# Review Open Call 8 – OptiPLANT Experiment

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intellia

VIRTUAL REVIEW FEC9

*Zoom, 28.05.2021*

# The Company


- Est. in 2016
- Data-driven start-up focusing on AI / ML
- Large Portfolio in industrial collaborations
- Predictive maintenance on
  - Ship machinery
  - Material flow logistics

# OptiPLANT

Host Testbed: **Tengu**

imec

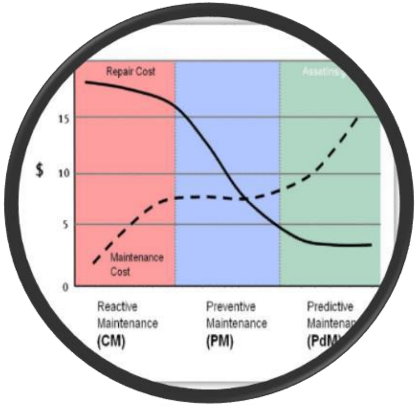
GHENT UNIVERSITY

## EVENT CORRELATION AND ROOT-CAUSE ANALYSIS FOR OPTIMISED PREDICTIVE MAINTENANCE

# The Problem (or the Business Motivation)

## REACTIVE MAINTENANCE COSTS A LOT!

80% of maintenance time is spent reacting to issues rather than proactively preventing them




37% lost production time

Estimated loss – Up to 250.000 Euros per hour

Source: eMaint, Plant Engineering Report 2018

# The OptiPLANT Concept

OptiPLANT aims to validate predictive maintenance solution using a big data architecture

**Objectives**

- Stress test the performance of event correlation schemes in real-time

- Optimised predictive maintenance through refined root-cause analytics

- Experiment with real-time reconfiguration of the algorithms

- Identify a set of best practices for industrial predictive maintenance

# Experiment Set-up

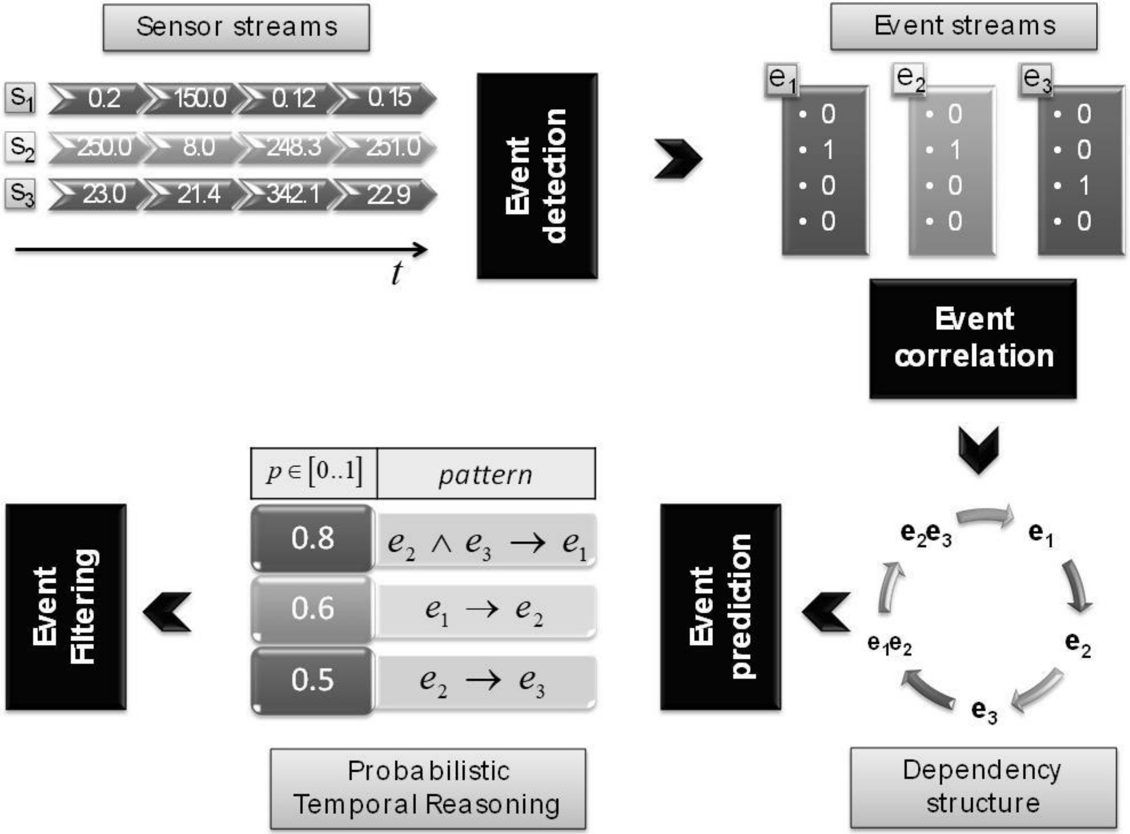
## Software

- **Minio** object storage to store OptiPLANT data.
- **Apache Spark**
  - *SparkCore* for processing
  - *SparkStreaming* for real-time streaming
  - *SparkUI* for monitoring
- **PySpark** as a Python API for SPARK
- **Jupyter** for easy and quick prototyping

## Resources

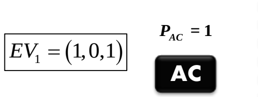
- We didn’t have to deal with actual resources making it easier for the experimenter
- Resources were organised in containers orchestrated by Kubernetes
- The experiment used 200GBs of real datasets in the form of sensor vectors (31 monitored variables + timestamp)
- Batch training, testing, real-time predictions (online)

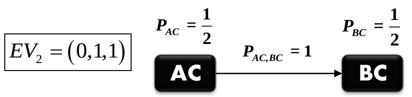
# Events Lifecycle in OptiPLANT

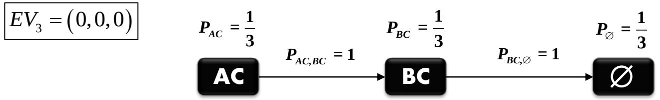


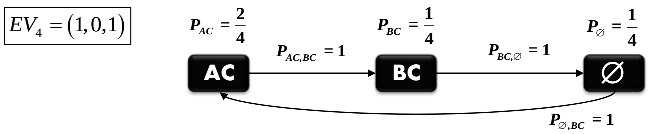
# Stepwise event correlation based on Markov chains

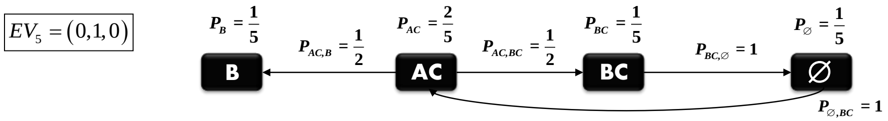
| A | B | C |
|---|---|---|
| 1 | 0 | 1 |
| 0 | 1 | 1 |
| 0 | 0 | 0 |
| 1 | 0 | 1 |
| 0 | 1 | 0 |
| 0 | 1 | 0 |
| 0 | 0 | 0 |
| 1 | 0 | 0 |
| 0 | 1 | 0 |

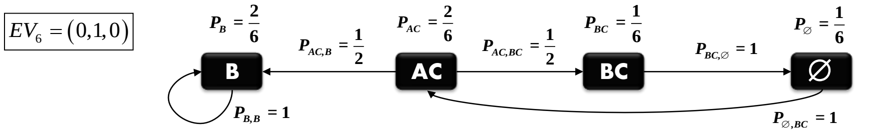


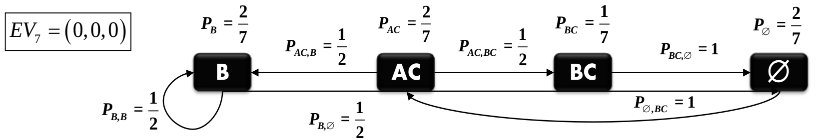



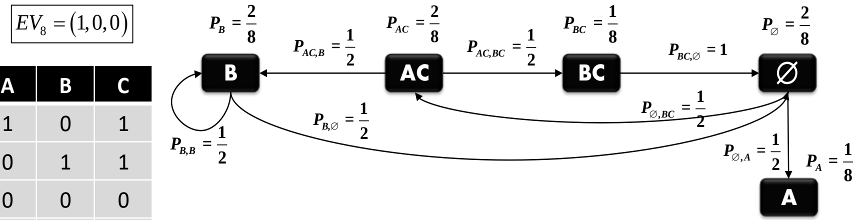

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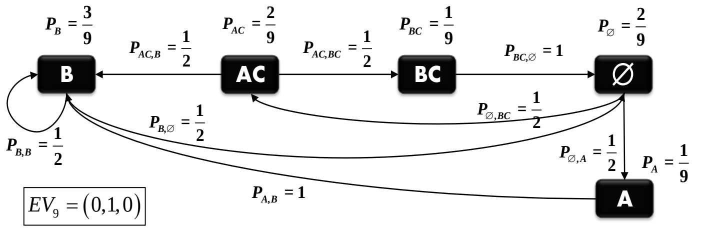
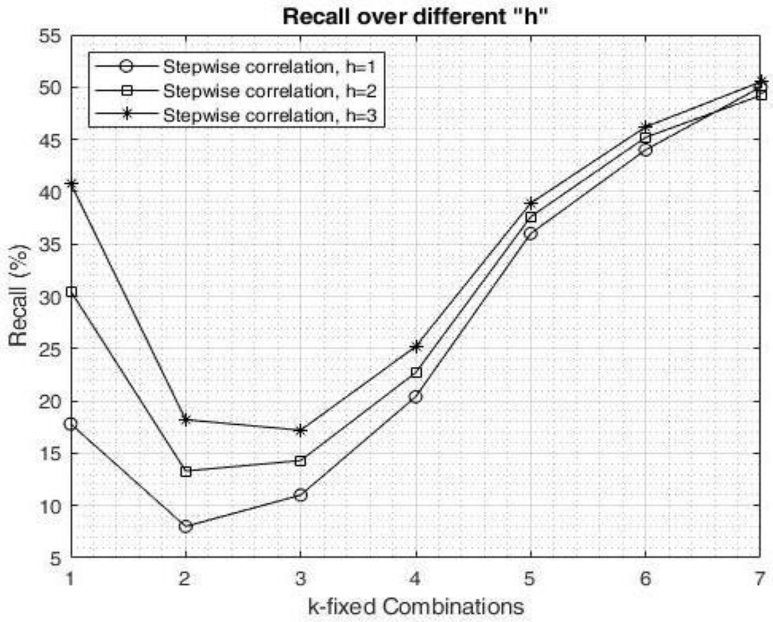
| 1 | 0 | 0 |
| 0 | 1 | 0 |

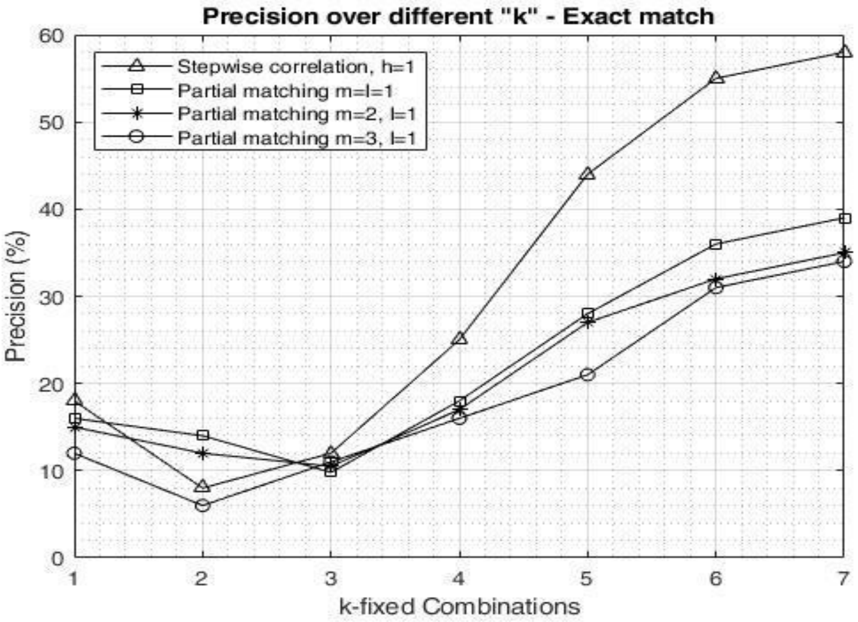



$$(\forall t\in N)\ (\forall v\in V)\ \ \sum_{u\in V} P_{vu}^{t}=1$$

$$(\forall t\in N)\ (\forall I_s\subseteq I)\ \ P_{I_s}^{t+1}=\sum_{I_v\supseteq I_s}\ \sum_{k\in V} P_k^t\cdot P_{kv}^t$$

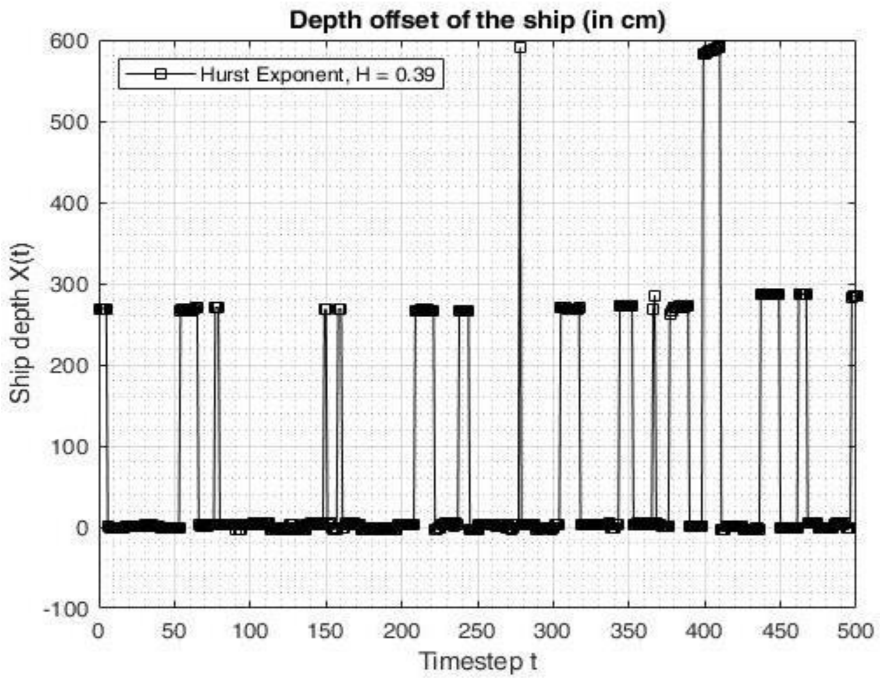
# Measurements – Precision & Recall

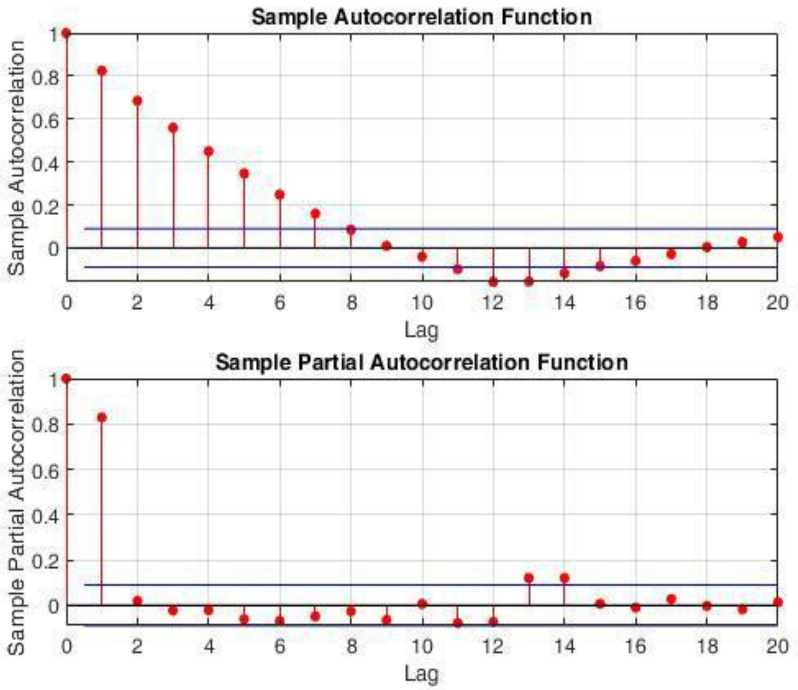



$$Precision = \frac{TP}{TP + FP} \qquad Recall = \frac{TP}{TP + FN}$$

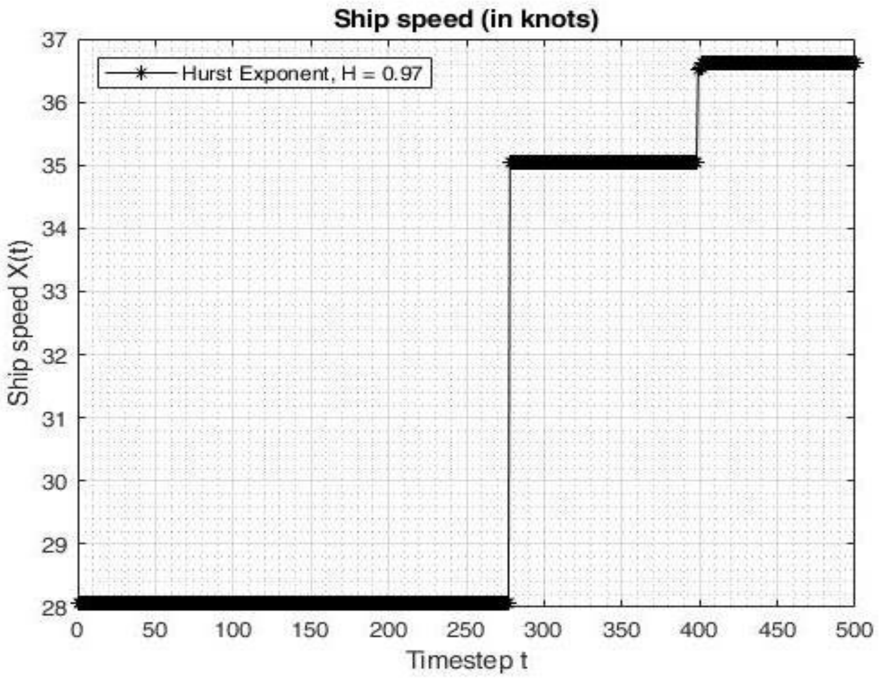
# Measurements – Hurst Exponent & Autocorrelation

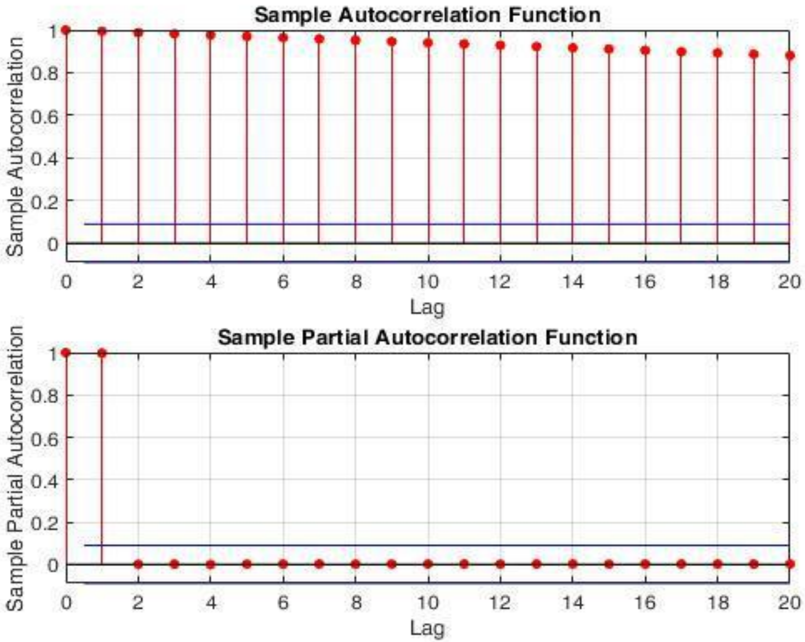



Ability to identify evidences of malfunctioning behaviour

# Measurements - Hurst Exponent & Autocorrelation



# The Market Opportunity

1. Source: General Manufacturing Global Market Report 2020-30
2. Source: IoT Analytics Research 2021

**€ 800 Bn+**

Global market of manufacturing industries[1]

**€ 8.2 Bn**

Total market for predictive maintenance[2]

**€ 500 Mn**

Estimated predictive maintenance costs for manufacturing SMEs

**€ 500 K**

Estimated Market Share 0.1% for 2026

# Business Plan

| Training cost | Charge |
|---|---|
| < 1GB | **20€** |
| < 100GB | **200€** |
| < 500GB | **1000€** |
| > 500GB | **Under request** |

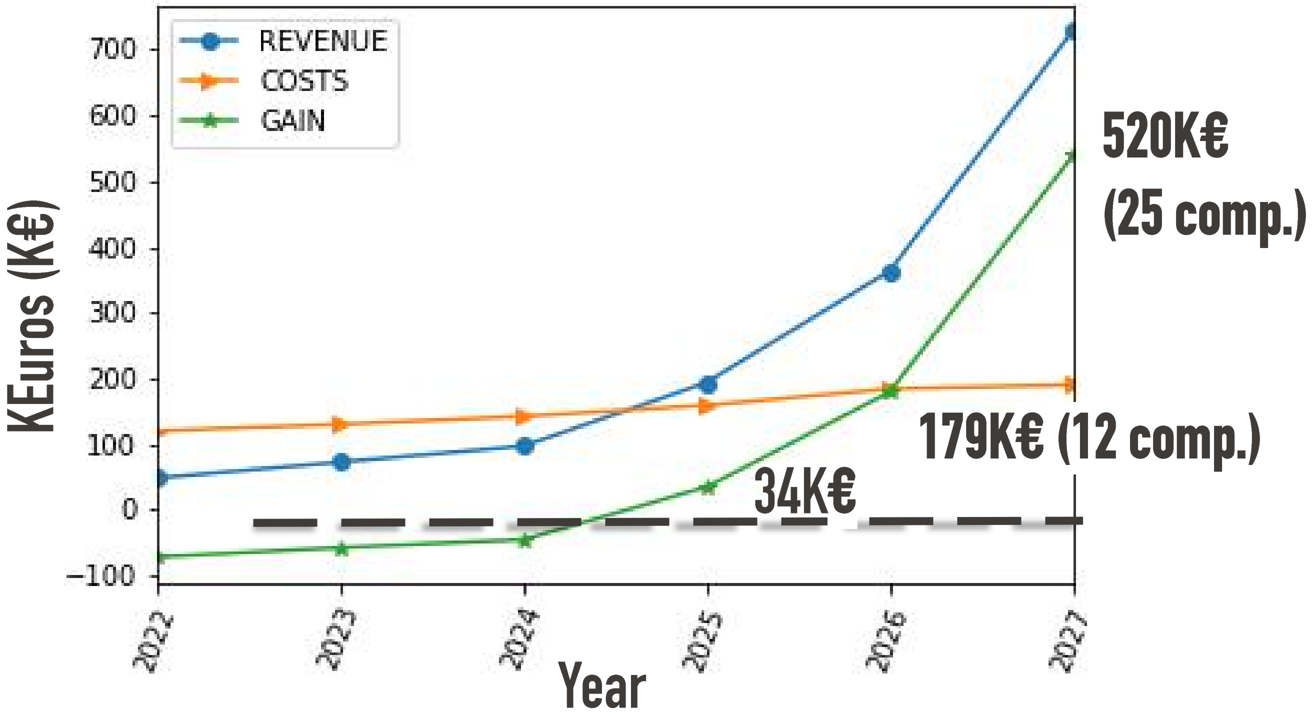
| Prediction's cost (per month) | Charge (per prediction) |
|---|---|
| First 1000 | **Free** |
| 1001 to 100,000 | **0.04€** |
| 100,001 to 200,000 | **0.03€** |
| 200,001+ | **0.02€** |

Burn rate: **10K€/month**
Beta users: **1 company**
Sales: **200€ + 2K€/month**

Go to market strategy: build on strategic partnerships

Trusted by: LÖDIGE INDUSTRIES

# Financial Projection



# Why we selected FED4FIRE?

## AND HOW FED4FIRE HELPED US TO GROW!

- Due to the lack of resources most of the times algorithms are tested only through simulations

- No big data tools easily available for SMEs

- Difficulty to access appropriate infrastructure for Big Data

- Setting up Big Data tools installations (e.g., Storm / Spark / Hadoop ) would be a time & money overkill for an SME

# Added Value for Fed4FIRE

- Validation of a real business-driven scenario
- Test of innovative big data algorithms with great impact on research
- Tengu was tested with a huge amount of data and with real-time needs
- Connection with the industrial sector
- Paper for IEEE WiMob 2021


# DEMO VIDEO

FED4FIRE

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Co-funded by the Swiss Confederation

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WWW.FED4FIRE.EU