

# Bonfiglioli IoTwins TB1 results

Paolo Cominetti – Research Projects Director

Bi-Rex 22 settembre 2022

# IoT AND PRODUCT SENSORIZATION

From components to talking products



**SENSORIZED HDO  
AND HDP  
GEARBOXES**



**IIoT PLATFORMS  
FOR AUTOMATED  
WAREHOUSES**



**SMART YAW DRIVE**



**SENSORIZED TRACK  
DRIVES**



**IIoT FOR FORKLIFT**



# IoTwins

Wind turbine test bed



**BIG DATA PLATFORM FOR OPTIMIZED AND REPLICABLE INDUSTRIAL AND FACILITY MANAGEMENT MODELS**



**#1 WIND TURBINE PREDICTIVE MAINTENANCE**

Partner.

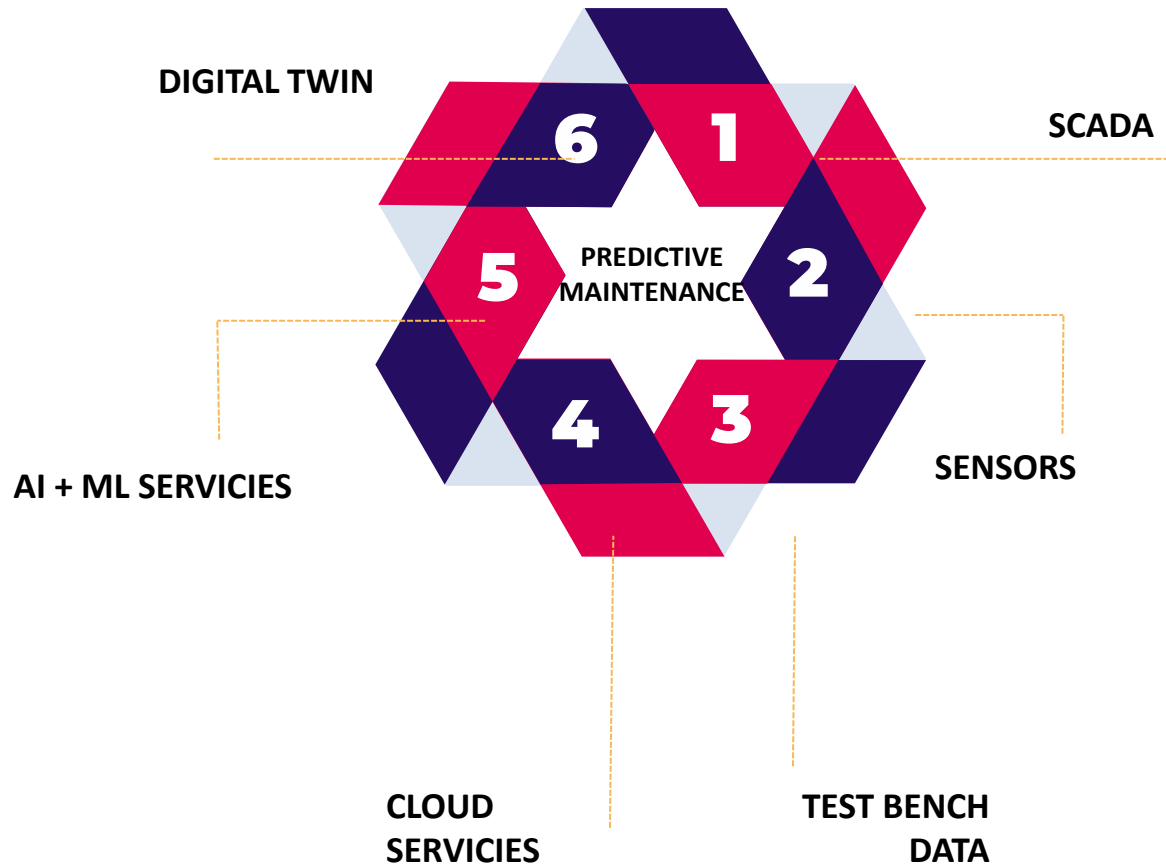


## OBJECTIVES

- 01. Smartifying the wind turbine, and especially Yaw and Pitch systems, by integrating sensors, edge nodes, and the associated software components
- 02. Providing efficient data transmission solutions
- 03. Optimizing the wind turbine control system
- 04. Developing a digital twin to simulate the best orientation of blades to increase energy production
- 05. Extending residual useful life of critical components in the wind turbine
- 06. Producing failure models for each turbine and for the whole wind-farm
- 07. Developing predictive maintenance algorithms for each component of the turbine and for the whole farm, based on the information gathered/elaborated and the scenarios simulated at the cloud side

### INVOLVED PARTNERS





### INVOLVED PARTNERS

Bonfiglioli

KK Wind Solutions

CINECA

INFN

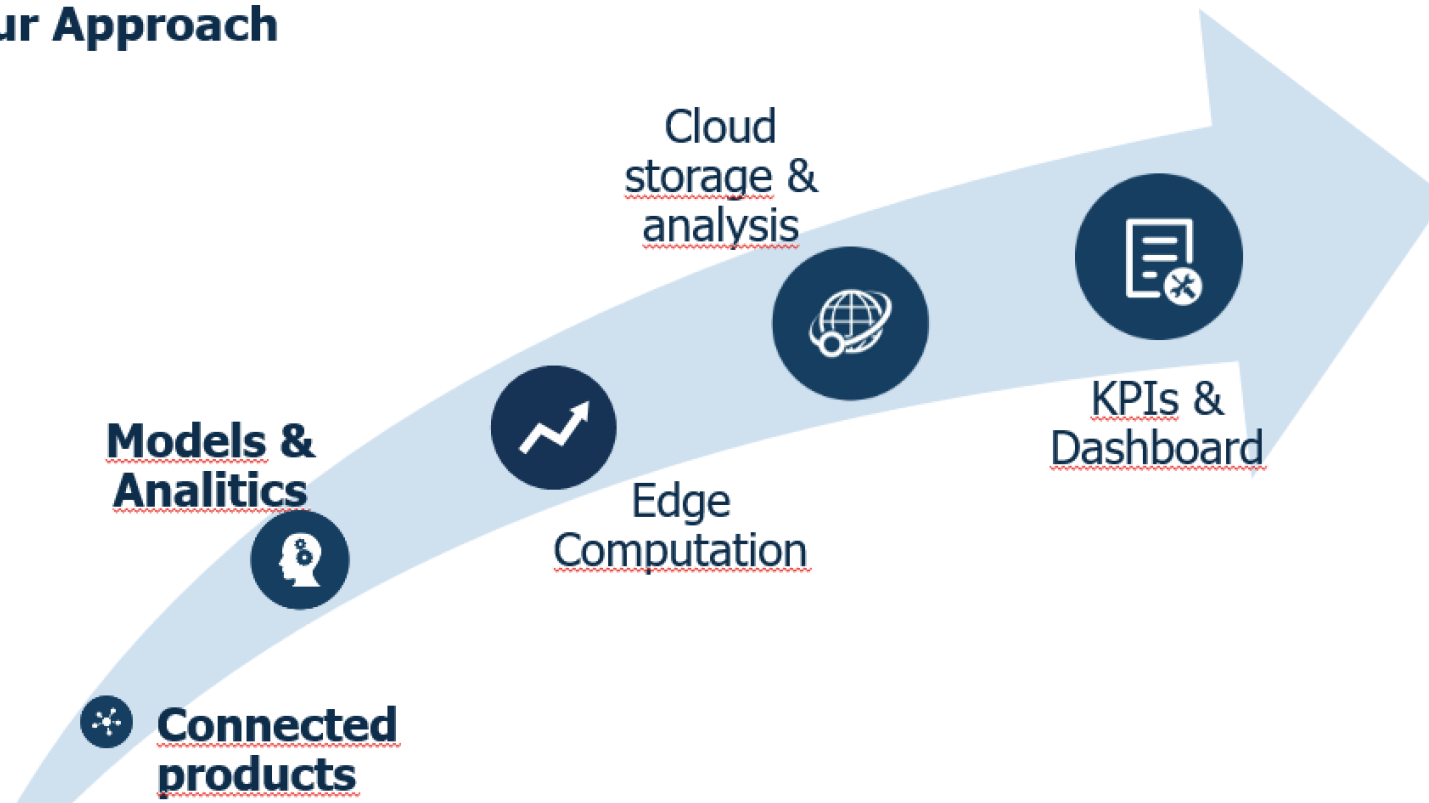
evi get it right

Arts et Métiers

# IoT AND PRODUCT SENSORIZATION

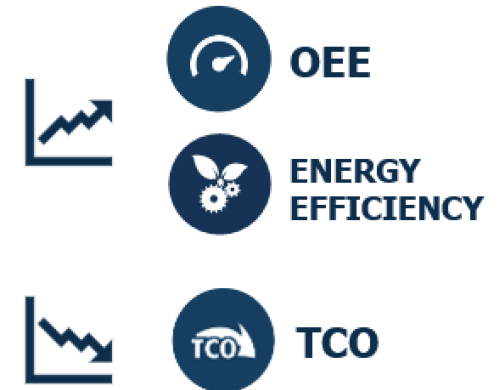
Wind Market how to face the LCOE from INDIRECT stand point?

## Our Approach



LCOE: Levelized cost of energy

## VALUE FOR CUSTOMER

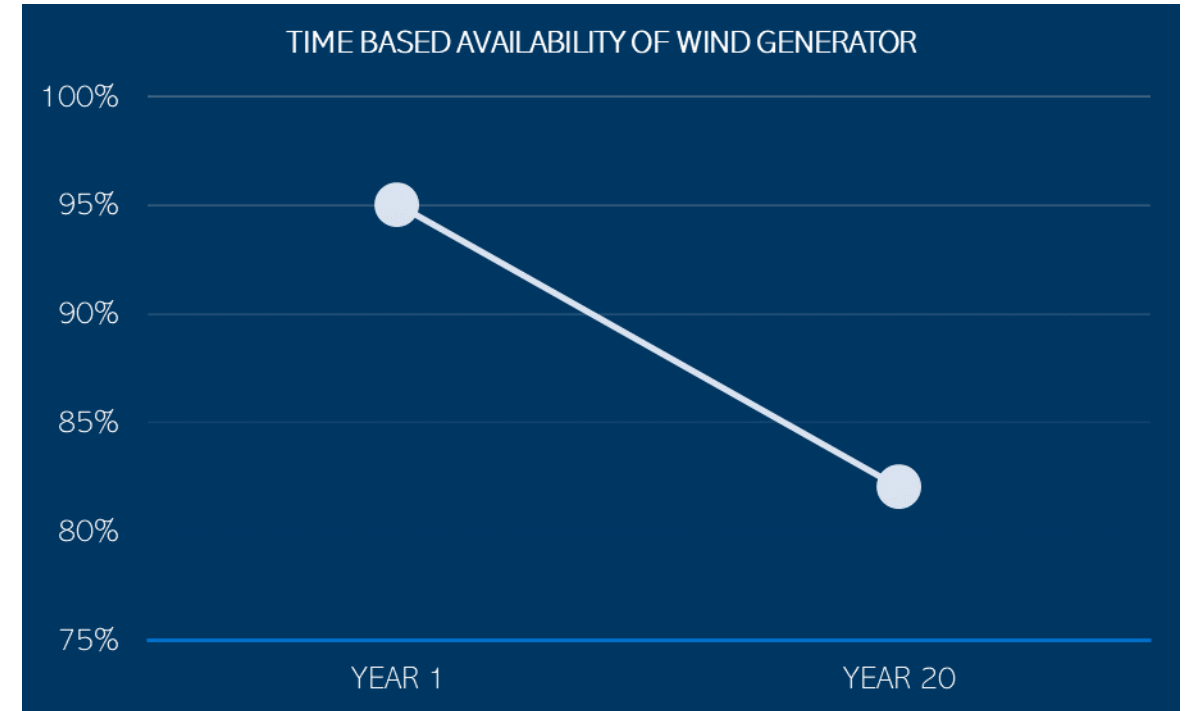


## INDIVIDUAL BUSINESS MODELS

# IoT AND PRODUCT SENSORIZATIONThe IoT

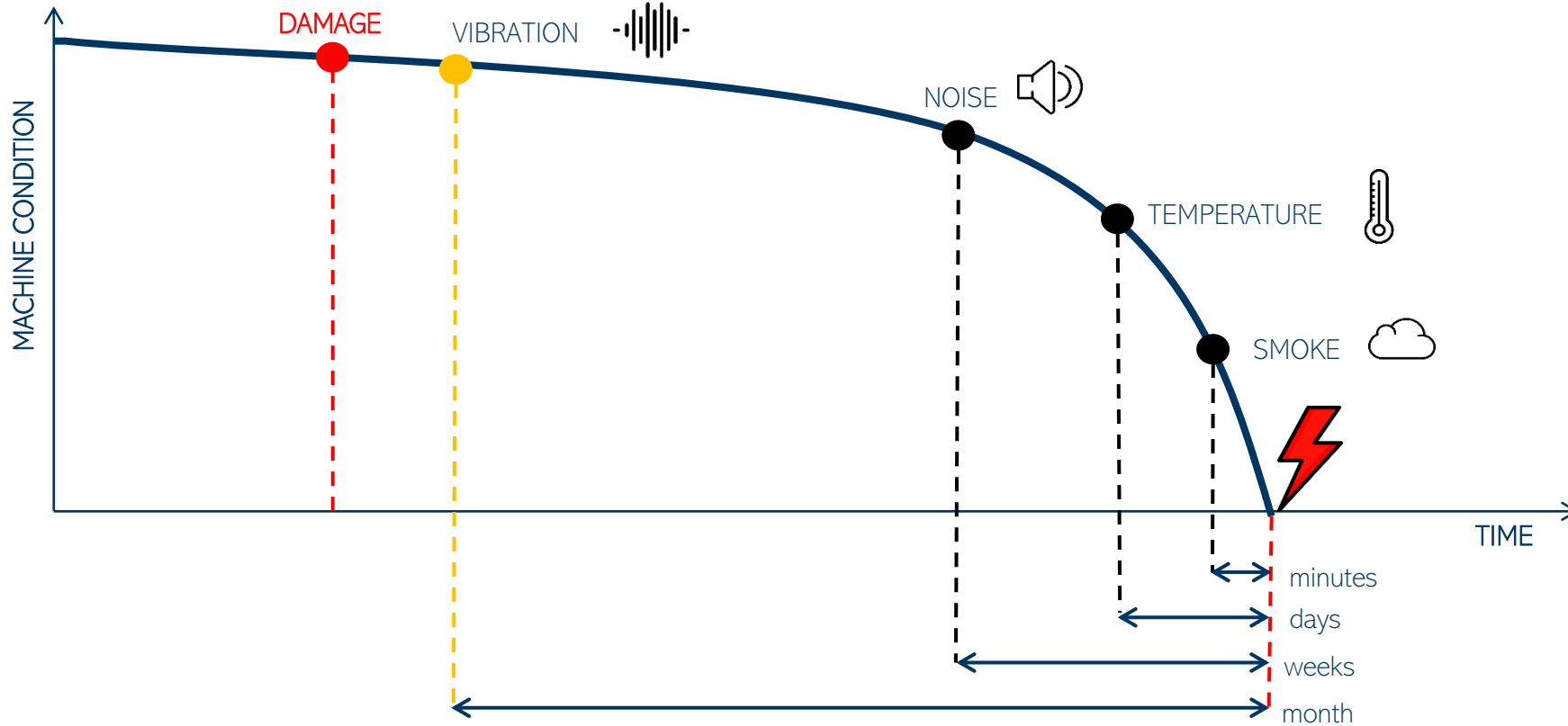
Case for wind turbine – 2,3 MW GENERATOR  
Profitability net of malfunctions

For a **2.3 mw wind power generator** we can consider extra cost values for loss of production due to malfunctions of 1.1 m € in 20 years.



# IoT AND PRODUCT SENSORIZATION

Transmission & maintenance: how to detect problems?



## PURPOSES

- Reduce downtime
- Increase operating efficiency

### IOT for Wind turbines

STANDARD  
INVERTERS &  
SERVO DRIVES



INTEGRATED  
OR CABLE  
SENSORS



REAL TIME  
DATA ACQUISITION

- Current
- Torque
- Power
- Speed
- Vibration
- Temperature



EDGE COMPUTER  
AI based algorithms

BONFIGLIOLI DASHBOARD

- **Dynamic lifecycle monitoring**
- **Predictive maintenance**
- **Health device assessment**



*Bonfiglioli IoT system solutions are focused on raising productivity and improving the efficiency of our customers machines.*

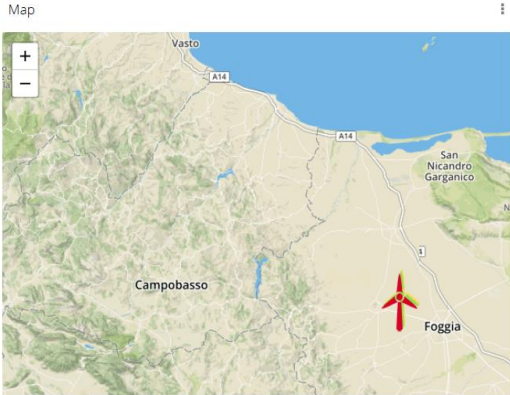




# BONFIGLIOLI IoT Dashboard



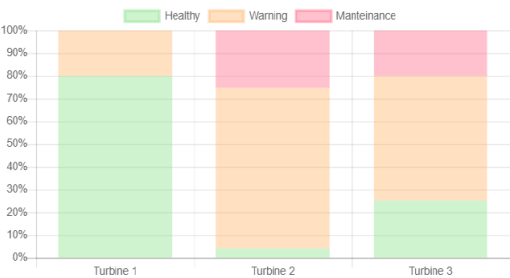
Wind park



Turbines list

Name	Health	Status	More
Turbine 1	Ok	Hold	
Turbine 2	Warning	Active	
Turbine 3	Maintenance	Maintenance	

Overall health park last 30 days



Yaw A

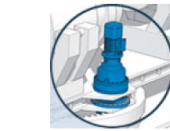
Apr 04 2019 10:

Weather forecast

FOGG

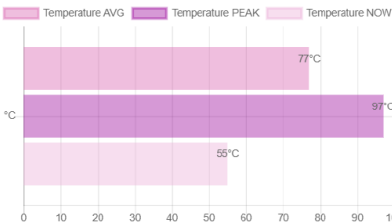


SAT 16 9

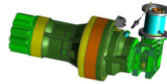


Yaw

Yaw A Temperature



Series 709



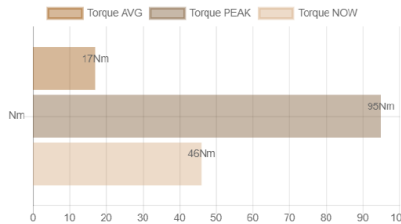
First stage	90%
Second stage	85%
Third stage	95%

BN 100LA 4

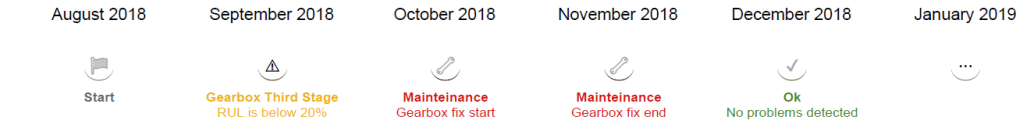


Bearings	95%
Motor Shaft / Balance	77%
Operation	81%

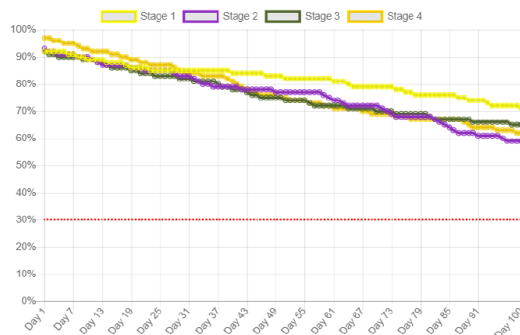
Yaw A Torque



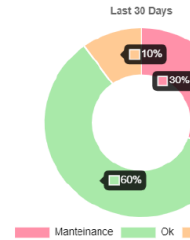
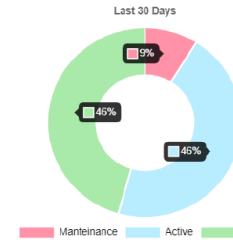
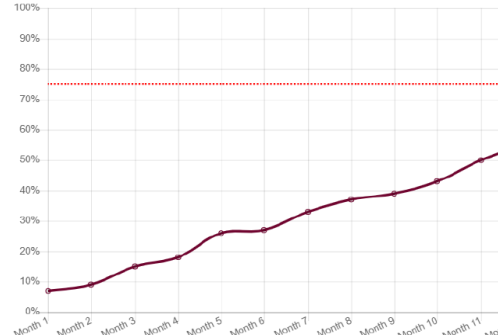
Timeline alternative



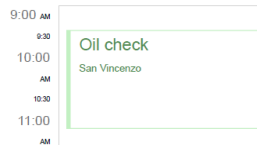
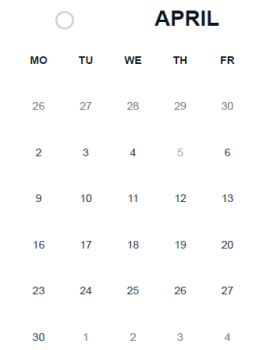
Yaw A RUL Gearbox



Yaw A Oil aging Trend

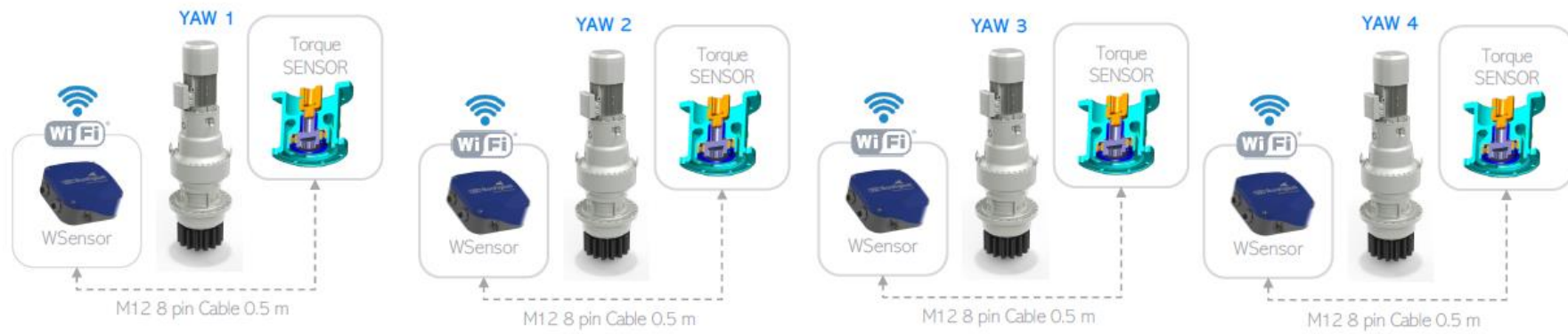
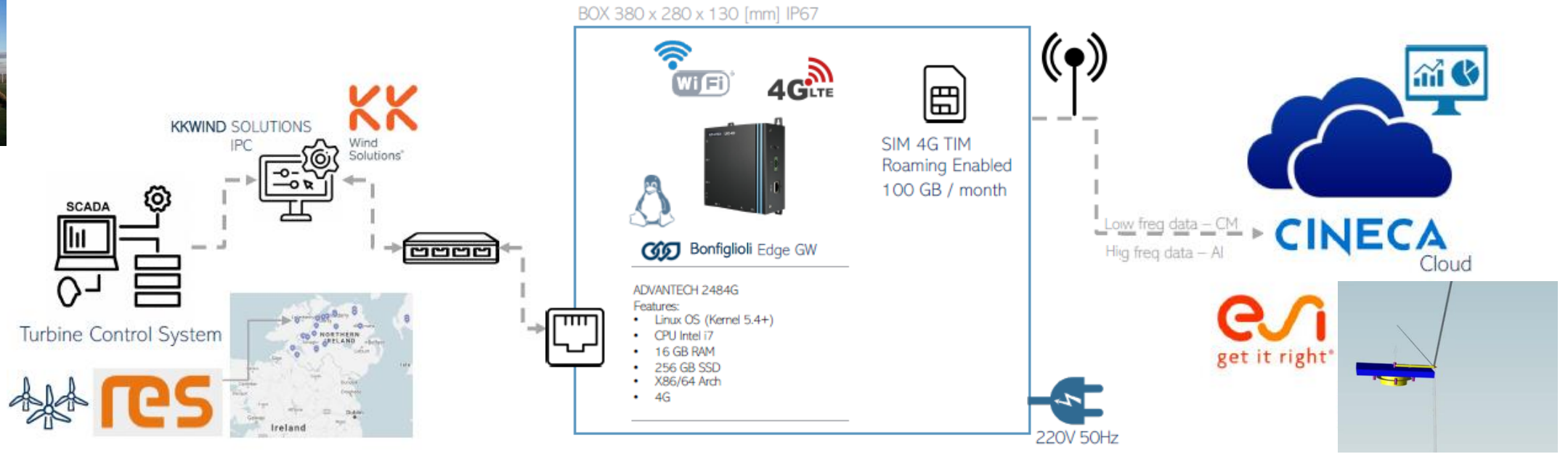


Calendar



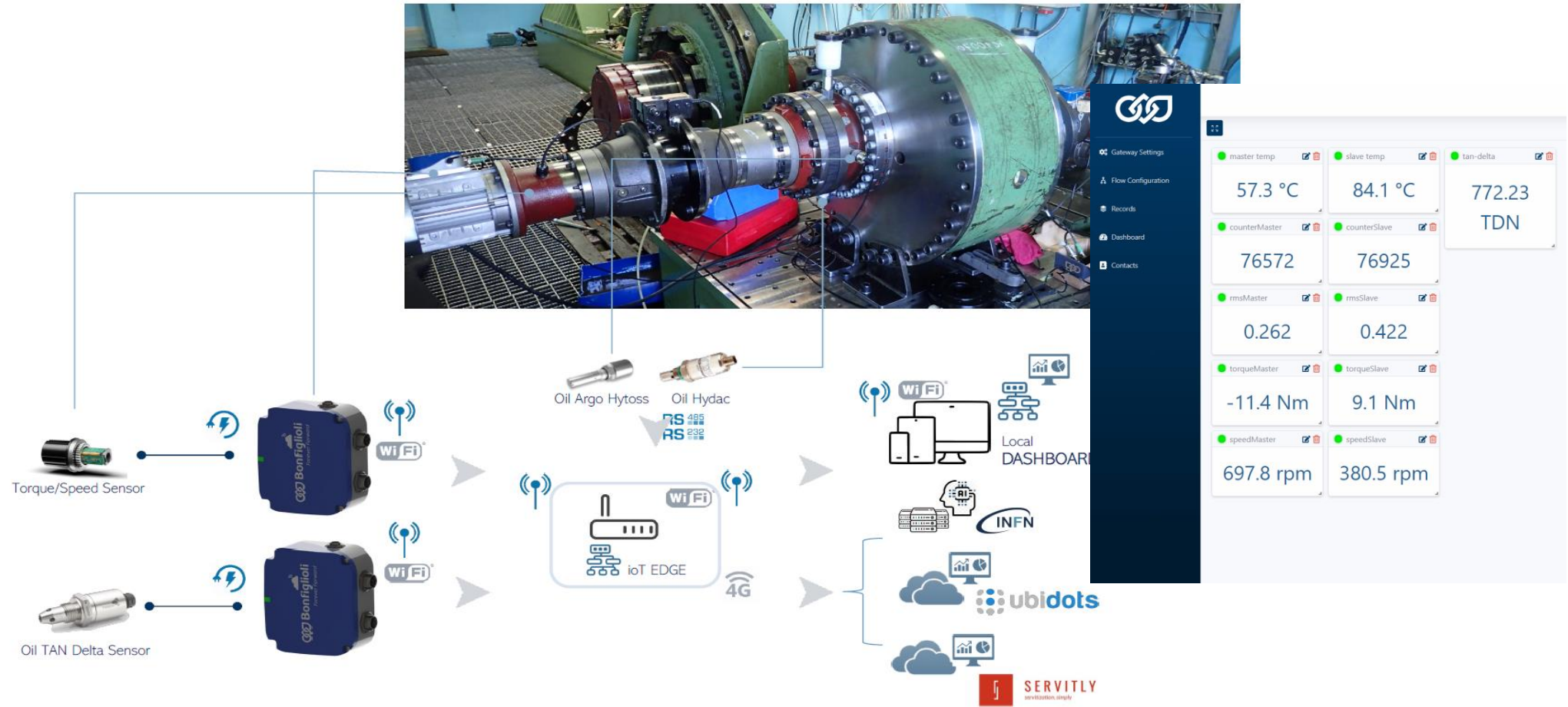
# IoTwins

## Data flow



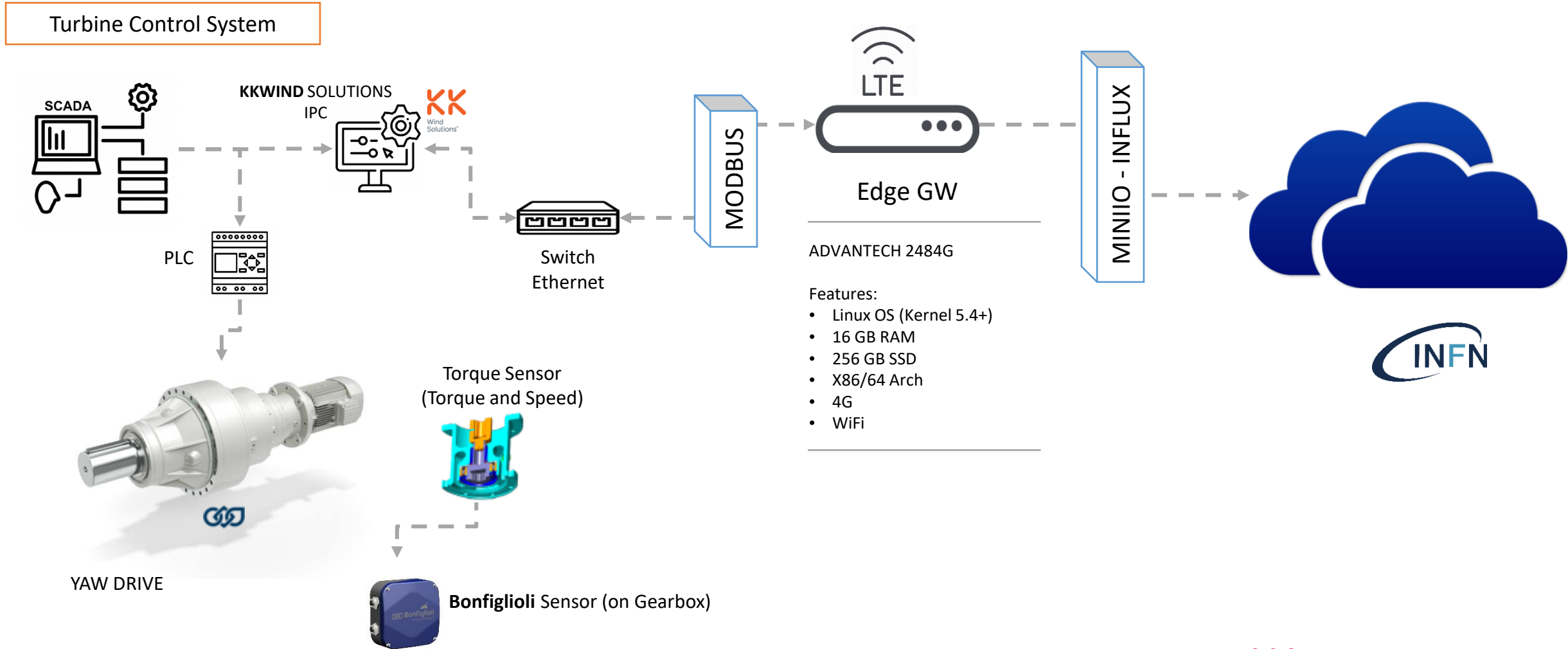
# IoTwins

## Laboratory validation



# IoT WIND TURBINE DIGITAL TWIN

## Technical solution: Solutions



# IoT WIND TURBINE DIGITAL TWIN

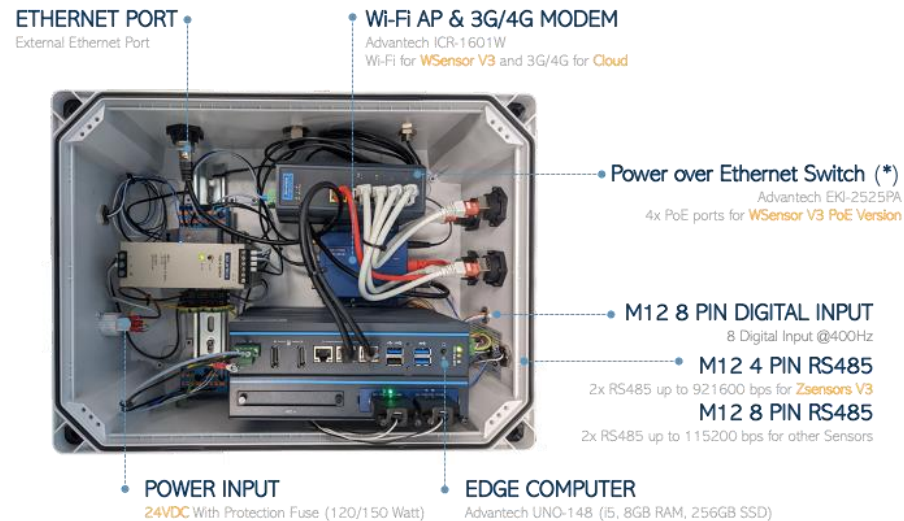
Technical solution: Enablers

## ENABLERS FOR DIGITAL TWIN

### SENSORS



### EDGE GATEWAY



### CLOUD



### IOTWINS BENEFITTING VS CURRENT AVAILABLE SENSORIZED SOLUTION:



High frequency sensor data acquisition on components not generally monitored



Torque and speed measure to know the real working conditions (for RUL estimation)



Hybrid IoTwins fed with low frequency data from SCADA system and high frequency data from dedicated sensors, for a more reliable predictive maintenance and prognostic



 Thank you.