# Operational Data Collection – Improvement in Data Quality

Presented by

Fabien Lemoine, EDF Energies Nouvelles

# Agenda

- Fact & Figures
- Method – Collaboration is Key
- Infrastructure – Replicable by Design
- Trust in Data – Check Everything
- Sample Use Cases
- Conclusion

# Facts & Figures

**9,100 MW**
Wind

**1,059 MWp**
Solar

**219 MW**
Other segments

## KEY FIGURES
at 31 December 2016

**€1,358 M**
Consolidated revenues

**€306 M**
Net income group share

**€918 M**
EBITDA

**3,108 employees**
Worldwide

Scope owned by EDF:
CA: 1,169 M€
EBITDA: 861 M€
RNPG: 242 M€

## CAPACITY
at 30 June 2017


### Generation activity

**10,378 MW gross**
**6,664 MW net**
Installed

**2,400 MW gross**
Under construction(1)

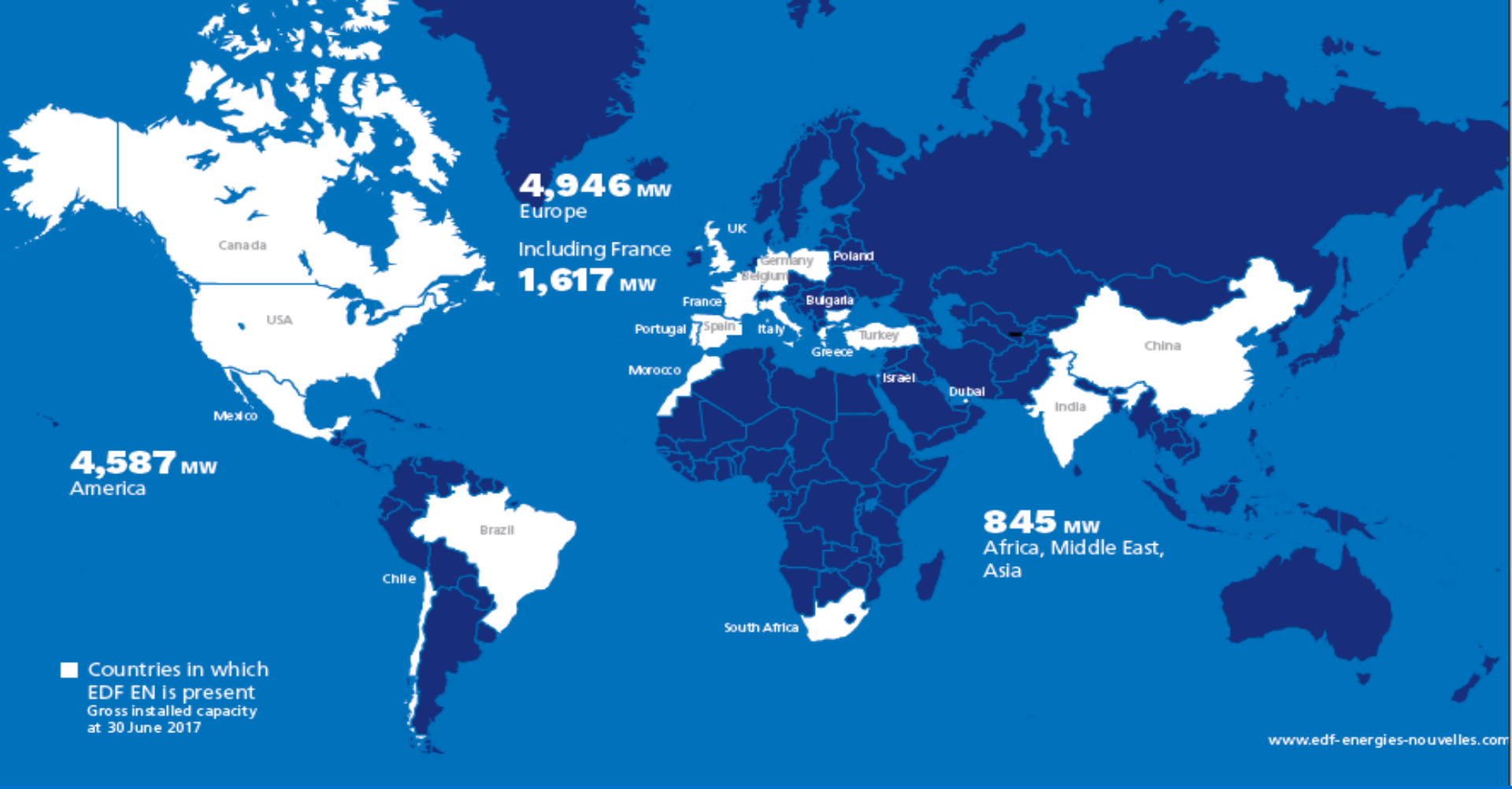
**16.5 billion kWh**
Green energy generated in 2016(2)

### Complementary activities

**3,689 MW**
Developed, built and sold

**13,359 MW**
In operation and maintenance(1)

(1) For own account and for third party.
(2) Annual economic output, including the proportion of output from jointly controlled assets.



# Industrial IT – Scope of Activities

***Wind Turbine***
***onshore & offshore***

***Solar***
***ground, roof, car parks PV***


***Few others…***

## Industrial IT in EMEA :

7 countries
11 people

## Managing :

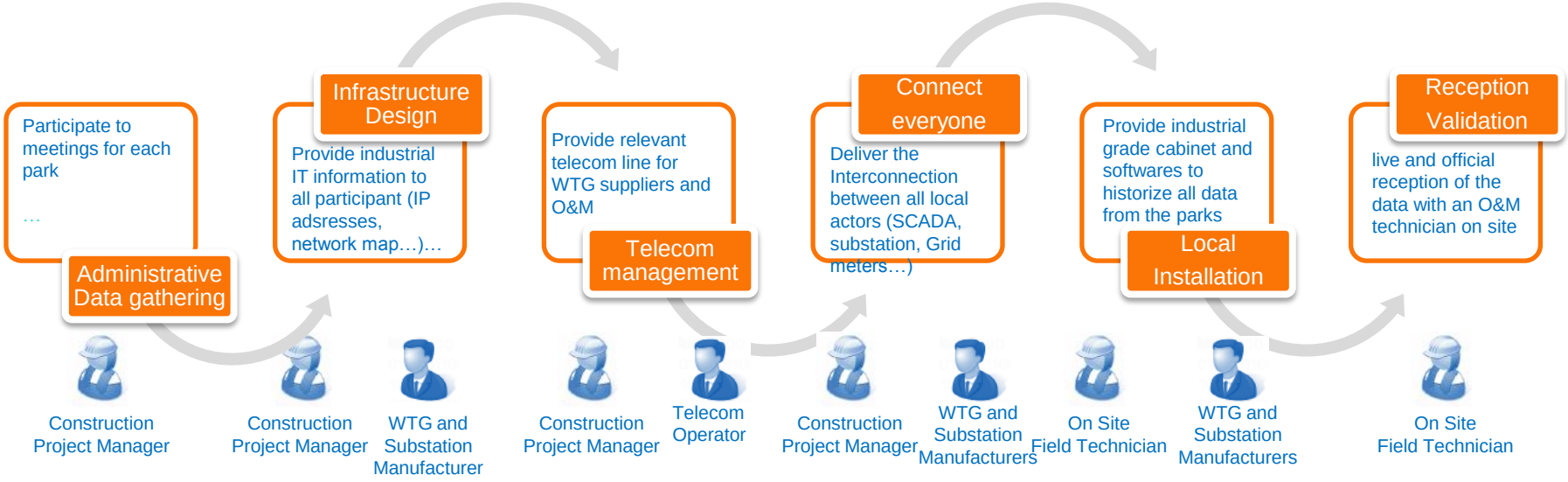
150 parks and substations
4 GW raw
200 local nodes
1 million+ tags, 2 Gb/day

# Method :
# Collaboration is Key

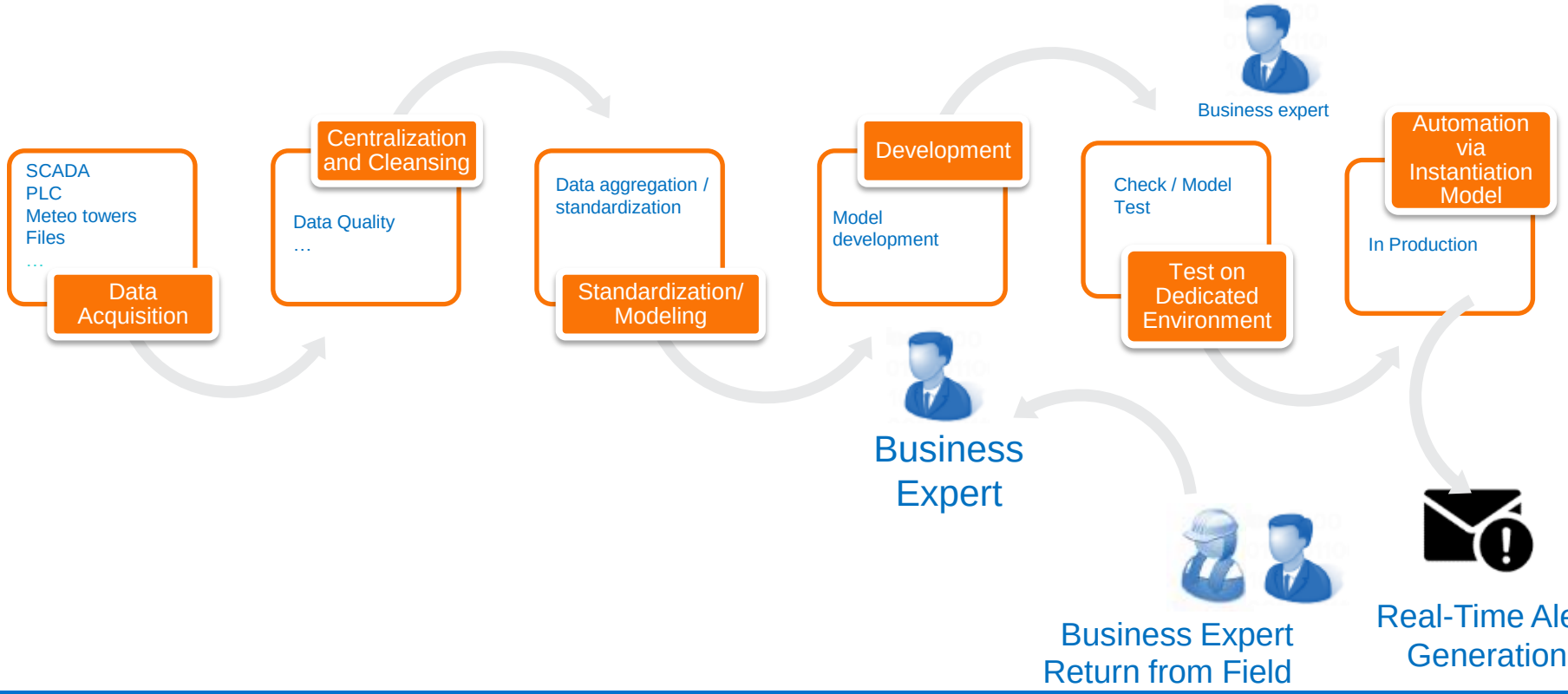
# Method : Collaboration is the key – Deployment

Since the very beginning of the construction phase and until the final delivery Industrial IT department works Closely with all differents parties.

A similar approach is used for O&M parks (3rd parties owned assets)



# Method : Collaboration is the key – Development



# Industrial IT Infrastructure : Reliable by Design

# Industrial IT Infrastructure : Links Reliability


PI_Notification@edf-en.com

**Alarm : Telecom Line Status - BAD**

À Fabien Lemoine

Ce message a été envoyé avec l'importance Haute.

Le lien télécom nommé [redacted] relatif au parc de [redacted] pose problème et nécessite une attention particulière immédiate

Etat des triggers de l'alarme:
Value Refresh : Bad
Date du trigger : 05/01/2017 10:43:51 Romance Standard Time (GMT+01:00:00)

Informations administratives :
Nom du site : [redacted]
Code Parc : [redacted]
Nom du serveur : [redacted]

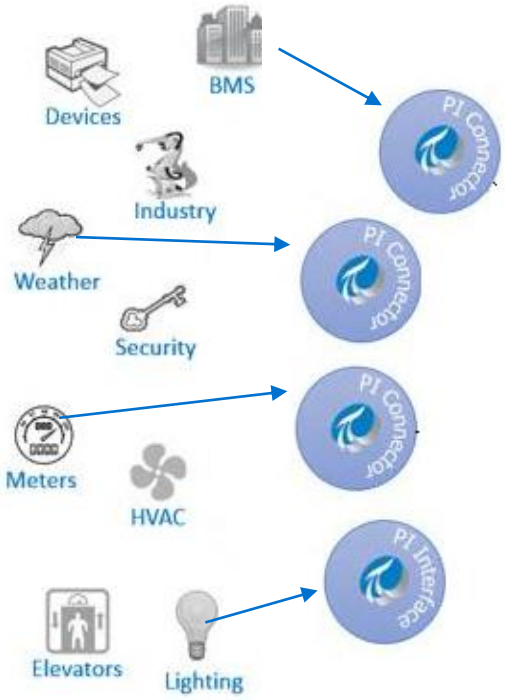
Priority: High

Actions:
Acknowledge
Acknowledge With Comment

## Industrialization of the monitoring of the telecom links and industrial IT assets

- Replacement of siloed / legacy IT monitoring tools by PI System
- Status analyse for local equipment, softwares and databases
- Dynamic Notifications for rapid response

# Industrial IT Infrastructure Designed for Reliabity and Sustainable Deployment at Scale




**Protocols**

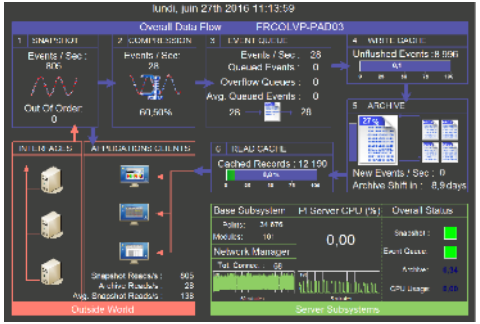
- Variety (Modbus, OPC, DNP3, IEC104…)
- Robust Interfaces

**Architecture**

- Common Design
- Easily Deployable / Replicable

**Monitoring**

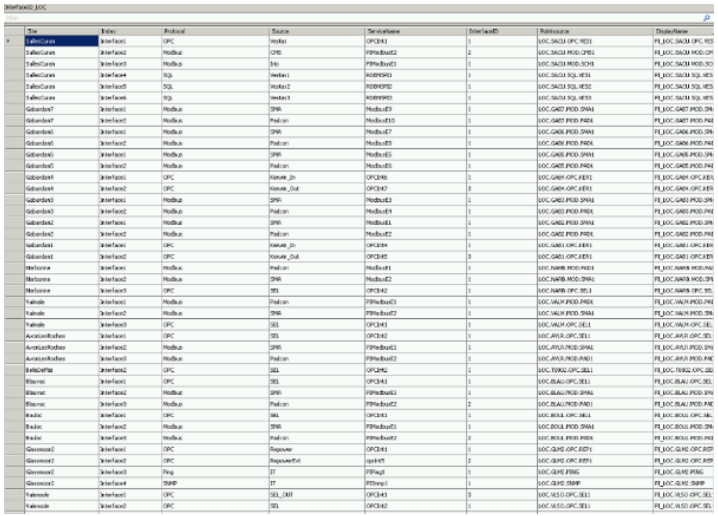
- Everything is Monitored
- Analytics and Notifications

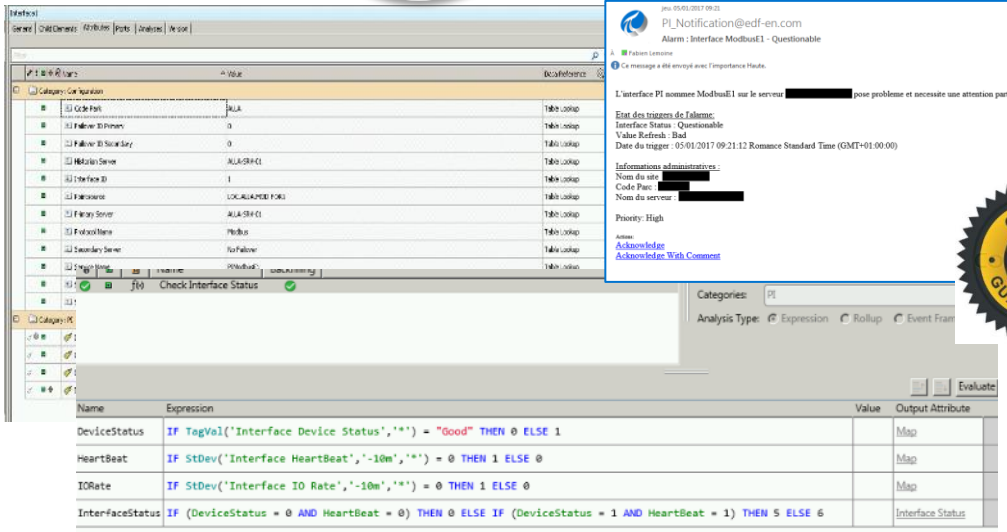




# Trust in Data: Check Everything

# Trust in Data : Collection Real Time Rating

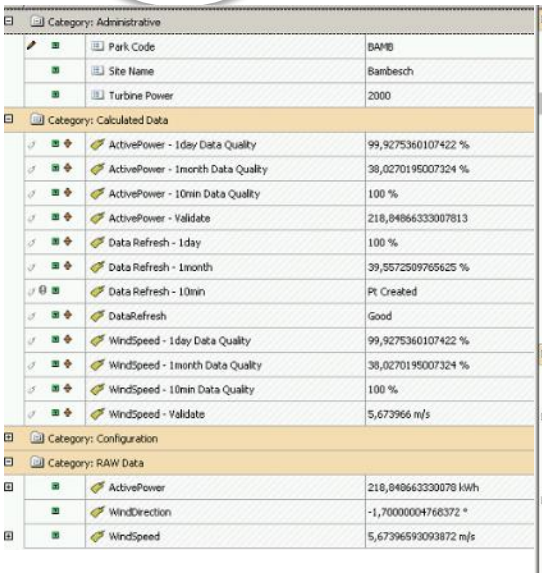
Inventory / Standardization + Health Tag / Analyses / Notification + Modeling / Templates = Data Confidence



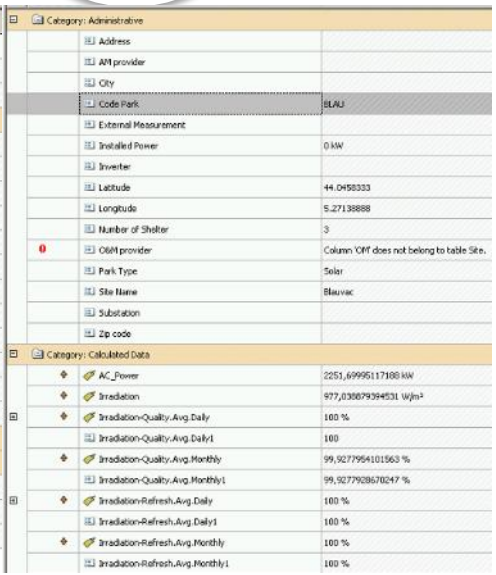



# Trust in Data : Value Real Time Rating

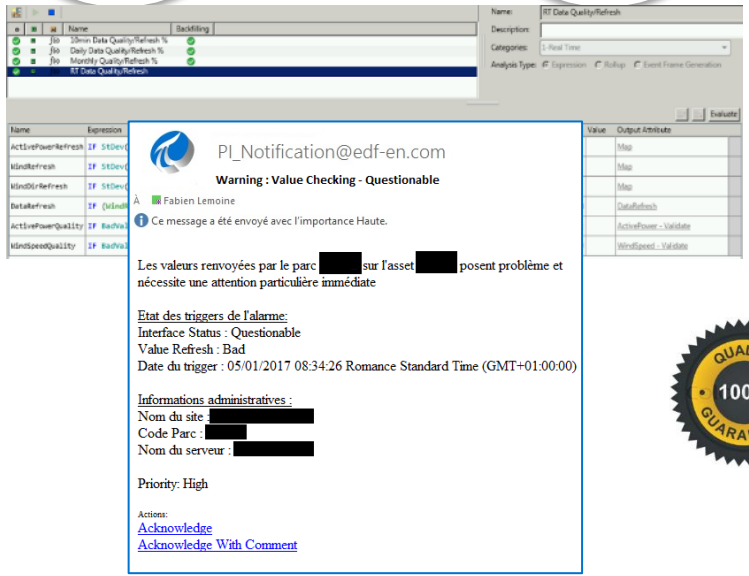
Refresh Rate + Value Checking + Modeling / Templates = Data Confidence



| Category: Administrative | |
|---|---|
| Park Code | BAMB |
| Site Name | Bambesch |
| Turbine Power | 2000 |
| **Category: Calculated Data** | |
| ActivePower - 1day Data Quality | 99,9275360107422 % |
| ActivePower - 1month Data Quality | 38,0270195007324 % |
| ActivePower - 10min Data Quality | 100 % |
| ActivePower - Validate | 218,84866333007813 |
| Data Refresh - 1day | 100 % |
| Data Refresh - 1month | 39,5572509765625 % |
| Data Refresh - 10min | Pt Created |
| DataRefresh | Good |
| WindSpeed - 1day Data Quality | 99,9275360107422 % |
| WindSpeed - 1month Data Quality | 38,0270195007324 % |
| WindSpeed - 10min Data Quality | 100 % |
| WindSpeed - Validate | 5,673966 m/s |
| **Category: Configuration** | |
| **Category: RAW Data** | |
| ActivePower | 218,848663330078 kWh |
| WindDirection | -1,70000004768372 ° |
| WindSpeed | 5,67396593093872 m/s |



| Category: Administrative | |
|---|---|
| Address | |
| AM provider | |
| City | |
| Code Park | BLAU |
| External Measurement | |
| Installed Power | 0 kW |
| Inverter | |
| Latitude | 44.0458333 |
| Longitude | 5.27138888 |
| Number of Shelter | 3 |
| O&M provider | Column 'OM' does not belong to table Site. |
| Park Type | Solar |
| Site Name | Blauvac |
| Substation | |
| Zip code | |
| **Category: Calculated Data** | |
| AC_Power | 2251,69995117188 kW |
| Irradiation | 977,03867939453 W/m² |
| Irradiation-Quality.Avg.Daily | 100 % |
| Irradiation-Quality.Avg.Daily1 | 100 |
| Irradiation-Quality.Avg.Monthly | 99,9277954101563 % |
| Irradiation-Quality.Avg.Monthly1 | 99,9277992670247 % |
| Irradiation-Refresh.Avg.Daily | 100 % |
| Irradiation-Refresh.Avg.Daily1 | 100 % |
| Irradiation-Refresh.Avg.Monthly | 100 % |
| Irradiation-Refresh.Avg.Monthly1 | 100 % |



PI_Notification@edf-en.com

**Warning : Value Checking - Questionable**

À Fabien Lemoine

Ce message a été envoyé avec l'importance Haute.

Les valeurs renvoyées par le parc [redacted] sur l'asset [redacted] posent problème et nécessite une attention particulière immédiate

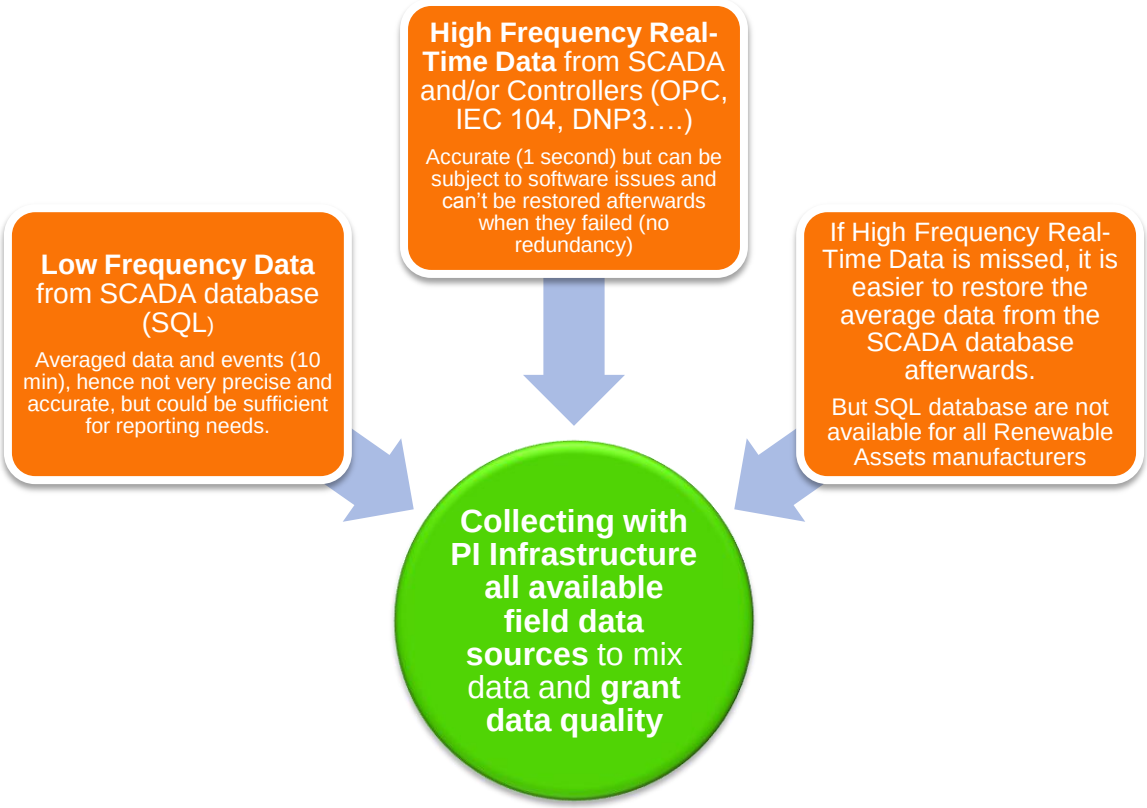
Etat des triggers de l'alarme:
Interface Status : Questionable
Value Refresh : Bad
Date du trigger : 05/01/2017 08:34:26 Romance Standard Time (GMT+01:00:00)

Informations administratives :
Nom du site : [redacted]
Code Parc : [redacted]
Nom du serveur : [redacted]

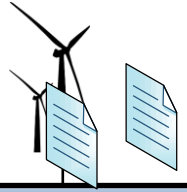
Priority: High

Actions:
Acknowledge
Acknowledge With Comment

# Trust in Data : importance of Dual Data Sourcing



# Trust in Data : Dual Data Sourcing on a Wind Park

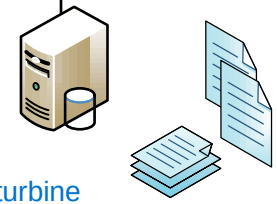


**1**. PLCs, Controllers and local SCADA generates Real Time Data

**2**. An average of this data is processed every 10 min and stored into local SCADA Database (SQL) as well as alerts and events

Local Wind – Control Network

Local EDF EN Network



Local Windturbine Generator SCADA

**3**. High Frequency data is published by the SCADA or controllers (OPC, Modbus) and acquired by local PI Interface node

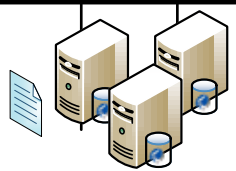
**4**. Every 10 minutes, averaged/low frequency data from local SCADA Database (SQL) is retrieved and acquired by PI Interface node

**5**. Local PI Interface node (with buffering) transfers Data to Central PI Server

**6**. High Frequency (1s) and Lower Resolution (10min) Data are both stored centrally in PI Data Archive

Colombiers Site - Office Network

**7**. Industrial IT infrastructure is monitored in real time and generates alarms and notifications



Central PI Data Archive

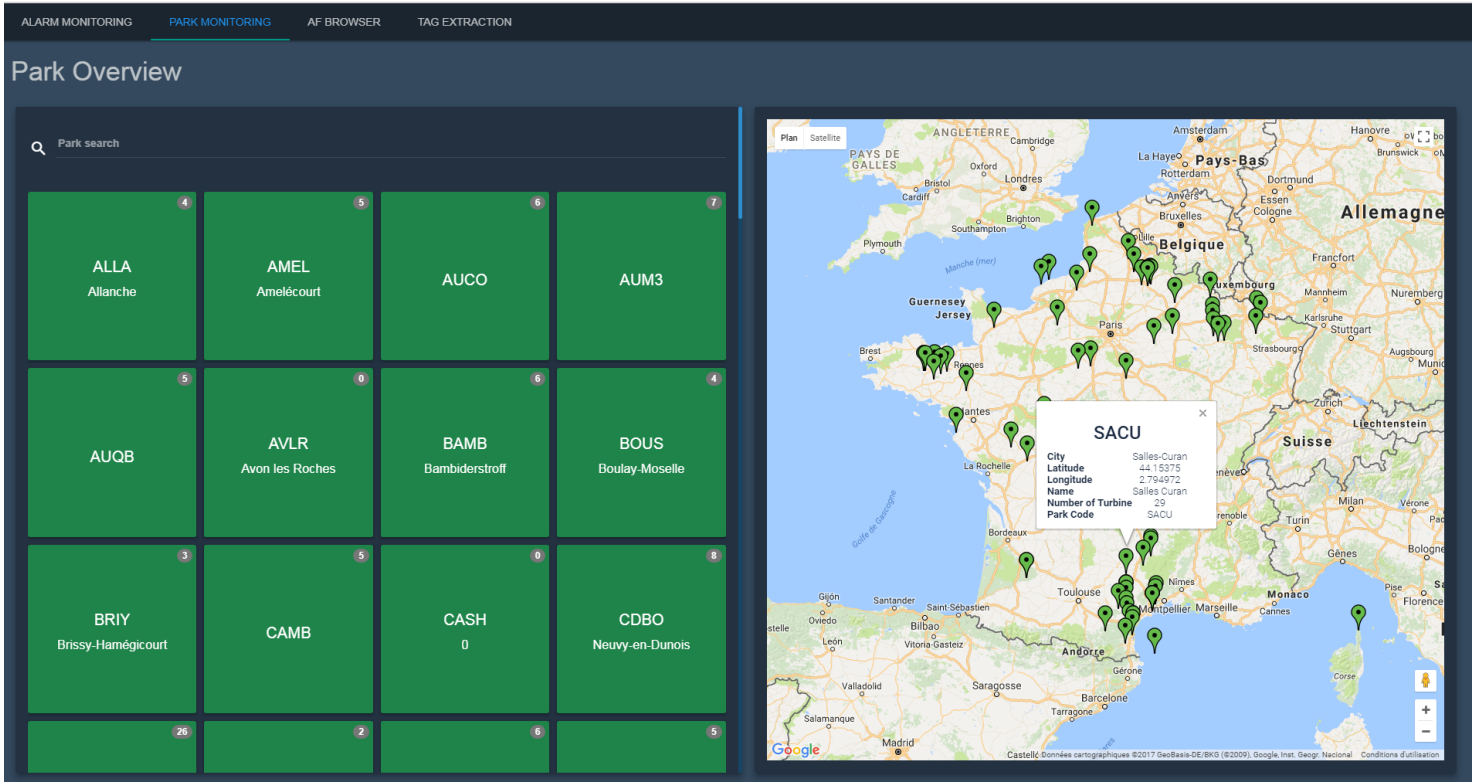
Field Data Analytics (PI AF, PI EF, Analytics)

**8**. Data is analyzed in real time to detect underperformance, value deviation, data quality… results of these analyse are stored in PI Data Archive

# Industrialized Deployment

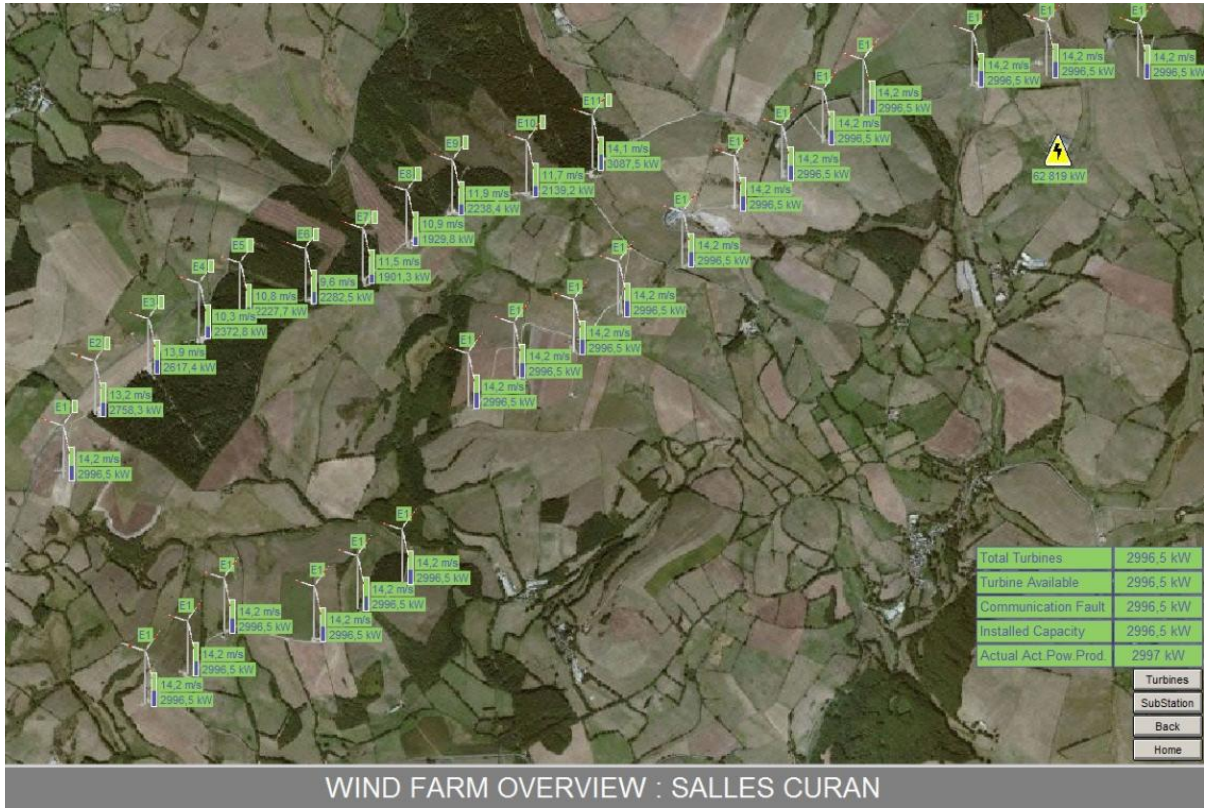
Acquisition devices, preprocessing and data transfer

# Real-Time Analytics and Situational Awareness on all IT assets



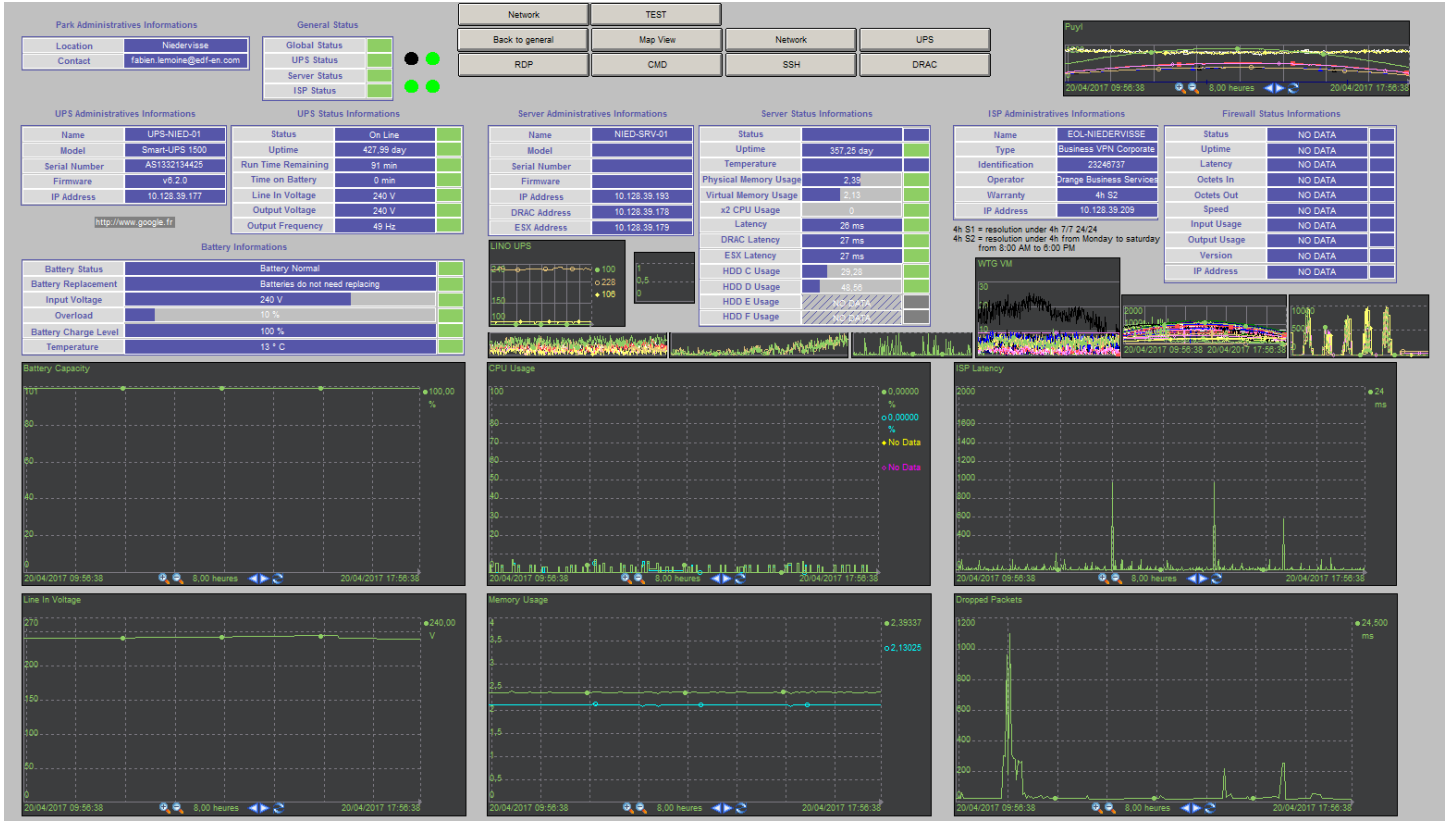

Parks Overview

# Extensive IT Infrastructure Real-Time Monitoring : example



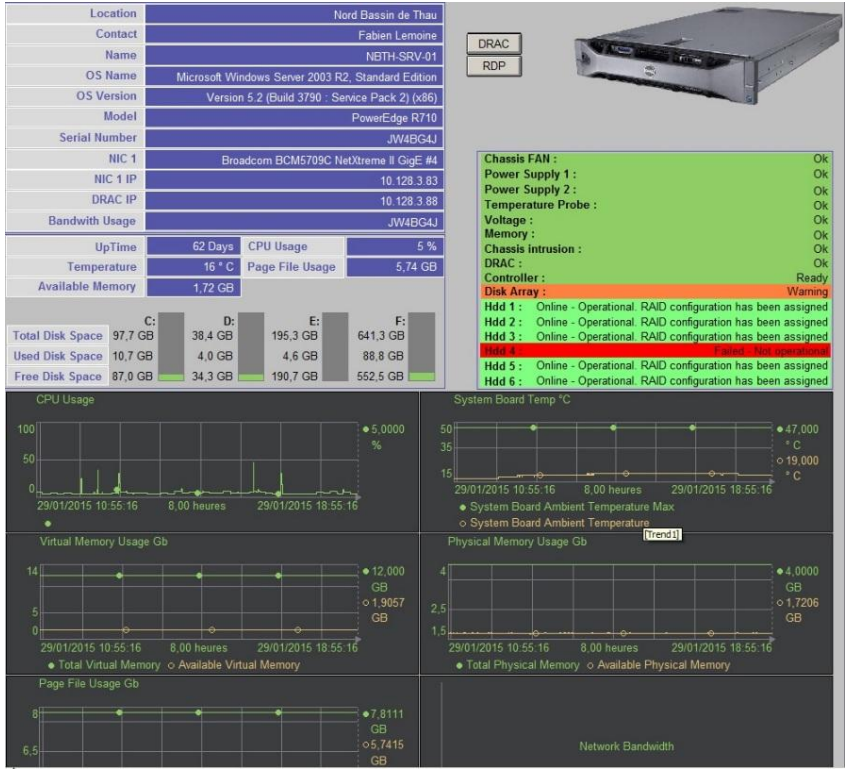

Windpark overview

# Extensive IT Infrastructure Real-Time Monitoring : example



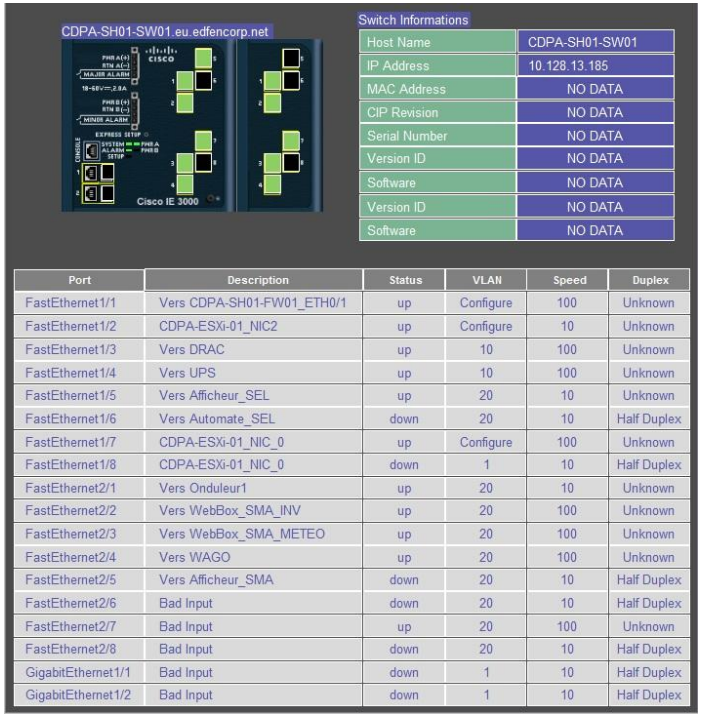

Local Servers Real-Time Monitoring

# Extensive IT Infrastructure Real-Time Monitoring : example




Drilldown :
Local Servers
Real-Time Monitoring

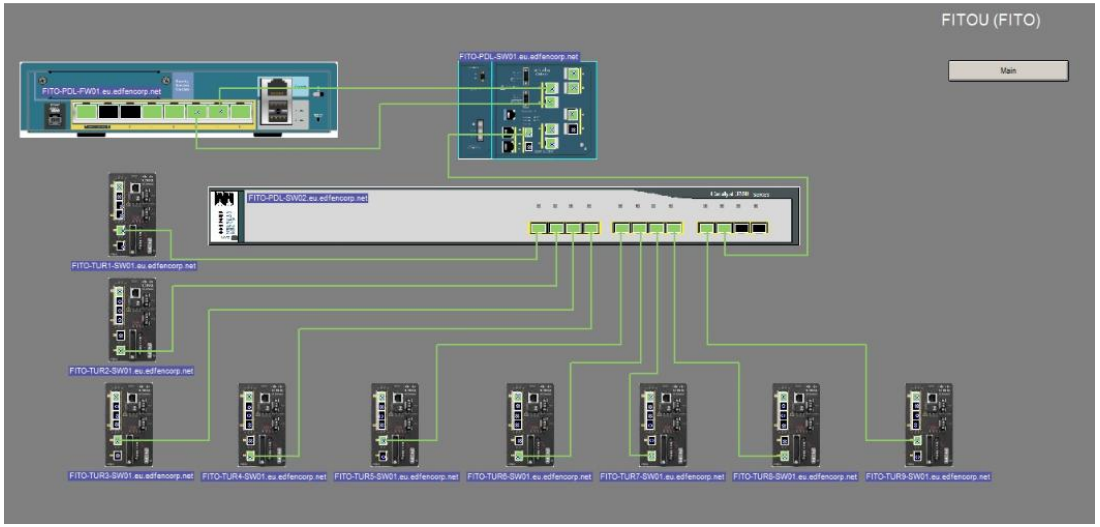
# Extensive IT Infrastructure Real-Time Monitoring : example




Switch Informations

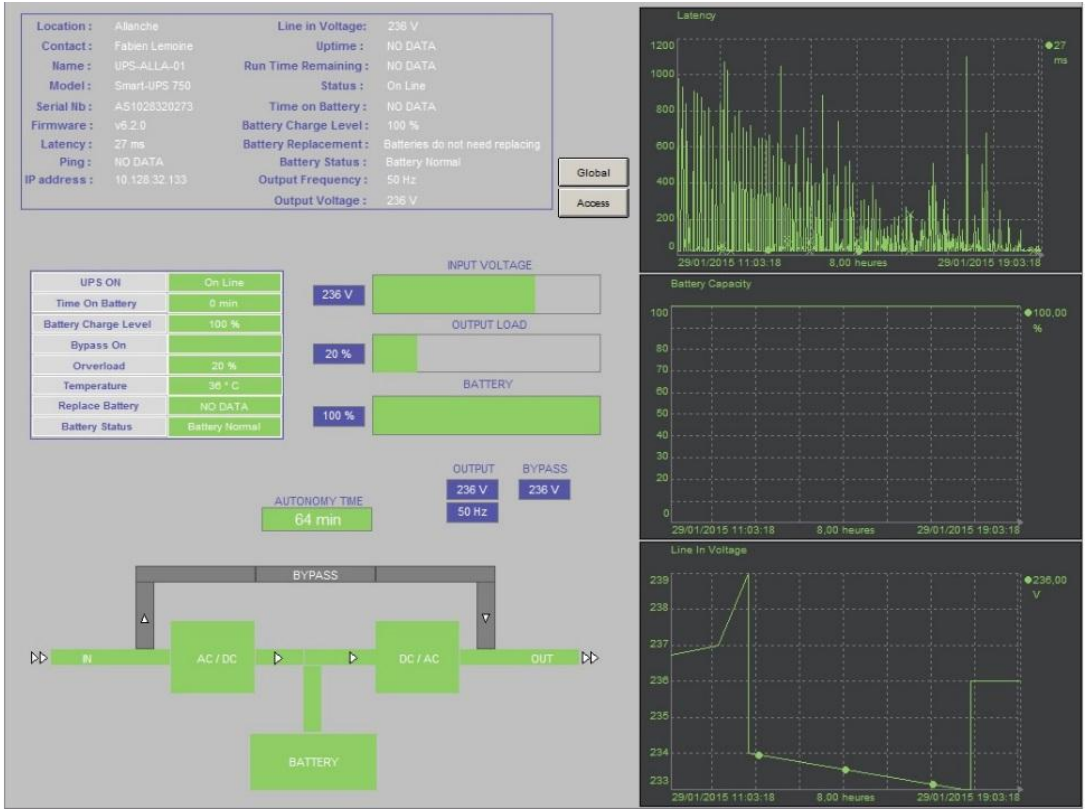
| | |
|---|---|
| Host Name | CDPA-SH01-SW01 |
| IP Address | 10.128.13.185 |
| MAC Address | NO DATA |
| CIP Revision | NO DATA |
| Serial Number | NO DATA |
| Version ID | NO DATA |
| Software | NO DATA |
| Version ID | NO DATA |
| Software | NO DATA |

| Port | Description | Status | VLAN | Speed | Duplex |
|---|---|---|---|---|---|
| FastEthernet1/1 | Vers CDPA-SH01-FW01_ETH0/1 | up | Configure | 100 | Unknown |
| FastEthernet1/2 | CDPA-ESXi-01_NIC2 | up | Configure | 10 | Unknown |
| FastEthernet1/3 | Vers DRAC | up | 10 | 100 | Unknown |
| FastEthernet1/4 | Vers UPS | up | 10 | 100 | Unknown |
| FastEthernet1/5 | Vers Afficheur_SEL | up | 20 | 10 | Unknown |
| FastEthernet1/6 | Vers Automate_SEL | down | 20 | 10 | Half Duplex |
| FastEthernet1/7 | CDPA-ESXi-01_NIC_0 | up | Configure | 100 | Unknown |
| FastEthernet1/8 | CDPA-ESXi-01_NIC_0 | down | 1 | 10 | Half Duplex |
| FastEthernet2/1 | Vers Onduleur1 | up | 20 | 10 | Unknown |
| FastEthernet2/2 | Vers WebBox_SMA_INV | up | 20 | 100 | Unknown |
| FastEthernet2/3 | Vers WebBox_SMA_METEO | up | 20 | 100 | Unknown |
| FastEthernet2/4 | Vers WAGO | up | 20 | 100 | Unknown |
| FastEthernet2/5 | Vers Afficheur_SMA | down | 20 | 10 | Half Duplex |
| FastEthernet2/6 | Bad Input | down | 20 | 10 | Half Duplex |
| FastEthernet2/7 | Bad Input | up | 20 | 100 | Unknown |
| FastEthernet2/8 | Bad Input | down | 20 | 10 | Half Duplex |
| GigabitEthernet1/1 | Bad Input | down | 1 | 10 | Half Duplex |
| GigabitEthernet1/2 | Bad Input | down | 1 | 10 | Half Duplex |




Drilldown :
Ethernet Switch Real-Time Monitoring

# Extensive IT Infrastructure Real-Time Monitoring : example

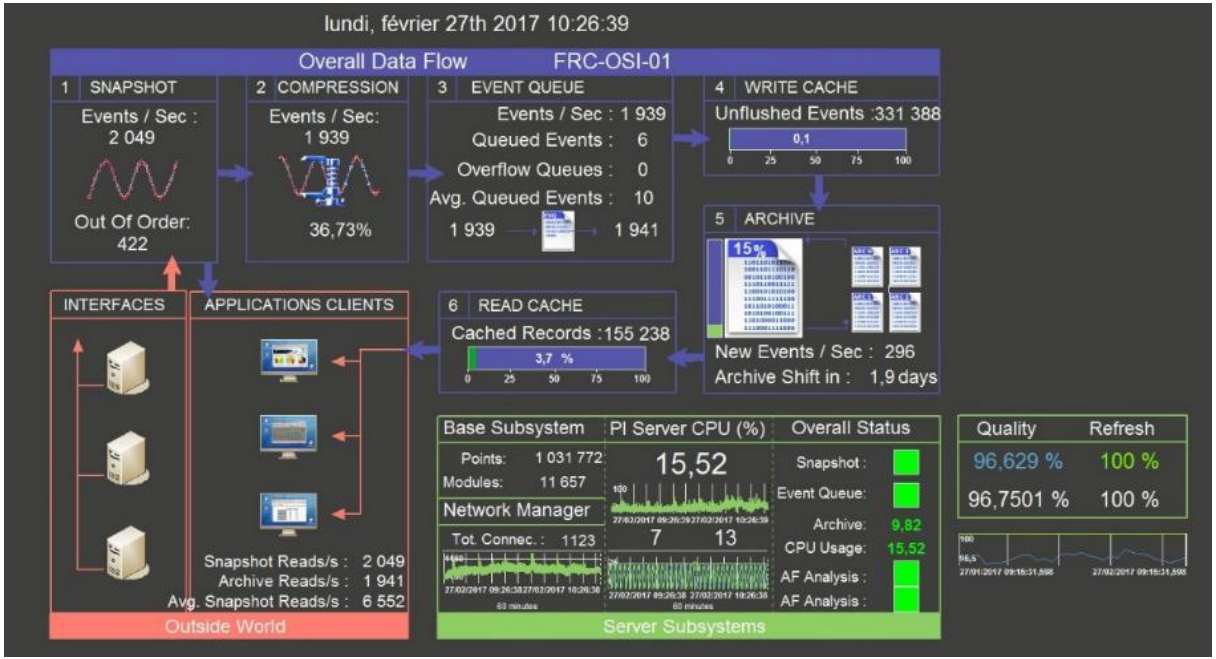



Drilldown :
UPS & power supplies
real-time monitoring

# Extensive IT Infrastructure Real-Time Monitoring : example

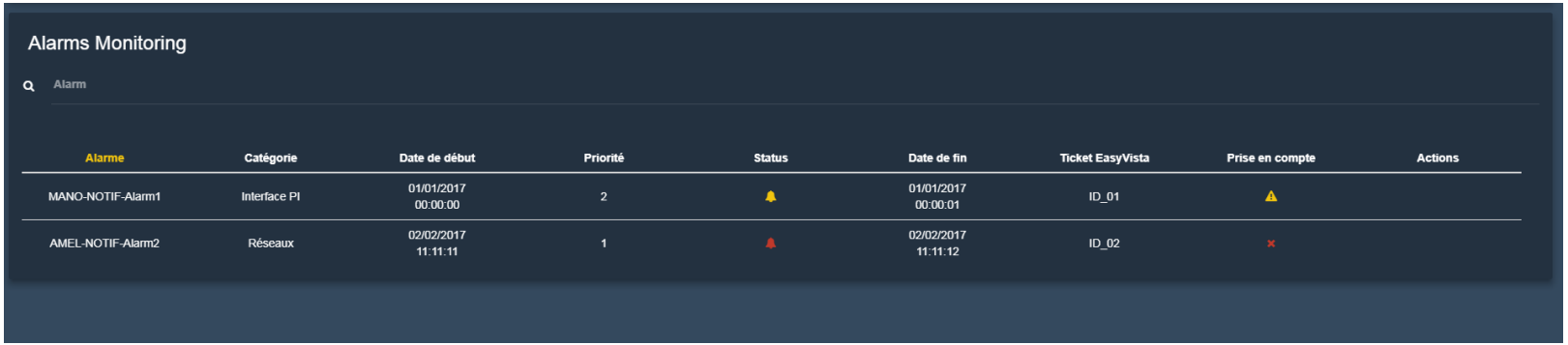

Local Server Real-Time Dashboard

# Extensive IT Infrastructure Real-Time Monitoring : example



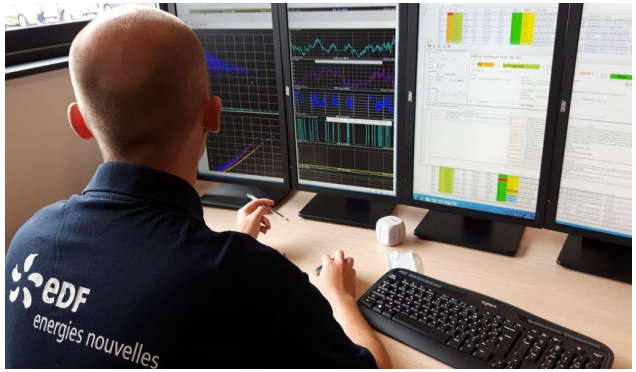

PI Interface Node Health

# Extensive IT Infrastructure Real-Time Monitoring : example




Managing Notifications
for Rapid Response with Commitment
to the Business (SLA)

# Leverage Field Real-Time Data to Maximize Asset Uptime & Performance




## COMPANY and GOAL

**EDF Energies Nouvelles**, a global renewable producer wants to **optimize its renewable generation**, and **excel in O&M activities**.

## CHALLENGE

Minimize impact of maintenance activities on production, reduce downtime, optimize control settings.

- Good decision starts with good data
- Collecting field data from distant windfarms is challenging
- Connect the field data with the people to take smart decision

## SOLUTION

Leverage PI System Infrastructure to monitor IT asset in real-time and deliver operational analytics :

- Exhaustive monitoring of IT assets to improve uptime and fix issues in short time
- Empirical analytics to detect weak signal patterns on assets in real time, spot suboptimal settings or future failures before they occur

## RESULTS

Improved Data Quality

Tangible business outcomes

- Field data quality has dramatically increased
- Catching suboptimal curtailment enabled the recovery of 50 k€ of production for one single wind farm over a few days. Today, with additional analyses, **700 k€ / year of production recovered for wind farms.**

**Fabien Lemoine**

Fabien.lemoine@edf-en.com

Head of industrial IT

EDF Energies Nouvelles

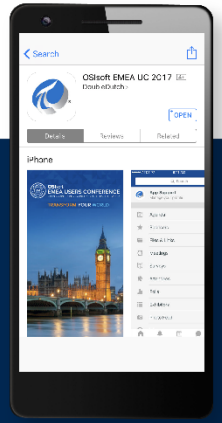
# Questions

Please wait for the **microphone** before asking your questions

State your **name & company**

# Please remember to…

Complete the Online Survey for this session

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Danke

谢谢

Merci

Gracias

# Thank You

ありがとう

Спасибо

Obrigado