EDF Hydro – PI System Integration

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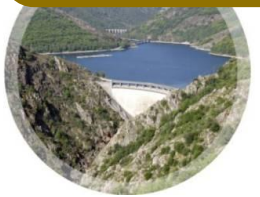
EDF-DPIH-CIH

EDF's French Hydraulic Production Fleet

- **447 power plants**
  - Built between 1896 and 1996
  - From 100 kW to 1800 MW
  - Automated or remotely operated
- **220 dams**
  - including 150 over 20m high
  - and 67 containing over 15 hm^3
- **5 production units**
- **Average age of the facilities is 50 years old :**
  - 75% of the fleet is over 24 years old
  - 50% over 44 years old
  - 25% over 74 years old

20 000 MW



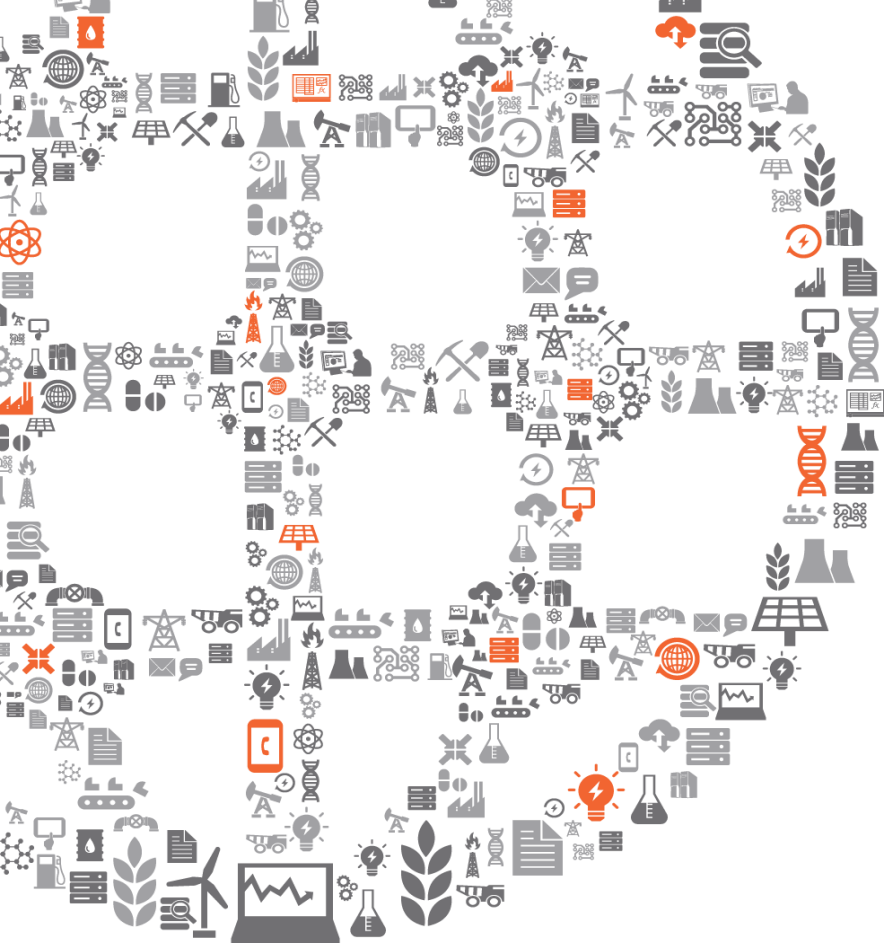
RenouvEau, a « Vision 2015 » program

- **Revamp the whole production and maintenance models :**
  - To produce more when expected by the market
  - To decrease the unavailability of the hydro production fleet
  - To maximize profits
- **Actions engaged :**
  - Modernize and standardize electrical and control command (≈1000 turbines)
  - Deploy a national Enterprise Asset Management (EAM) system
  - Create a Centralized Monitoring & Control Center in each of the production units (5)
  - Set up of a robust telecommunication network to support the new IT systems
  - Design, develop and deploy new IT solutions & systems
  - Deploy an advanced monitoring system

EDF DPIH new Monitoring Model

Level	Actors	Temporal aspect
1	On site operators CMCC operators	Real Time
2	Support Cell Regional Experience Feedback Sharing	Deferred Time (Answers to level 1 requests)
3	Experts (DTG, CIH, R&D) National animation (MPHy, R2S) National experience Feedback Sharing	On demand expertise (Answers to level 2 requests)

All the levels must use the same data when monitoring and troubleshooting incidents



Focus on the IT pre-study

PREX

Name of the entire computing system (software and infrastructure) used by real time operators and production support cells

Sizing

- Number of data concentrators (PLEX3)
  - 82
- Number of hydro power plants to be connected to CMCCs until 2017
  - 350
- Number of real-time information acquired per data concentrator
  - 10 000 (estimated average)
- Number of alarm and events information per data concentrator
  - 6 000 (estimated average)
- Number of real time information (to be archived in a data historian) per data concentrator
  - 8 000 (estimated average)
- **Estimated Target:**
  - **820 000 real-time I/O**
  - **492 000 alarm and events information**
  - **656 000 historized data**

Software Pre-Study : Selection criterias

- Industrials Criterias
  - **Budget** (CAPEX/OPEX)
  - Program management decision : **use of industrial softwares from the market**
  - Take into account previous **EDF choices** and **internal skills** on products
  - **Evolutivity of the solution** : ease of version upgrades without any operational disruptions in real time
  - **Continuity of versions, upward compatibility**
  - **Technical Support quality and reactivity (+ support in French)**
- Technical Criterias
  - Capacity to **take on line modifications into account** without stopping the system
  - Capacity to **import/export** configurations
  - Capacity to **manage the target volume** of information while keeping a good performance level
  - Capacity to manage a **centralized configuration and deployment reference**
  - Ease of **administration** and deployments management
  - **Native redundancy** features
  - **Global performances** (data acquisition, rendering, calculation…)
- Functional Criterias
  - **Native client softwares**
  - **Open system** (data within the system must be accessible using different technologies)
  - **Loading time** to query or visualize data

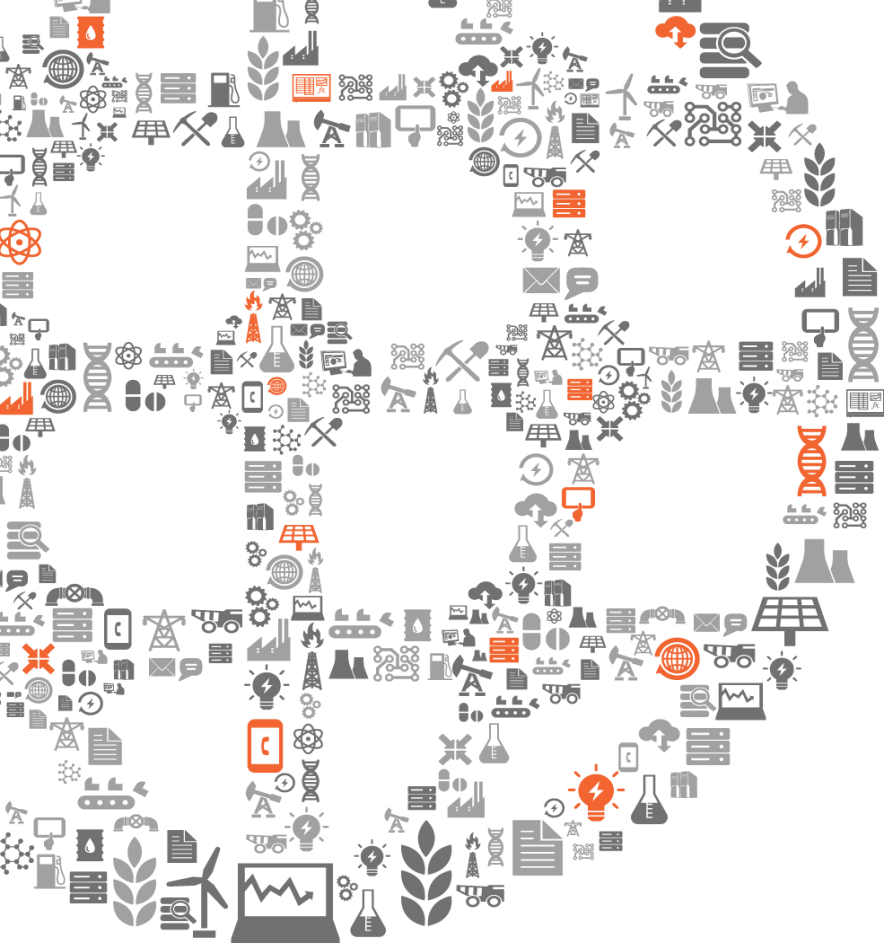
Software Pre-Study : Selection

- SCADA: Wonderware System Platform
- Data Historian : **OSIsoft PI System**
  - Enterprise choice : PI System is also used in the new thermal power plants computing system (since 2009)
  - PI System can handle the amount of tags we target
  - In 2010, PI System is providing the best performances in the POC we performed

Choosing among several possible IT solutions…

- Several scenarios were considered for the IT systems:
  - Which hosting ?
    - A computer room nearby each CMCC
    - A centralized datacenter for 5 CMCCs
  - How to execute ?
    - Physical servers
    - Virtualization
  - How to publish to users ?
    - Thick clients
    - Thin clients
- A detailed survey helped us to :
  - Determine the target architecture : ≈ 300 servers & 50 distinct networks
  - Evaluate acquisition and maintenance costs of the global solution
  - Carry out some proof of concept on alternative technologies (virtualization, application publication…)
  - Determine the software strategy : custom development versus third party software usage
  - Cross unit technological choices, shared with the thermal unit
- And finally we decided…

The history of industrial computing projects within the DPIH recommended :



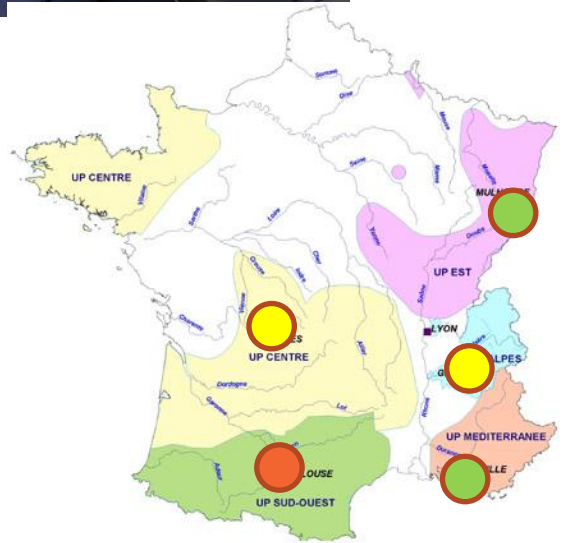
Focus on the IT implementation

Deployed Solutions

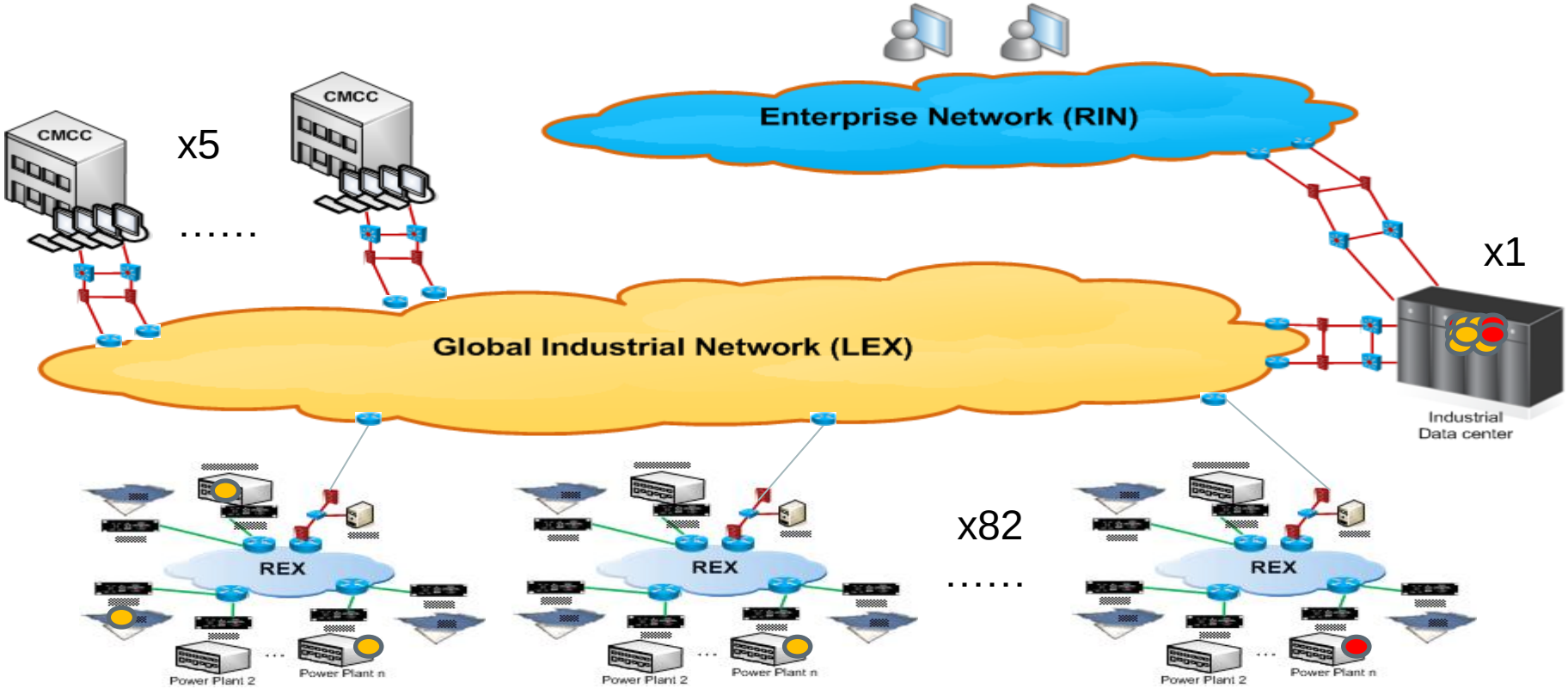
Centralized Monitoring and Control Centers
Industrial DataCenter
Data Acquisition & Publication

Centralized Monitoring & Control Centers (CMCC)

- Collect data from all the power plants
- Real time regional operators assist local on site operators
  - To anticipate and analyze problems, and optimize the production
- First production pilot CMCC started in December 2010
  - A team of 3 operators (between 7h30 & 17h, Monday to Friday)
  - 15 power plants connected (Feb 2013)
  - More than 40 alarms detected per year
  - 10 functioning incidents avoided
  - Deployment validated by unit management on 350 power plants
- 2 CMCC in 2013
- and 2 in 2014

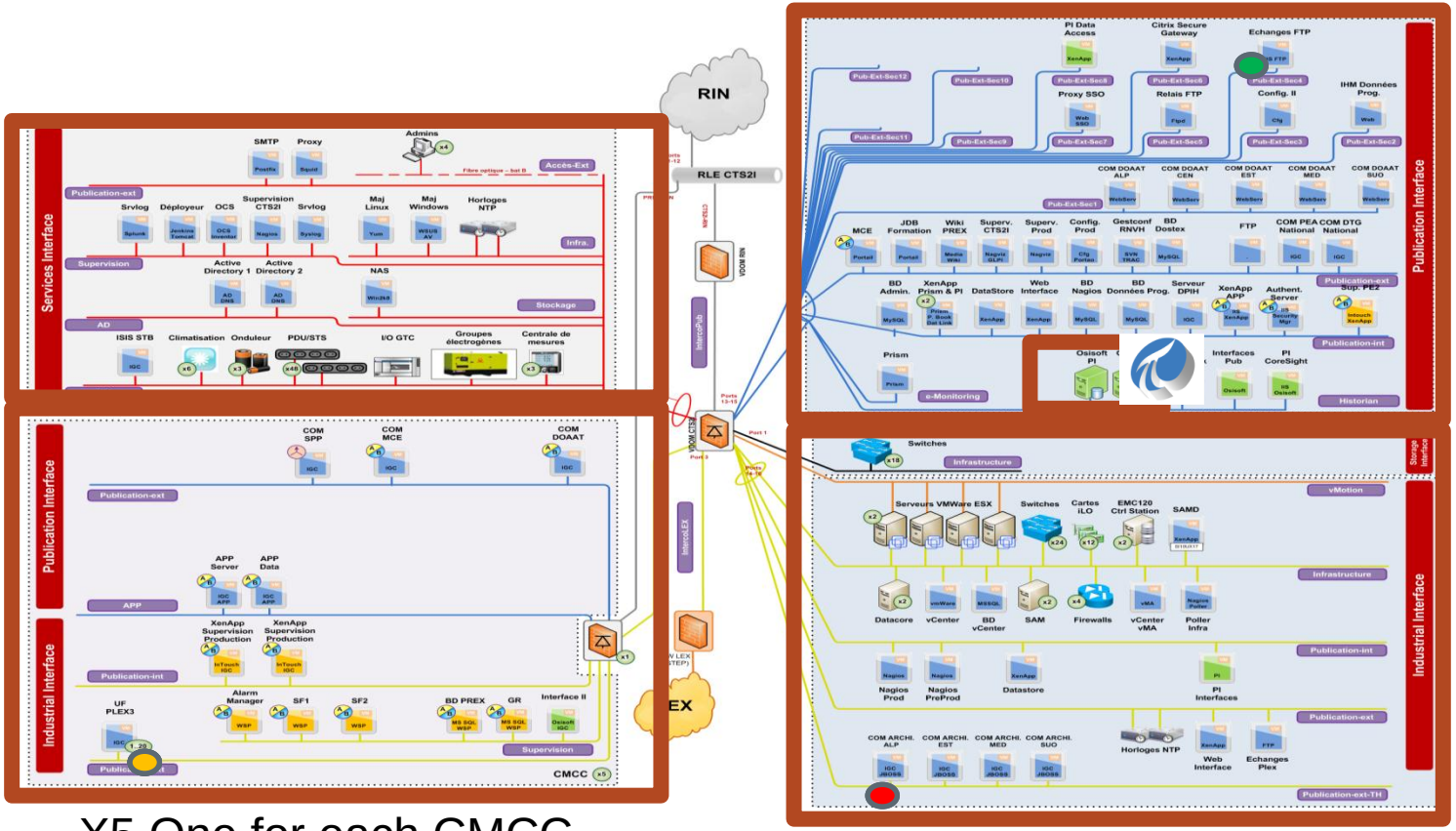


Data Acquisition & Publication



REX : Local Industrial Network

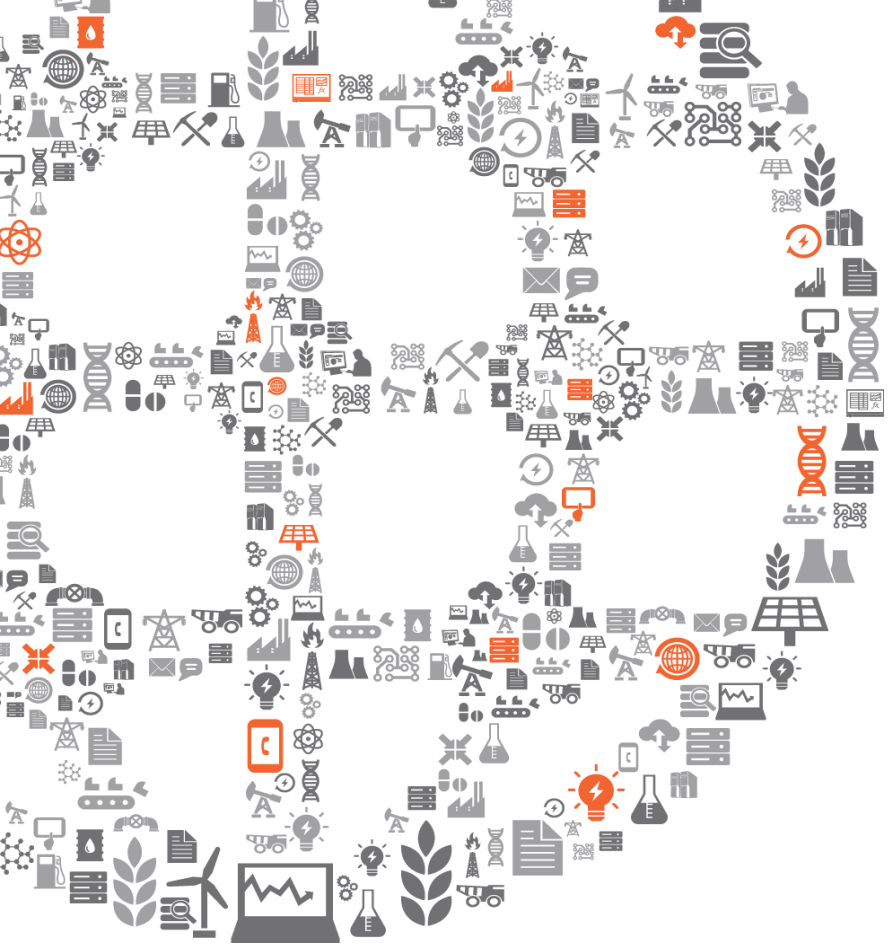
IDC Network, Servers, Security Architecture and PI Server



X5 One for each CMCC

PI OPC

PI UFL



Focus on the Hydro IT System

PI System

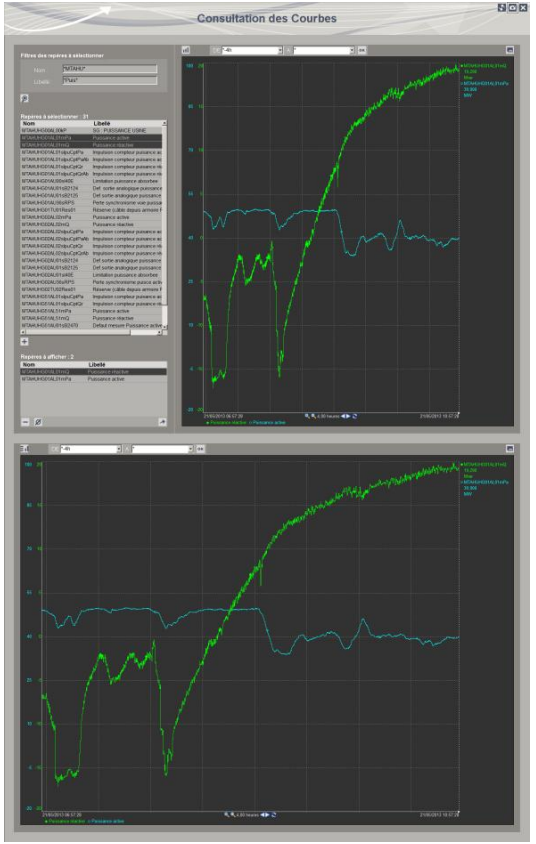
How the PI System is used by Hydro systems & operators

Hydro PI System Configuration

- 2 PI Servers 100K in HA (target 600-700K)
- PI Vizualisation Suite (PI ProcessBook, PI DataLink, PI Coresight, PI ActiveView, and more)
- PI AF
- 7 PI Interfaces for Universal File and Stream
- 1 PI Interface for OPC DA
- 2 PI COM Connector for OLEDB
- PI JDBC, PI OLEDB Enterprise, PI SDK/API

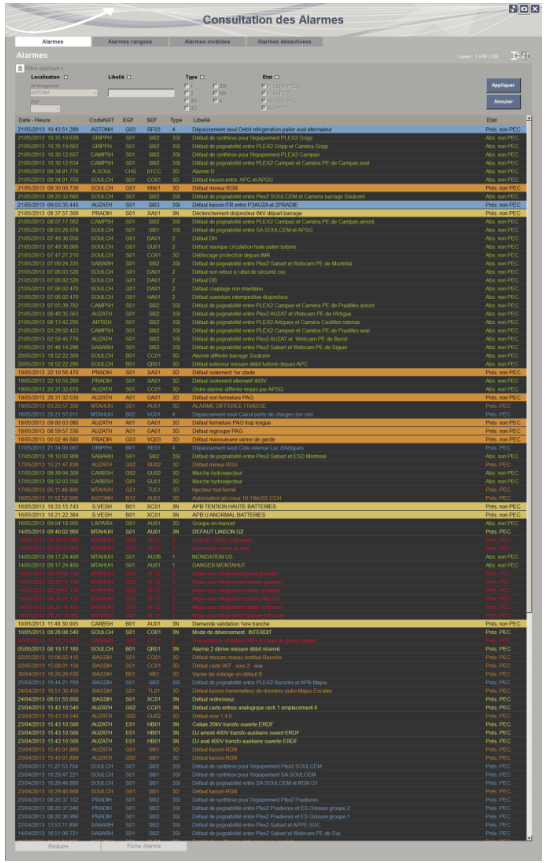
Use Case 1 : Real-time & History Trends Display within the Hydro SCADA system

Integration of PI ActiveView, PI ProcessBook in Wonderware System Platform



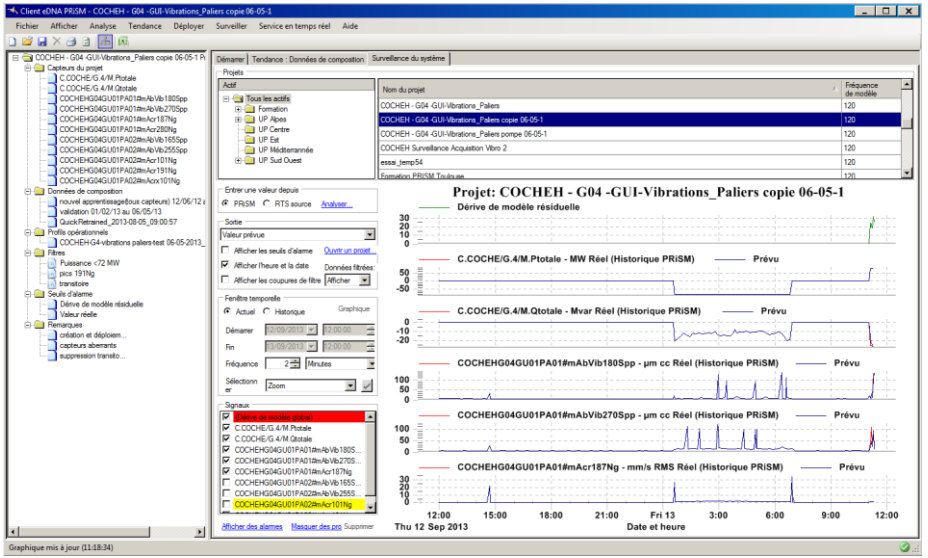
Use Case 2 : Alarms & Events storage

Integration of PI SDK to retrieve alarms from the Wonderware System Platform



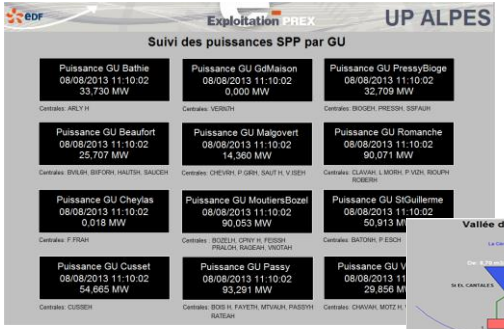
Use Case 3 : Provides data to several other sub-systems

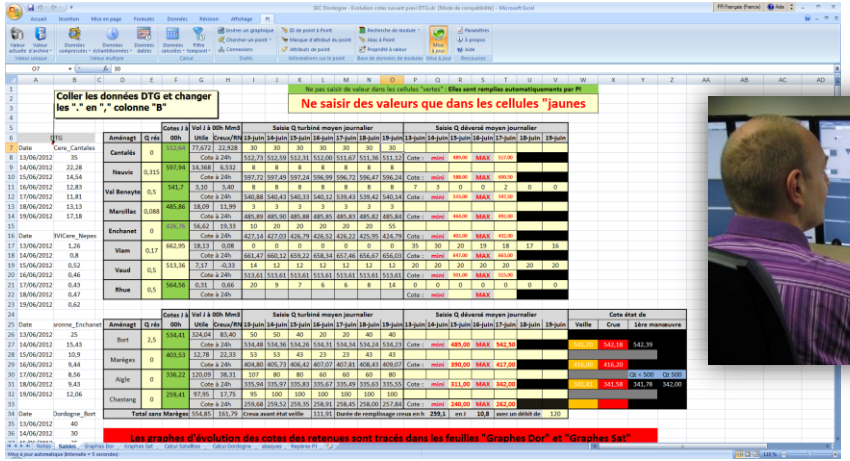
- PI System is collects and archives all the information required by the software which calculates the production programs for some specific power plants
- InStep's PRiSM software is a predictive analytics platform for continuous real-time monitoring of the health and performance of critical assets. It retrieves archived data from the PI System using a connector based on PI SDK
- UReason OASYS analyzes all the alarms in our systems and retrieves archived data using PI JDBC/PI SQL DAS/PI OLDEB Enterprise

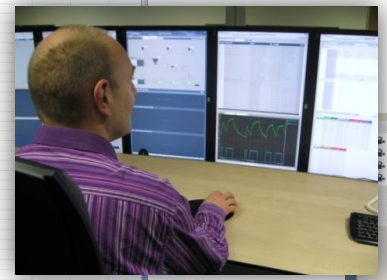


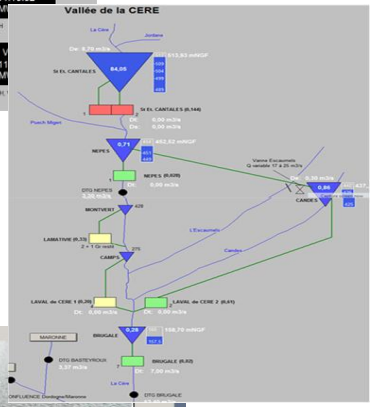
Use Case 4 : Provides analysis tools to Support Cell

- Using a thin client technology (Citrix), PI DataLink, PI ProcessBook & PI Coresight are published to Level 2 & Level 3









Feedback

Business Challenge

- Define a new common operation and maintenance model for all the production units
- Produce more when expected by the market
- Decrease the unavailability of the hydro production fleet
- Maximize profits
- Connect heterogenous control command systems

Solution

- Modernize & Standardize CC
- Deploy a national EAM
- Deploy a robust telecom network
- Build 5 CMCCs
- Deploy new IT solutions & Systems
  - **PI System placed in the earth of the Hydro IT System** (Single source of archived data)

Results and Benefits

- Better experience sharing between hydro actors
- Data easily shared between all the actors

What's next with our PI Sytem?

- Technical
  - Migrate to PI System 2012 (Q4 2013)
  - Implement PI AF High Availability
  - Generalize the use of PI ACE
- Functional
  - Model the Hydro fleet in PI AF
  - Integrate PI System with the Esri GIS (POC)

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Managing Conception & Deployment of IT Systems for Centralized Monitoring & Control Centers

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