IoT, Beyond The Hype

Johan Kumps

IoT Solutions Architect

Johan.kumps@realdolmen.com

https://www.linkedin.com/in/johankumps/

REALDOLMEN
a Gfi Group company

DEFINING THE INTERNET OF THINGS

" The Internet of Things (IoT) is the **network of physical objects** embedded with **electronics**, software, sensors and actuators. **Connectivity** enables these objects to **connect** and **exchange data** with humans, each other, business applications or the cloud. "
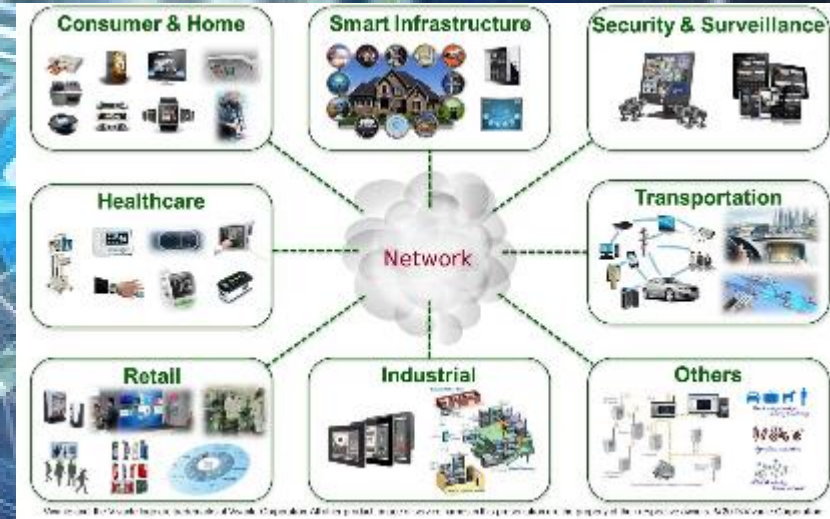
" The Internet of Things (IoT) is all about taking advantage of **the state of the physical world** around us **improving situational awareness** and **supporting the decision taking** process in our day to day life. **Physical objects** in the broad sense become **transparently** part of **World Wide Web**, forming The Web of Things. Their **data and capabilities** are accessible, **discoverable** and **composable** using well known technologies. "

Some IoT Use Cases

Connected bikes: Track the location of rented bikes; User can report the bike as stolen; Renting company can send out someone to recover the bike; Solution integrated with insurence company
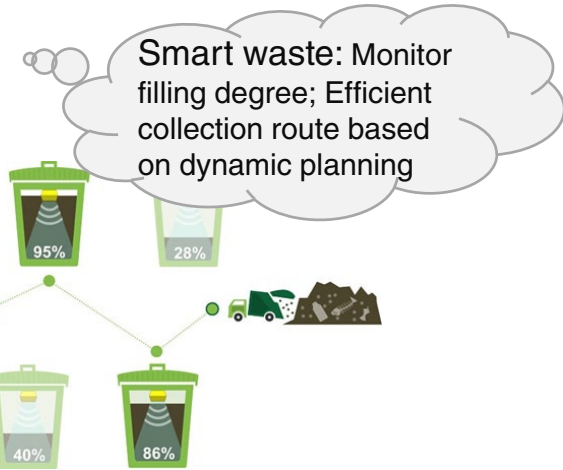
Connected trap: Detect the status of the mousetrap (armed, unarmed or unarmed with catch); Cost saver thanks to efficient inspections

Connected container: Company renting construction livable units and containers; Federate diverse tracking sensors; Real-time asset monitoring; Visualize business and geo-based information; Alarm when container crossing geofence boundary

Smart farm: Get crop and soil information; Better crop protection and irrigation

Smart waste: Monitor filling degree; Efficient collection route based on dynamic planning
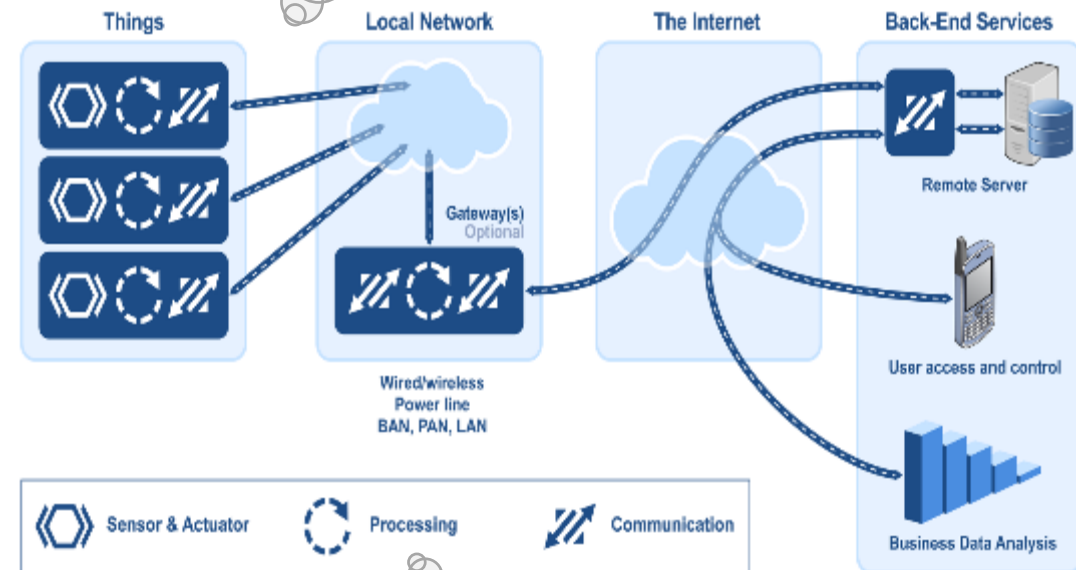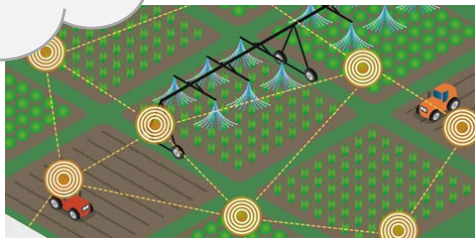
Many more…
…Parking Management, Traffic / Incident Management, Snow Removal, Environment sensors, Smart Work Centers, Smart Bus / public transport, Smart Metering, Physical security, Asset tracing, Building Management, Physical Access Management, Tourist apps & services

Things Local Network The Internet Back-End Services

Gateway(s) Optional

Remote Server

User access and control

Business Data Analysis

Wired/wireless
Power line
BAN, PAN, LAN

Sensor & Actuator   Processing   Communication

CHANGE OPPORTUNITIES

- Collect important specific information from assets (= machines, vehicles, containers, infrastructures, IT devices, technical installations, sensors, ….)
  - ▸ automatically vs (semi) manual
  - ▸ more frequently and structured
  - ▸ With higher quality and less error prone
- Follow-up of assets
  - ▸ Track & Trace: Know the location of your valuable assets at all times
  - ▸ Control & monitor objects in remote location easily
  - ▸ Avoid costly reparations thanks to predictive maintenance based on real time monitoring of your assets
  - ▸ Avoid down times of critical infrastructures
- Increase situational awareness and enlarge span of control on your environment

to create new business models & generate new revenues
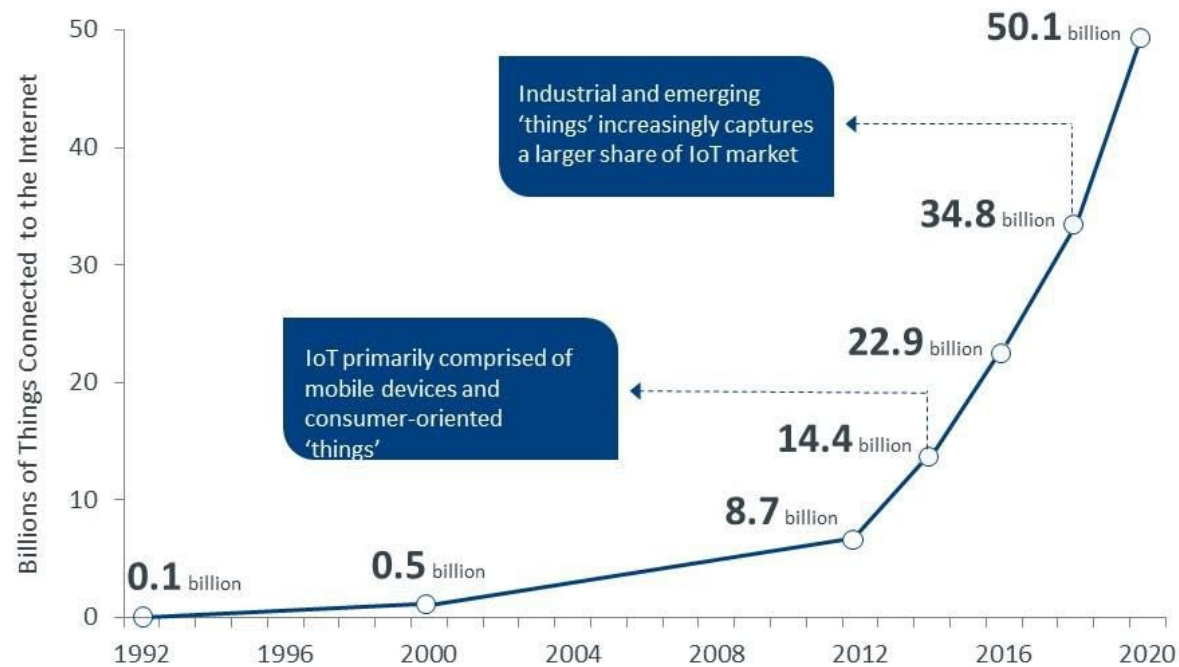to enable better decision taking, better way of working, and save costs

IoT IS GAINING MOMENTUM
POTENTIAL

"The number of connected things, from computers to household monitors to cars, is projected to grow at an annual compound rate of 23.1% between 2014 to 2020, reaching 50.1 billion things in 2020."
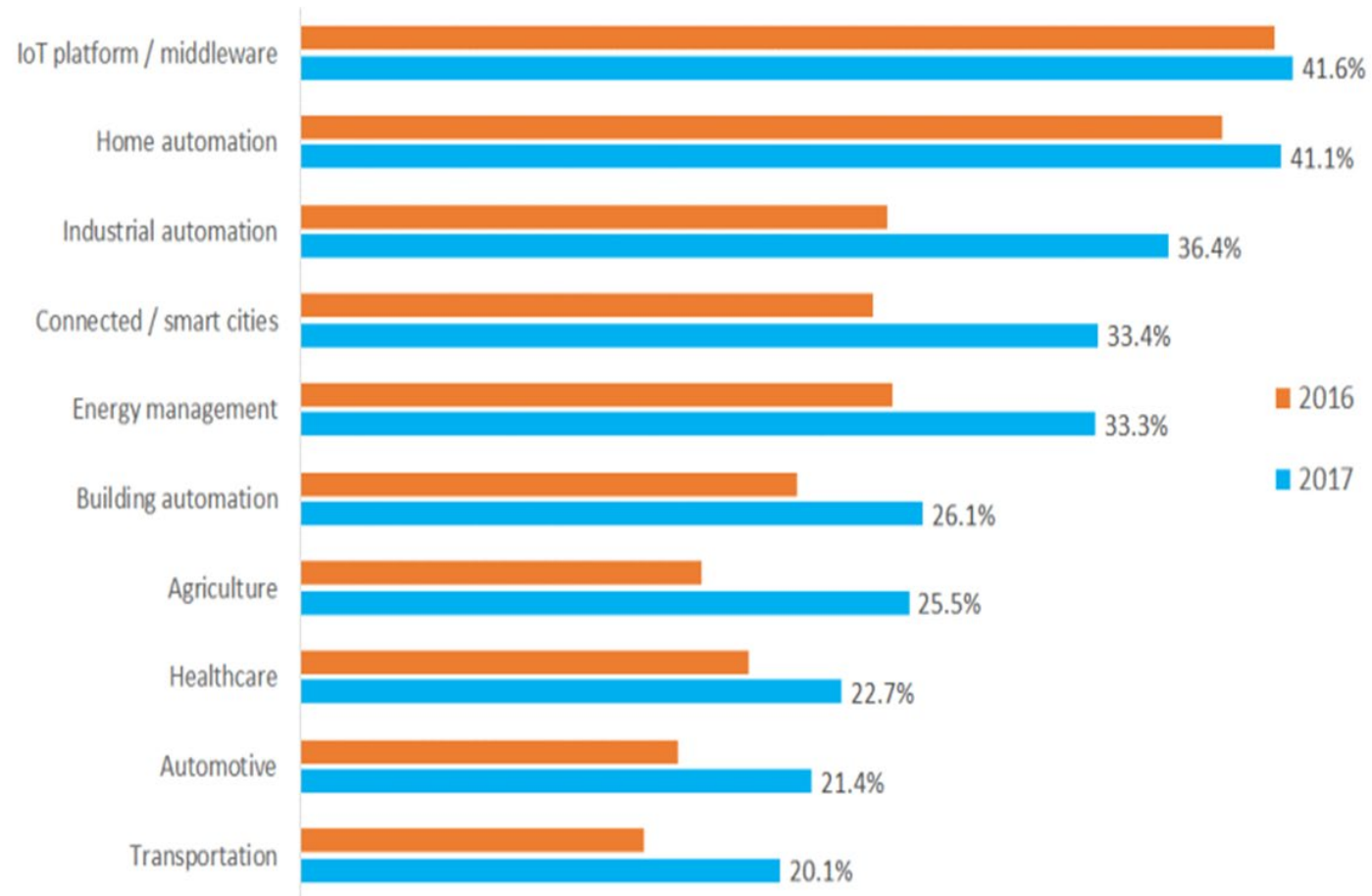
Projecting the 'Things' Behind the Internet of Things

From 2014-2020, IoT grows at an annual compound rate of 23.1% CAGR

Billions of Things Connected to the Internet

- 50.1 billion
- 34.8 billion
- 22.9 billion
- 14.4 billion
- 8.7 billion
- 0.5 billion
- 0.1 billion

Industrial and emerging 'things' increasingly captures a larger share of IoT market

IoT primarily comprised of mobile devices and consumer-oriented 'things'

1992 1996 2000 2004 2008 2012 2016 2020

CompTIA

Sources: Group SJR | Cisco | CompTIA

IoT Adoption Across Major Industries
Trends

INDUSTRIAL IoT

IoT and the Industrial Revolution

- Changing business models
  - From selling a product to providing a managed service
  - Products become assets that can be connected to the internet, which means they can be remotely monitored
  - Understand how assets are used, to predict when they need maintenance and to sharpen the total cost of ownership models
- Technological Transformations
  - Previously, connected devices such as vending machines needed mains charging and relied on Wi-Fi, cellular or Bluetooth connectivity
  - We now have power-efficient sensors and a multitude of different ways of connecting devices to cloud-based analytics (low-power wide-area networks, 4G, 5G)

Digital transformation is opening up new opportunities for organizations by transforming costs, improving customer experiences, generating operational efficiencies, new business models

HOW IIoT WORKS

- IIoT is a network of devices connected via communications technologies to form systems that monitor, collect, exchange and analyze data

- IIOT delivers valuable insights that enable industrial companies to make smarter business decisions faster.

- An industrial IoT system consists of:

  - ▶ intelligent assets -- i.e., applications, controllers, sensors and security components -- that can sense, communicate and store information about themselves

  - ▶ data communications infrastructure, e.g., the cloud

  - ▶ analytics and applications that generate business information from raw data

  - ▶ people

- Measured data is converted into actionable information on how a certain piece of machinery is operating

- This information can then be used for predictive maintenance, as well as to optimize business processes

# EFFICIENCY AND PRODUCTIVITY BENEFITS OF IIoT ADAPTION
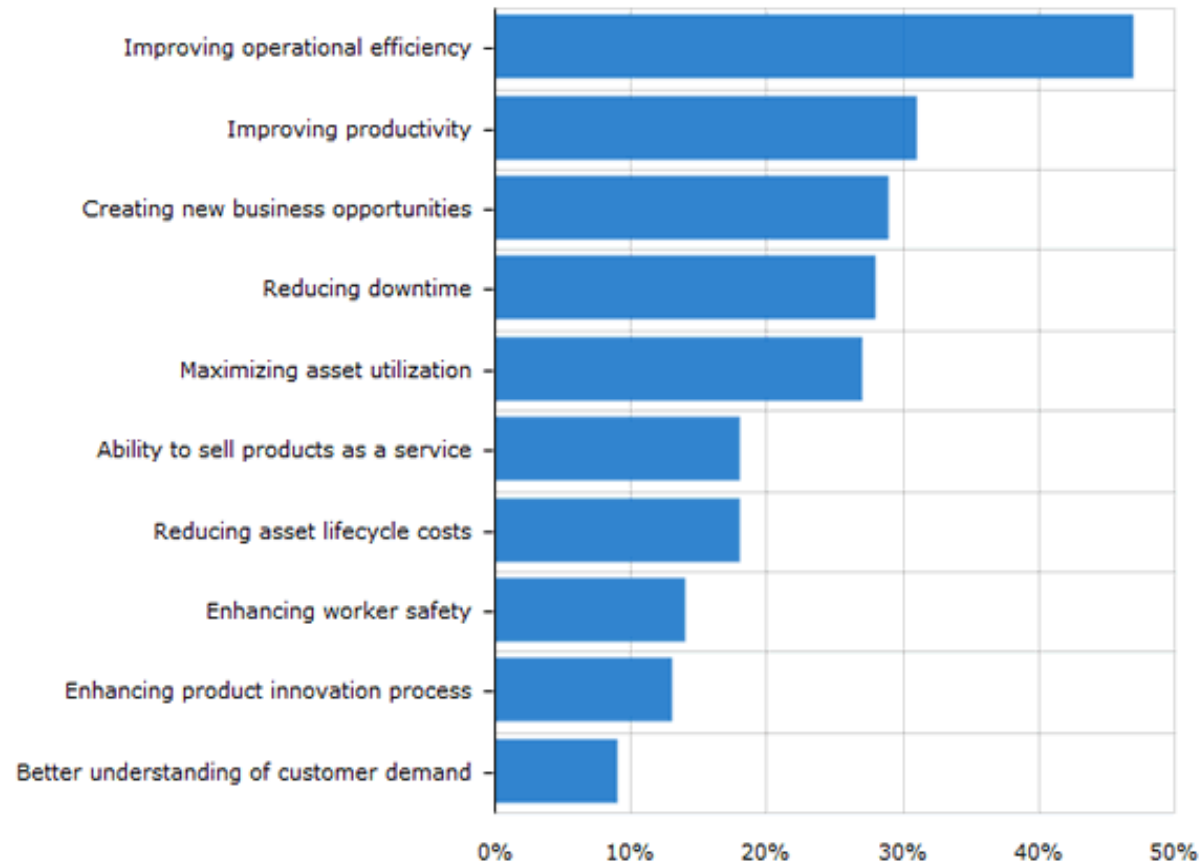
THE MULTI-PURPOSE IoT PLATFORM

WHAT IS A MULTI-PURPOSE I(I)OT PLAFORM?

- Often IoT information will be used by numerous and diverse applications

- Business applications are interested in using IoT information originating from a diverse set of IoT devices

- Today's general IoT systems that are designed to support specific single-purpose applications forming so-called IoT silo's
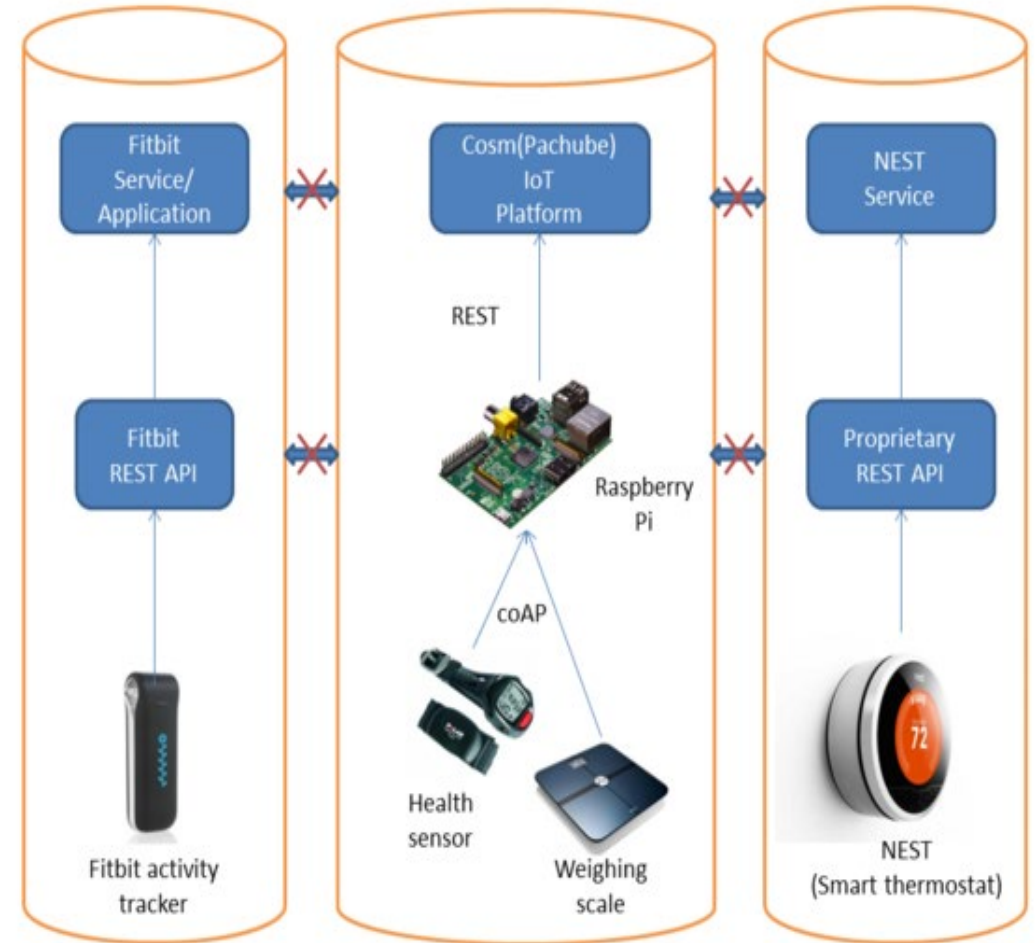
WHY SHOULD WE AIM FOR A MULTIPURPOSE IoT PLATFORM?

- Organizations own piles of data. The full potential of this data is not exploited by the organization itself due to interoperability issues (syntactical and/or semantical)

- Also outside the company the data might be of great value. Sharing and selling data and services leads to new business models.

- The real business value of IoT lies in the ability to support innovative cross-domain applications. Domain that earlier were disconnected are now integrated with each other enabling them to use information of each other and provide new value added services to multiple parties.

  - ▶ Web Of Things
    - REST APIs + standardazed message model (Ex: SenML)

  - ▶ Semantic Web of Things
    - REST APIs + machine interpretable descriptions of IoT data, IoT services and contextual information

MAKING SENSE OF DATA
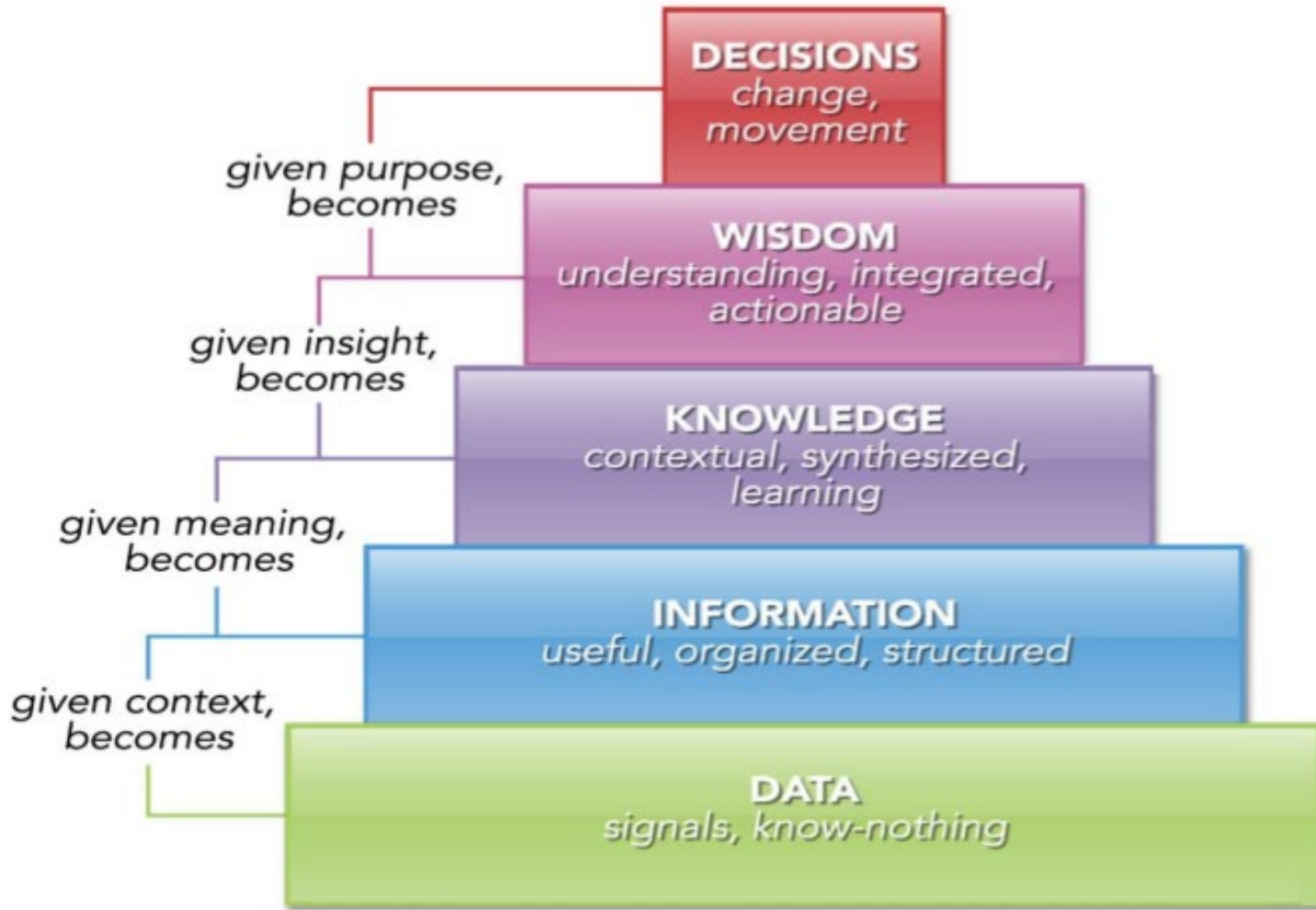
Example

Activate air freshener, air conditioning, …

Air polution index, Discomfort index

Temperature in living room

*[{"n":"temperature", "v":22.5, "u":"cel",
{"n":"humidity", "v":20, "u":"%"},
{"n":"co2", "v":403.57, "u":"ppm"}]*

A1B0FF120ABEF52

Benefit to humanity

Smart Factory as a feature of Industry 4.0

SMART FACTORY

- Smart factory, is one of the key features of Industry 4.0
- The concept of Smart Factory is the seamless connection of individual production steps, from planning stages to actuators in the field
- In a Smart Factory, machinery and equipment will have the ability to improve processes through self-optimization and autonomous decision-making
- The Smart Factory enables all information about the manufacturing process to be available when and where it is needed across entire manufacturing supply chains and product lifecycles
- Takes advantage of advanced information and manufacturing technologies to enable flexibility in physical processes.
- It all has to do with technology connectivity and the advances in the contextualization of data

SMART FACTORY CHARACTERISTICS

- Connected Manufacturing
  - horizontal integration through the numerous operational systems that power the organization
  - vertical integration through connected manufacturing systems; and end-to-end, holistic integration through the entire value chain.
- Convergence of IT and OT
  - convergence of the digital and physical worlds—including information technology (IT) and operations technology (OT)
- Fully connected and Flexible System
  - can use a constant stream of data from connected operations and production systems to learn and adapt to new demands

Smart Factory Benefits

- Make better, data-driven decisions
  - ▶ Visibility into the operational status of machine components (both historically and in real-time) allows plant managers to remotely monitor and diagnose systems quickly, as well as identify and resolve problems before the impact on machine availability and productivity compounds

- Maximize Machine Uptime
  - ▶ Predictive analytics allows for more accurate planning of machine maintenance, which can help reduce machine downtime, increase mean time between failure (MTBF), and reduce costs of unnecessary preventative maintenance and spare parts inventory.

- Increase Productivity
  - ▶ Interconnectivity enables seamless communication among machines, components, and people. It also increases efficiency by allowing for more autonomous machine performance and streamlined manual processes.

- Enhanced Customer Satisfaction
  - ▶ The manufacturer can capture and analyze data about how customers use their products, enabling manufacturers and product designers to tailor future IoT devices and build more customer-centric product roadmaps
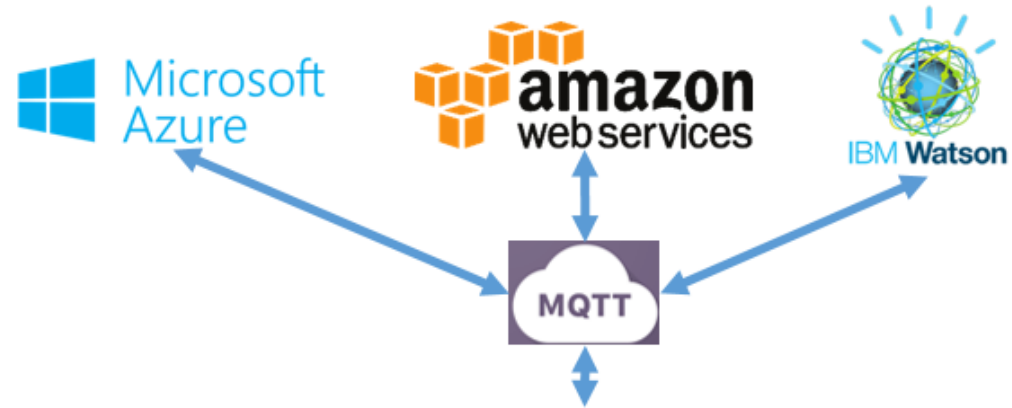
WHAT ARE THE CHALLENGES?

- Interoperability
  - ▶ Devices and machines use different protocols and have different architectures
- Latency
- Scalability
- Security
  - ▶ Companies need to be sure that their data is secure
  - ▶ Rise of MQTT since it is a very secure IIOT protocol

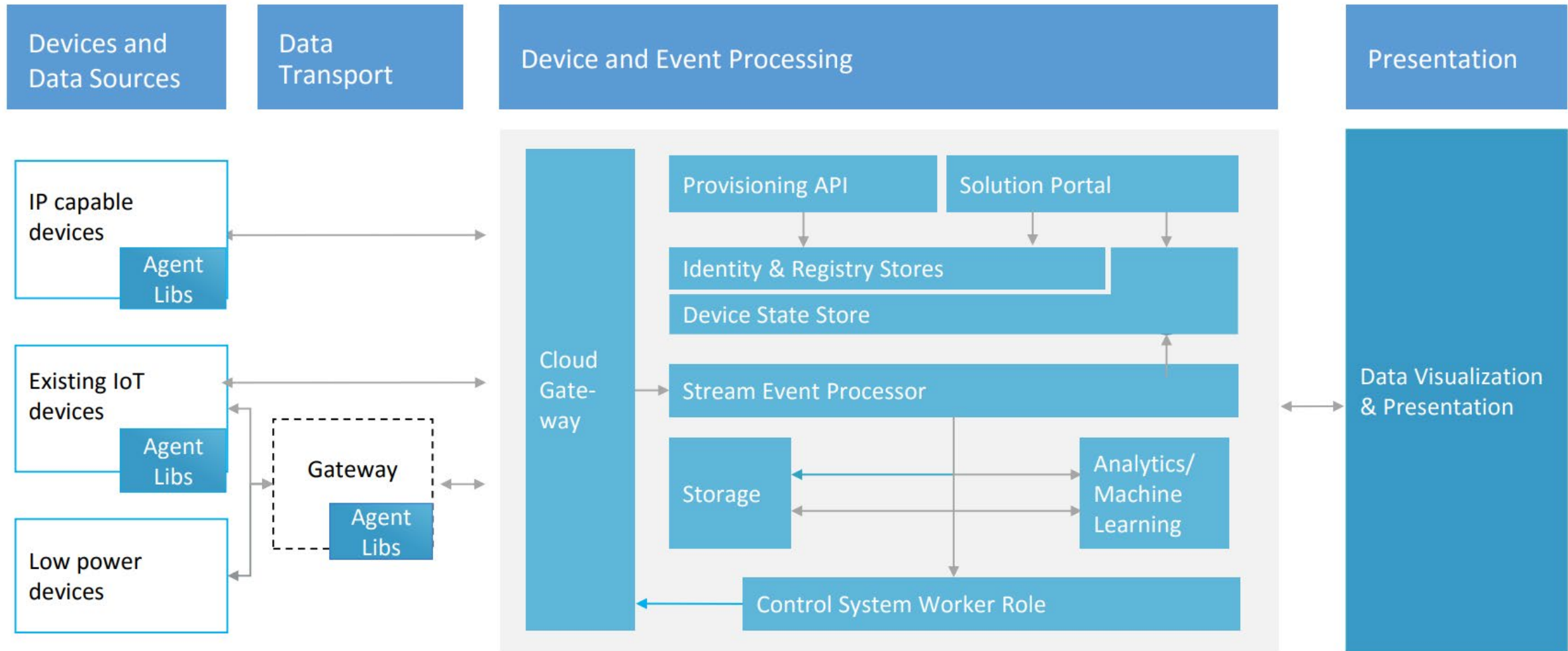# OT AND IT PROTOCOLS WORKING TOGETHER

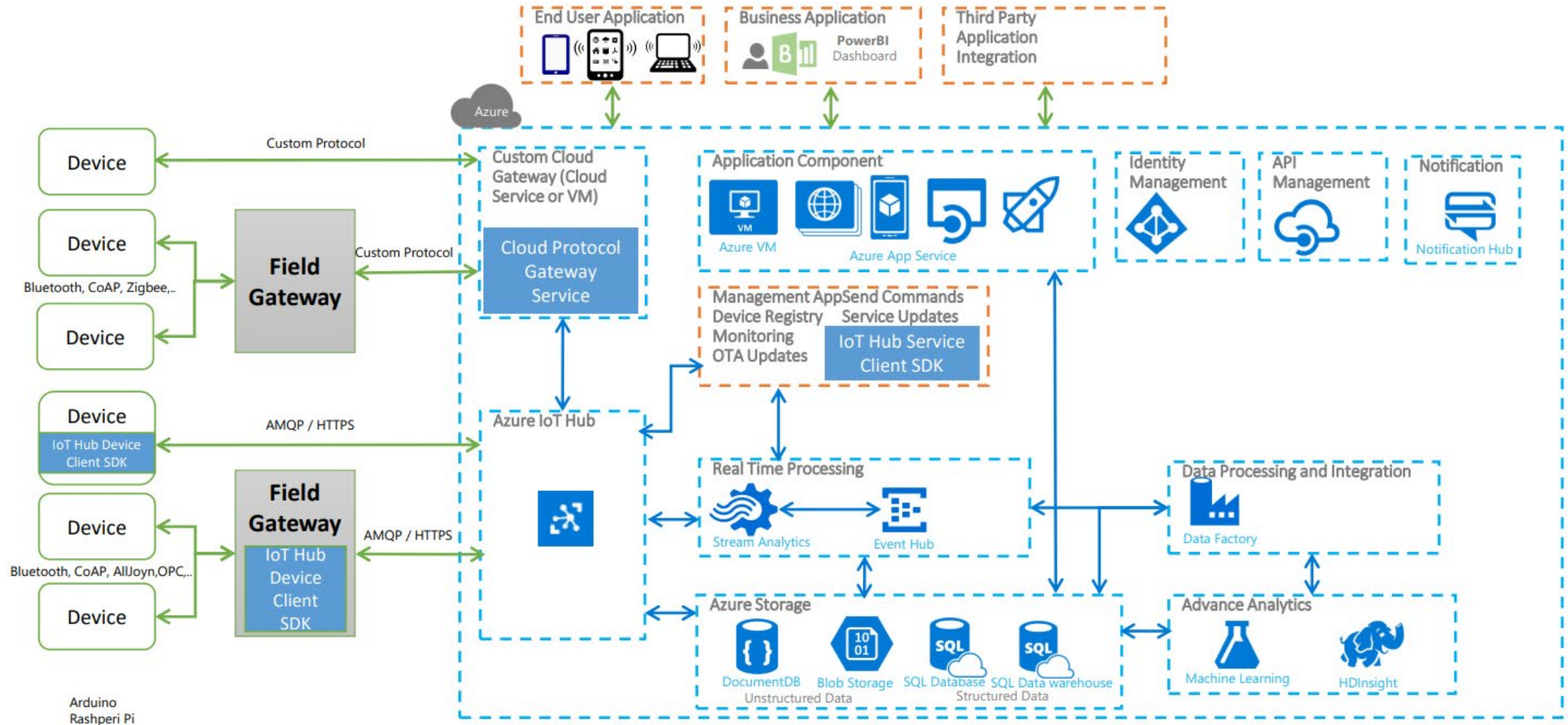Secure, Bi-Directional, Bandwidth Efficient, Redundant Communications
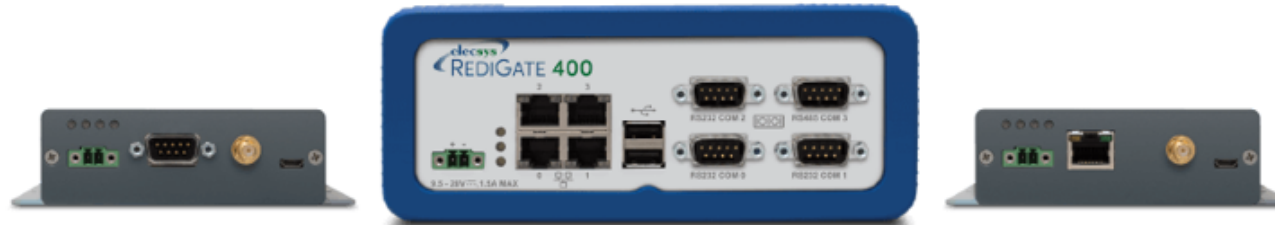
60+ Field Device Protocols

AZURE (I)IoT REFERENCE ARCHITECTURE

TYPICAL AZURE IOT SOLUTION ARCHITECTURE

KPN (NETHERLANDS)
KPN THINGS

- Functional

  - ▶ We are building an IoT platform aiming at decreasing the complexity to interact with IoT devices. We provide APIs and outgestion channels to enable traditional IoT systems to work with data coming from IoT devices. Using the semantic framework we are able to provide smart services on top of the raw data.

- Technical

  - ▶ LoRa connectivity

  - ▶ 2G, 3G, 4G connectivity

  - ▶ Implementation of multiple decoders for specific devices (Track&trace, environment monitoring, …)

  - ▶ API Management

  - ▶ Coupling of IoT devices to traditional IT via APIs and outgestion channels (Azure Event Hub, AWS, MQTT, …)

  - ▶ Semantic layer on top of data

    - Reasoning

    - Discovery

KPN Things building blocks
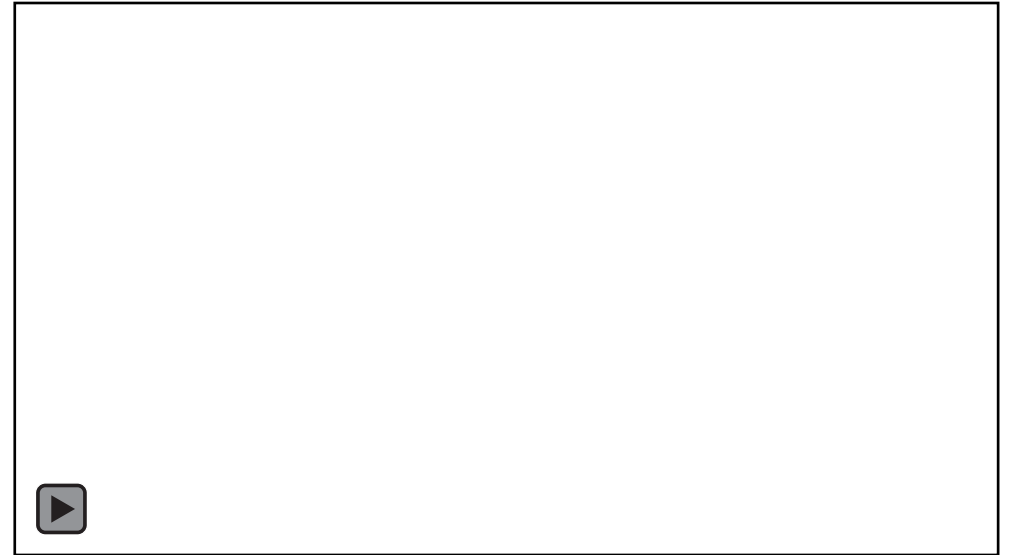Architecture and overview of modulair functionalities
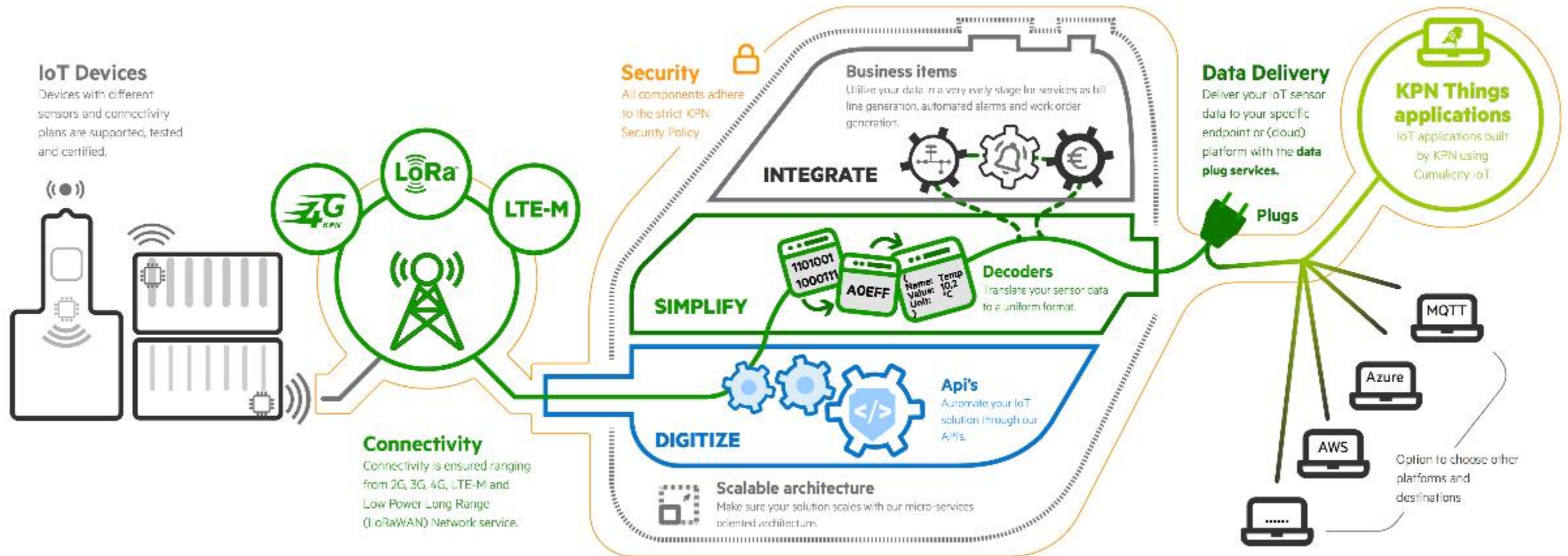
TNT Euro Hub

- In 2016 TNT replaced the (manual) sorting system at the Liege Hub in order to scale up and be ready for the future
- Equipment
  - ▶ Document & Parcel sorter, Xray, Barcode scanners, weighing machine, conveyor belt, …
- Goal : Couple OT with TNT enterprise applications
- Non Functionals
  - ▶ 40 planes and 140 trucks and vans every day
    - 24000 documents per hour
    - 24000 parcels per hour
  - ▶ Prepare for volume increases
- Platform :
  - ▶ WSO2 Enterprise Service Bus ← Custom Connectors
  - ▶ WSO2 Application Server ← OSGI services (ex : Destination Server)
  - ▶ WSO2 Complex Event Processor ← corellation of events (ex : E2E logging)
  - ▶ Infinispan distributed cache
  - ▶ Delphi based user interface to create and upload sorting plan

SOME IMPRESSIONS

Air Compressor Manufacturer - IoT Demonstrator
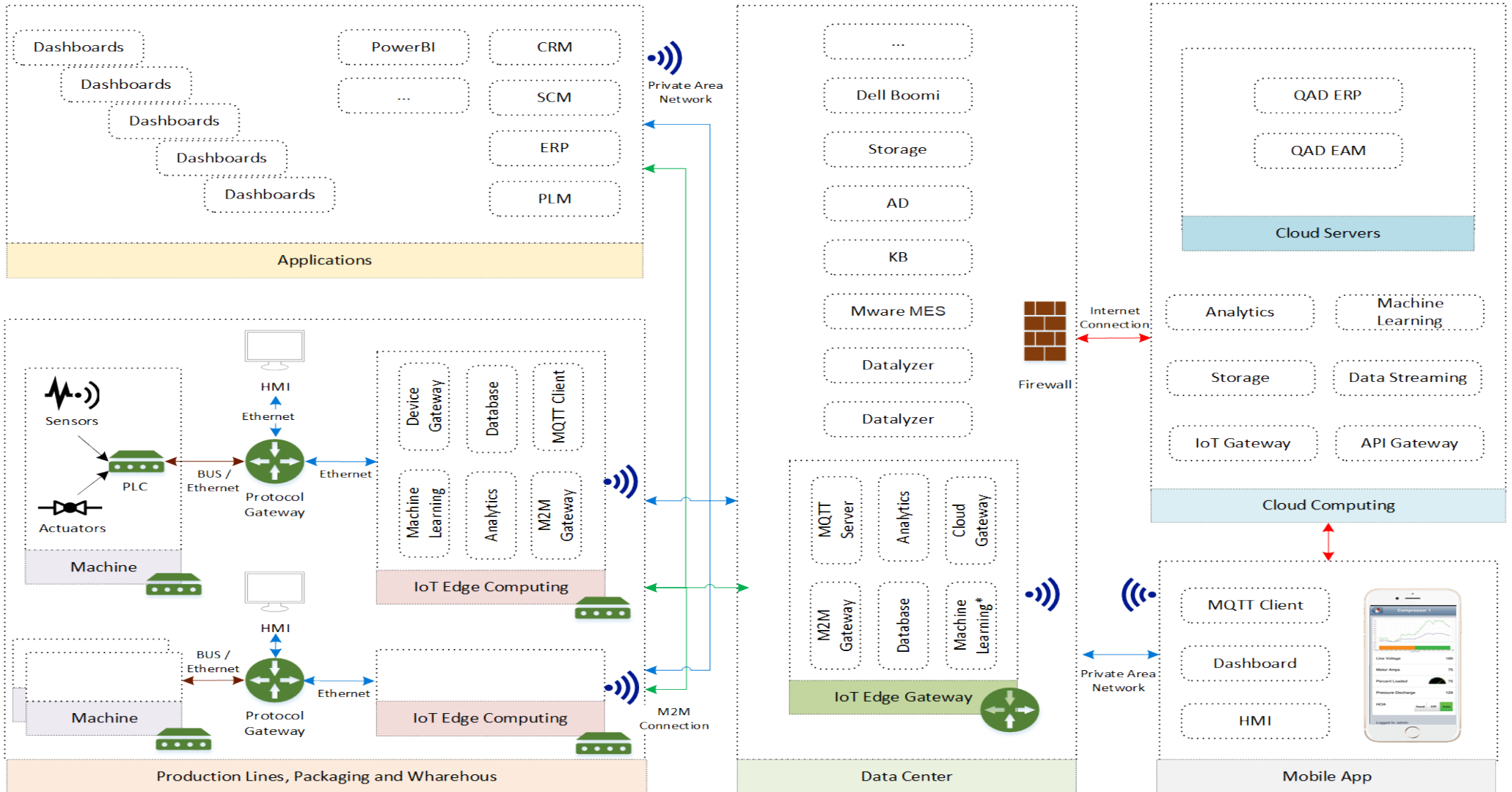
BATTERY MANUFACTURER

Applications

- Dashboards
- Dashboards
- Dashboards
- Dashboards
- Dashboards
- PowerBI
- ...
- CRM
- SCM
- ERP
- PLM

Private Area Network

Production Lines, Packaging and Wharehous

- Sensors
- PLC
- Actuators
- Machine
- BUS / Ethernet
- HMI
- Protocol Gateway
- Ethernet

IoT Edge Computing
- Device Gateway
- Database
- MQTT Client
- Machine Learning
- Analytics
- M2M Gateway

- Machine
- BUS / Ethernet
- HMI
- Protocol Gateway
- Ethernet

IoT Edge Computing

M2M Connection

Data Center

- ...
- Dell Boomi
- Storage
- AD
- KB
- Mware MES
- Datalyzer
- Datalyzer

IoT Edge Gateway
- MQTT Server
- Analytics
- Cloud Gateway
- M2M Gateway
- Database
- Machine Learning*

Firewall

Internet Connection

Cloud Servers
- QAD ERP
- QAD EAM

Cloud Computing
- Analytics
- Machine Learning
- Storage
- Data Streaming
- IoT Gateway
- API Gateway

Private Area Network

Mobile App
- MQTT Client
- Dashboard
- HMI

Q & A

WHAT'S NEXT ?

	Technical Track	Services & Management Track
15:00-15:30	Break	
15:30-16:15	Improve your security score with Azure Security Center *Bart Verboven*	Discover new insights with Azure's Data Science Services *Tim Van Durme*

New challenges
NEW IDEAS

HQ Realdolmen Huizingen

A. Vaucampslaan 42
1654 Huizingen
+32 2 801 55 55

www.realdolmen.com