Naples, December 10th 2018

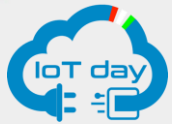
Digital Twins for IIoT

New approach for industrial IoT

Vito De Gaetano – Industrial IoT Solution Manager

redhat

UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

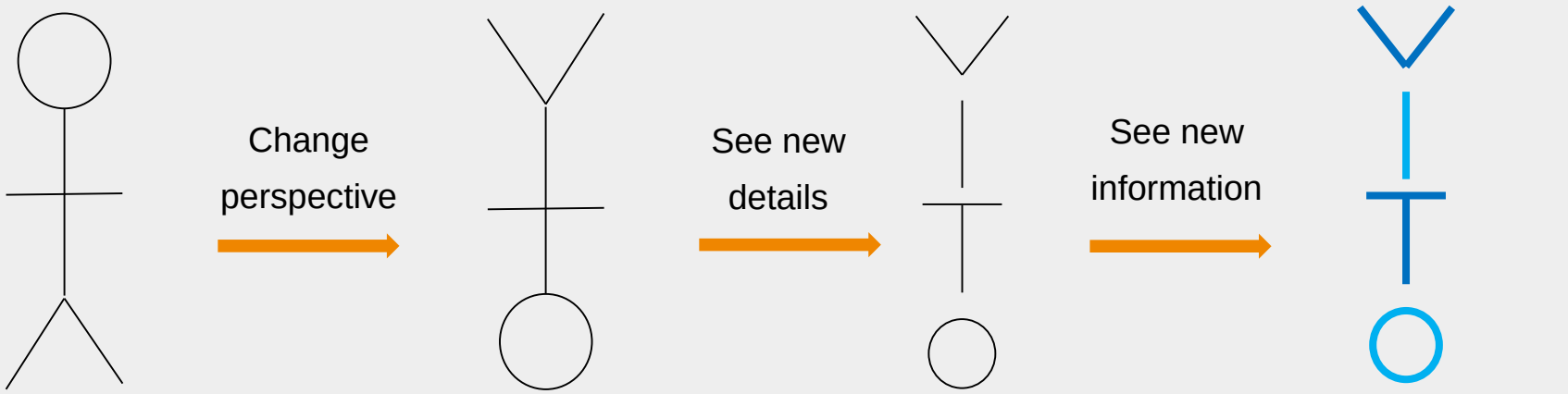


Follow the agenda, the speakers & vote the sessions!

Agenda

1. Think different
2. The reason for Industrial IoT
3. What are Digital Twins
4. How to use them
5. Business Cases

Think out of the box



VITO De Gaetano

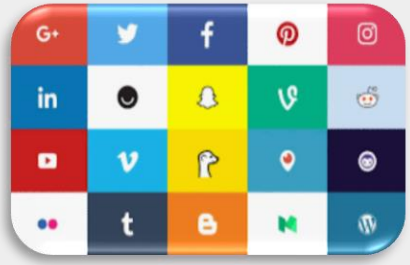
„We can‘t solve our problems by using the same kind of thinking we used when we created them.“ *(Albert Einstein)*

Self introduction: Vito De Gaetano

- Degree in microelectronic engineering
- In Bosch since 1999
- For 17 years: SAP – Project Leader, Business Consultant, Section Head
- Starting from 2013, actively involved in Industry 4.0 projects
- Since mid 2017 “Industrial IoT Architect and Solution Manager”
- Main focus in Cloud apps, digital twins and new business models
- Xelerator

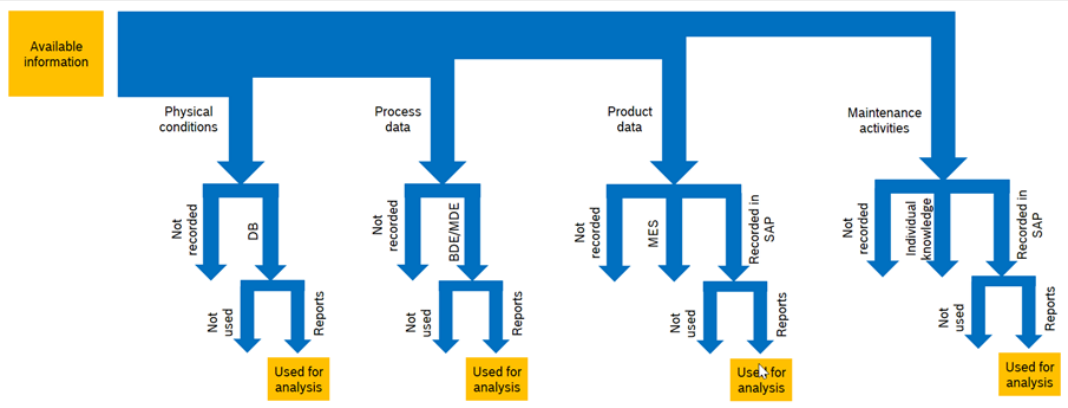
Real life….really?

- Communication, real if near in time and space
- Phone calls: digital representation of our voice
- Videoconferencing: digital representation of our image
- Social media: digital fingerprints of our activities with profiles
- Even online games….

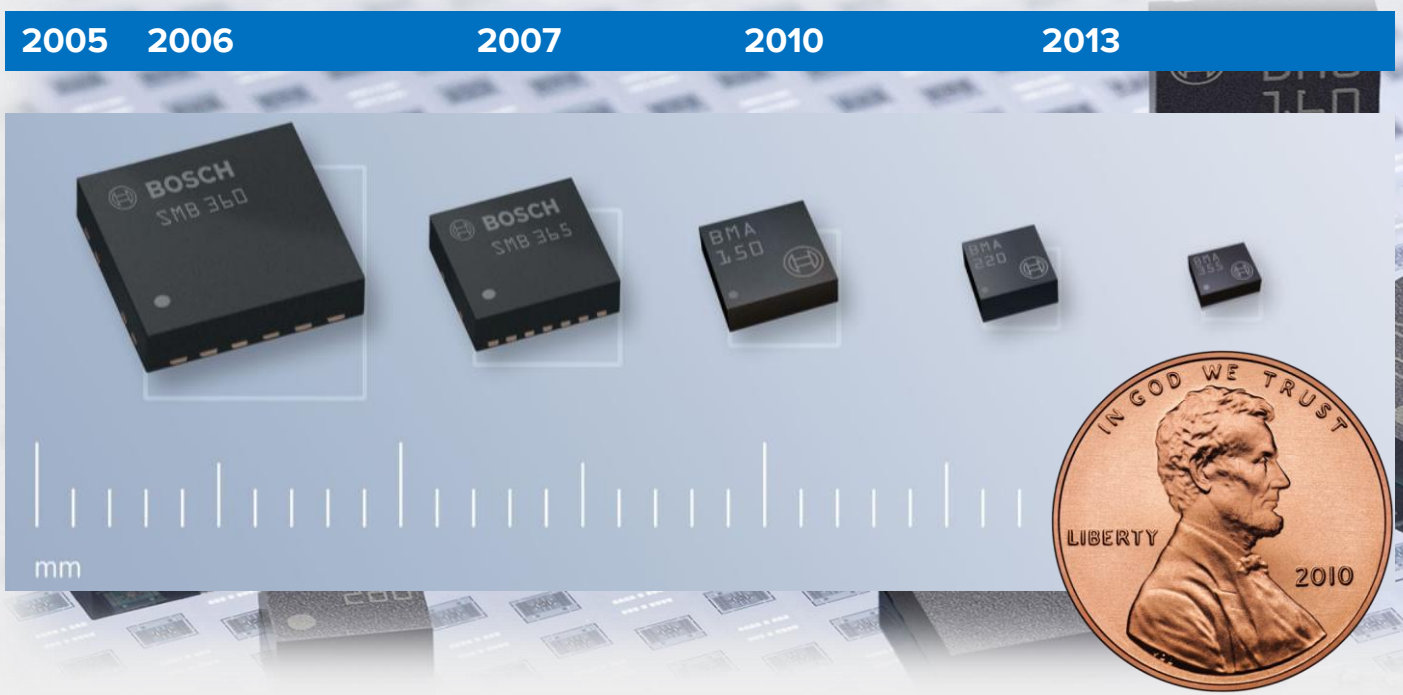


Sources of data, sources of truth

- What is “Data”?
- Where are data generated?
- Where are they stored?
- What do they mean?
- How can I access them?
- How secure are they?



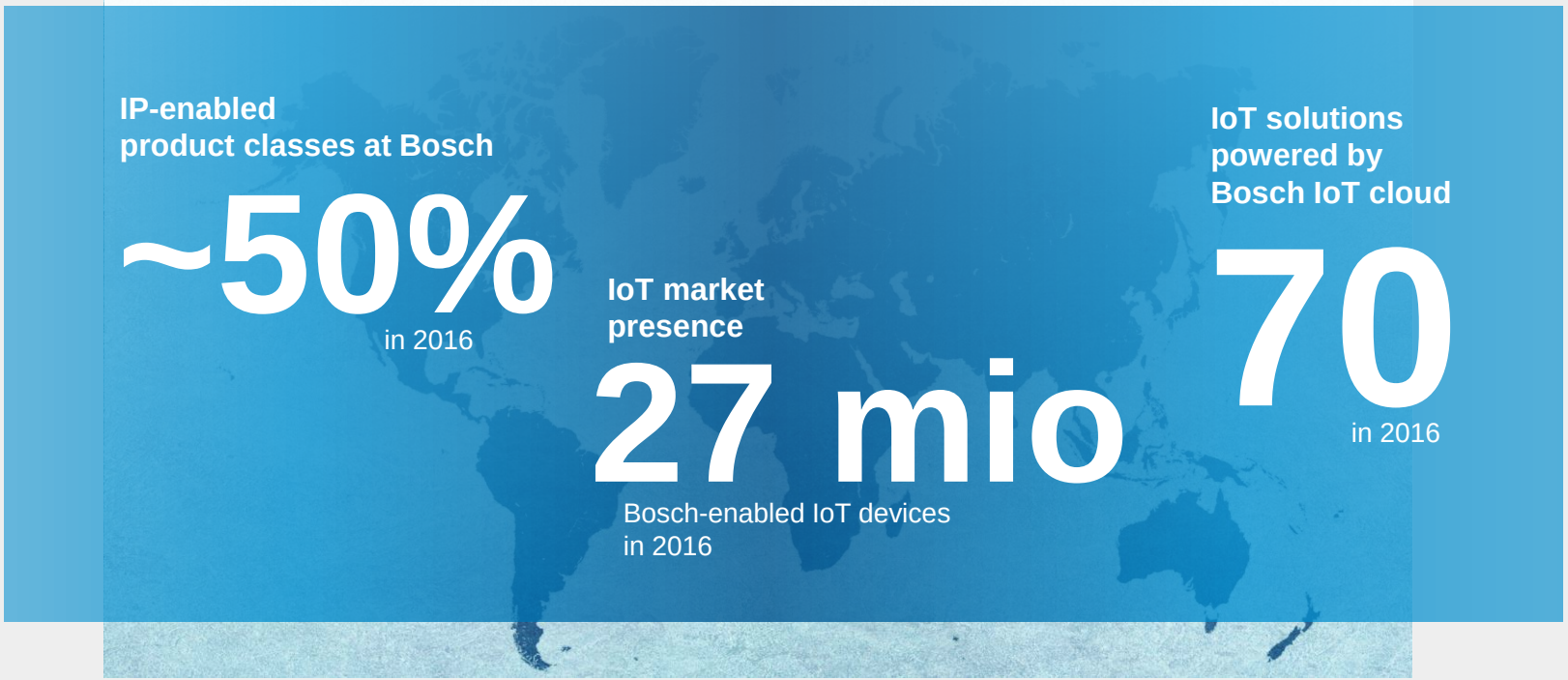
Sensors, enablers for smart things



World's leading MEMS producer

- Industrial scale production since '95
- Six billion MEMS sensors produced
- 100% in-house (design & manufacturing)

~50% of our product classes are now IP enabled



Target 2020: 100% product classes are IP enabled

PACKAGING MACHINES

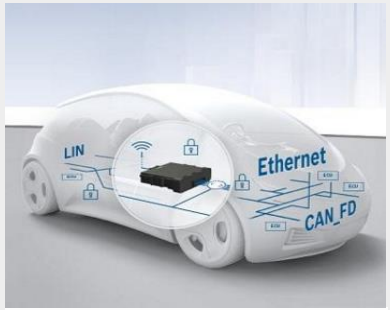
100s

BOILERS

10.000s

RETROFIT ECALL

100.000s

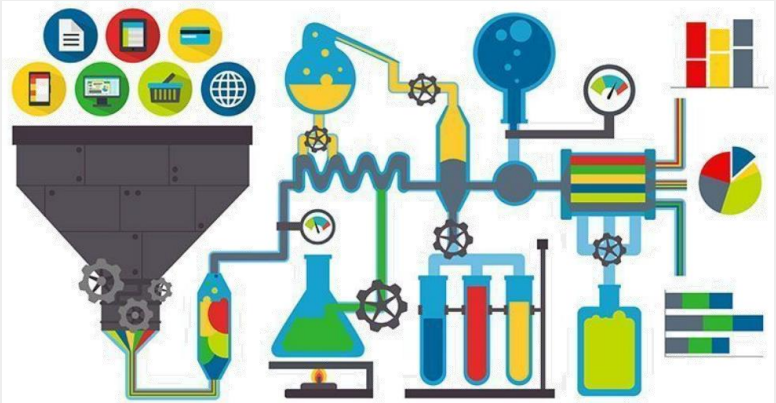


IN-VEHICLE CONNECTVITY UNITS

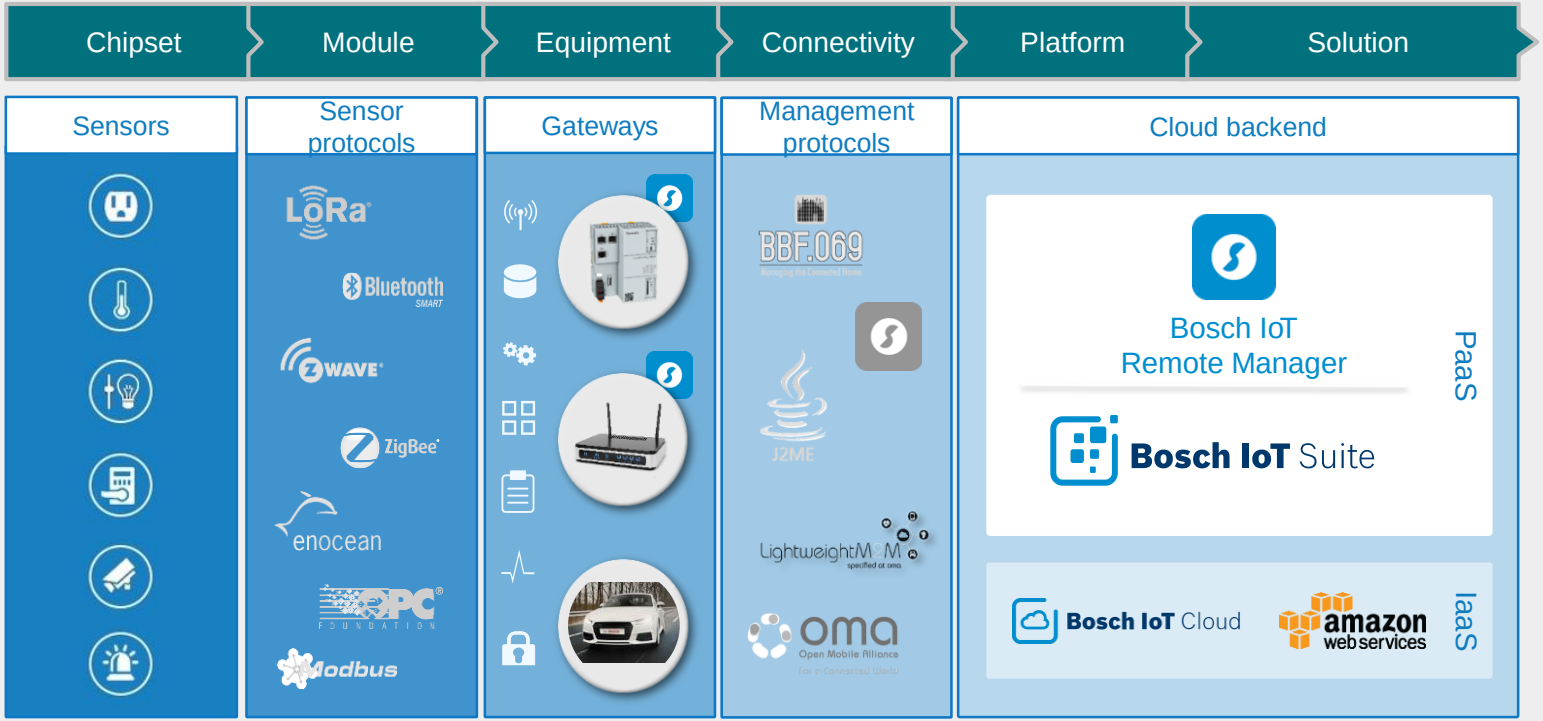
1.000.000s

Information and the Chemistry of Data

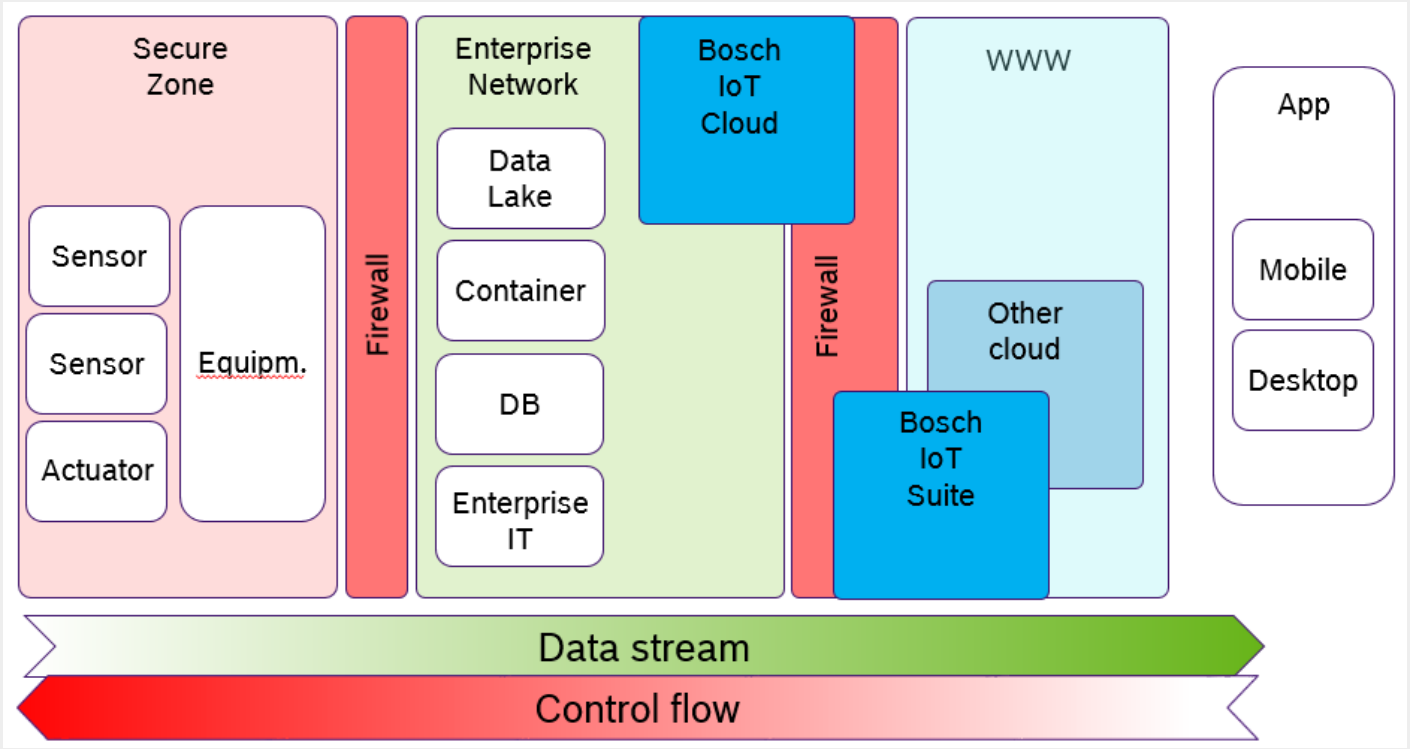
- Data ≠ Information
- Clean, process, evaluate, classify, ….
- Generate information from data
- From Alchemy to Algorithm



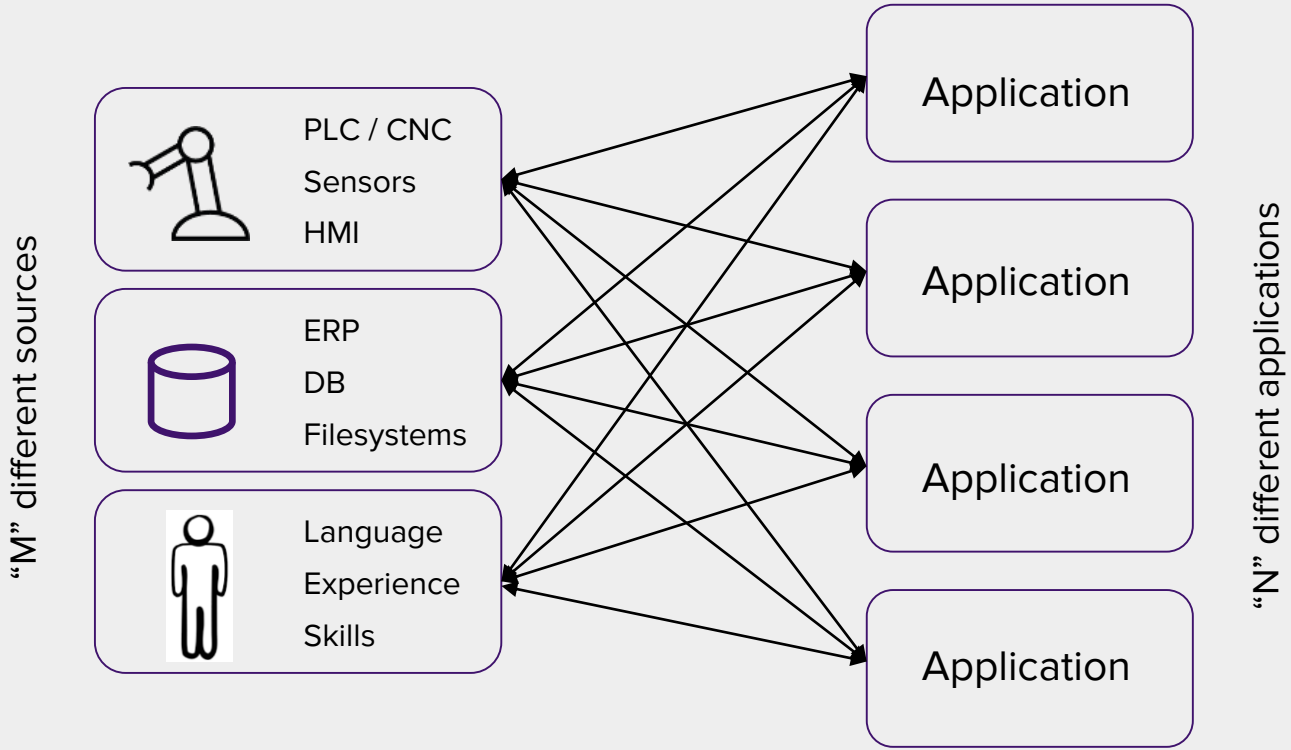
Full stack of IoT sensor and connectivity elements



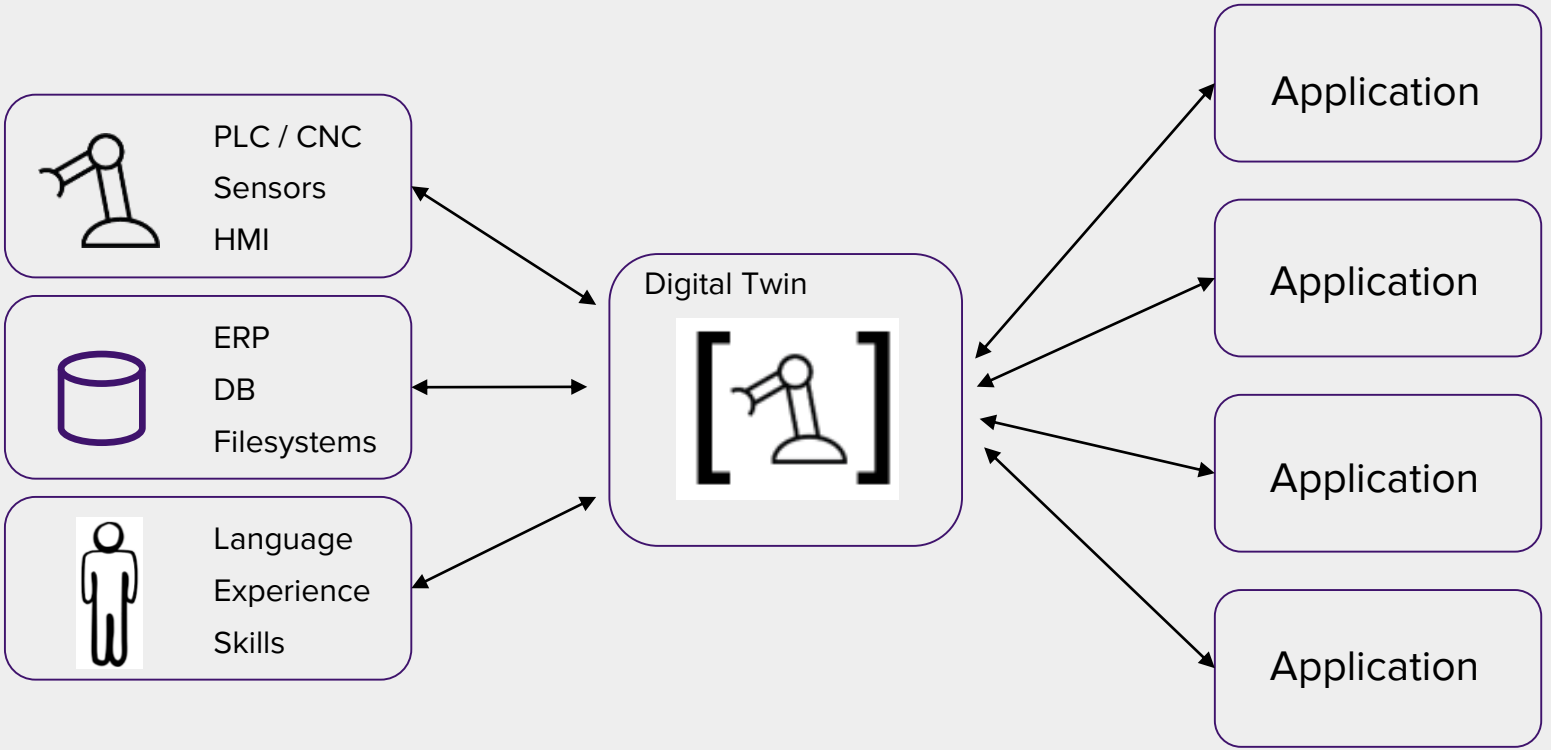
Data streams and controls



The MxN problem



From MxN to M+N

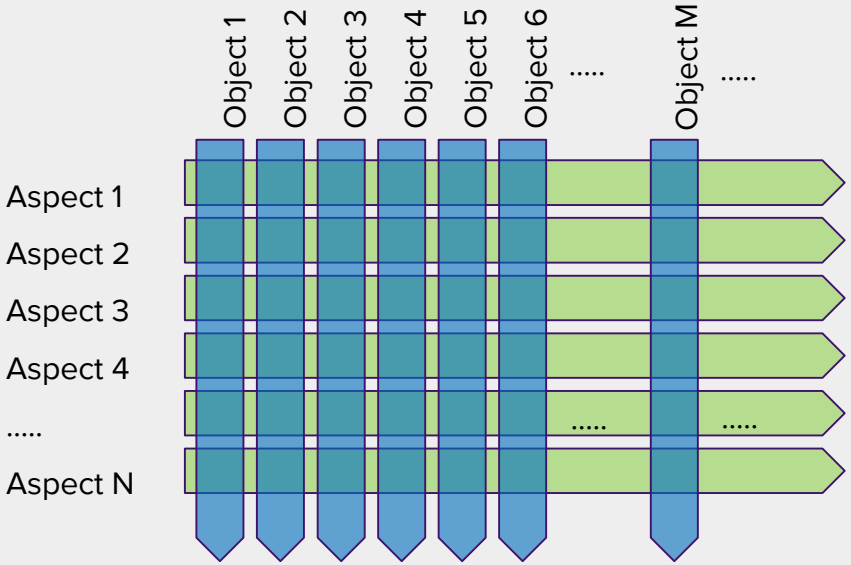


From the mass to the individual

Each person is unique	->	Personal ID
Each machine is unique	->	Asset number
Each manufactured product is unique	->	Serial number
Everything….every thing….is unique	->	UUID (IPv6?)

Thing Model (Class) -> Thing Item (Instance)

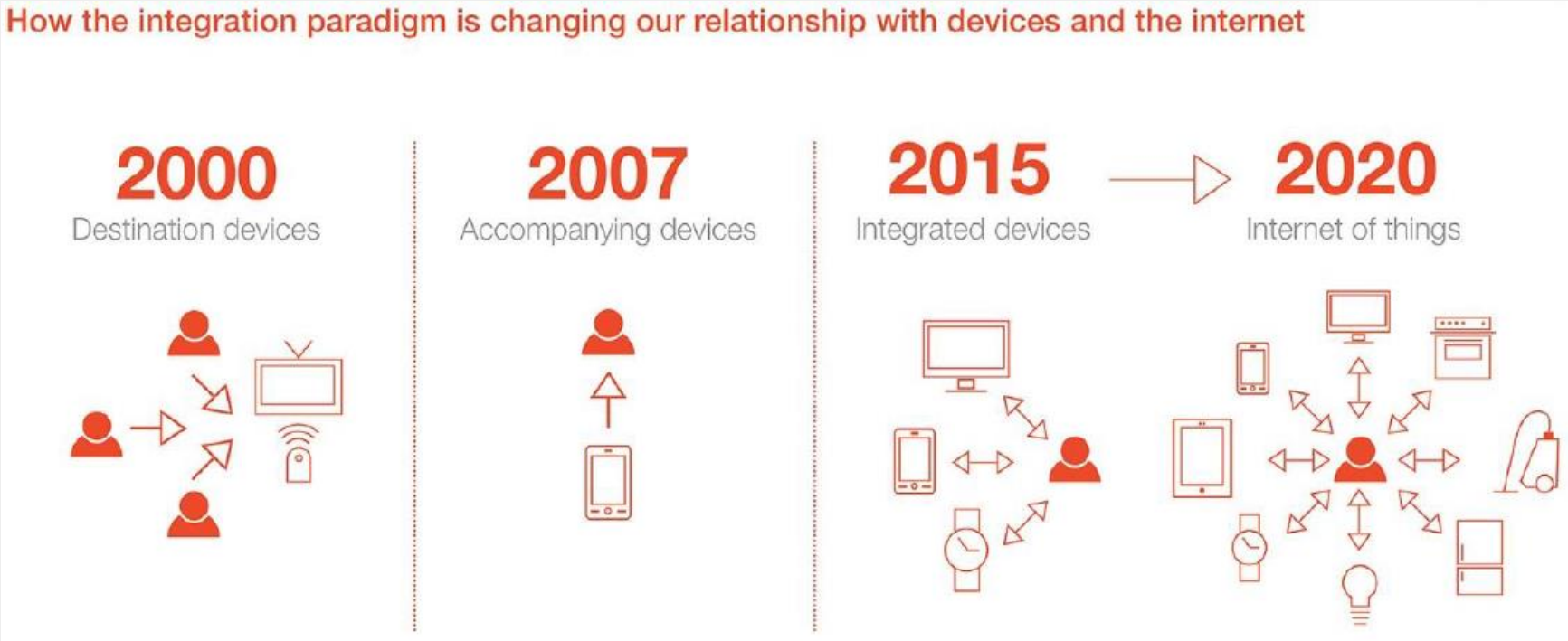
The dual aspect of «things»



Digital Twins perspective

Big Data perspective

Trend for connected devices



Eclipse Ditto

- Defines a software pattern called “Digital Twins”
- Web API interface to interact with objects called “Things”
- Decouples front-end from back-end
- Detailed control of authorization for access to the data

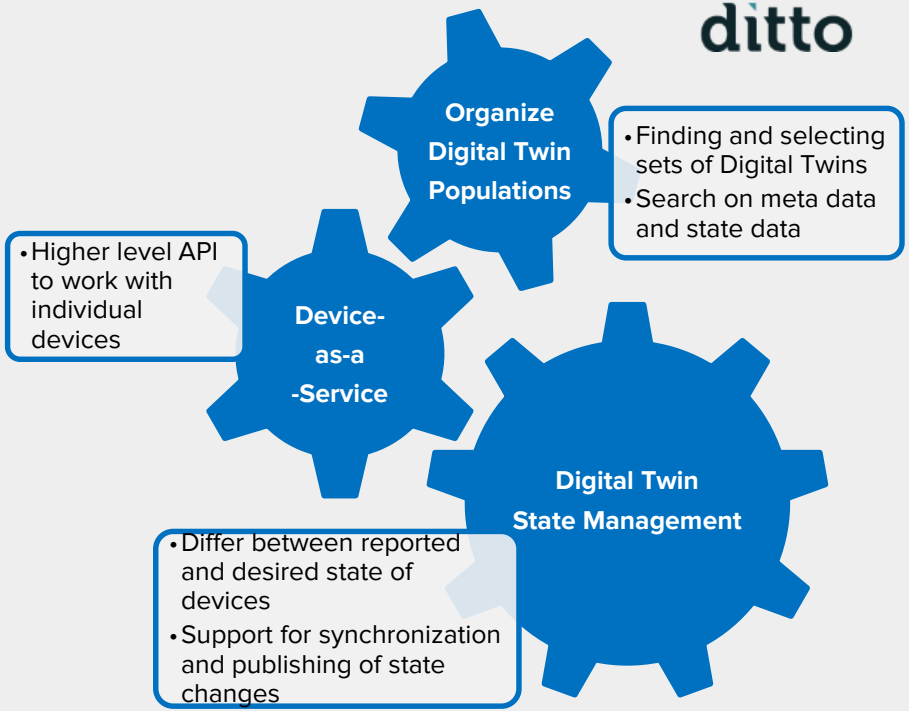
Eclipse Ditto

… where IoT devices and
their digital twins get together

Digital Twin … is a holistic view of all capabilities and aspects of a device/product asset including its digital representation.

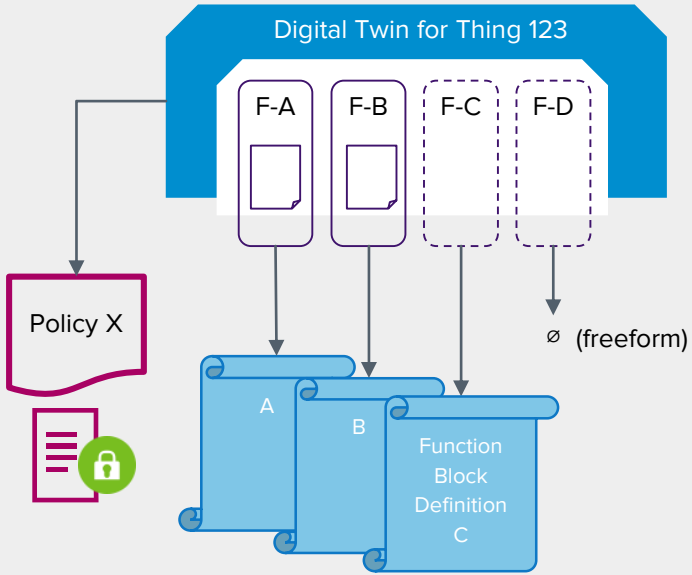
Eclipse Ditto addresses core aspects of the "Digital Twin" metaphor to understand and manage industrial and consumer IoT scenarios by bringing back simplicity to IoT developers.

https://eclipse.org/ditto/

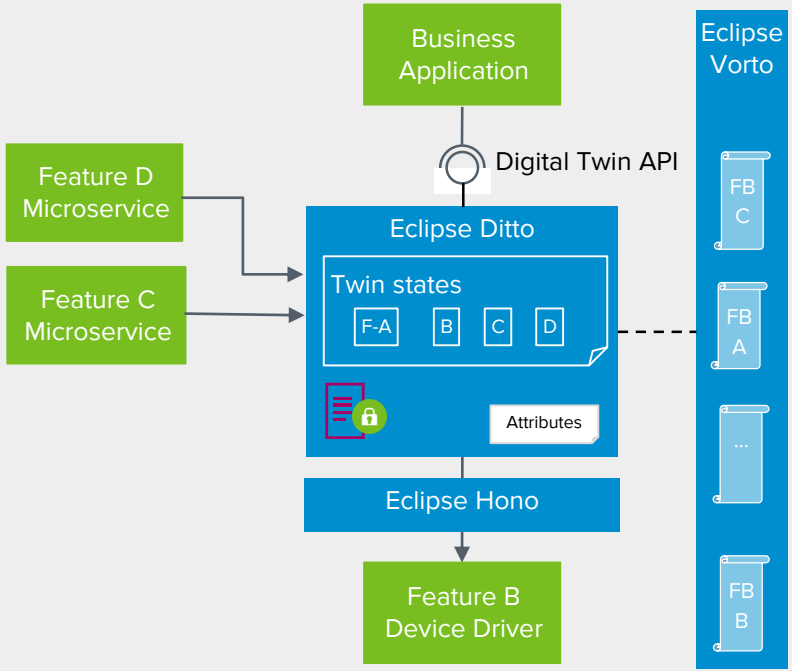


Eclipse Ditto

Conceptual Model



Deployment Model



ditto

ELERATOR

IoT day

Turn device data into API

ditto

```
{
  "thingId": "namespace:car-1"
  "acl": { ... },
  "attributes": {
    "manufacturer": "ACME corp
    "productionData": {
      "serialNo": 4711
    }
  },
  "features": {
    "headlights": {
      "properties": {
        "on": false
      }
    }
  }
}
```

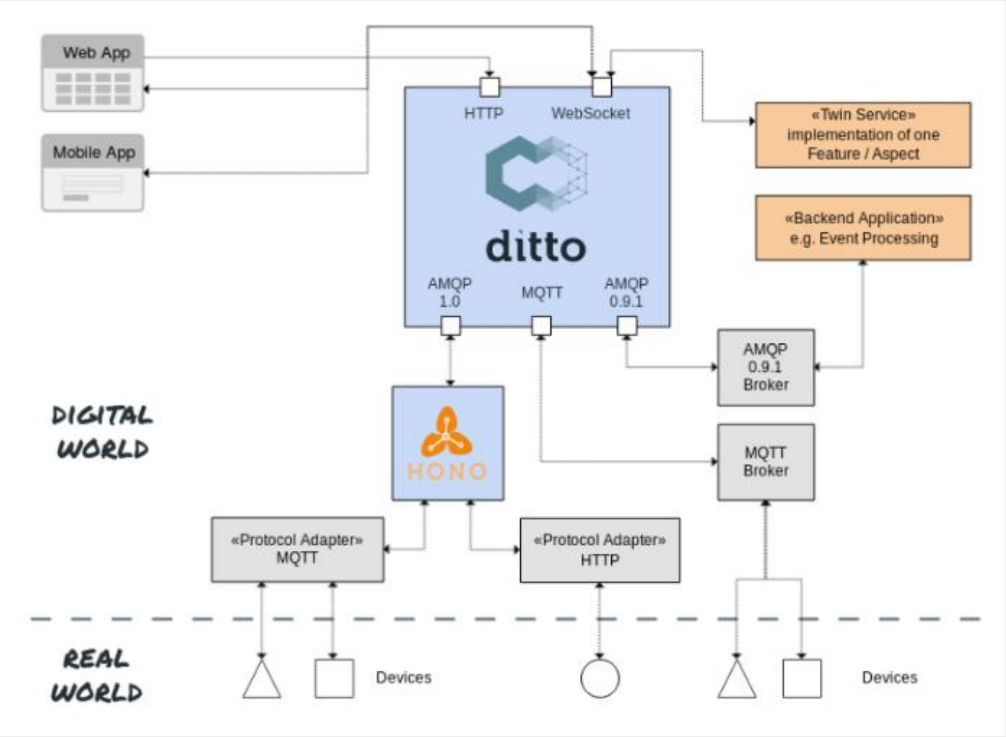
```
GET/PUT/DELETE /api/1/things/namespace:car-1
 /api/1/things/namespace:car-1/thingId
 /api/1/things/namespace:car-1/acl
 /api/1/things/namespace:car-1/attributes
 /api/1/things/namespace:car-1/attributes/manufactu
 /api/1/things/namespace:car-1/attributes/productio
 /api/1/things/namespace:car-1/attributes/productio


 /api/1/things/namespace:car-1/features
 /api/1/things/namespace:car-1/features/headlights
 /api/1/things/namespace:car-1/features/headlights/
 /api/1/things/namespace:car-1/features/headlights/
```

Policies: example

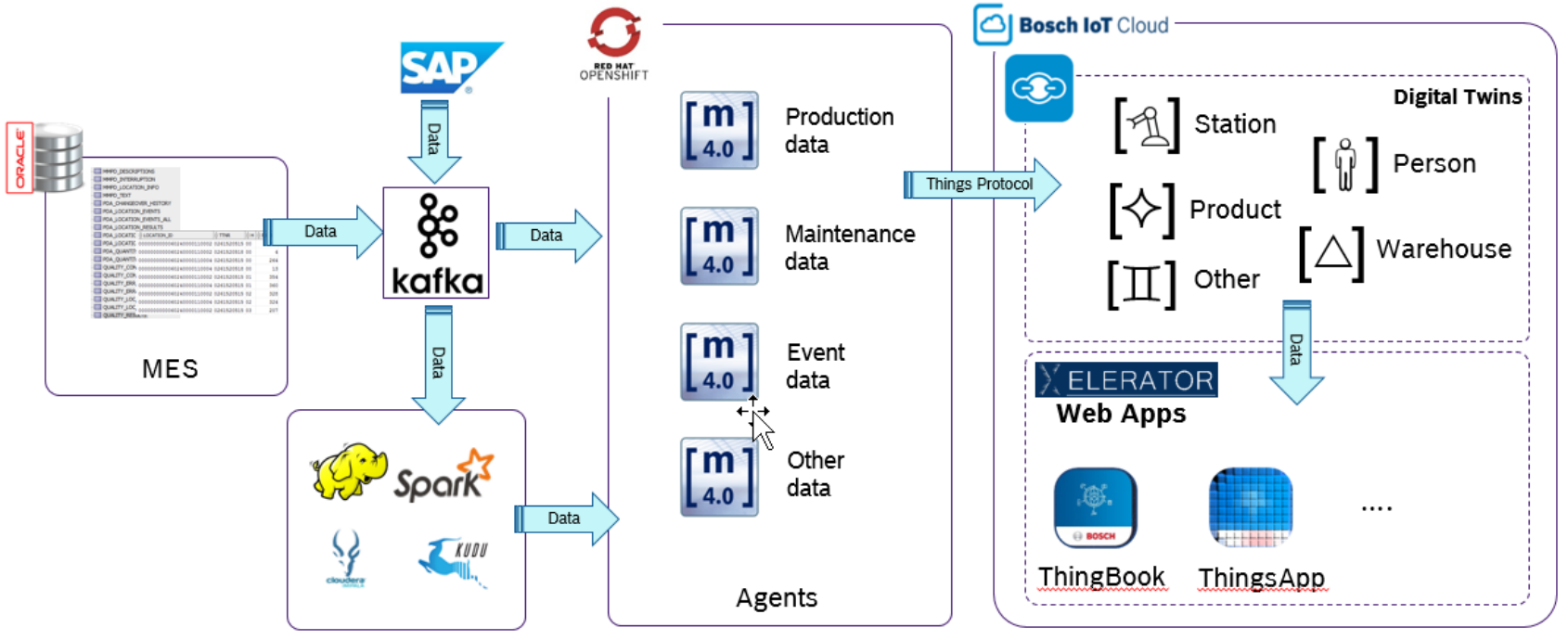
```
{
  "thingId": "my.namespace:thing-123",
  "policyId": "my.namespace:policy-a",
  "attributes": {"key": "value"},
  "features": {
    "featureX": {
      "properties": {
        "key": "value"
      }
    },
    "featureY": {
      "properties": {
        "location": {
          "city": "Berlin",
          "country": "Germany"
        }
      }
    },
    "featureZ": {
      "properties": {
        "key": "value"
      }
    }
  }
}
```

```
{
  "policy": {
    "policyId": "my.namespace:policy-a",
    "entries": {
      "owner" : {
        "subjects": {
          "nginx:ditto": {
            "type": "nginx basic auth user"
          }
        },
        "resources": {
          "thing:/": { "grant": ["READ","WRITE"], "revoke": [] },
          "policy:/": { "grant": ["READ","WRITE"], "revoke": [] },
          "message:/": { "grant": ["READ","WRITE"], "revoke": [] }
        }
      },
      "observer" : {
        "subjects": {
          "nginx:observer-client": {
            "type": "technical client"
          },
          "nginx:some-users": {
            "type": "a group of users"
          }
        },
        "resources": {
          "thing:/features/featureX": { "grant": ["READ"], "revoke": [] },
          "thing:/features/featureY": { "grant": ["READ"], "revoke": [] }
        }
      },
      "private": {
        "subjects": {
          "nginx:some-users": {
            "type": "a group of users"
          },
          "resources": {
            "thing:/features/featureY/properties/location/city": {
              "grant": [], "revoke": ["READ"]
            }
          }
        }
      }
    }
  }
}
```

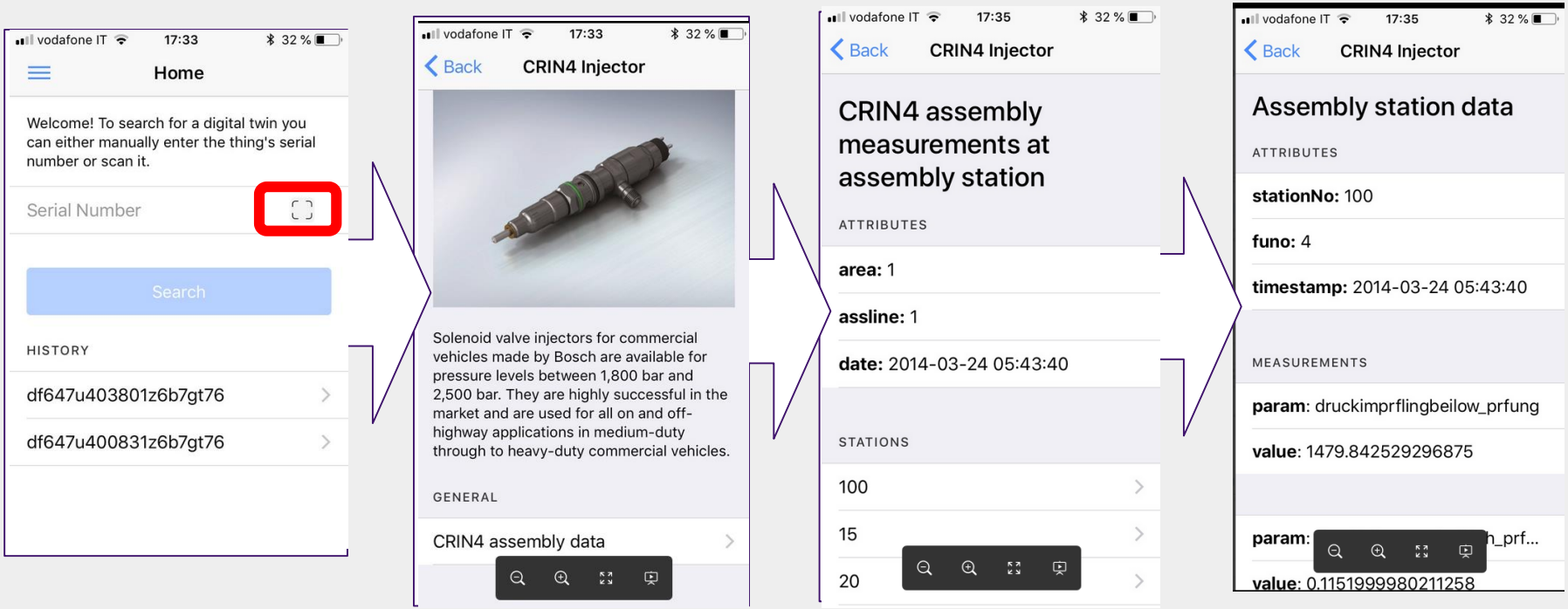
Device-as-a-Service



Business case: manufacturing data



Business case: ThingsApp



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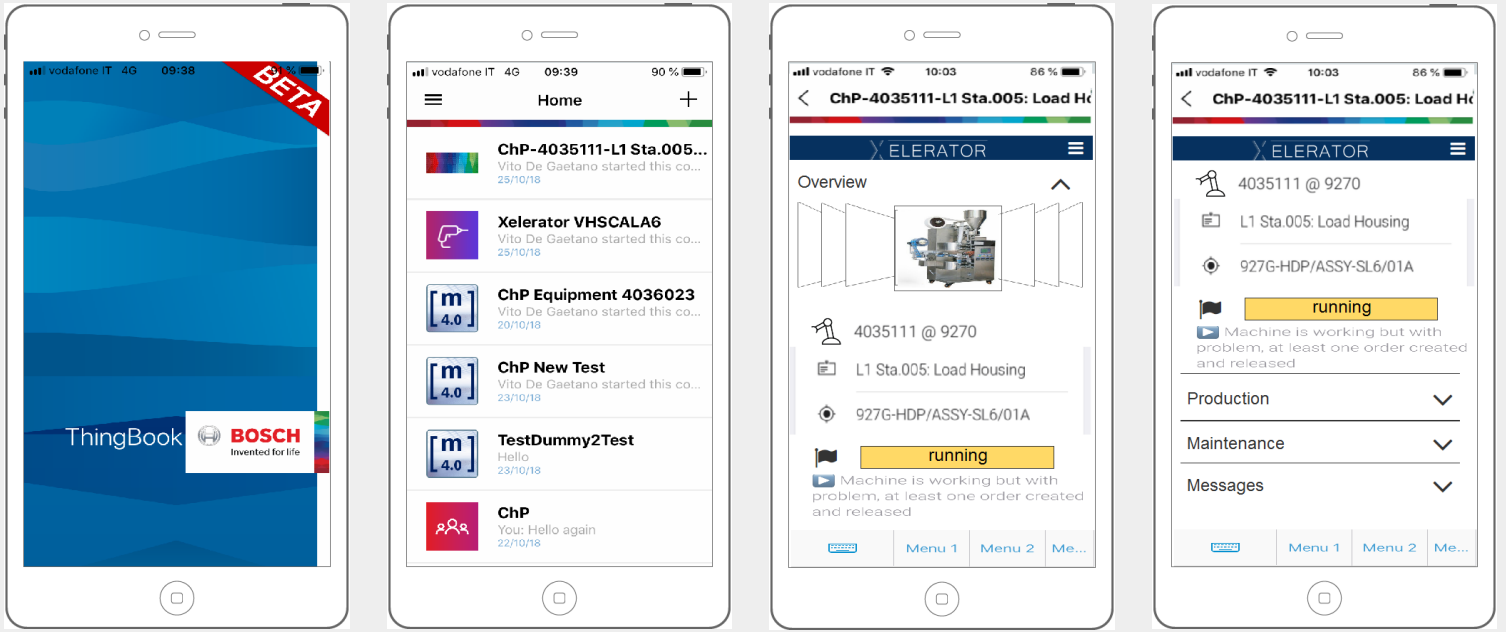
IoT day

Business case: ThingBook



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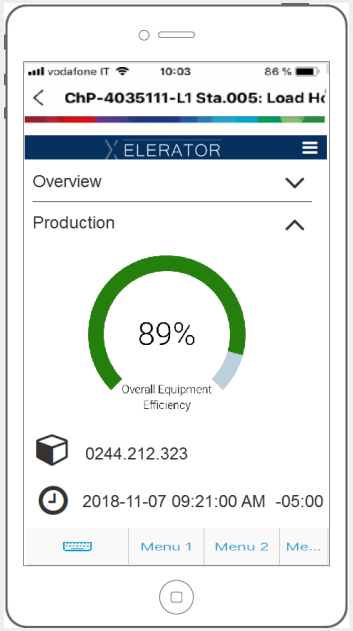
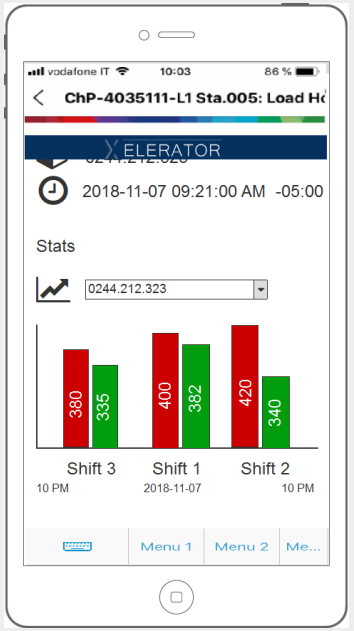
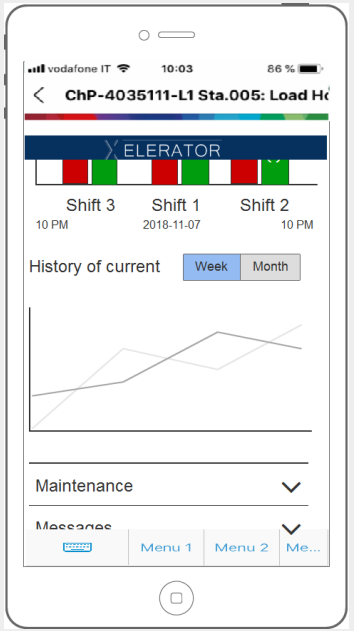
IoT day

Business case: ThingBook







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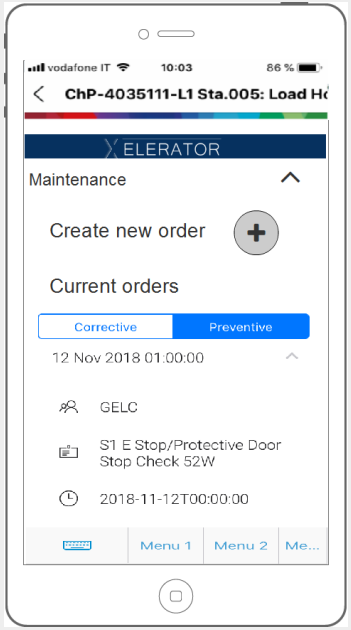
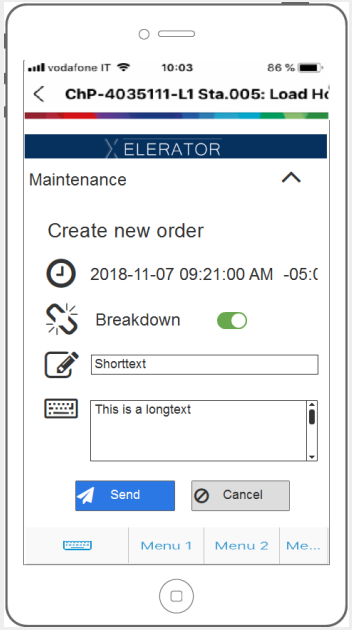
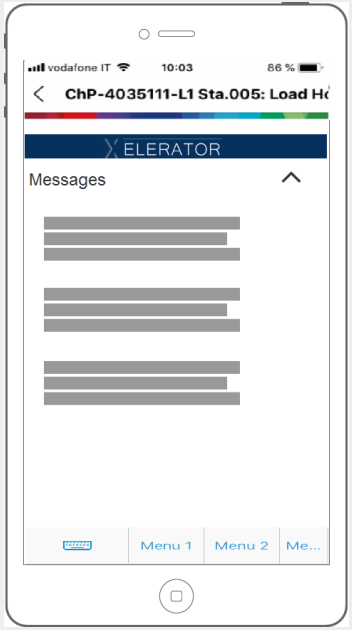
IoT day

Business case: ThingBook







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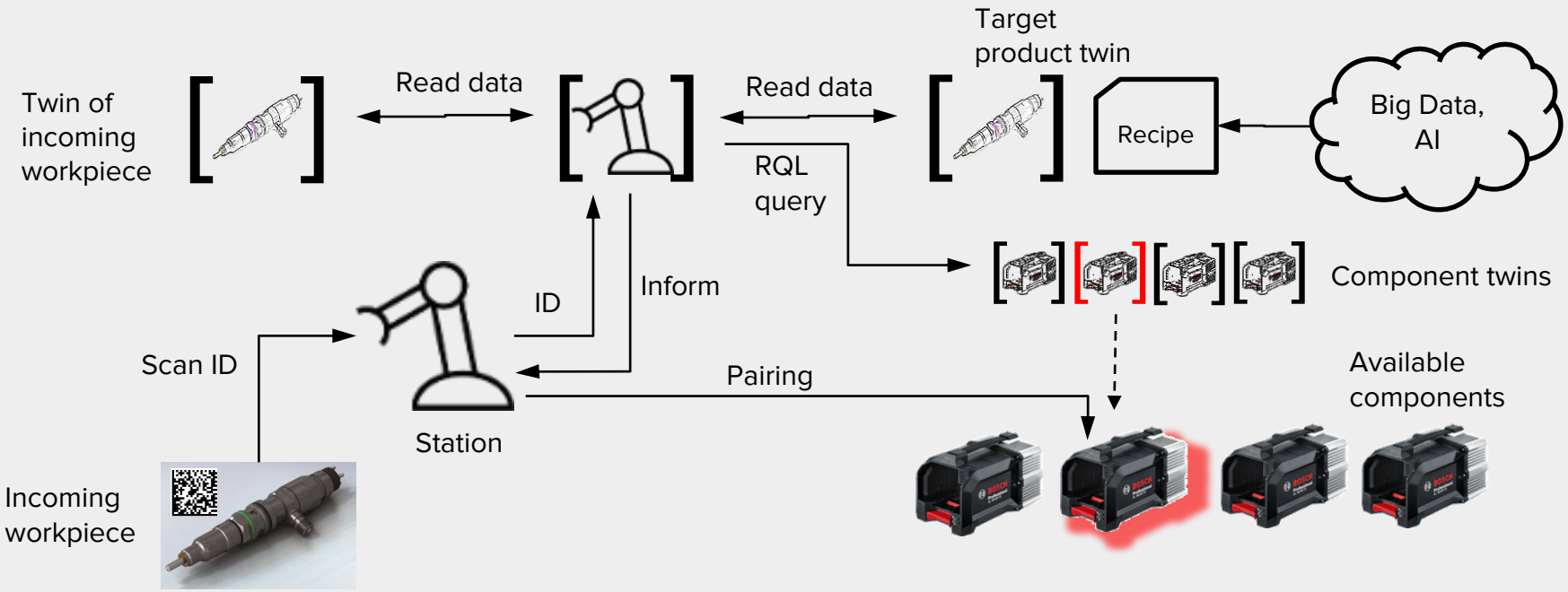
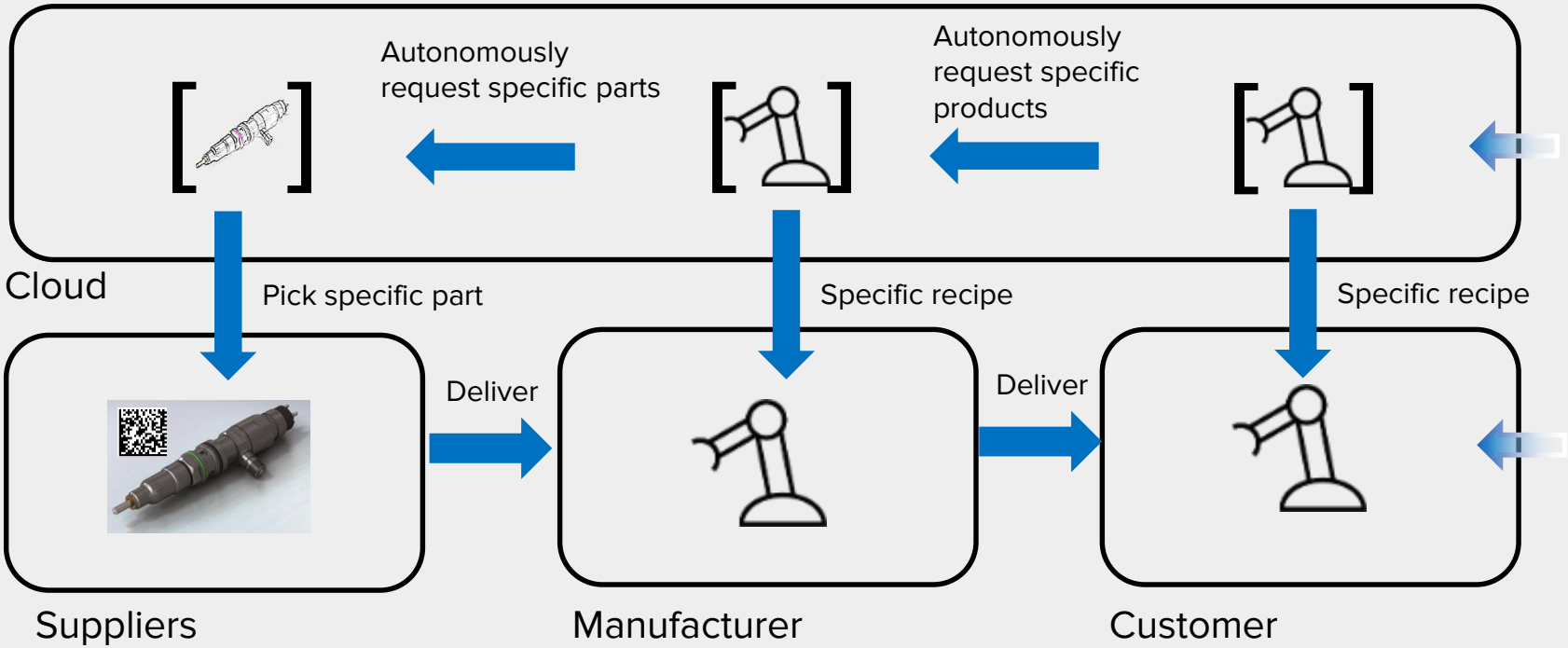
IoT day

Business case: Intelligent pairing



Business case: Smart contracts in supply chain



Thanks !

Questions ?