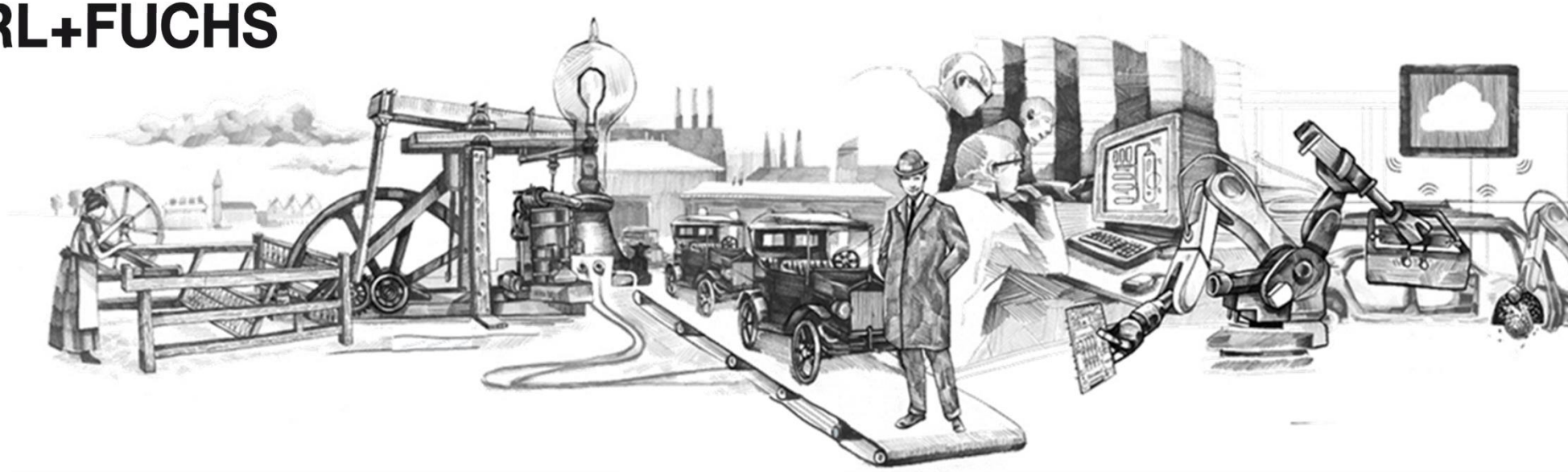
PPERL+FUCHS



Digitization of Automation Industries

Arasu Thanigai
Pepperl+Fuchs Singapore
Mumbai – 17th Nov 2018

Instrumentation Experts Club

Agen

- Pepperl+Fuchs – A brief introduction
- What is Digitization?
- Digital industrial networks and the fourth industrial revolution
- IIOT / Industrie 4.0
- “Industrie 4.0” - Emerging Technologies
- Futuristic Technologies in AI - NLP, ML, DL and Robotics technologies
- Conclusion

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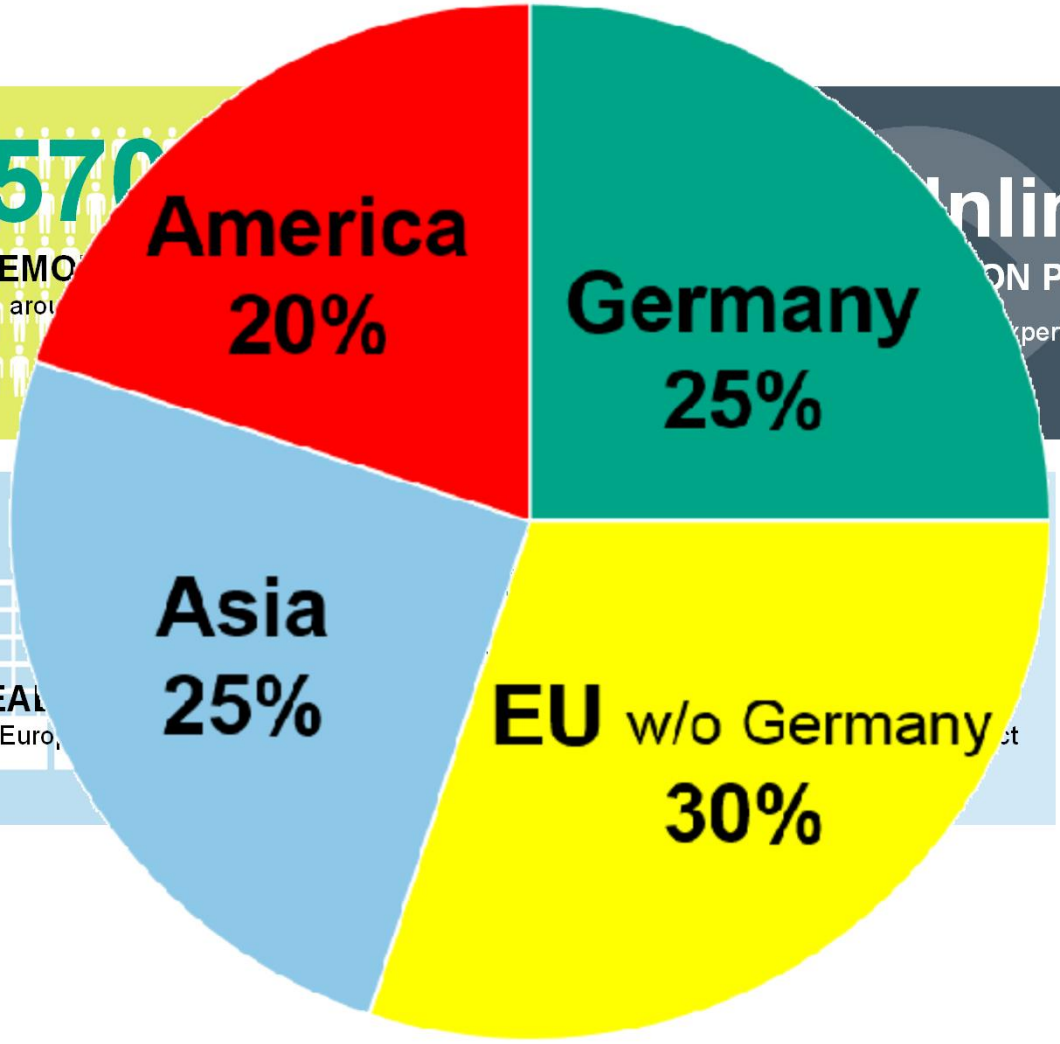
P+F Group at a glar

Global Sales



nlimited
ON POSSIBILITIES
xperts throughout the world

60
YEARS
since the company was founded in Mannheim, Germany

3000
PRODUCT
for the individual ne
our customer'
applications

5
GLOBAL MANUFACTURING SITES

2
FOUNDER FAMILIES
privately own 100% of the company in the third generation.

50%
OF ALL EMPLOYEE
generate value
production

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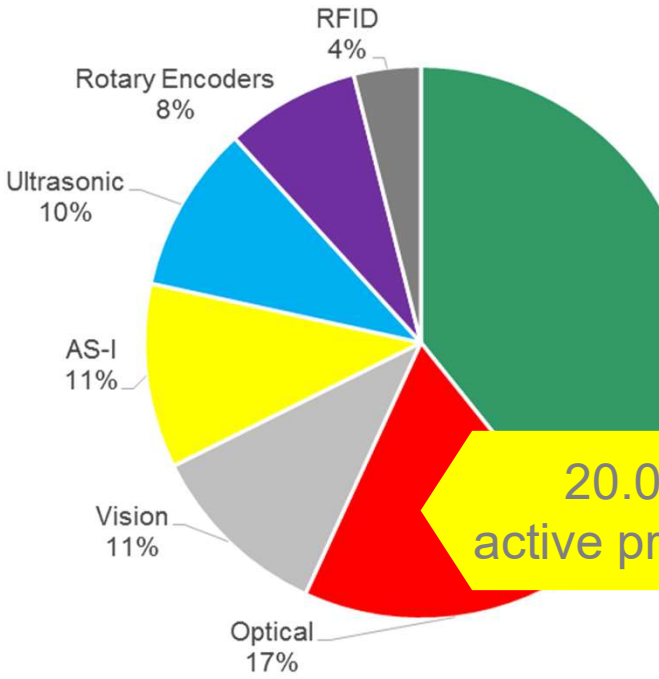
Division Factory Automa

Industrial Sensors + Sys



- Proximity sensors
- Photoelectric sensors
- Industrial vision
- Ultrasonic sensors
- Rotary encod
- AS-Interface
- RFID

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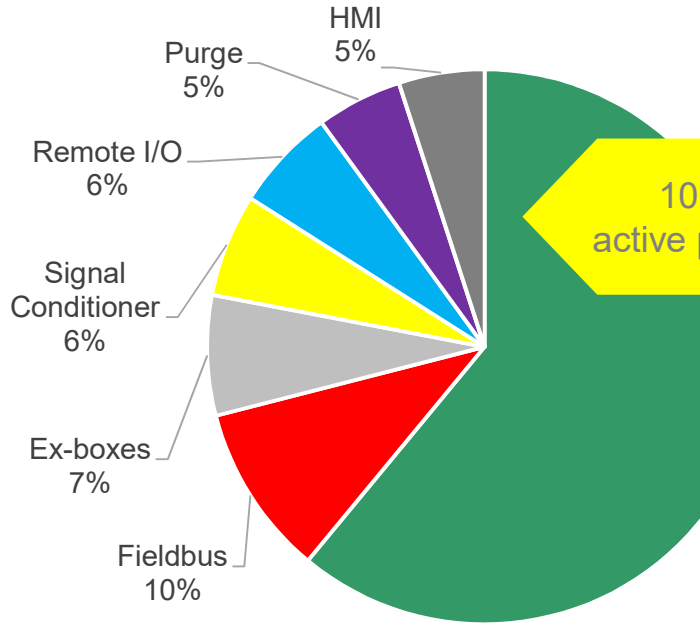
Division Process Automat

Explosion Protection + Connect



- Intrinsically safe barriers
- Signal conditioners
- Fieldbus
- Remote I/O-Systems
- Purge syste
- HMI systems
- Explosion pr equipment
- Wireless Tec

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bile Computing Equipment

eld equipment is accessible via Ethernet form “everywhere” maintenance people wou

ave access to it from the field.

s requires

A wireless access in the field (WiFi, GSM, LTE, …)

Mobile Computing Equipment such as Tablet’s, Ipad’s, mobile phones…

sable in the field, including hazardous areas

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Digitization Vs Digitalization Vs Digital Transformati

What is Digitization?

It is the automation of a process by digitizing information and injecting technology for the purpose of automation

Analog to Digital data

4-20mA to Digital System (Fieldbus / Ethernet Based)

Digitization Vs Digitalization Vs Digital Transformati

Digitization is not new

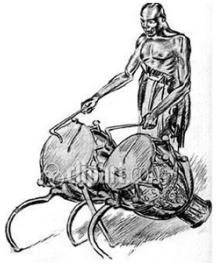








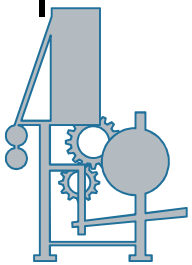




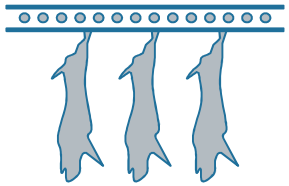


Digitization Vs Digitalization Vs Digital Transformati

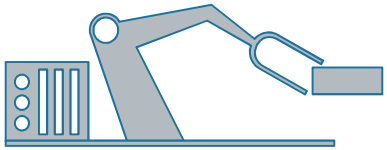
Process Control Digitization



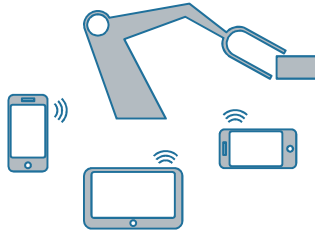
ter and steam
able mechanical
duction



Electricity separates
work steps



Electronics automate
production processes



Based on cyber-
physical systems

Digitization Vs Digitalization Vs Digital Transformati

Digitalization

Use of digital technologies and of data (digitized and natively digital) in order to create revenue, improve business, replace/transform business processes *(not simply digitizing them)*

Create an environment for digital business, whereby digital information is at the core

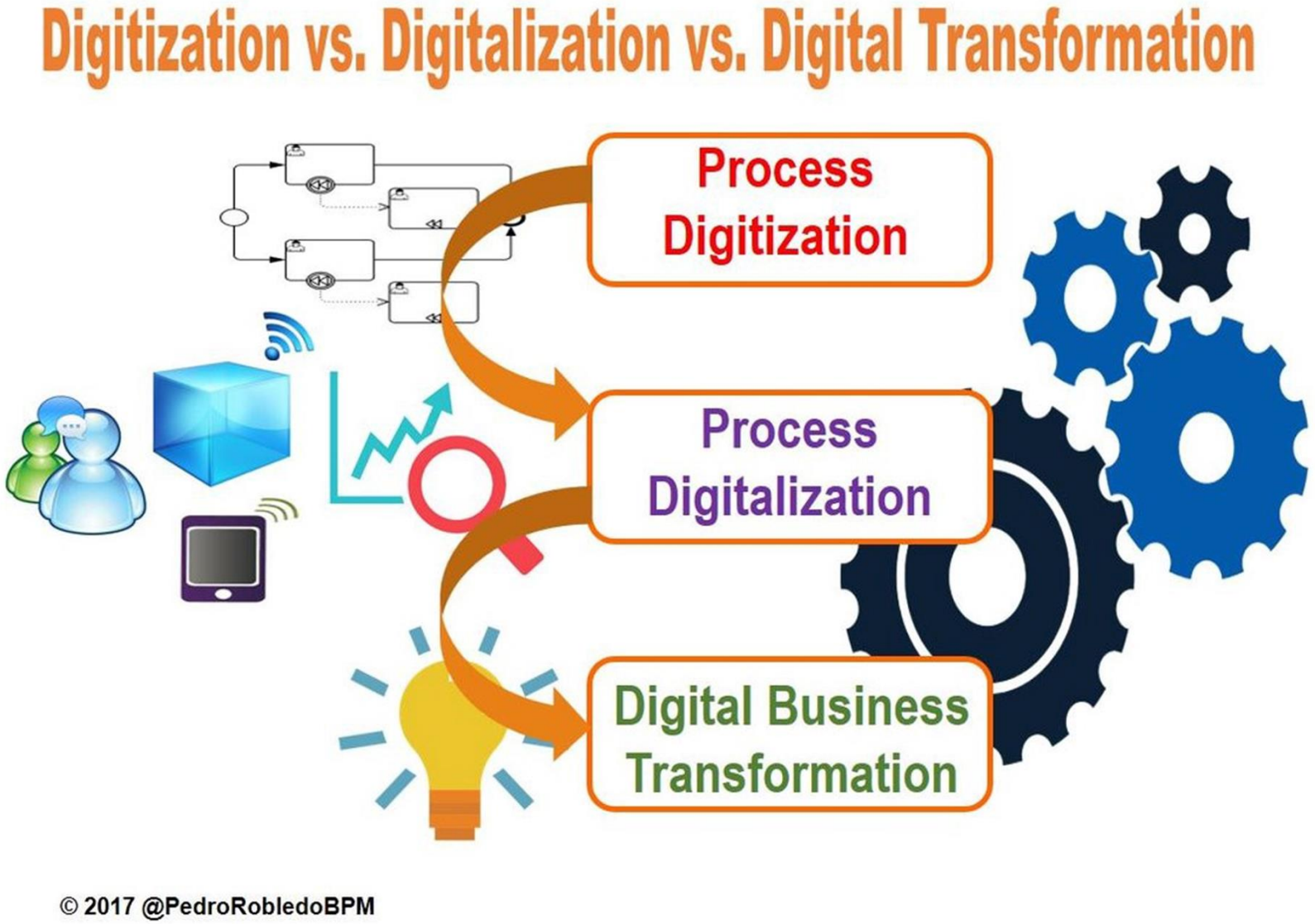
Digital Transformation

It is about doing things differently

creating new business designs by using digital technologies.

Not just automating or inserting technology into an existing process (digitalization) to optimize the current value chain, but to go further, modifying the business model, changing the value chain and surely creating a new supply of products and services – Provide new and better value to customers

Digitization Vs Digitalization Vs Digital Transformati



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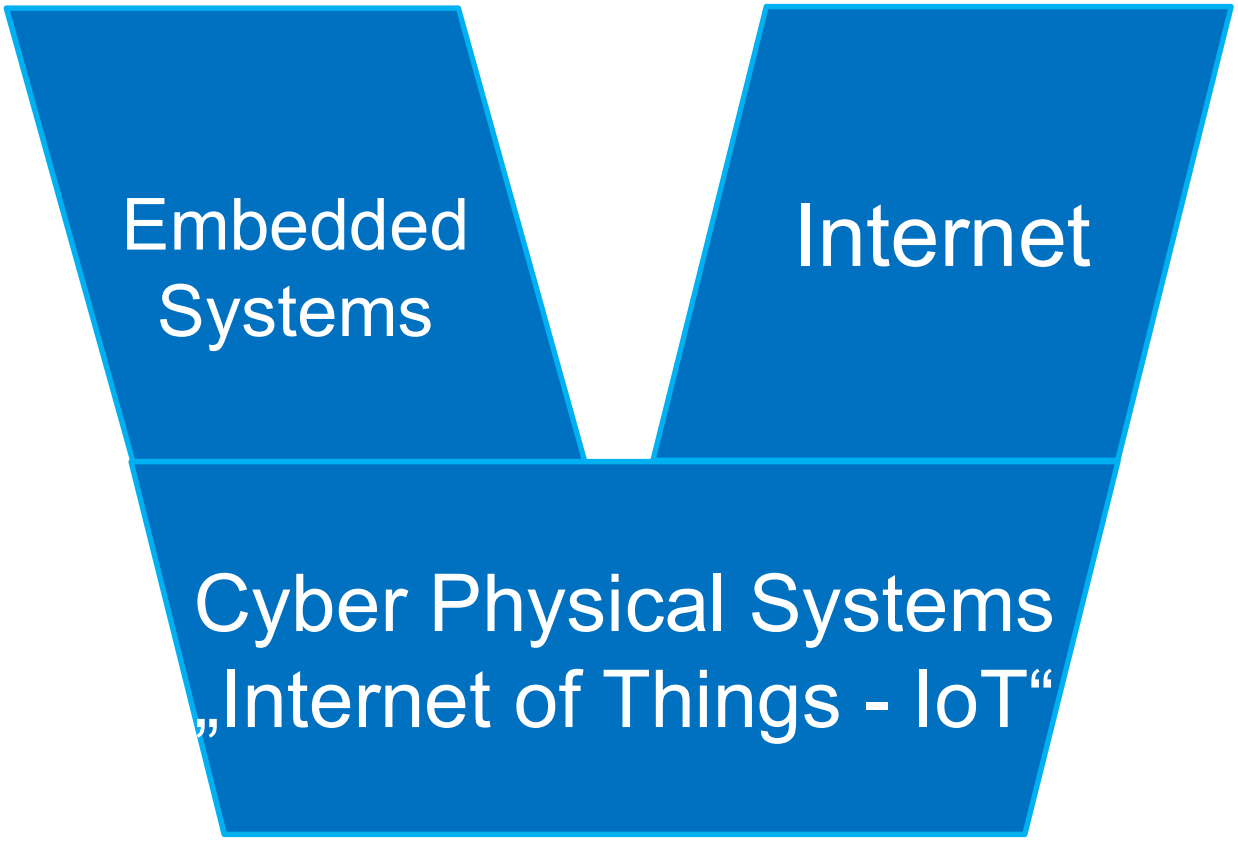
Embedded Systems
Internet
Cyber Physical Systems
„Internet of Things - IoT“

Basic Changes

- Devices will become digital „entities“!
- „Entities“ will be connected to and through the IoT!
- The (real-time) data will be used to optimize existing industrial and business processes!
- New „big data” methods will process the giant data and develop new business models that have the potential to cannibalize the existing industrial processes.

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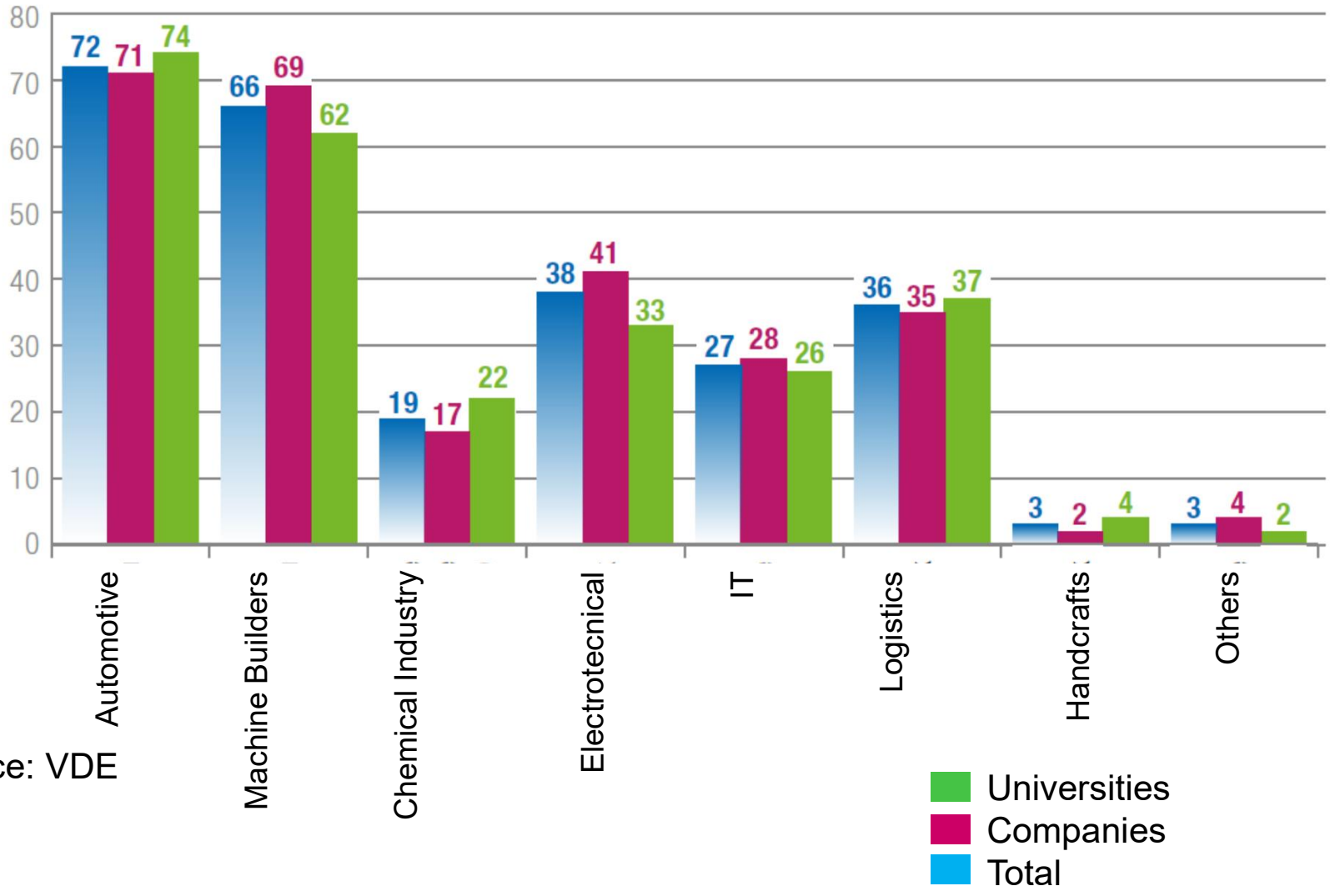
Which of the listed branches will benefit the most from „Industr



Source: VDE

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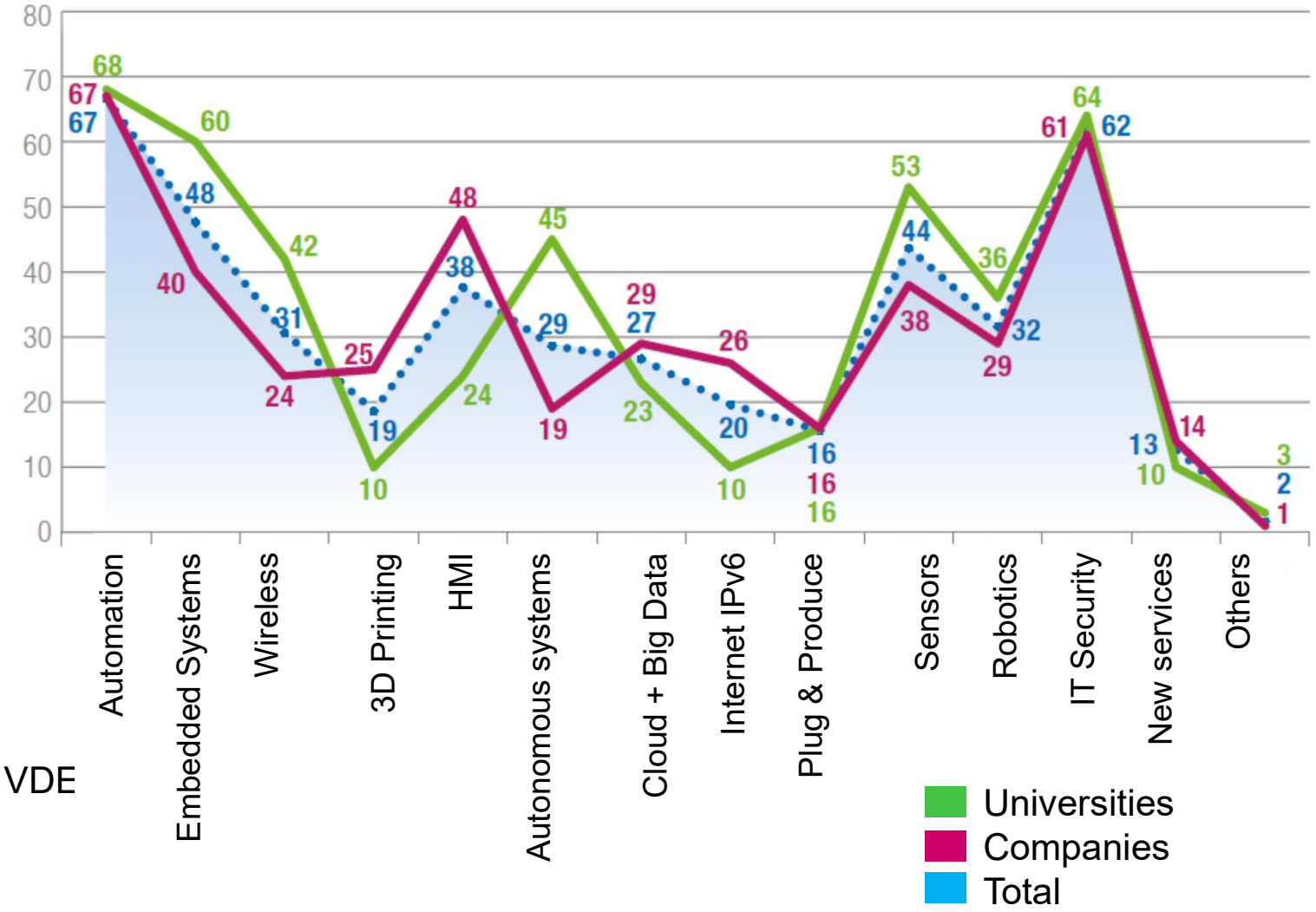
Which of the listed technologies are important for “Industrie



Source: VDE

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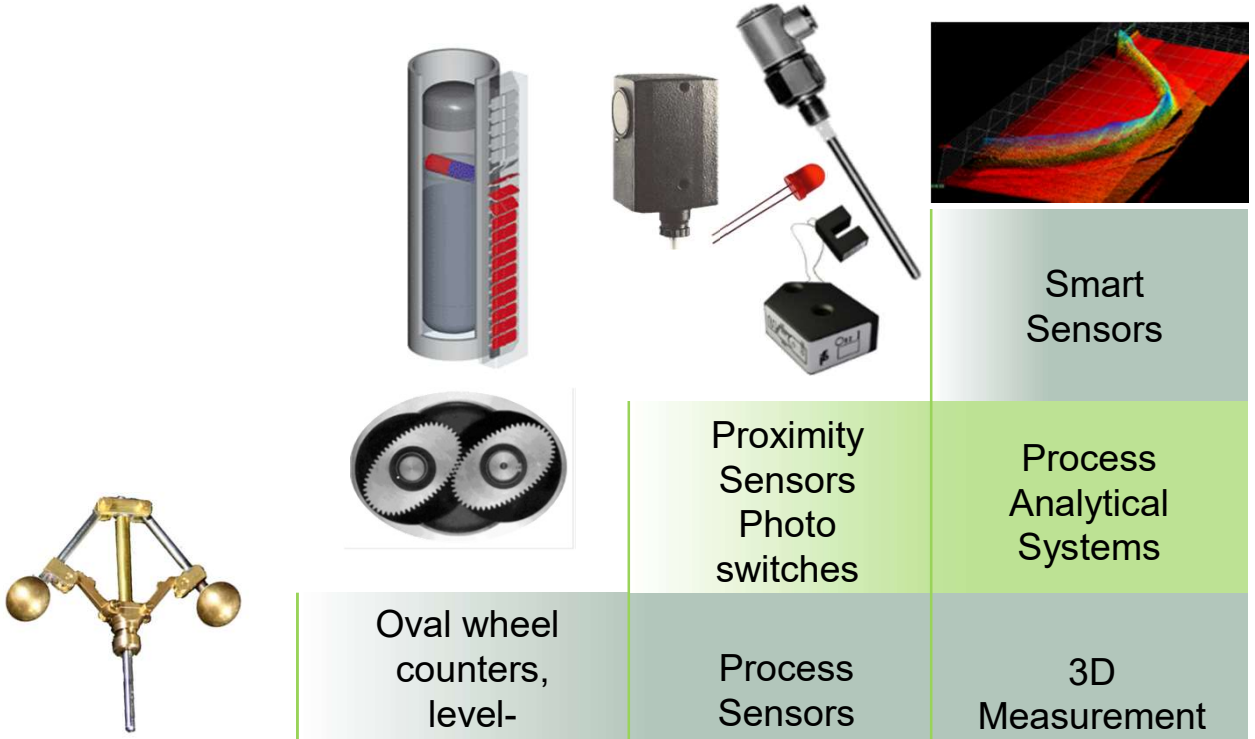
Sensors 1.0 …. Sensors 4.



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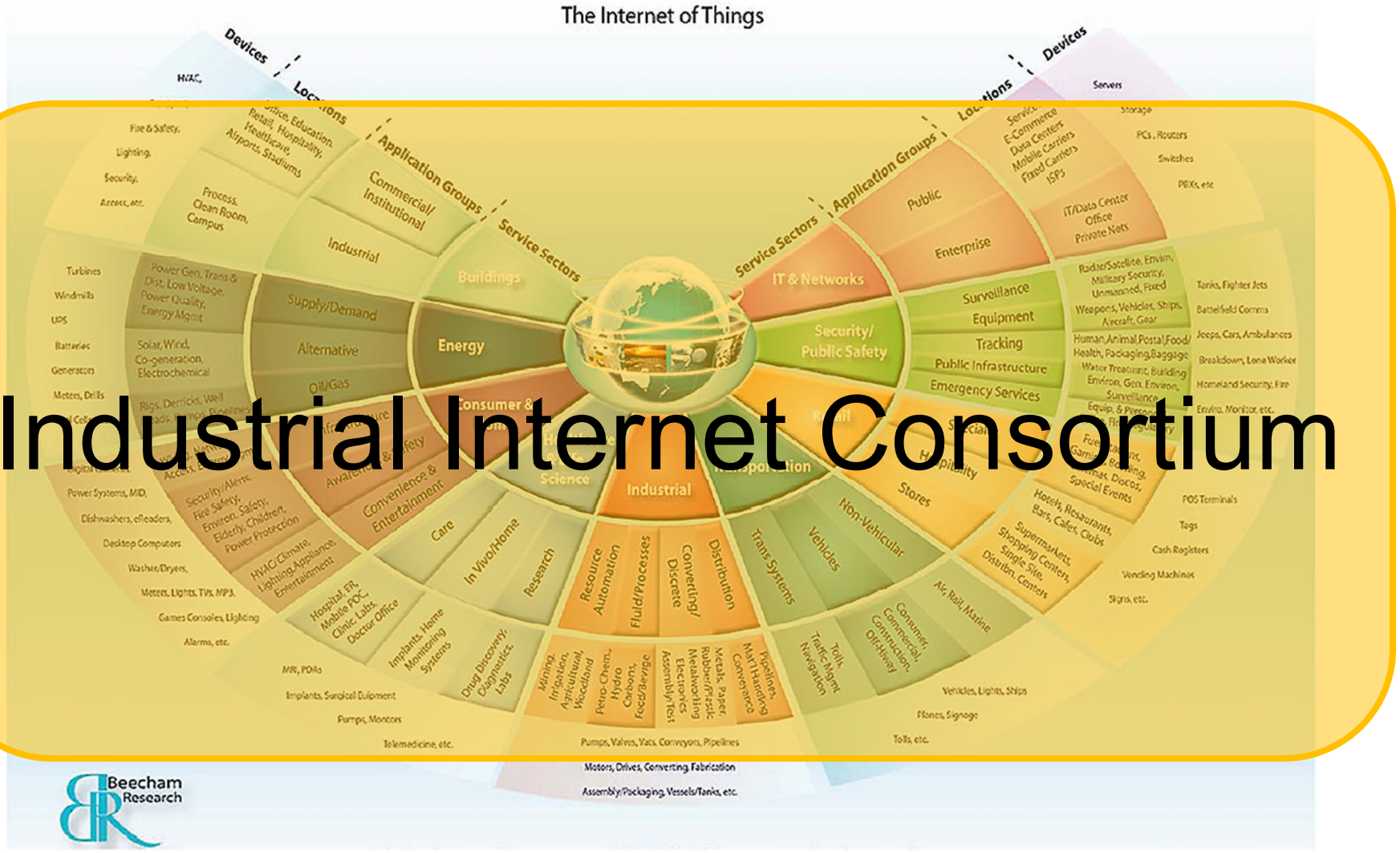
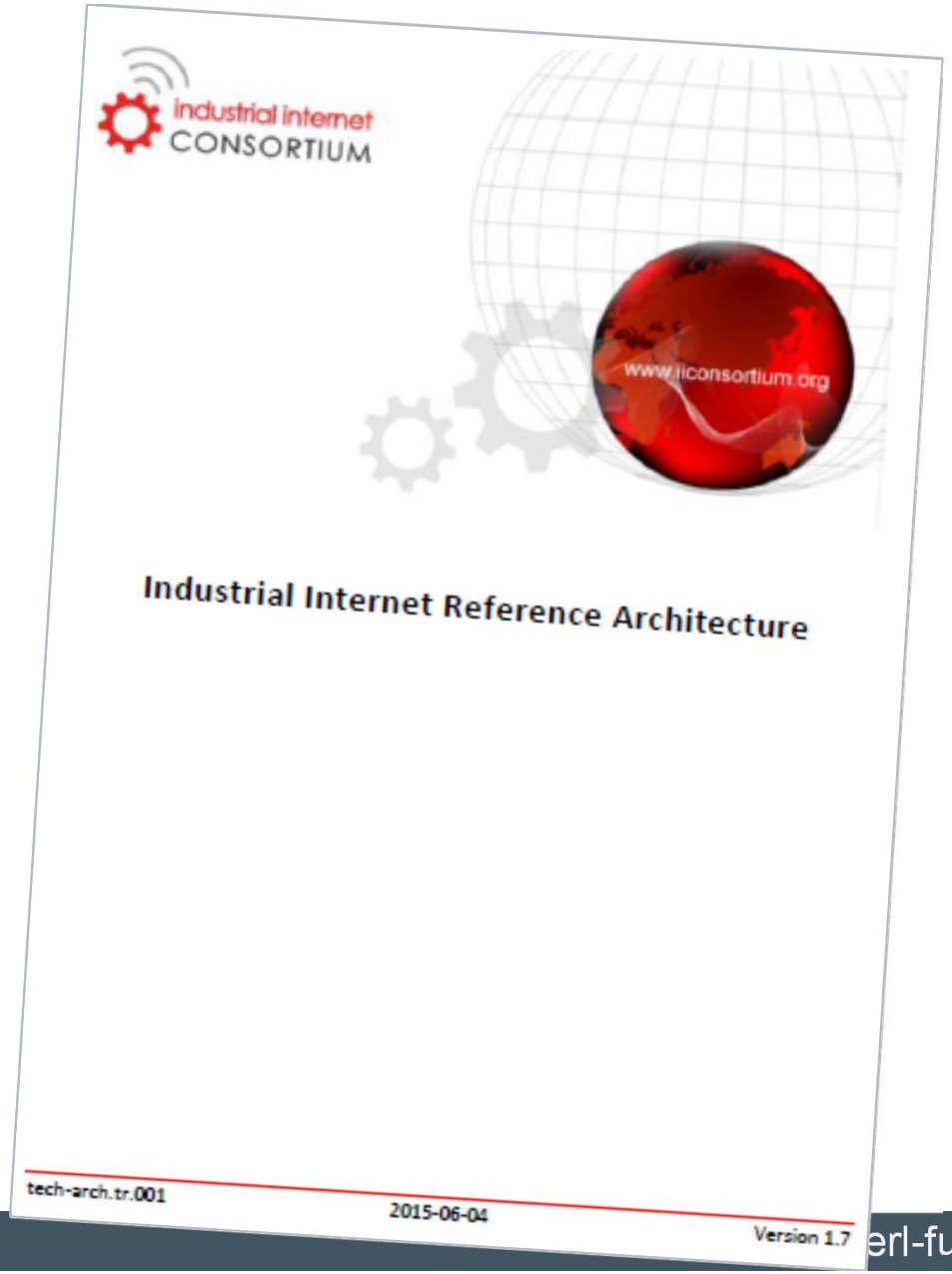


Industrial Internet Consortium

Industrial Internet Reference Archite

- Viewpoint oriented structure
- Decomposed into 4 layers
- Each layer again decomposes further down
- Role model based communication
- Security concepts included



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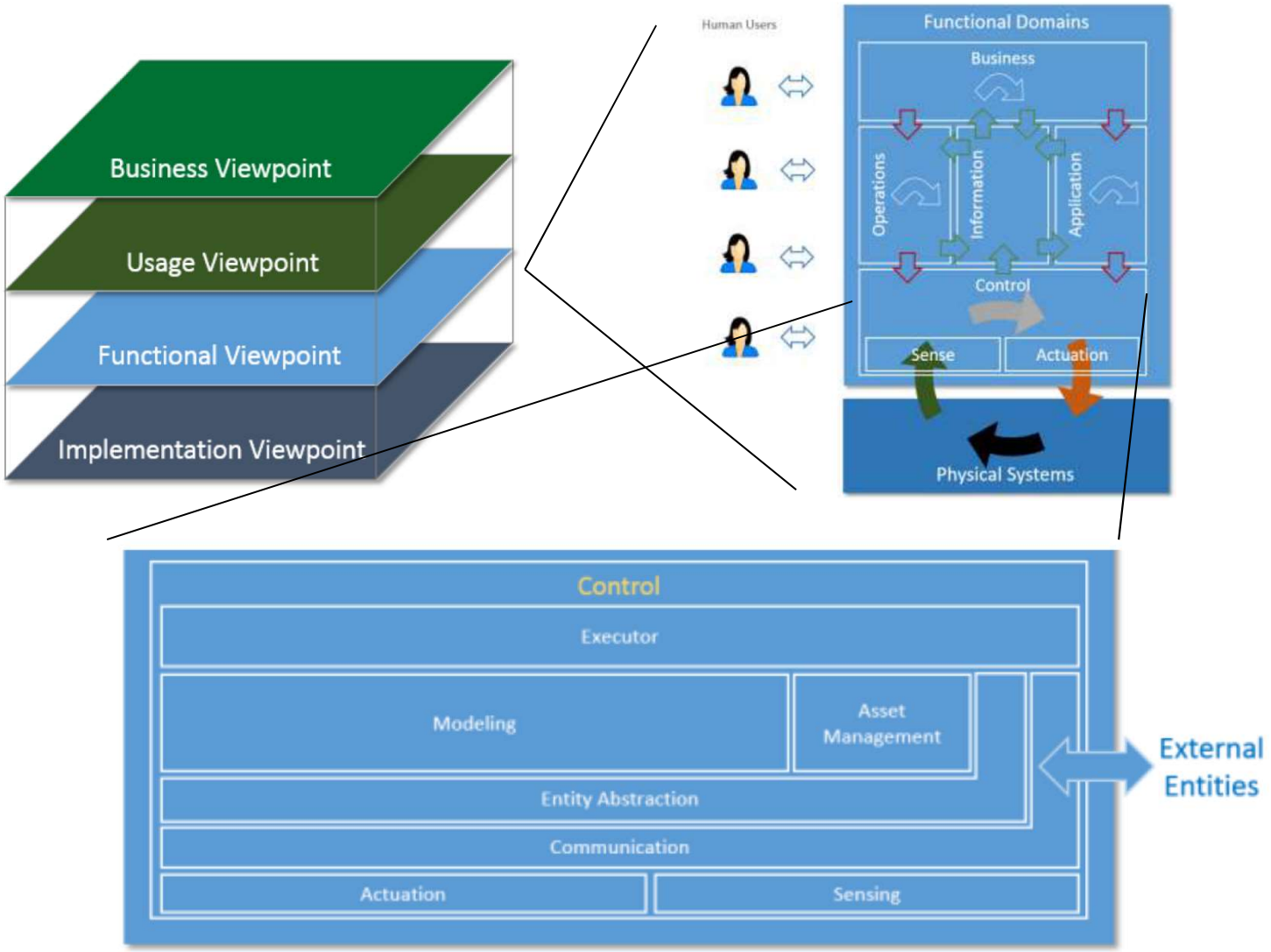
Industrial Internet Reference Archite



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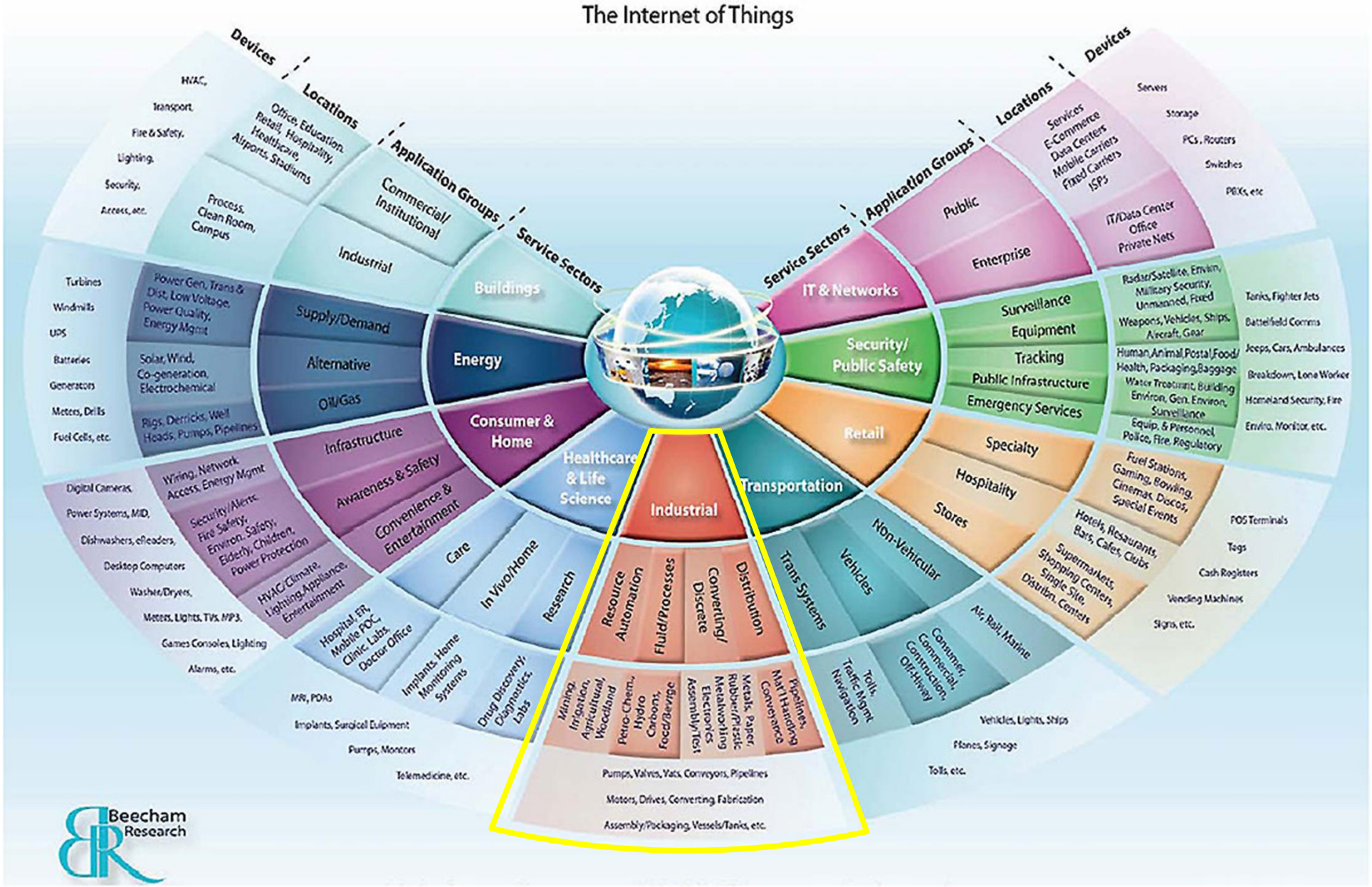
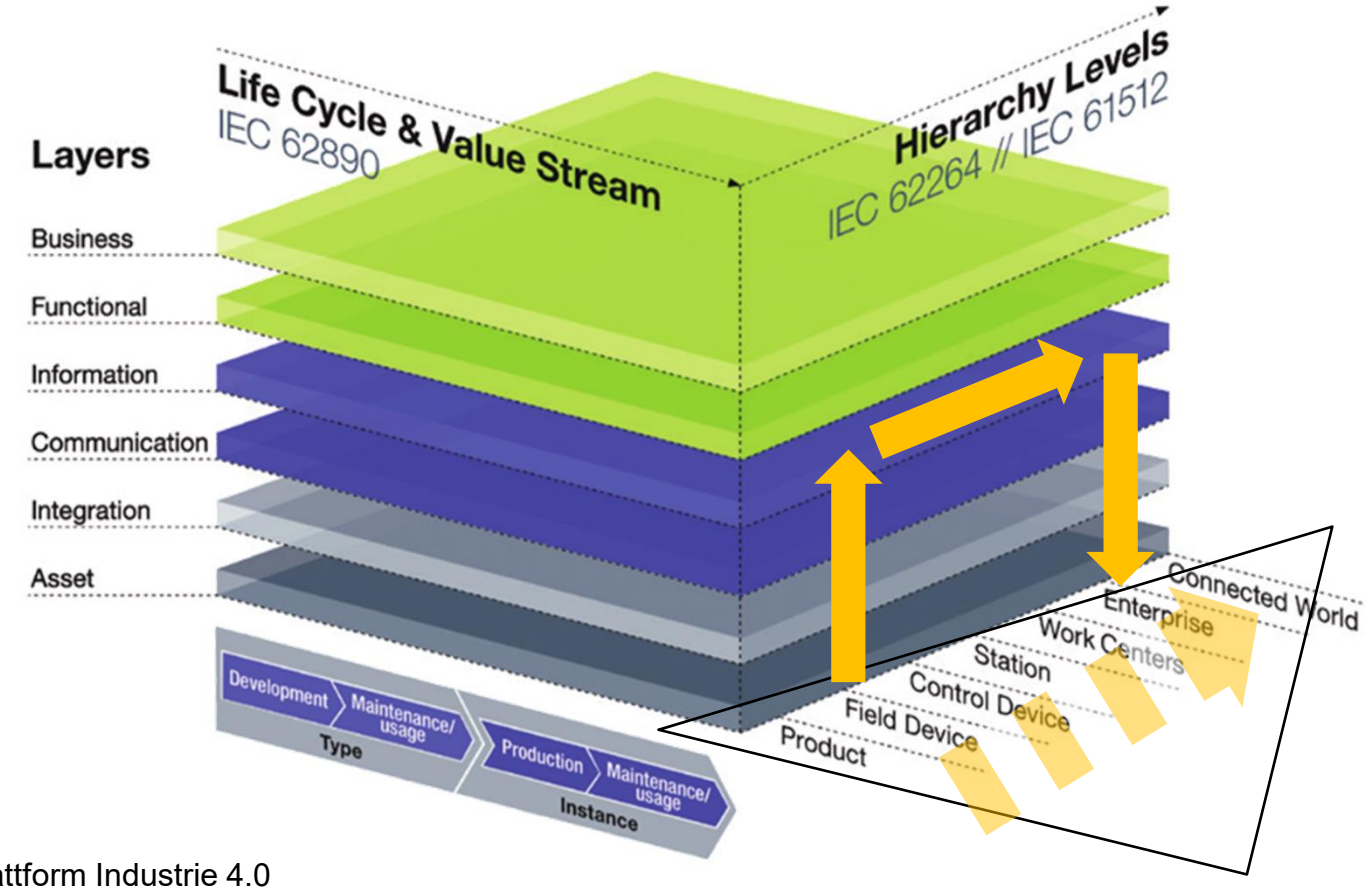

The Internet of Things
Devices
Locations
Application Groups
Service Sectors
HVAC,
Transport,
Fire & Safety,
Lighting,
Security,
Access, etc.
Office, Education, Retail, Hospitality, Healthcare, Airports, Stadiums
Process, Clean Room, Campus
Commercial/ Institutional
Industrial
Buildings
Turbines
Windmills
UPS
Batteries
Generators
Meters, Drills
Fuel Cells, etc.
Power Gen, Trans & Dist, Low Voltage, Power Quality, Energy Mgmt
Solar, Wind, Co-generation, Electrochemical
Rigs, Derricks, Well Heads, Pumps, Pipelines
Supply/Demand
Alternative
Oil/Gas
Energy
Digital Cameras,
Power Systems, MID,
Dishwashers, eReaders,
Desktop Computers
Washer/Dryers,
Meters, Lights, TVs, MP3,
Games Consoles, Lighting
Alarms, etc.
Wiring, Network Access, Energy Mgmt
Security/Alerts, Fire Safety, Environ. Safety, Elderly, Children, Power Protection
HVAC/Climate, Lighting,Appliance, Entertainment
Infrastructure
Awareness & Safety
Convenience & Entertainment
Consumer & Home
MRI, PDAs
Implants, Surgical Equipment
Pumps, Monitors
Telemedicine, etc.
Hospital, ER, Mobile POC, Clinic, Labs, Doctor Office
Implants, Home Monitoring Systems
Drug Discovery, Diagnostics, Labs
Care
In Vivo/Home
Research
Healthcare & Life Science
Mining, Irrigation, Agricultural, Woodland
Petro-Chem, Hydro Carbons, Food/Bevrge
Assembly/Test Electronics
Metalworking Metals, Paper, Rubber/Plastic
Pipelines, Mat'l Handling Conveyance
Resource Automation
Fluid/Processes
Converting/ Discrete
Distribution
Industrial
Pumps, Valves, Vats, Conveyors, Pipelines
Motors, Drives, Converting, Fabrication
Assembly/Packaging, Vessels/Tanks, etc.
Vehicles, Lights, Ships
Planes, Signage
Tolls, etc.
Trans Systems
Tolls, Traffic Mgmt, Navigation
Non-Vehicular
Vehicles
Consumer, Commercial, Construction, Off-Highway
Air, Rail, Marine
Transportation
Devices
Locations
Application Groups
Service Sectors
Servers
Storage
PCs, Routers
Switches
PBXs, etc
Services
E-Commerce
Data Centers
Mobile Carriers
Fixed Carriers
ISPs
IT/Data Center
Office
Private Nets
Public
Enterprise
IT & Networks
Surveillance
Equipment
Tracking
Public Infrastructure
Emergency Services
Security/ Public Safety
Radar/Satellite, Envsn, Military Security, Unmanned, Fixed
Weapons, Vehicles, Ships, Aircraft, Gear
Human,Animal,Postal,Food/ Health, Packaging,Baggage
Water Treatment, Building Environ, Gen. Environ, Surveillance
Equip. & Personnel, Police, Fire, Regulatory
Tanks, Fighter Jets
Battlefield Comms
Jeeps, Cars, Ambulances
Breakdown, Lone Worker
Homeland Security, Fire
Envirn. Monitor, etc.
Specialty
Hospitality
Stores
Retail
Fuel Stations, Gaming, Bowling, Cinemas, Discos, Special Events
Hotels, Resaurants, Bars, Cafes, Clubs
Supermarkets, Shopping Centers, Single Site, Distribn. Centers
POS Terminals
Tags
Cash Registers
Vending Machines
Signs, etc.
Beecham Research

RAI
Reference Architecture for Indust

Sensor -2-ERP communication



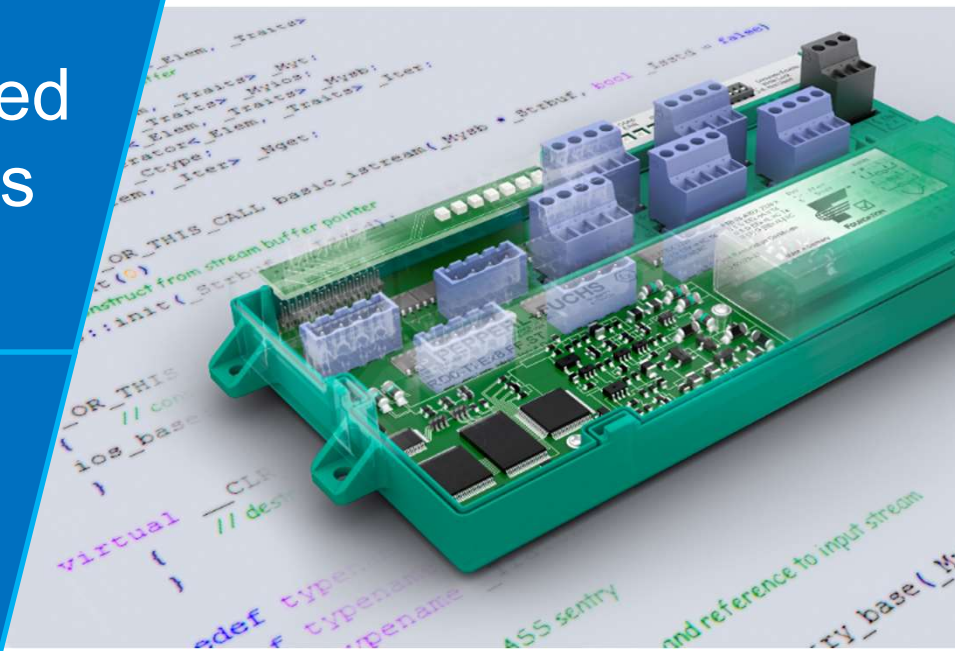
Source: Plattform Industrie 4.0

Internet of Things

Internet

Embedded Systems

Cyber Physical Systems
„Internet of Things - IoT“



Is it just the next phase of automation?

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IoT enforces basic chan

very device becomes a digital „Entity“!

Entities“ will be connected via the „Internet of Things“!

he available data (in real-time) will be used to further optimiz
xisting processes and business models.

ew „big data“ methodologies to process the gigantic data wi
nable new business models that – to a certain degree – will
ake existing business models obsolete.

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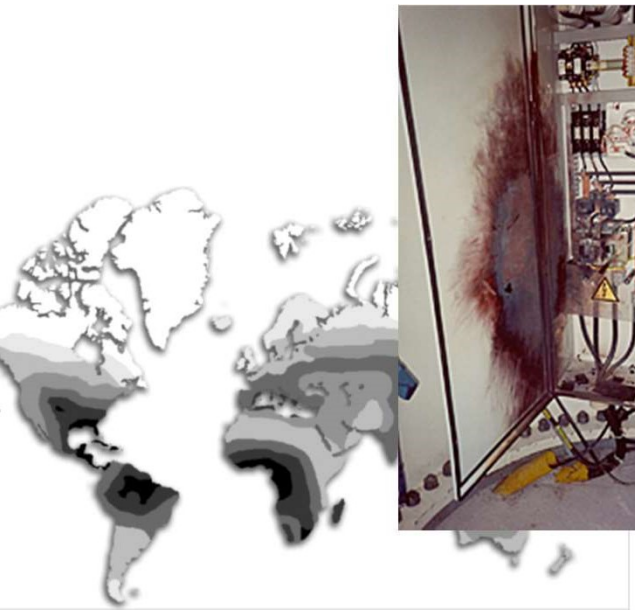
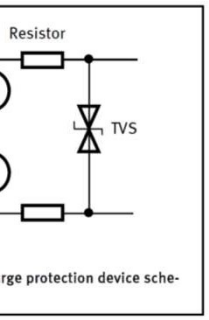
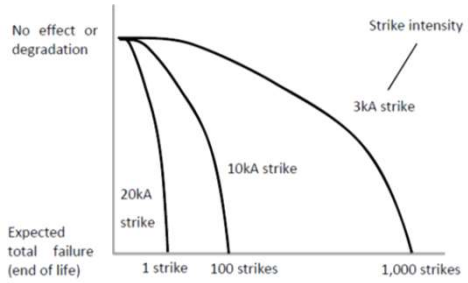
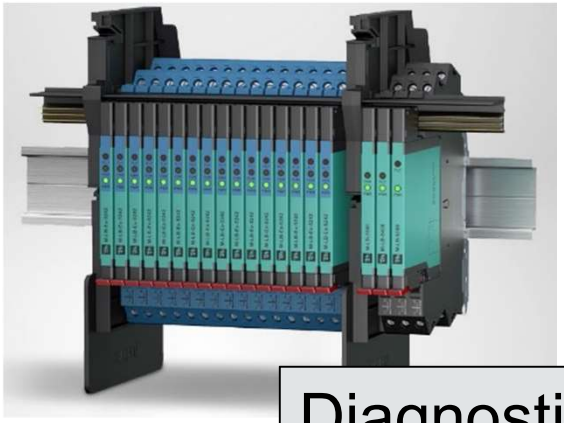


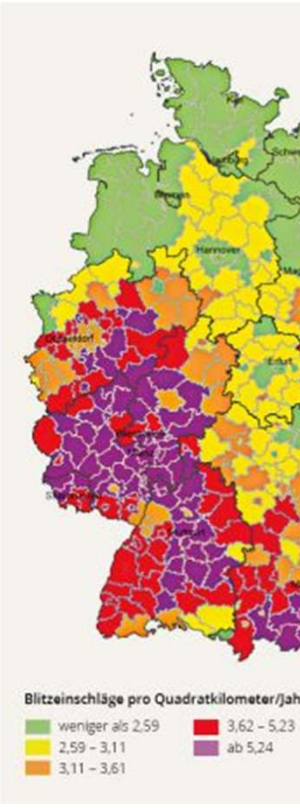


rge protection device sche-





Diagnostics



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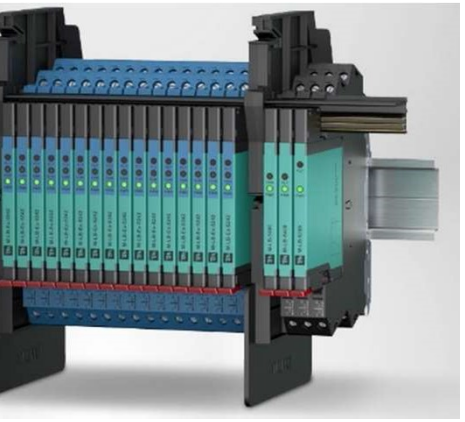
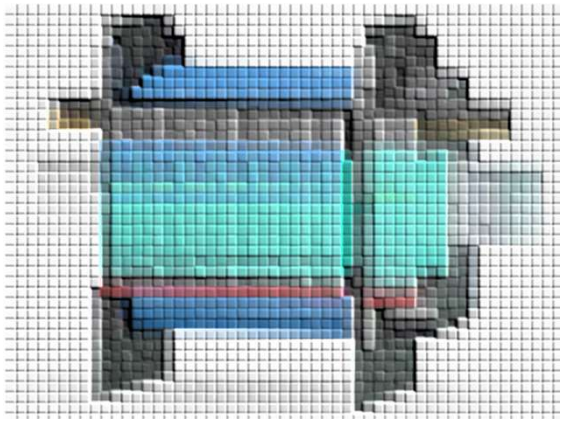
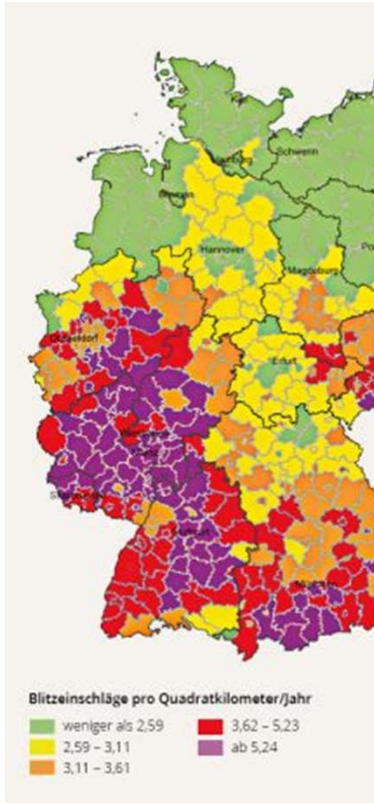


gital Device



Virtual Device
in the IIoT



New Softwa
Applicatio

PPERL+FUCHS

Political Platform „Industry

Mirroring Working Groups in the associa

GS: Spiegelgremium

PPERL+FUCHS 145 Participants from 90 Companies and Unive

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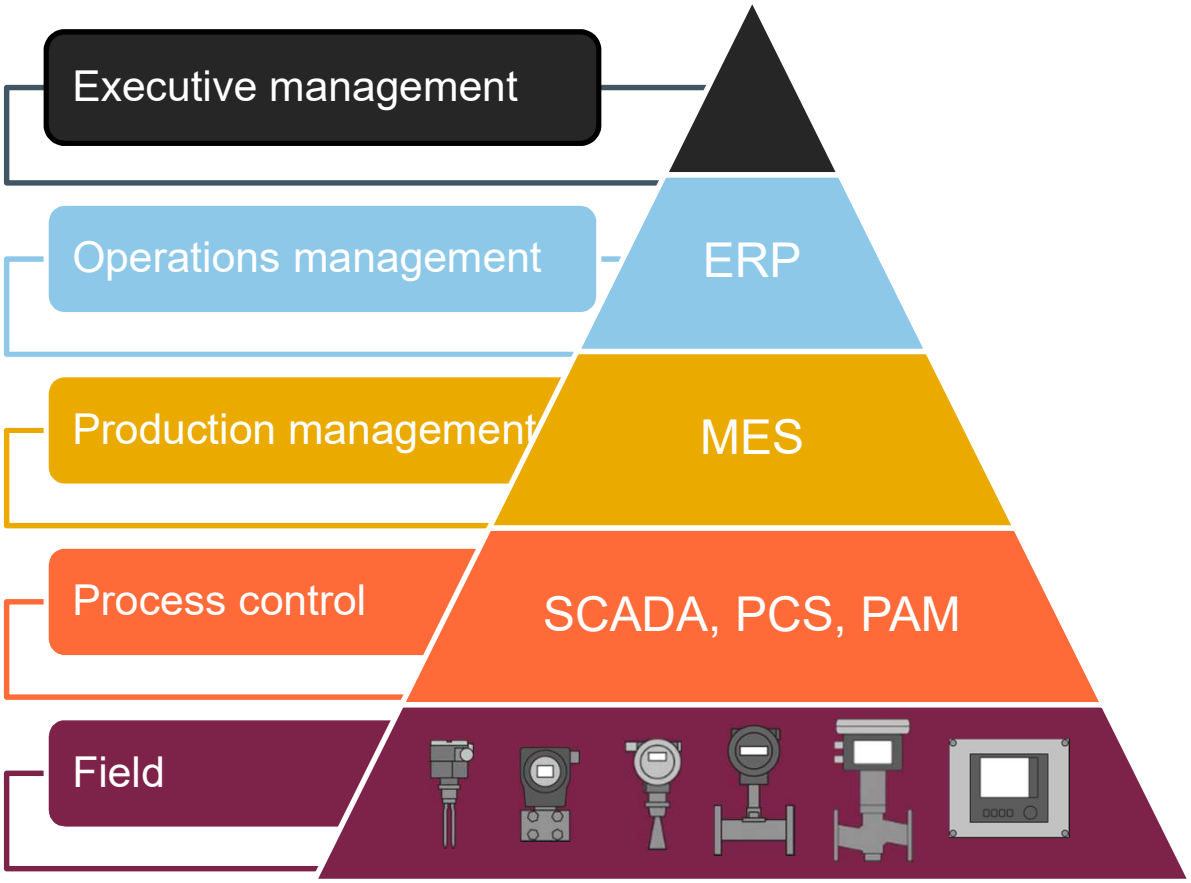
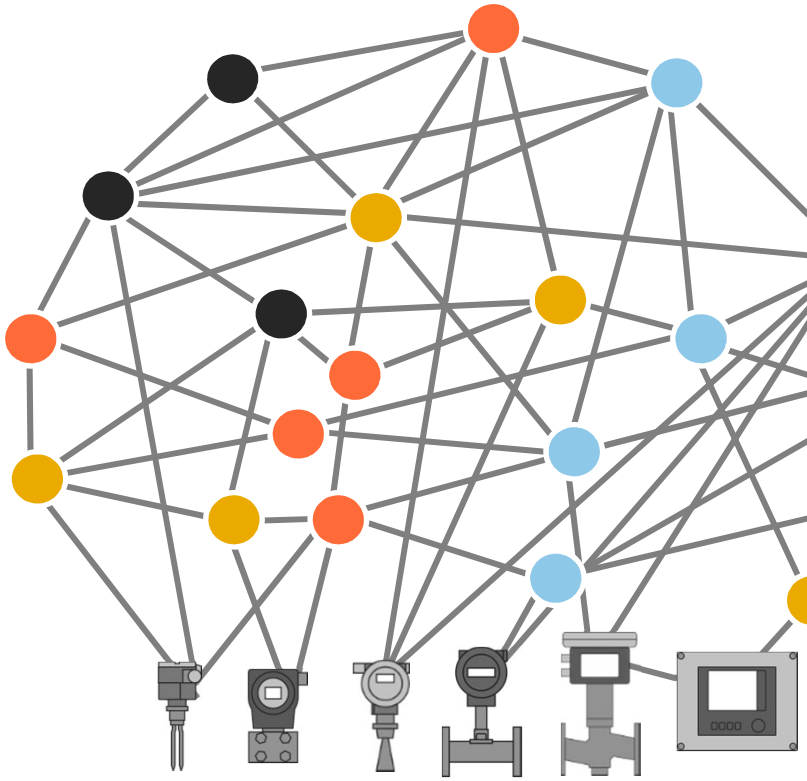
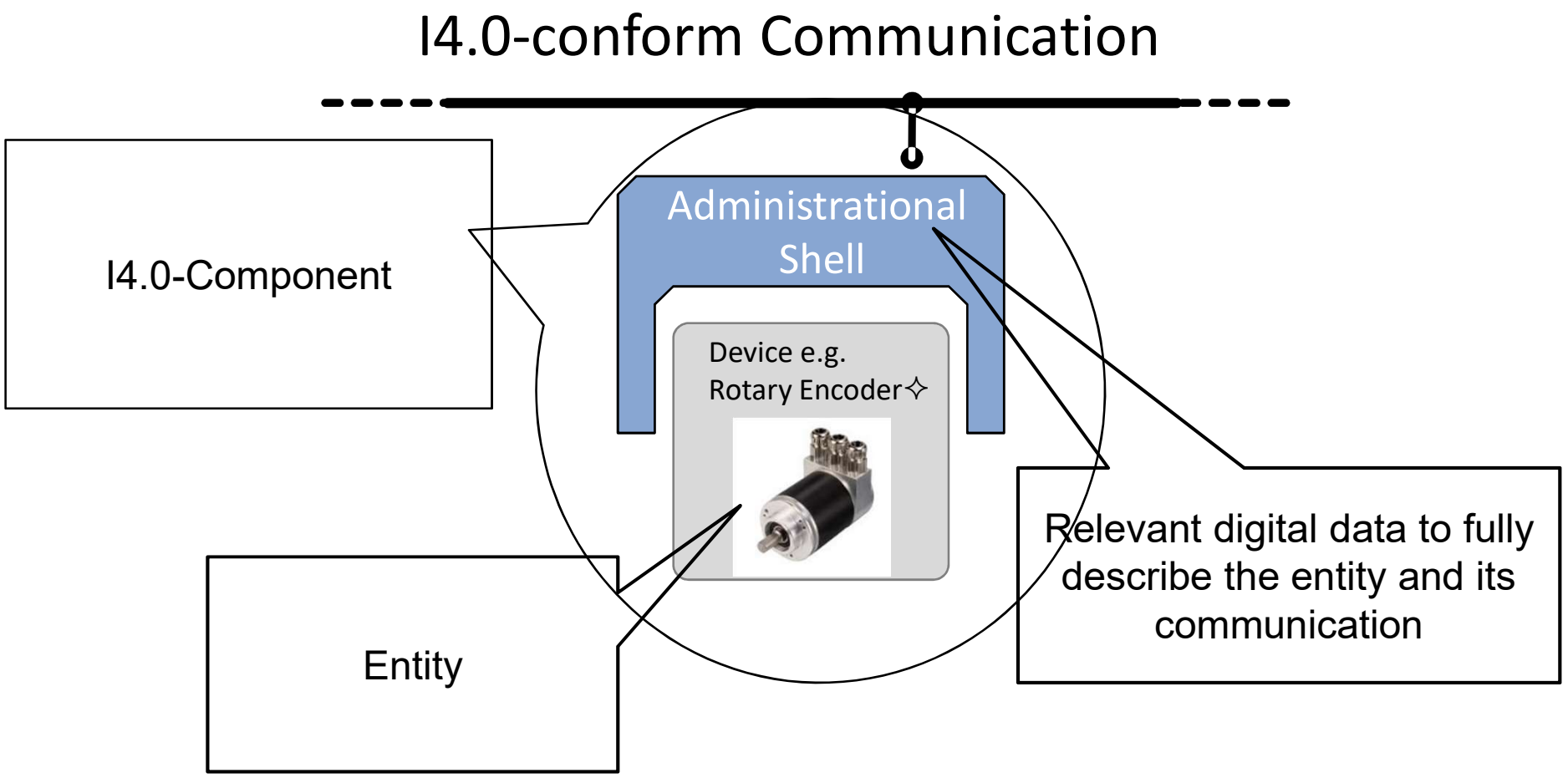
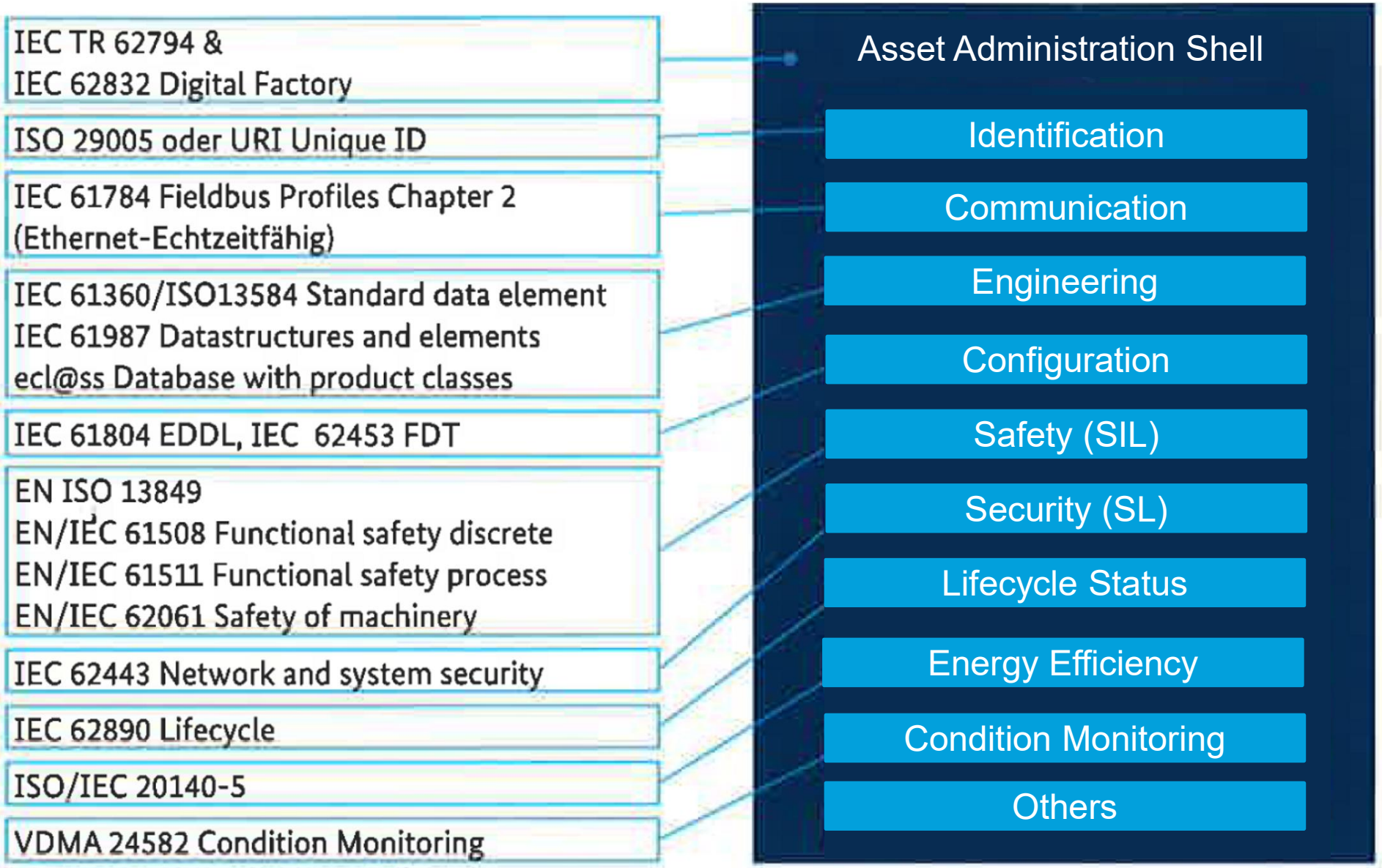
What does this mean for Automat





„Industry 4.0“-Compon




IEC TR 62794 &
IEC 62832 Digital Factory
ISO 29005 oder URI Unique ID
IEC 61784 Fieldbus Profiles Chapter 2
(Ethernet-Echtzeitfähig)
IEC 61360/ISO13584 Standard data element
IEC 61987 Datastructures and elements
ecl@ss Database with product classes
IEC 61804 EDDL, IEC 62453 FDT
EN ISO 13849
EN/IEC 61508 Functional safety discrete
EN/IEC 61511 Functional safety process
EN/IEC 62061 Safety of machinery
IEC 62443 Network and system security
IEC 62890 Lifecycle
ISO/IEC 20140-5
VDMA 24582 Condition Monitoring
Asset Administration Shell
Identification
Communication
Engineering
Configuration
Safety (SIL)
Security (SL)
Lifecycle Status
Energy Efficiency
Condition Monitoring
Others

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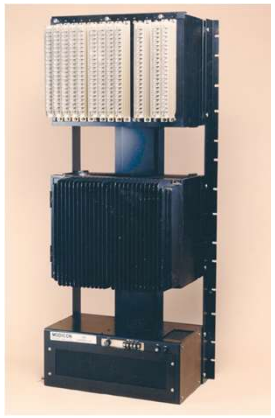
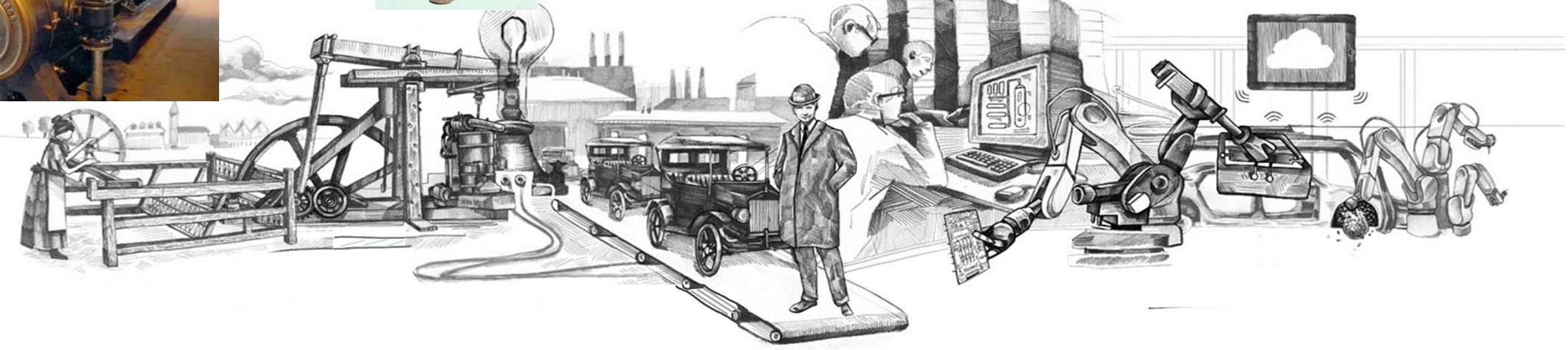
Fourth Industrial Revolut





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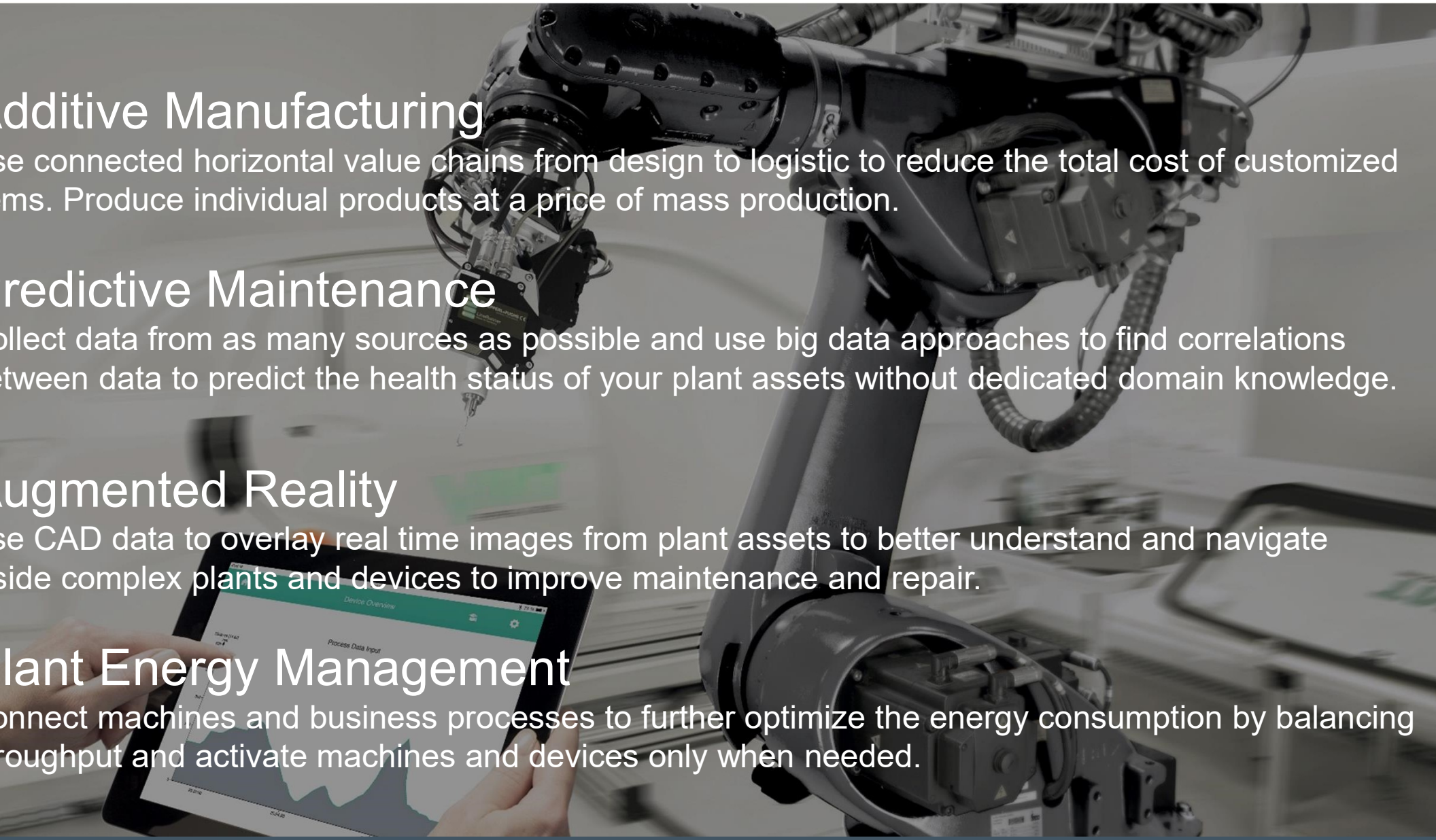
I4.0 - What are the benef



dditive Manufacturing

se connected horizontal value chains from design to logistic to reduce the total cost of customized
ms. Produce individual products at a price of mass production.

redictive Maintenance

ollect data from as many sources as possible and use big data approaches to find correlations
tween data to predict the health status of your plant assets without dedicated domain knowledge.

ugmented Reality

se CAD data to overlay real time images from plant assets to better understand and navigate
side complex plants and devices to improve maintenance and repair.

lant Energy Management

onnect machines and business processes to further optimize the energy consumption by balancing
roughput and activate machines and devices only when needed.

PPERL+FUCHS

I4.0 What are the benef

lug and Produce

change complex devices in multi-vendor automation systems of large plants seamless by passing
-up parameters automatically across new versions and releases.

Big Data" based Demand Management

llect data along the complete supply chain of production facilities and companies to reduce
ermediate stock, create a dedicated demand forecast on all levels, reduce "bull-whip" effects and
duce lead-time whenever sudden demand changes are occurring.

odulare Manufacturing

eate manufacturing modules with open interface architecture plugged together to create a value
ain allowing a numbering-up instead of scaling up in case of increased throughput demands.

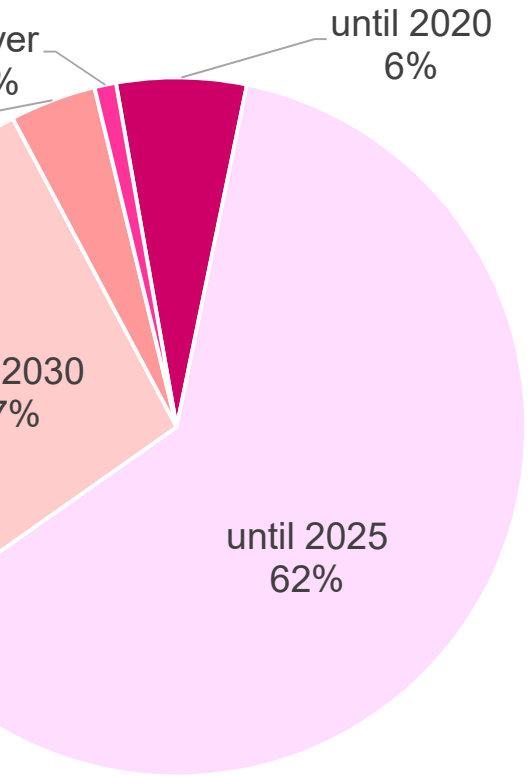
loud-based-pay-per-use Distributed Control

ntrol distributed process plants – such as sewage plants of tank farms – by connecting the plant
sets to the internet and share one control software by implementing it in the cloud.

PPERL+FUCHS

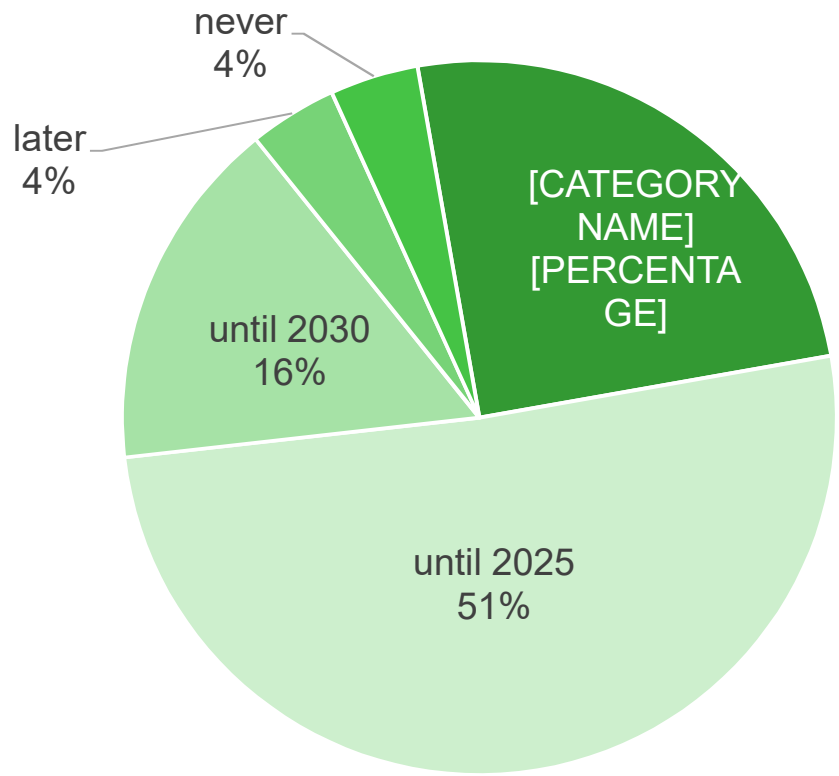
When will „Industry 4.0” create a substa impact on the econo

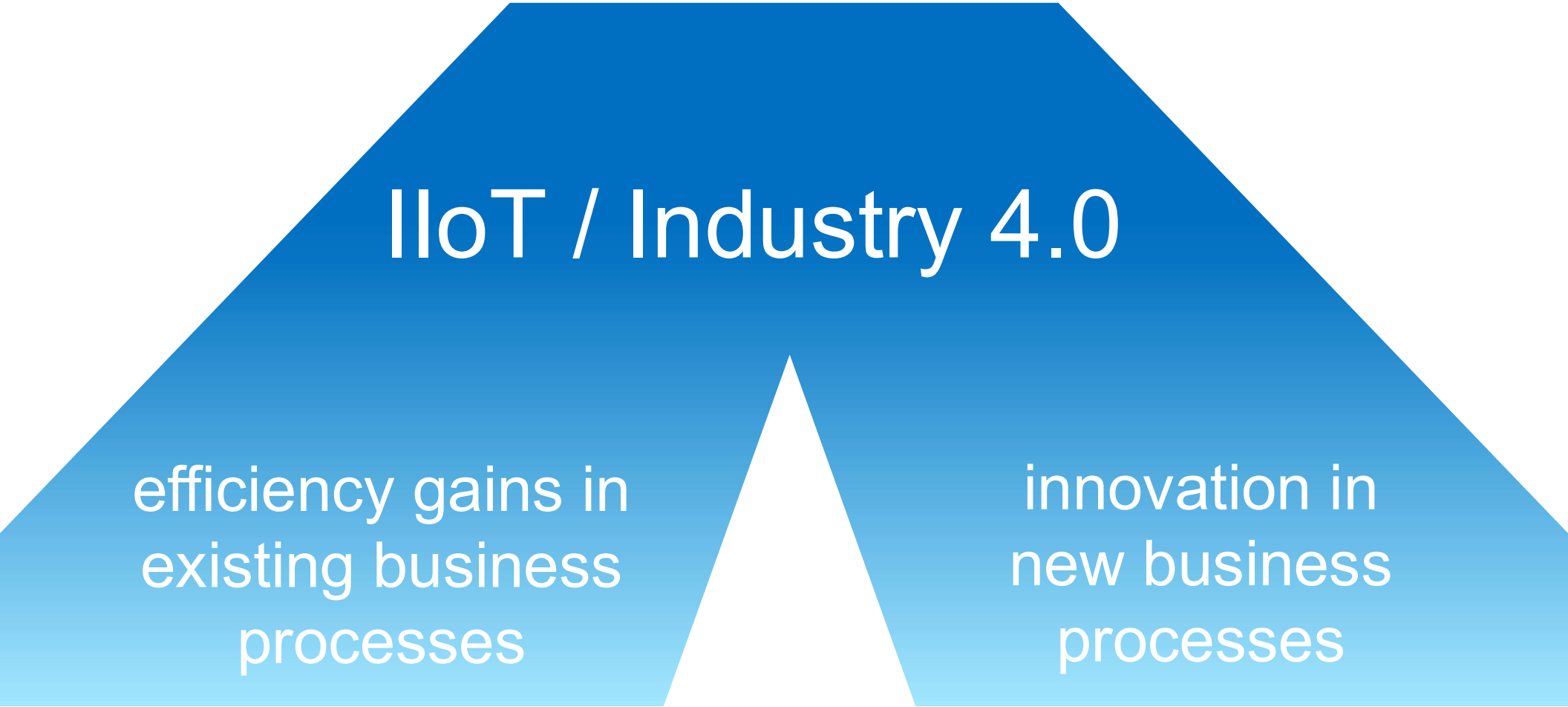
Companies



: VDE

Universities




IIoT / Industry 4.0
efficiency gains in existing business processes
innovation in new business processes

Smart Business Processes

Smart Production Processes

Smart Products, Smart Connectivity, Smart Service

Smart Collaboration, Smart Standardization

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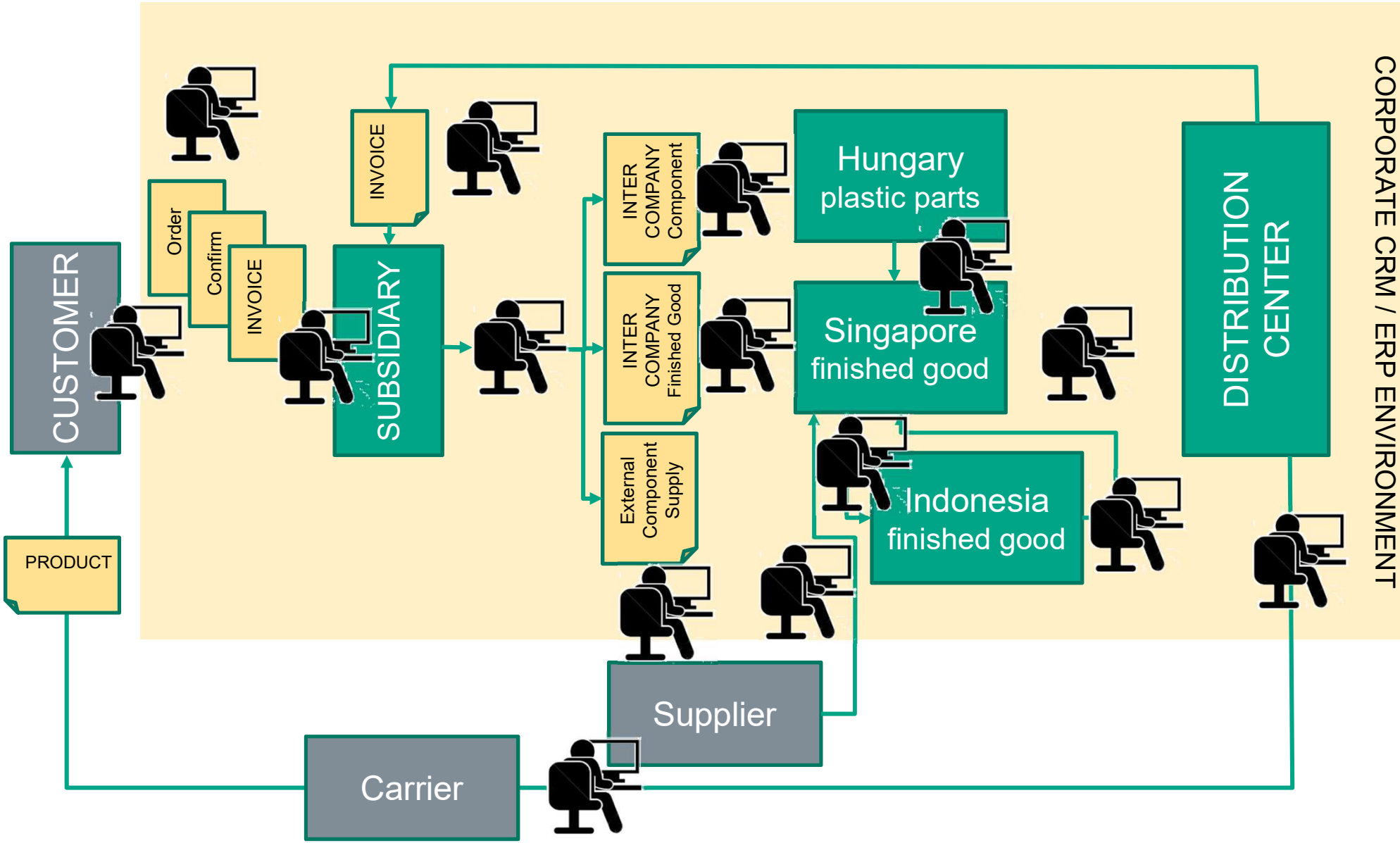
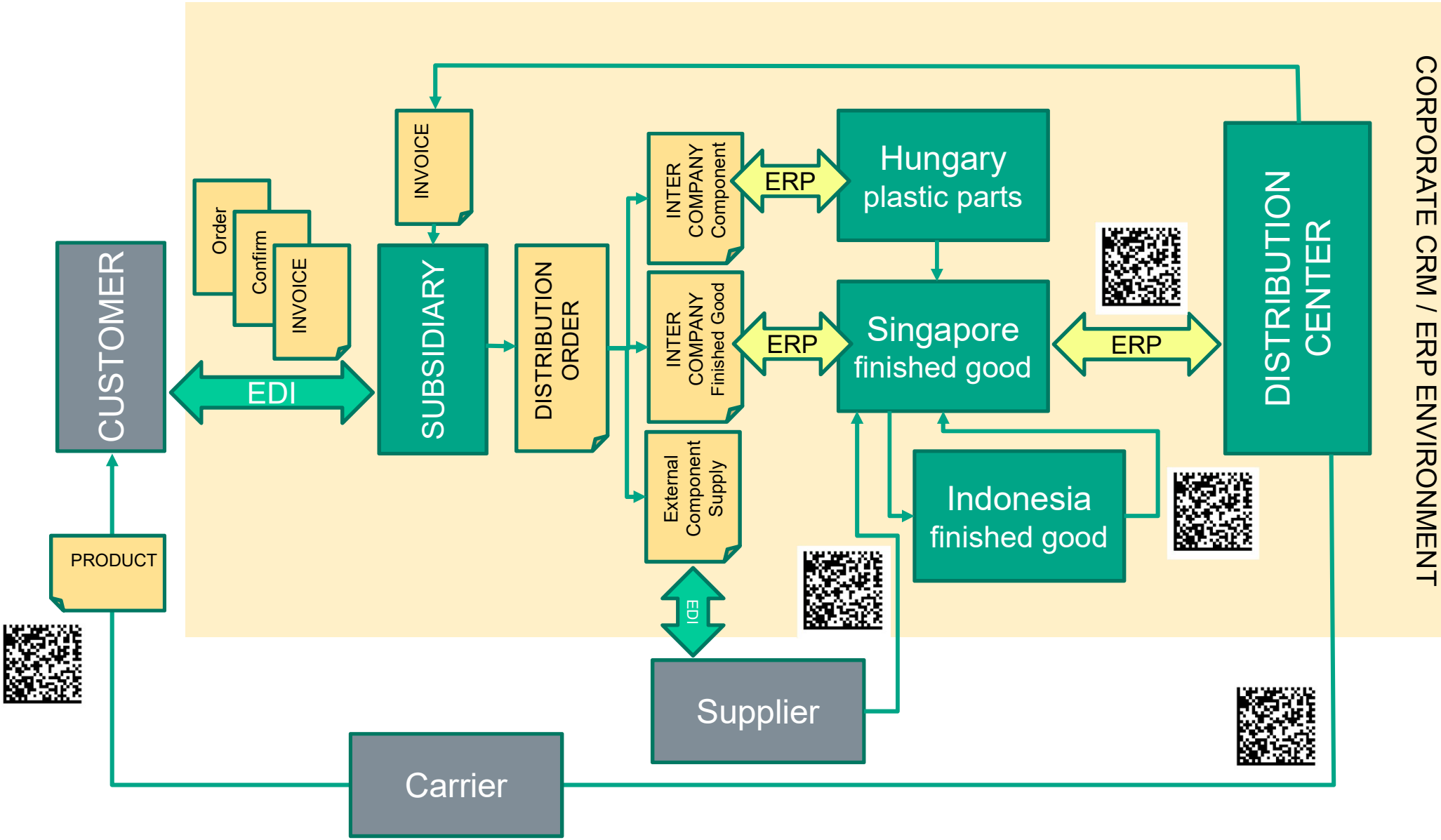

CUSTOMER
Order
Confirm
INVOICE
INVOICE
SUBSIDIARY
INTER COMPANY Component
INTER COMPANY Finished Good
External Component Supply
Hungary plastic parts
Singapore finished good
Indonesia finished good
DISTRIBUTION CENTER
PRODUCT
Supplier
Carrier
CORPORATE CRM / ERP ENVIRONMENT


CUSTOMER
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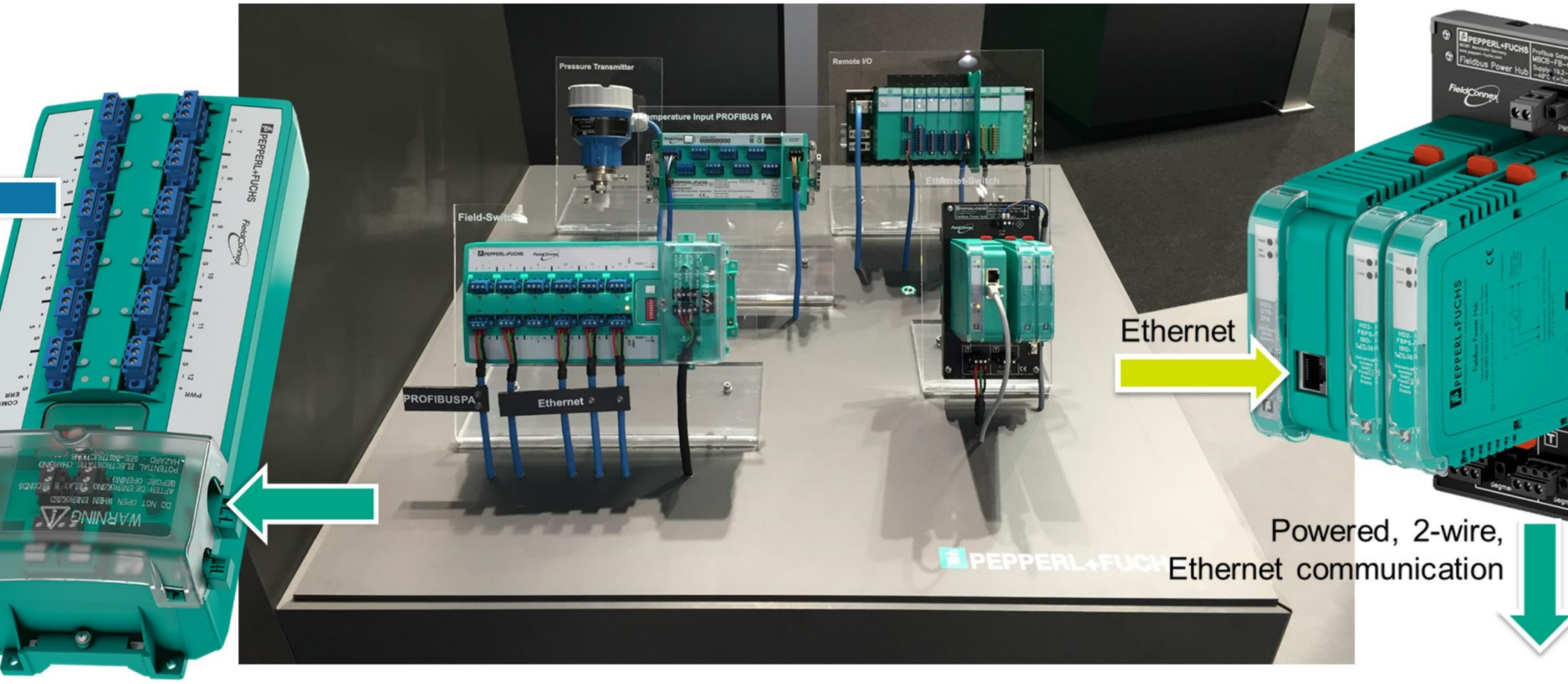
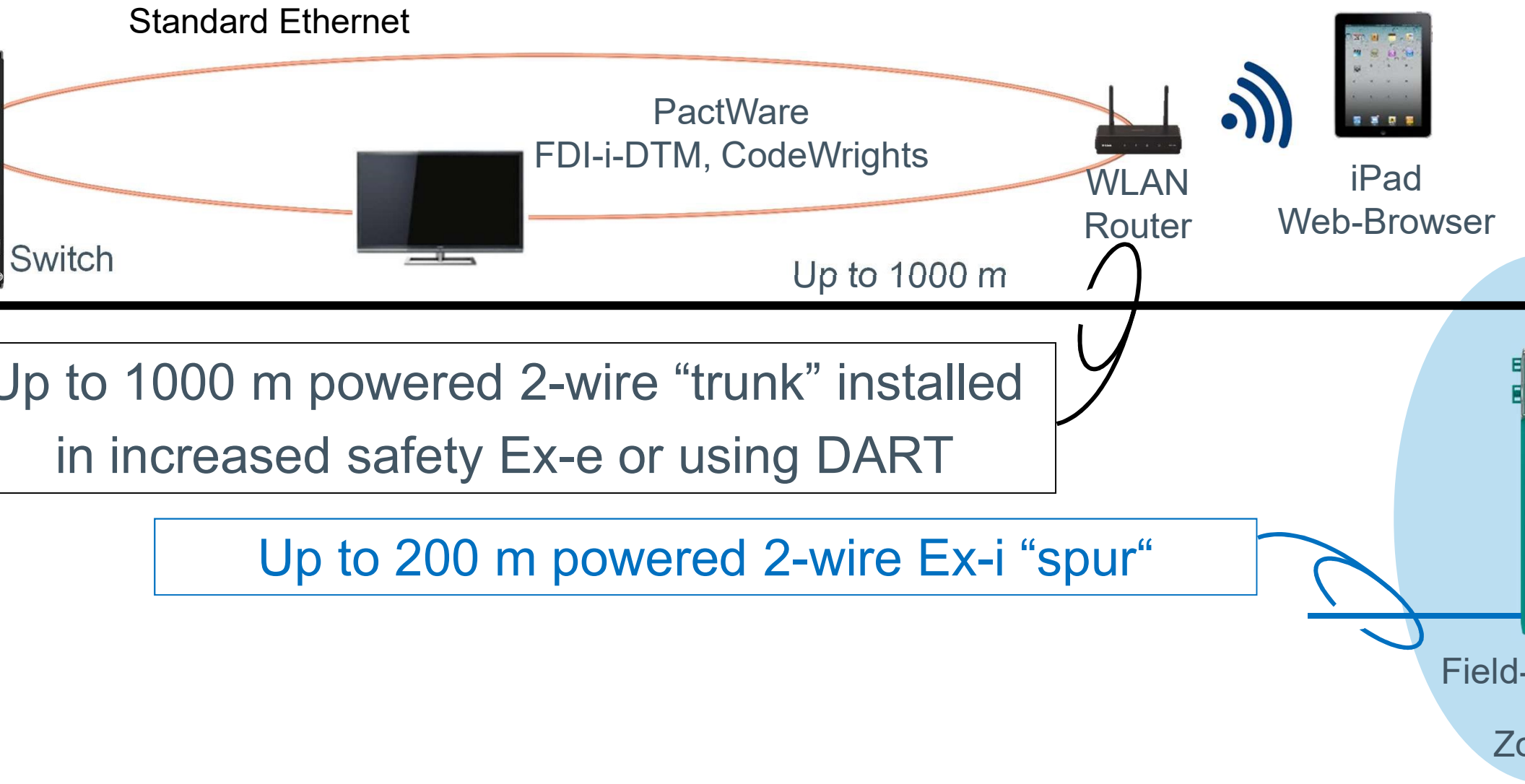
2-wire-Ethernet in the F
for explosion hazardous ar

Live Demonstration in Hanover 2015 / 2016 /



Ethernet to the Field - Demons



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MOBILE SAFE

Communication	Mobile Computing	Portable Lighting	Measurement and Calibration

cquiring ECOM the Process Automation business of Pepperl+Fu
s found an ideal connection between present and future – betwe
Explosion Protection and the Industrial Internet of Things.

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le Worker Concept - Ready for Industry 4.0

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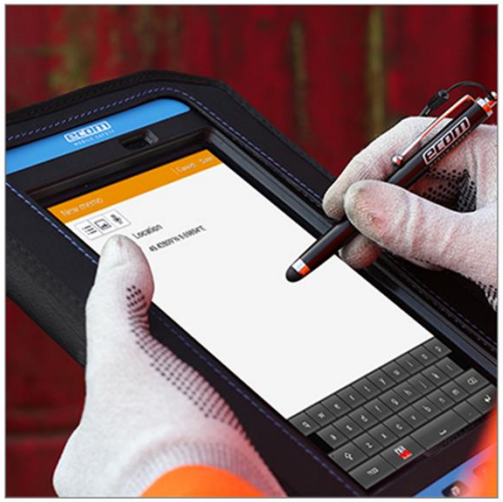
tions for Data Capture in Hazardous Areas

- keyboard extension for your mobile device
- Intrinsically Safe PDA
- Intrinsically Safe Barcode Scanner & RFID Reader



APPLICATION
Scanning Barcodes with Built-in
Camera of your Smartphone or Tablet

MOBILE COMPUTER / PDA
with Modular Head System

BARCODE SCANNER / RFID READER
Bluetooth® Hand-held Scanner &
Peripheral Device

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T Communicators for Hazardous Areas

- Pads preloaded with HART Com software
- No wires
- The Bluetooth wireless interface between the HART modem and tablet provides user safety and comfort
- All components are certified for use in hazardous areas. Hazardous areas covered include CSA (Class 1, Division 1), ATEX, and IECEx.

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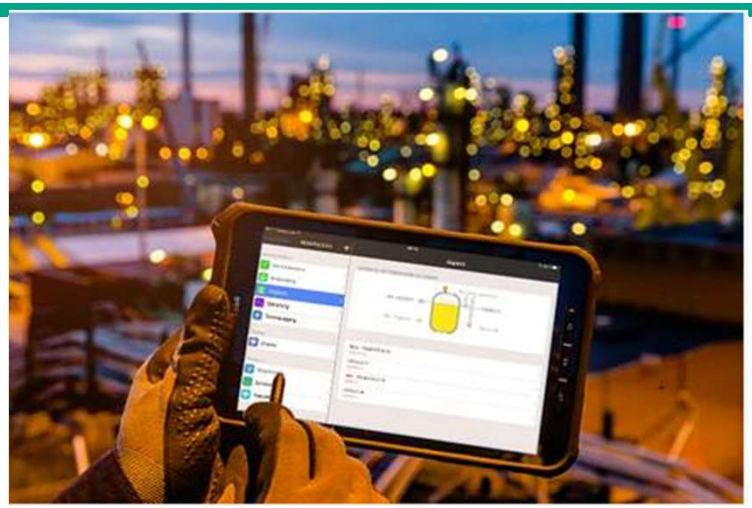
case: Smart Sensor stments



- Sensors are located at difficult-to-reach, potentially dangerous locations or in case of hazardous areas, complex permits and certifications are required

- **There were also two technical requirements for the essential Bluetooth communication**

  Supply of wireless communication via the standard two-wire signal line 4 ... 20 mA / HART
  Downward compatible with the plics sensors since 2002, without software updates

- Tablets and phones for Zone 1 and Zone 2 were used for mobile measurements at high tanks in difficult-to-reach sections, in harsh environments and in potentially dangerous areas.

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Over IP - What's PTT and Why It is needed?

- PTT is a service, provides group communication being used on Radio communication systems like TETRA, DMR and the classic PMR analog Radios
- Medium for that communication standard 802.11 protocol
- Typical for PTT is when one person is speaking to a group of people, while others are not speaking, else this will interrupt the person.
- A device is able to run the PTT Client software
  - Smart-EX; TAB-EX; iroc; Ex-Handy 09
- PTT Server that could be on site or in the cloud
- Internet connection via 4G / 5G and as well as WIFI connection
- A small data flat 200Mbit Data traffic per month should be enough

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case: SafeEx - More factory Ex inspections

Traditionally, Ex inspections have been conducted with pen and paper as well as subsequent manual registration in own system or with various software solutions for the individual routines and processes

•SafeEx system performs this otherwise time-consuming task by autonomously synchronizing inspection details from the RFID PDA into the secure Ex register server

•noticeable improvement is a considerable reduction in the man hours required to manually populate details of inspections performed into the Ex register.

•overall improvement in the efficiency of Ex maintenance, improved safety, easy to use tools for reporting, trending and tracking the overall status

•system can provide improved project quality control for the E&I construction phase ensuring construction yard installations meet the Ex criteria

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case: Mobile camera – streams for the suring station

Chemical plants, refineries, pharmaceutical production plants are many times equipped with traditional cameras and a video management system.

- But how does the information return to the hazardous area?
- Pad and Phone cameras as well as a complete selection of different radio communications make it possible to record defective plant sections, components, or deviations
- An immediate remote diagnosis can be carried out and the required actions can be initiated.
- With the right infrastructure, this also works vice versa: Video data, available in the measuring station, can also be displayed on the Ex Pad.

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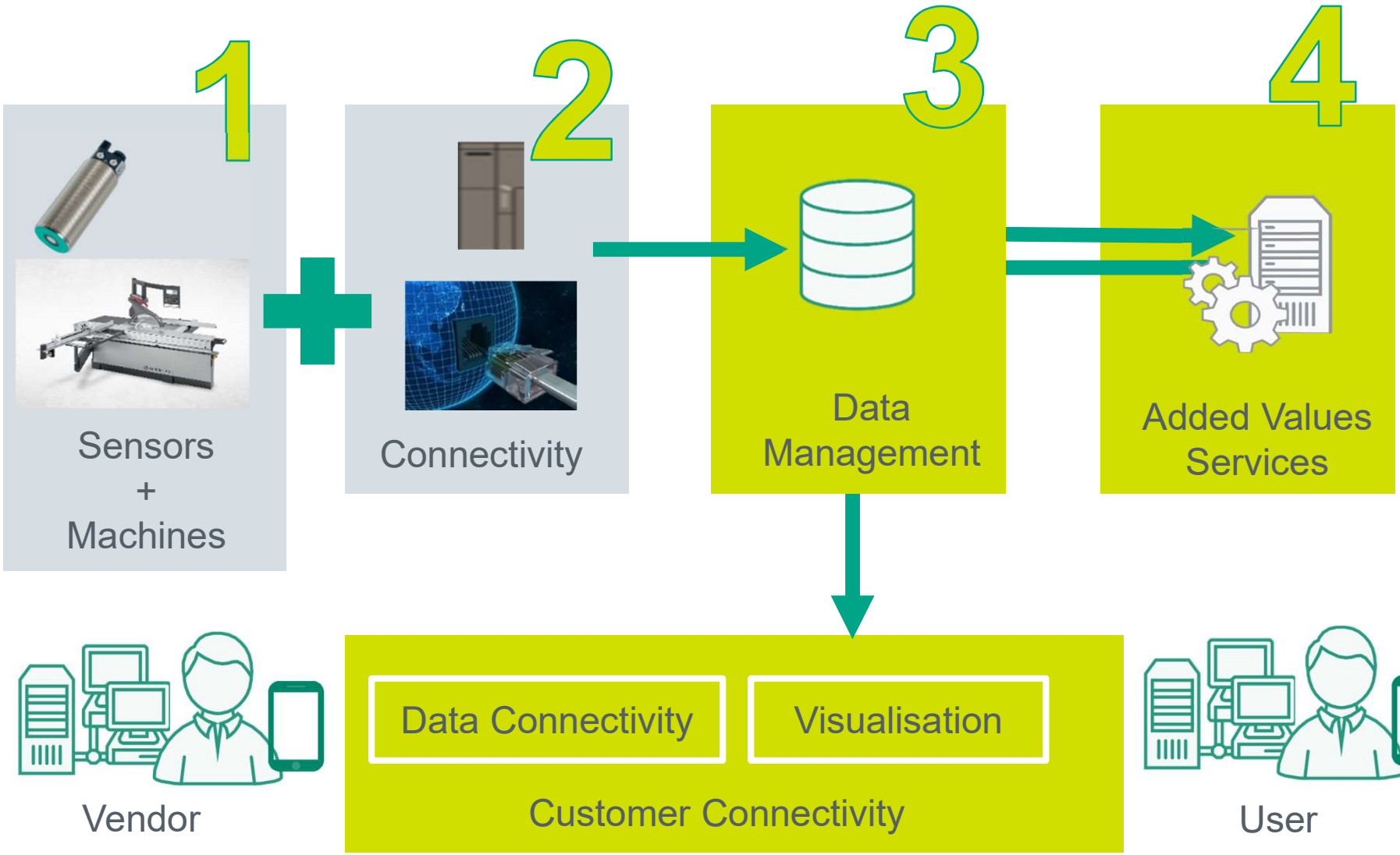
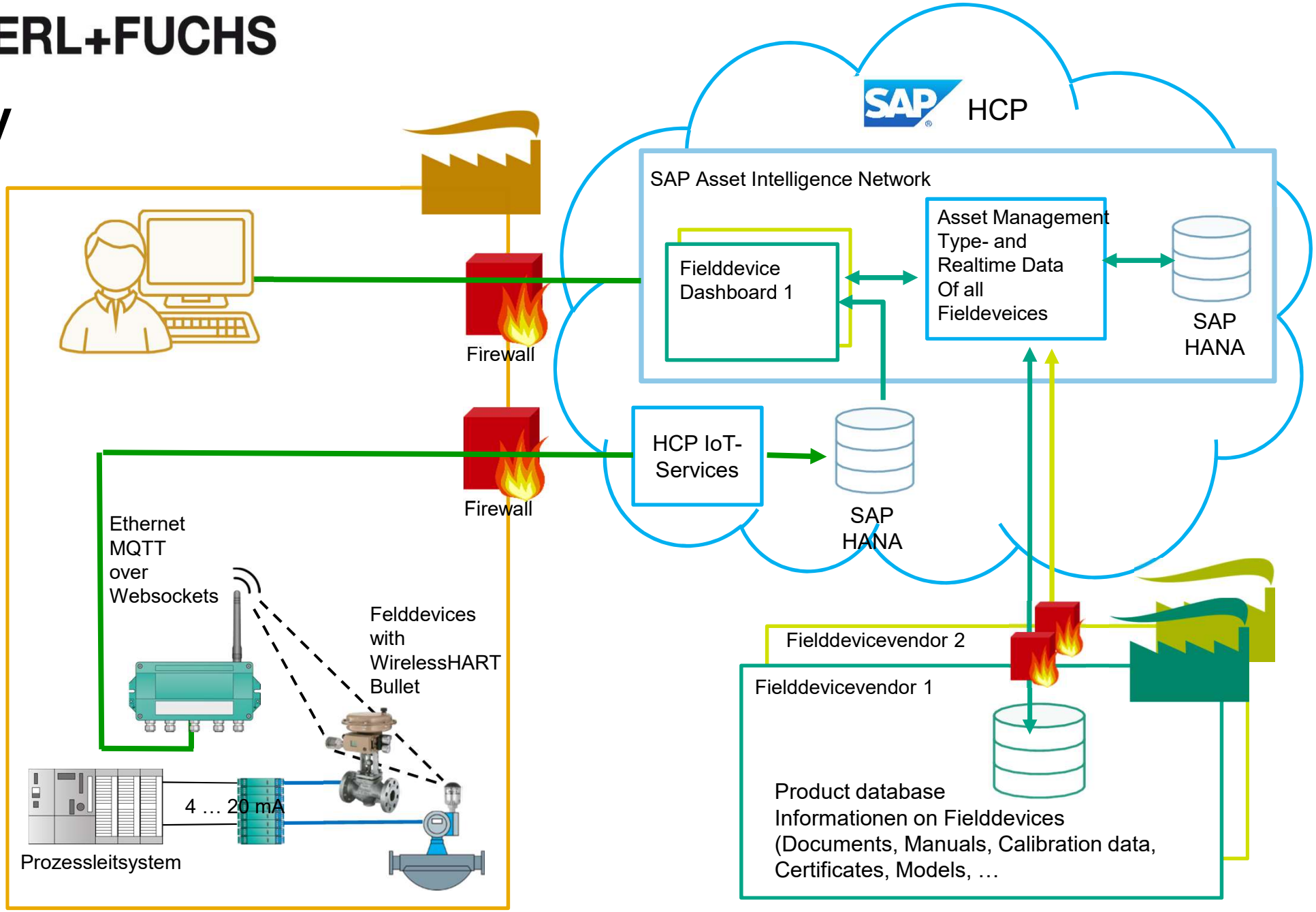
kflows are Changing - Mobile Solutions


1
2
3
4
Sensors
+
Machines
Connectivity
Data
Management
Added Values
Services
Vendor
Data Connectivity
Visualisation
Customer Connectivity
User

PPERL+FUCHS

rity



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Laser Scann

Self-organizing P

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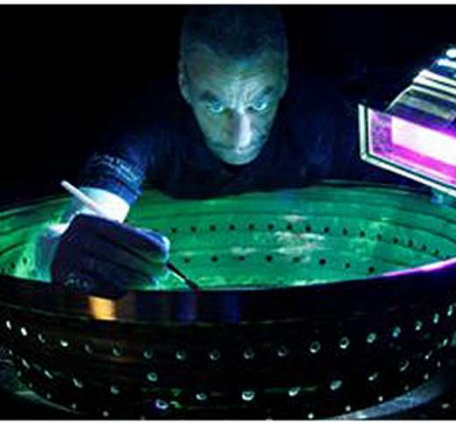
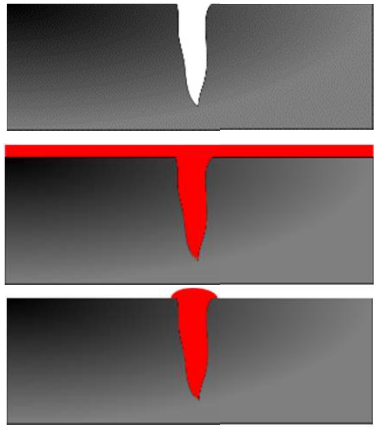
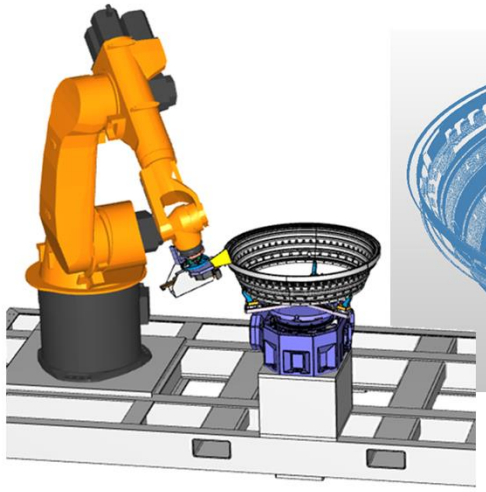
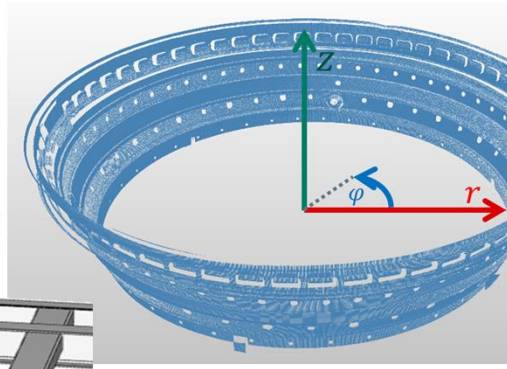
µm Crack Detection in turbine cha

Lifecycle Manage

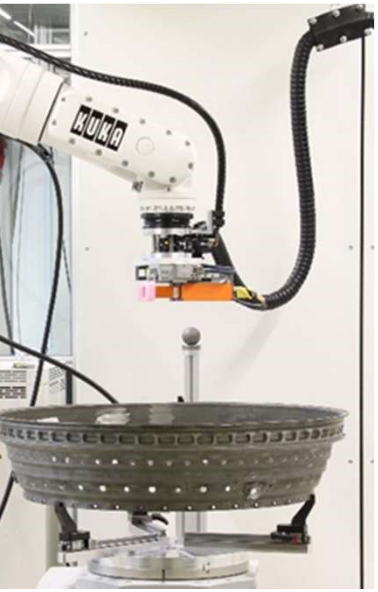


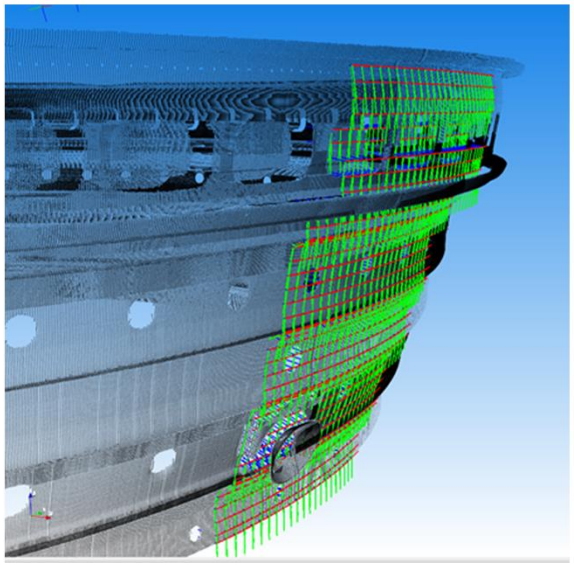


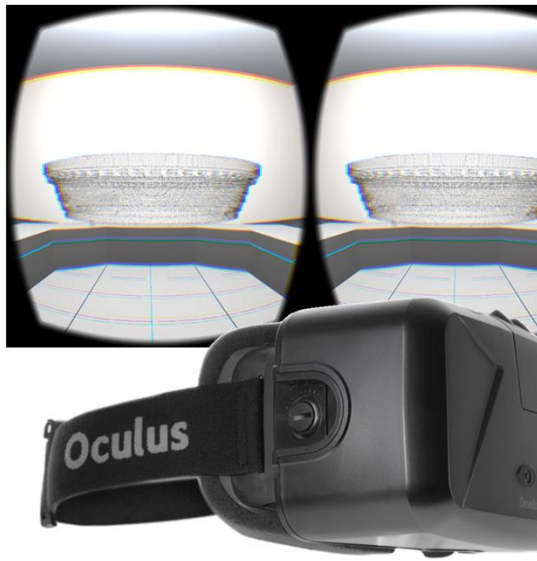




Source: Lufthansa Technik AG







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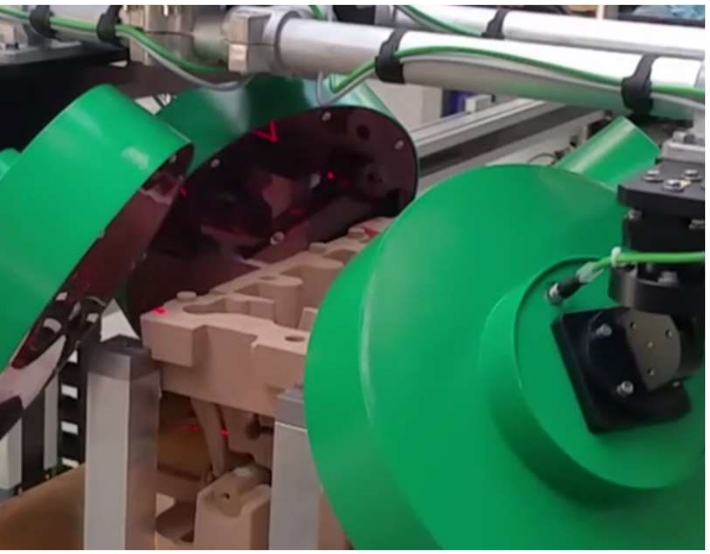
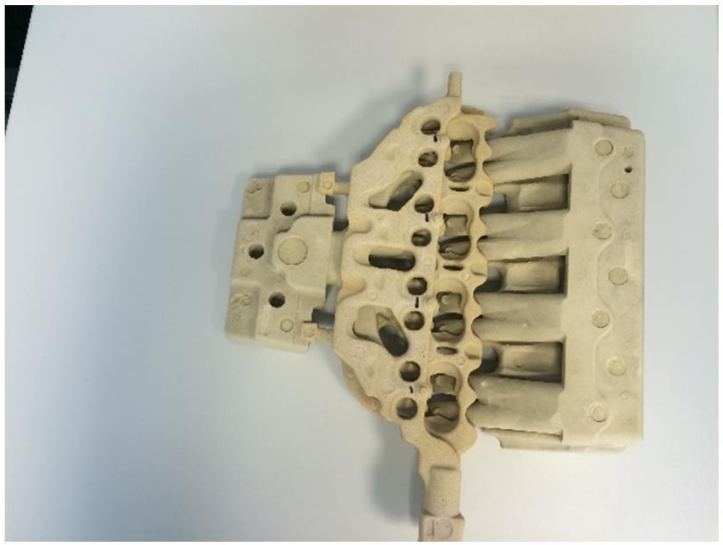
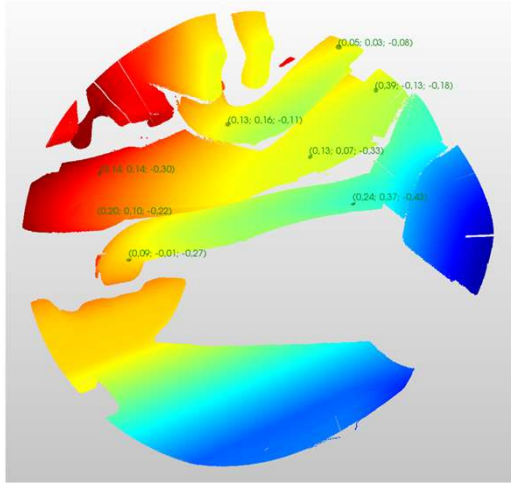
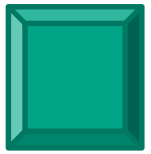
3D Laser-Cross-Section Cam

Augmented R









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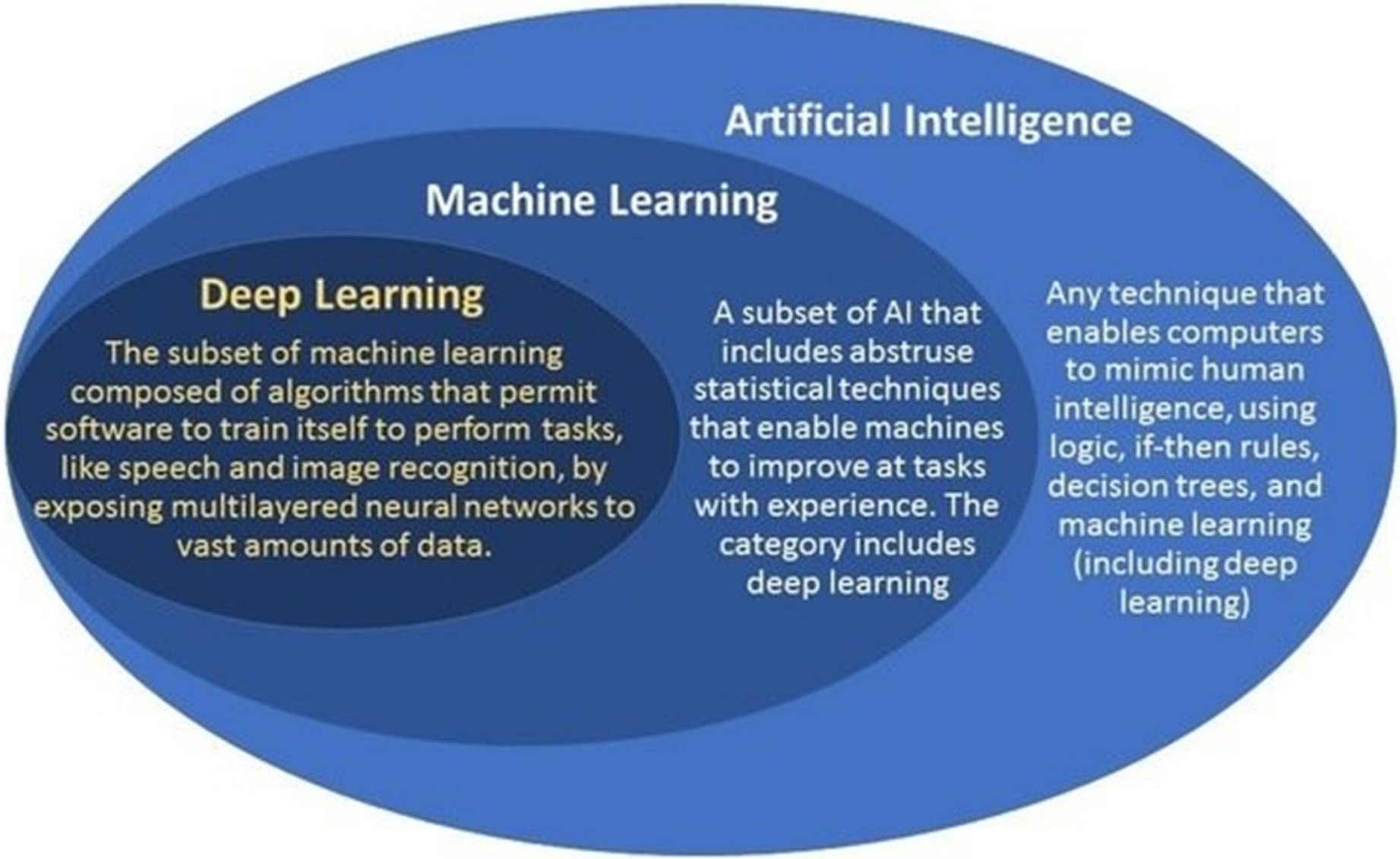
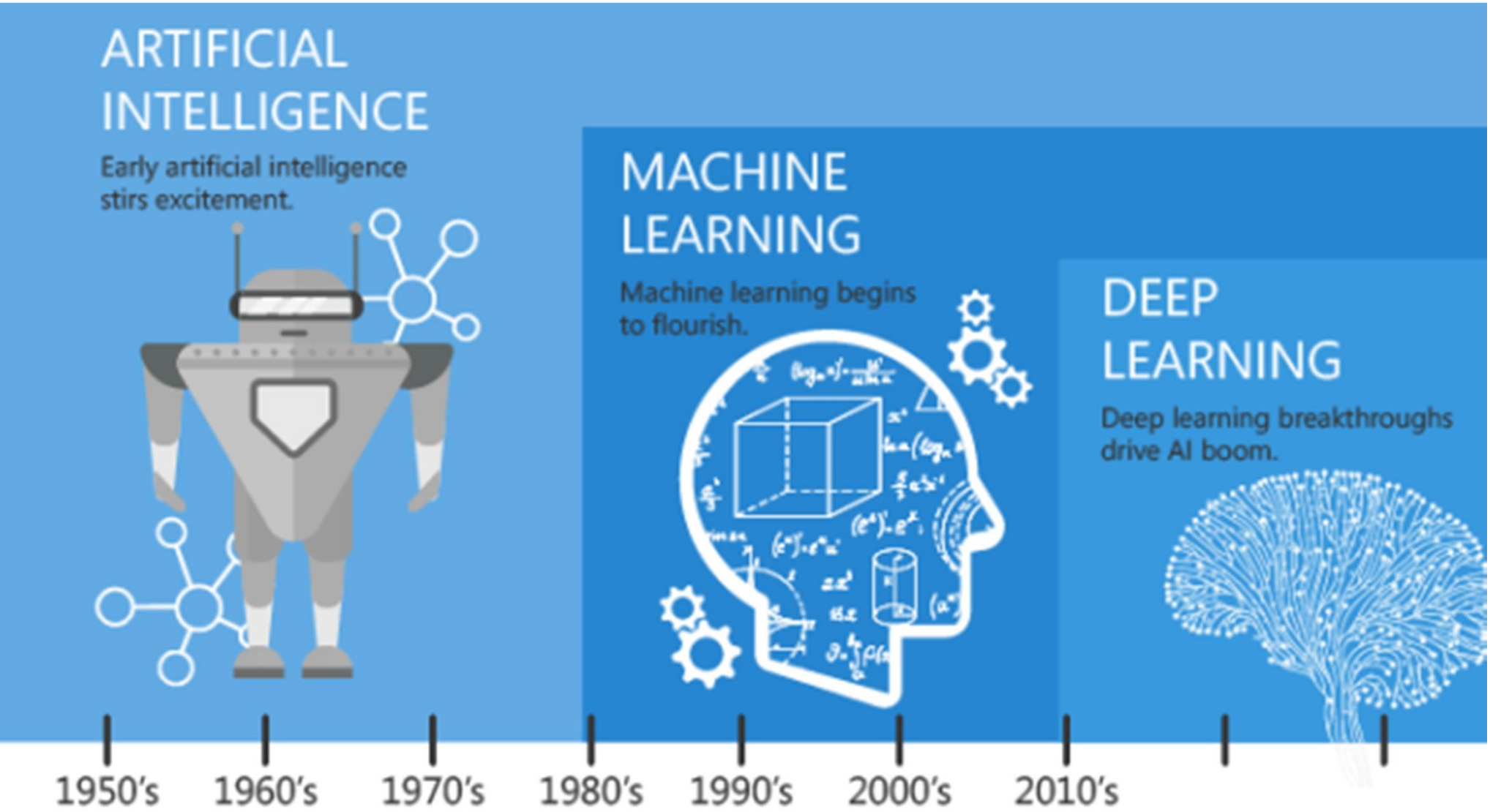
- What is AI and How it can be used at process industries

Artificial Intelligence - Development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.

Artificial Intelligence - Subse



Artificial Intelligence - Evolv



Artificial Intelligence – Already in u

- Smart phones
- Autonomous / Self Driving vehicles
- Facebook / Twitter / Chatbots
- Digital Assistants / Smart Home devices
- Navigation / Travel
- Banking / Finance
- Security and Surveillance Drones

Artificial Intelligence – Digitization is a mu

Our Parents' Car

- Four sensors
- Hardwired

Modern Car

- 60-100 sensors
- Digitally networked
  - Bus
  - Wireless

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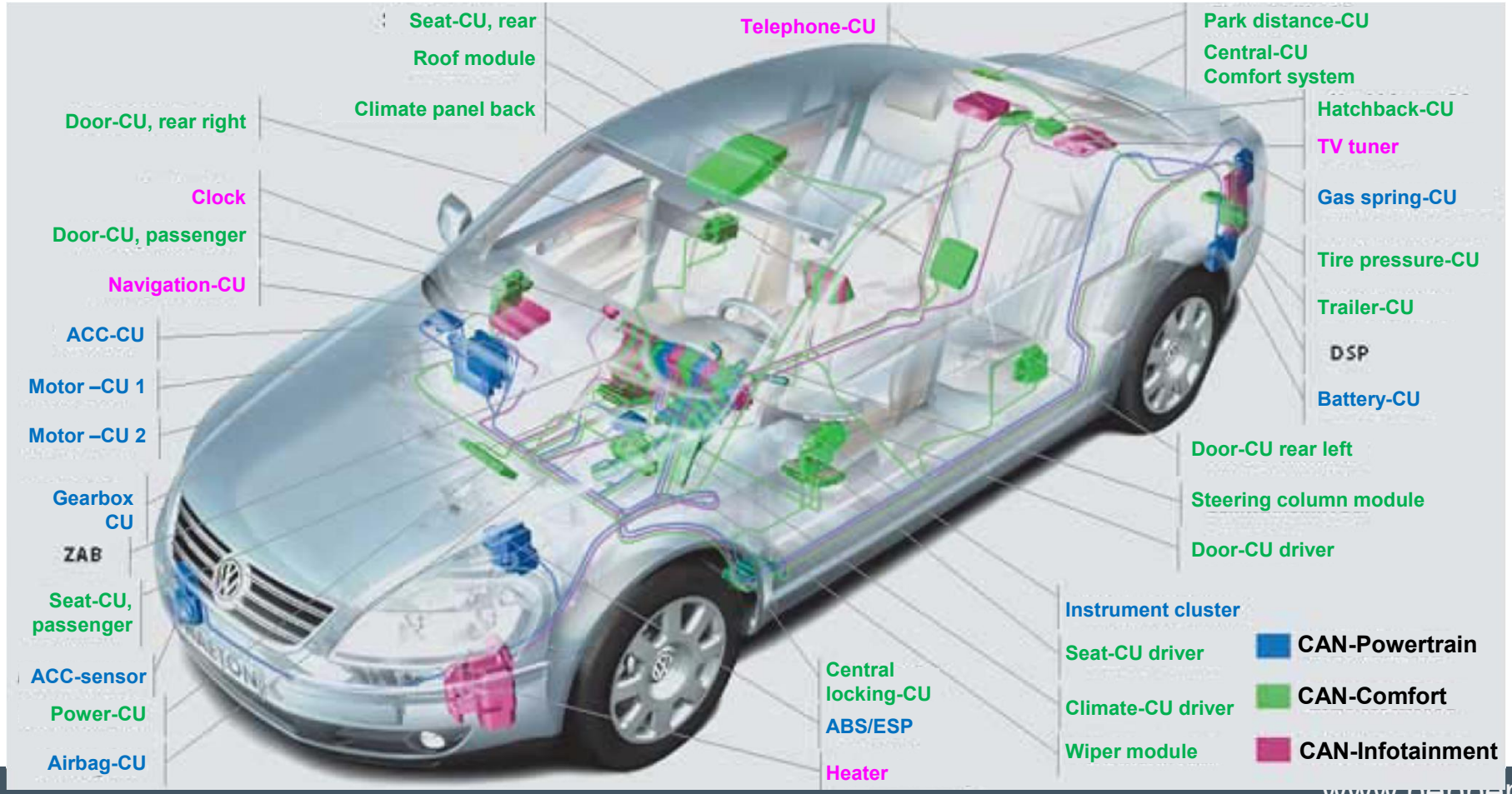
Artificial Intelligence – Digitization is a mu

- More reliable
- More fuel efficient
- Environmentally friendlier
- Safer



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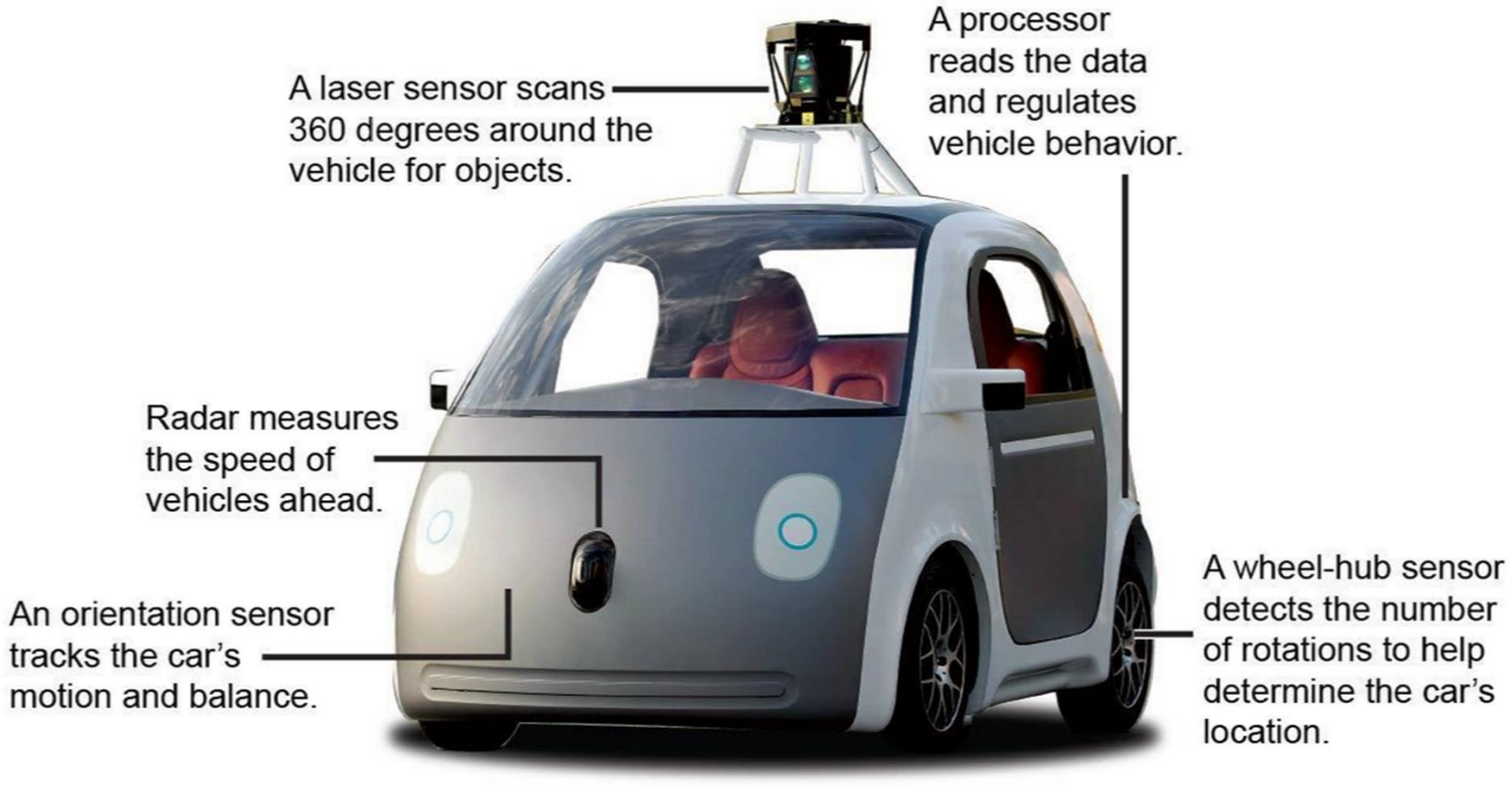
Artificial Intelligence – Digitization information is vi
Smart Se



Source: Google

Raoul Rañoa / @latimesgraphics

Artificial Intelligence – Checks & Continuous improveme

Artificial Intelligence – Machine and Deep learni

Information is digitized

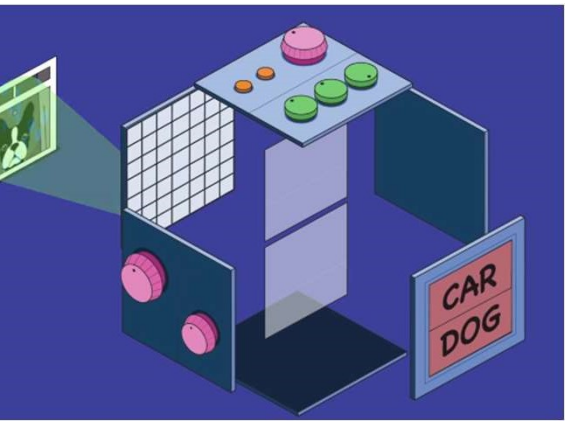
Feed it to Deep leaning algorithm

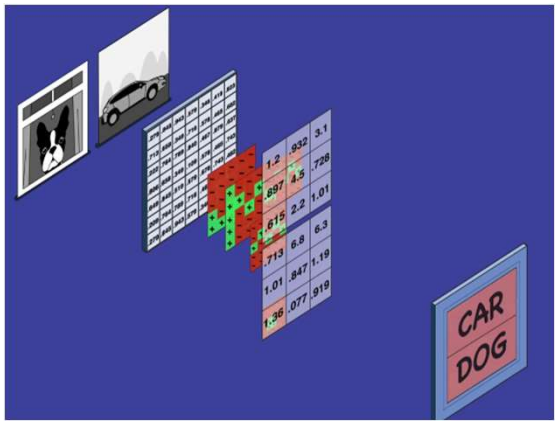
Make Business Decisions

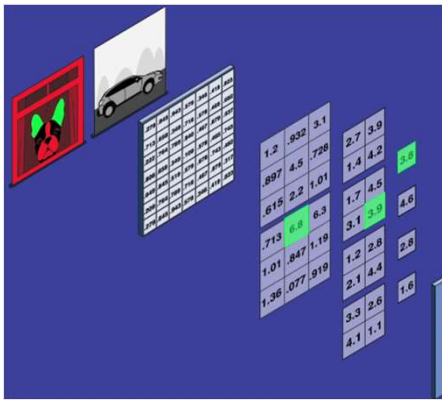
Optimise the algorithms and continuous improvements

ntifying Objects – e.g dog and a car

Layers of leaning algorithms – may be 30 or r



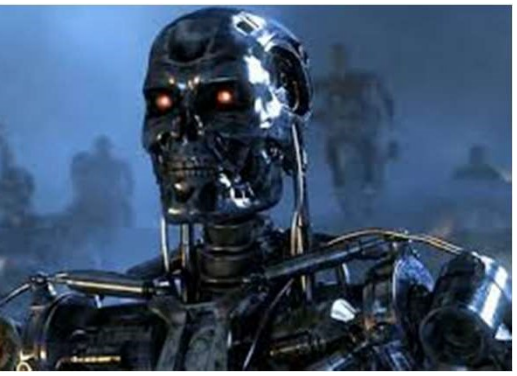


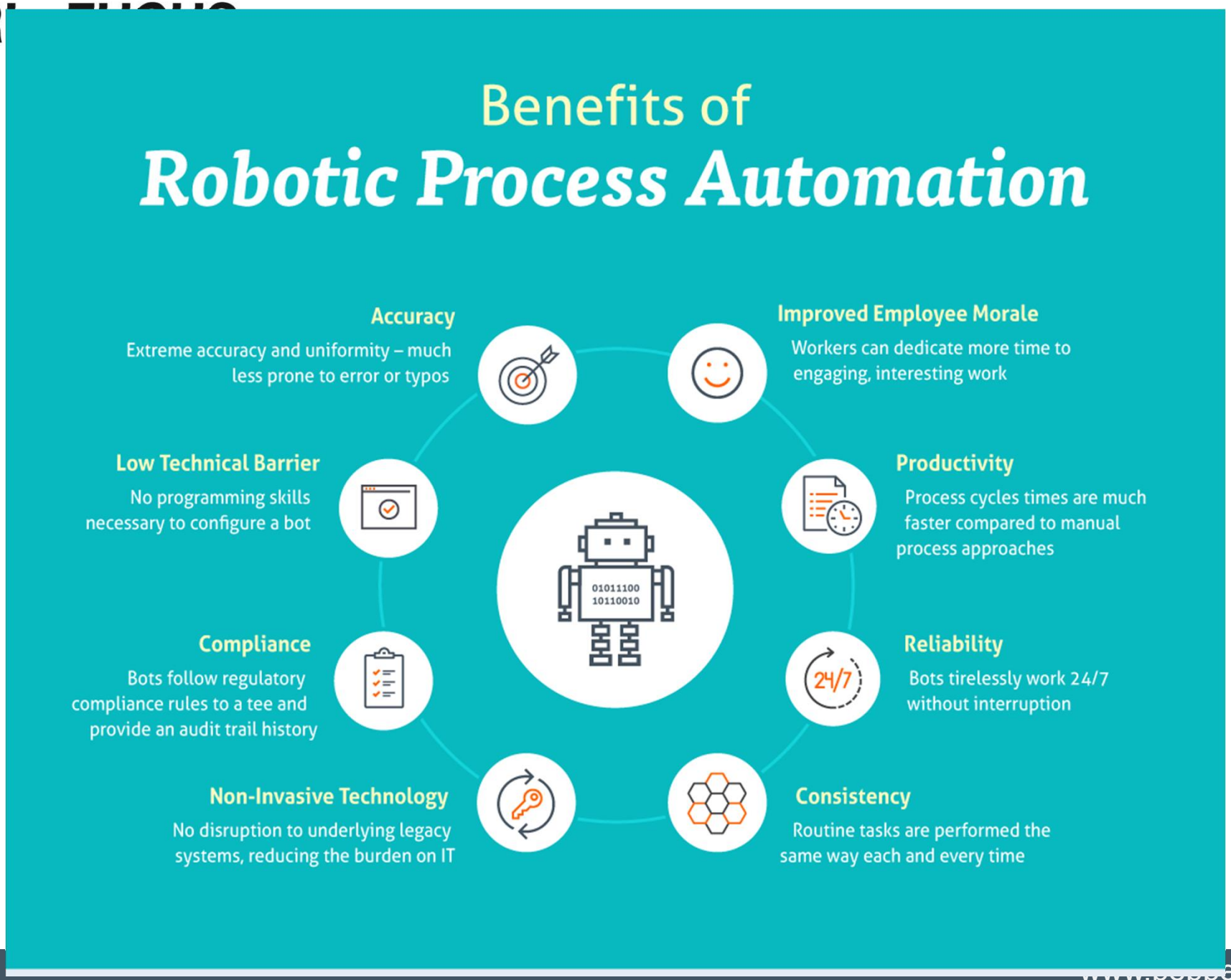


- Superior Predictive analysis
- Leaning to predict and early detection
- E.g With machine learning based on input such as audio signatures, the computer learns as a human would, by first paying attention to how a machine sounds when it's healthy and then understanding anomalies.
- A crack in a machine or an object could be easily identified by deep learning image recognition algorithms

- Already widely used in Automation industries
- Mostly to do a dedicated and repeated tasks- Welding, High voltage tests, Sorting machines, AGVs

- Not necessarily to look like human (self driving cars) and it could be any automated process – RPA - Automatic work order handling to create an operator tasks – any mismatch in the data will send an email to supervisor automatically and request for right information etc..




Benefits of
Robotic Process Automation
Accuracy
Extreme accuracy and uniformity – much less prone to error or typos
Improved Employee Morale
Workers can dedicate more time to engaging, interesting work
Low Technical Barrier
No programming skills necessary to configure a bot
Productivity
Process cycles times are much faster compared to manual process approaches
01011100
10110010
Compliance
Bots follow regulatory compliance rules to a tee and provide an audit trail history
Reliability
24/7
Bots tirelessly work 24/7 without interruption
Non-Invasive Technology
No disruption to underlying legacy systems, reducing the burden on IT
Consistency
Routine tasks are performed the same way each and every time

Summary

- New Technologies will Emerge and the digitization will complement the existing infrastructure to make them smarter and efficient
- Better Predictive maintenance at all levels even at hazardous locations
- Improve safety and Protect people
- Increase Wrench time and Plant reliability
- Emergency situation management
- Translating these advantages into cost benefits and safety of the environment is the ultimate goal







ur automation,
r passion.

PEPPERL+FU