

iQunet.®



Wireless Asset Health Monitoring



**Winner BEMAS
Digital Innovation Award
2017**
Wireless Vibration Sensor

**Winner BEMAS Professional Jury
Digital Innovation Award
2021**
Edge Anomaly Monitor 4.0

**Finalist BEMAS
Digital Innovation Award
2022**
Wireless Sensor Bridge

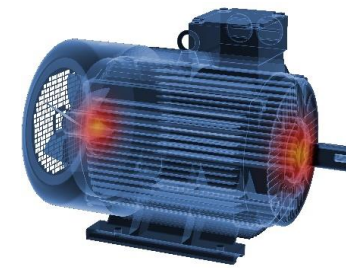
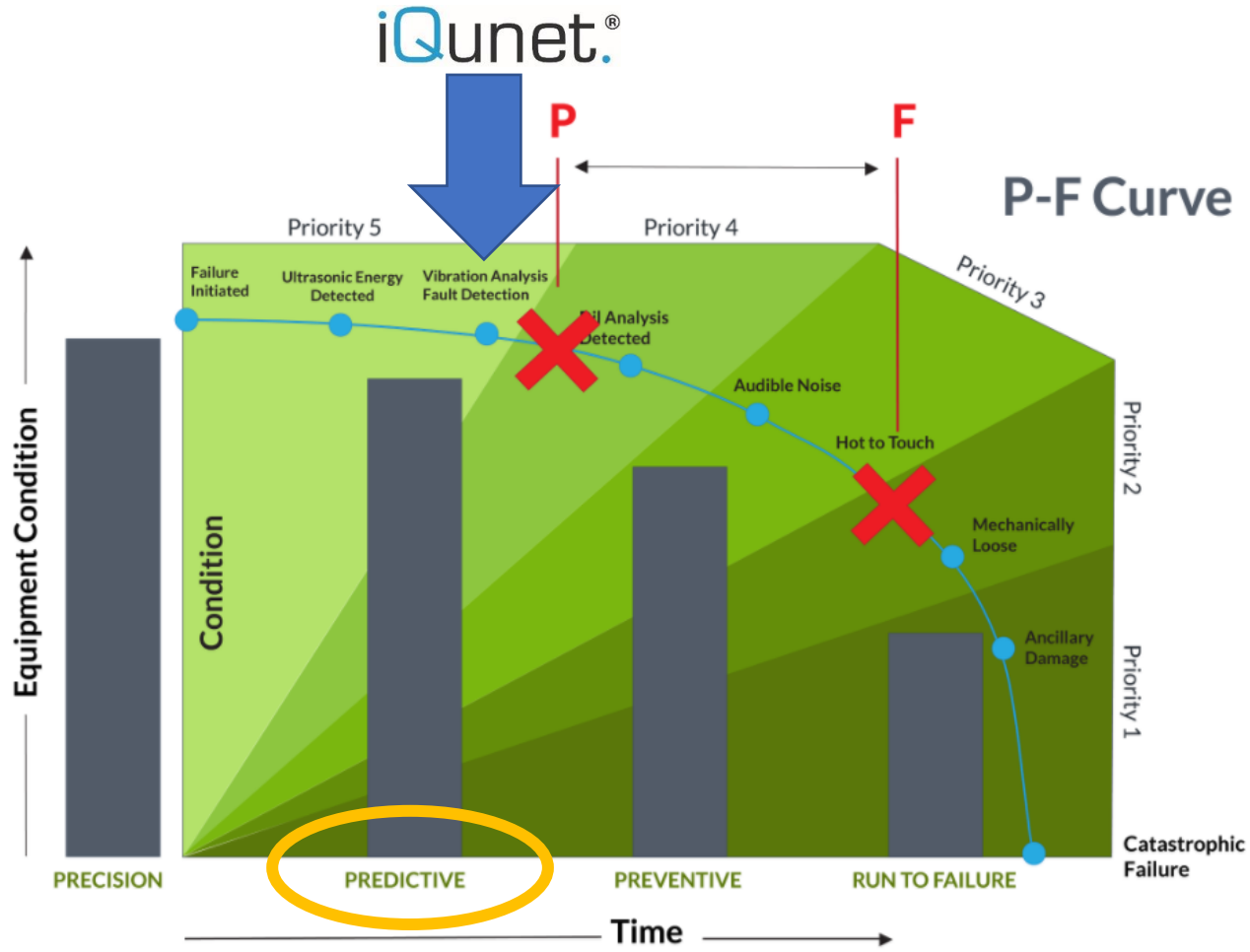


- Why is asset health monitoring important?
- How to increase Plant Asset Availability?
 - How to start & reach Level 3 & 4 of PdM Maturity
- Which solution and (sensor) technology monitors your critical assets?
- How can I make use of it?
 - Standard dashboards (health status traffic lights)
 - Detailed analytic dashboards
- What does it cost?
 - Capex cost model
- Which Services are available for supporting my business?
 - Product support services



Why asset health monitoring
is important !

Why Asset Health Monitoring



Potential Failure



Functional Failure

89% of failures are random in nature* !



Start

Condition Monitoring & AI /ML Anomaly Detection

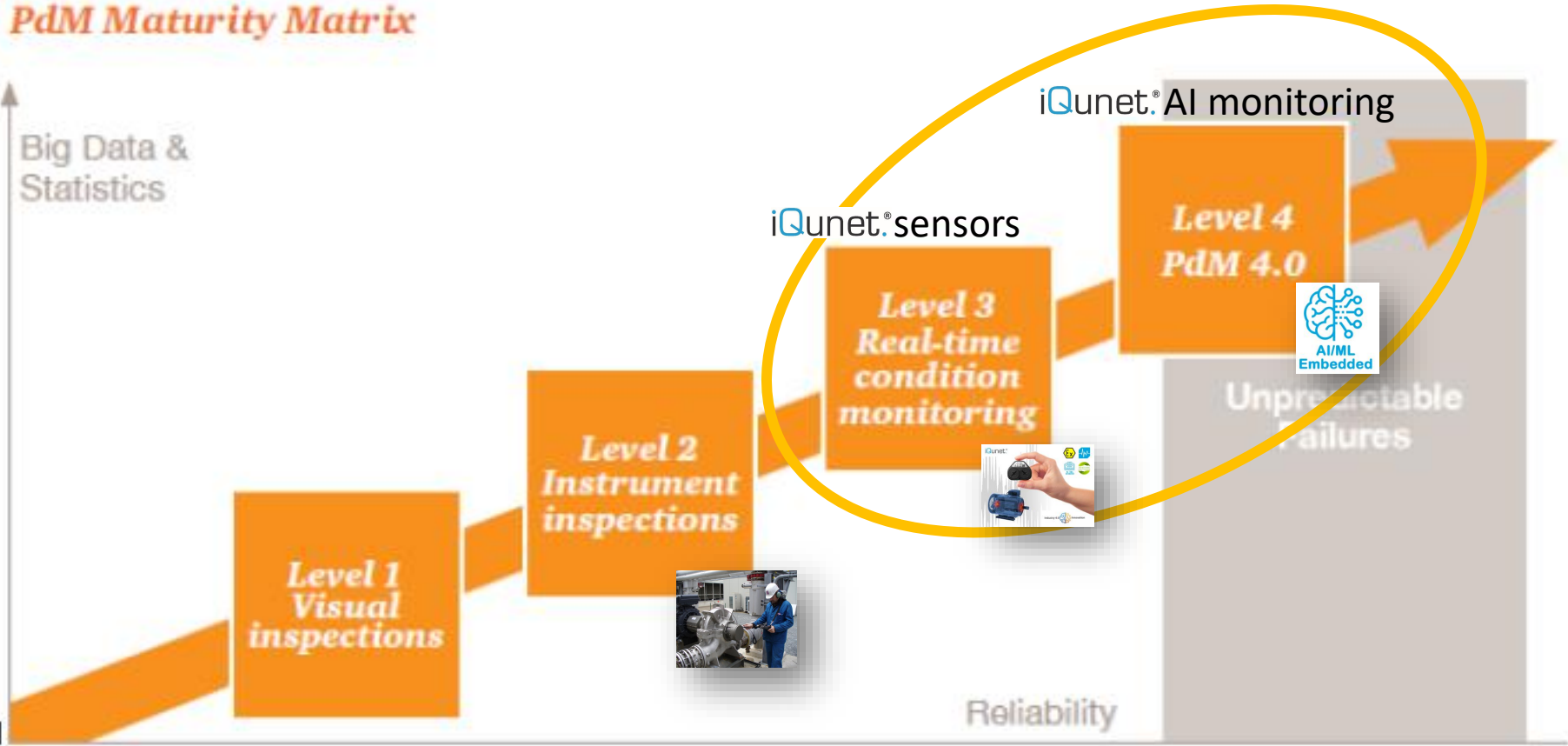


Increase KPI
Plant Asset Availability

* https://www.researchgate.net/publication/235636285_The_Challenges_of_Condition_Based_Maintenance

How mature is your organisation in reaching Reliability Excellence?

(What are the iQunet solutions for reaching this?)



PdM Maturity Matrix : Source- Mainnovation

Disadvantages of Instrument Inspections (PdM Maturity Level 2)



Photo source: ACD

Measurements:

- Labour-intensive, waste of experts time
- Safety issues
- Snapshot
- Limited trends, not “real time”
- limited reproducibility
- Measurement in standard conditions
 - Standard speed, unloaded, ...
- No combinations (current, vibration, ...)



Photo source: SKF

Analysis:

- Lack of expertise
 - Pensioned
 - Change company
 - Illnesses
 - Increasing demand
- Human mistakes
- Waste of time if asset in good condition



How to increase Plant Asset Availability?

How to start
&
reach Level 3 & 4 of PdM Maturity?

Define the Criticality of Equipment

(recommended in-plant assessment; consultancy is not provided by iQunet)

Criticality analysis should cover multiple areas of the organization including:

- Customer impact
- Impact on safety and environment
- Ability to isolate single-point failures
- Preventive maintenance (PM) history
- Corrective maintenance history
- Mean time between failures (MTBF)
- Spare parts lead time
- Probability of failure

How to Rank Your Equipment



Equipment Criticality Risk Matrix

1. List your equipment
2. Form an assessment team
3. Score your equipment
4. Consider the business risk if an item fails
5. Convert score to risk rating



Which end-to-end solution
&
(sensor) technology
monitors your critical assets?

Hardware



Vibration

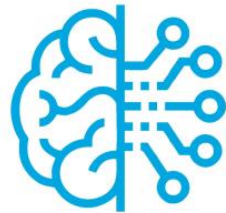


Current



Analog

Software



AI/ML
Embedded



Analytics
Dashboards



Embedded
Server

Benefits



Real Time
Edge



Data
Ownership



End-to-End
Solutions



iQunet.[®] **Predictive** Asset Health Monitoring Solutions

iQunet's sensor hardware covers most important potential Drive Train failures

Time series (full spectrum) from:



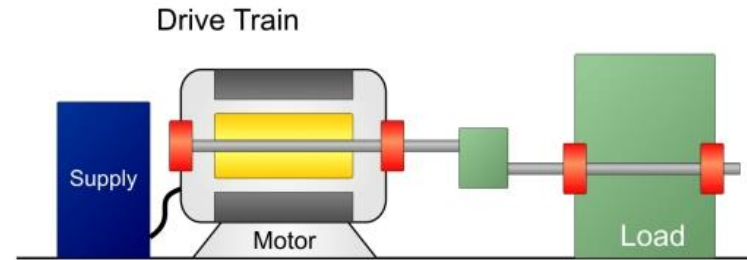
Vibration Monitoring

✔ 3/7



(ESA) Current Waveform Monitoring

✔ 5/7



	Supply	Power Quality	EPVA (Voltage)	
✔	Mec. Imbalance or Misalignment	MCSA	Vibration	EPVA
	Insulation Faults	Partial Discharge	EPVA	
✔	Stator Electrical Imbalance	EPVA	MCSA	Power Quality
✔	Broken Bars	MCSA	EPVA and IPSA	
✔	Bearing Faults	Vibration	Wavelet on Current	MCSA, EPVA and IPSA
✔	Coupling and Load Mechanical Failures	Vibration	MCSA, EPVA and IPSA	

Legend:

- ideal
- good
- workable

iQunet.® Wireless Asset Health Monitoring Solutions

iQunet provides **Time Series** from Vibration, Current, Analog & Digital signals



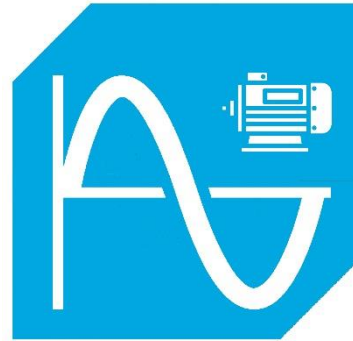
**Wireless
Vibration
Monitoring**
Rotating Equipment



MEMS



IEPE



**Wireless
Current Waveform
Monitoring**
Electric Motors



CT



**Wireless
“Other Attribute”
Monitoring**
Quality or Process Parameters
3th party Analog / LoRaWan / ... sensors



ANALOG
4..20mA / 0..10V





DIGITAL
LoRawan Sensors *

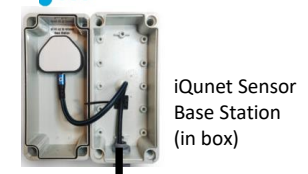
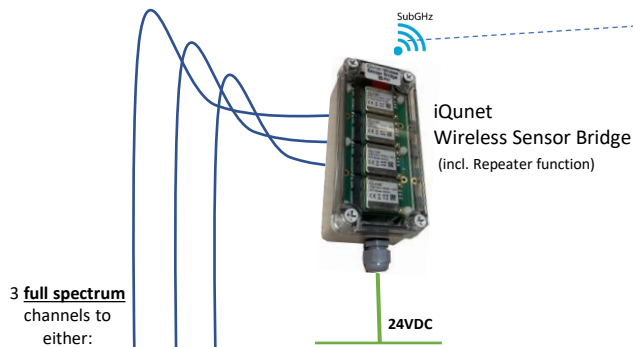
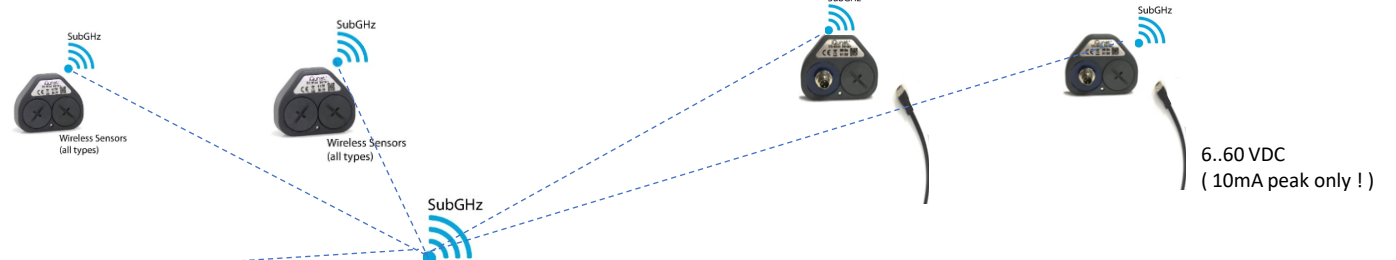
*available in 2023

Wireless System Overview

@ **High Sampling Rates**
(IP67 installation)

 iQunet wireless **Battery** powered 3-Ax + T°
full spectrum vibration sensors (@time interval)

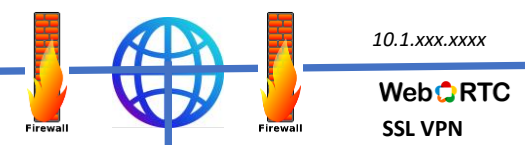
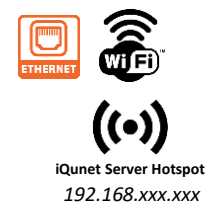
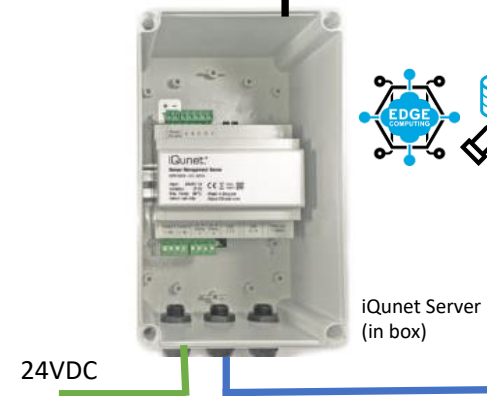
 iQunet wireless **DC** powered 3-Ax + T°
full spectrum vibration sensors (always on / self triggering)



Management dashboards
Google
Looker Studio
(traffic lights)



iQunet Sensor & analytics dashboards
- Analytics
- AI-ML Anomaly Detection



No Cloud Storage !!

iQunet.® Typical Sensor Range and Layout for high data rate SRD's*



* e.g. up to 25000 datapoints per measurement



Sensor Base Station (+ iQunet Server)



Sensor Repeater



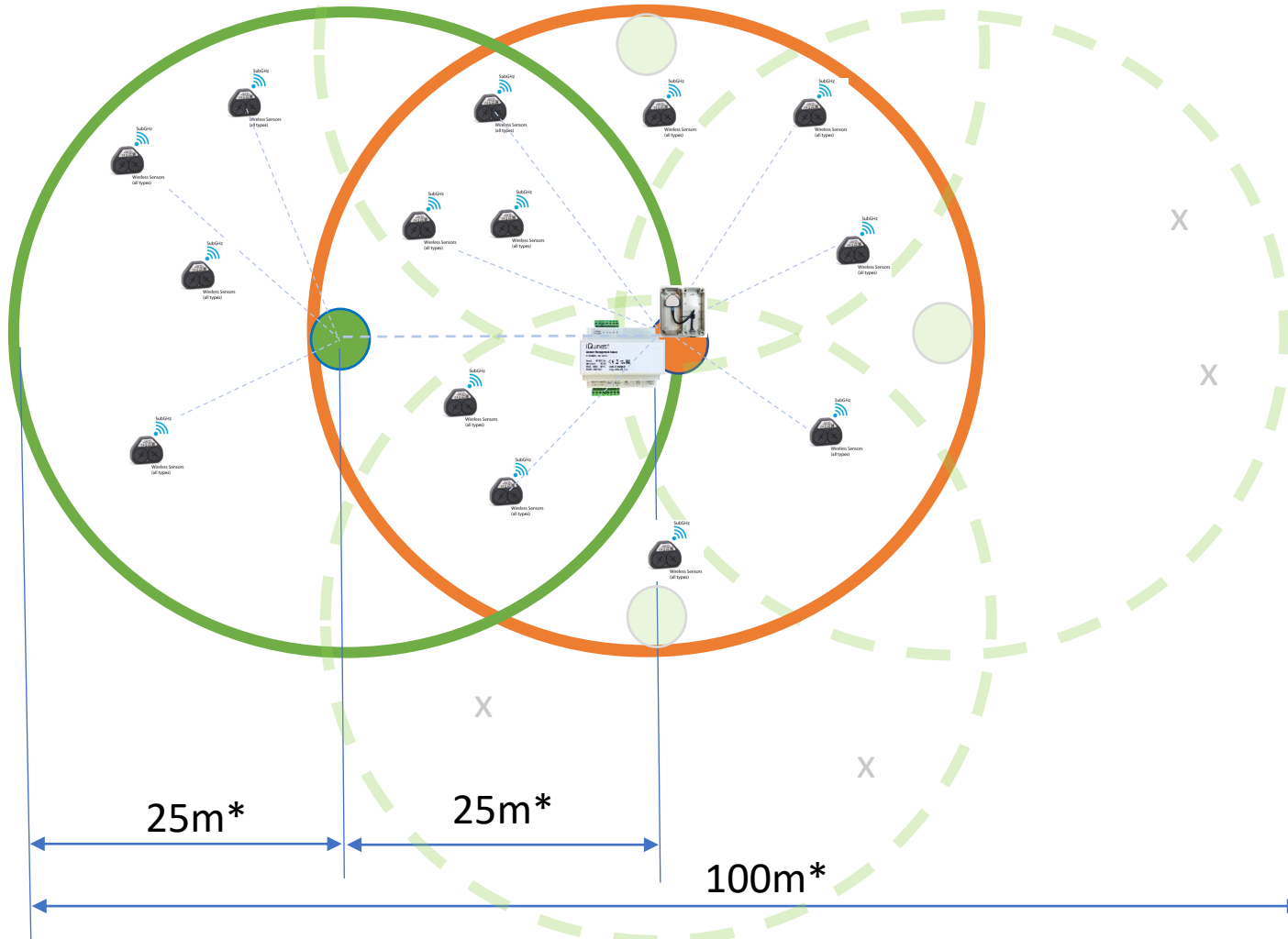
High Data Rate iQunet Sensors

(= SRD's / Short Range Devices)

(number of sensors is not limited)



Possible extensions (Repeaters)



(*) Radio ranges are indicative. Plant topology like walls, ceiling, metal covers and machines could influence the radio range **positive** or **negative**. Mounting of the sensors and sensor network components shall be made according to iQunet instructions.

(*) Wireless Range is limited due to worldwide legal limitations in radio communication for SRD's. 14

iQunet.®

Wireless System Overview

@ **Low Sampling Rates**
(IP67 installation)

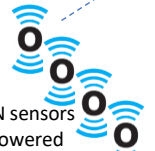
iQunet wireless **Battery** powered 3-Ax + T°
full spectrum vibration sensors (@time interval)

iQunet wireless **DC** powered 3-Ax + T°
full spectrum vibration sensors (always on / self triggering)



No need for LoRaWAN gateway !
No need for Cloud Network Server !
No need for Private Network Server !

LoRaWAN™ **Direct** → **OPC UA**



LoRaWAN sensors
Battery powered

- Pressure air&liquid, level, pulse, distance, ...
- T°/RH/VOC/CO2/H2O, ...
- Oil contaminations, valve position, ...



iQunet Sensor Base Station (in box) **LoRaWAN™**

Max. 5m



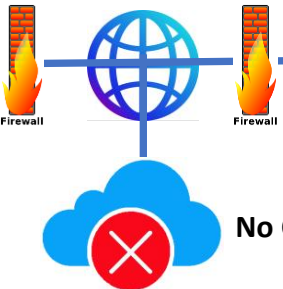
On premise LoRaWAN™ Data !

iQunet Server (in box)

24VDC



iQunet Server Hotspot
192.168.xxx.xxx



No Cloud Storage !!

Google Looker Studio
Visualisation Tool
(traffic lights)

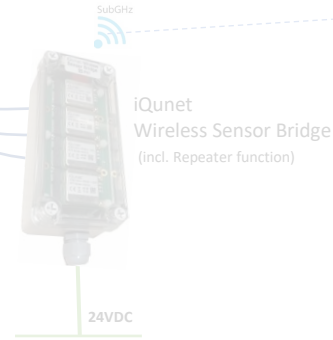


iQunet Sensor dashboard
- Analytics
- AI-ML Anomaly Detection



10.232.xxx.xxxx
**WebRTC
SSL VPN**

3 full spectrum channels to either:



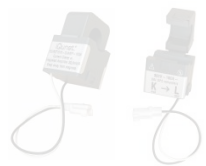
iQunet Wireless Sensor Bridge (incl. Repeater function)

24VDC

IEPE (top+side)
(waveforms & spectrum)



Current Clamps (100A, 300A or 600A)
(waveforms & spectrum)

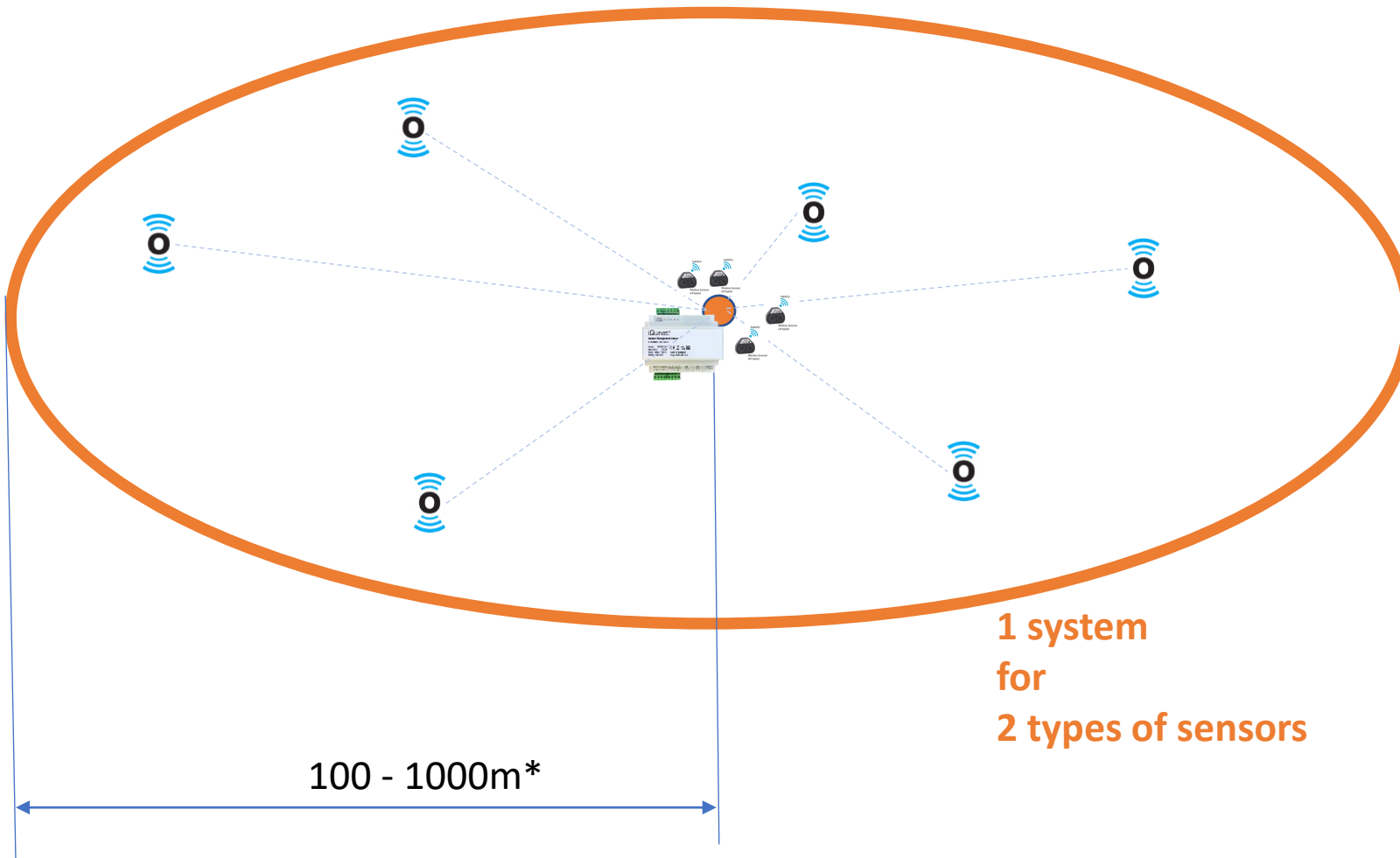


Third Party Analog (0-10V/4-20mA) Sensors
(24VDC powered)



iQunet.® Typical Sensor Range and Layout for Long Range Devices*


LoRaWAN™ * e.g. up to 5 -20 messages per measurement (per hour)




 Sensor Base Station (+ iQunet Server)

 LoRaWAN™ Sensors

- Pressure air&liquid, level, pulse, distance, ...
- T°/RH/VOC/CO2/H2O, ...
- Oil contaminations, valve position, ...

 Other iQunet High Data Rate sensors (Short Range Devices = SRD's)

 The LoraWAN sensors have direct local link to the iQunet server! Data is stored local!
There is **no gateway nor (private) LoRa network** access necessary at all.

**1 system
for
2 types of sensors**

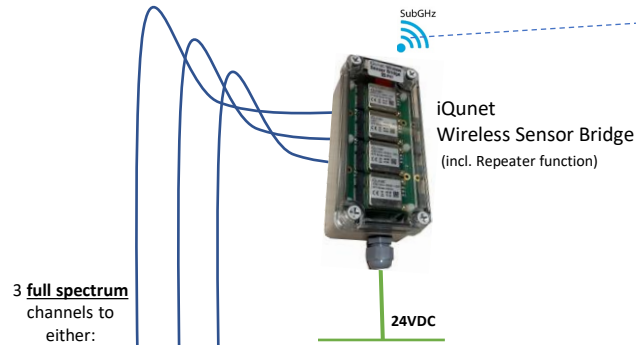
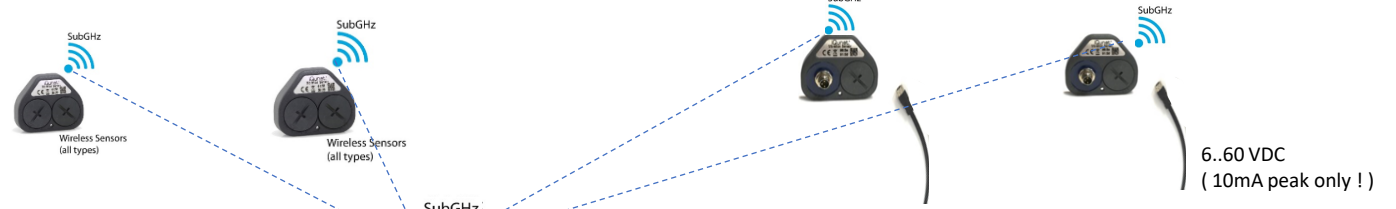
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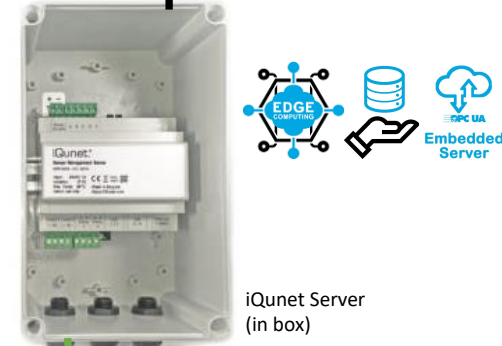
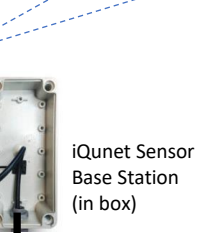
**One System
Many Sensors**

iQunet wireless **Battery** powered 3-Ax + T°
full spectrum vibration sensors (@time interval)

iQunet wireless **DC** powered 3-Ax + T°
full spectrum vibration sensors (always on / self triggering)



- LoRaWAN sensors
Battery powered
- Pressure air&liquid, level, pulse, distance, ...
 - T°/RH/VOC/CO2/H2O, ...
 - Oil contaminations, valve position, ...

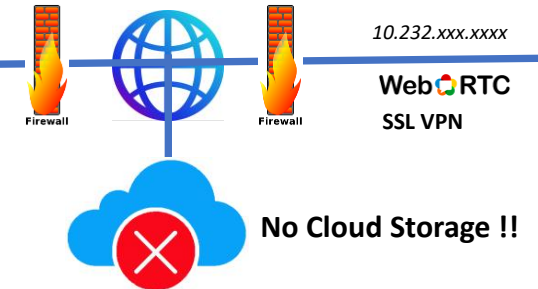


Google
Looker Studio
Visualisation Tool
(traffic lights)



iQunet Sensor
dashboard

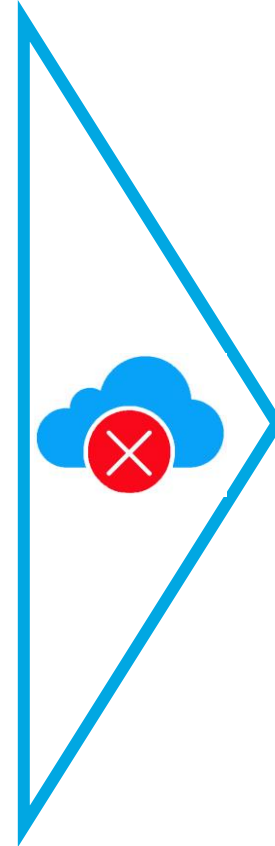
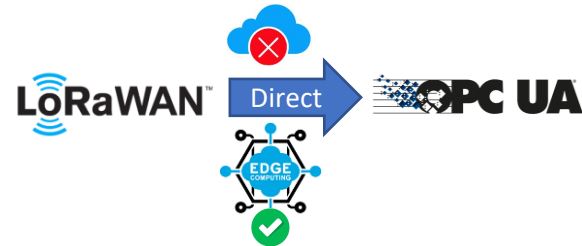
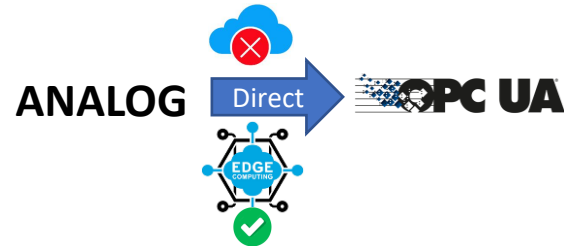
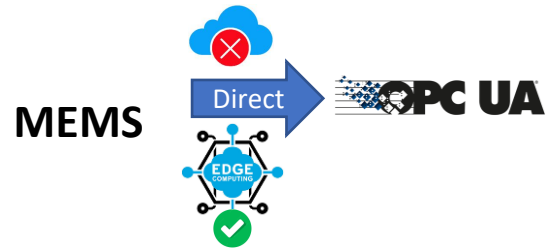
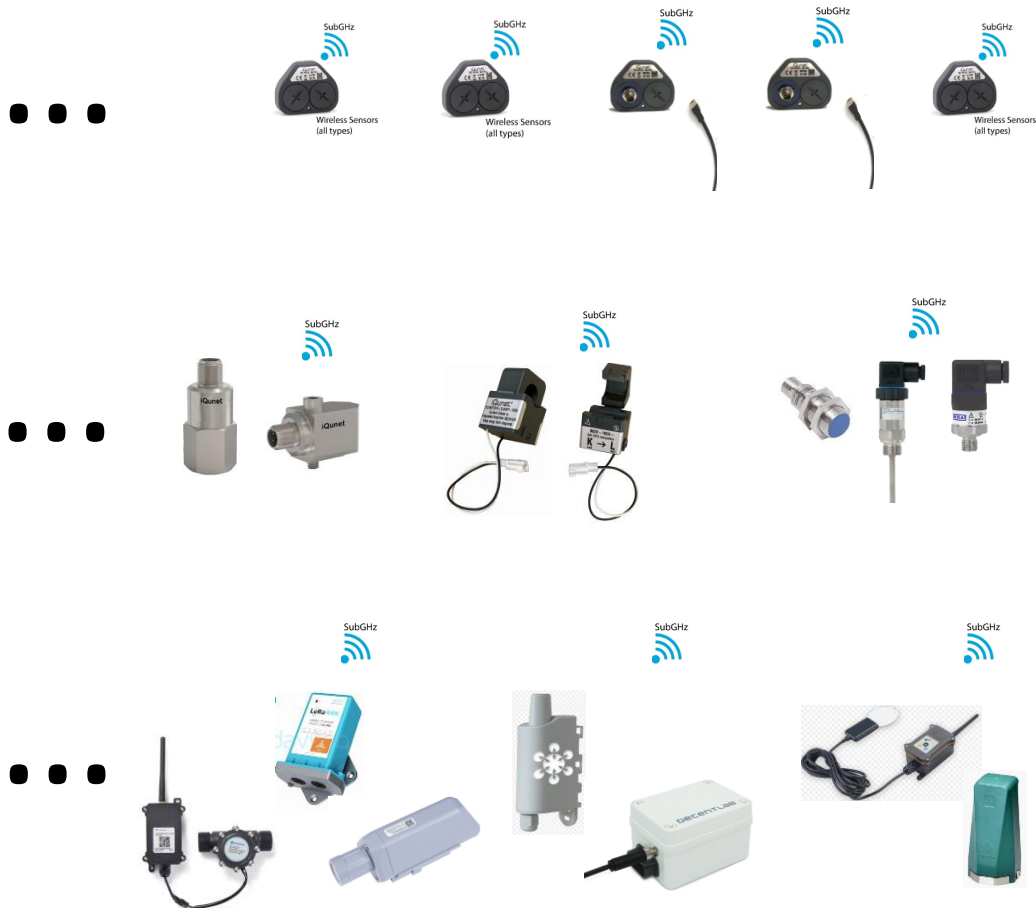
- Analytics
- AI-ML Anomaly Detection



iQunet®



One System
Many Sensors



Hardware



Vibration

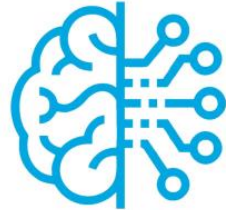


Current



Analog

Software



AI/ML
Embedded



Analytics
Dashboards



Embedded
Server

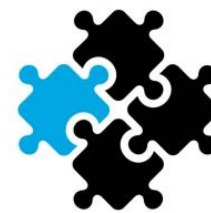
Benefits



Real Time
Edge



Data
Ownership



End-to-End
Solutions



Software Innovation

Standardized OPC UA communication / Analytic Dashboards / AI embedded



Embedded Server

Easy Integration

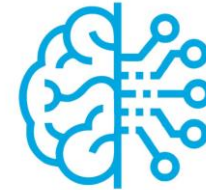
HMI/SCADA (large Co.)
Google Data Studio (SME)



Analytics Dashboards

Analytics Dashboards

Anomaly Trends & Alarms,
Detailed Full Spectrum



AI/ML Embedded

Edge AI Anomaly Monitor 4.0

On Premise,
Brand & Asset Independent

iQunet.®

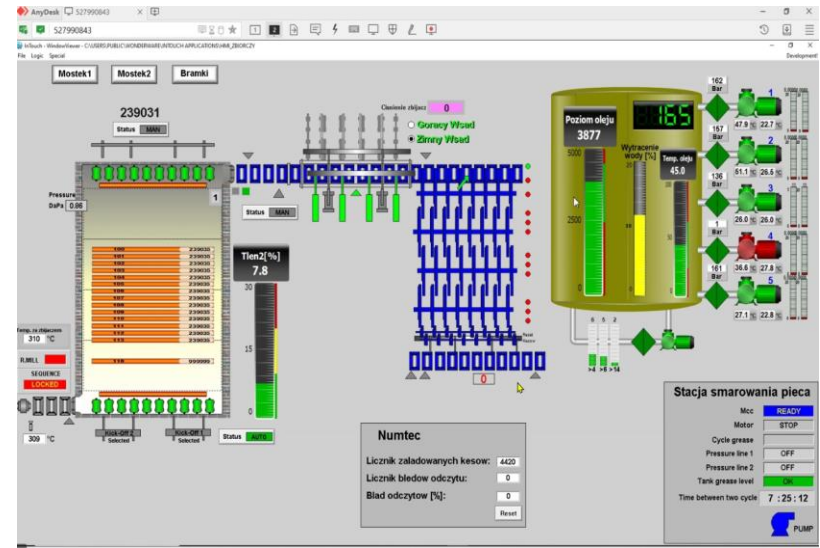
Software Innovation

OPC UA Embedded Server

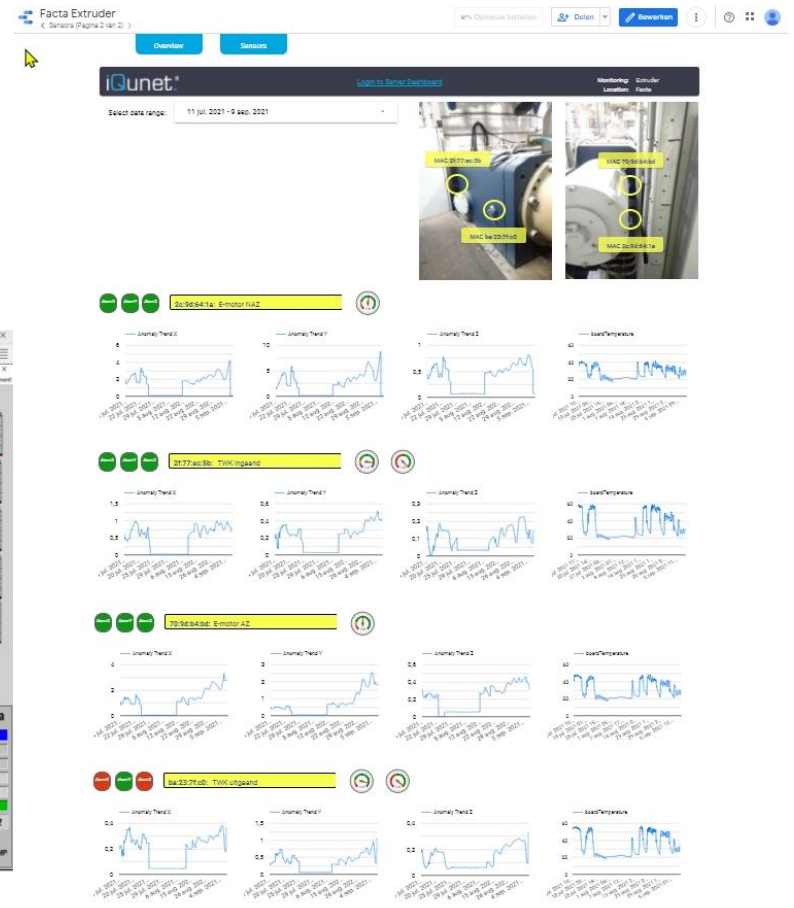


Easy Integration

HMI/SCADA (large Co.)
Google Looker Studio (SME)



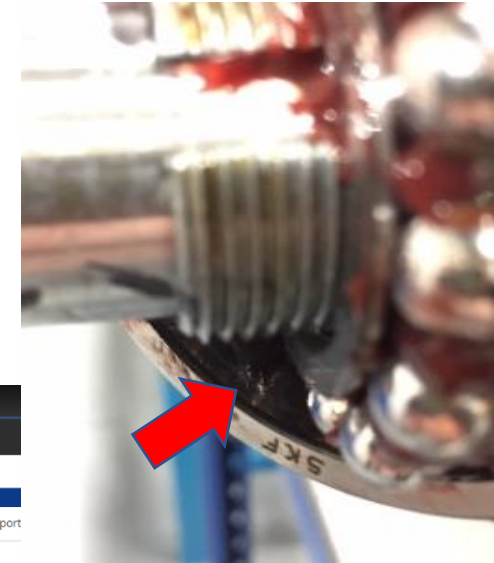
HMI/SCADA (large Co.)



Google Looker Studio (SME)

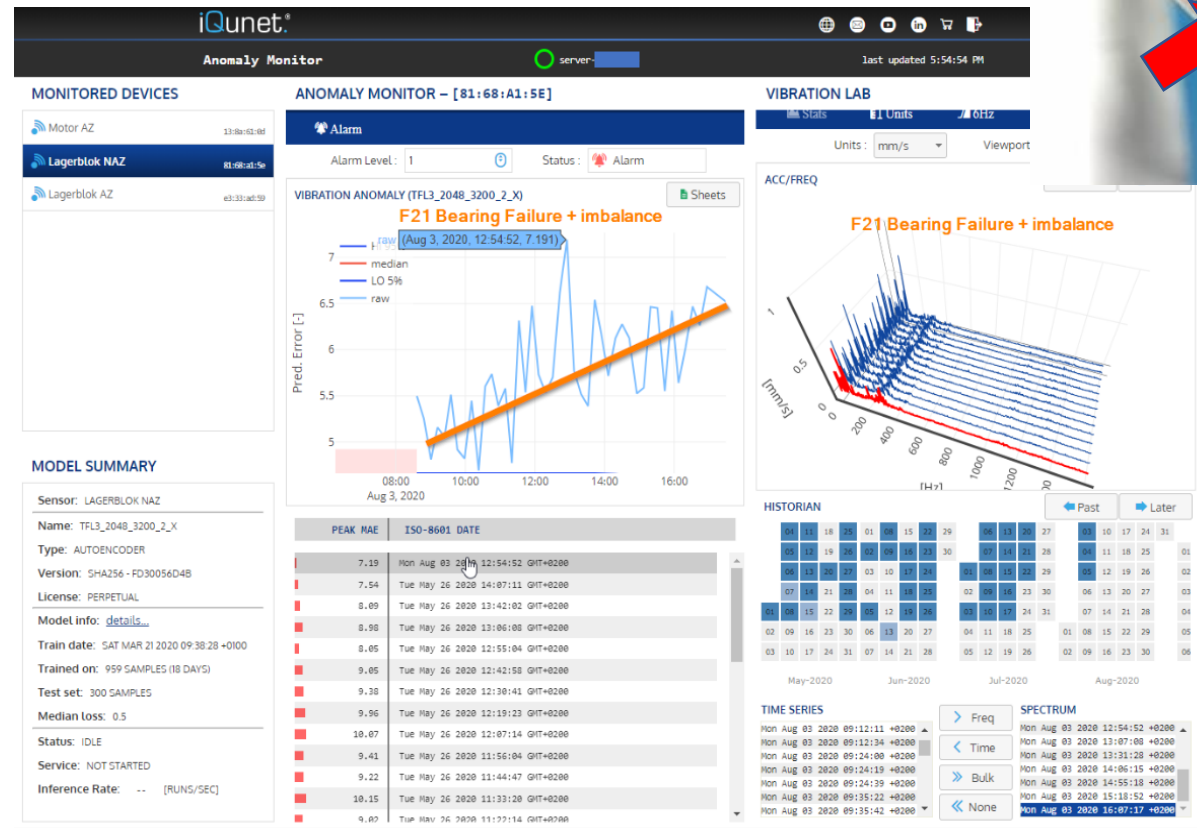
iQunet.® Software Innovation

Analytics Dashboards



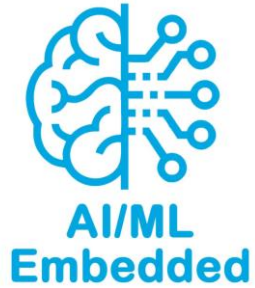
Dashboards

Anomaly Trends & Alarms,
Detailed Full Spectrum



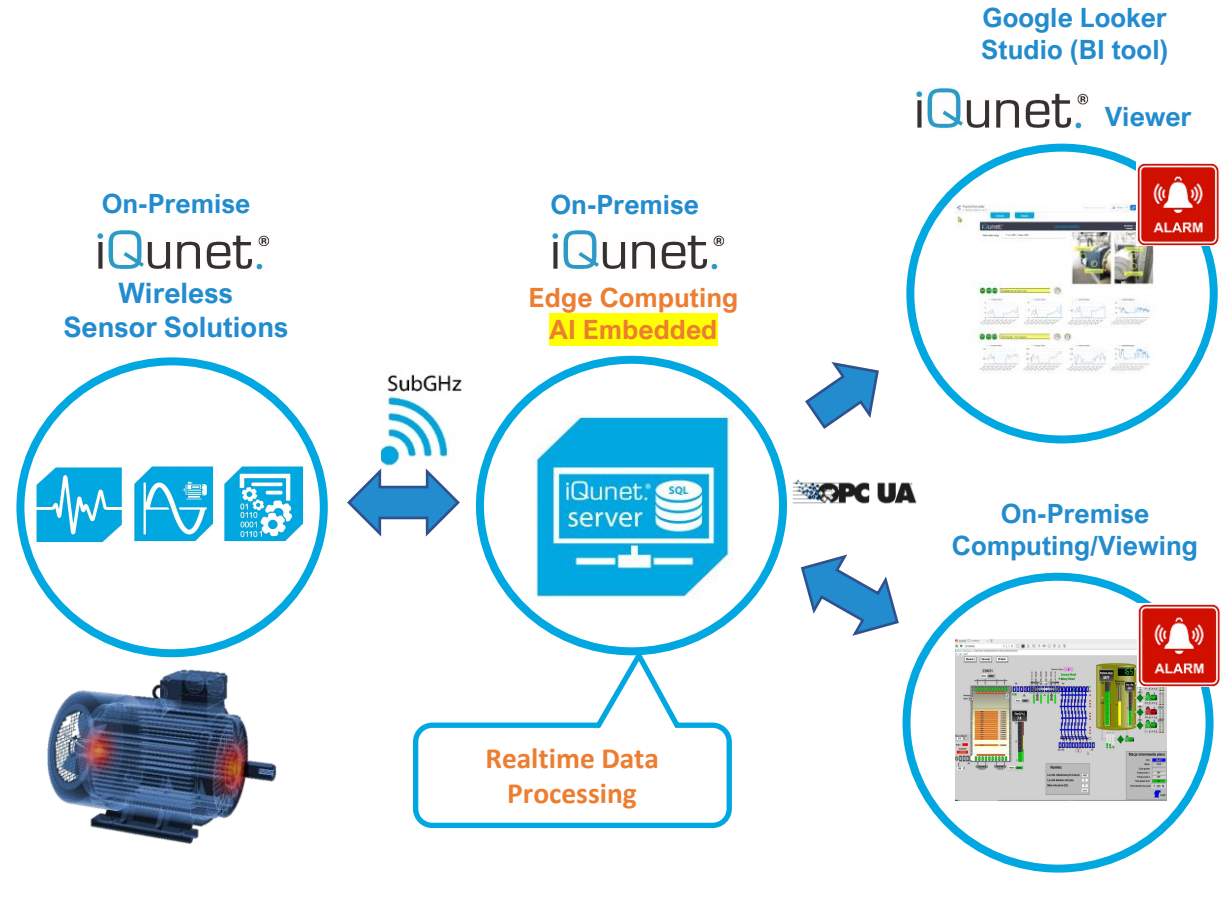
iQunet.® Software Innovation

Embedded AI/ML



Edge Anomaly Monitor 4.0

On Premise,
Brand & Asset Independent



Hardware



Vibration



Current



Analog

Software



Embedded
Server



Analytics
Dashboards



AI/ML
Embedded

Benefits



Real Time
Edge



Data
Ownership



End-to-End
Solutions



Key Benefits

Edge Computing / Data Ownership / End-to-End solutions



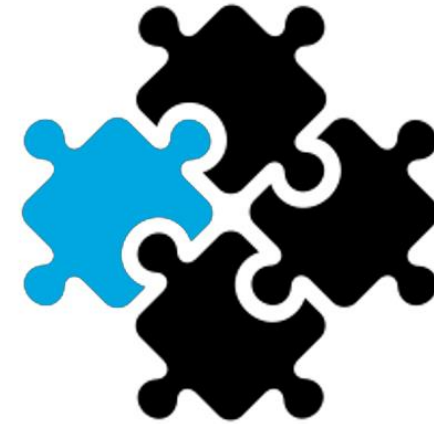
**Wireless &
Edge Computing**

**Unique Remote
Real Time Processing,
embedded AI**



**Data Ownership &
Local Data Storage**

No Vendor Lock-in



End-to-End solutions

**High Interoperability
High ROI**



How can I make use of it?

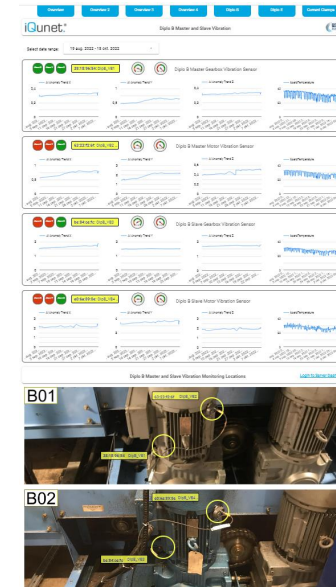
Standard dashboards (health status)

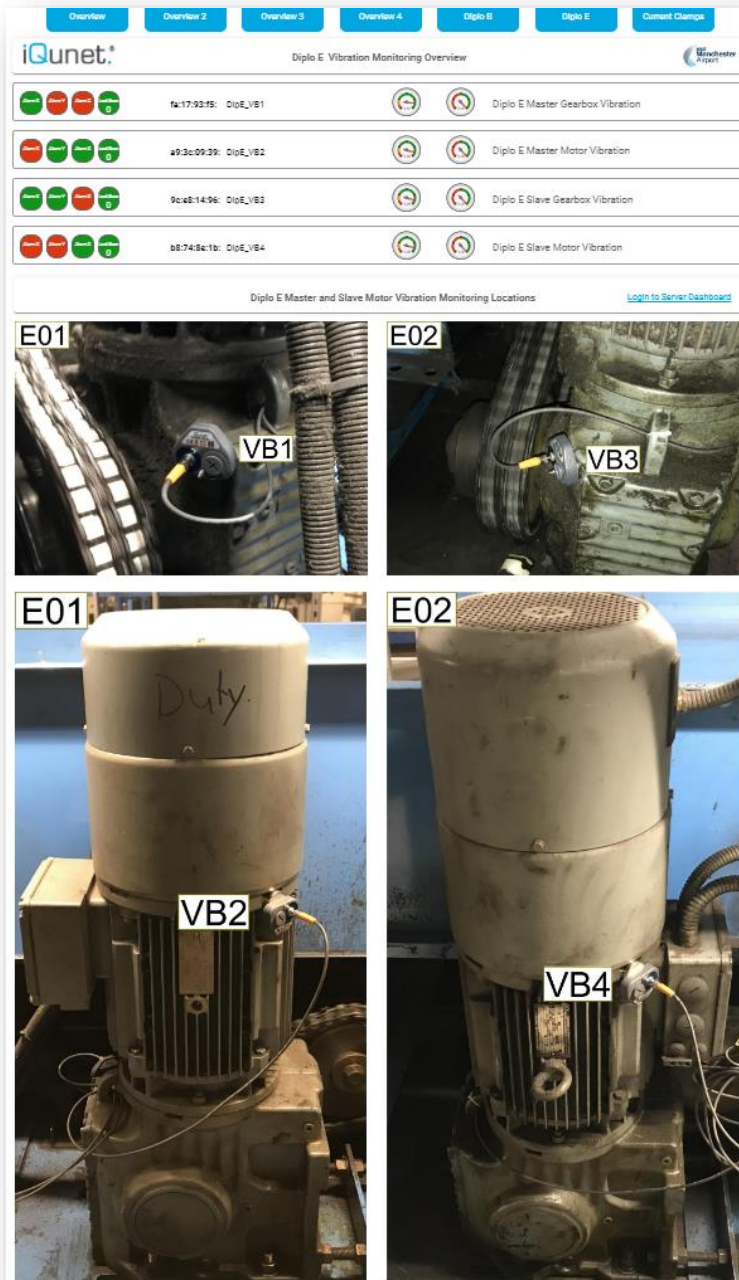
&

Detailed analytic dashboards

iQunet.® Dashboards

- Management Dashboards
(traffic lights / heat maps)





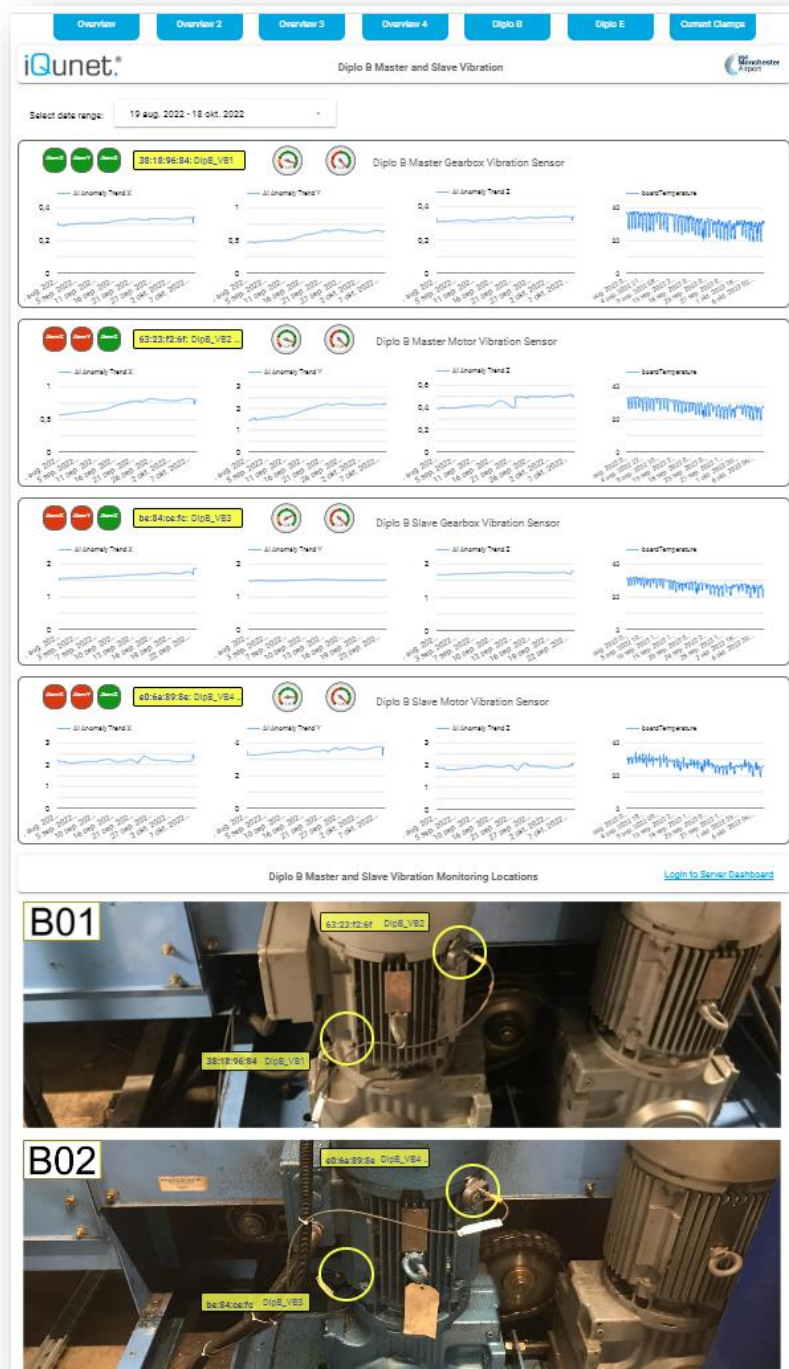
Overview dashboards

- Anomaly Detection Alarms (red buttons) (must run AI-aaS)
- Battery status gauges
- Background text

Features

- Easy switch to iQunet analytics dashboards
- Fully customizable solution by (granted) user
 - Change colors and layout
 - Add any pictures*

* Photographs are entered by user



Detailed dashboards

- Anomaly Detection Alarms (red buttons) (must run AI-aaS)
- Anomaly Detection trend graphs XYZ (must run AI-aaS)
- Temperature trend graph
- Battery status gauges

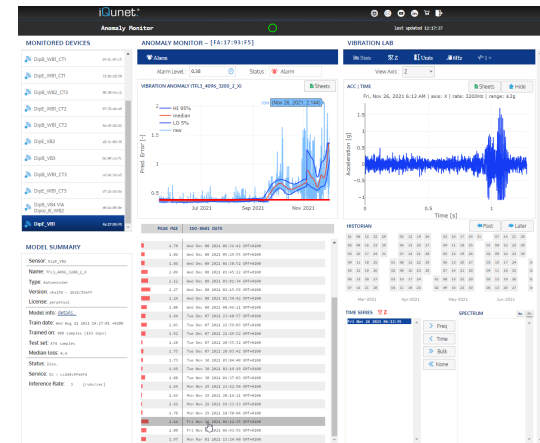
Features

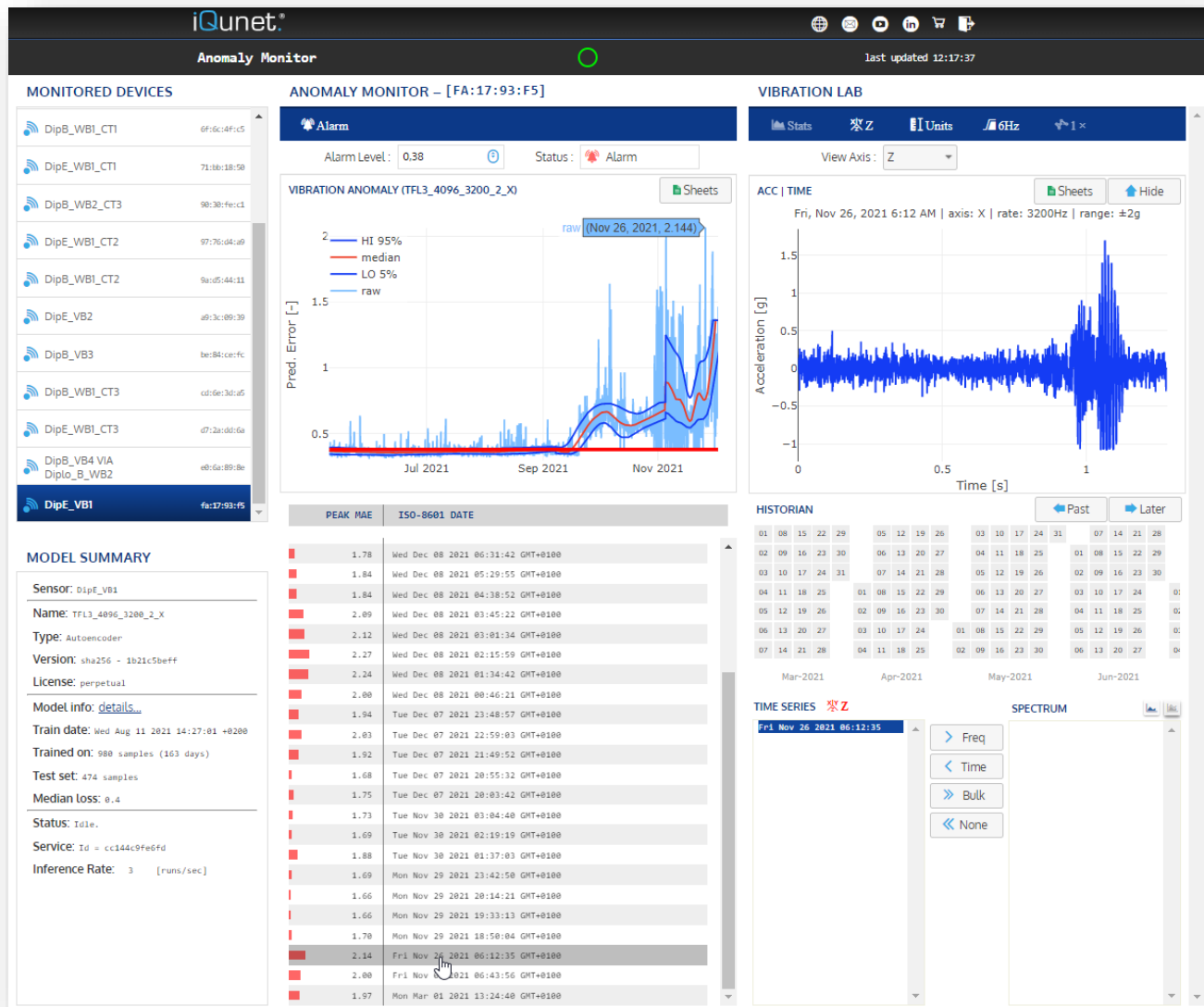
- Selectable period
- Easy switch to iQunet analytics dashboards
- Fully customizable solution by (granted) user
 - Change colors and layout
 - Add any pictures*

* Photographs are entered by user

iQunet® Dashboards

- Comprehensive analytic Dashboards
- Available via OPC UA





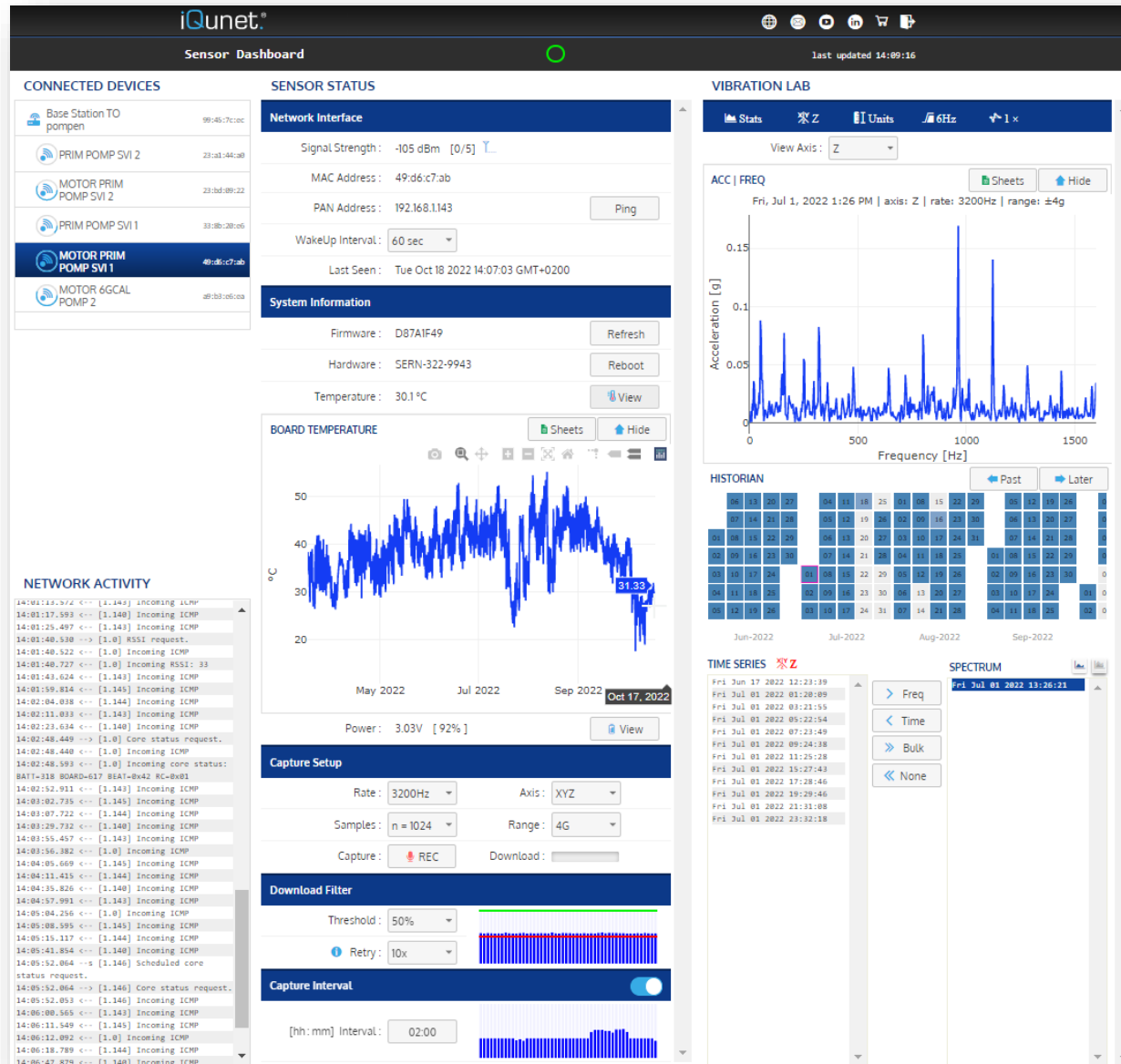
Anomaly Monitor Dashboard (must run AI-aaS)

- Anomaly Detection Alarms
- Anomaly Detection trend graphs XYZ
 - Raw anomalies
 - Trend lines (5%/50%/95% probability above set alarm level)
- Detailed AI model information
- Selectable list of peak anomaly values
- Immediate visualization of anomaly related
 - time series
 - FFTs
 - 3D-FFTs
- Analytical tools
 - Acceleration / velocity
 - Signal filtering & averaging options
 - Ax selection options
 - Historical data queries



All above OPC UA (historical) node data is free accessible!





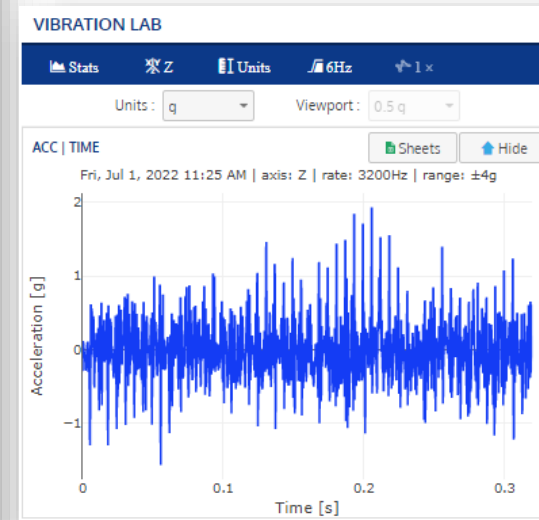
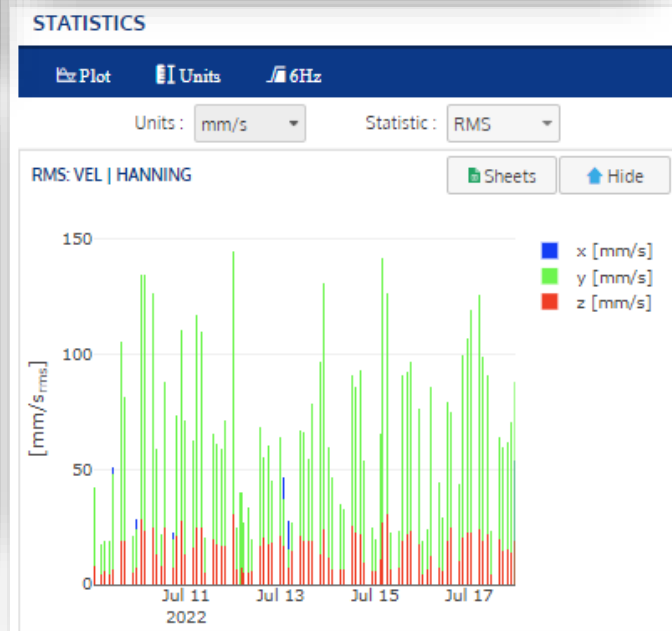
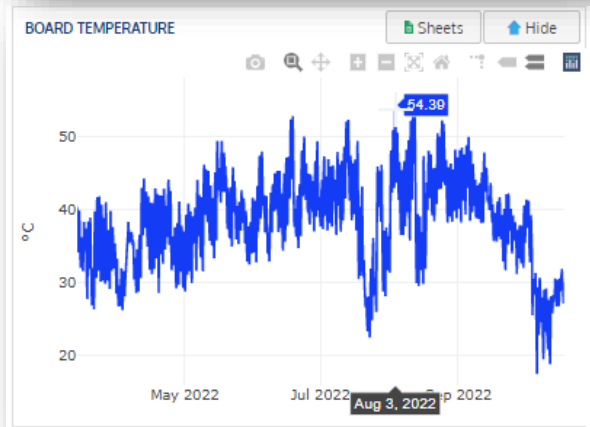
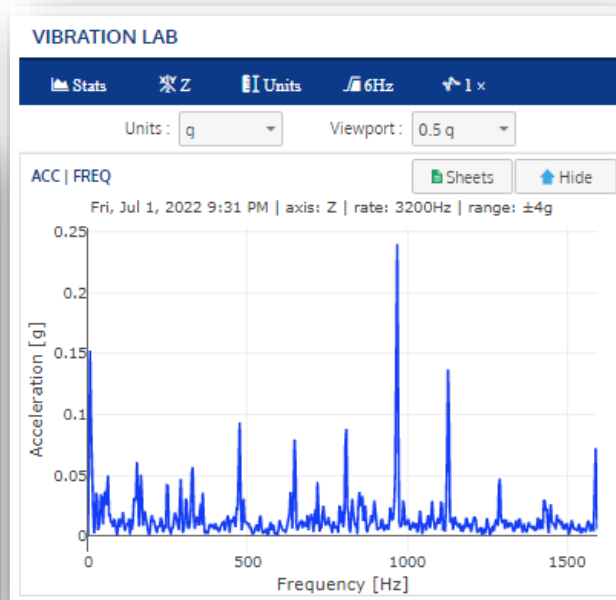
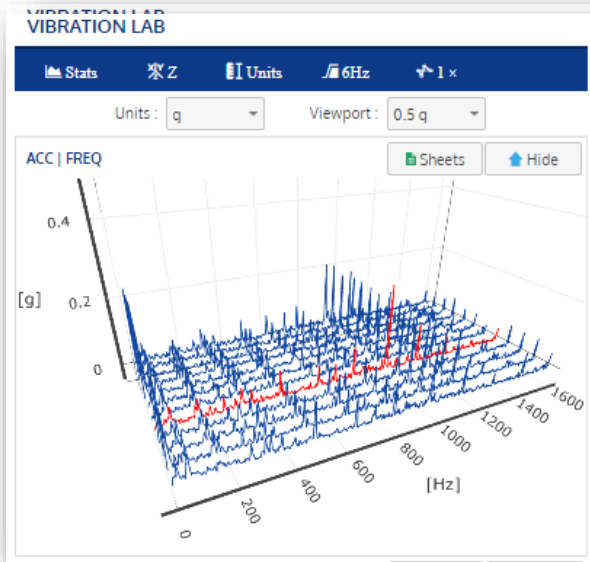
Capturing and Analytics Dashboard (standard included)

- General sensor information and overview
- Sensor Status information
 - Connectivity
 - Historical temperature graph
 - Historical battery level graph
- Capture setup pane
- Capture interval setup pane
- Sensor download threshold setup pane
- Analytics pane (historical data)
 - Vibration Lab
 - velocity and acceleration selection
 - HP filter settings
 - Time series graph
 - FFT graph
 - 3D FFT plot
 - Statistics
 - velocity and acceleration selection
 - HP filter settings
 - RMS trend graph
 - Kurtosis trend graph



All above OPC UA (historical) node data is free accessible!





Graphs functions (standard included)

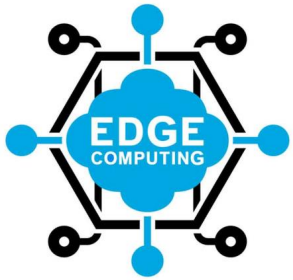
- Zoom
- Pan
- Autoscale
- Data comparison tools
- Orbital rotation tools
- Camera capture
- Hoover functions
- Google Sheets Graph export function
 - attribute consolidation in one file
 - Ideal for quick reporting of events



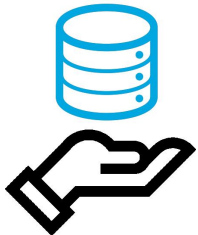
What does it cost?

Capex Cost Model

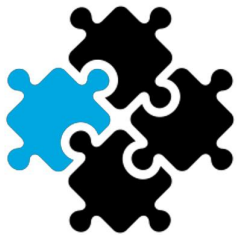
iQunet.[®] Cost model



All iQunet products are from the shelf available for a one-time-cost (CAPEX cost model)



All data on the Edge iQunet Server is free available (= at no cost !)

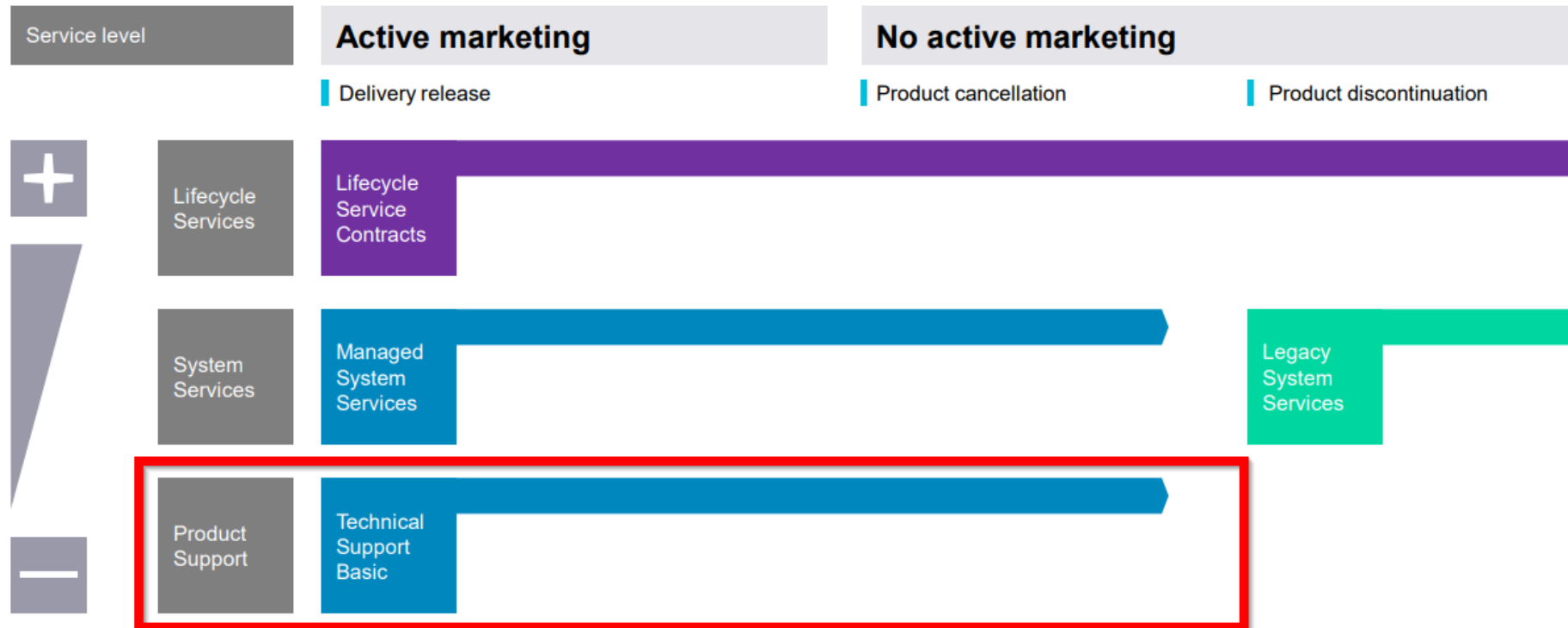


Additional end-to-end solution and services are available as CAPEX or OPEX

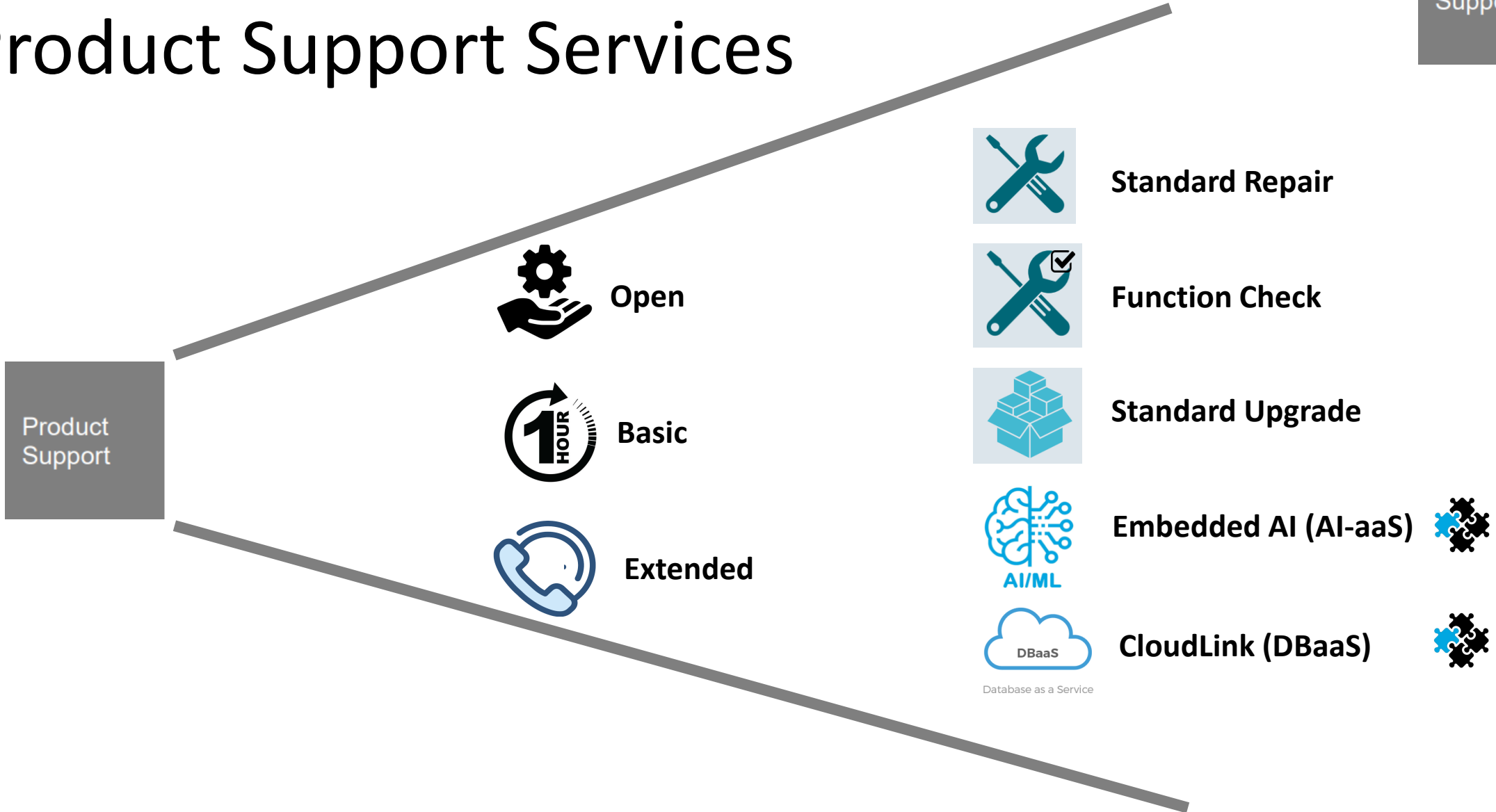
iQunet.®

End-to-end Solutions
&
Services

Product Support Services



Product Support Services



Product Support Services

iQunet Open Service

- Online Support is the iQunet information portal for products & services
 - FAQ
 - Extensive knowledge base
 - free of charge sample applications
 - Manuals and datasheets
 - Interface to Support Request for further help



Product Support Services

PSS Basic

- As part of our **Basic Support**, you receive **essential e-mail support** via our hot-email. Our service experts have knowledge of the local installed base and can be reached by email and call back or email back for a processing time of **up to one hour free of charge**.



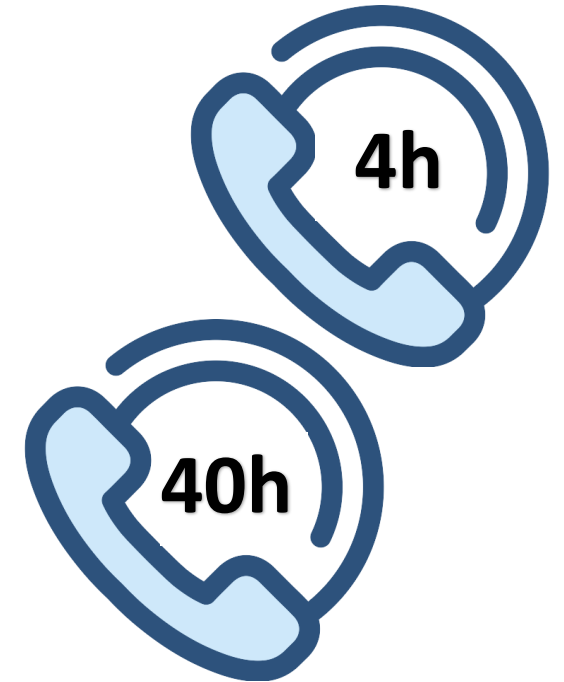
Product Support Services

PSS Extended

- Our "**Extended**" support offers you support for complex inquiries - which take more than an hour - and ranges from **configuration support** and **technical support during commissioning** to a comprehensive and individual service for all iQunet Products. Billing takes place via our iQunet Technical Support Extended Packages.

Extensive and individual support for complex requests

- The Technical Support **Extended Packages** are a payment option for specific support requests to Technical Support in Belgium. The packages are available in sizes of **4 or 40 hours**. The number of packages required to process the specific support request is estimated by the technical support expert. Billing takes place upfront to completion of the support request. Used credits hours are calculated according to the quantity actually required.



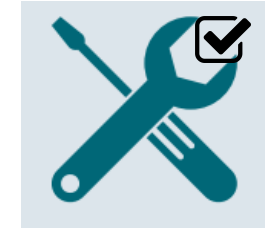
Repair Services

Standard Repair

- Standard repair with our worldwide **repair options** is the best choice when you have specific reasons for not replacing defective components with new ones.

Benefits:

- Exclusive use of **original parts**
- Additional information supplied by **reports** on repair and findings
- Highest standards of **quality**
- Use of the comprehensive **test** concept of series production



Function Check

- To guarantee that the spare parts in your **stock** are also functioning properly, we offer a function check. The first step involves cleaning the spare part. Then all relevant hardware and software/firmware **enhancements** from development, production, suppliers, service, and quality management are implemented.
- Using the comprehensive **test** concept of series production, all the functions of software, firmware, and complex and less complex function blocks are then **checked**. If a fault is detected during the function check, **troubleshooting and repair** are performed immediately at the repair price.

Benefits:

- Exclusive use of **original** parts
- Additional information supplied by **reports** on repair and findings
- Highest standards of **quality**
- Use of the comprehensive **test** concept of series production

Upgrade Service



Standard Upgrade

- In the course of their lifecycle, electronic components such as storage devices in the iQunet Edge Servers (e.g. SD, SSD, ...) are prone to failures over time. Thanks to the upgrade service, you always receive **new storage** build in where applicable including the **latest Software/Firmware**. A planned upgrade prevents unplanned downtimes from the monitoring system.

Benefits:

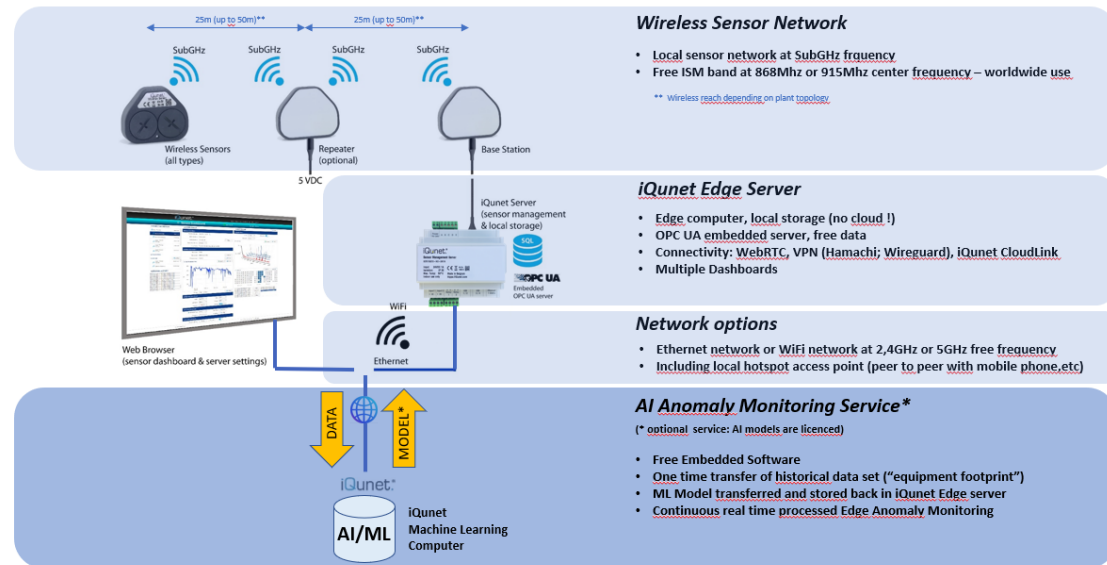
- **Price advantage** compared to purchasing new components
- **Extended availability** of your monitoring system
- **Prevention** of downtimes
- Latest technology from the **original** manufacturer

AI - Anomaly Detection Service



iQunet Anomaly Detection Service is an optional AI service

- Based on **real measurement data** (footprint)
- Automatically transferred data to iQunet ML computers
- Comprehensive **autoencoder** (model) creation
- **Embedded** autoencoder running on local Edge Server (on premise)
- **Automatic** detection of anomalies



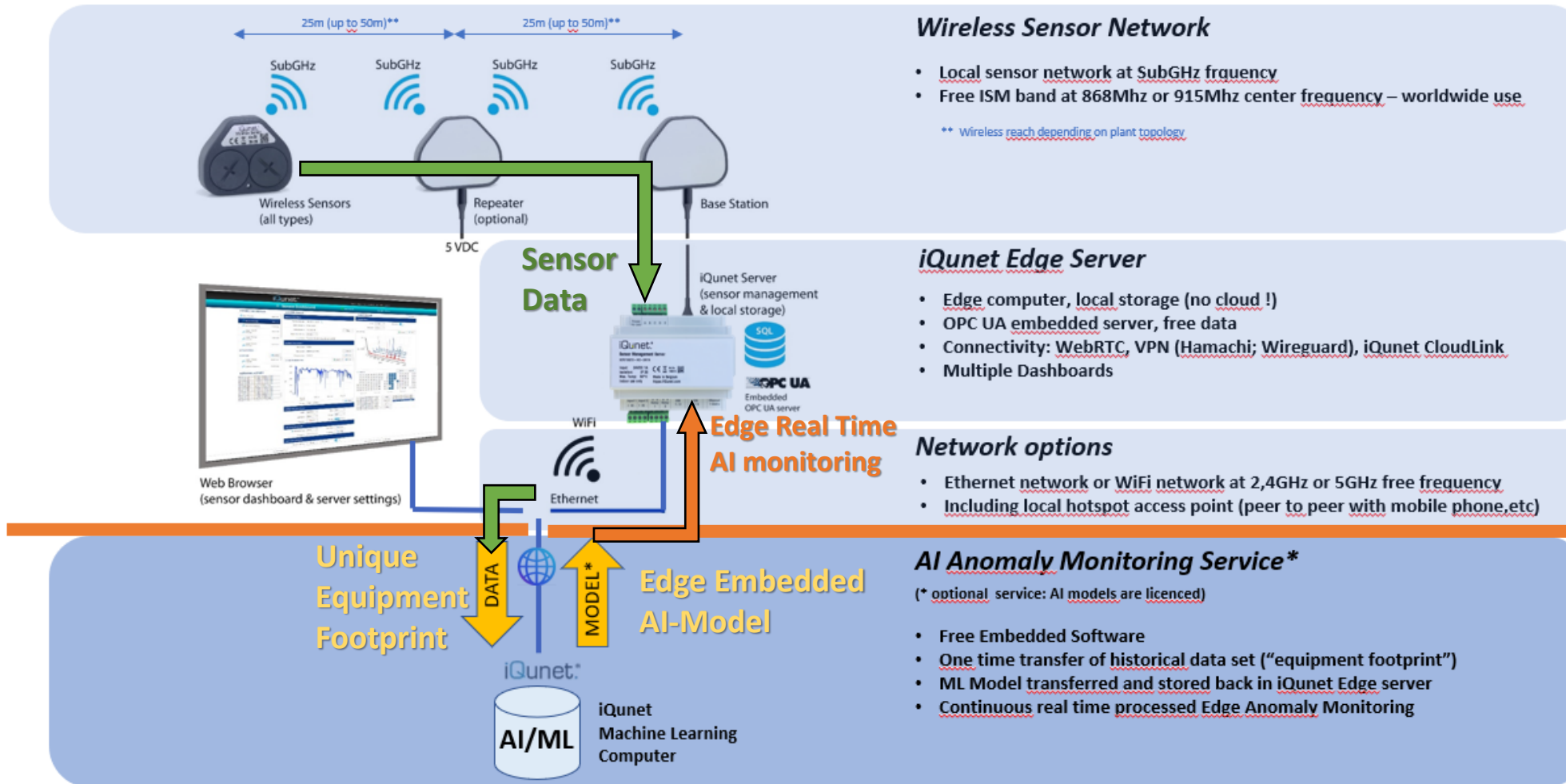
Benefits:

- Fast and sensitive **alarming in the Edge**
- **Embedded** AI service
- Comprehensive **dashboards**

iQunet.[®] AI as a Service (AI-aaS)



Product Support



iQunet.[®] CloudLink: Database as a Service

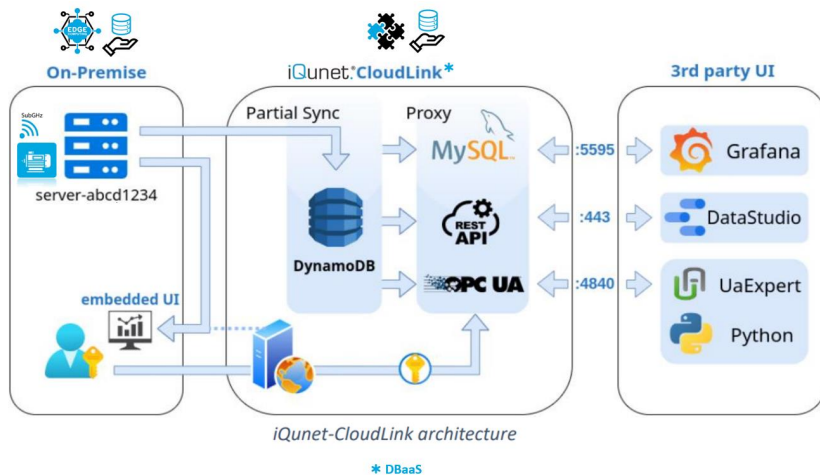


Database as a Service

Product
Support

iQunet-CloudLink is an optional database service (DBaaS)

- **Synchronizes** its mirror database with the database of your locally installed iQunet Edge Servers
- Due to the additional frontends that become available, iQunet-CloudLink drastically increases the **interoperability** of the iQunet condition monitoring solution.
- iQunet-CloudLink is an optional service that is useful when running **multiple Edge Server devices** in for example different locations which makes integration complex.



Benefits:

iQunet-CloudLink acts as a cache for Edge Server devices, so that end users:

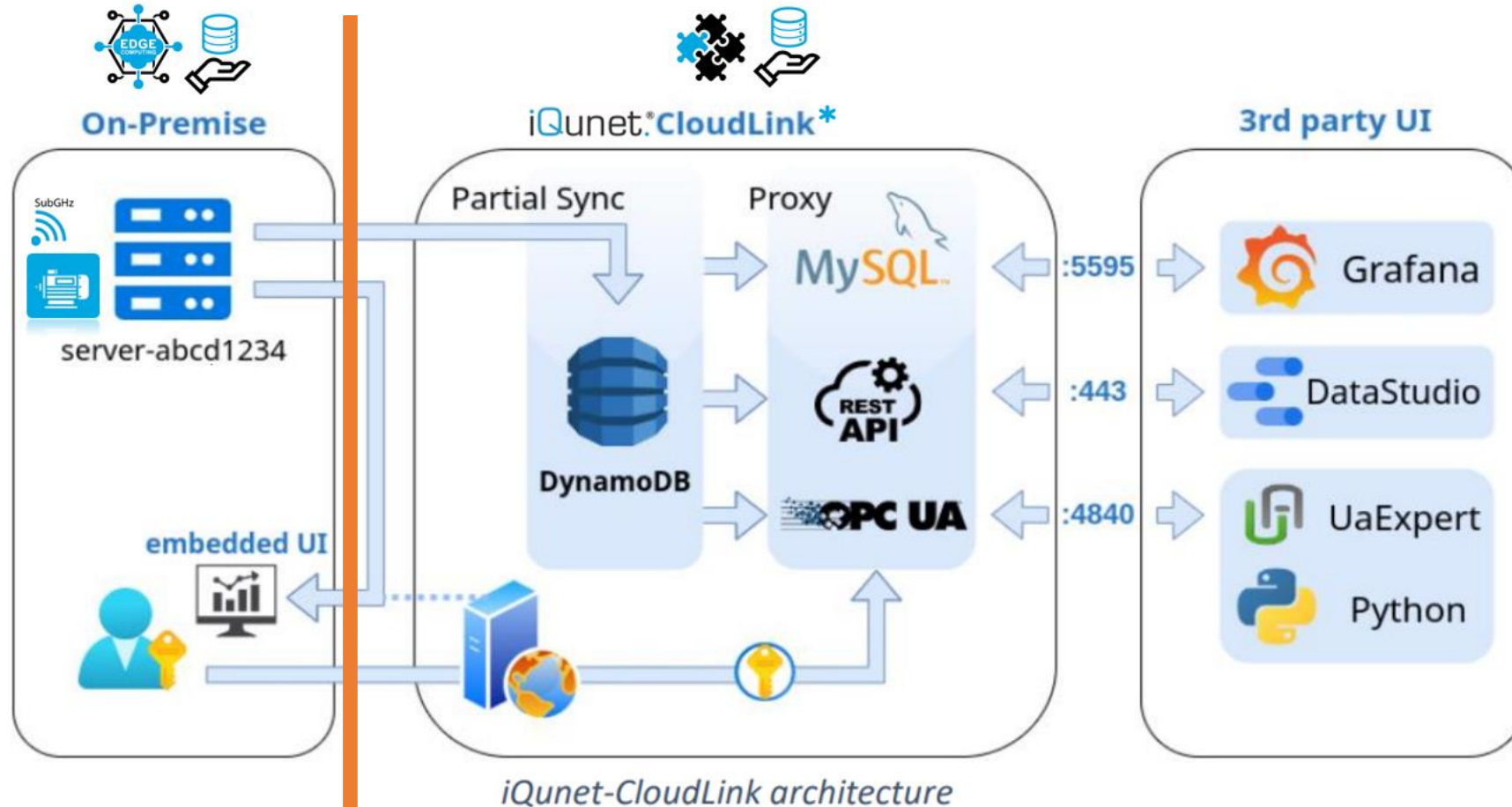
- do not have to deal with **offline** devices,
- do not have to deal with the **connection** setup of end devices,
- have a **single access point** to request data of multiple iQunet Edge Servers,
- do not have to deal with **firewall settings** and restrictions at the location of the Edge Servers.

iQunet.[®] CloudLink: Database as a Service



Database as a Service

Product
Support



Included Database as a Service (DBaaS) *

iQunet.®

Asset Health Monitoring Made Easy



Please contact us for a live demo (via online meeting)

www.iQunet.com

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Winner BEMAS Digital Innovation Award 2017

Winner Professional Jury BEMAS Digital Innovation Award 2021

Finalist BEMAS Digital Innovation Award 2022