An introduction to IoT

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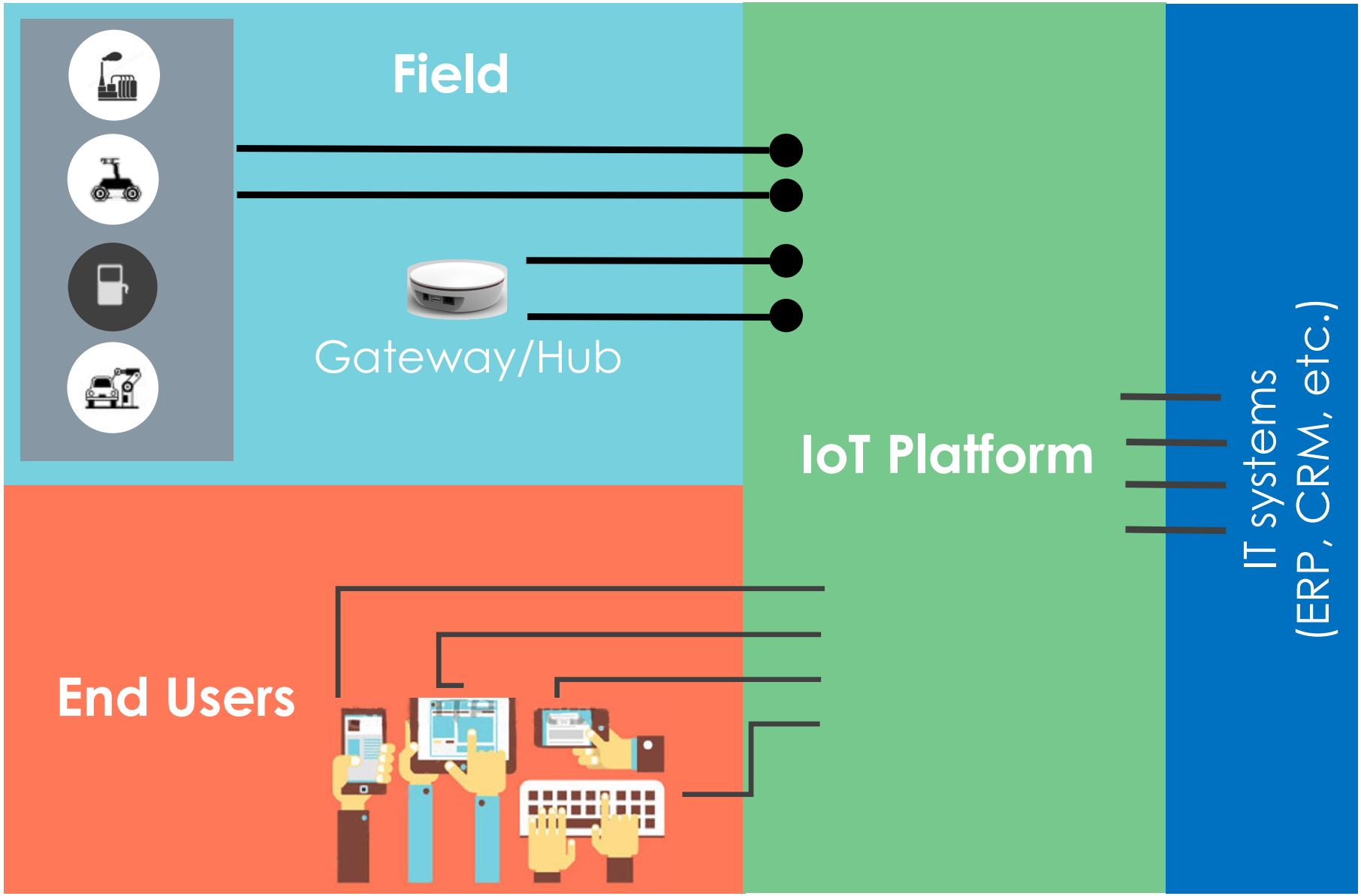
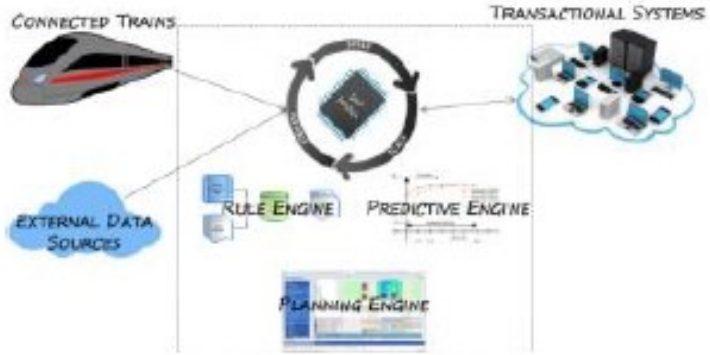
General Architecture



Dynamic Maintenance Management System for Railway Operators

Leveraging highly granular telemetry data, it becomes possible to shift from standard maintenance schedules to ***dynamic plans*** that reflect the specific status of each and every component of the train



SENSE

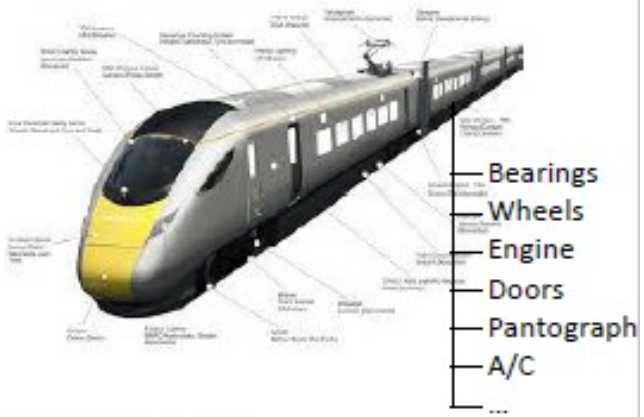
- IT/OT data convergence

PREDICT

- Remote diagnostic on the current operational conditions
- Predictive models to derive probability of future failures
- Indicators-based planning, considering current and future detailed life- and health-status of each component

ACT

- Dynamic optimization of maintenance schedules based on operational needs, and availability of resources



>700 TB of data managed annually

8 – 10% reduction in maintenance costs

Improved reliability and customer service

TRENITALIA

Real-Time Aircraft maintenance

Avoid unplanned downtime, increase turn-around-time and service levels

SENSE

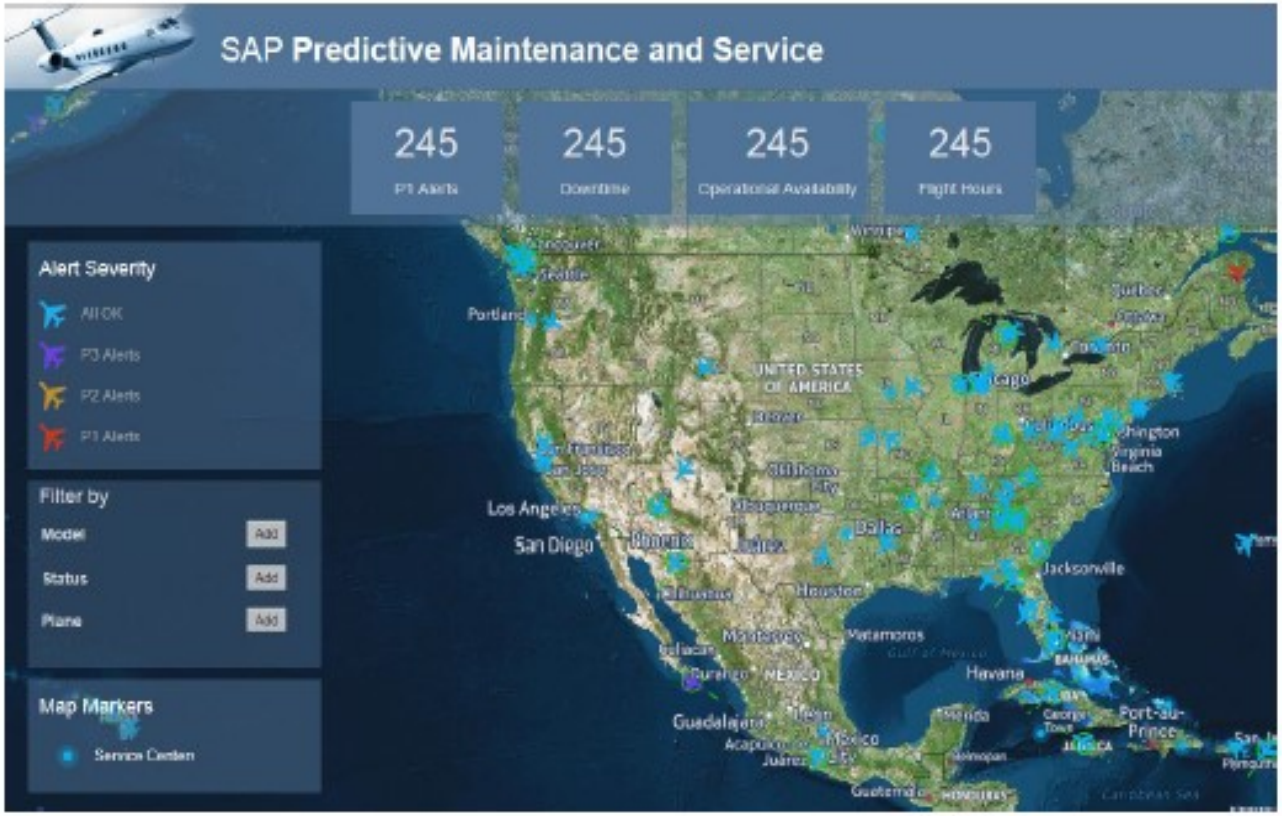
- ~1 TB per flight
- Trending and alert management framework

PREDICT

- Stream and analyze millions of signals/second
- Probability of failures

ACT

- Integrate analysis with SAP Plant Maintenance
- Schedule maintenance order ahead of time
- Schedule resources for on-time availability



https://www.youtube.com/watch?v=ZSYITS9pcUE

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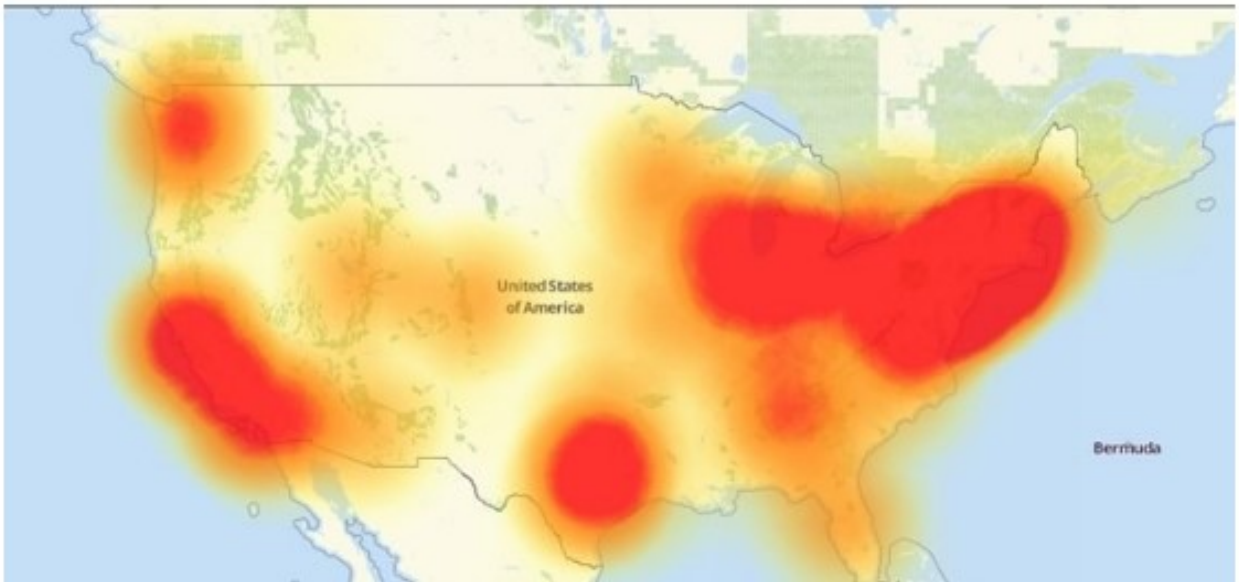
NEWS

DDoS attack shows dangers of IoT 'running rampant'

Experts, U.S. senator call for greater Internet of Things security

By Matt Hamblen | Follow

Senior Editor, Computerworld | OCT 25, 2016 2:02 PM PT



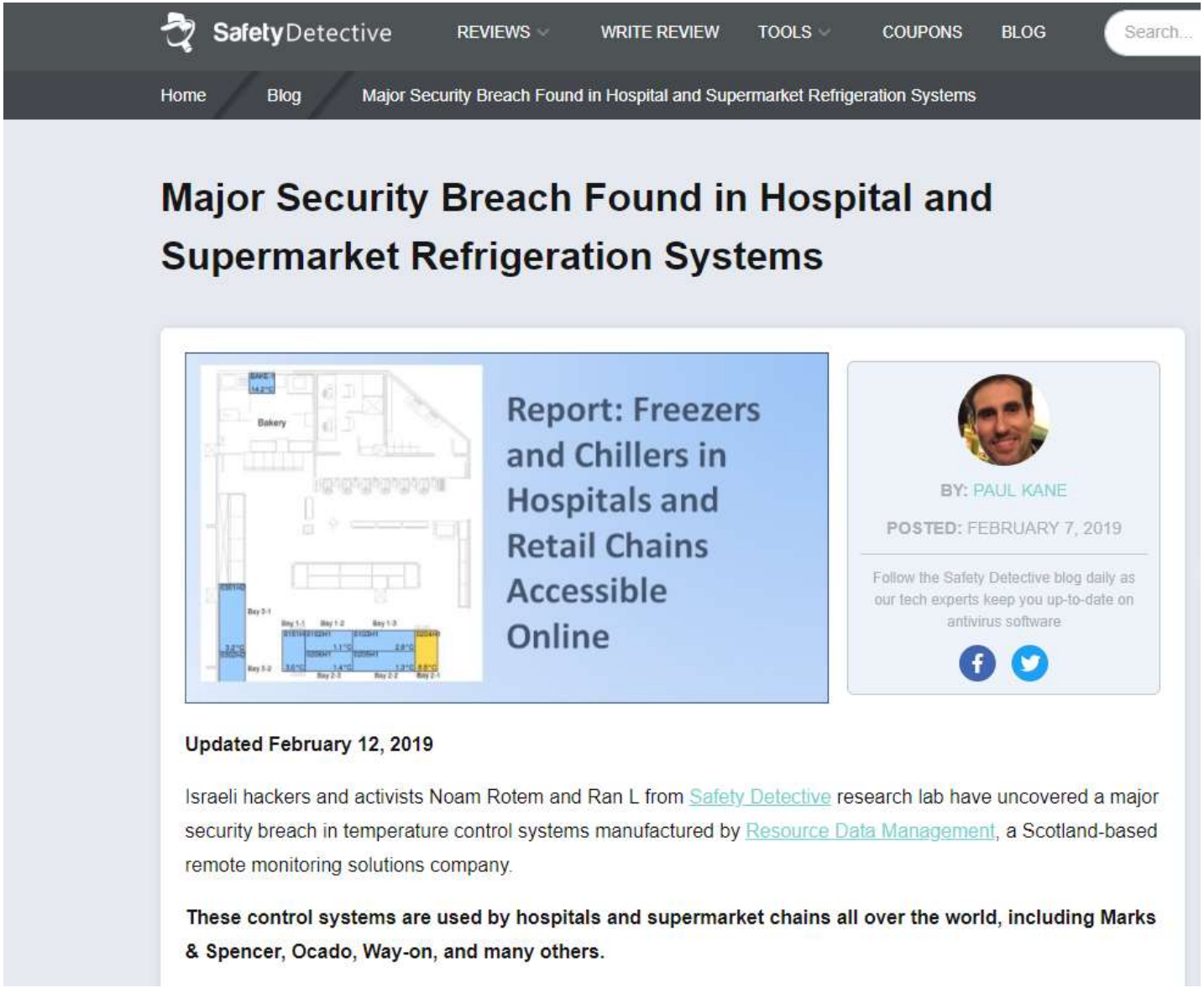
MORE LIKE THIS

After DDOS attack, senator seeks industry-led security standards for IoT...

Code in the wild to infect millions of IoT devices for crippling DDoS attacks

Hackers abusing a 12-year-old flaw to attack the internet of insecure things

https://www.safetydetective.com/blog/rdm-report/



INDUSTRY 4.0

DATA TYPES	DATA SIZE (PER WEEK)	EXAMPLES
Machine parameters and error logs	~5 GB per machine	Used to monitor machine performance: dispense height, placement (x, y, z), belt speed, flow rate, oven temperature, laser power, etc.
Machine events	~10 GB per machine	Used to measure process time: start dispense, end dispense, start setup, and end setup
Defect images from vision equipment	~50 MB per unit or 750 GB per lot	Used to identify root cause of failure modes, defect commonality, defect mapping

• Corpo livello cinque

Source: Intel

INDUSTRY 4.0

Preventive Maintenance
Systems are maintained at fixed intervals to ensure continuous availability.

- ⊕ no in-process sensors needed
- ⊕ reduces unplanned downtimes
- ⊖ waste in life cycles of spare parts
- ⊖ excessive maintenance and downtime

Condition Based Maintenance
Systems are maintained based on simple rules using equipment information.

- ⊕ good usage of equipment life cycle
- ⊕ limits unplanned downtimes
- ⊖ limited failure forecasting accuracy
- ⊖ medium risk of failures remains

Predictive Maintenance
Systems are maintained before failure, but run as long as possible without interruption.

- ⊕ optimal usage of equipment lifetime
- ⊕ minimizes unplanned downtimes
- ⊖ upfront investment necessary
- ⊖ expert knowledge required

INDUSTRY 4.0

Production Lines

Atlanta ⚠ | Singapore ⚠

Frankfurt | Raleigh

Line	Current Run	Time Left	Status
Line 1	Standard Run Genco Pura	-89 Hours	✖
Line 2	Standard Run Sterling Cooper	-89 Hours	✔
Line 3	Standard Run Good Burger	-87 Hours	✔
Line 4	Standard Run Cheers	-88 Hours	✔
Line 5	Standard Run Good Burger	-85 Hours	✔
Line 6	Standard Run Wonka	-87 Hours	✔

Facility Calendar

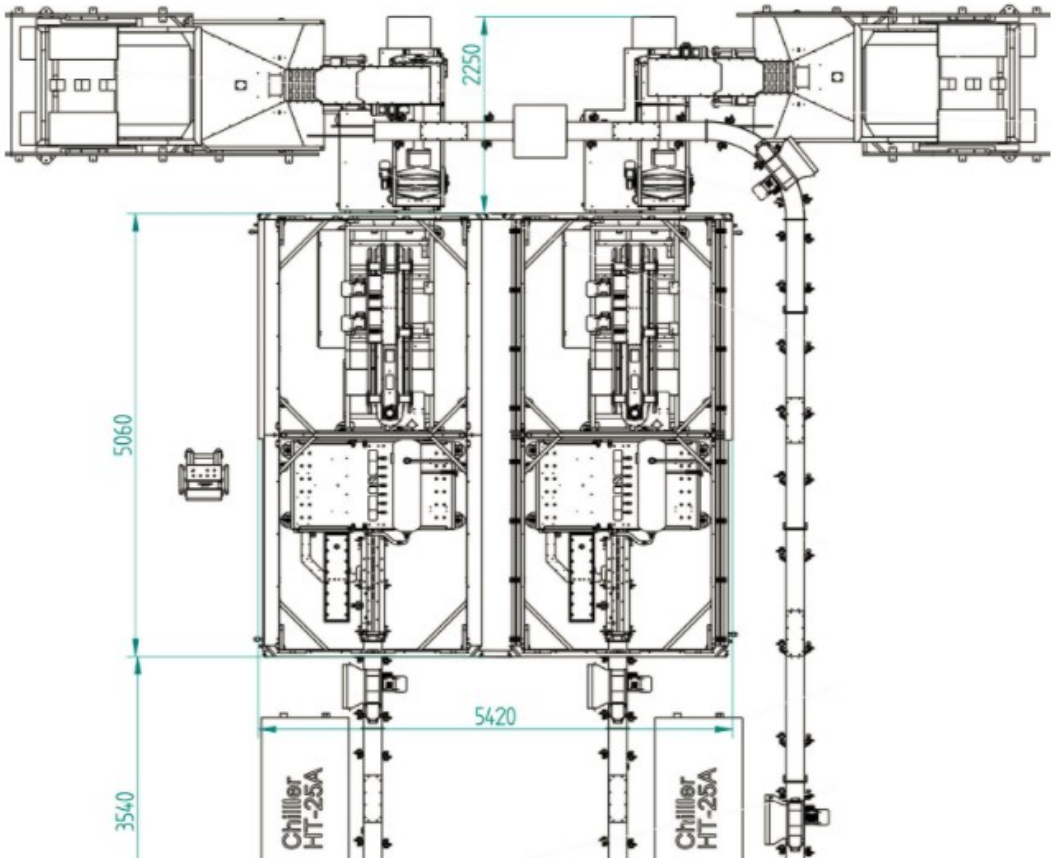
December 15, 2017

week | day | today | < | >

Friday

Product Line Floor

-- Select Line --



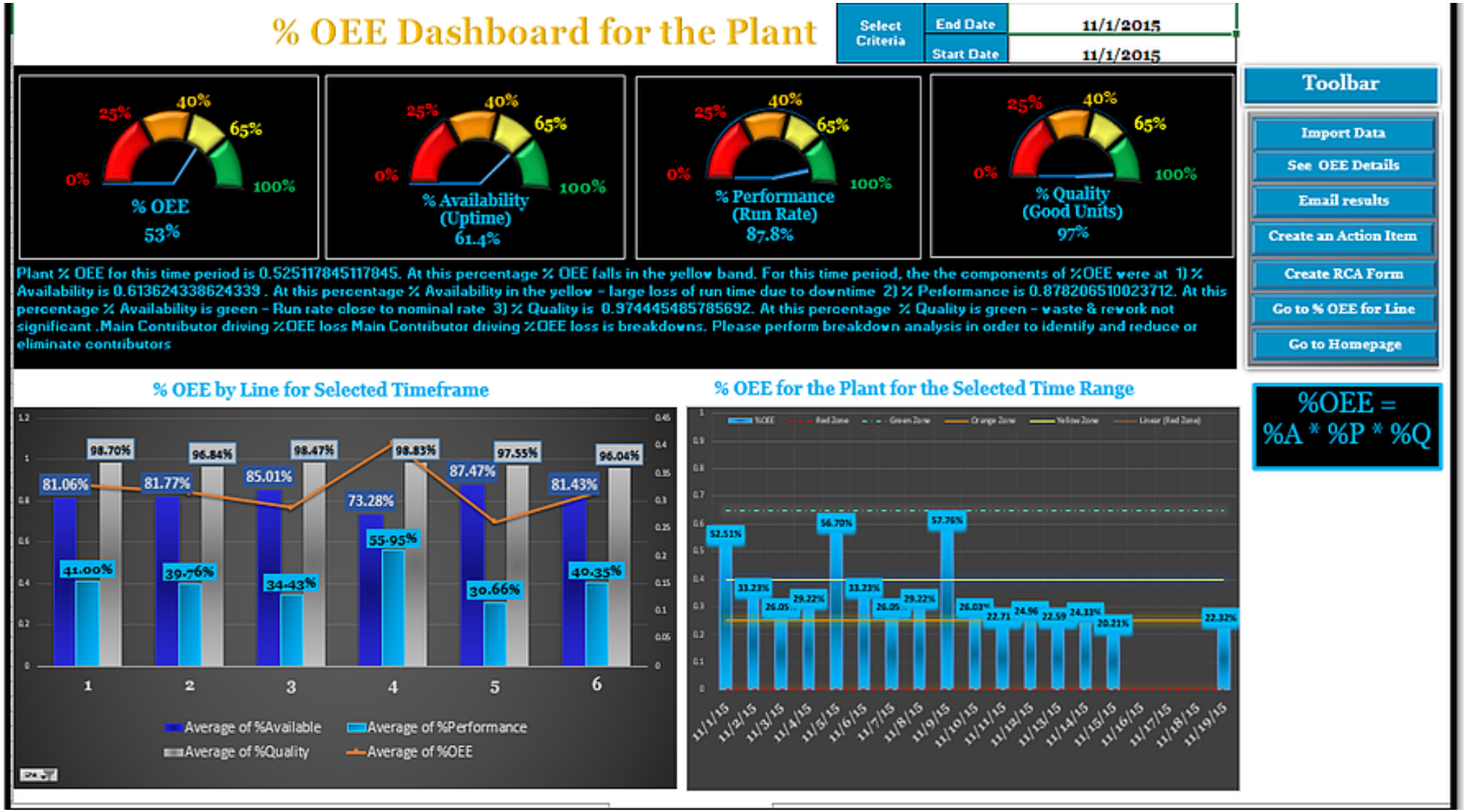
Production Line Details

ℹ Choose a line to view its details

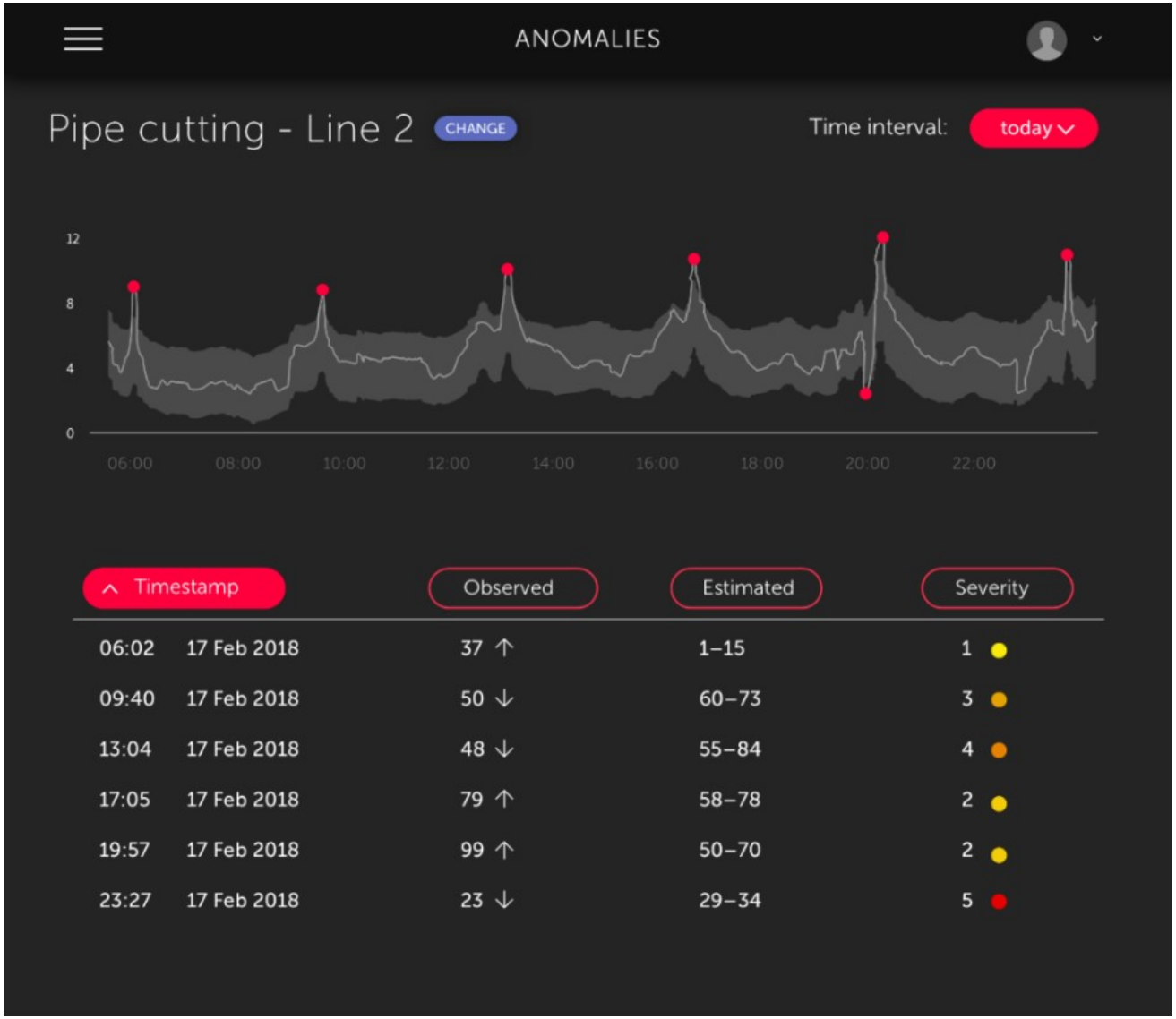
Machine Telemetry

ℹ Choose a machine to view its telemetry

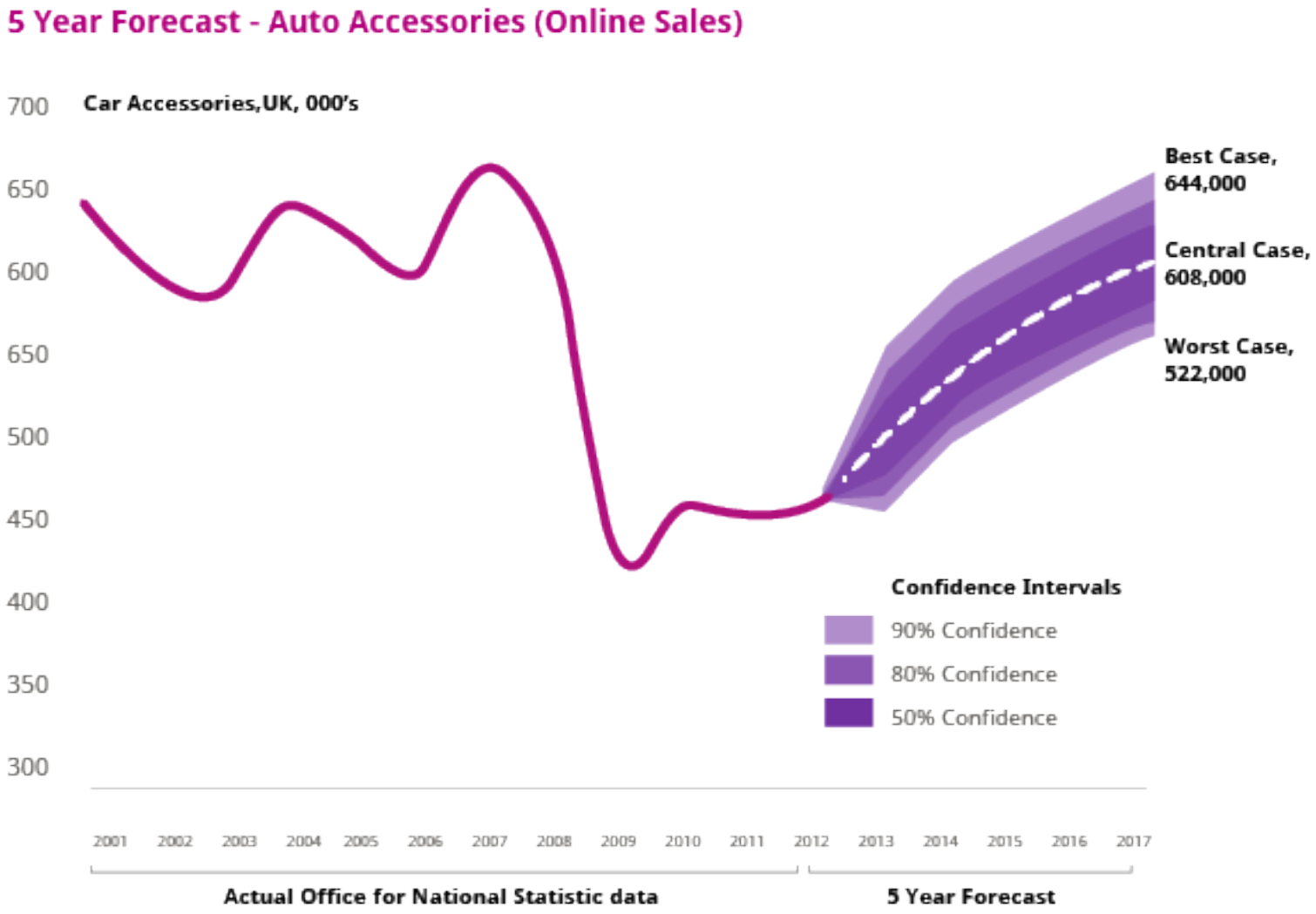
INDUSTRY 4.0


% OEE Dashboard for the Plant
Select Criteria
End Date
11/1/2015
Start Date
11/1/2015
% OEE
53%
% Availability (Uptime)
61.4%
% Performance (Run Rate)
87.8%
% Quality (Good Units)
97%
Plant % OEE for this time period is 0.525117845117845. At this percentage % OEE falls in the yellow band. For this time period, the the components of %OEE were at 1) % Availability is 0.613624338624339 . At this percentage % Availability in the yellow - large loss of run time due to downtime 2) % Performance is 0.878206510023712. At this percentage % Availability is green - Run rate close to nominal rate 3) % Quality is 0.974445485785692. At this percentage % Quality is green - waste & rework not significant .Main Contributor driving %OEE loss Main Contributor driving %OEE loss is breakdowns. Please perform breakdown analysis in order to identify and reduce or eliminate contributors
Toolbar
Import Data
See OEE Details
Email results
Create an Action Item
Create RCA Form
Go to % OEE for Line
Go to Homepage
% OEE by Line for Selected Timeframe
Average of %Available
Average of %Performance
Average of %Quality
Average of %OEE
% OEE for the Plant for the Selected Time Range
%OEE = %A * %P * %Q

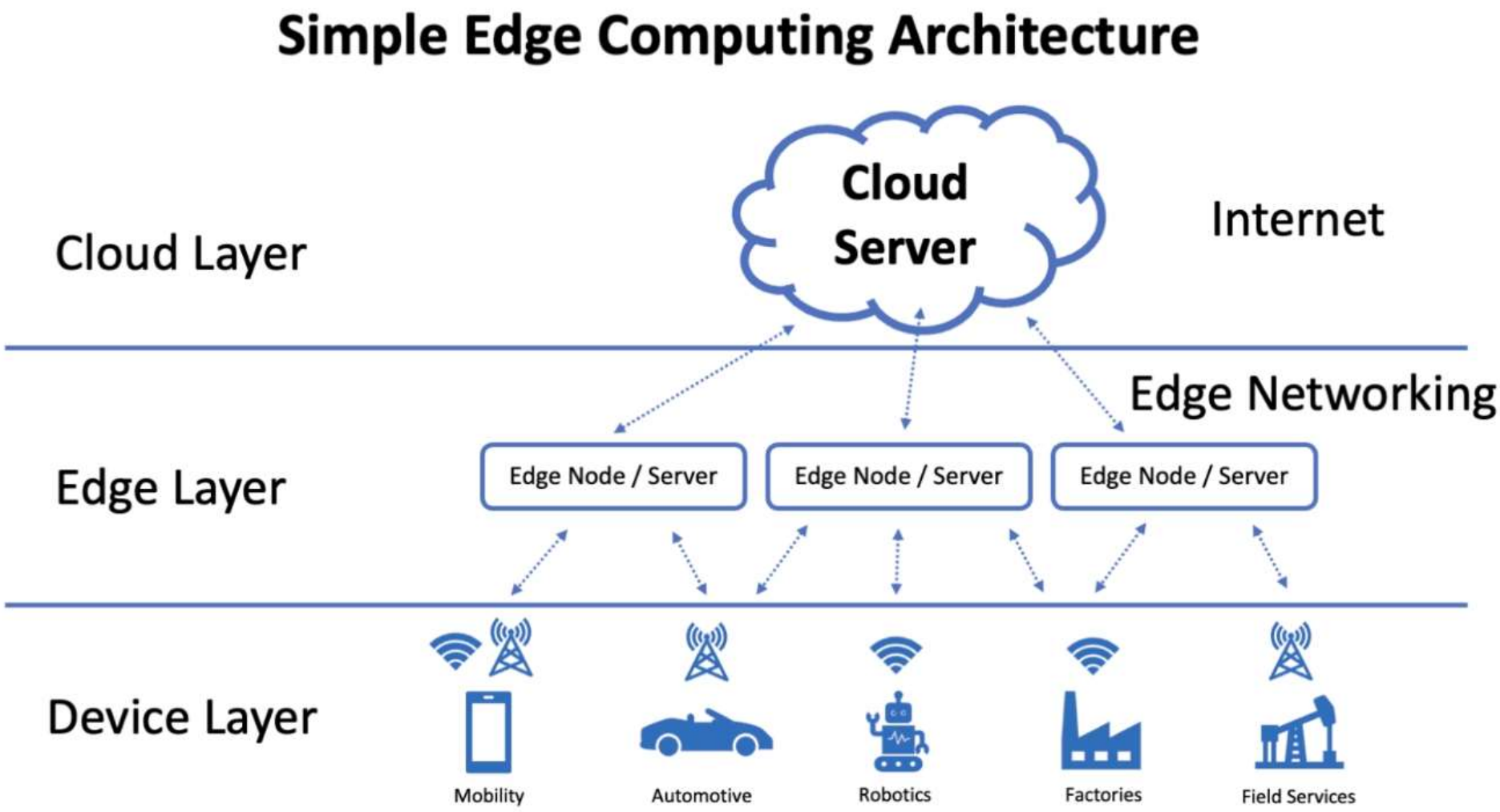
ANOMALY DETECTION



Forecasting



Edge Computing



Wired

Wireless

Short-range

Middle-range

Wide-range