



# NATURAL LANGUAGE PROCESSING (NLP) AND ARTIFICIAL INTELLIGENCE (AI) AS ENABLERS FOR ASSET MANAGEMENT OF MISSION CRITICAL INFRASTRUCTURES

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ASSYSTEM E&I



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## Mission critical infrastructures context



**Complex projects**

**Numerous Interfaces**

**Very long cycles**

***Engineering +5 years***

***Construction & Commissioning  
+5years***

***Operations +50 years***



**Safety and Security**

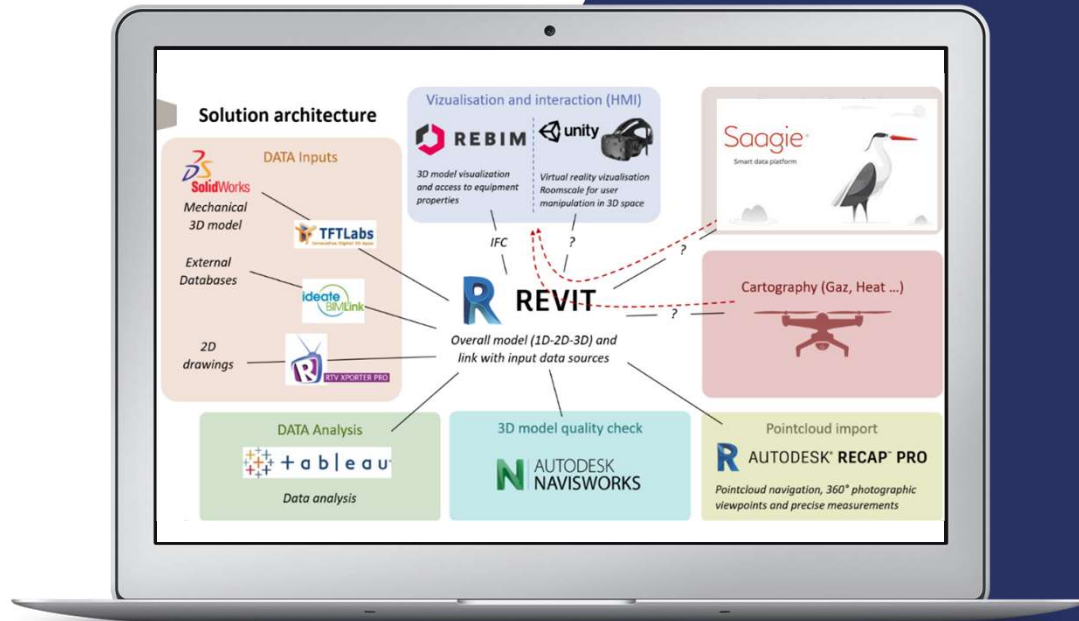
**Resilience**

**Dependability**

# The CyberPhysical Systems Engineering driven by Data and Requirements



# Two integration routes



Distributed data aggregator

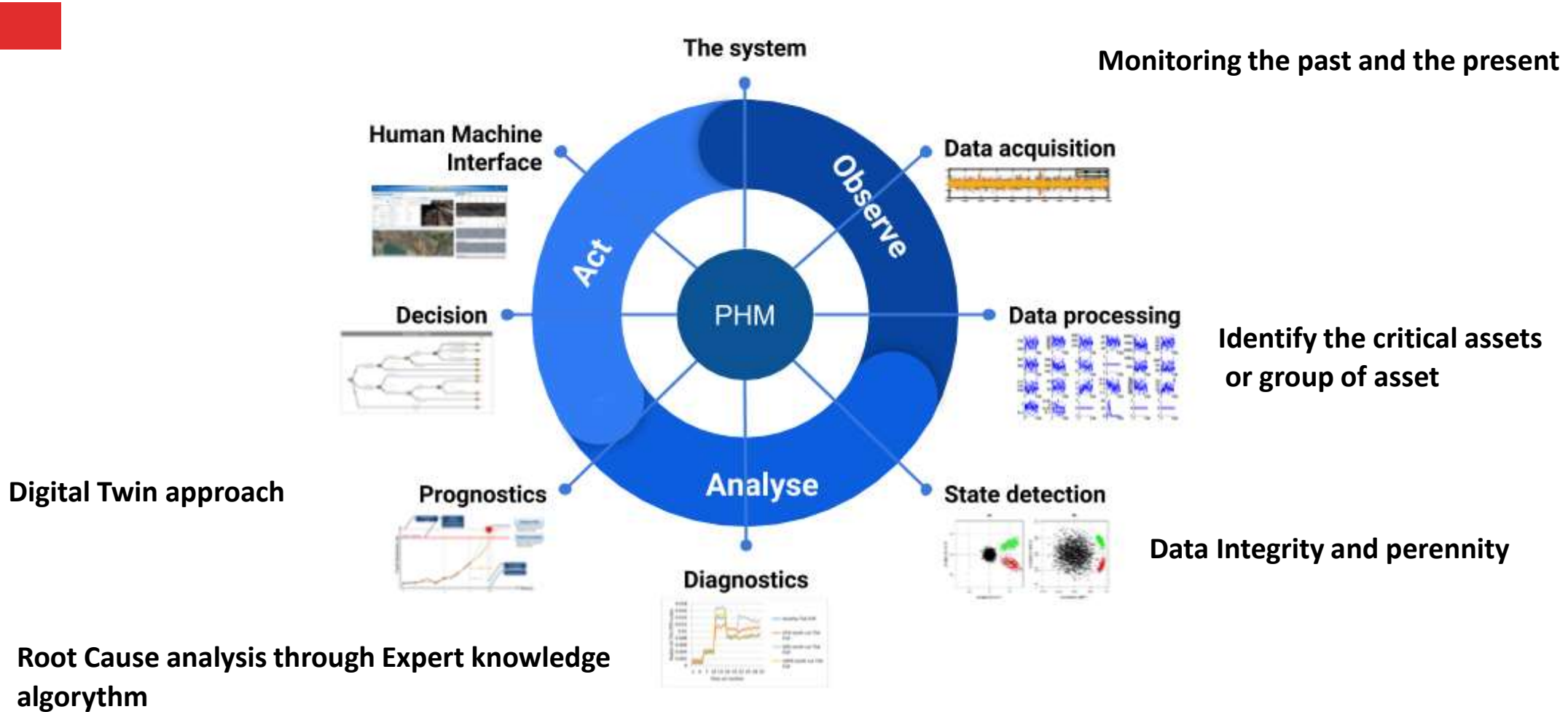


Integrated platform



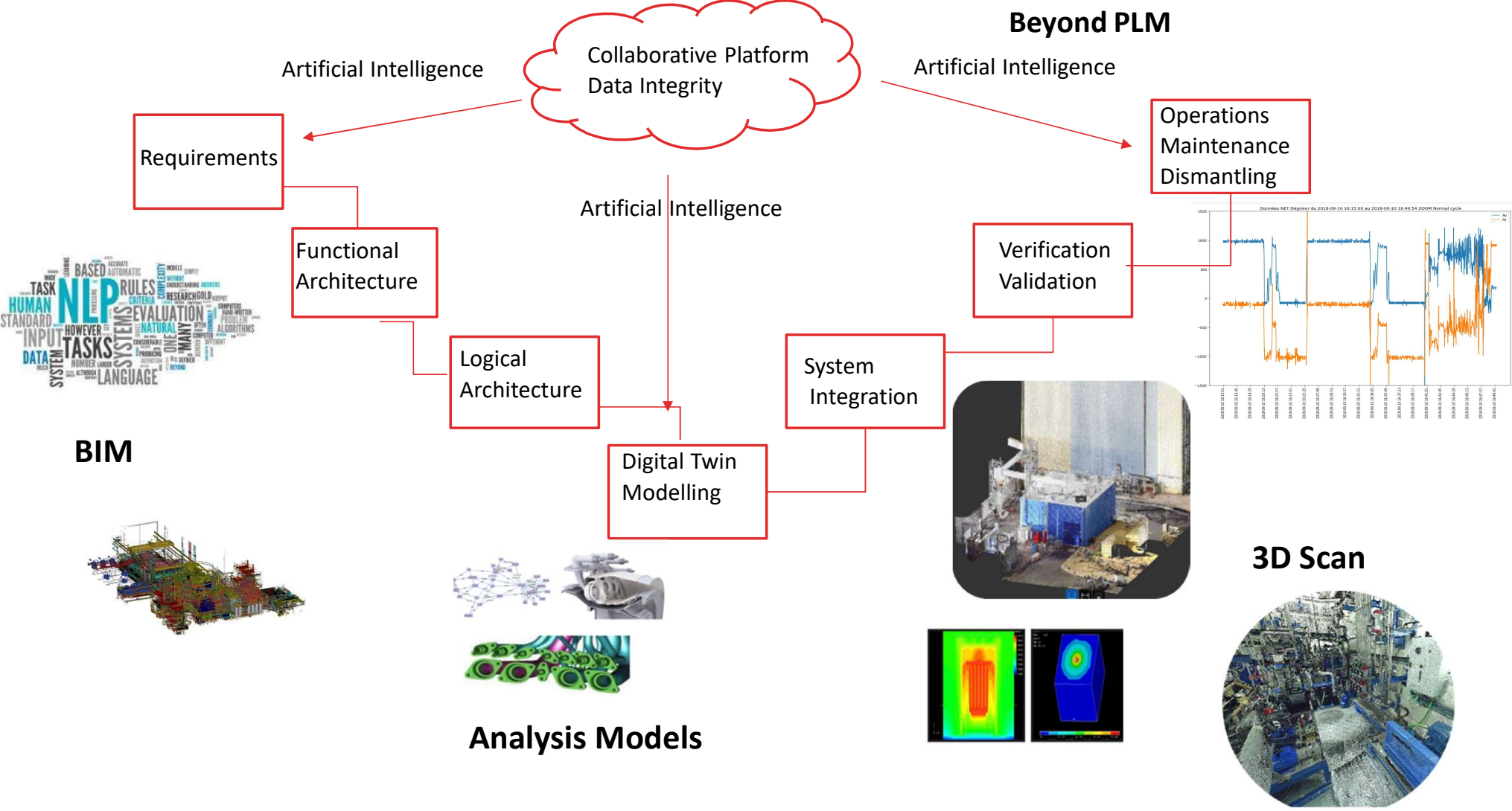
# The Asset Management Methodology

We need to understand how the system operates



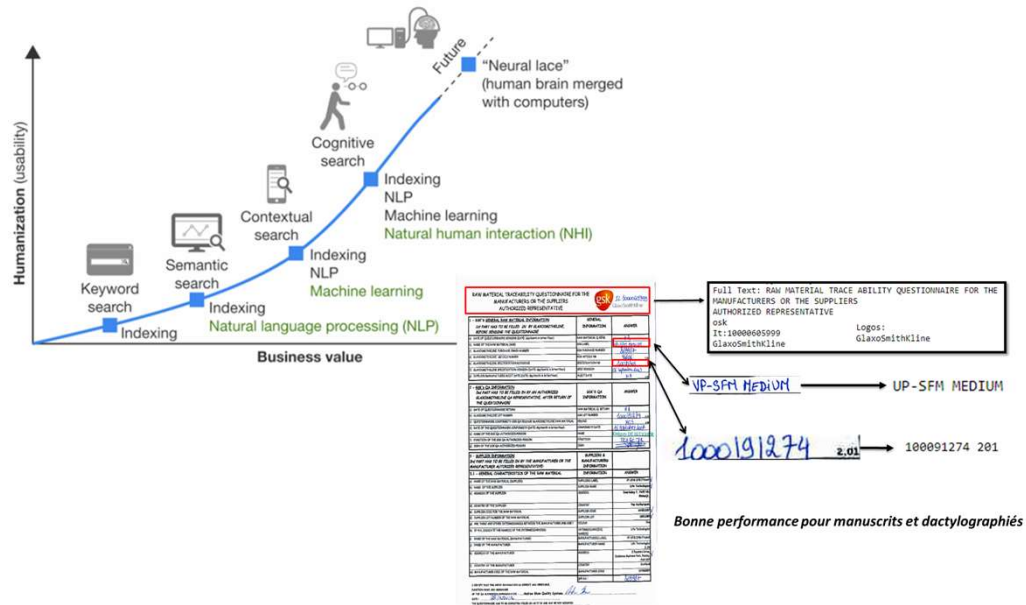
# We need a Model and Data based System Engineering

## Beyond PLM



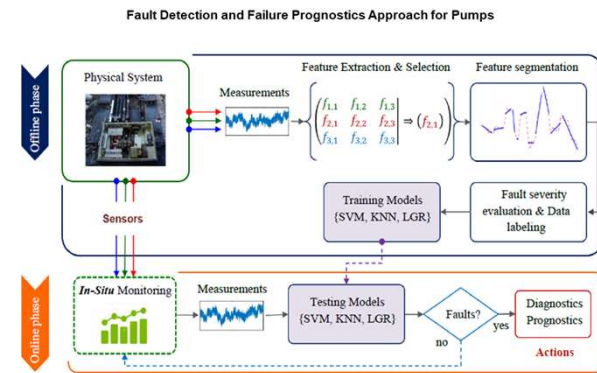
# A need for Data Engineering

## Text mining and document processing

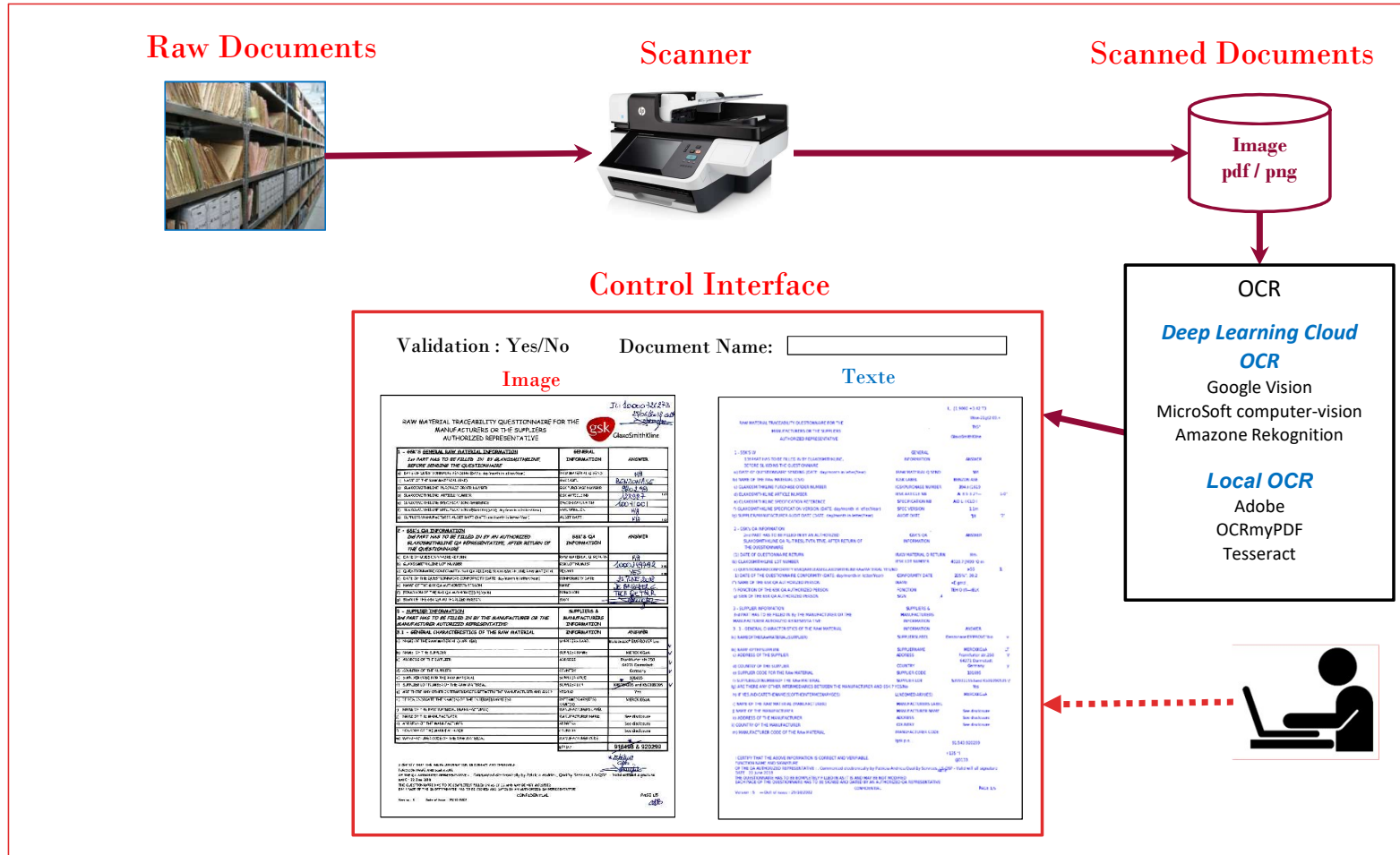


## Machine Vision, Video and Image Processing

## Time Series Analysis & Processing Predictive Maintenance

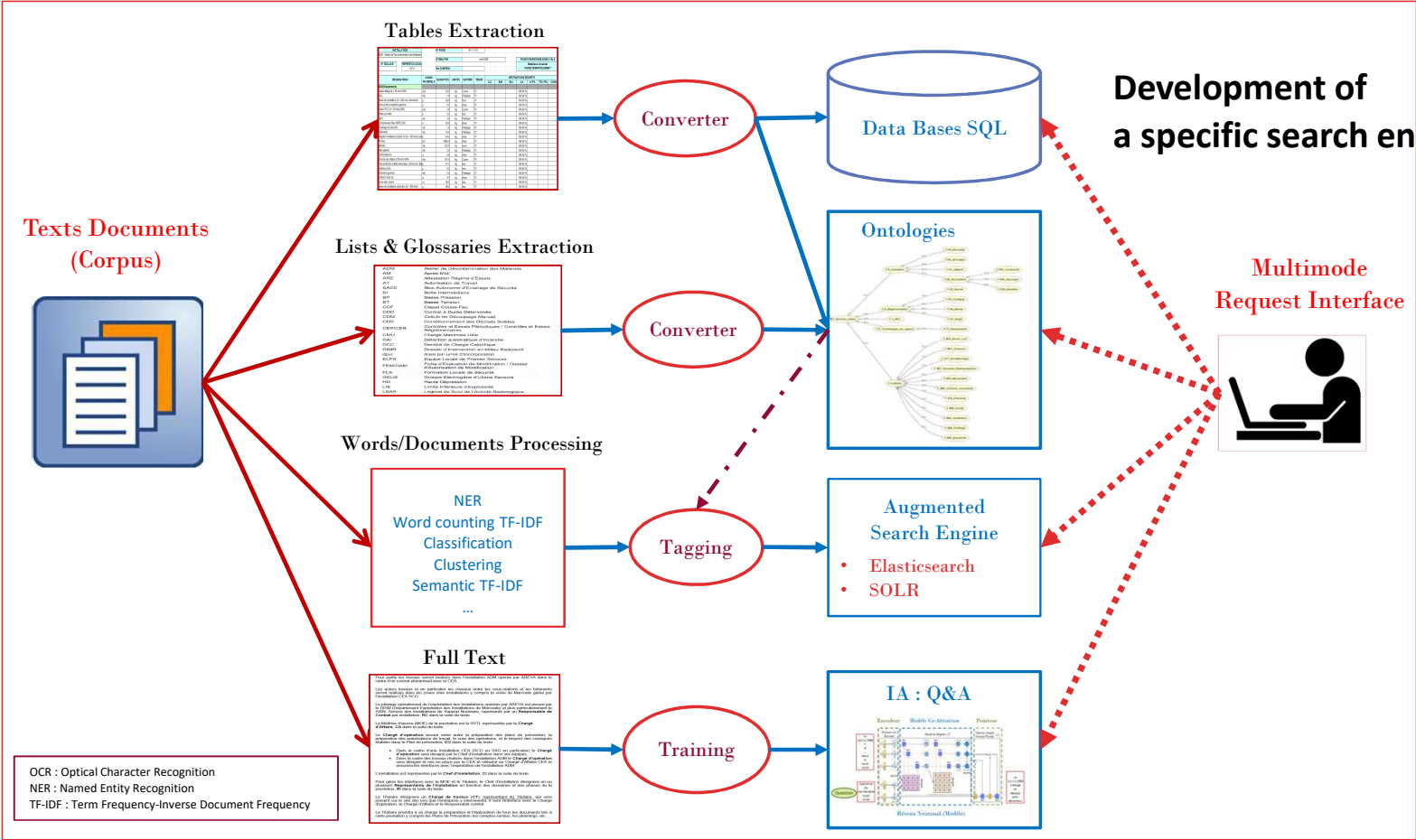


# The digitalization process : Scan-OCR-Control

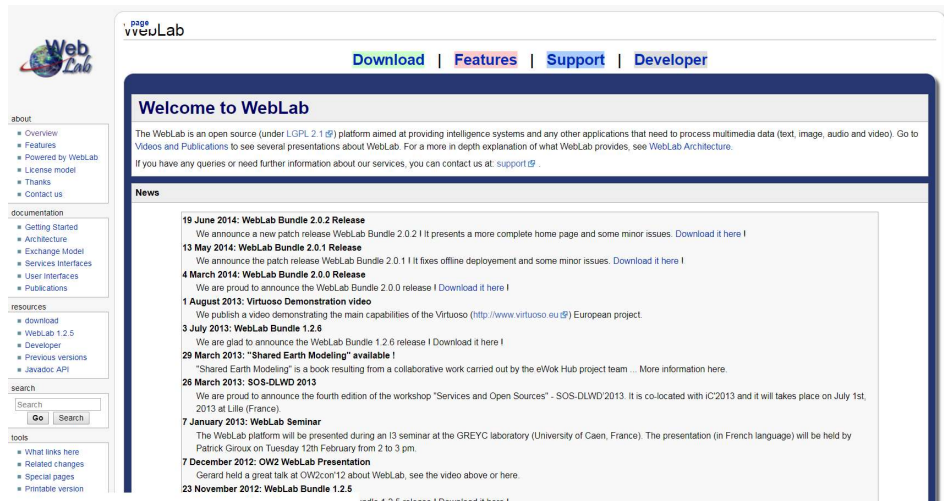




# Non Structured Data Engineering Methodology



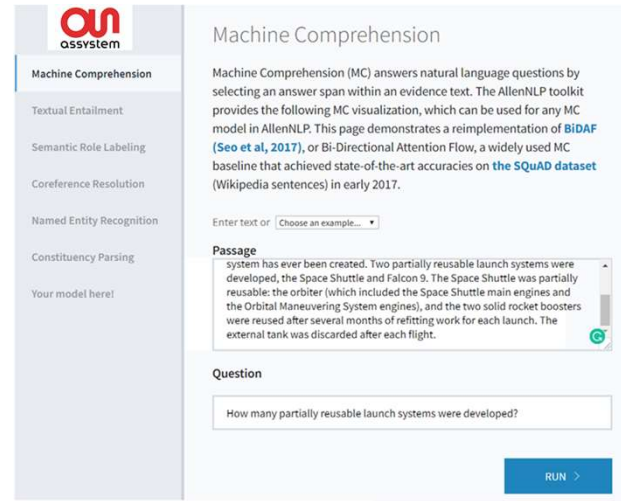
# Artificial Intelligence for Nuclear Power Plant Exploitation



First solution: Smart Query (MVP)

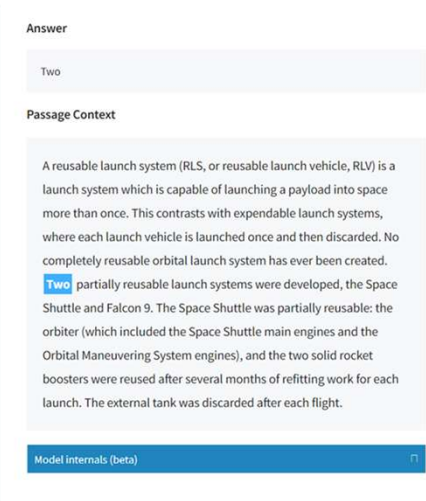
Identification of critical design zone and components

Identify commissioning issues

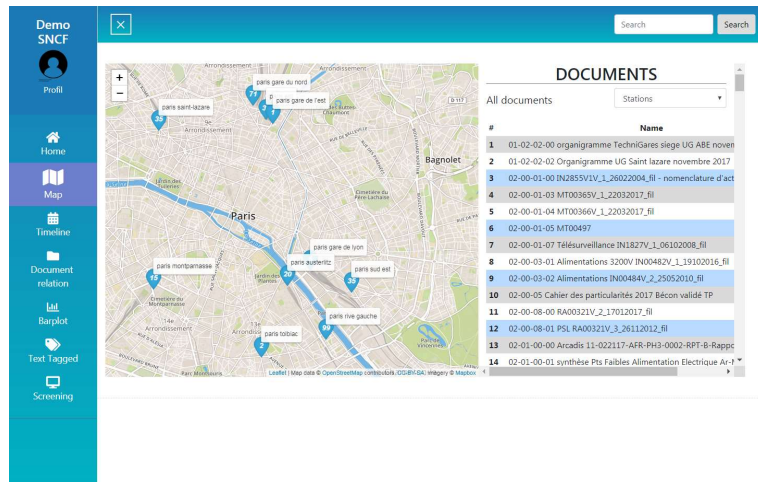


Nuclear explorer

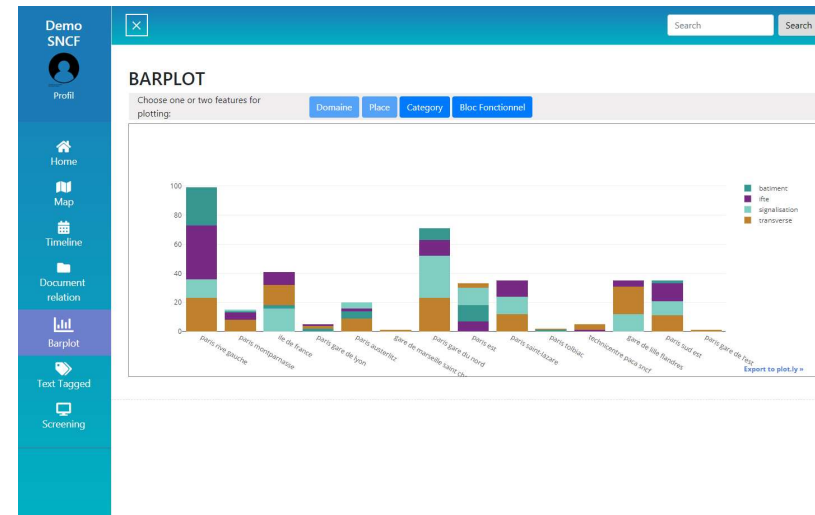
Correlation between design, commissioning and maintenance



# Automatic definition of asset criticality in Railway Station



Prediction of the location of a document based on its content



Prediction of domains and category.

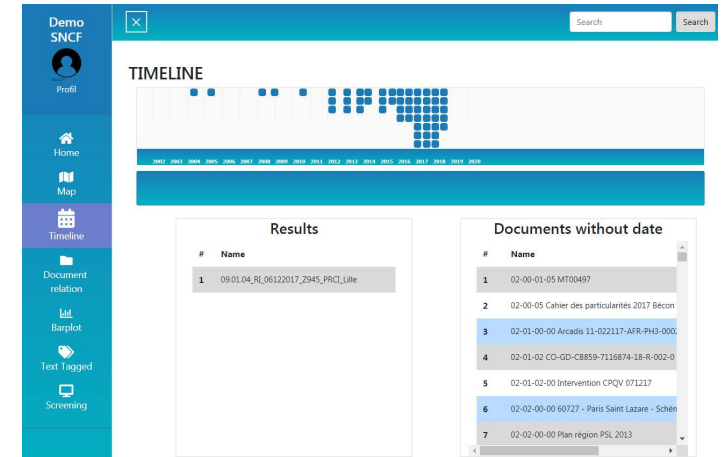
# Analyse the field services data

## SCREENING

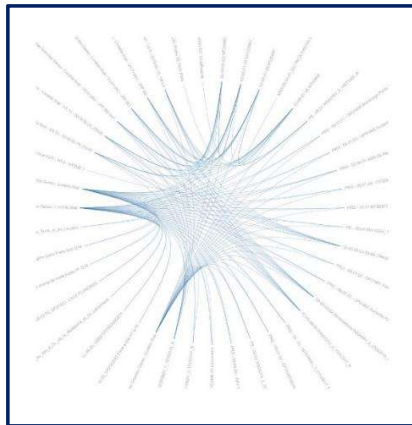
Generate Excel File The date format is year-month-day

Show All 3 entries Search:

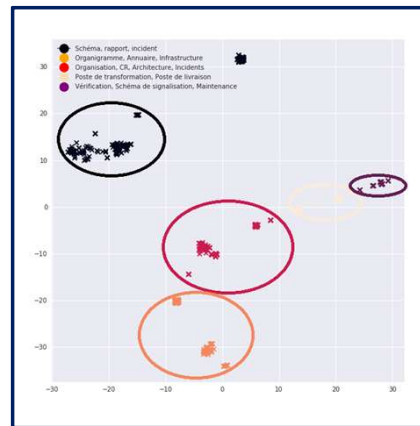
#	Name	Place	Date	Category	Domaine	Bloc Fonctionnel	Actifs
1	01-02-02-00 organigramme TechniGares siege UG ABE novembre2017	paris saint-lazare, paris montparnasse, paris sud est, paris rive gauche, paris gare de l'est, paris gare du nord, paris austerlitz	2017-11-01	organigramme	transverse		
2	01-02-02-02 Organigramme UG Saint lazare novembre 2017	paris saint-lazare	2017-11-01	organigramme	transverse		
3	02-00-01-00 IN2855V1V_1_26022004_fil - nomenclature d'actifs	paris gare du nord	2004-02-26	infrastructures	signalisation	telesurveillance, catenaire, alimentation	BLOCK ,systeme capi ,REGLEMENTATION generalites ,TELECOMMUNICATIONS ,transmission AUTRES DOCUMENTS ,gabarits ,POSTES ET ENCLICHEMENTS ,dispositifs de controle



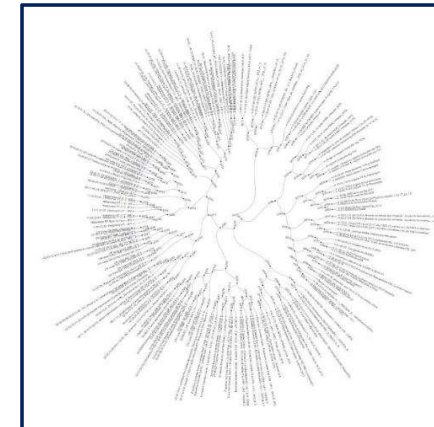
## Document Relations



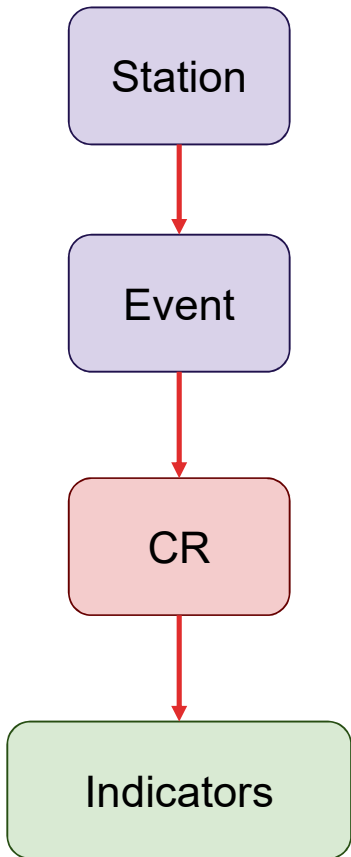
## Domains



## Hierarchical Clustering

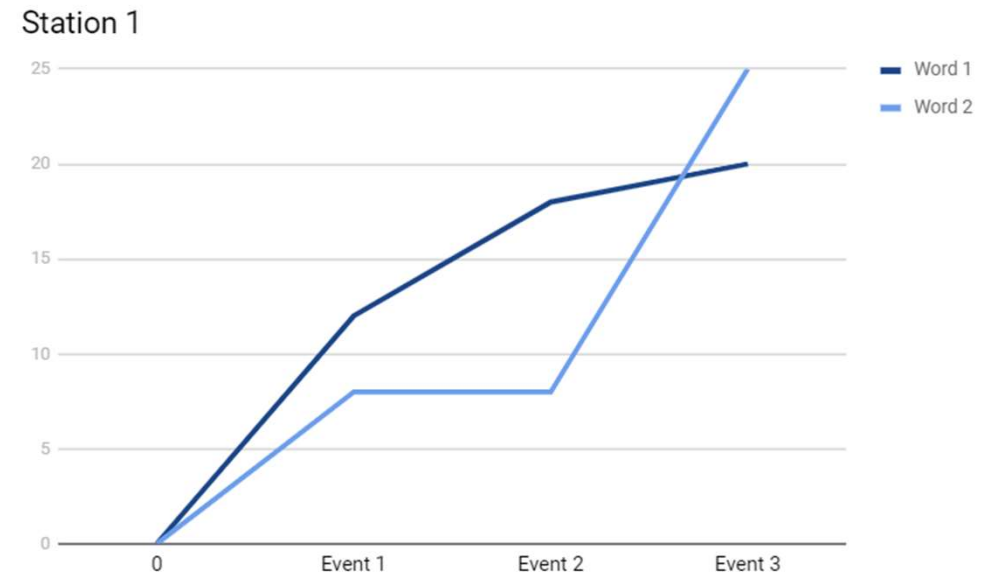


## Status Detection : Nuclear Power Plant

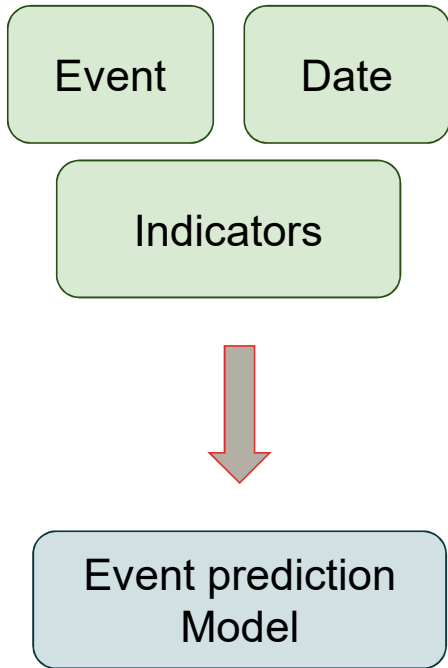


By establishing correlation between data inside documents and event, the aim of this functionality is to move from document based approach to data centric approach.

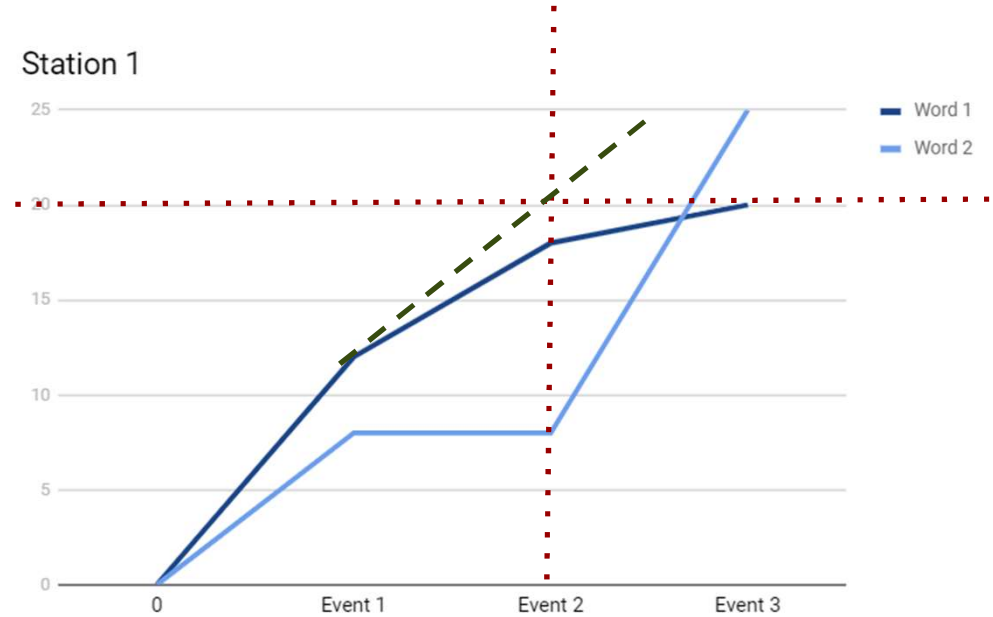
The identification of indicators allows to visualize the status of the station and to make actions according to it.



# Next Event prediction for a Nuclear Power Plant



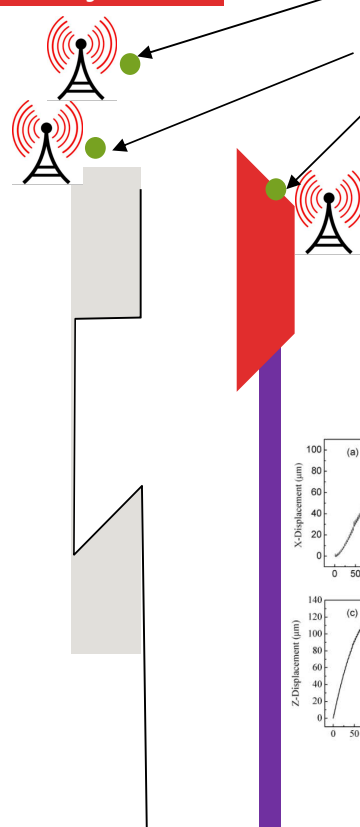
Train a prediction model.  
By following the indicators evolution,  
Develop a prognostic  
functionality based on data  
inside documents.



# Screen Cleaners monitoring in Flamanville : PWR NP



**Projet final**

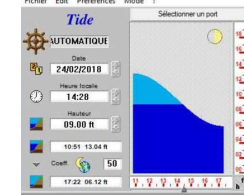
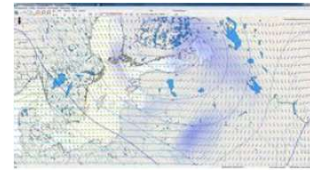


- Smart metering
- Vibration sensor on the motor
- Position sensor on rake

**Wireless sensor  
NDT based  
system**

Quick implementation

Data Capture

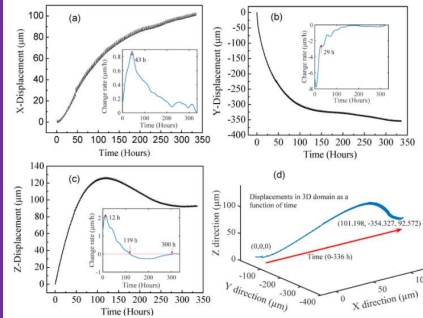


Maintenance data

Weather forecast

Tide data

Data analytics, anomaly detection, RCA, FMEA



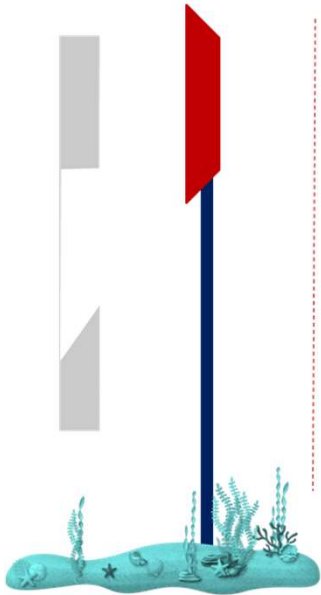
Mail sent to the customer with Health Index Status, Anomaly report  
Maintenance scheme



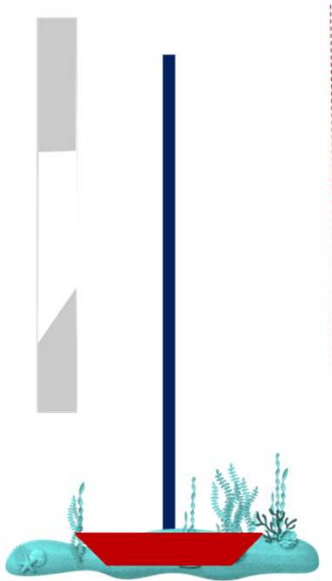
# Screen cleaners monitoring

assystem imagine

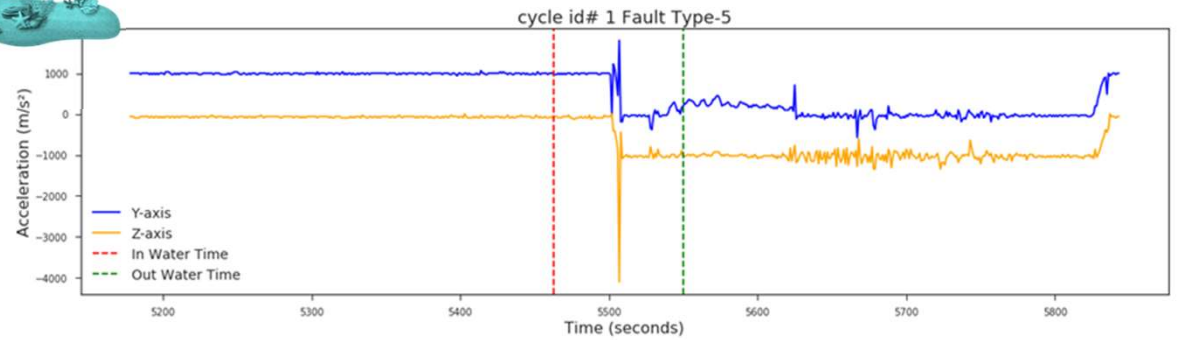
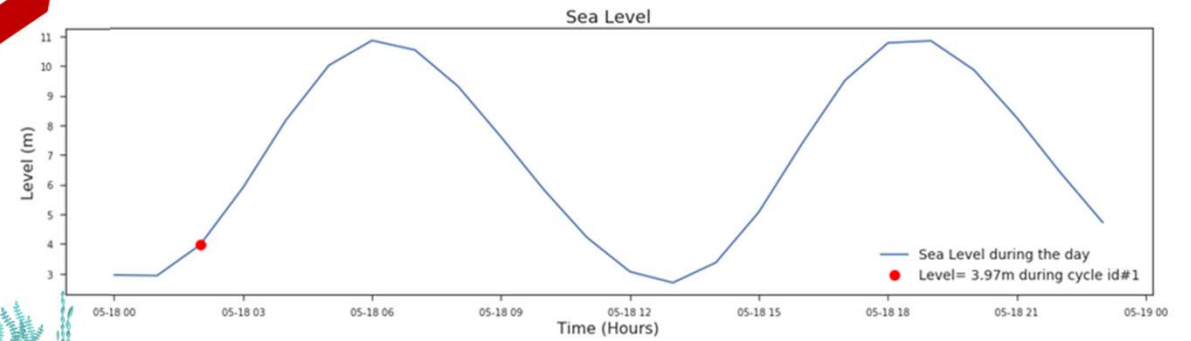
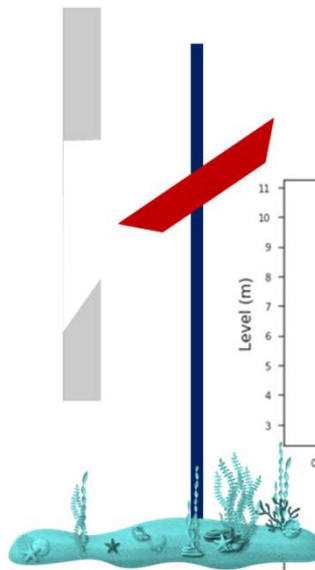
Upper Position



Lower position



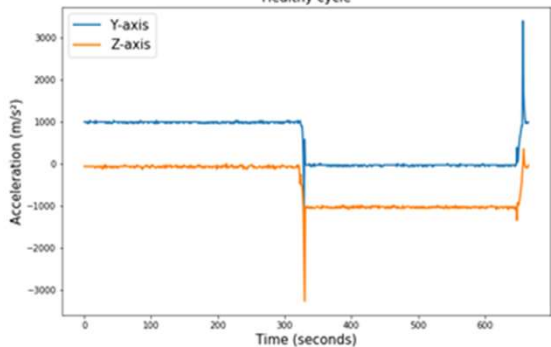
Drain position



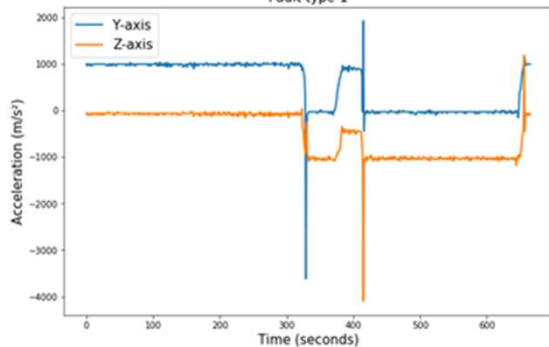


# Root Cause Analysis

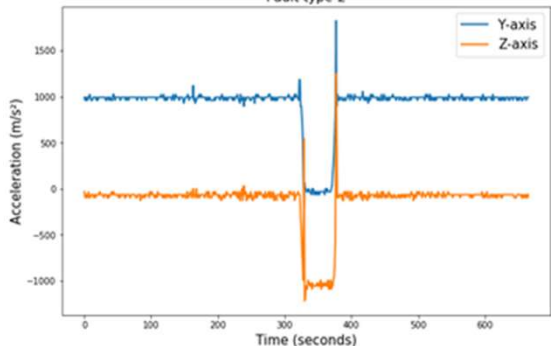
Healthy cycle



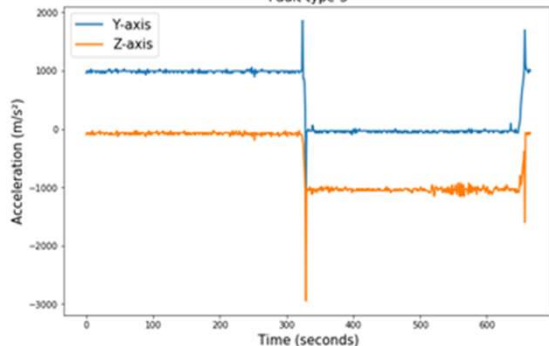
Fault type-1



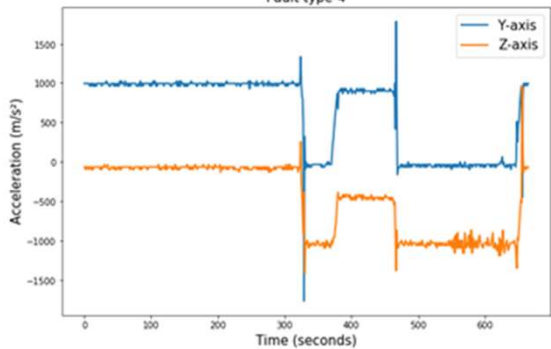
Fault type-2



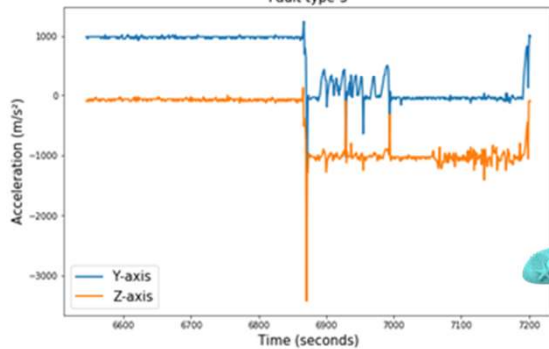
Fault type-3



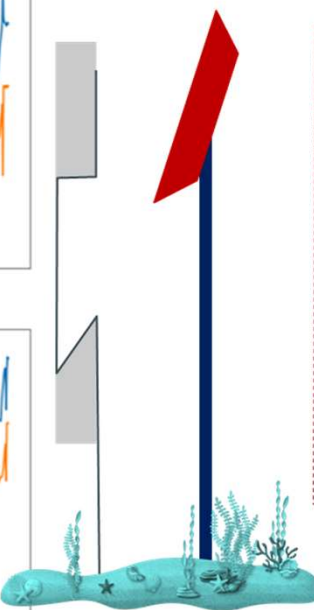
Fault type-4



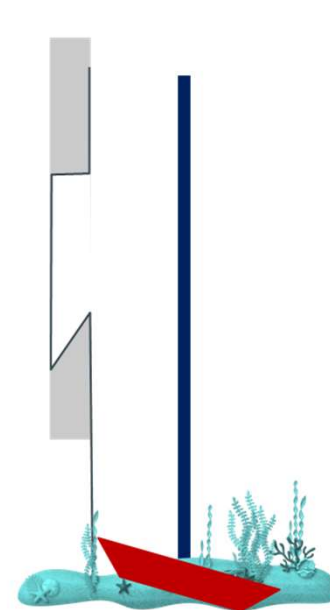
Fault type-5



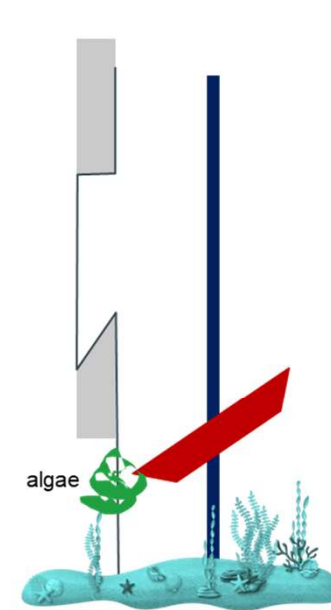
Upper Position



Lower position

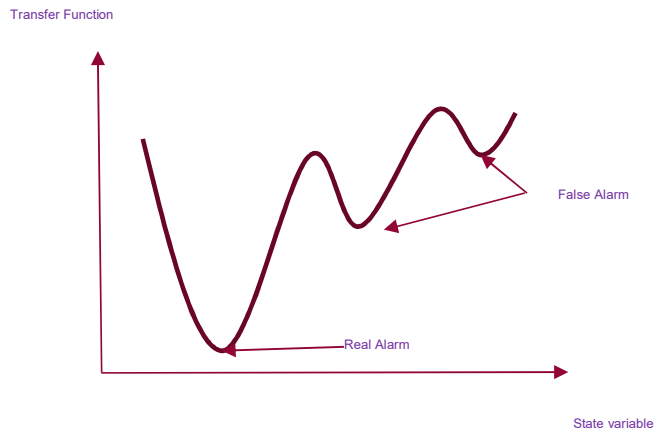


Drain position

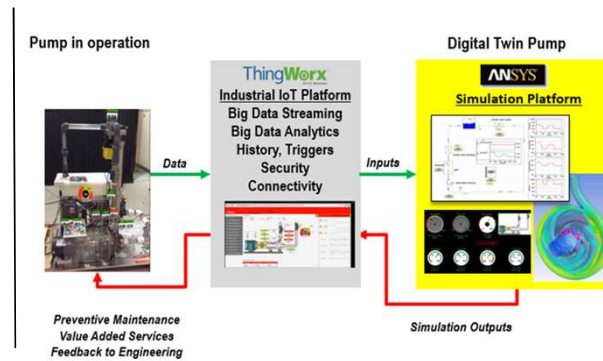


# Digital twin paradigm as a key enabler

## False alarms issues

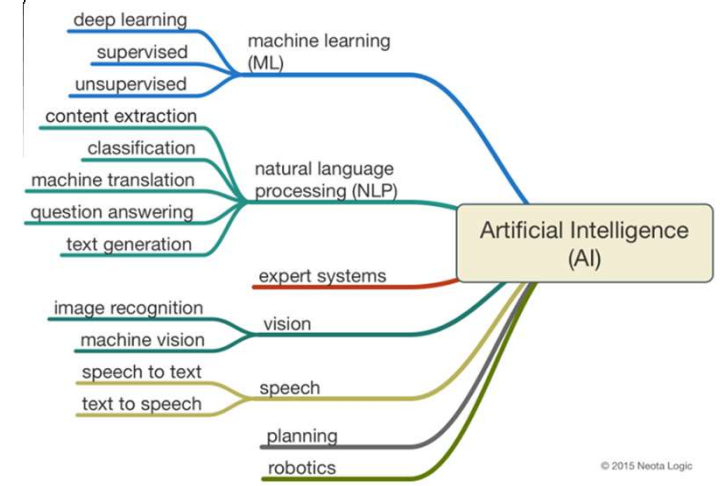


## The embedded system concept is generalized



## Digitalize the OPEX

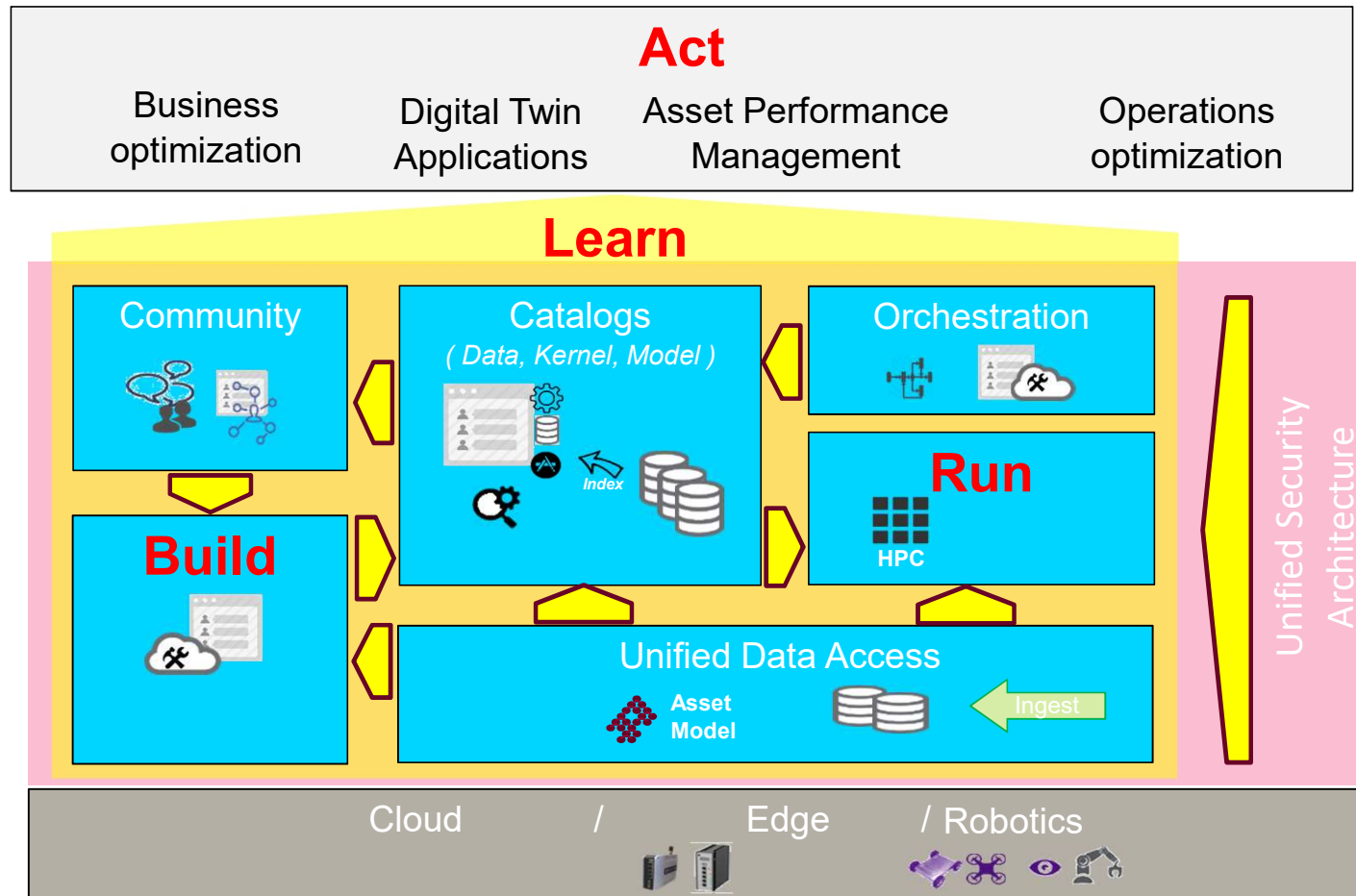
implementation of human knowledge in the form of algorithms.



Physics + Data + IA =

In Vivo Model

# The Digital Twin Factory



## Take Away messages



- Mission Critical infrastructures are very specific
- Data Continuity will be key
- NLP and Artificial Intelligence will enable to get more hidden information
- Asset Management will be enriched through these approaches combined with Digital twin one