SOGETI
High Tech

Case of predictive maintenance by analysis of acoustic data in an industrial environment

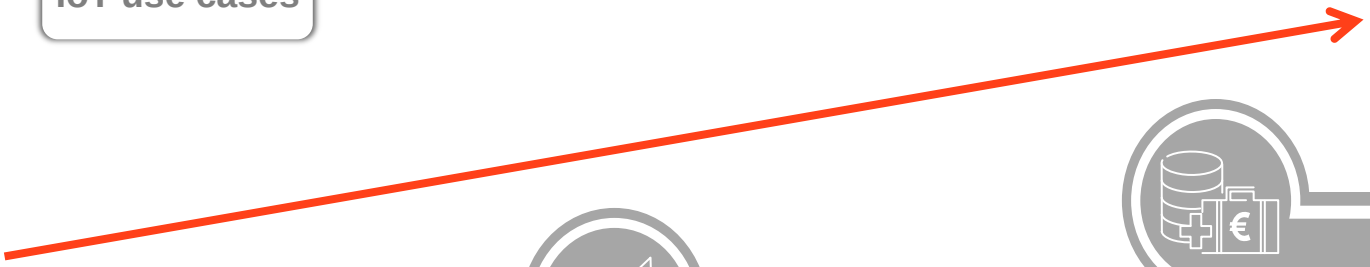
June 29,2016

Presented by Philippe Duhem – Sogeti High Tech

Inspiring TECHNOLOGY

IoT impact in Manufacturing for the 10 next years

IoT use cases



Operational excellence

Examples of use cases:

- Production equipment management
- Building management
- Inventory management
- Delivery tracking
- Production of customized products

Product improvements

Examples of use cases:

- Remote product upgrades
- Remote maintenance
- Data insights for engineering

New business models

Examples of use cases:

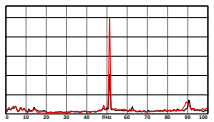
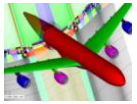
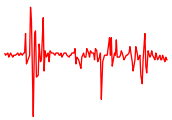
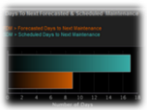
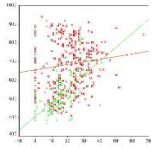
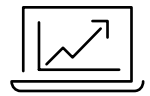
- Pay per use models
- Lease + maintain vs. sell

IoT will have pervasive impact in Manufacturing with a $2.5 trillion impact & over 50% around operational excellence (TBC!)*

*by 2025. Source: McKinsey

What's new?

	Model Driven	Data Driven
Sources	Sensors, PLC, Machine data Physical Models Simulation behaviors Empirical models, Tests data	Sensors, PLC, Machine data Operators data Quality data, TRS, Maintenance Raw material, Traceability, Tests
Treatment	Scientific software Pre&Post treatment Adapt the model to real behaviors Thresholds, alarms CAX	Statistic analysis Machine Learning, Clustering, Forecast, Decision trees Linear regressions, Neuronal network
Infra	HPC LSF Family, PBS, SGE, SLURM Dedicated infrastructure	NoSQL DB, Distributed computing framework Cloud
What	Physical engineering: Structural, Thermal, CFD, EM, Accoustic, Vibration, …	Probability Predictive models Recommendations

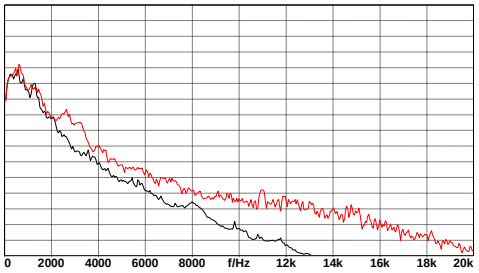
Manufacturing Intelligence & Predictive Maintenance

Manufacturing Intelligence

Predictive Maintenance

	Manufacturing Intelligence	Predictive Maintenance
Use case	Monitor and control production units based on factual decisions defined by all collected data	Predict potential breakdowns of a machine through data analysis
Business Values	Reduce non quality costs Decrease Non TRS Master standard cycle time Optimize consumption (raw material, energy…)	Decrease Non TRS Reduce maintenance costs
Output	Production teams will quickly identify key factors impacting production objectives	Maintenance teams will anticipate preventive activities
How	Exhaustive Mathematical method Dashboards Action plan	Predictive models Dashboard Recommendations

Troubleshooting by data acoustic analytics



Background

- Our Customer operates production units of energy located in France.
- Objective: decrease the maintenance costs by optimizing the maintenance activities and machines availability rates.
  - Experiment acoustic and vibration troubleshooting
  - Implement a global predictive maintenance platform
- The target machine for the first stage is a high-powered air compressor. It represents a strategic and critical asset for the production units.

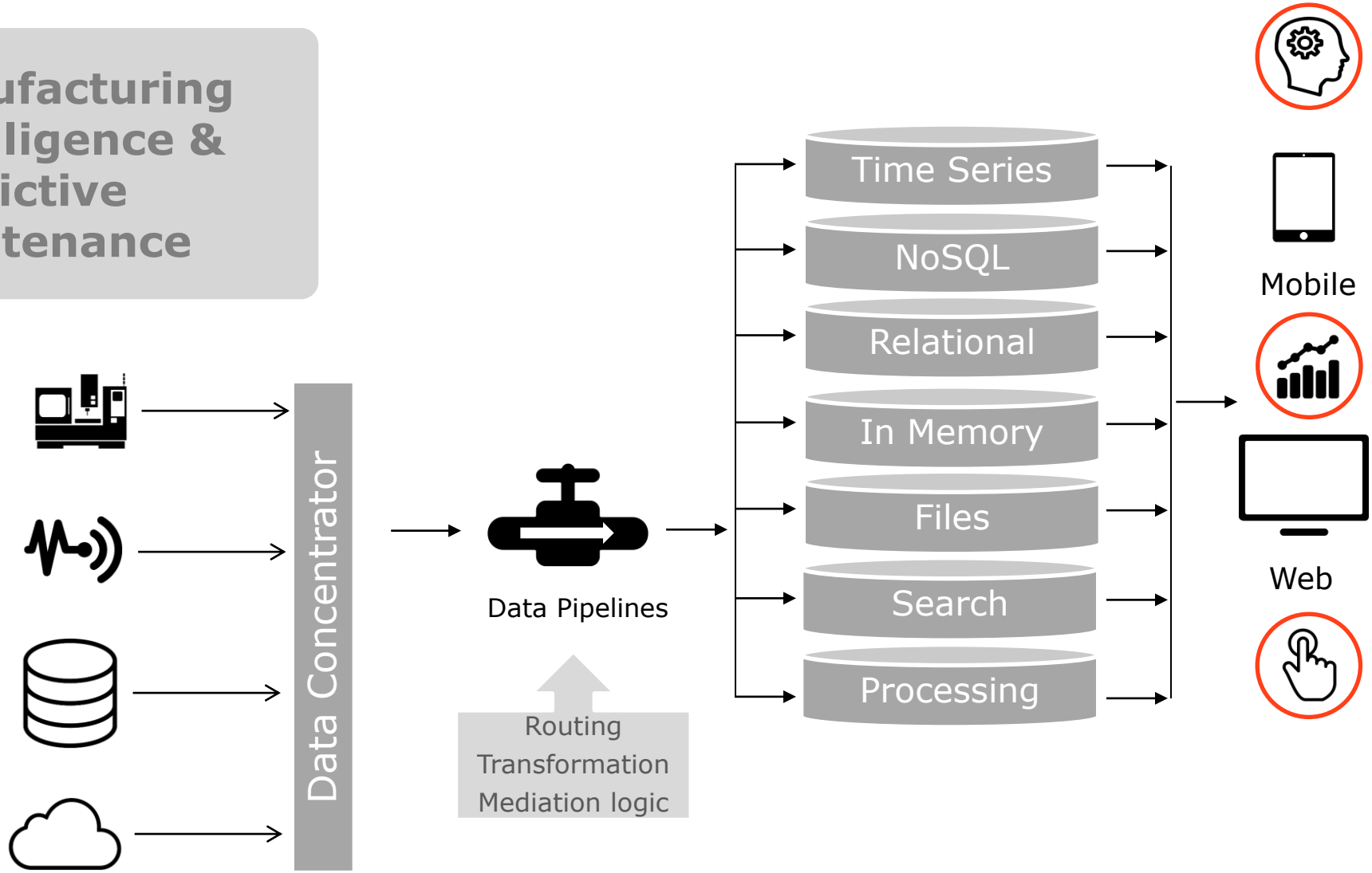
Solution

- The noise and vibration troubleshooting are used to identify mechanical, electrical, hydraulics and aerodynamics problems. The method is based on a comparison of noise and vibration spectra to an acoustic and vibration database.
- Data storage:
  - The measurement data with an operational context
  - Maintenance & Machine Data
- Platform:
  - Acquisition & collect: open, scalable, secure
  - Analytics platform hosted on a cloud

Benefits

- Rapid implementation: platform available after 1 month, models ready to use after 2 months
- Relevant statistic model supported by a model driven approach
- Scalable and secured solution based on an IIOT architecture
- Hybrid cloud with operational treatments in the customer premises and analytics in the cloud

Manufacturing Intelligence & Predictive Maintenance



Data Sources - IIoT | **Data Ingestion – IIoT** | **Data Lake** | **Analysis & Usage**

IIoT Platform eObject: from edge to analytics

1. IoT MODULES	2. FUNCTIONS	3. DESCRIPTION	4 FEATURES
1 **e-OBJECT Edge**	**Data acquisition**	• **A software Agent is embedded** on : objects (Sensors, devices, gateways) with communication, security and processing services.	Linux, android, intel, Windows CE
2 **e-OBJECT Cloud**	**Data storage & administration**	• **A Middleware Platform** collects & stores of large amount of data. • Devices & sensors managing services. • Hosted in **a public or private cloud**	IBM BlueMix, Capgemini, Microsoft Azure, amazon
3 **e-OBJECT Analytics**	**Data analysis & visualization**	• **An Analytics Platform** analyses data from multi sources/multi files. • Data are transformed into information displayed on a visual interface.	cloudera, hadoop, elastic, IBM SPSS, BRAIN CUBE

IoT Architecture

Edge

Industrial

Building

Infrastructure

Data Sources

ERP GMAO MES

eObject Platform

Security Management

Cloud Management

Acquisition

- Connectivity
- Device Management
- System Monitoring & Control
- Orchestration

M2M Layer

Aggregation

- Storage
- Fusion
- Correlation

Data Lake

Analysis

- Analytics
- Predictive Models

Big Data Analytics Engine

Assignment

- Visualisation/ Dashboard
- Real-time Monitoring
- Benchmark Trends
- Forecasts

Core Business Services

Applications

Action

- Predictive Maintenance
- Manufacturing & Storage
- Smart Grid
- Metering
- Tracking & positioning
- Smart Building
- +++...

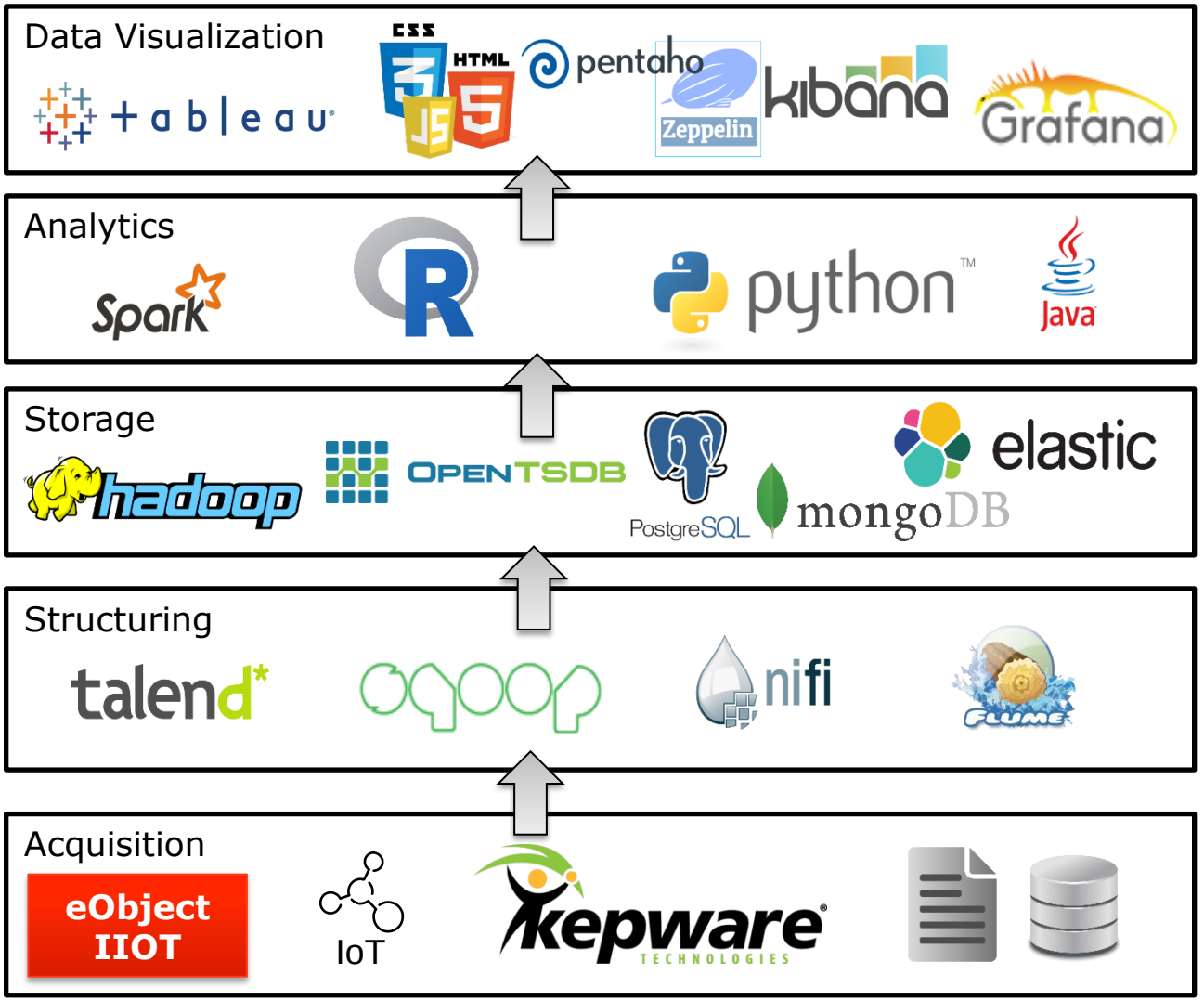
Business Services

Build on micro-services

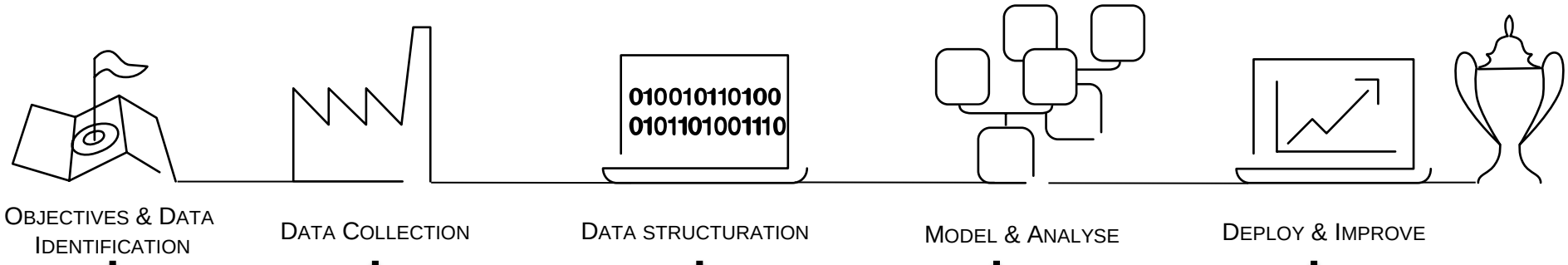
Choose the right service for the right use

Interconnect them to build your application

Use the best of every world



MIPM Deployment Phases



OBJECTIVES & DATA IDENTIFICATION

DATA COLLECTION

DATA STRUCTURATION

MODEL & ANALYSE

DEPLOY & IMPROVE

MIPM DEPLOYMENT

- **Define clear objectives**
- **Identify if relevant data are available**
- **Prepare Change**

- **Industrial IS**
- **Machines connected**
- **Data collection**
- **Secure & scalable**

- **Data structuration**
- **Data Lake**
- **Analytics platform**

- **Monitoring**
- **Modeling**
- **Dashboarding**

- **Deployment**
- **Adapt, optimize**
- **Change management**

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About Sogeti High Tech

Engineering excellence & Digital Manufacturing

With an experience of over 25 years, Sogeti High Tech makes its skills and know-how available to Aeronautics- and Space-, Defense-, Energy-, Telecoms & media-, Railway- and Life Sciences industries.
To be more responsive to market needs, Sogeti High Tech has developed a range of expertise based on its R&D department, High Tech Labs, a real innovations incubator.
In close partnership with its customers, Sogeti High Tech develops and manufactures solutions with a high added value in the areas of Digital Manufacturing.
Subsidiary company of Capgemini Group, Sogeti High Tech is a center of excellence in System Engineering, Physical Engineering, Software Engineering, Testing, Consulting services and Industrial Information Technology.

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