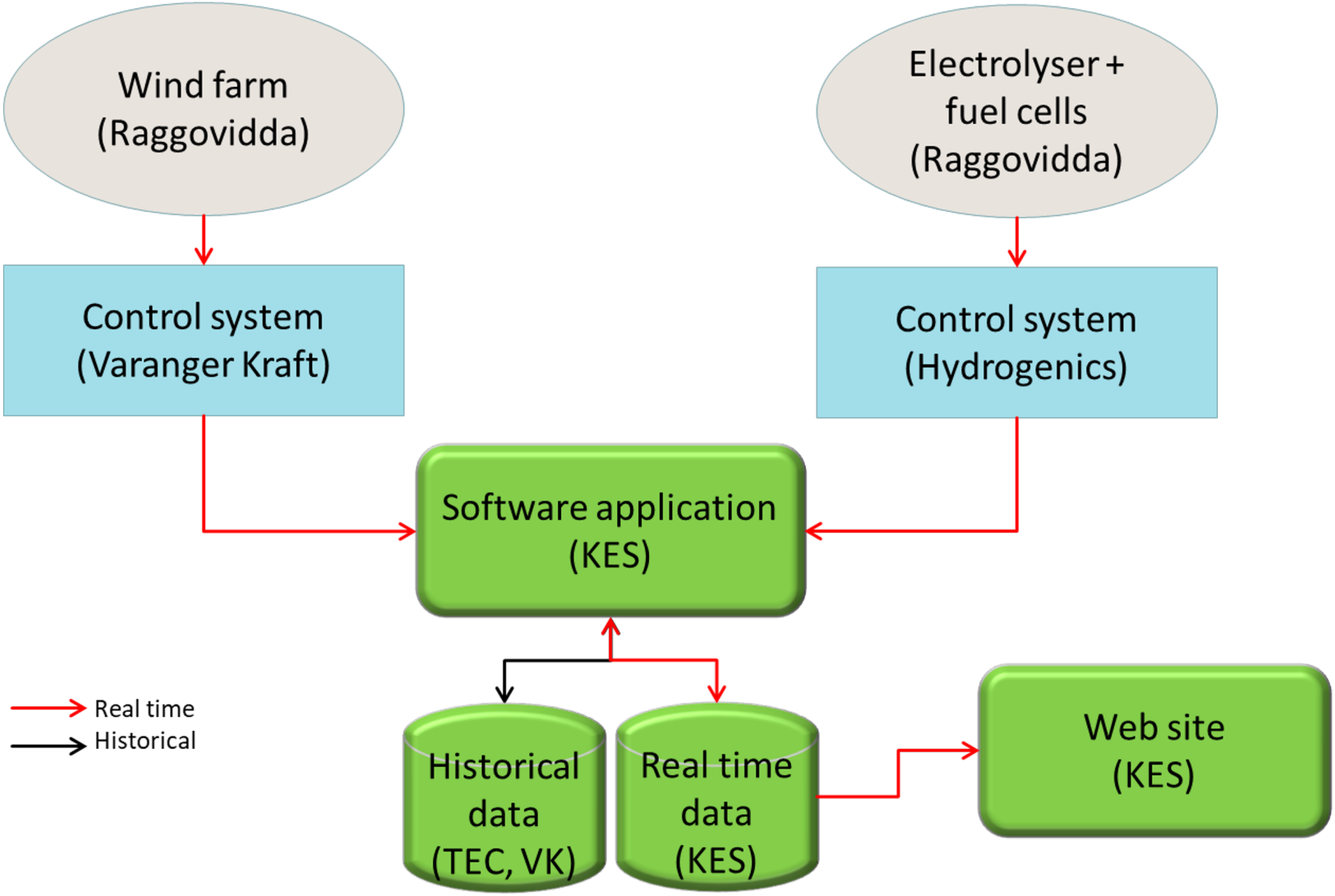


ThingsBoard is an open-source IoT platform for data collection, processing, visualization, and device management

MicroService Architecture of the software platform



Information & Communication architecture



Data transmission from the wind farm

1) ***Get new access token:***

POST https://haeolus.italdata.it/....
BODY: x-www-form-urlencoded
grant_type: xxxx.xxxx.xxxx.
scope: openid
client_id: xxx
client_secret: xxxx-xxxx-xxxx-xxxx

2) ***Publish data service:***

POST https://haeolus.italdata.it/....
BODY: xml

Two step transmission:

- Token authentication
- Data transmission with POST over HTTPS

```
<PLANT>
        <NAME>Raggovidda</NAME>
        <DATE>2019.10.25 09:37:30</DATE>
        <MEASUREMENT>
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                <DESCRIPTION>Raggovidda Site TurbineActivePower</DESCRIPTION>
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                <STATUS>Normal</STATUS>
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                <UNIT>MVAr</UNIT>
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                <DESCRIPTION>Raggovidda Site TurbineWindspeed</DESCRIPTION>
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                <UNIT>m/s</UNIT>
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                <DESCRIPTION>Raggovidda Site TurbineMeanTemperature</DESCRIPTION>
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                <UNIT>C</UNIT>
        </MEASUREMENT>
</PLANT>
```
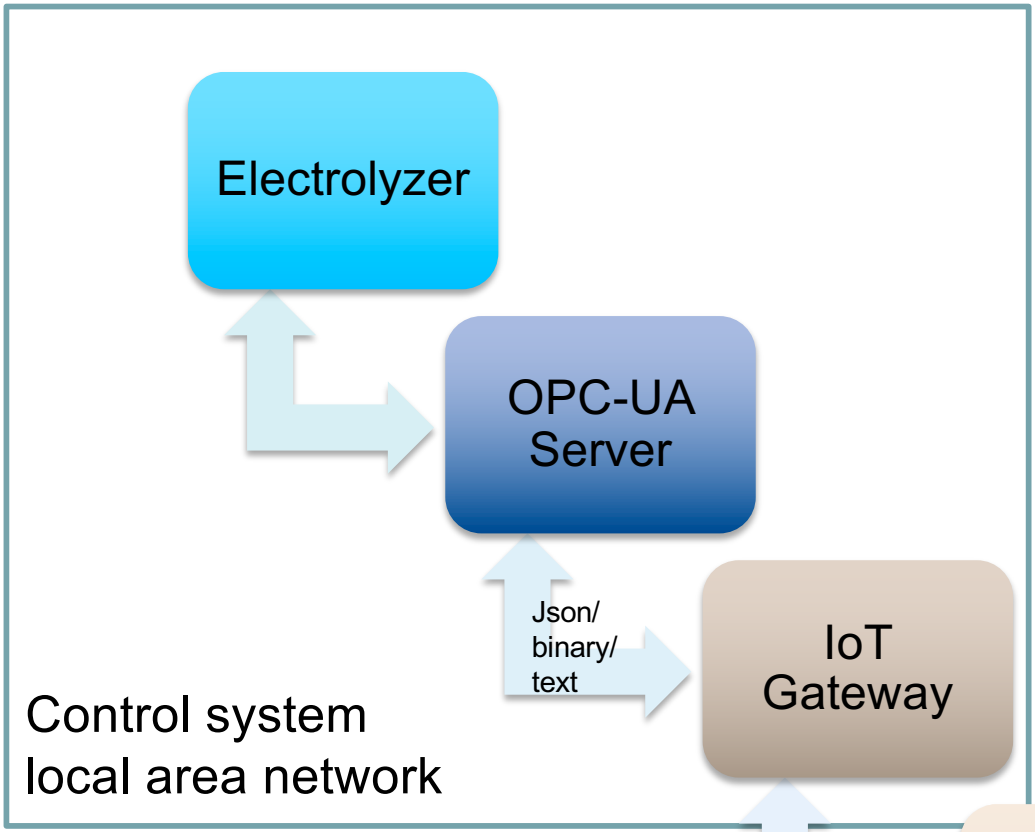
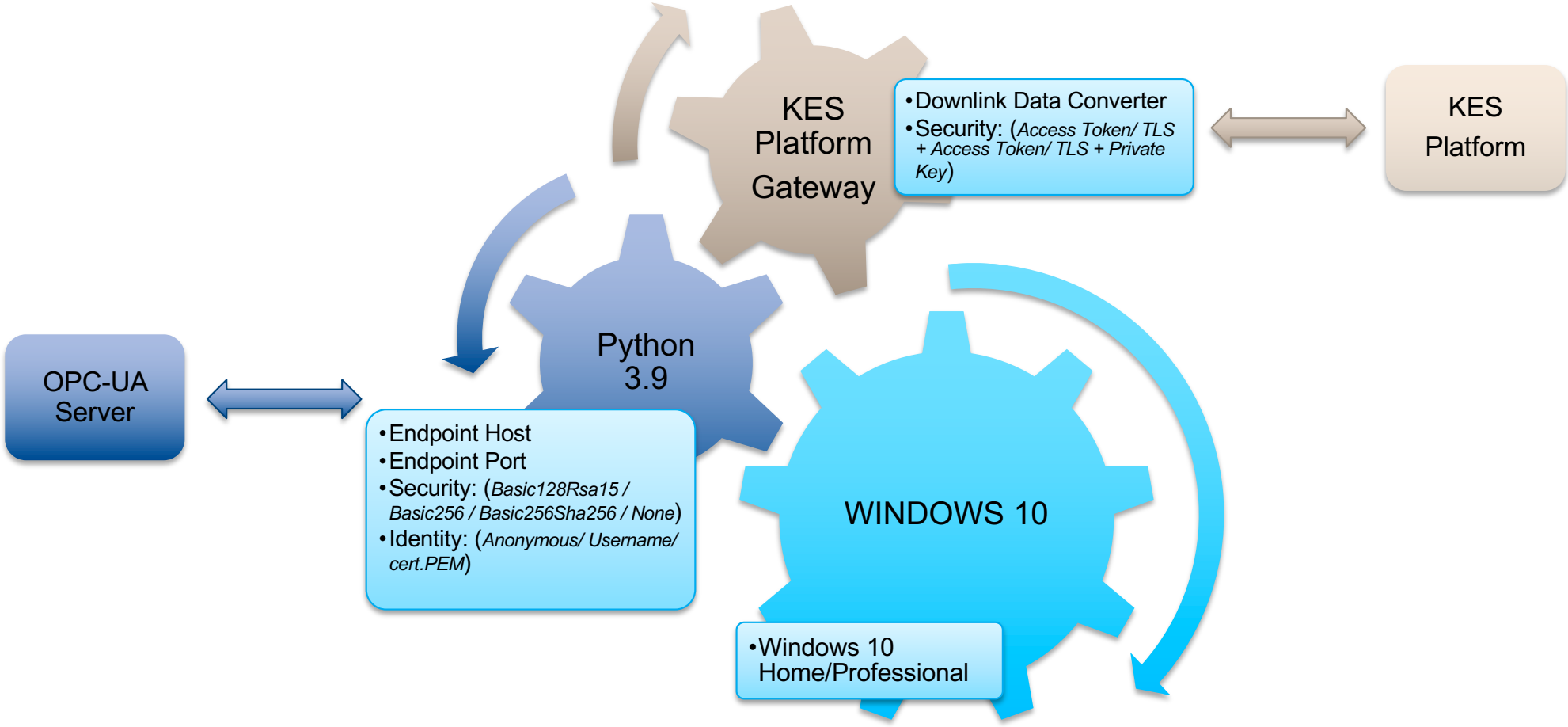
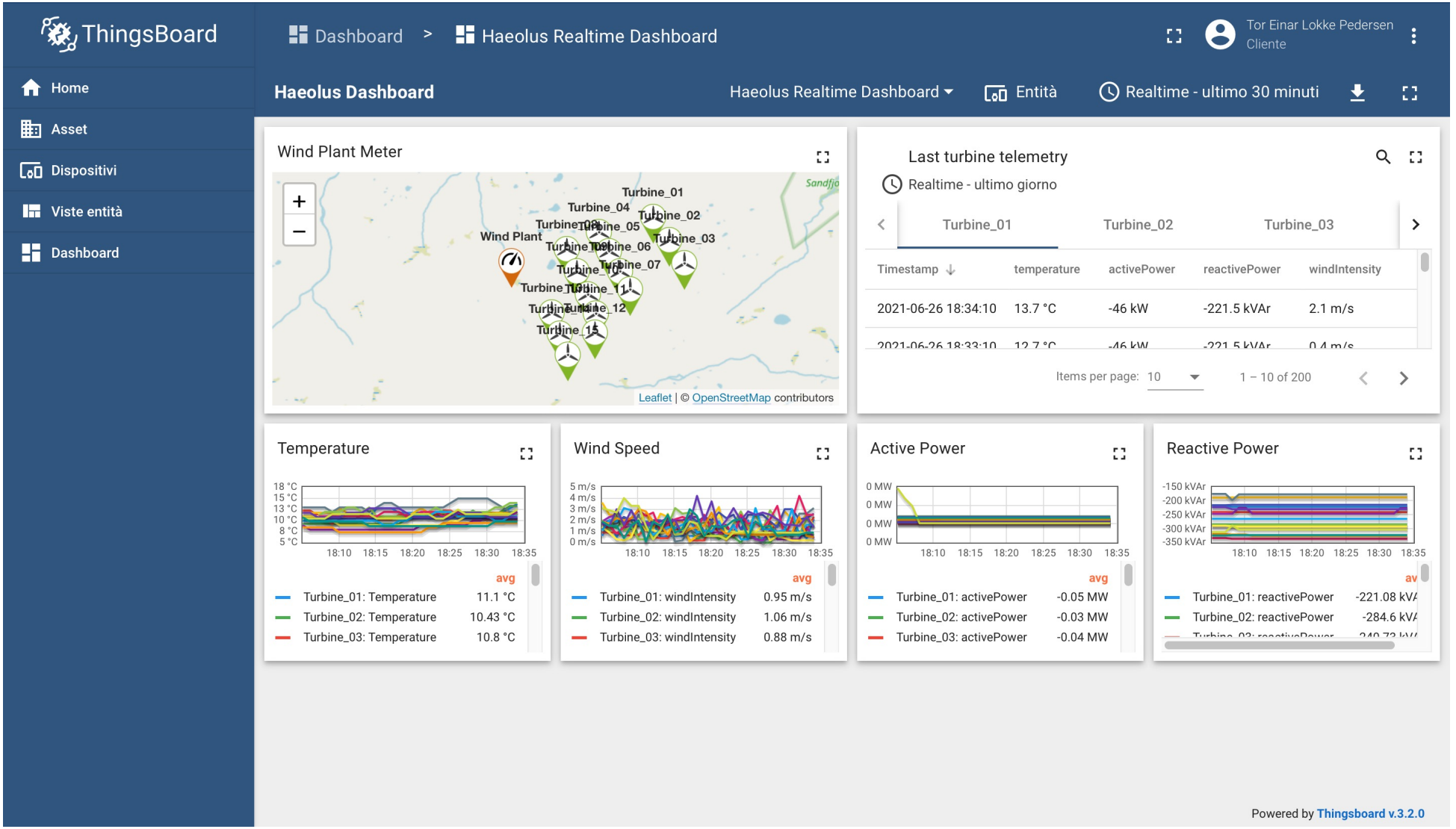

Data transmission from ELY and FC



IIoT Gateway Architecture



KES cloud platform WEB GUI (real time)



Conclusions

KES is completing the development and deployment of a IIoT cloud platform for energy management demonstration

Next steps:

- Complete the interconnection of ELY and FC to the cloud plaform
- Deploy optimization developed as Python scripts by our partners

Thanks!

H2AEOLUS

Hydrogen-**A**eolic **E**nergy with **O**ptimised e**L**ectrolysers **U**pstream of **S**ubstation

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