LOCALIZATION WITH LORAWAN UPLINK IN THE PRODUCTION LOGISTICS OF A WOLFSBURG CAR MANUFACTURER

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Darmstadt, October 30, 2018

TRANSPARENT AUTOMOTIVE LOGISTICS WITH IOT

1. IoT in Logistics: Sensing and Sensemaking
2. The Service Cycle of an Automaker's Pallet
3. Energy Optimization of an IoT Tracker
4. Planning an IoT Project

IoT in Logistics

Sensing and Sensemaking during the Process

Technology Push

- Mobile sensemaking: Smartphone
- Affordable sensors: QR, NFC, RFID and IoT
- Connectivity: 5G and IoT [LPWAN]
- Cloud computing: New data services

Logistical Needs

The end consumer / business customer / logistics provider must have transparency and integrity along the supply chain to

- reduce losses and damage and
- increase the utilization level

by

- monitoring shipments and shipping conditions of freight and
- optimizing logistics processes and the level asset utilization.

Transparency and Integrity along the Supply Chain

Automatic Identification of Transferred Freight

RFID

Discrete tracking

?

IoT

Continuous tracking

for

Container management

Prototype development

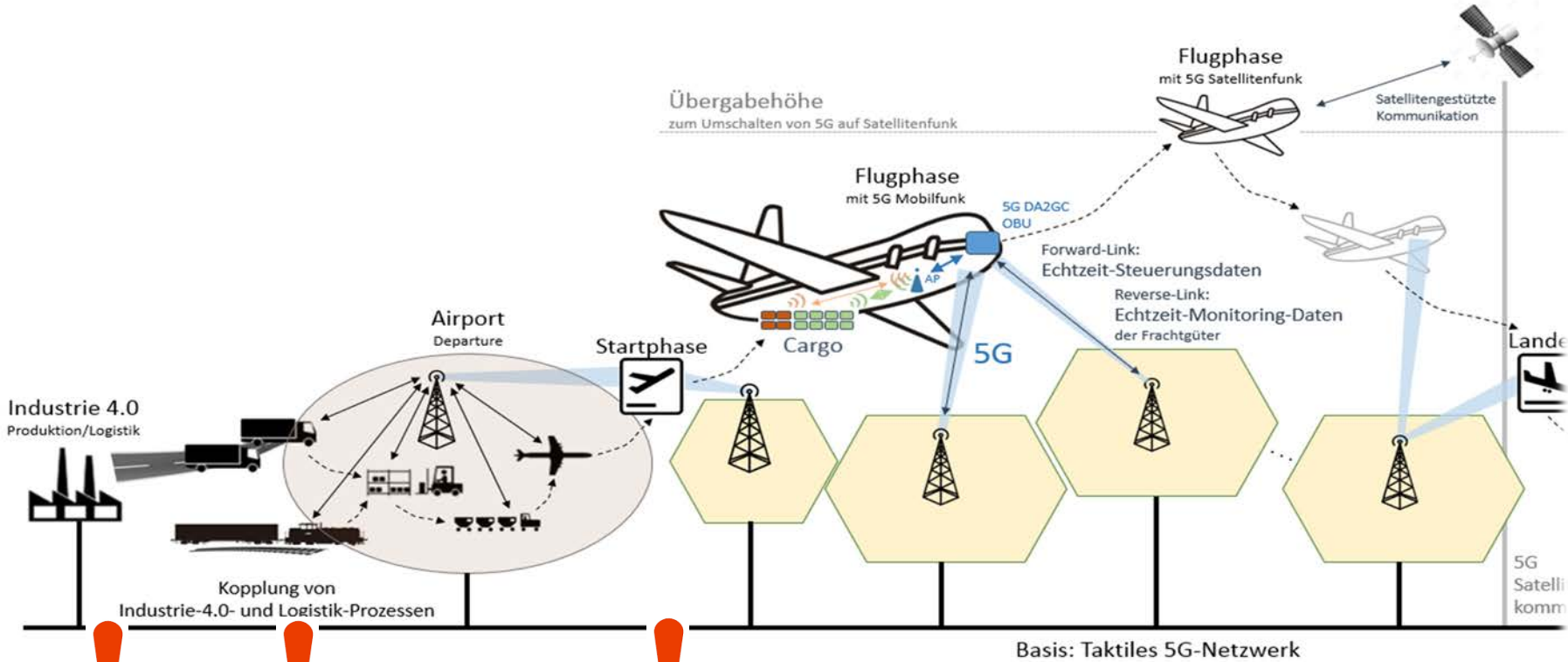
Serial production

Outbound logistics

Car distribution

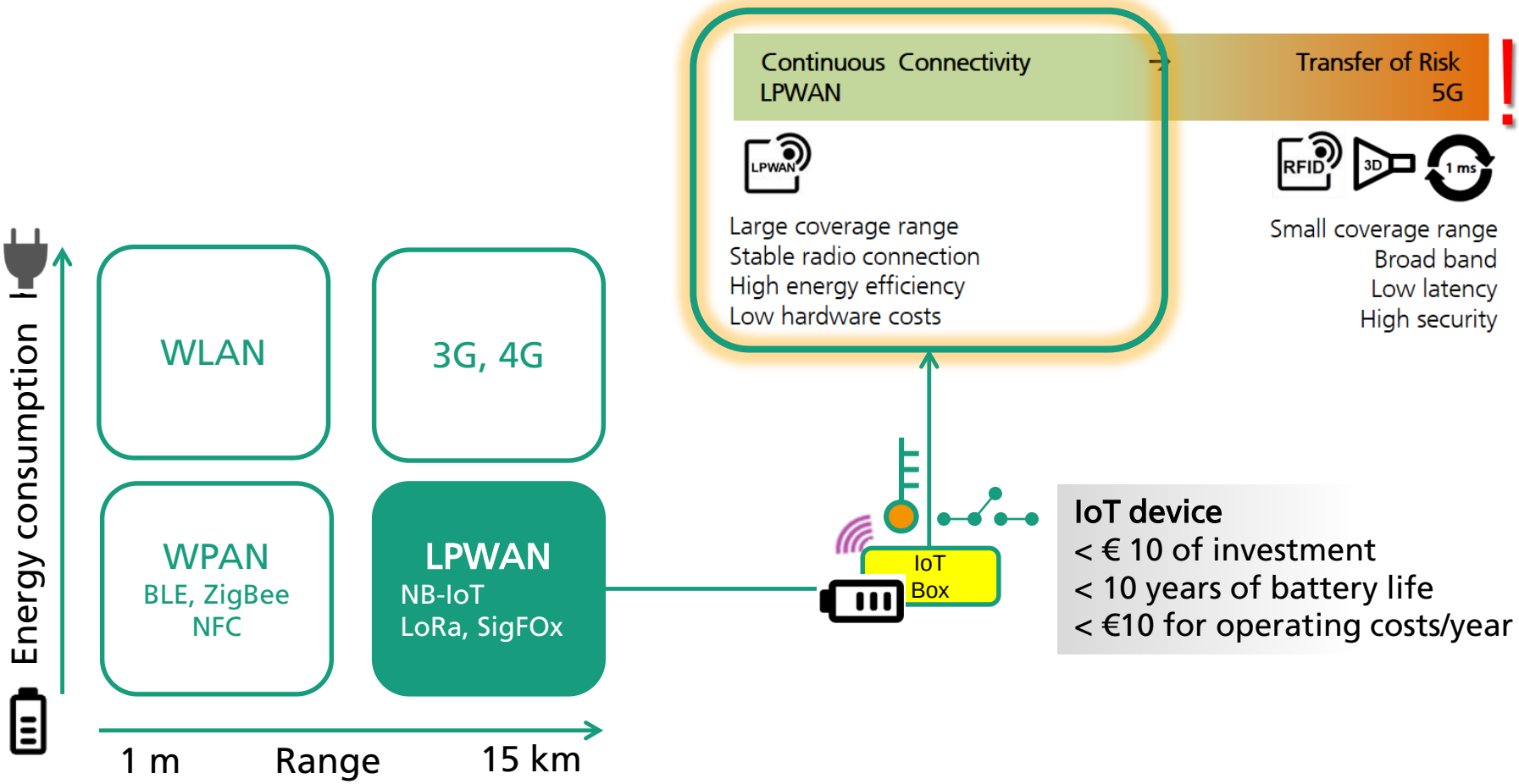
Long Supply Chains

Transferring Freight in Different Spatial Categories



New Technologies for Better IoT Connectivity

Low Power Wide Area Network LPWAN



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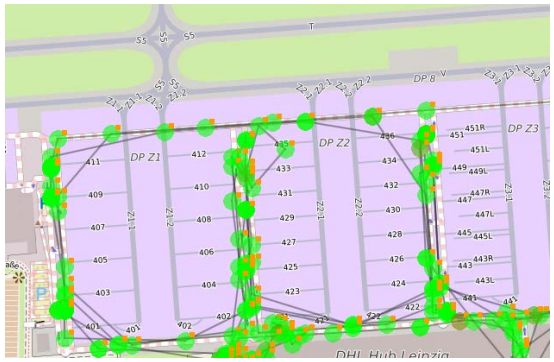
IoT Connectivity in Logistics Zones

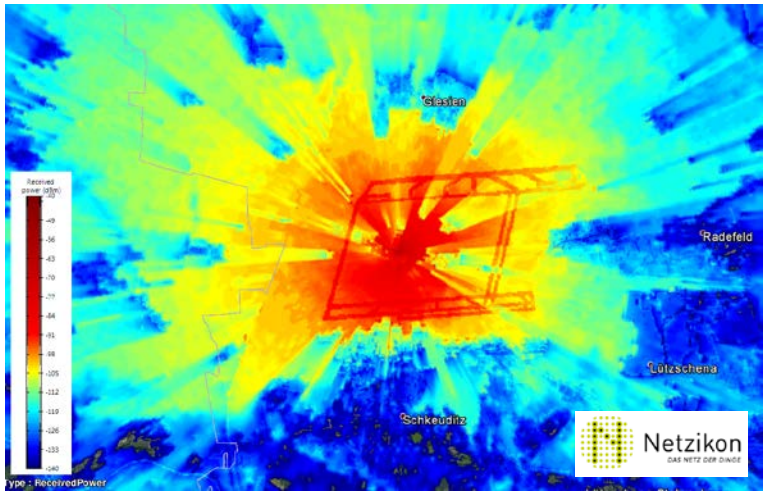
Spatial Categories

Logistics hub (Leipzig/Halle Airport)

1 IoT gateway at the airport center

Outdoor connectivity: SF7

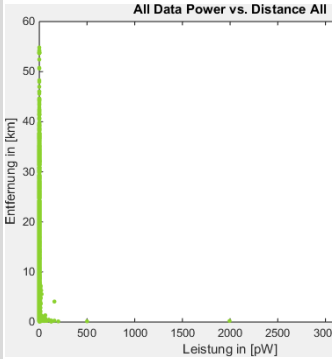


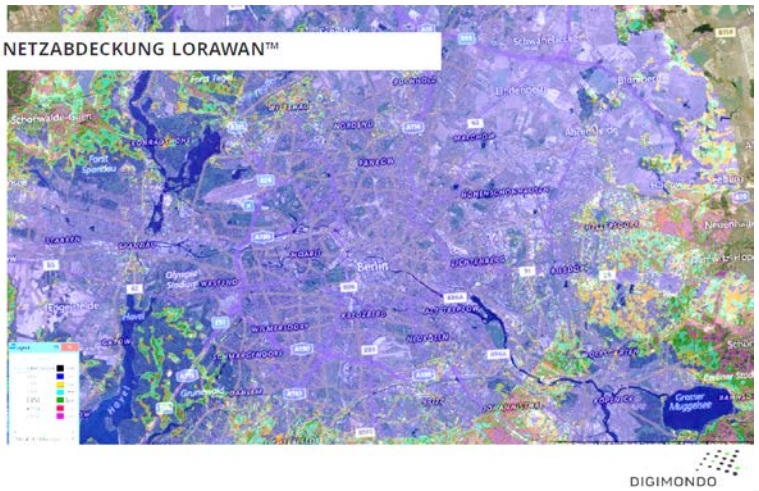


Urban area (Berlin)

9 IoT gateways at prime locations

Outdoor connectivity: SF12 up to 55 km





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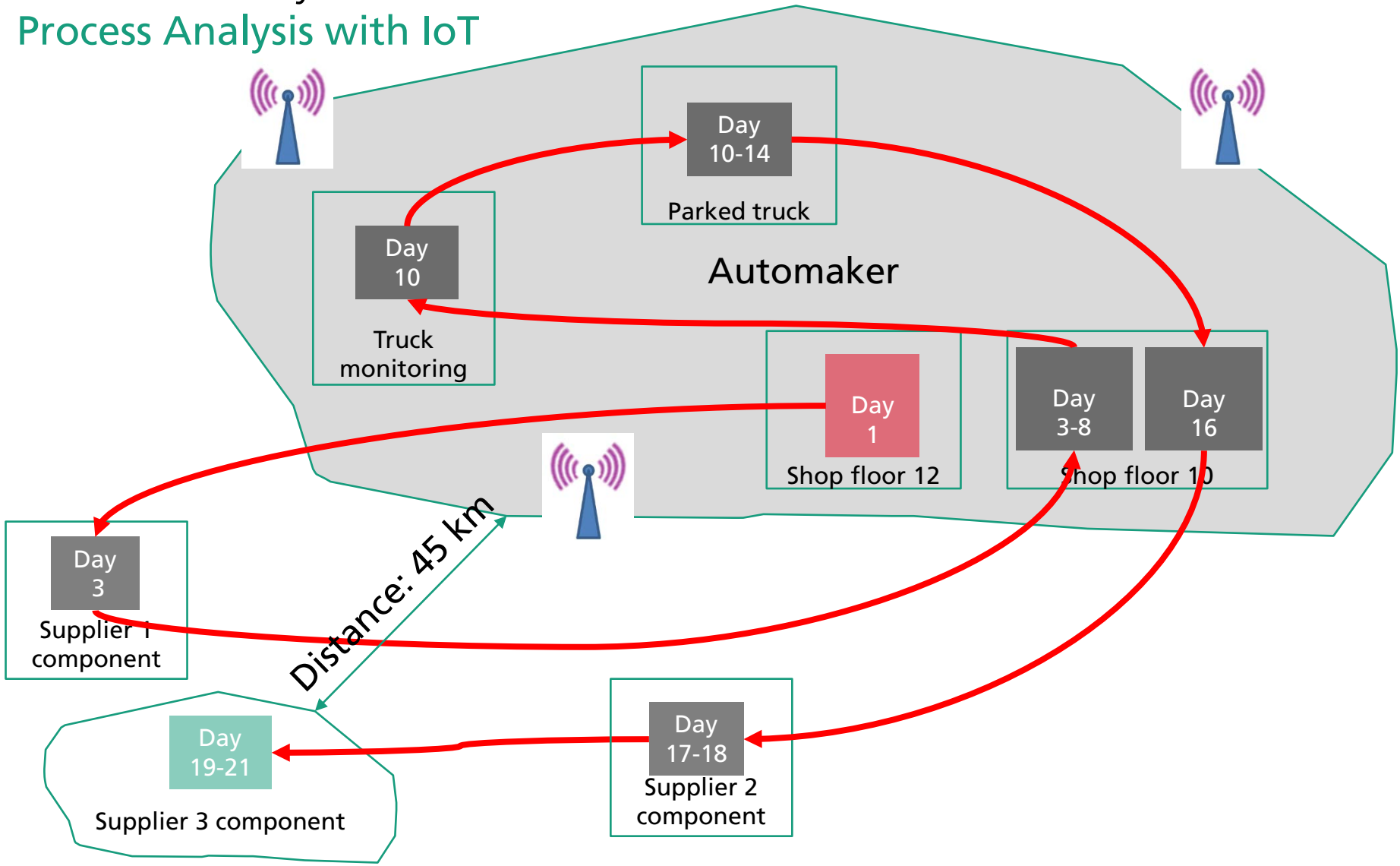
The Service Cycle of an Automaker's Pallet

Process Analysis with IoT



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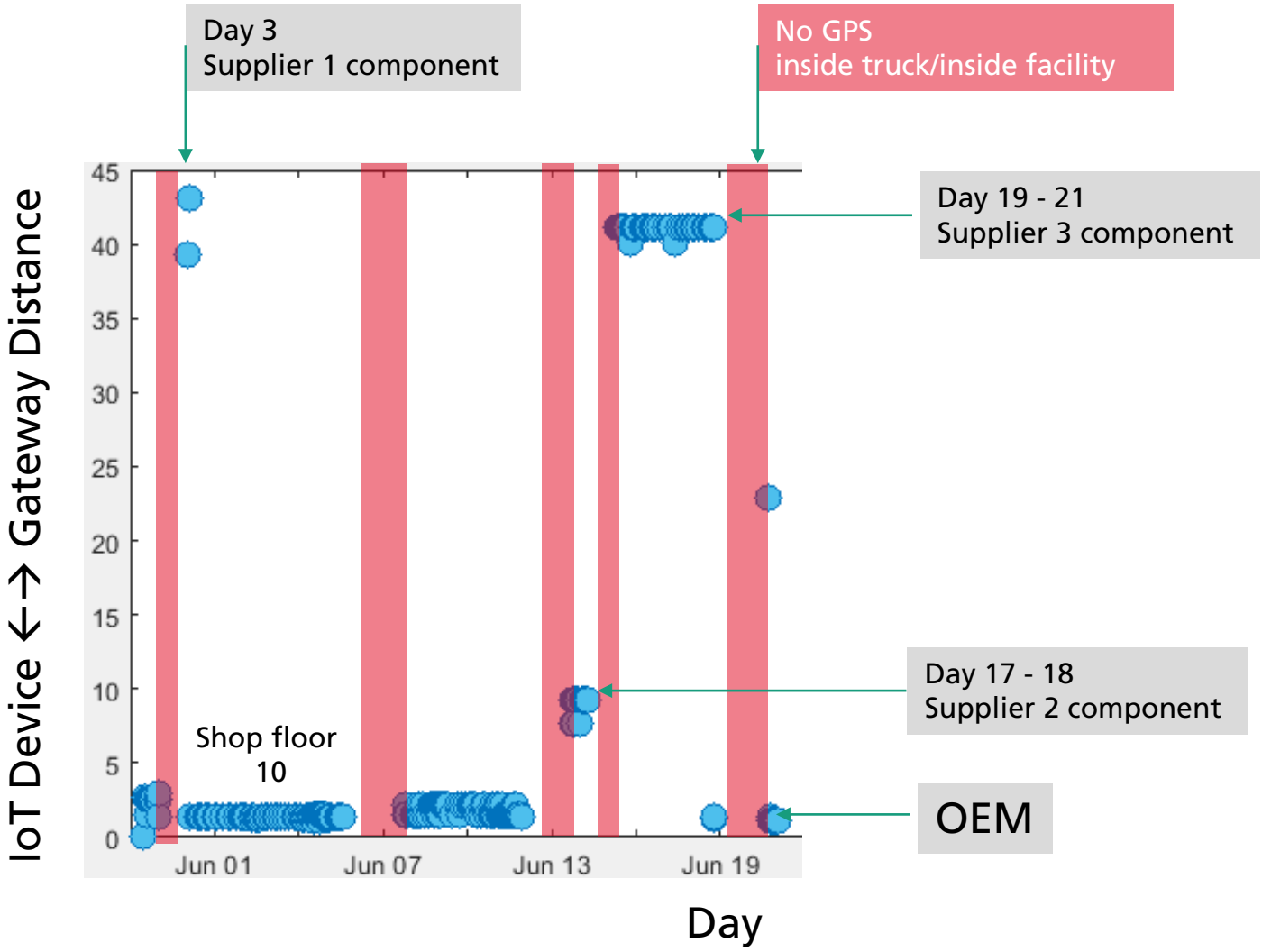
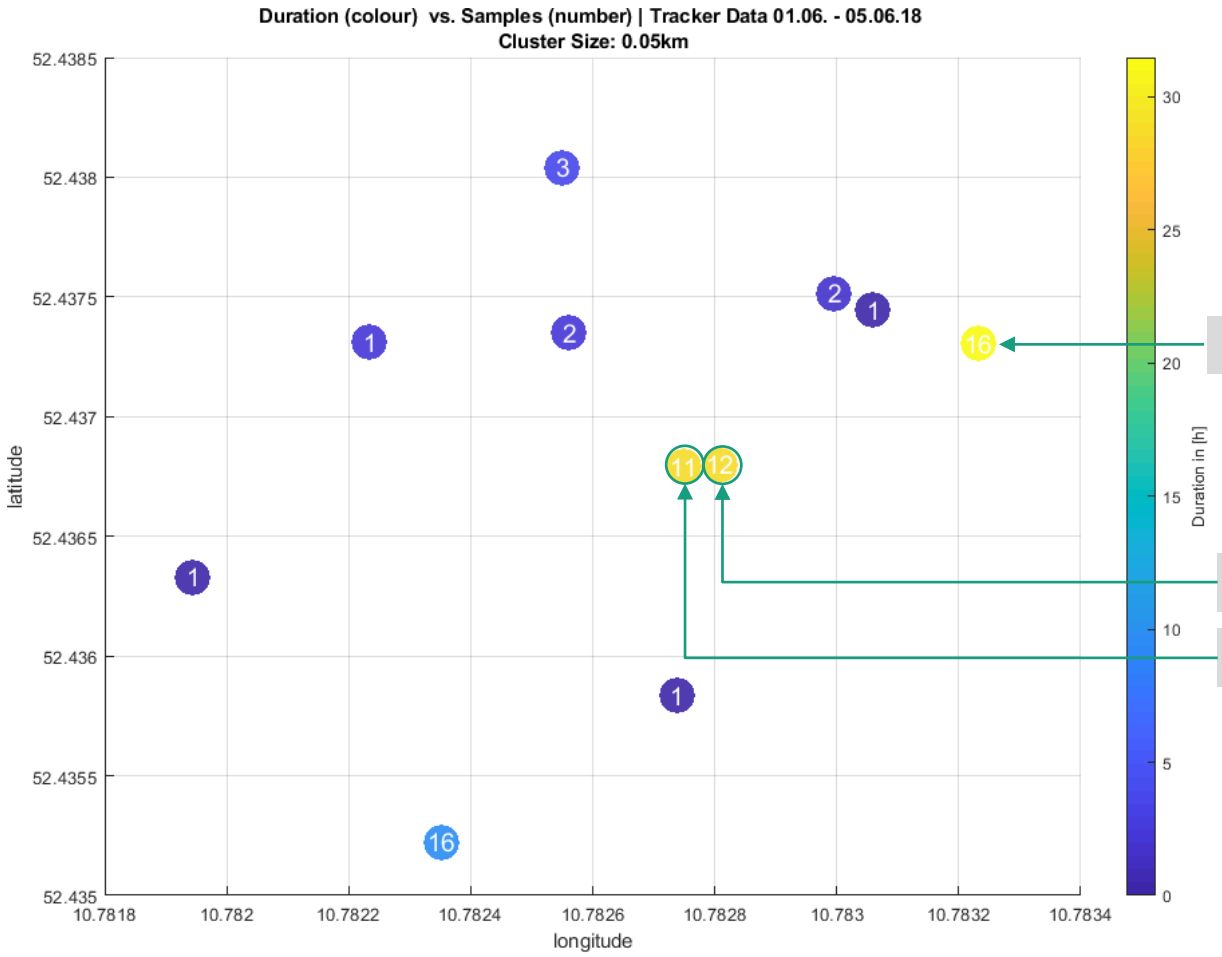
The Service Cycle of an Automaker's Pallet

Outbound Logistics



The Service Cycle of an Automaker's Pallet

Analysis in Shop Floor 10 to Reduce GPS Activation in the IoT Device



16 GPS events at the same location

12 GPS events at the same location

11 GPS events at the same location

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3. IoT Tracker Energy Optimization

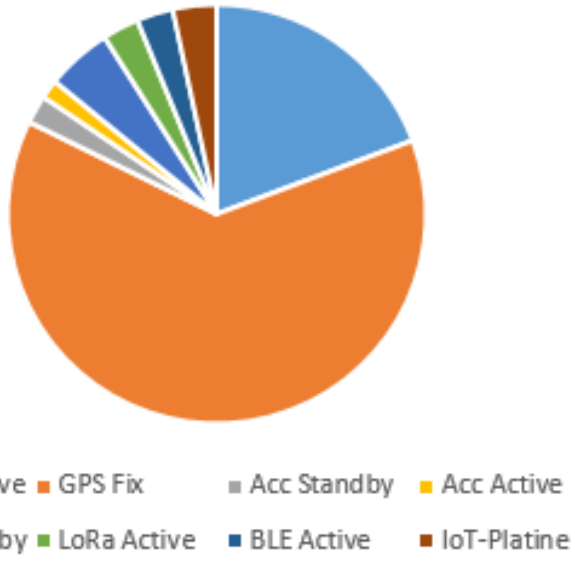
Recommendations

Sensor	GSM tracker flash rate	IoT tracker flash rate
Communication	GSM ↓	LPWAN ↑
GPS tracking	↓	A-GPS ↓
Wi-Fi tracking	↓	
WPAN tracking		BLE ↑
Acceleration	↑	↑
Other low-power sensors	↑	↑

IoT Device Energy Management

Focus on GPS Consumption

	Percentage power consumption/battery	Number of events/day	Duration of event in seconds
Battery power	2500		
Battery reserve	20		
GPS fix	65.21	4	60
Acceleration in standby	2.28		
Acceleration active	1.52	24	120
LoRa in standby	0.53		
LoRa active	4.67	96	0.1
BLE active	1.17	24	2
IoT PCB	3.50		
	98.88		



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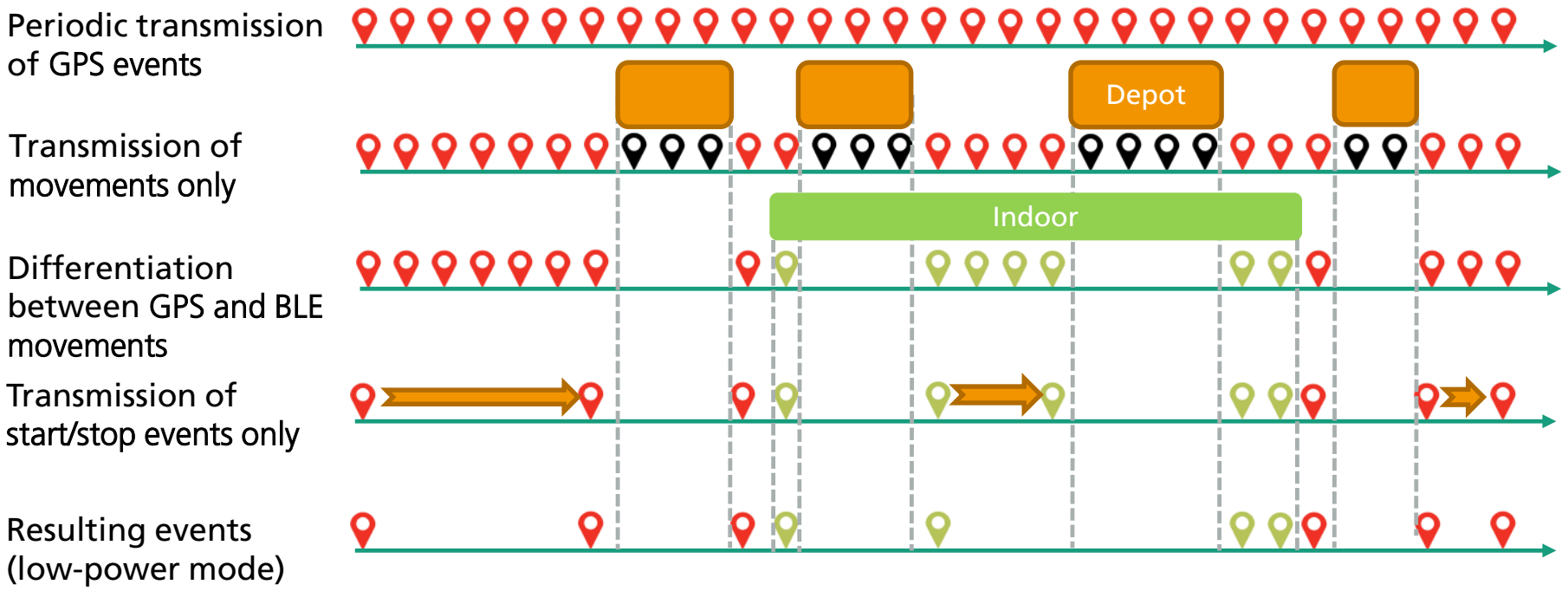
Operation Modes of an IoT Device

IoT Tracker's Tracking Mode Optimization



32 activity events	→	10 activity events!
32 GPS events	→	6 GPS events

IoT Device Operating Modes

Secondary Effects of IoT Tracker Analysis

a) GPS geolocation in a facility with low absorption

b) Tropospheric propagation in communication uplink

c) [No GPS, activity] → operating mode in a facility

d) [No GPS, no activity] → storage

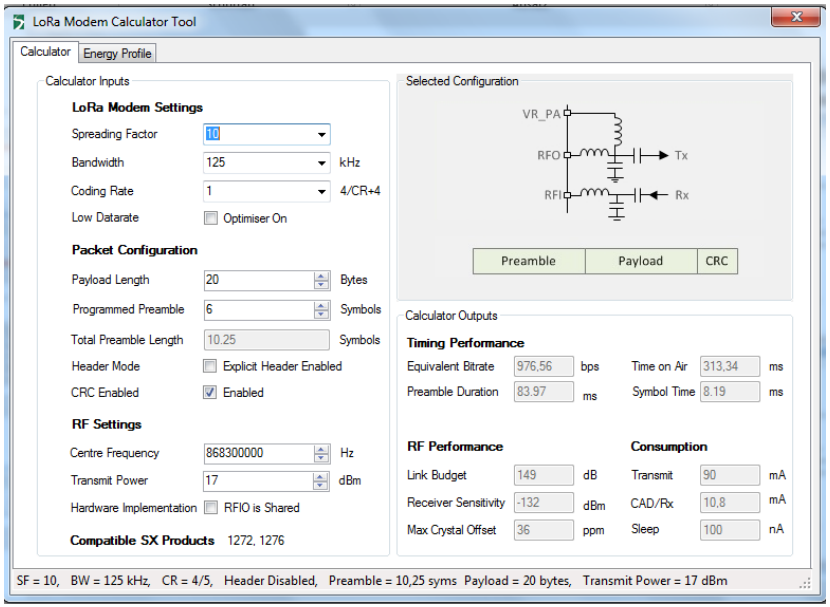
e) Short duration + identical GPS geolocation → pallet handling

f) Long duration + identical GPS geolocation → storage

LoRaWAN Communications Strategy

Use Cases with Different Spreading Factors

Spreading factor	7	10
Payload	20 byte	20 byte
Time on air	49 milliseconds	313 milliseconds
Battery life	202 days	44 days
Duty cycle	30 seconds	30 seconds



Semtech LoRa Calculator

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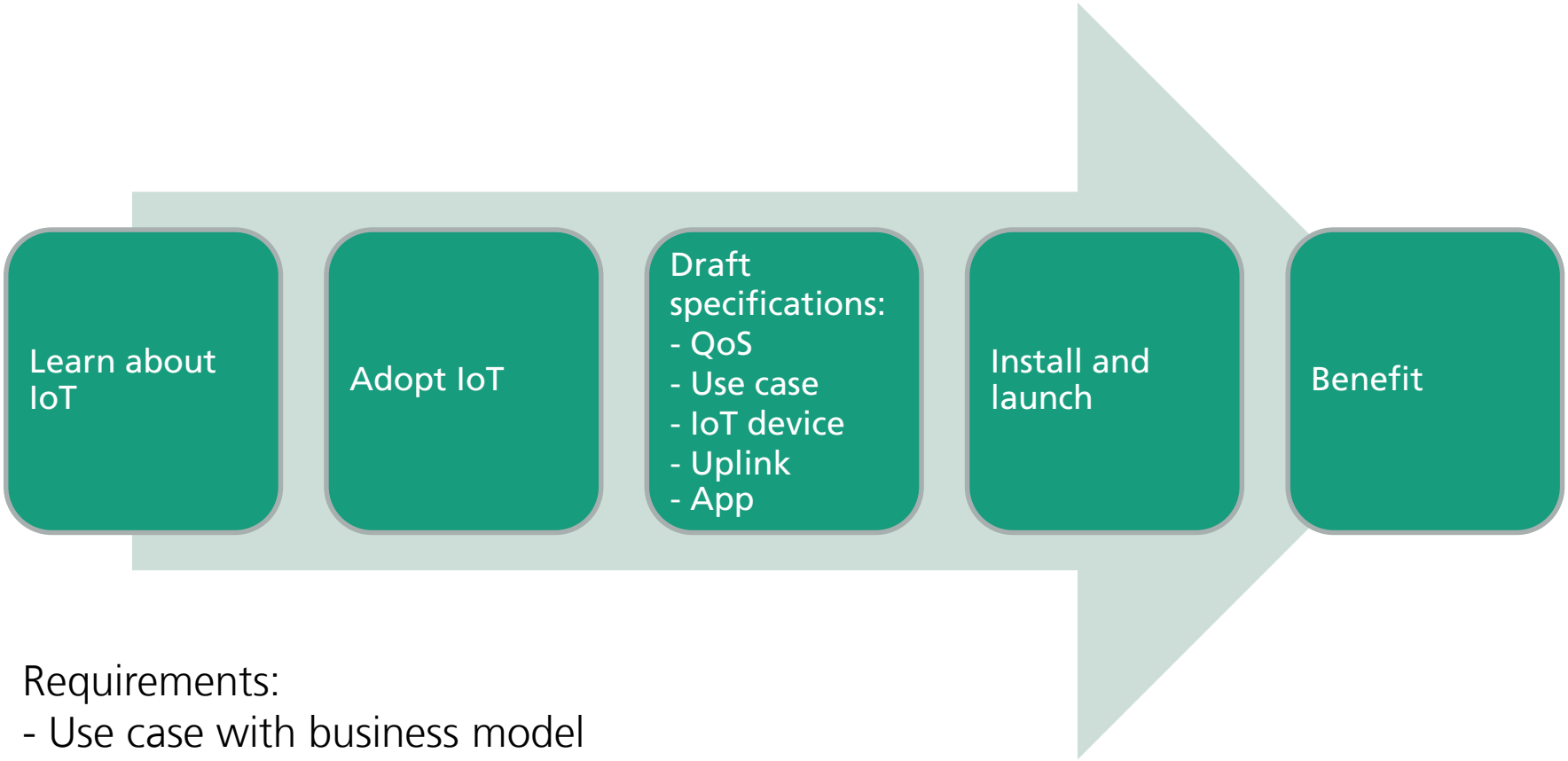
Planning an IoT Project

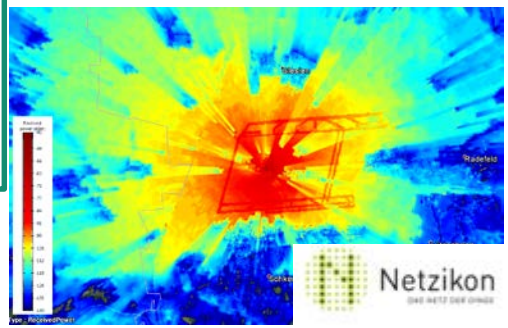
IoT Campaign for Logistics



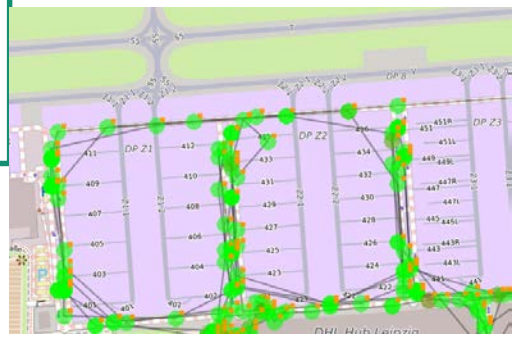
Requirements:
- Use case with business model
- Useful IoT device with app
- Accessible LPWAN uplink

IoT Project Planning
IoT Connectivity

Network plan



Connectivity test



Productivity check

IoT Pallet Project

Smart Devices around the IoT Pallet

IoT Smart Watch
Handsfree HMI

ePaper Node
Integrated sensor tracker
Recorded alerts

Logistics Data Hub

Smartphone
Internet access

IoT Box
Sensing
Indoor tracking
Outdoor tracking
LoRa uplink

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Step-by-Step Plan for Data-Driven Services

Role of Data Governance

Value added service

Big data – Smart data

Data governance

Device management/connectivity

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