Ubiquitous Computing in Business Processes
Part II

Prof. Dr. Lutz Heuser
Urban Software Institute

Darmstadt
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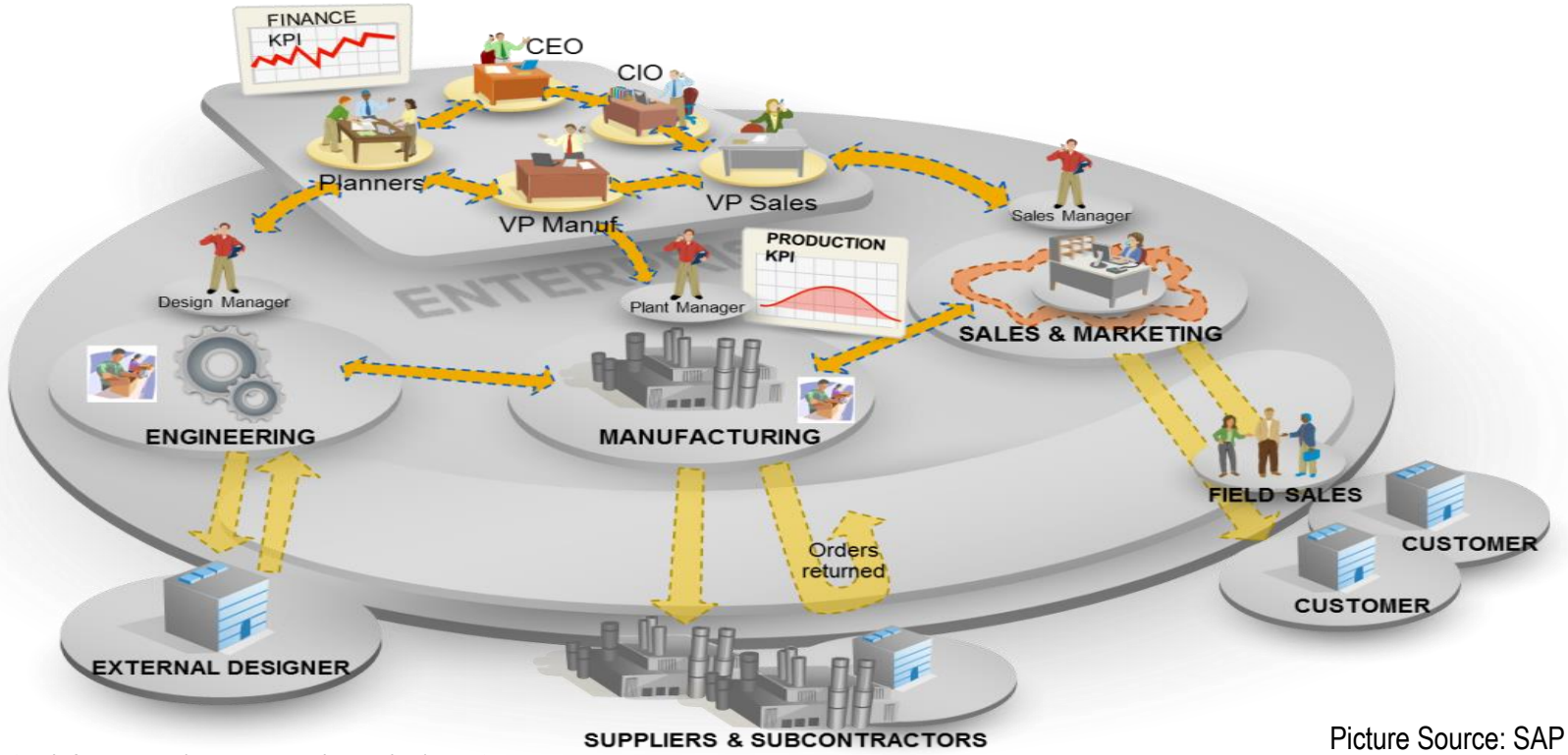
Outline

1. Recap

What kind of Business Processes are out there?

We can categorize typical enterprises' business processes:

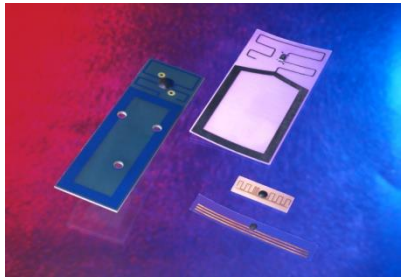
- **Management processes**, incl. strategy and process management, etc.
- **Core business processes**, incl. production, sales, marketing, purchasing, customer care, etc.
- **Supporting processes**, incl. human capital management, accounting, facility management, IT management, etc.



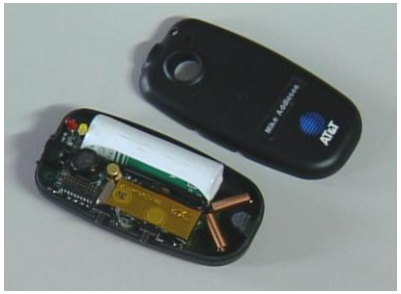
Picture Source: SAP AG

Smart Items – Generic Definition

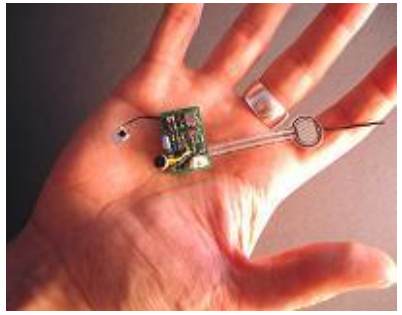
A smart item is …



- Object of the Real world,
  - Basically every thing - buildings, vehicles, machines, tools, pallets, boxes, shopping carts, shelves, consumer products, etc.

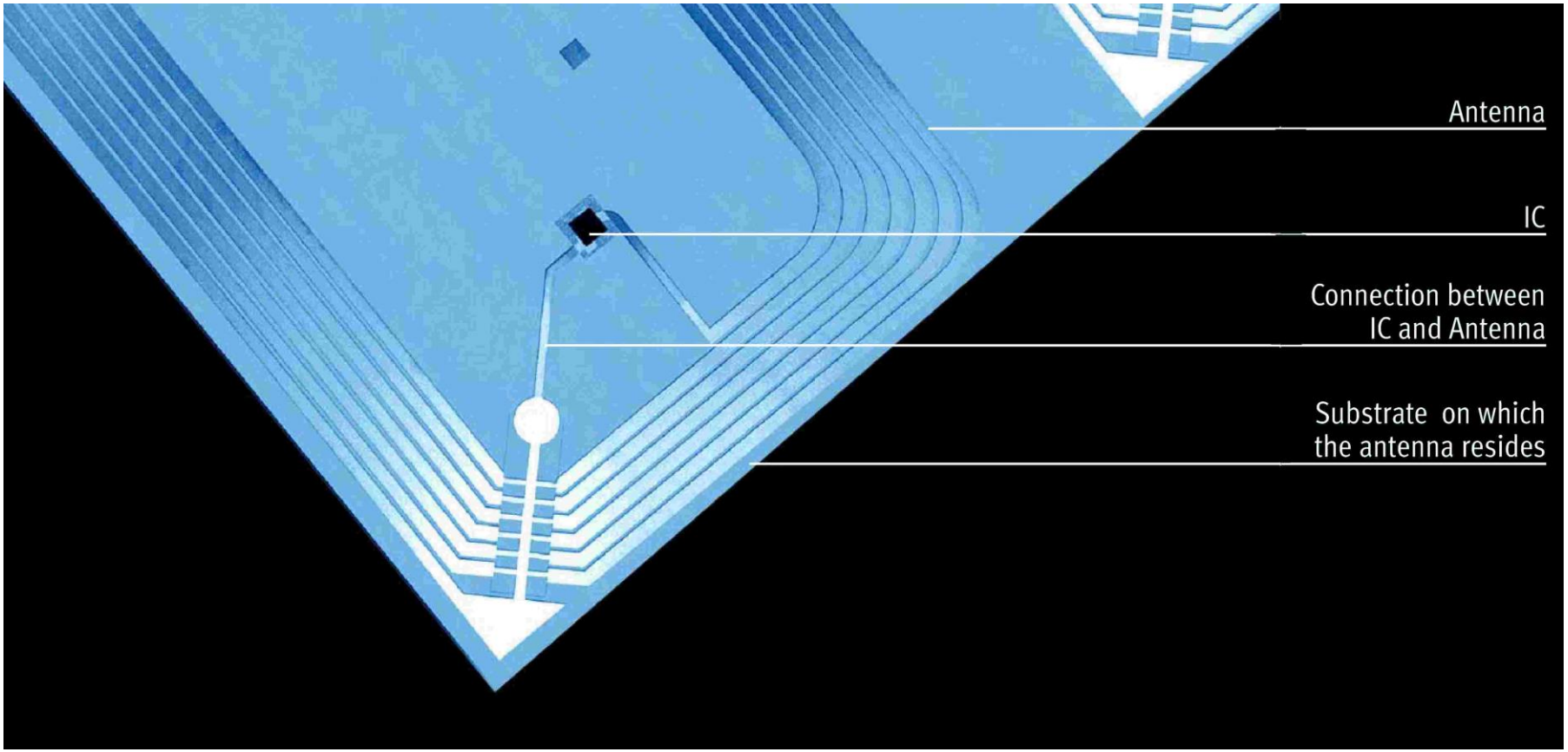


- Capable to store data about itself or its environment
  - e.g. identifier, temperature, location, etc.



- Capable to exchange data via a communication interface
  - wired or wireless

Example HF RFID Tag



Source: Auto-ID Center

Outline

2. RFID in Business Processes: Asset Management

RFID supported Asset Maintenance Process

1.) Technician reads information stored on RFID-tag

2.) Maintenance and repair planning based on information on RFID tag loaded

RFID tag on asset

3.) Execution of maintenance and repair activities

4.) Information update on RFID tag after maintenance has been performed

Source: SAP AG

Benefits

- Assets can be identified locally without access to backend system
- Assets can be identified correctly (no manual data entry needed)

- Technician can perform work efficiently because all important information can be found on the tag, such as
  - Manufacturer information
  - Technical specification
  - Production date
  - Safety instructions or
  - As-build configuration

- RFID tag stores service history (the 'item's memory'): "Who did what by when?"
- RFID tags can be read through non-metallic substances, paint, grease or other obscuring materials (rugged environmental conditions)
- Always access to up-to-date technical object information

Example: Fire shutter maintenance at FraPort (1)

- Maintenance orders are downloaded by mobile device assigned to the service technician
- Service technician goes to fire locker
- RFID tag on the fire locker is read and the equipment is identified
- Maintenance order for this equipment is automatically found and displayed. Service technician may enter a damage code.

Source: SAP AG

Example: Fire shutter maintenance at FraPort (2)

- Service technician inspects and maintains the equipment
- After finishing his work, technician updates information on the RFID tag by adding inspection date and personal identification. The time between start and end of the work is automatically recorded as well.
- Orders with damage codes and times are synchronized with the enterprise backend system, later.

Source: SAP AG

Project at FraPort: Costs and Monetary Benefits

Main cost elements

- Hardware
  - Mobile Devices
  - Tags
- Tagging
- Software licenses
- Implementation and consulting

Specific customer benefits

- Time savings
  - Per day and technician
  - Per year
- Avoidance of double orders (5% of orders before the project)
- Increased asset safety and compliance thanks to proven maintenance records

Outline

3. RFID in Business Processes: Supply Chain Management

The Supply Chain - A complex puzzle!

Where is my product?

How will my partners gain visibility?

How can my supply chain improve?

How can I prove delivery to customer?

Am I compliant to regulations?

Why is there a delay?

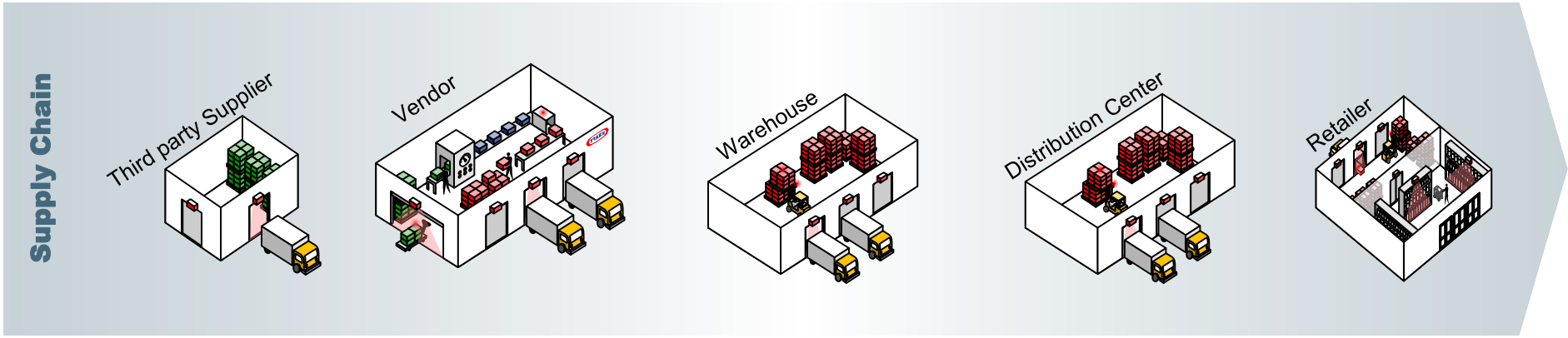
How can I manage recall and returns?

When will my shipment arrive?

Is the product genuine?

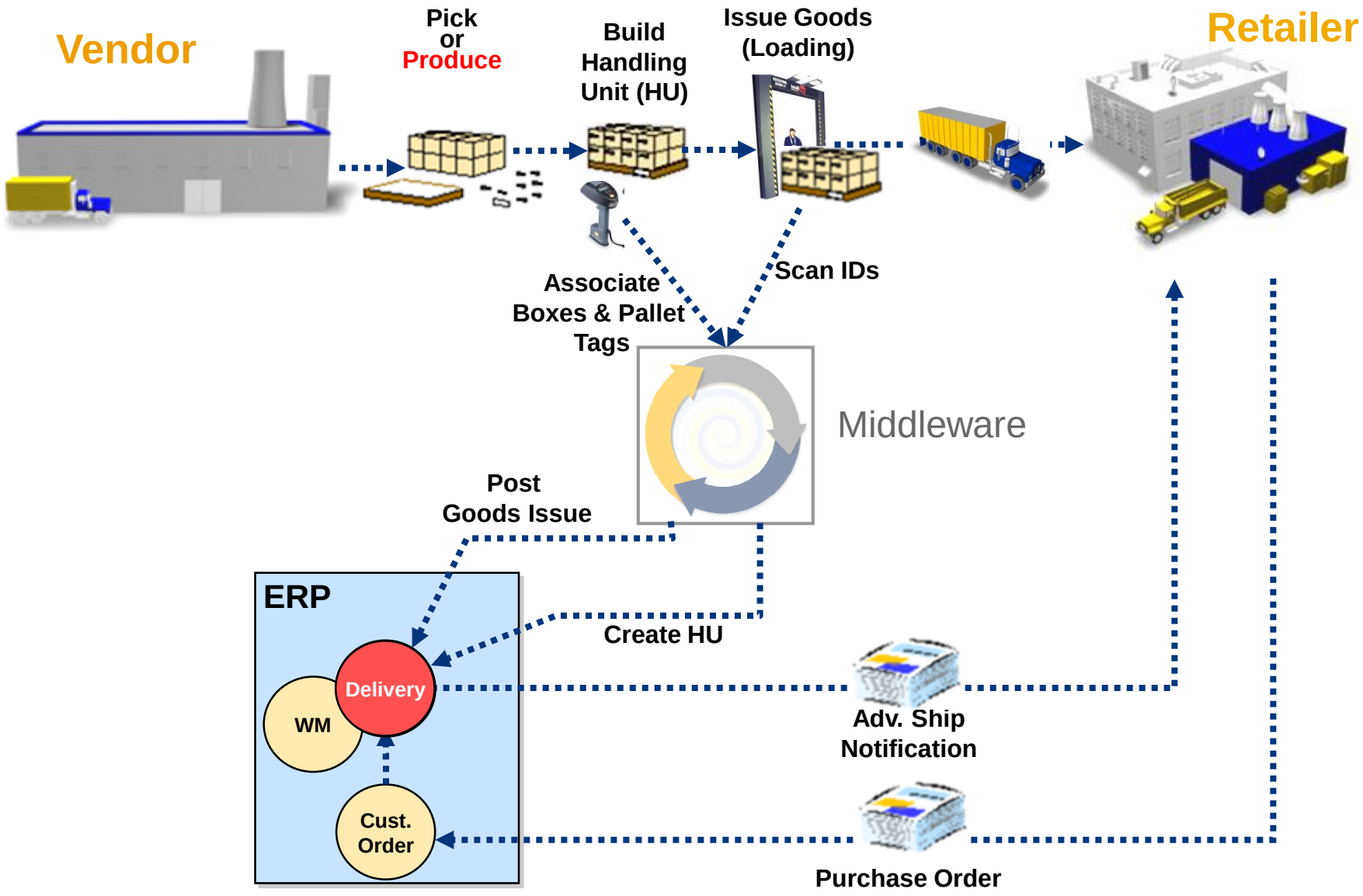
What is causing the bottleneck?

How can I track my assets?



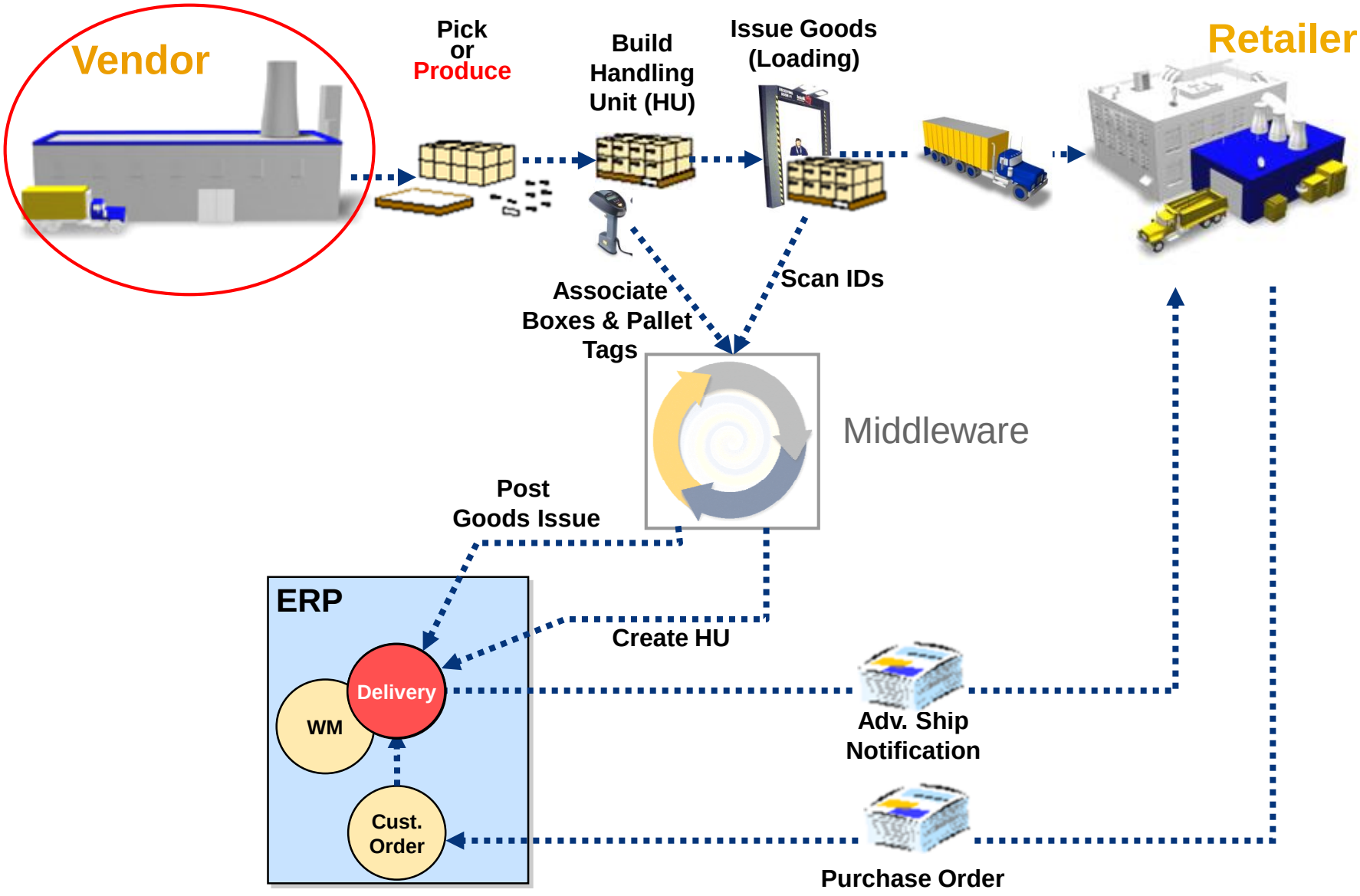
Source: SAP AG

RFID in Order Fulfillment Process



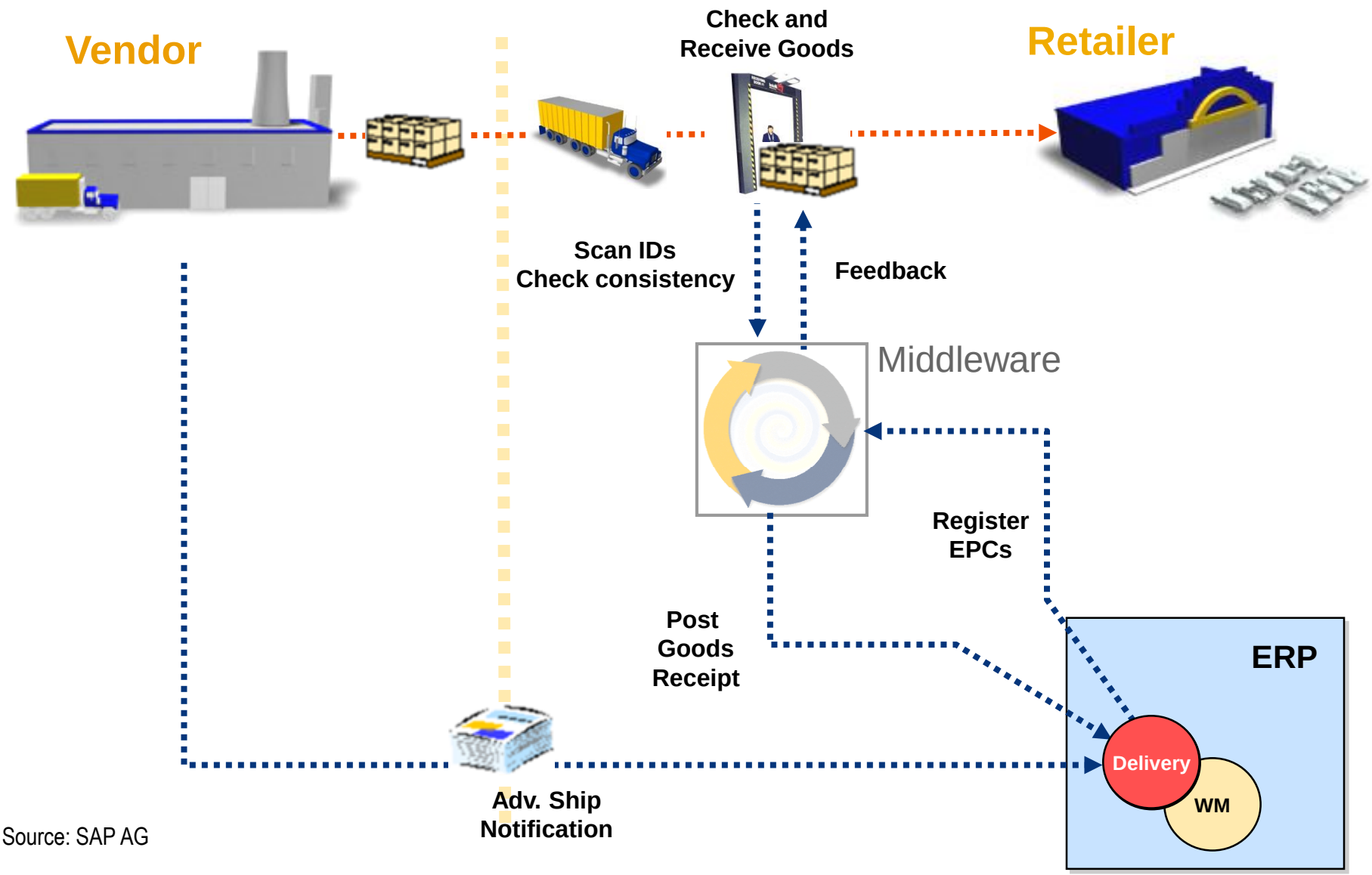
Source: SAP AG

Let's have a look into the Factory!
RFID in Discrete Manufacturing Process



Source: SAP AG

RFID in Goods Receipt Process



Source: SAP AG

Outline

4. Open Urban Sensor-Data Platforms

Caloundra - Australia

- Southest city of the Sunshine Coast in Queensland
  - Area: 1.100 km^2
  - Population: 87.600


UrbanPulse
[ui!] the urban institute
67 BPM
HISTORY
REALTIME
FORECAST
Oct 31, 2016 09:12:23
Caloundra
SUNSHINE COAST QUEENSLAND AUSTRALIA
WATER CONSUMPTION
Map
Location: Caloundra
2 Litres
were consumed within the last 15 minutes
2/2
DIGITALLY MONITORED
67 l
WERE CONSUMED WITHIN THE LAST 24H
SMART LIGHTING
56 of 56 lamp posts connected
2.68 kW
Lights on
0 %
50 %
100 %
98 %
Brightness level
92 %
SMART WIFI
Location: Caloundra
6 %
of nearby devices are connected to the WiFi
95/95
ACCESS POINTS IN OPERATION
74
DEVICES CONNECTED
ENVIRONMENT
2 of 2 sensors connected
AMBIENT LIGHT
1004 hPa
BAROMETER
54.3 %
HUMIDITY
8.5 °C
TEMPERATURE
0 µg/m³
DUST
499 ppm
CO2
0 ppb
OZONE
49 dBA
SOUND INTENSITY
PARKING SPACE
Location: Caloundra
13/35
Parking bays available
63%
in use
URBAN TRASH BINS
0 trash bins connected
0 bins
0 bins
0 bins
FULL
FILLED
EMPTY
◄ ADJUST DISPLAYTIME ►
TIMELINE
REALTIME
200
150
100
50
HISTORY
FORECAST
-11h
-10h
-9h
-8h
-7h
-6h
-5h
-4h
-3h
-2h
-1h
+1h
+2h
+3h
+4h
+5h
+6h
+7h
+8h
+9h
+10h
+11h

UrbanPulse - Frameworks

Vert.x is a polyglot event-driven application framework that runs on the Java Virtual Machine

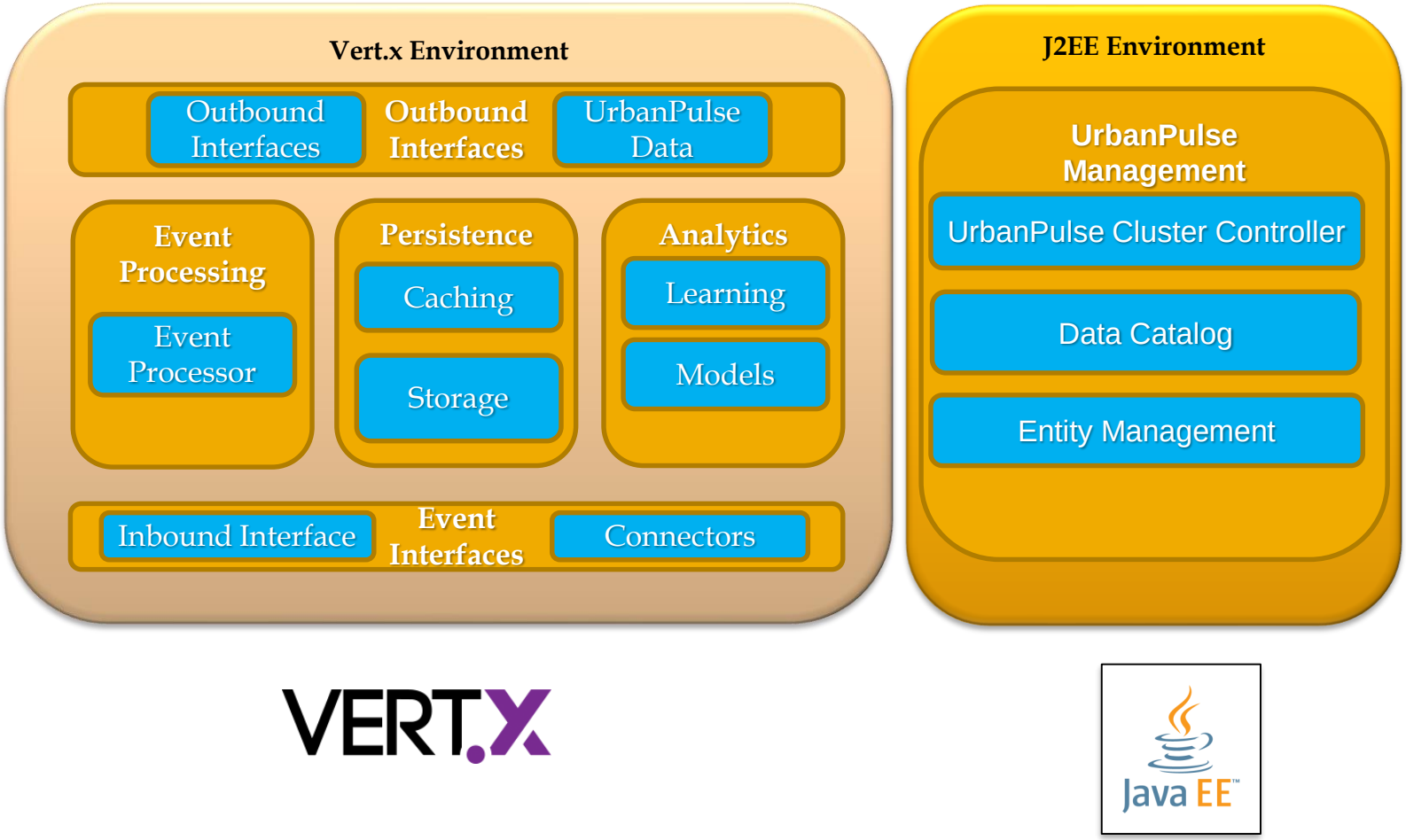
- Simple concurrency model. All code is single threaded, freeing from the hassle of multi-threaded programming.
- Simple, asynchronous programming model for writing truly scalable non-blocking applications.*

Java EE is a widely used enterprise computing platform developed under the Java Community Process.

The platform provides an API and runtime environment for developing and running enterprise software, including network and web services, and other large-scale, multi-tiered, scalable, reliable, and secure network applications.*

*en.wikipedia.org

UrbanPulse - Frameworks

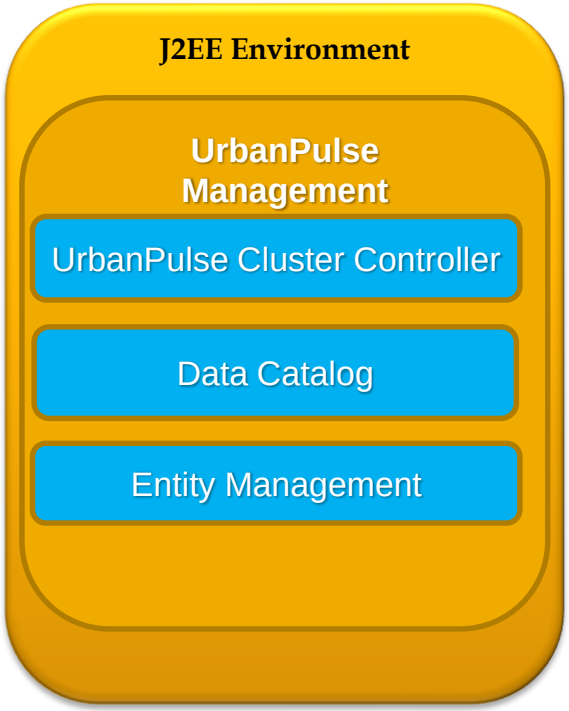


UrbanPulse Management

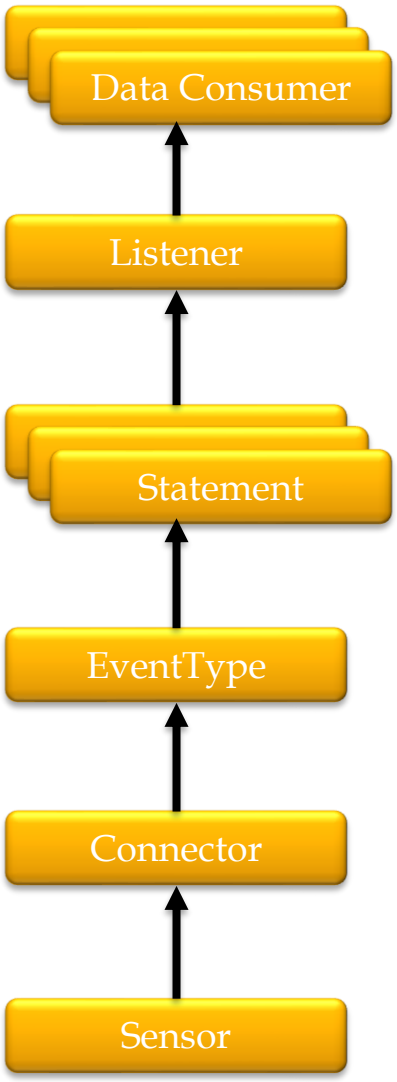
UrbanPulse - Management

Functions

- Management API
- Configuration and Management of Cluster-Nodes
- User Management
- Sensor data catalogue



UrbanPulse – ER Modell (vereinfacht)



e.g. [ui!] Cockpit

Listener receives events, which are defined by statements.

Statements select and combines events to „business events“

Each Sensor detects events of a given Type (EventType)

A connector wraps the API to the sensor data provider

Each sensor has a definition and a universal unique ID.

UrbanPulse
Event Processing

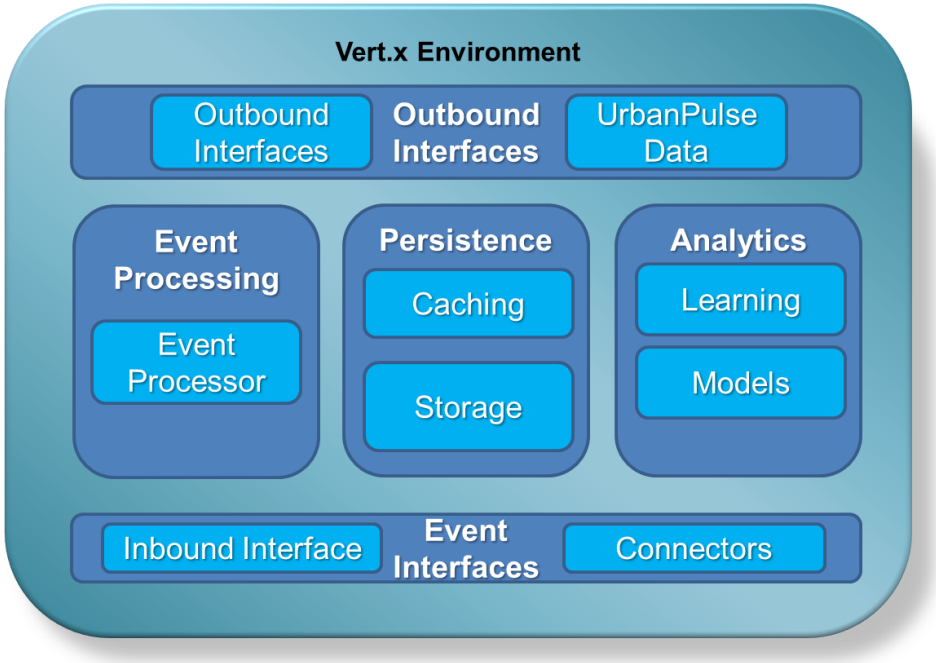
UrbanPulse – Event Processing

Tasks

- Detect
- Analyse
- Store
- Distribute

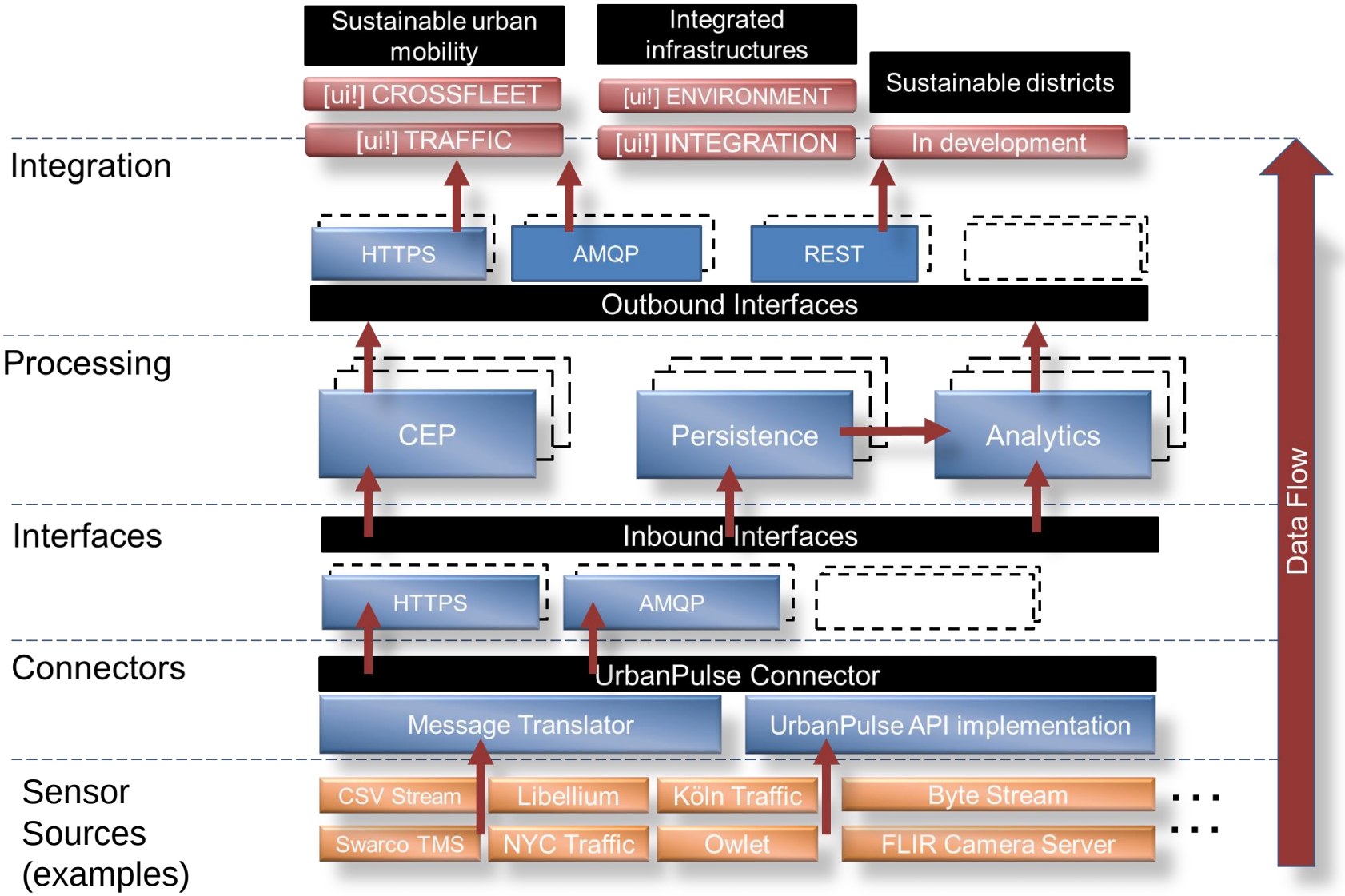
… urban Data

… in (near) real-time



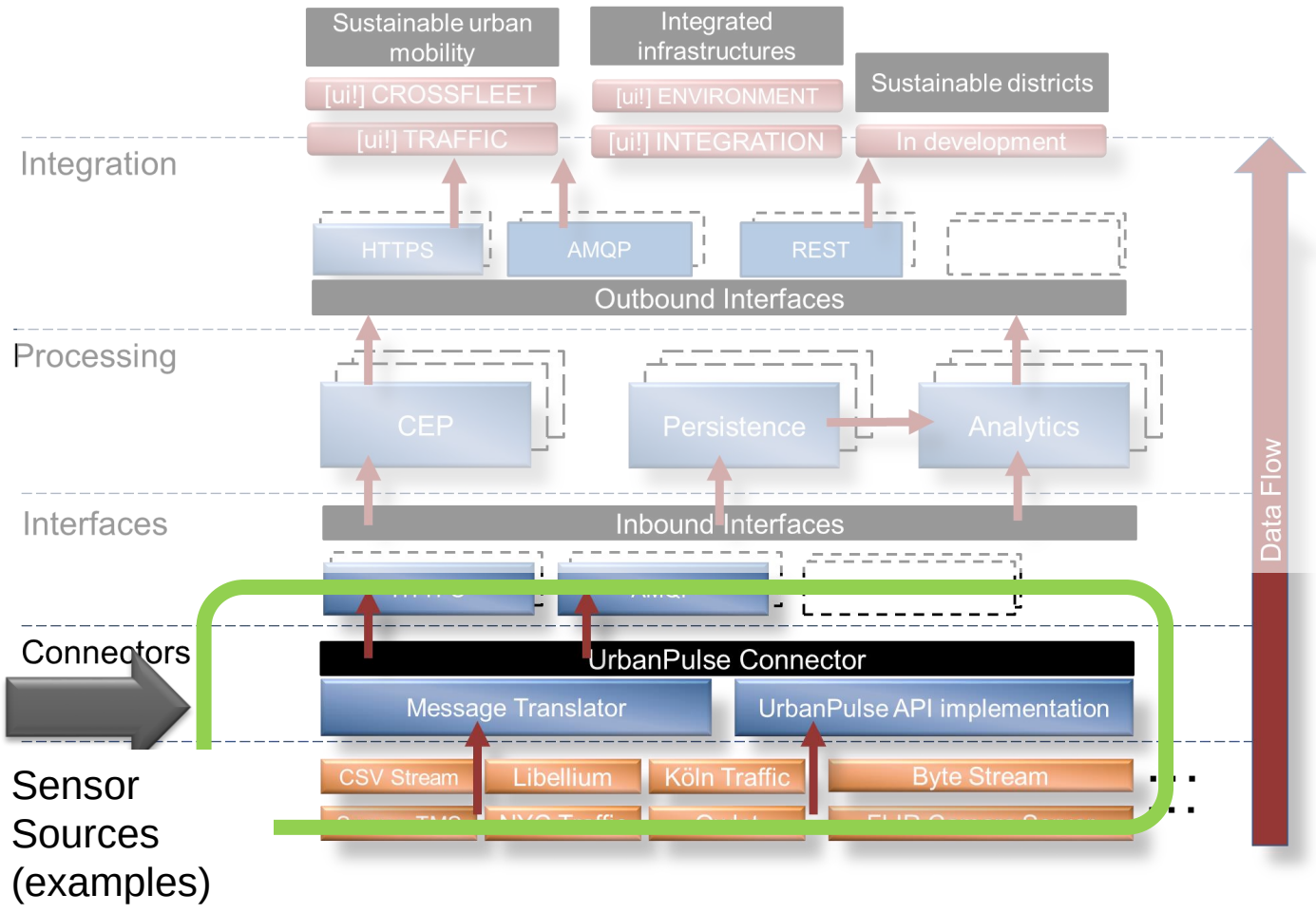
VERT.X

UrbanPulse - Eventverarbeitung



UrbanPulse Modules

UrbanPulse - Connectors



UrbanPulse - Connectors

Connectors allow to connect systems and sesnor nodes of different vendors, types, and domains:

- Energy
- Traffic
- Buildings
- Environmentt

Tasks

- Communicate with UrbanPulse API
- Authentication
- Transformation of raw data in sensor agnostic format

UrbanPulse - Connectors

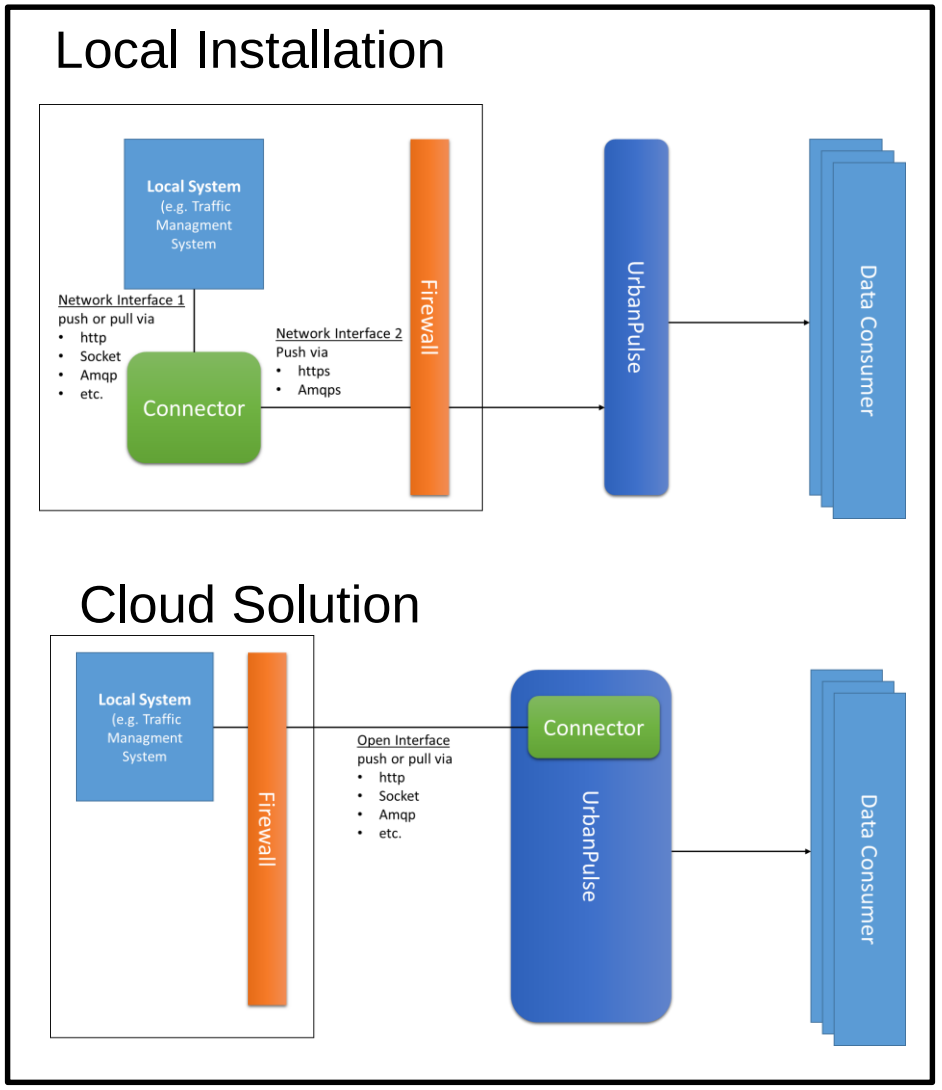
Connectors can be operated locally or in the cloud.

Supported communication protocols

- TCP/UDP
- HTTP(S)
- Web socket
- Amqp
- And if needed, more…

Benefits

- Easy
- Simple
- Scalable

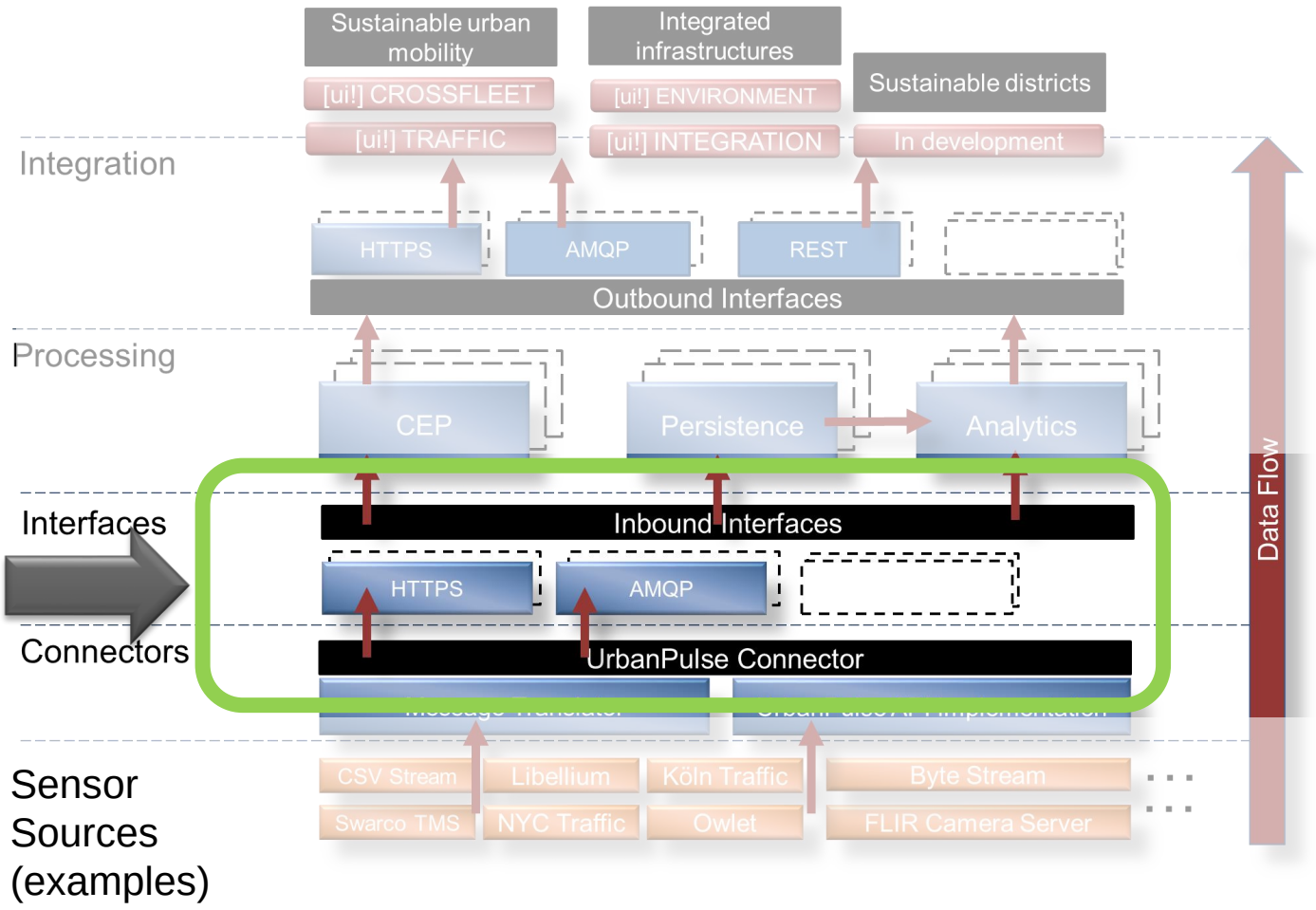


UrbanPulse - Connectors

SM!GHT
smart.city.light

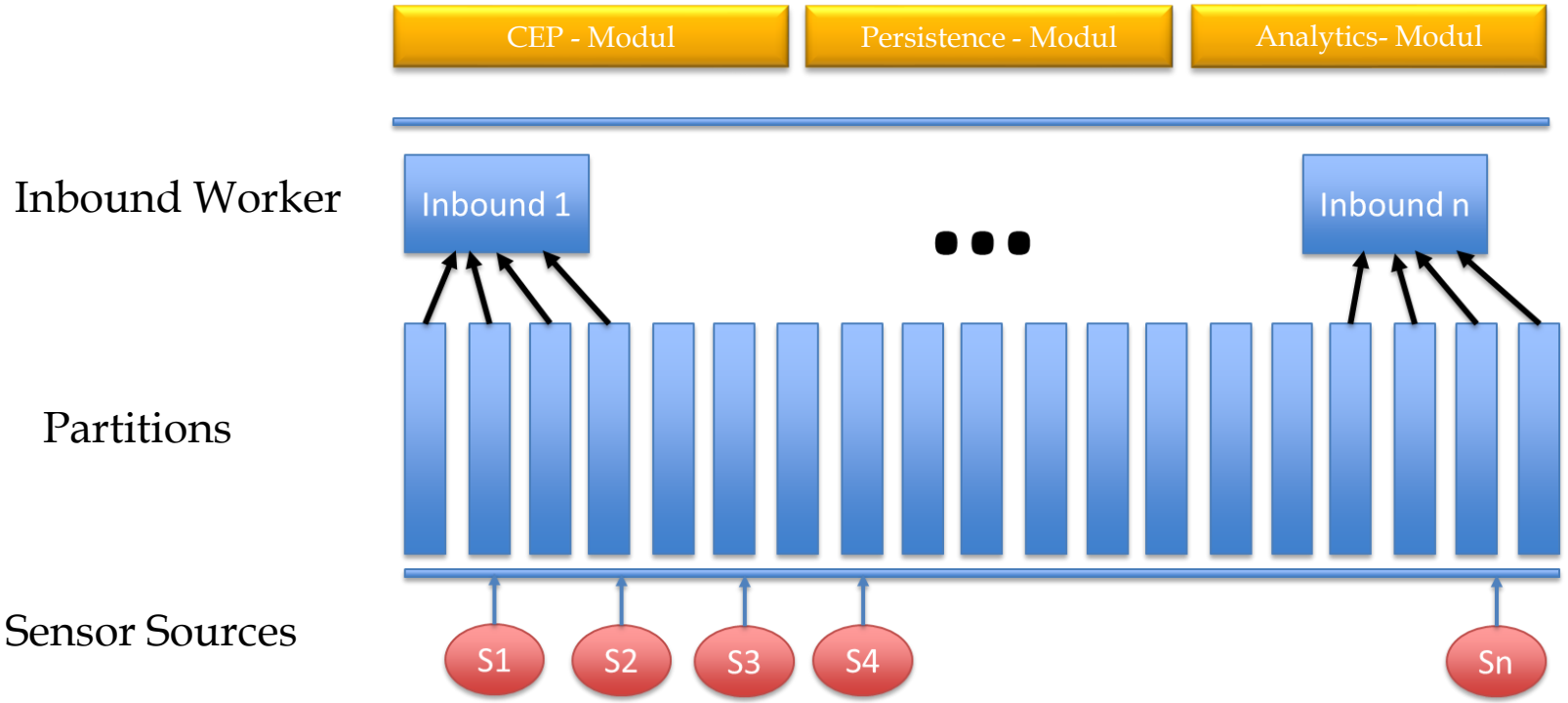
```
public class ProcessingVerticle extends DefaultProcessingVerticle {
    /**
     * @param event
     * @return EnBW event type name mapped from 'sensorTyp' field, null in case of null or
invalid field
     */
    @Override
    public String getEventTypeName(JsonObject event) {
        String sensorTyp = event.getString("sensorTyp");
        if (null == sensorTyp) {
            container.logger().warn("null 'sensorTyp' field!");
            return null;
        }

        switch (sensorTyp) {
            case "Dust detector":
                return "DustEventType";
            case "Ambient Light V2":
                return "AmbientLightEventType";
            case "Barometer":
                return "BarometerEventType";
            case "Humidity":
                return "HumidityEventType";
            case "Sound Intensity":
                return "SoundIntensityEventType";
            case "Temperature":
                return "TemperatureEventType";
            default:
                container.logger().warn("unsupported 'sensorTyp' value: " + sensorTyp);
                return null;
        }
    }
```

UrbanPulse – InboundInterfaces

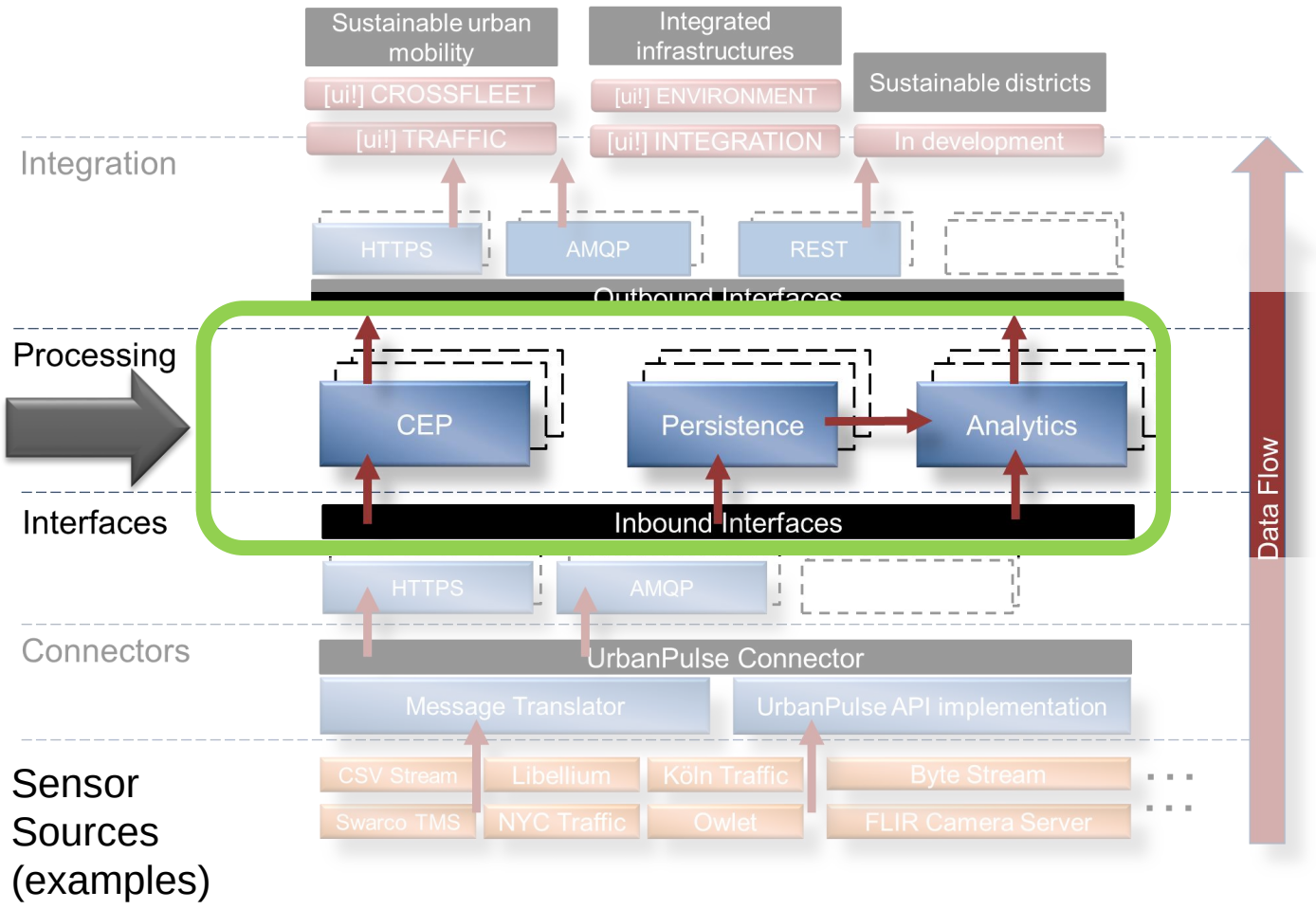


UrbanPulse – Inbound Interfaces

High performance and scalable interface for Events.

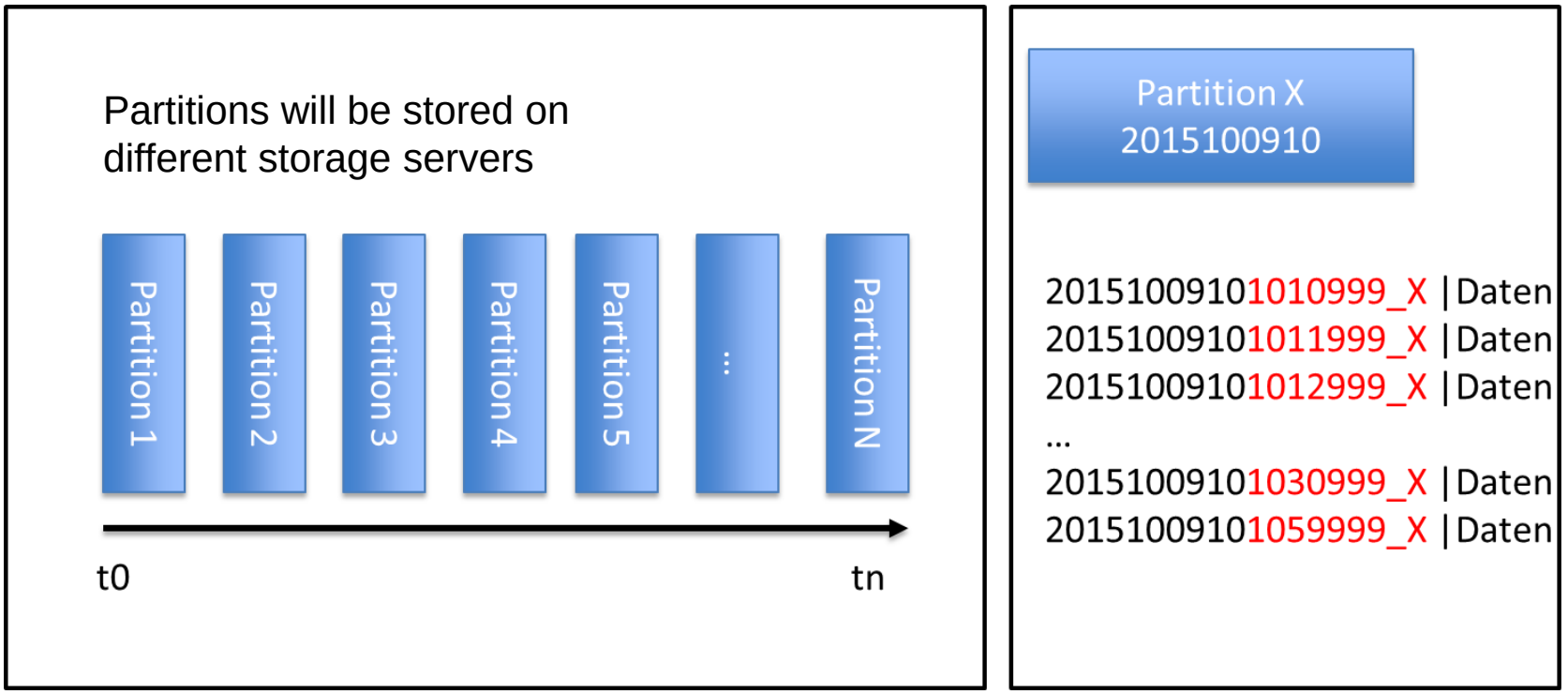


UrbanPulse - Processing



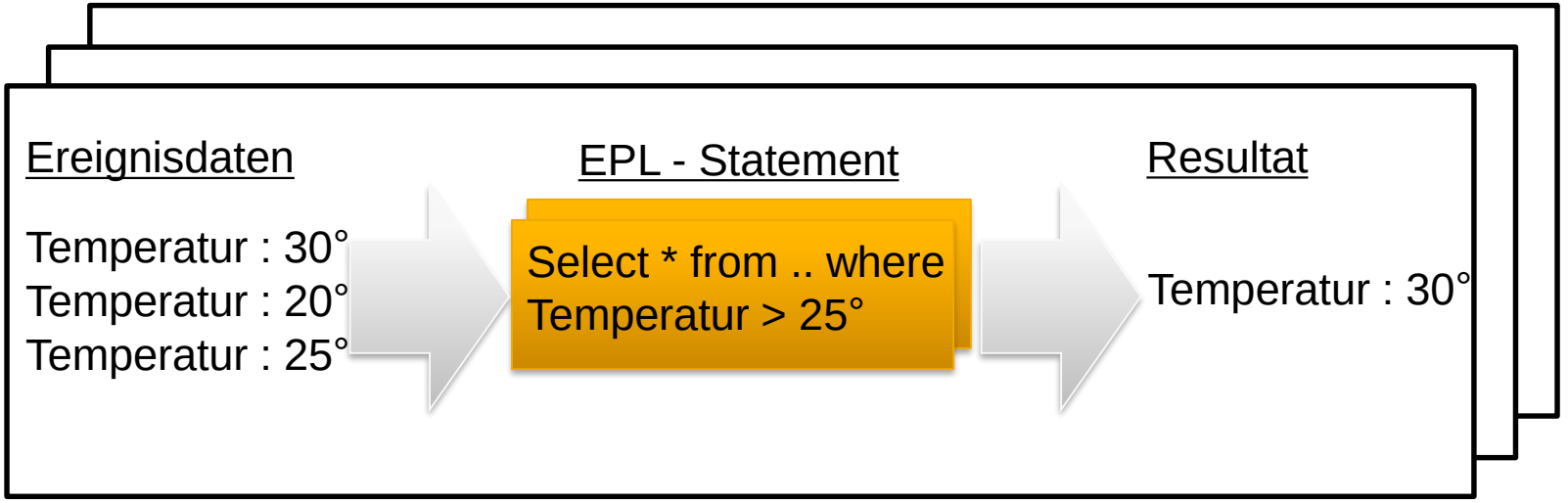
UrbanPulse - Persistence

High performance and scalable storage structure for events



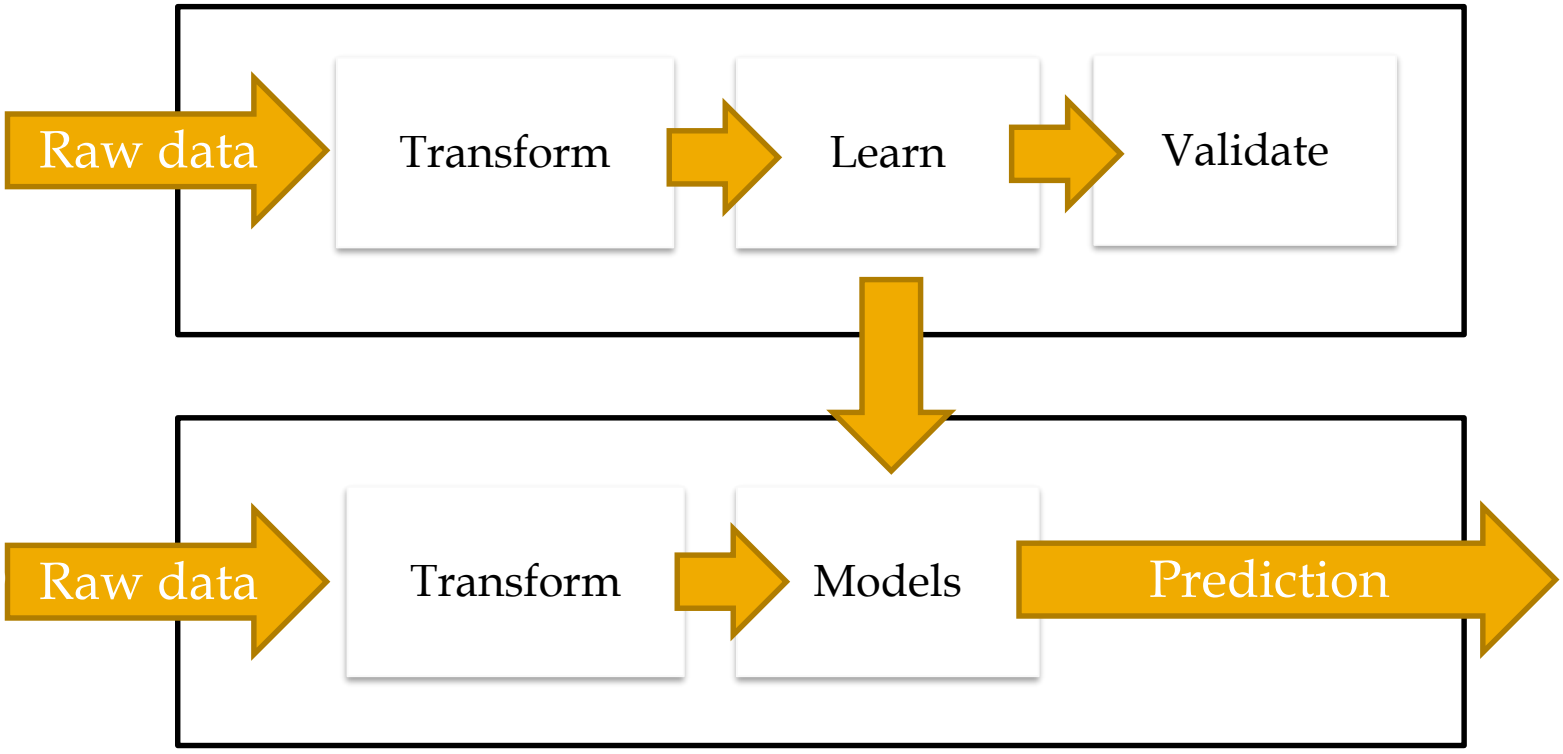
UrbanPulse – Complex Event Processing

Complex Event Processing Module to select and aggregate events

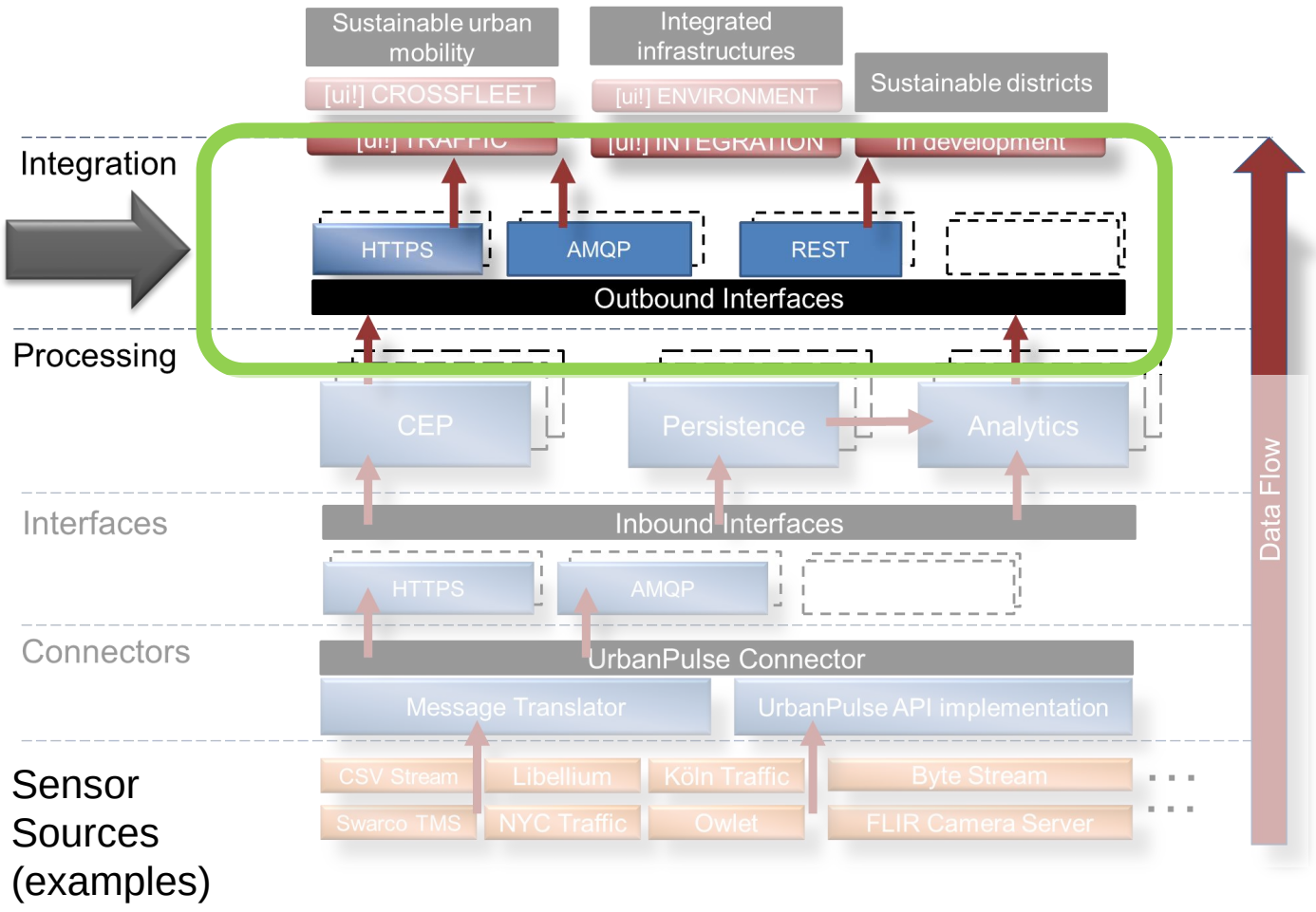


UrbanPulse - Analytics

Stream Processing und Machine Learning

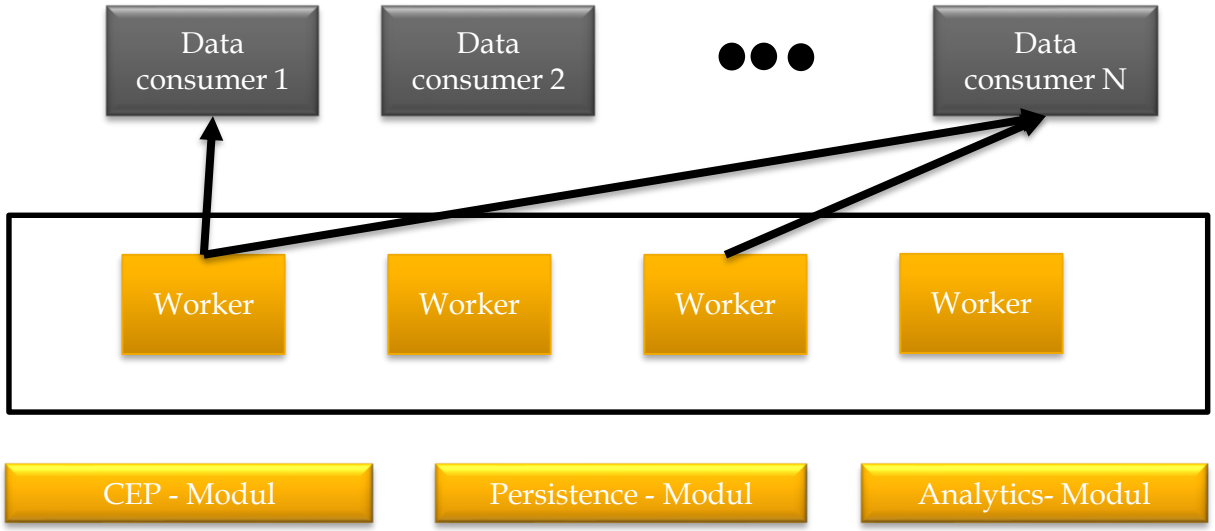


UrbanPulse - Integration



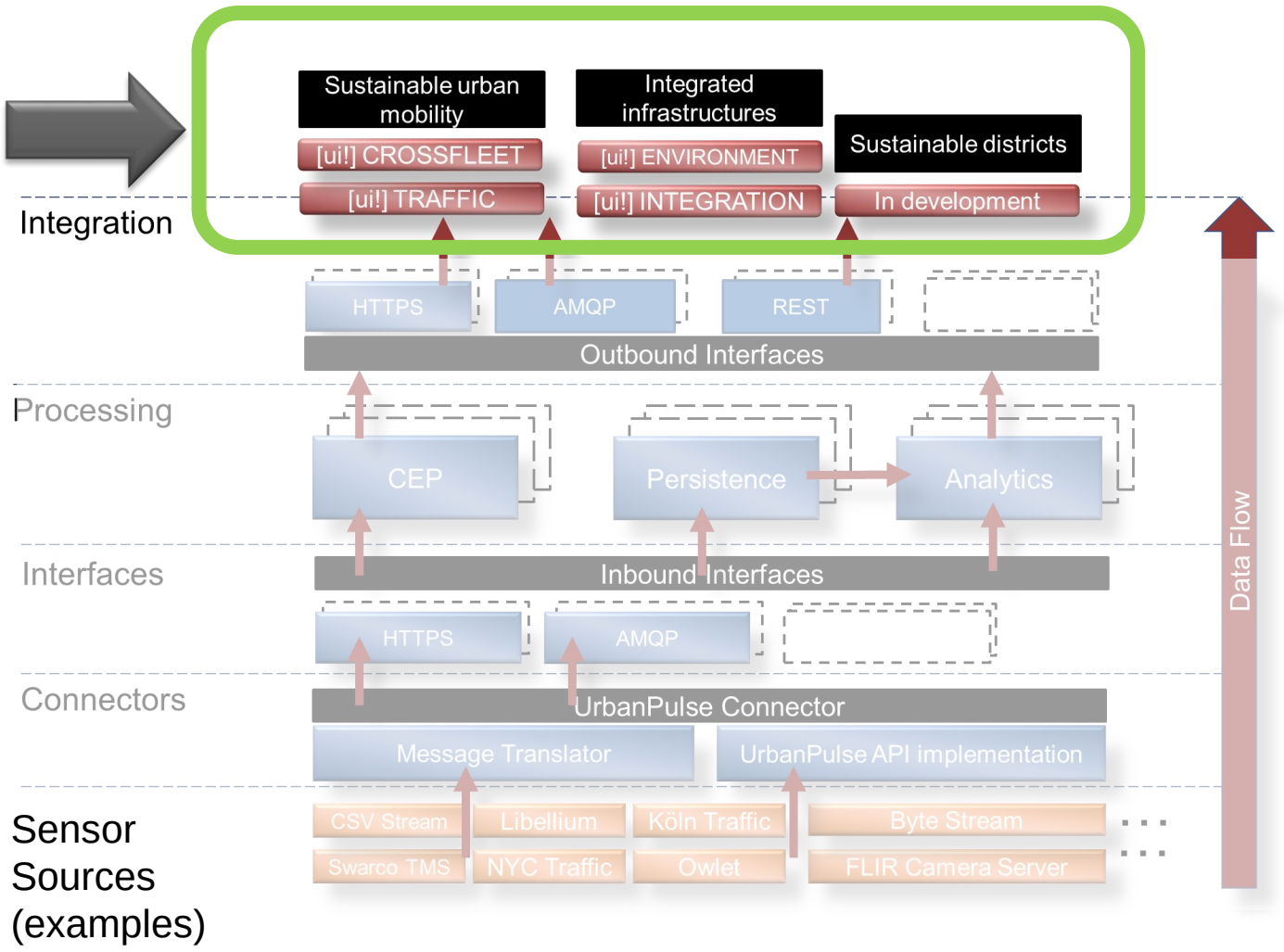
UrbanPulse – Outbound Interfaces

Worker of Outbound Interfaces distribute the Data to different consumers



Use Cases

UrbanPulse - Use Cases



UrbanPulse – [ui!] COCKPIT

[ui!] COCKPIT

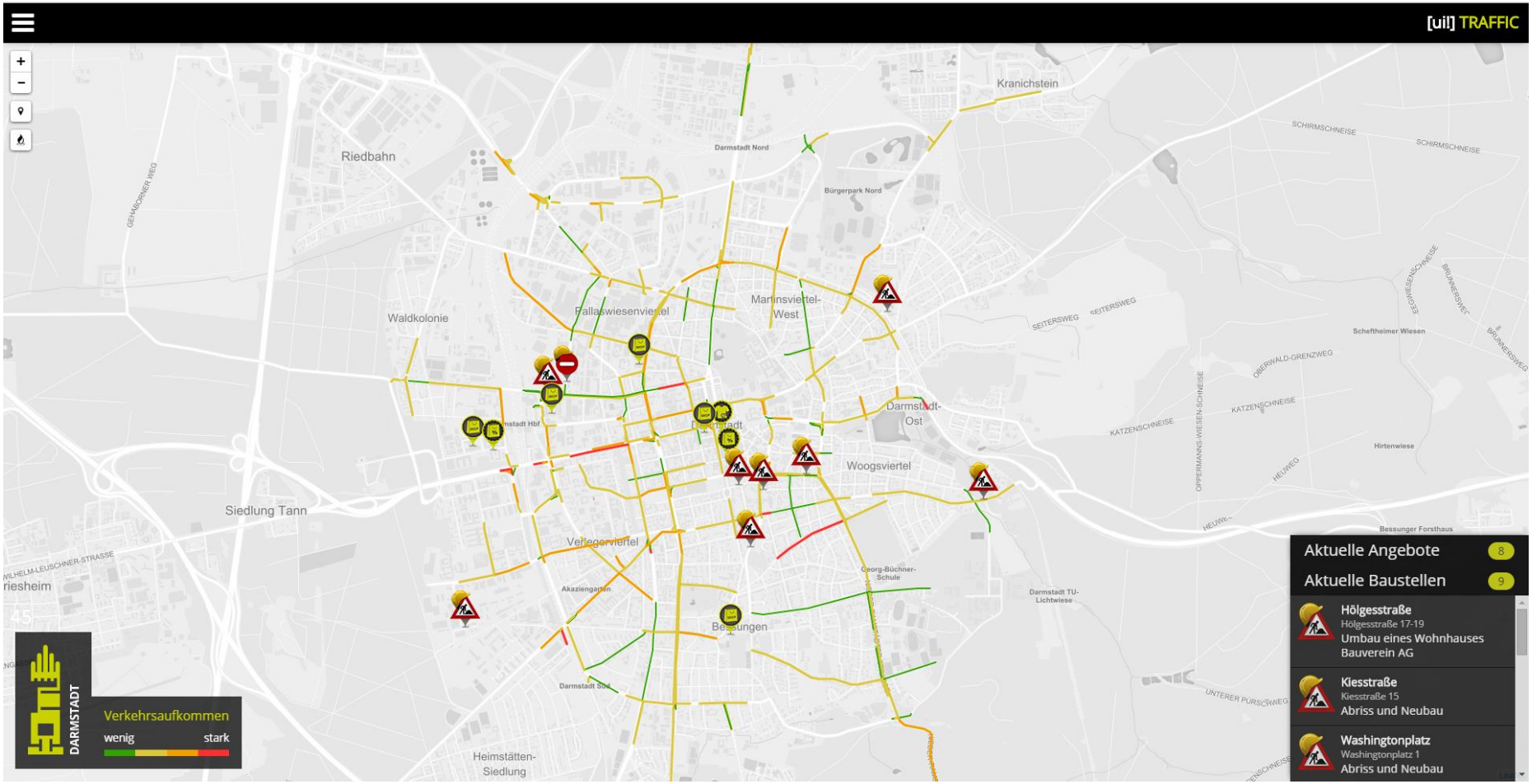
[ui!] INTEGRATION

[ui!] TRAFFIC

clevercitiparking

[ui!] CROSSFLEET

[ui!] TRAFFIC


[ui!] TRAFFIC
Riedbahn
Kranichstein
Darmstadt Nord
Bürgerpark Nord
Waldkolonie
Pallaswiesenviertel
Martinsviertel-West
Darmstadt-Ost
Woogsviertel
Siedlung Tann
Verlegerviertel
Akaziengarten
Georg-Büchner-Schule
Bessungen
Darmstadt TU-Lichtwiese
Darmstadt Süd
Heimstätten-Siedlung
Bessunger Forsthaus
Schefflheimer Wiesen
Hirtenwiese
Aktuelle Angebote 8
Aktuelle Baustellen 9
Hölgesstraße
Hölgesstraße 17-19
Umbau eines Wohnhauses
Bauverein AG
Kiesstraße
Kiesstraße 15
Abriss und Neubau
Washingtonplatz
Washingtonplatz 1
Abriss und Neubau
DARMSTADT
Verkehrsaufkommen
wenig
stark

UrbanPulse – Data feed

Echtzeitdaten

Empfangene Ereignisse:

{"statement":"ConnectedSignals","statementId":"5","event":[{"D49-64":0,"S20":"D","S22":"D","S21":"D","S02":"R","S24":"R","S01":"R","S23":"R","S04":"G","S03":"R","S25":"R","S28":"D","S05":"R","S27":"D","
01-11T14:14:16.625+0000","Status":0,"Datum":"11.01.2016","Umlaufsekunde":345,"Programm":12,"D01-16":24705,"Bezeichnung":"A
51","SID":"109","S31":"","S30":"","S11":"G","S32":"","S10":"G","S13":"D","Uhrzeit ms":625,"S12":"R","S15":"D","S14":"a","D17-
32":0,"S17":"D","S19":"D","S18":"D","D33-48":0}]}
{"statement":"ConnectedSignals","statementId":"5","event":[{"D49-64":0,"S20":"","S22":"","S21":"","S02":"R","S24":"","S01":"G","S23":"","S04":"R","S03":"R","S25":"","S28":"","S05":"G","S27":"","S08":"R","S0
01-11T14:14:16.609+0000","Status":0,"Datum":"11.01.2016","Umlaufsekunde":445,"Programm":10,"D01-16":2356,"Bezeichnung":"A
45","SID":"132","S31":"","S30":"","S11":"R","S32":"","S10":"R","S13":"R","Uhrzeit ms":609,"S12":"R","S15":"G","S14":"G","D17-
32":0,"S17":"","S19":"","S18":"","D33-48":0}]}
{"statement":"ConnectedSignals","statementId":"5","event":[{"D49-64":0,"S20":"","S22":"","S21":"","S02":"G","S24":"","S01":"R","S23":"","S04":"G","S03":"R","S25":"","S28":"","S05":"D","S27":"","S08":"G","S0
01-11T14:14:16.625+0000","Status":0,"Datum":"11.01.2016","Umlaufsekunde":455,"Programm":10,"D01-16":1,"Bezeichnung":"A
17","SID":"104","S31":"","S30":"","S11":"D","S32":"","S10":"D","S13":"A","Uhrzeit ms":625,"S12":"G","S15":"","S14":"R","D17-
32":0,"S17":"","S19":"","S18":"","D33-48":0}]}
{"statement":"ConnectedSignals","statementId":"5","event":[{"D49-64":0,"S20":"D","S22":"A","S21":"D","S02":"R","S24":"A","S01":"R","S23":"A","S04":"A","S03":"G","S25":"R","S28":"","S05":"R","S27":"","S08
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32":0,"S17":"R","S19":"D","S18":"R","D33-48":0}]}

Outline

5. Group Exercise

Group Exercise - Setting

- Goal: Develop a Smart City Service Business Case including PoC
- Team of 4 -5
- Exercise consists of two parts
  - Build a business case for a Smart City Service
    - Description of the Service
    - Deployment and operation of the Service
    - Business Plan using a business model canvas (see attached)
  - Build a PoC using UrbanPulse and [ui!] COCKPIT
    - Identify the smart data source and connect it via [ui!] CONNECTOR
    - Visualize the Service using [ui!] COCKPIT
    - (Build an App)
- Kick-off on **November 17th, 2017** with a tutorial on UrbanPulse and [ui!] COCKPIT
- (Review / Feedback opportunity on **December 16th, 2016**)
- Jam Session on pitch on **January 12th, 2018 – first two hours**
- Successful presentations will influence result of exam

Business Model Canvas

Bundesministerium
für Wirtschaft
und Energie

Business Model Canvas: Vorlage

Schlüssel-Partner

Wer sind unsere Schlüsselpartner?
Wer sind unsere Schlüssellieferanten?
Welche Schlüsselressourcen kommen von Partnern?
Welche Schlüsselaktivitäten kommen von Partnern?

Vorteile von Partnerschaften:

- Verbesserung der Leistung, Einsparung von Aufwand und Kosten
- Verringerung von Risiken und Unsicherheiten
- Zugang zu Ressourcen und Leistungen

Schlüssel-Aktivitäten

Welche Schlüssel-Aktivitäten erfordern unsere

- Nutzen-Versprechen?
- Vertriebs- und Kommunikations-Kanäle?
- Kunden-Beziehungen?
- Einnahme-Quellen?

Kategorien

- Produktion
- Problemlösung
- Plattform/Netzwerk

Schlüssel-Ressourcen

Welche Schlüssel-Ressourcen benötigen wir für unsere

- Nutzen-Versprechen?
- Vertriebs- und Kommunikations-Kanäle?
- Kunden-Beziehungen?
- Einnahmequellen?

Ressourcen-Arten

- Produktionsmittel
- Wissen (Patente, Markenschutz, Urheberrechte, Daten)
- Personal
- Finanzen

Nutzen-Versprechen

Welchen Nutzen bieten wir dem Kunden an?
Welches Kunden-Problem helfen wir zu lösen?
Welches Produkt- bzw. Leistungspaket bieten wir welcher Kunden-Art an?
Welche Kunden-Bedürfnisse befriedigen wir?

Eigenschaften

- Neu
- Leistungsstark
- Kundengerecht
- Arbeitserleichterung
- Design
- Marke/Status
- Preis
- Kostengünstig
- Risikoarm
- Verfügbar

Kunden-Beziehungen

Welche Art von Kunden-Beziehung erwarten die verschieden Kunden-Arten von uns?
Welche haben wir bereits geschaffen?
Wie passen sie zum Rest des Geschäftsmodells?
Welche Kosten verursachen sie?

Beispiele

- Persönliche Unterstützung
- Spezielle persönliche Unterstützung
- Hilfe zur Selbsthilfe
- Automatisierte Dienstleistungen
- Communities
- Kreative Partnerschaft

Vertriebs- und KommunikationsKanäle

Über welche Kanäle wollen unsere Kunden-Arten erreicht werden?
Wie erreichen wir sie jetzt?
Wie funktionieren diese Kanäle gemeinsam?
Welche funktionieren am besten?
Welche sind besonders kostengünstig?
Wie können wir sie mit typischen Kundenaktivitäten in Berührung bringen?

Kanal-Phasen

1. Aufmerksamkeit: Wie können wir Aufmerksamkeit für unser Unternehmen und seine Angebote erzeugen?
2. Bewertung: Wie helfen wir unseren Kunden dabei, die Nutzen-Versprechen unseres Unternehmens zu bewerten?
3. Kauf: Wie ermöglichen wir es Kunden, bestimmte Produkte und Leistungen zu kaufen?
4. Vertrieb: Wie liefern wir unser Nutzen-Versprechen an den Kunden?
5. Nach dem Kauf: Wie betreuen wir die Kunden nach dem Kauf?

Kunden-Arten

Wem bieten wir einen Nutzen an?
Wer sind unsere wichtigsten Kunden?

- Massenmarkt
- Nischenmarkt
- Ein Marktsegment
- Verschiedene Marktsegmente
- Vielseitige Plattformen

Kosten

Welches sind die wichtigsten Kosten in unserem Geschäftsmodell?
Welche Schlüsselressourcen sind besonders kostenintensiv?
Welche Schlüsselaktivitäten sind besonders kostenintensiv?

Ist unser Geschäftsmodell eher

- Kostenorientiert (geringe Kosten, geringes Preis-Leistungs-Versprechen, maximale Automatisierung, extensives Outsourcing)?
- Nutzenorientiert (Nutzen-Angebot im Vordergrund, Premium-Nutzen-Versprechen)?

Beispiele für Kosten-Arten

- Fixkosten (Löhne, Mieten, Betriebsmittel)
- Variable Kosten
- Kostenersparnis durch Masse (z.B. Einkauf, Produktion)
- Kostenersparnis durch Synergieeffekte

Einnahmequellen

Für welchen Nutzen sind unsere Kunden bereit, Geld auszugeben?
Wofür geben Sie es derzeit aus?
Wie bezahlen sie derzeit?
Wie würden sie lieber bezahlen?
Welchen Anteil haben die jeweiligen Einnahmequellen an den gesamten Einnahmen?

Arten

- Verkauf
- Nutzungsgebühr
- Abonnement
- Verleih/Vermietung/Leasing
- Lizenzen
- Vermittlungsgebühr
- Werbung

Feste Preise (Listenpreis, abhängig z.B. von den Produktionskosten, vom Kunden-Segment, von der Menge)
Variable Preise (Verhandlungssache, ertragsabhängig, marktabhängig)

Quelle: www.businessmodelgeneration.com / eigene Übersetzung

www.existenzgruender.de

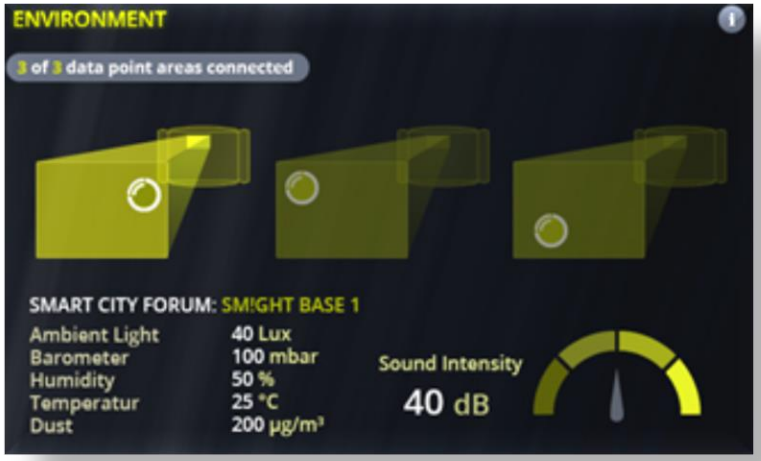
Smart City Dashboard – Shows the urban data of the city

Smart City Dashboard - Sample Urban Sensor Data

Example: Environmental Data

→ Identify thresholds of air quality

Stake holder: City Authorities



Technical Solution:

Multi-sensor nodes as smart items collect data and send them to a sensor data platform for evaluation.

Smart City Dashboard – PoC – Build your own Tile