

IOT & I4.0 DIGITAL TRANSFORMATION IN MANUFACTURING

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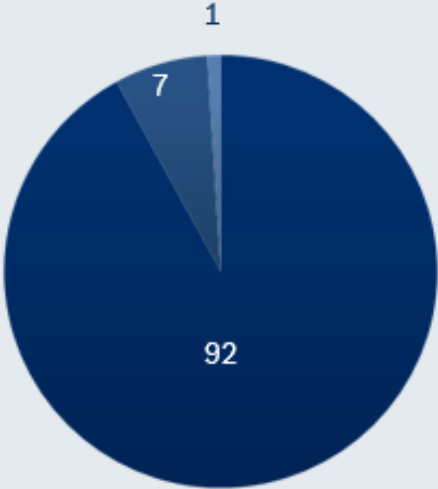
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Bosch Group

Business Sectors

Shareholders



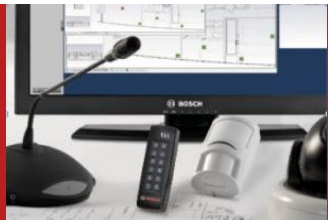
1 Robert Bosch GmbH
7 Bosch family
92 Robert Bosch Stiftung



Mobility
Solutions



Industrial
Technology



Energy and Building
Technology



Consumer
Goods

Bosch Business

Key figures 2017



total sales

390 bn MYR

€78bn

→ +6.7% from 2016



EBIT from operations

€5.3bn

→ 6.8% of sales

27bn MYR



total number of associates

400,500

11.200 more associates than previous year

R&D

9.6% of total sales

€7.5bn

38 bn MYR

Bosch is a financially-independent company, highly committed to R&D investment & constant innovation to ensure the future of the company & its associates.

Bosch at a glance | 2017



280 plants

Penang
3 plants

15 out of every
100 employees
in R&D

The corporate research
and advance engineering
sector's international research
network has

12 locations

in 8 countries

120

engineering locations

worldwide

59,000

associates

in research and development



3,000

additional associates

in research and development



>1 new patent
every 30 mins



€7.5bn

research and development
expenditure



R&D 38 b MYR

Bosch IOT Connected Boiler Management



Energy and Building
Technology

In house.
Remote.
Overseas

Boiler control
BCO

BCO



UL-S
UNIVERSAL Steam boiler



WA
Water analyser



WTM
Water treatment
module



WSM
Water service
module



CSM
Condensate
service module

Bosch IOT Connected Boiler Management



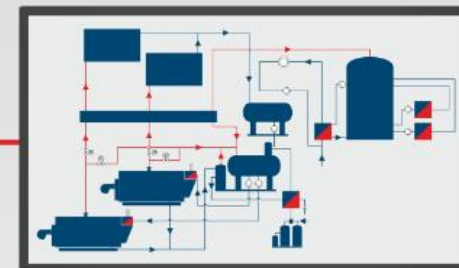
Energy and Building
Technology

In house.
Remote.
Overseas



System control
SCO

Process control system



Boiler control
BCO

BCO



UL-S
UNIVERSAL Steam boiler



WA
Water analyser



WTM
Water treatment
module



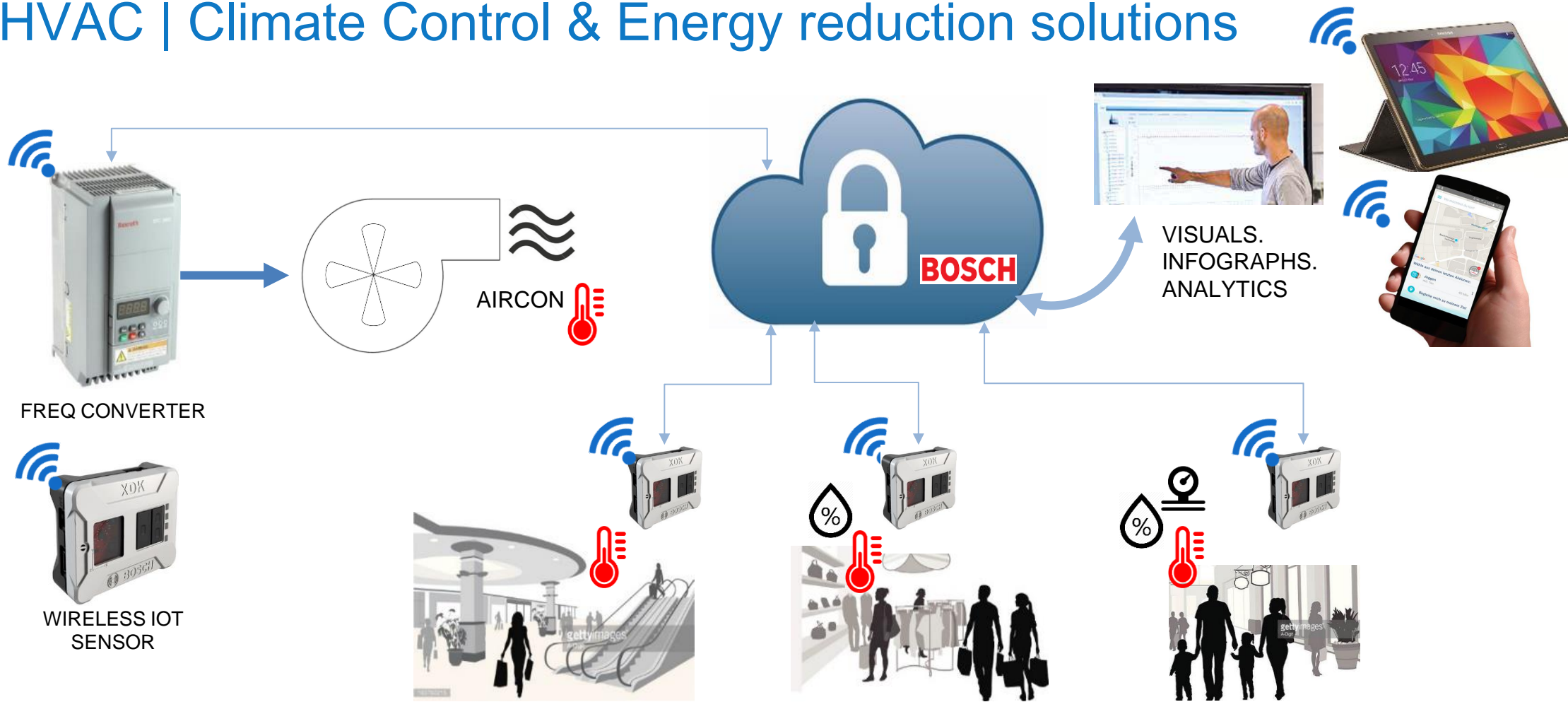
WSM
Water service
module



CSM
Condensate
service module

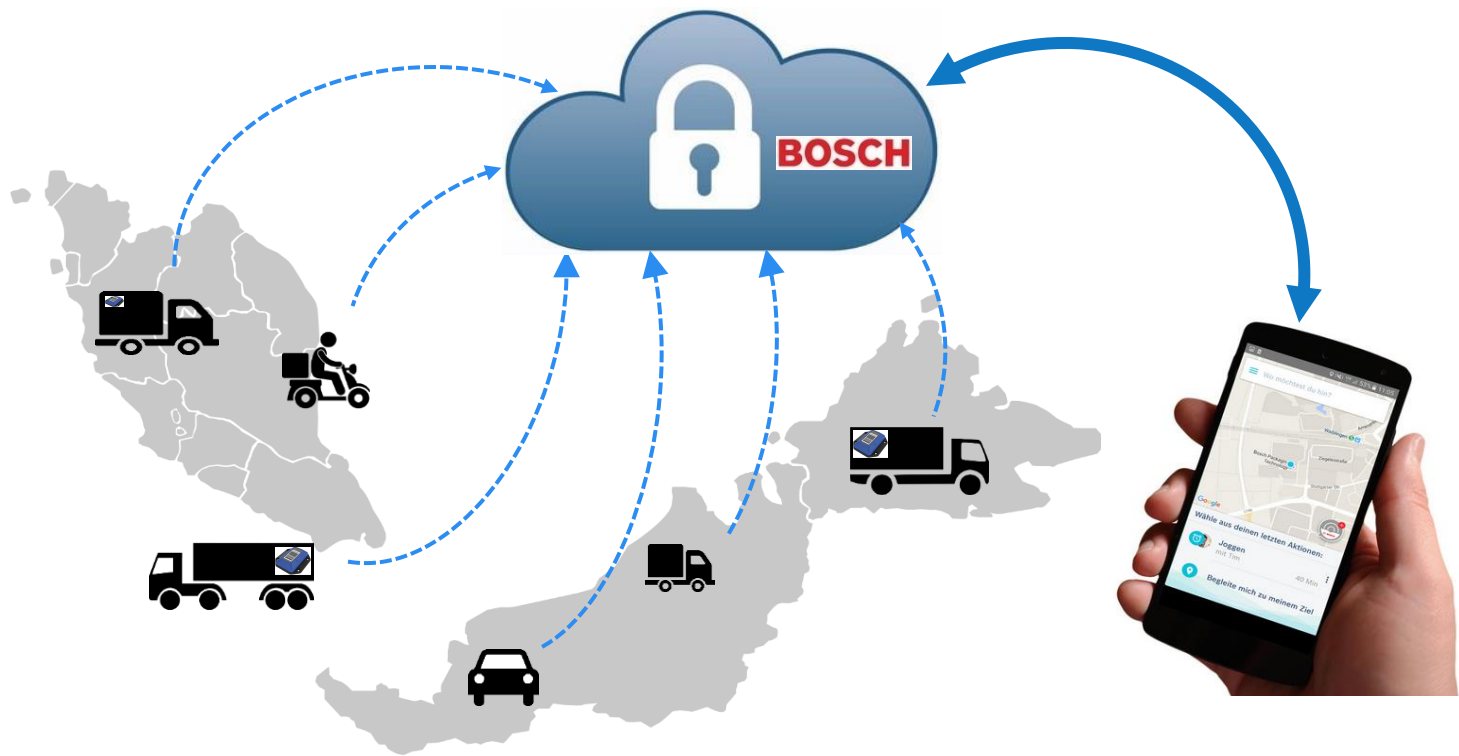
Bosch smart building solutions

HVAC | Climate Control & Energy reduction solutions

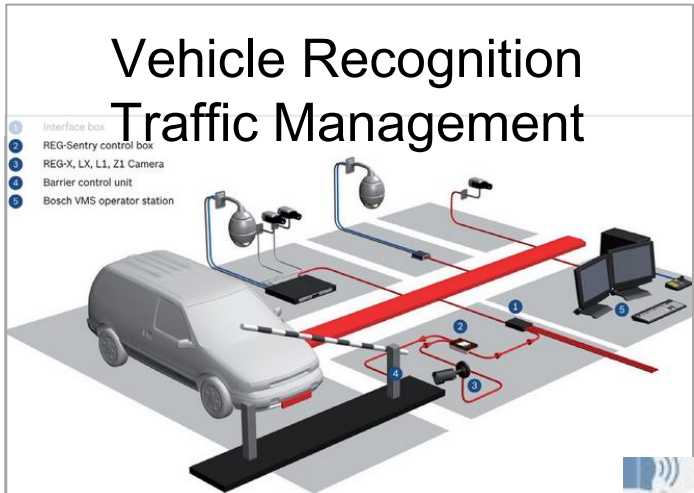


Bosch Mobility Smart Solutions

Fleet Management. Cargo Tracking & Monitoring



Bosch Security Technology



We need the best IP security solutions

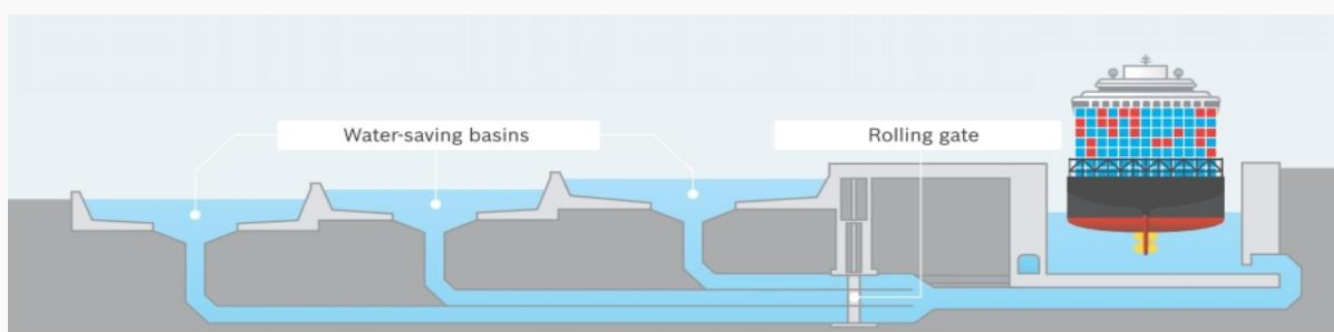
Integration Partner Program

Bosch easily integrates with even more partners



Connected Infrastructure

Panama Canal 2014-2017



Bosch—a planning & solution partner
3 yrs construction
158 hydraulic units and drive cylinder
Skills & production capacities from
DE,NE,CN,SK,MX,BR,USA.
New locks conserve regional water
supply²

Infrastructure

Flood Monitoring & Management | Ho Chi Minh City



Photo: Example of one of the flood barriers, design based on Dutch 'Hartelkering' (with courtesy of TrungNam)

Bosch delivers hydraulic system for Ho Chi Minh City flood mitigation projects
8kms on Saigon River
to help reduce risk of flooding
on 6.5 million people, over 570 sqkm

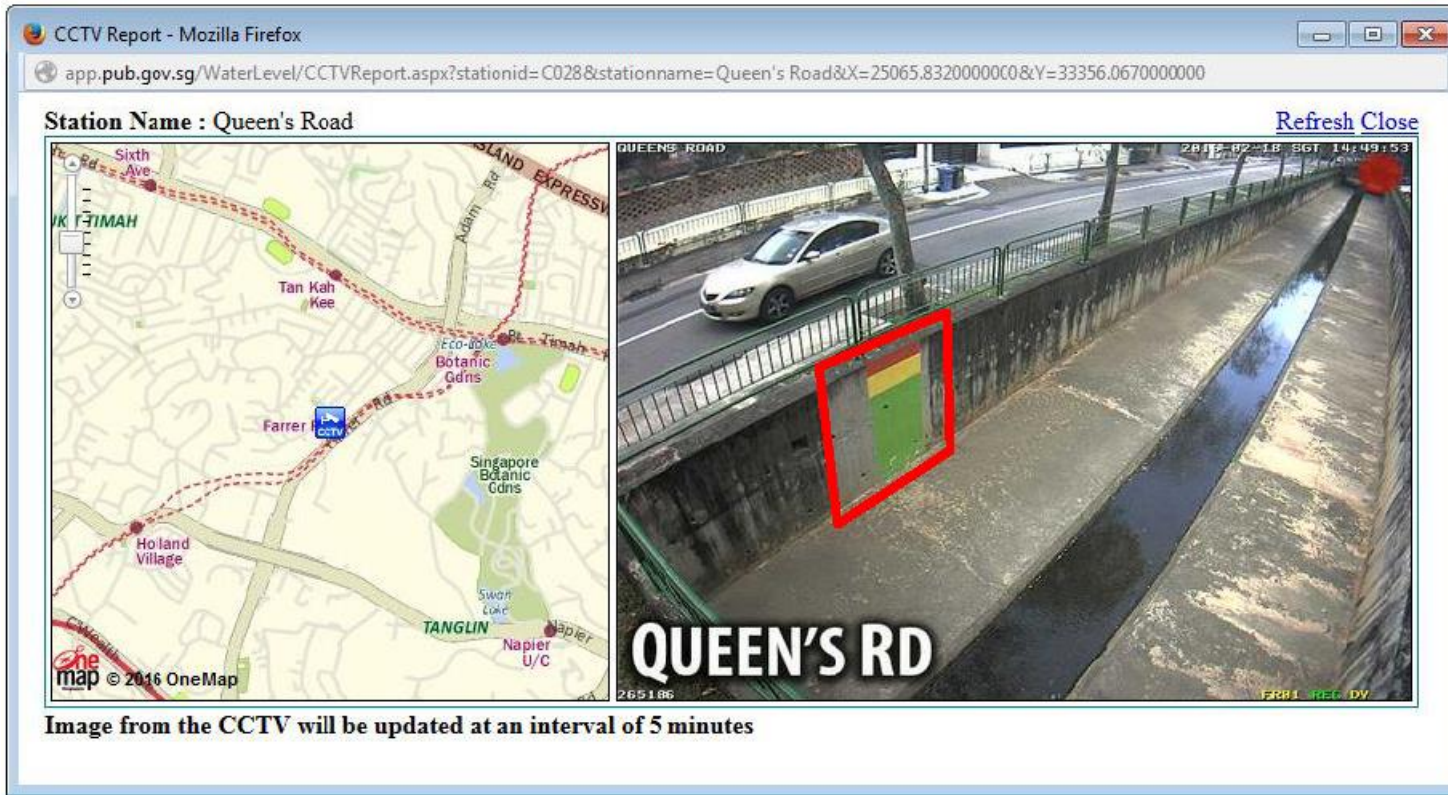
comprises 94 cylinders & 36 power pack
2017Nov.. 2018Apr
to drive & control 2 types of gates :
sluice gate & ship gates, both vertical &
rotating gates; operates storm surge barriers

Sensors & automatic response system

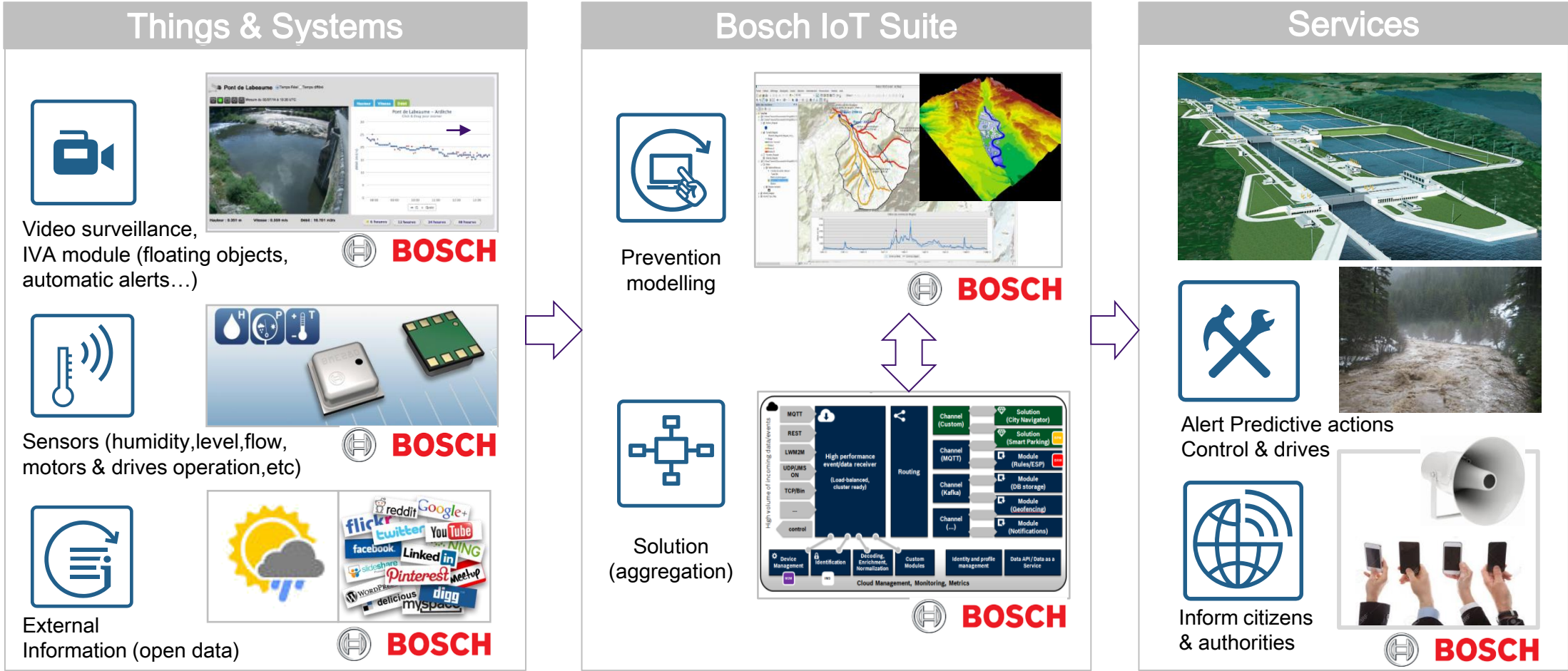
Cylinder rods protection from corrosion
by Bosch Enduroq 2200 >60,000 hours protection,
operating lifetime of 25..30 years.

Connected Security

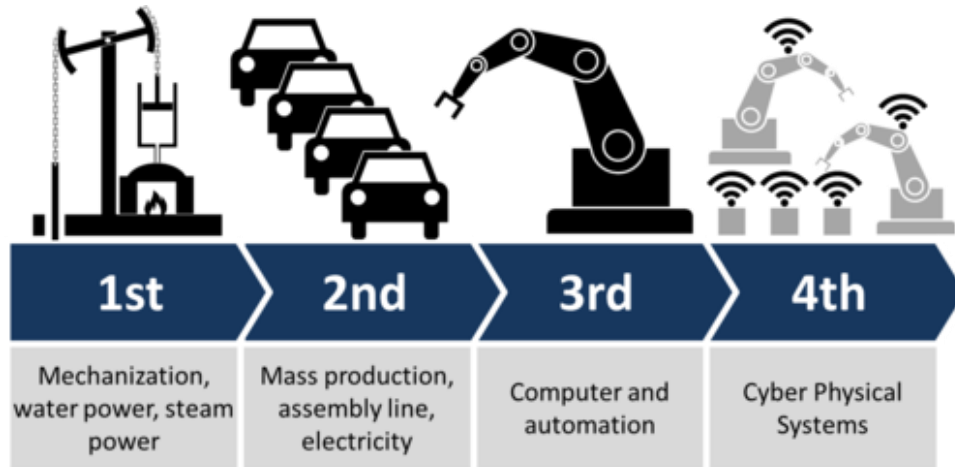
Flood Monitoring & Management | Singapore



Bosch Smart Solution | Flood Monitoring & Management



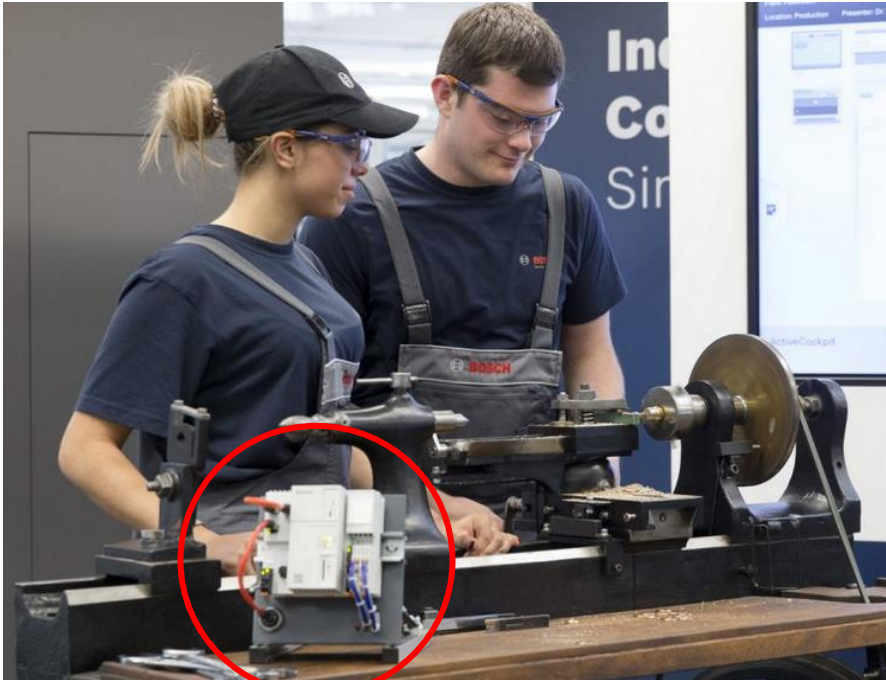
Industry 4.0



From Museum to I4.0

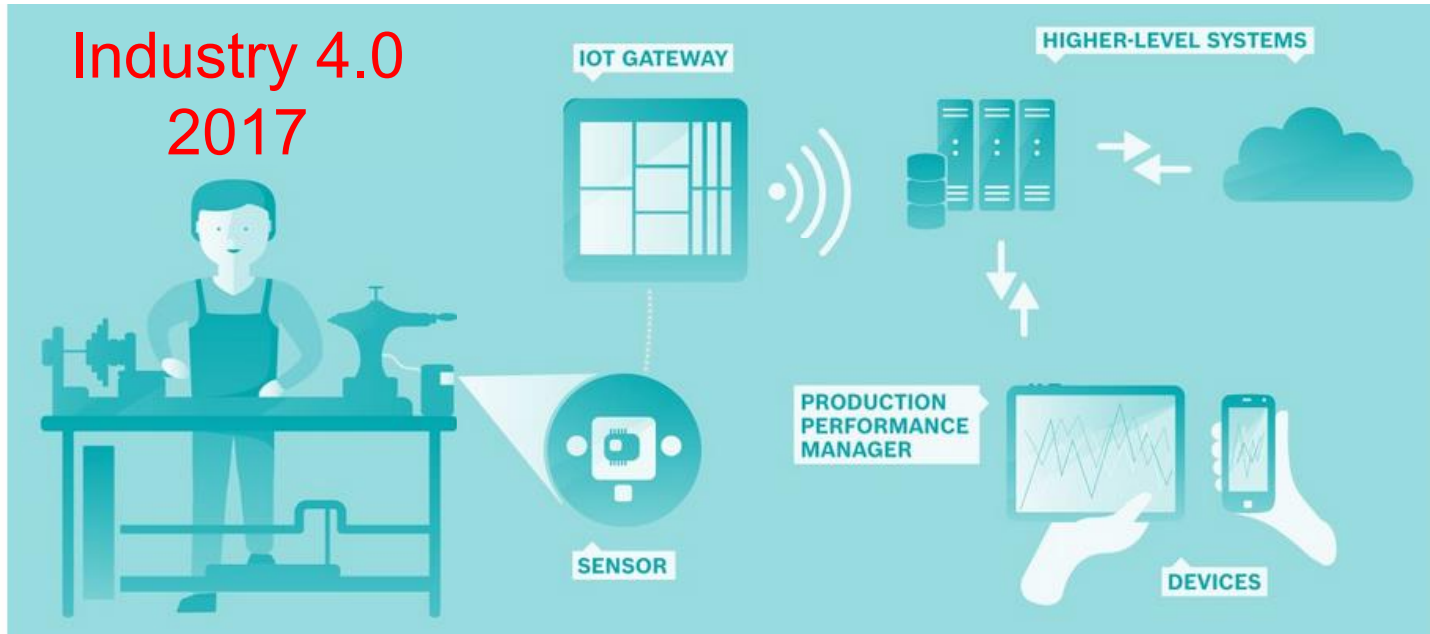
Year 1888, cast iron workbench to wind coil for starter motor taken out of the museum

Year 2017 upgraded into the Industry 4.0 using
Sensors and IoT Gateway from Bosch



Bosch I4.0

How to turn a workbench into I4.0



Sensors monitor process & parameters

IOT Gateway transmits data :
can be viewed by the foot pedal operator in real time on a monitor.
He can control how fast/slow to pedal.

Connected workbench recognises the smallest changes on the drive.
eg. the aging leather drive wheel & the spindle can start to slip: invisible for the human eye.
Sensors recognise minute deviations.

Perpetual & continuous **quality control**.

Constant **state of equipment state** and **process monitoring** to prevent unplanned downtimes.

Industry 4.0 in Practice – Use cases

Multi products line: Flexible manufacturing

30%

stock reduction,
no setup



Up to
0.5 mio €
savings
year / line

10%
output
increase

Active Cockpit: Shopfloor digitalization

Interactive
information &
communication
platform for
shop floor



30%
efficiency increase
in presentation
of information &
decision making

Condition Monitoring & Maintenance Support System

12%

reduce of
unplanned
stoppages



Stock
reduction
20%

People as
key players



Connecting machines & using their data with IOT Gateway

25%
Maintenance costs

20%
Reduce of
manual testing

ROI <
1,5 years

Collaborative robots



Energy Platform

Reduction of
energy consumption
1.65 Mio. €
p.a. in Homburg
plant



Improved
resource
efficiency with
condition-based
maintenance

40%
cost reduction for
compressed air

Consulting to Implementation Services

Bosch Connected Industry Solutions

We have a diverse experience of I4.0 consulting for multiple manufacturers. We had created the complete I4.0 blue print with solutions implementation roadmap.



Multiple
Companies

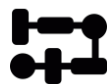
Consulting & Design



Value Stream
Design

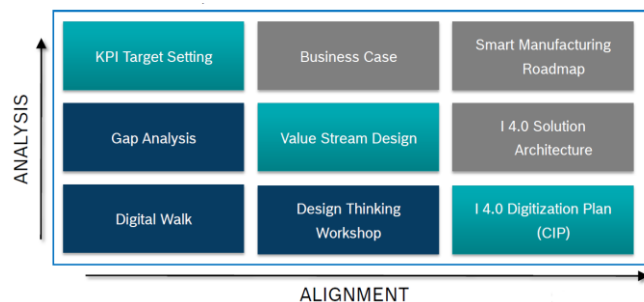


Improvement
Plan &
Roadmap



Smart
Manufacturing
BluePrint

- Industry 4.0 Domain Experts
- Lean Manufacturing Experts
- Solution Architects



Industry 4.0 live at Bosch

i4.0 use cases and benefits – examples

Digital Supply Chain

- ✓ stock saving
- ✓ efficiency increase
- ✓ transparency along supply chain

Convertible Equipment

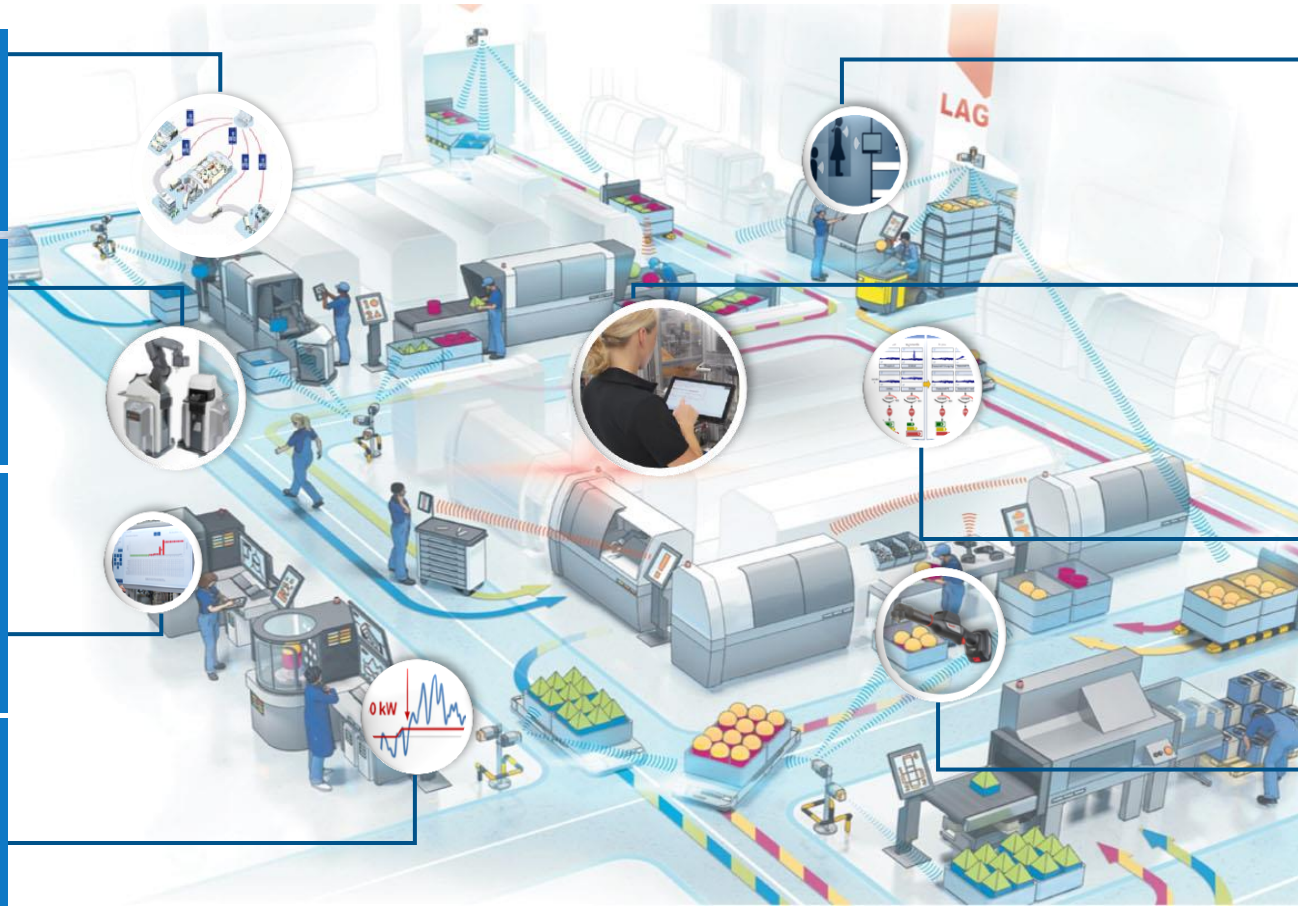
- ✓ fix cost reduction
- ✓ efficient M2H collaboration
- ✓ human relief of heavy load / repetitive tasks

Shop Floor Mgmt. Information

- ✓ real time data
- ✓ fast escalation
- ✓ paperless

Power / Energy Management

- ✓ peak reduction
- ✓ energy cost saving



Operator Support

- ✓ agility & quick reaction
- ✓ quality increase
- ✓ efficiency increase

Predictive Maintenance

- ✓ improve OEE
- ✓ no sudden breakdown

Adaptive Testing

- ✓ increase efficiency
- ✓ less invest

Quality Improvement

- ✓ instant feedback
- ✓ fast identification of error sources

Industry 4.0 live at Bosch

Flexible Automation - APAS assistant

- Flexible
- Mobile
- Collaborative
- Connected



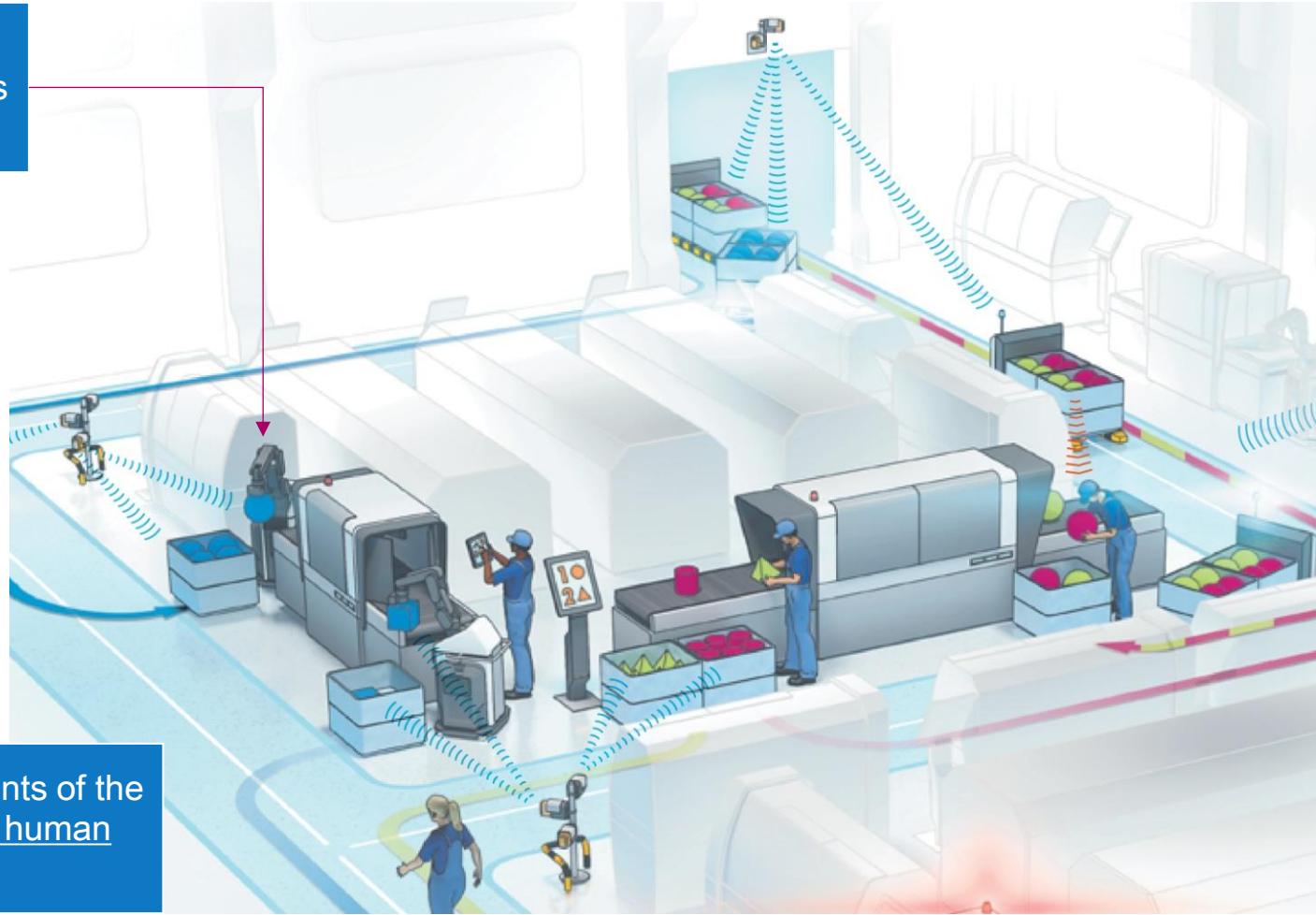
Industry 4.0 live at Bosch

Robots share the load:

Handling of dangerous, strenuous, or monotonous tasks so associates don't have to.



The APAS Family: The mobile production assistants of the APAS family already work hand in hand with their human colleagues. APAS: Automated production assistant



Industry 4.0 live at Bosch

Round or angular?: Components tell machines how they need to be shaped. The system then adjusts itself accordingly.



Bosch Rexroth in Homburg:

A manufacturing system with batch size of one already is in place producing many products on one line.

Industry 4.0 live at Bosch

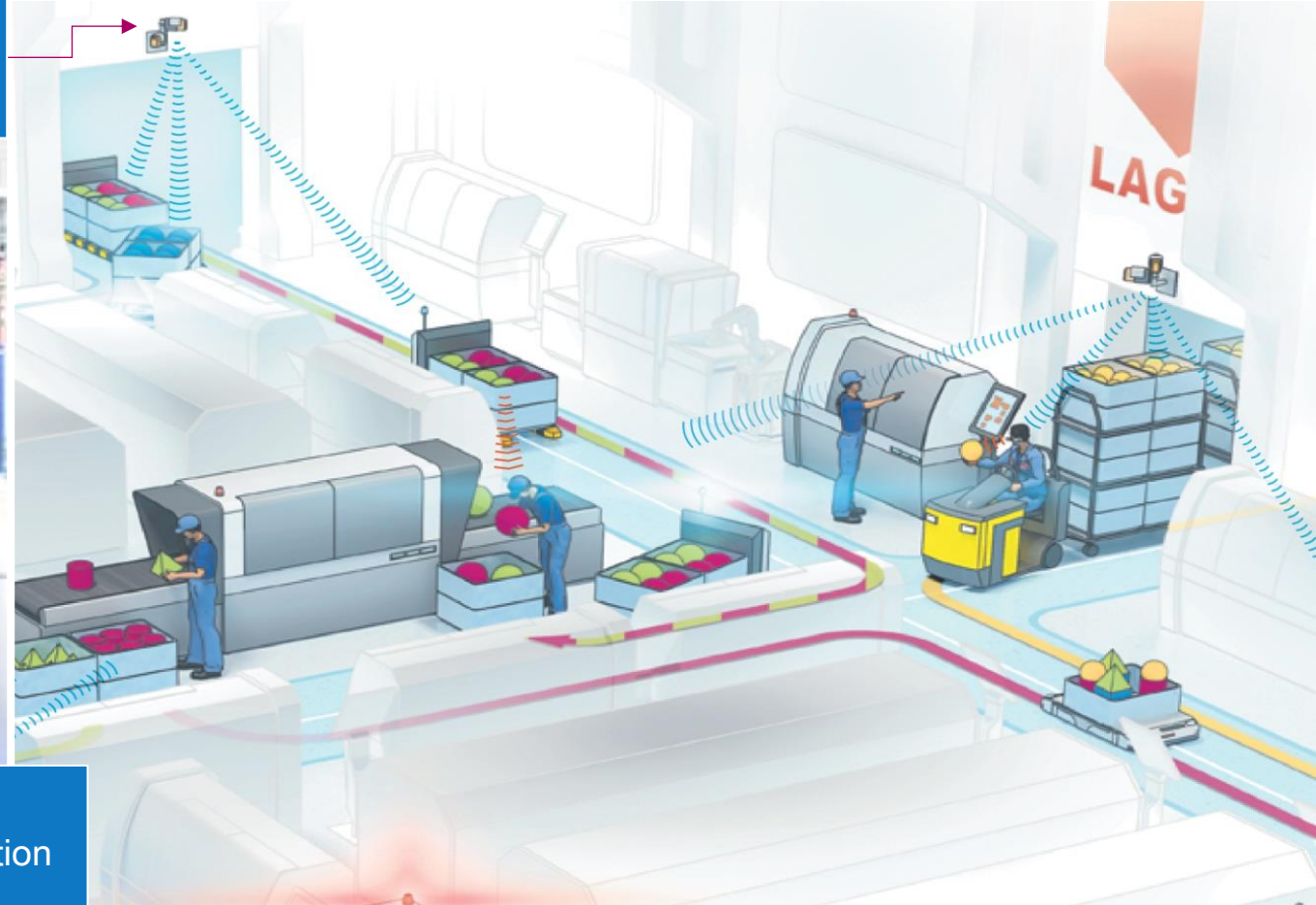
Flows of Goods digitally recorded:

Due to automatic data capture the supply chain is virtually mapped and logistics are optimized.

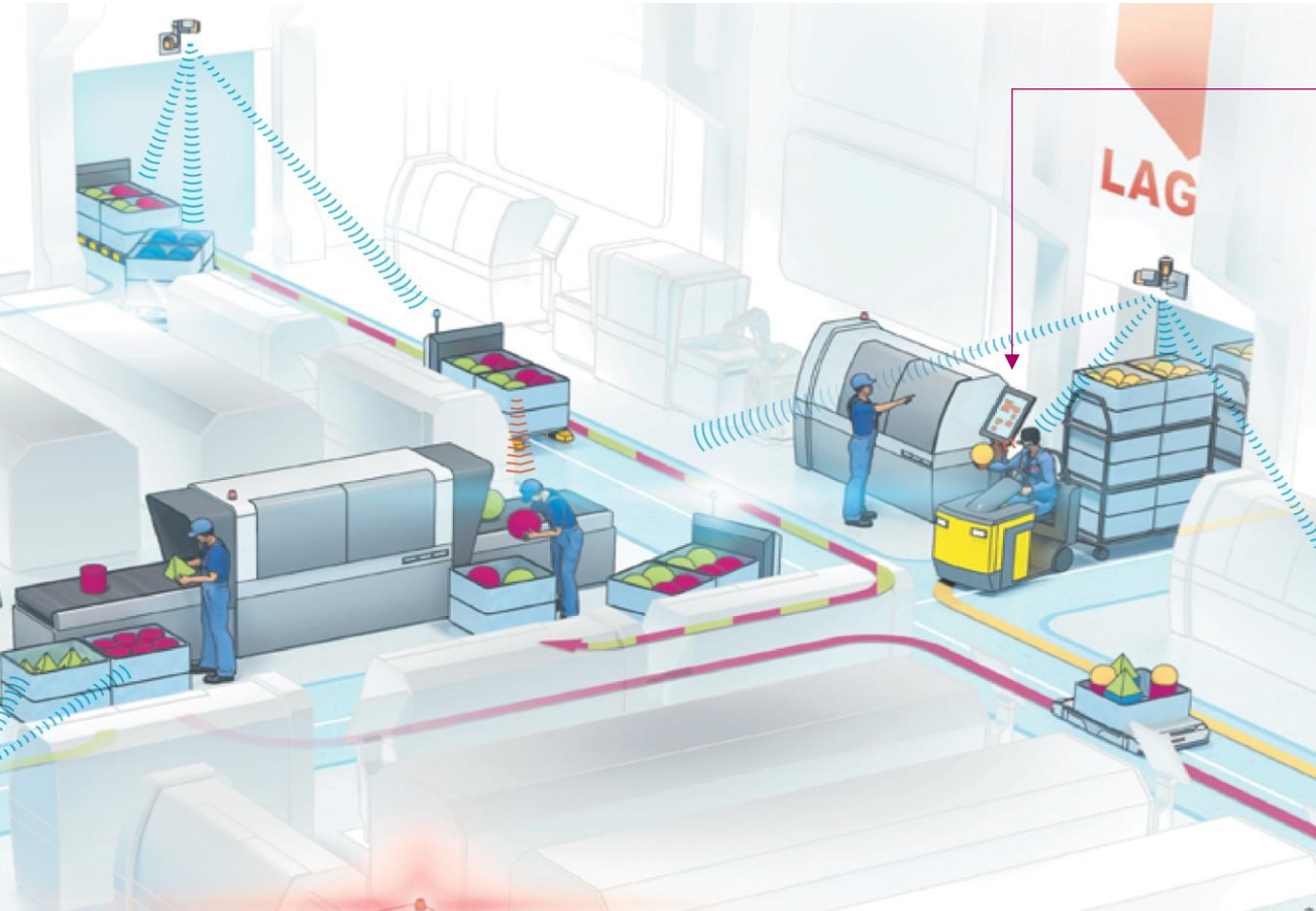


RFID technology:

In pilot projects the plant is already aware of the condition of products and containers via RFID technology.



Industry 4.0 live at Bosch



Faster Work with technical aids:
Warehouse associates receive their orders and operating instructions directly on displays.



Smart glasses:
Technical aids like smart glasses make work easier. Initial tests are being conducted in Bosch plants.

Industry 4.0 live at Bosch

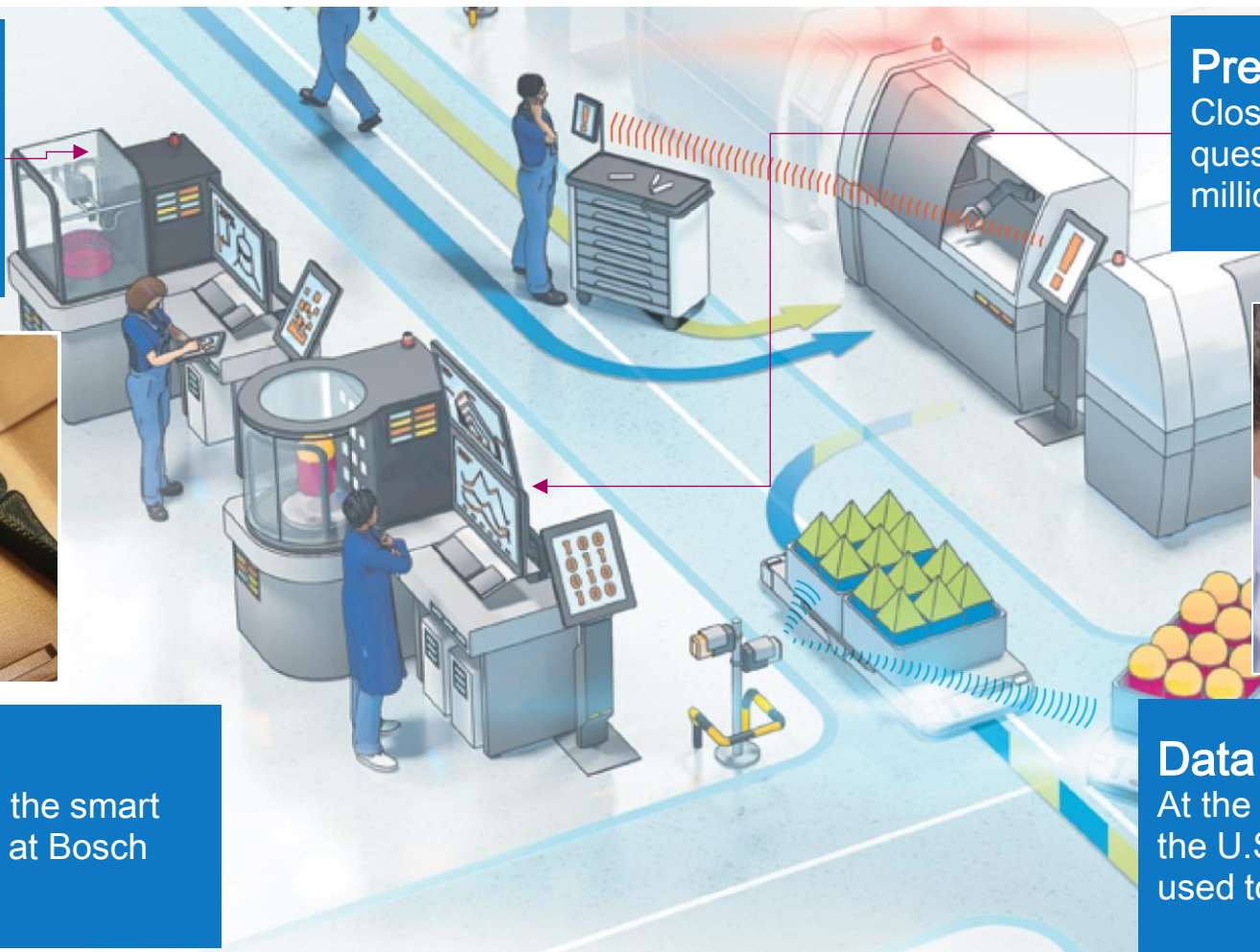
Models at top speed:

A component is drafted on the computer, sent to the device, and produced there from a base material



Rapid prototyping:

3D- printers have a place in the smart production. One application at Bosch is prototype production.



Predictive quality:

Close examination of questionable parts based on millions of data points.



Data mining for quality:

At the Anderson plant in the U.S. “data mining” already gets used to improve quality.

Industry 4.0 live at Bosch

Facilities predict problems:

Smart lines analyze data and report problems directly to the service department.

Data from Tools:

Tools are networked and send important data to server for quality proof.



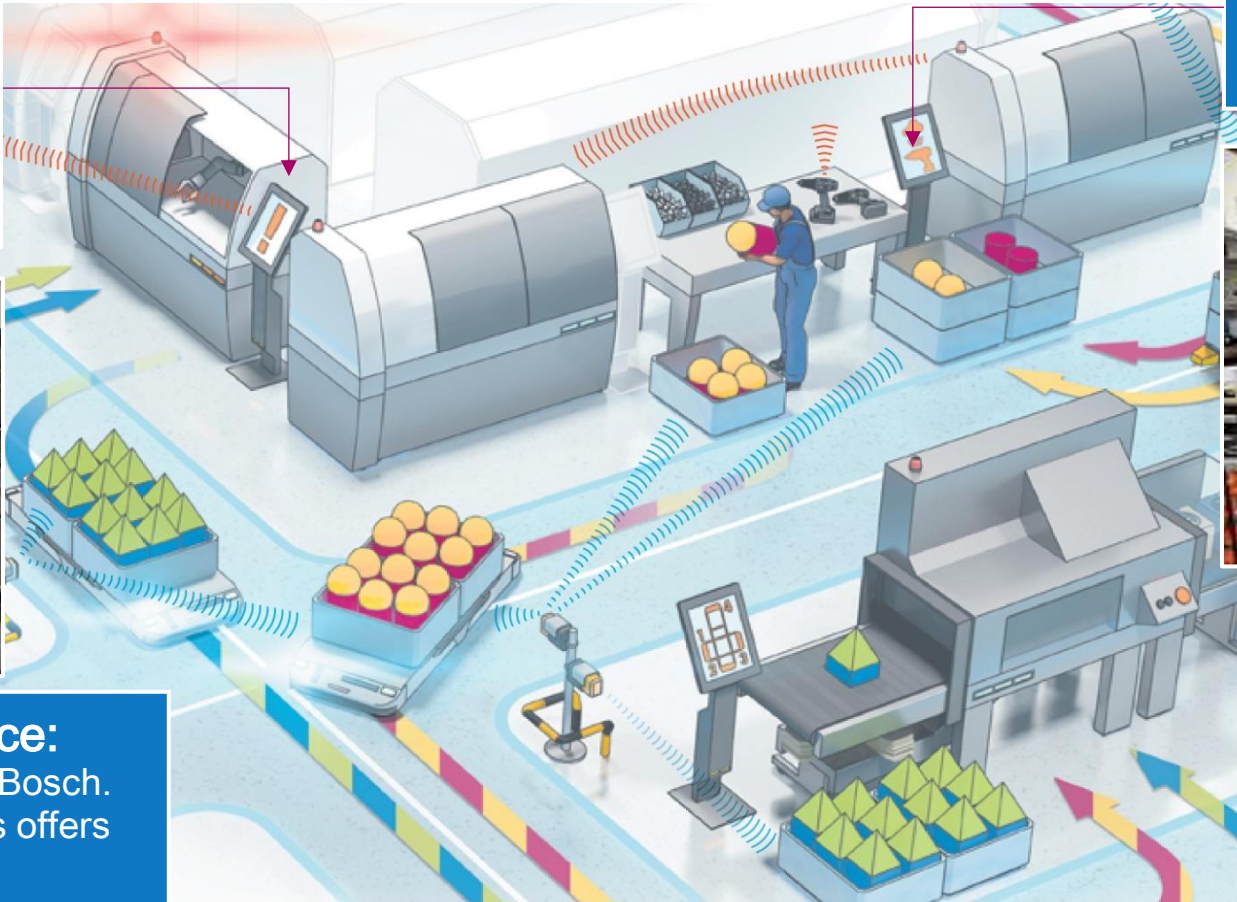
“Nexo” Smart Tightening:

Screwdriver is able to measure and submit the tightening torque & screwing angle for quality prove.



Predictive Maintenance:

A pilot is up and running at Bosch. Bosch Software innovations offers this type of solutions



Industry 4.0 live at Bosch

Logistics with RFID




**LOGISTIK
AWARD 2014**
VDA | Verband der
Automobilindustrie

10%
efficiency increase
in processes

30%
reduction of stock
in processes



30%
stock reduction
no setup

Up to
0.5 mio €
savings
year / line

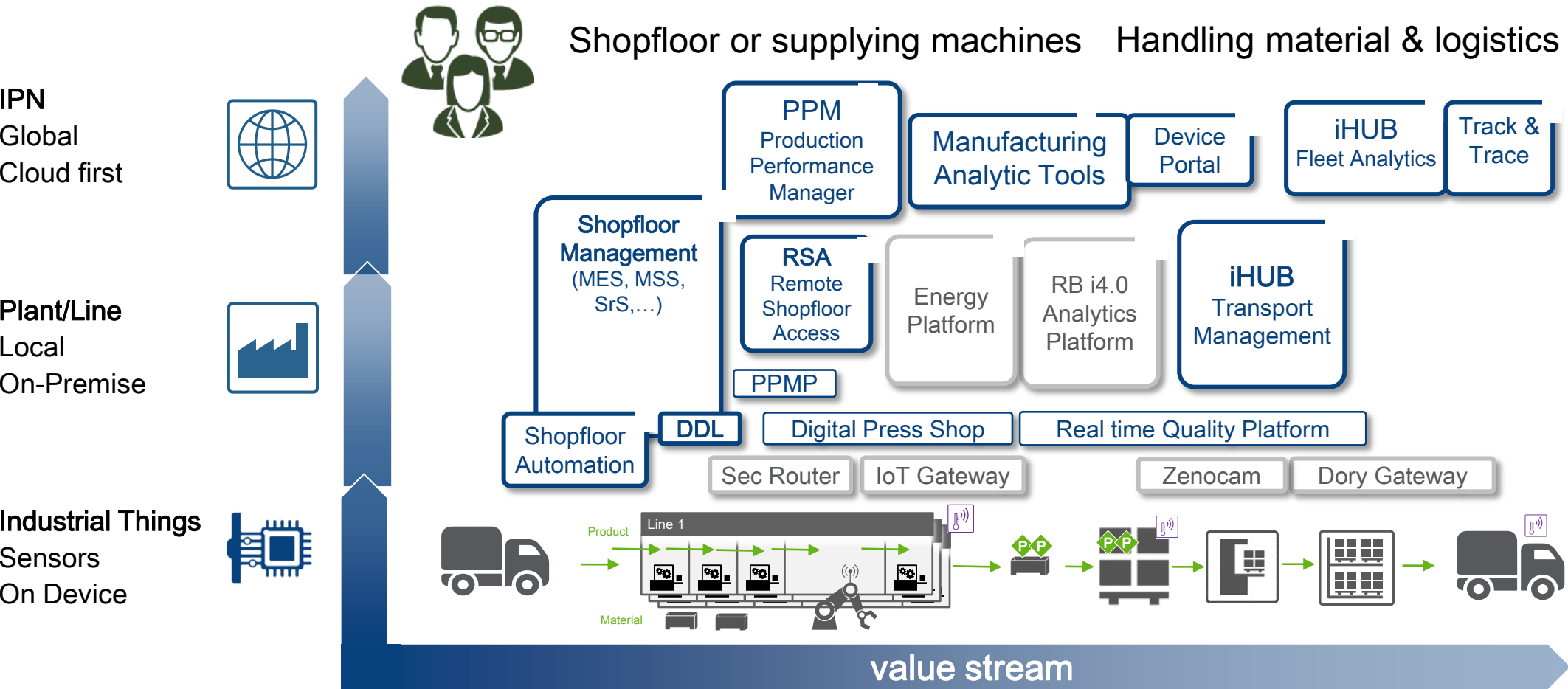
10%
output
increase


People as
key players



Bosch Industry 4.0 Platform Portfolio

Bosch Connected Industry solution overview



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