

SMART BUILDING & SMART CITY PANEL DISCUSSION

Moderator: Byron Bemiller, Semtech

Jean Baptiste Raphanaud, LHIRR for Accorinvest

Hany Zekry, Digimondo

Tim Giesendorf, Digitalstadt Darmstadt GmbH

Yannik Kopp, LORIOT.io AG

Hans Scholten, Cap Gemini

Becky Oh, PNI Sensor

ACCORINVEST – CARBON ACTION PLAN

How Accorinvest Transforms its Building Asset Management Strategy Thanks to LoRaWAN® Private Networks

J-B. RAPHANAUD – LHIRR for Accorinvest

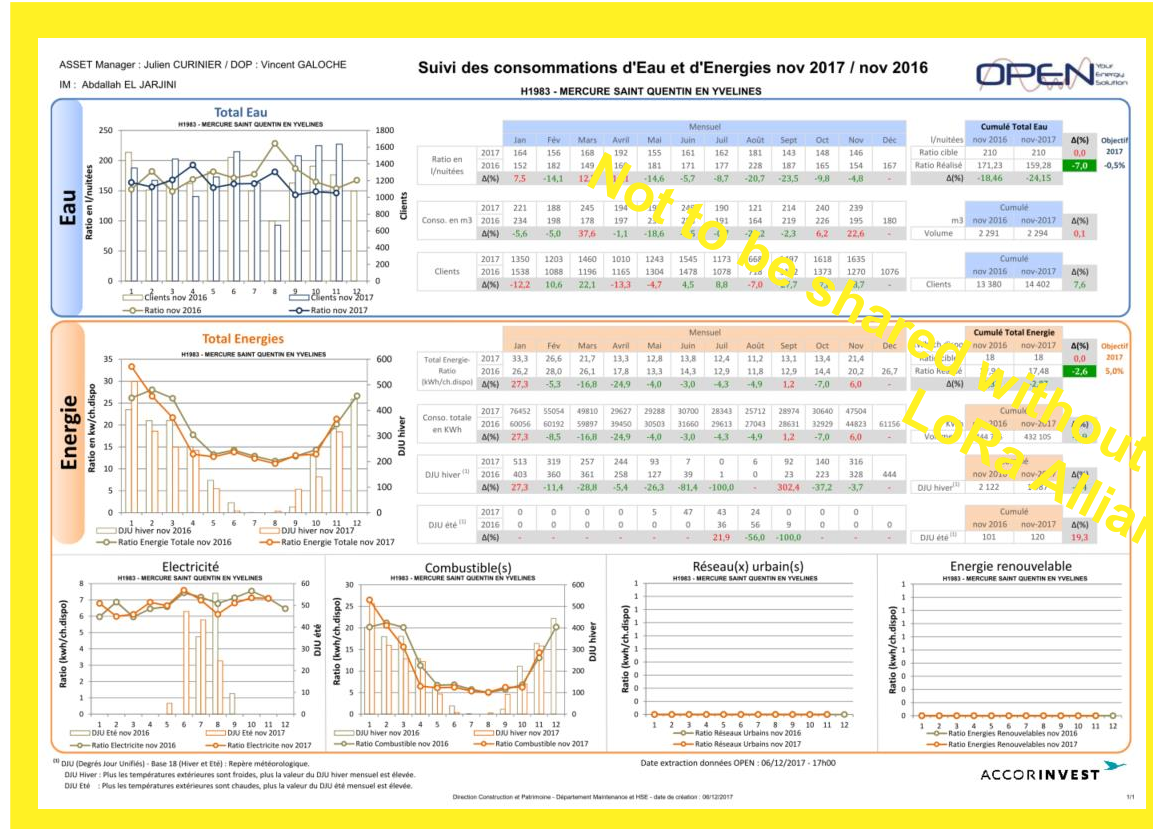


**Creating
Valuable**

IOT
Connections



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CAP

CARBON ACTION PLAN

From 2017:
A new way of management
for Water, Energy
and Critical Processes

Connected to daily hotel activity, involving GM,
TE, HoD.

Bringing new skills to hotels for building
systems management.

Until 2016, a tool for:
Manual data collection
Monthly report for Technical Engineer
2 reviews/year

Our IoT solution: figures



70

70 hotels in 2018 (BE, DE, ES, FR, GB, NL)
+ 55 in 2019 (+ BR, IT, PL, PT)
Target: 850+ hotels in 26 countries by 2021.

126

126 references in our connected devices catalogue from 9 european suppliers

11

11 video tutorials, 1 web & mobile application for provisioning,
1 helpdesk available by phone and e-mail.

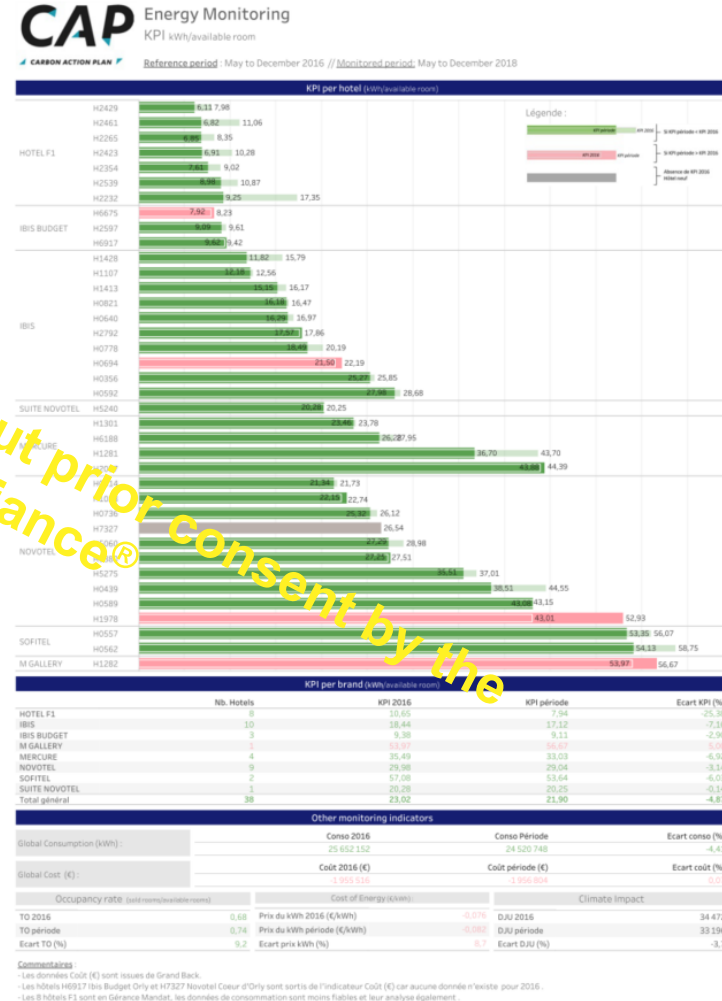
1

1 flexible, cutting-edge, accorinvest-owned infrastructure and software environment for connected buildings.

5286

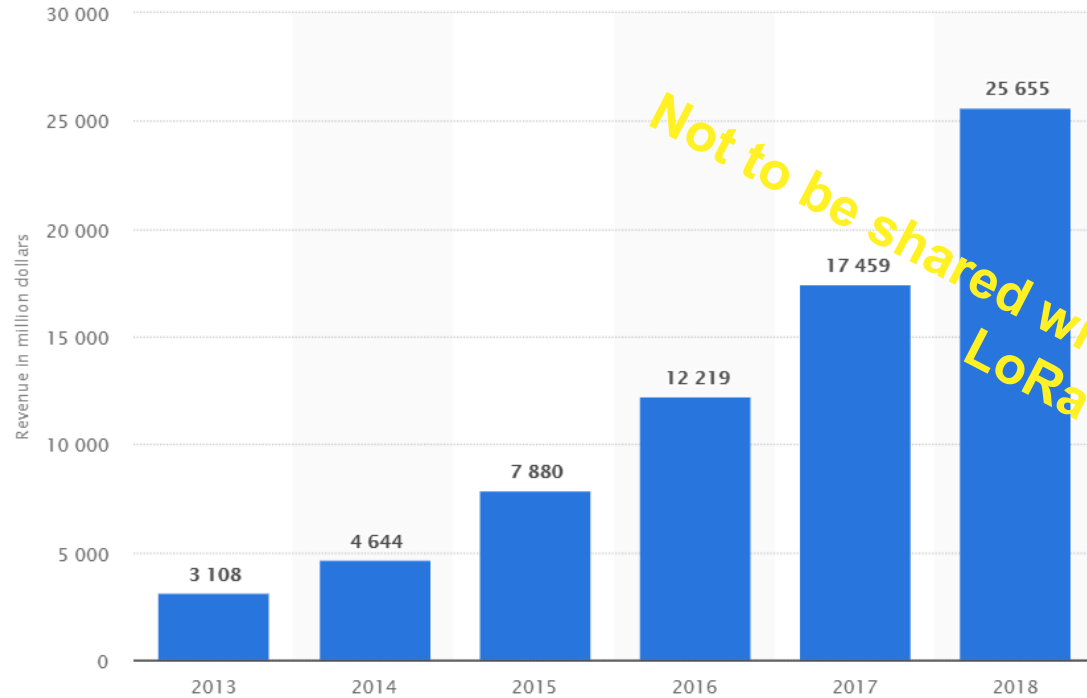
5286 data streams including 2956 streams from LoRaWAN devices and 2330 streams from web and internal services.

A key-feature: getting results



Building an IoT solution, our five rules

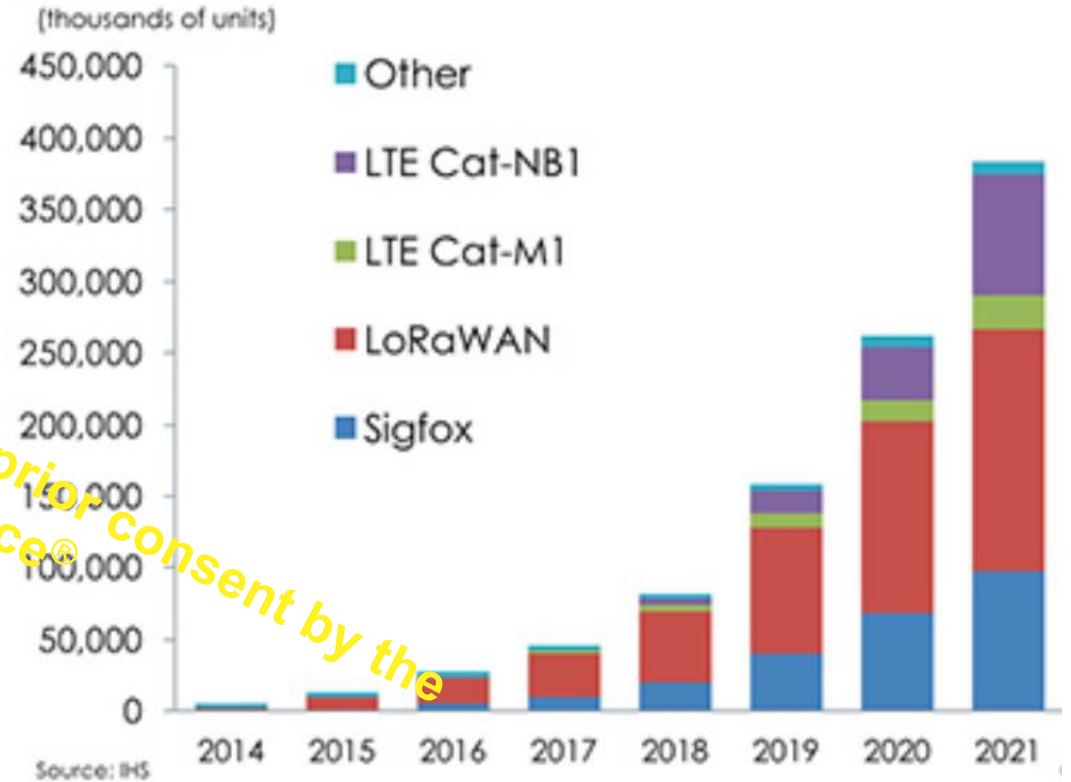
Rule #1: Never fall asleep – A market review every 6 months



© Statista 2019

AMAZON WEB SERVICES REVENUE GROWTH

In Millions Dollars - Source: Statista

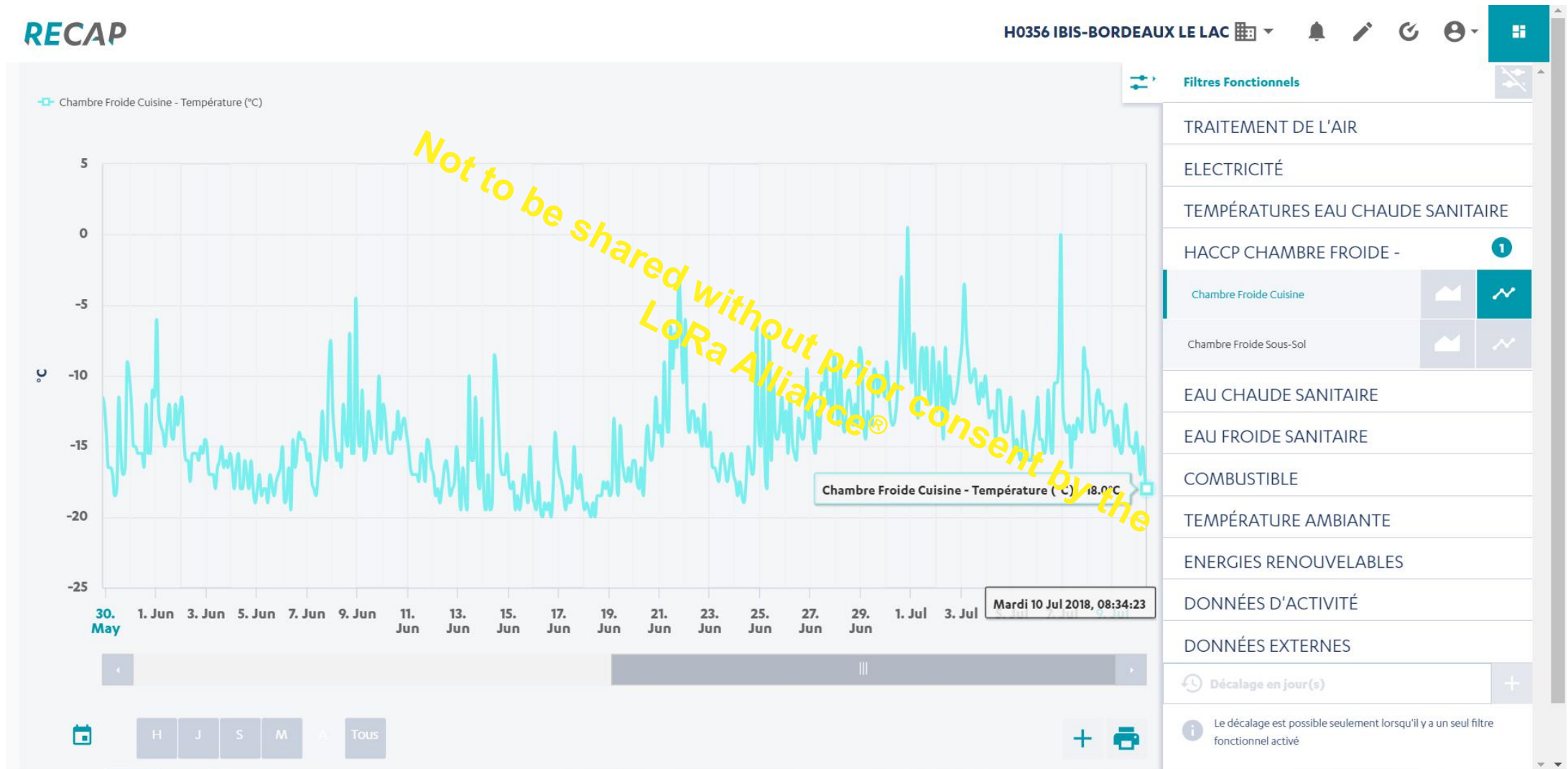


PUBLIC IOT NETWORKS GROWTH

In Thousands of Units - Source: IHS

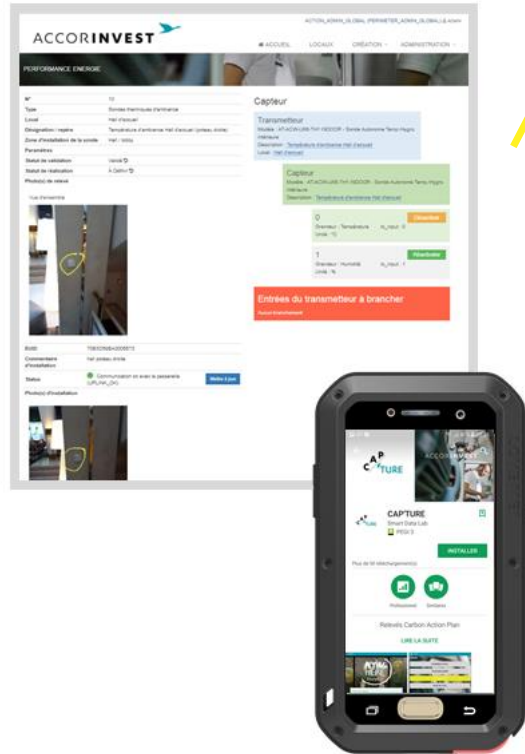
Building an IoT solution, our five rules

Rule #2: Stay focused on your core-business – Do not listen tech-gurus



Building an IoT solution, our five rules

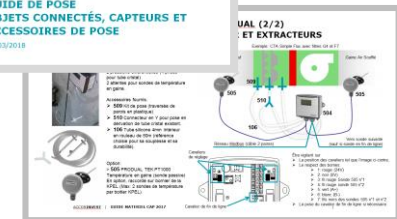
Rule #3: Get out of your office, use the tools you designed



Tutoriels



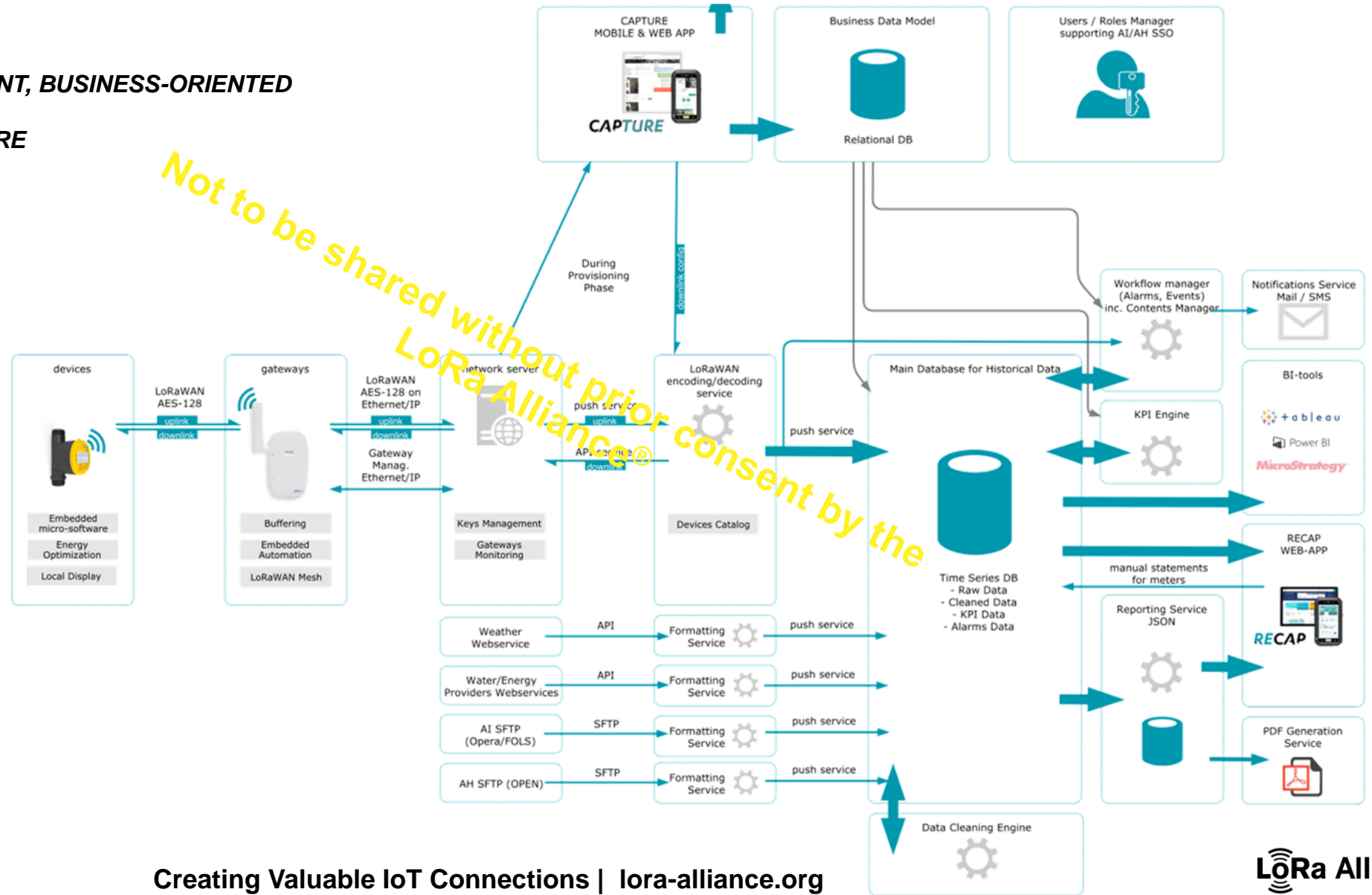
Hardcopy of support documents



Building an IoT solution, our five rules

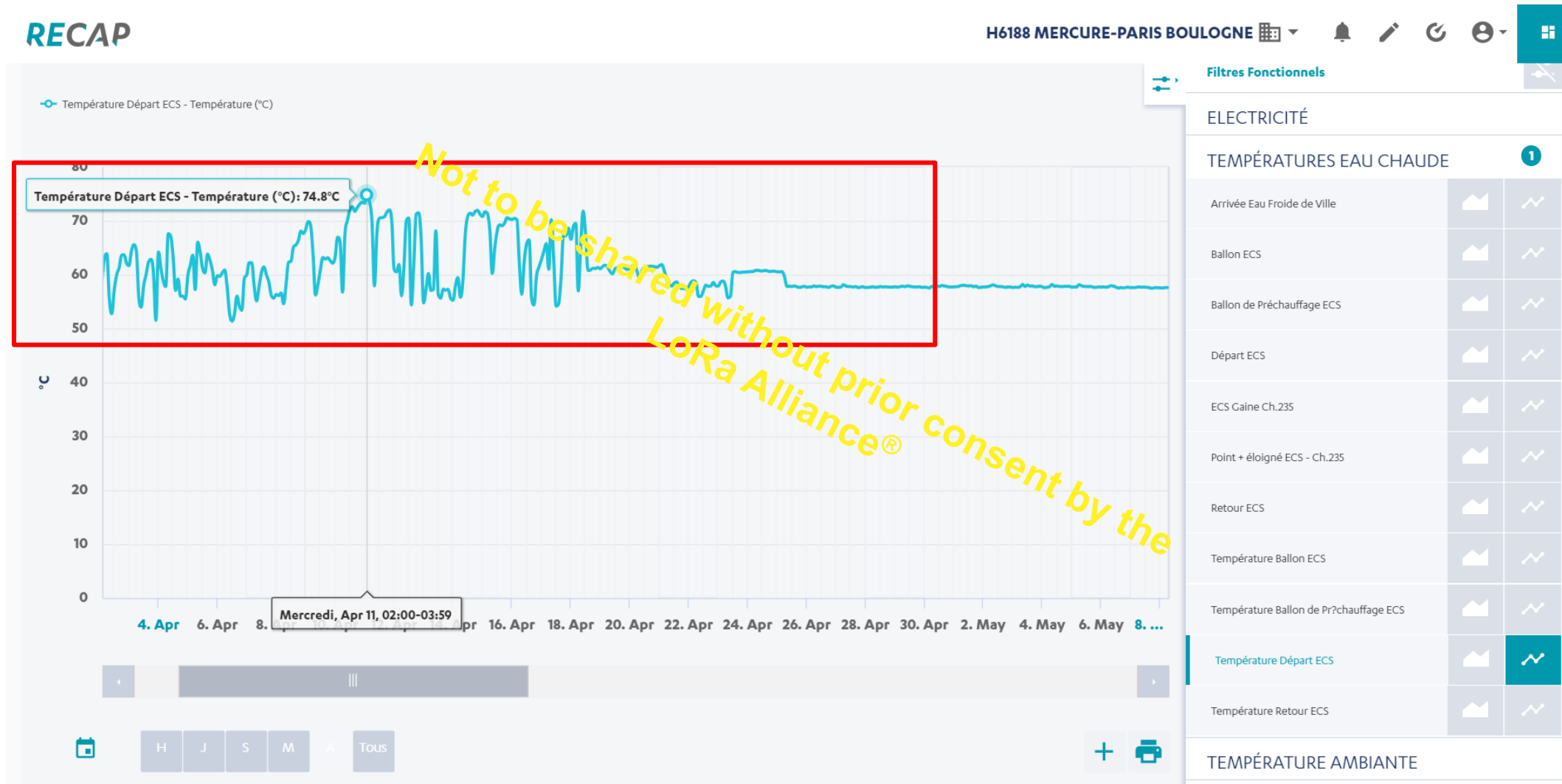
Rule #4: Popularize

A FLEXIBLE, TRANSPARENT, BUSINESS-ORIENTED
SOFTWARE ARCHITECTURE
FOR ACCORINVEST



Building an IoT solution, our five rules

Rule #4: Feed your roadmap with feedback



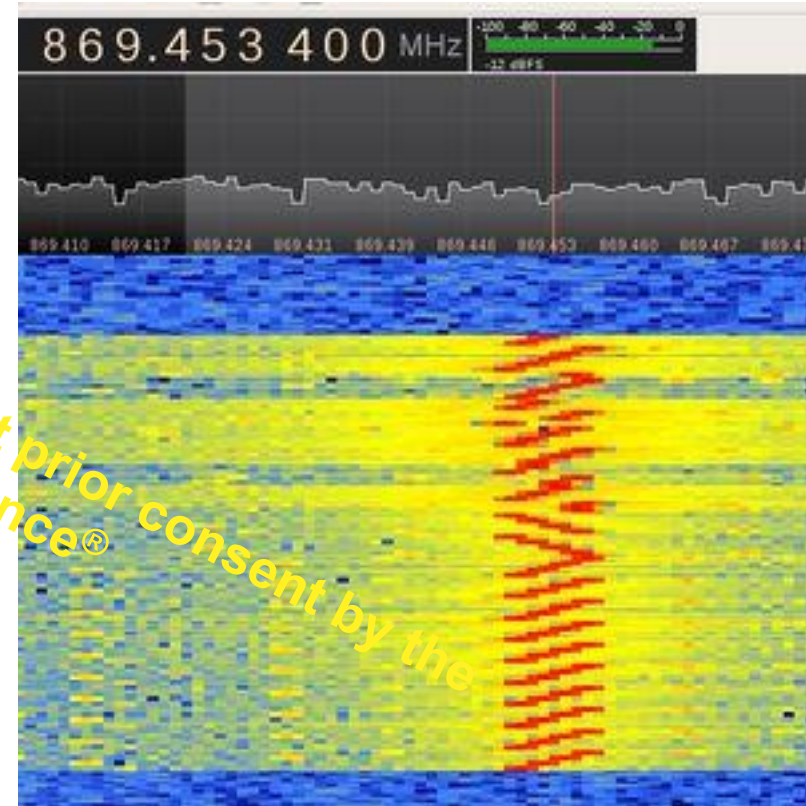
IoT is not IT.

Why LoRaWAN® with a private network? 1/4

RADIO PERFORMANCE

**LORA MODULATION IS
VERY POW...**

YOU KNOW IT.

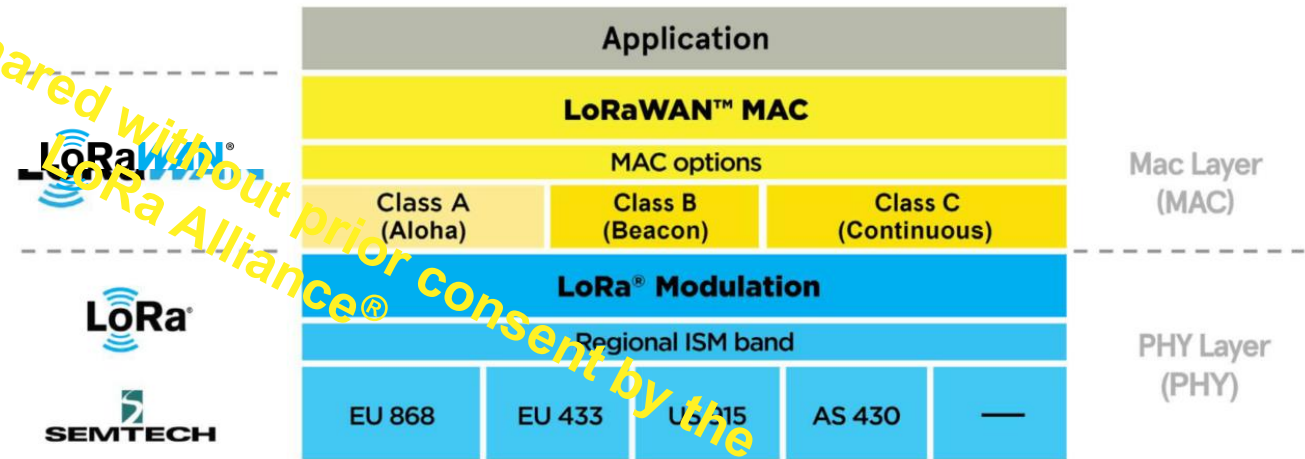


Source: revspace.nl

Why LoRaWAN® with a private network? 2/4

A SMART PROTOCOL

LoRaWAN®
ADAPTATIVE DATA
RATE (ADR)
BRINGS FLEXIBILITY
IN USE-CASES DESIGN
FOR BUILDINGS.



Why LoRaWAN® with a private network? 3/4

OPENNESS AND SIMPLICITY



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ADEUNIS CODEC Online decoder Decoder source code Download library en

Payload

Supported products: HUMIDITY, DRY CONTACTS, MOTION, PULSE, TEMPERATURE

Supported frames: 10, 11, 12, 1f, 20, 30, 40, 43, 46, 47, 48, 4c, 4d, 4e, 4f, 50, 51, 52

Enter below the payload to be decoded

Decode

Product TEMPERATURE See the source code

```
{
  "frame_counter": 2,
  "type": "0x43 Temperature data",
  "ambient_probe_id": 0,
  "ambient_temperature_celsius_degrees": 24.4,
  "remote_probe_id": 0,
  "remote_temperature_celsius_degrees": 24.1
}
```

Why LoRaWAN® with a private network? 4/4

COMPETITIVE DIRECT AND INDIRECT COSTS



Private LoRaWAN®

networks:

4x4 connectivity for buildings

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BUSINESS TRACK 2.00PM – 6.00PM**

BERLIN, JUNE 13, 2019



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HOW LoRaWAN® MAKES SCHOOLS SMARTER AND SHAFT CONTROL SAFER

Hany Zekry, Digimondo



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About DIGIMONDO



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DIGIMONDO

- Based in Hamburg
- Provider for IoT software solutions
- Simplify digital transformation, automation, visualization and IoT

DIGIMONDO's goals



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DIGIMONDO

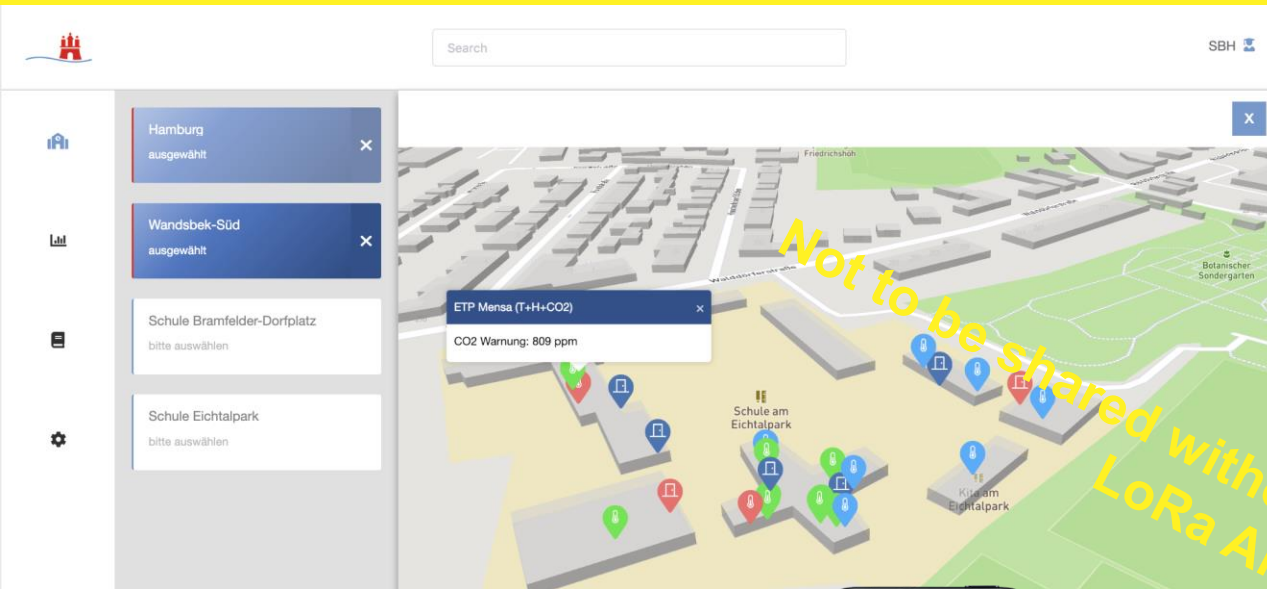
- Make IoT and building automation for public buildings as simple as possible
- Use IoT for local municipality and ensure a safe work environment

How DIGIMONDO uses LoRaWAN® to make schools smarter

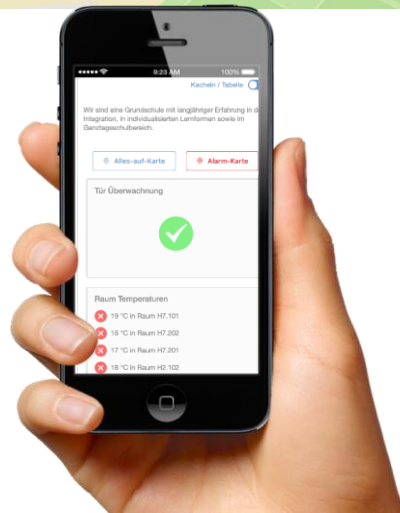


- Janitor Peter has many tasks at school
- The school ground is extensive and utilized by many people
- Last year, the toilets were vandalized at night
- Bad air quality makes children perform worse in schools

The solution: MONITORING WITH REDUCED PERSONNEL EXPENSES



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- ✓ Wireless monitoring of schools with LoRaWAN®
- ✓ Integrated 3D app to show alarms about CO² or open doors in real time
- ✓ Battery operated
- ✓ Easy installation
- ✓ Next step: LoRaWAN® network for locking system in sports facilities in Hamburg

How public building companies and schools benefit from LoRaWAN®



- Facility management companies bear the risk of liability for public buildings
→ **LoRaWAN® prevents risks and warns before potential damage**
- Instead of 30.000 transponder cards (25 € each) for all sports facilities in Hamburg, companies only need one locking system
→ **LoRaWAN reduces costs and staff**
- Schools become bigger and more difficult to maintain
→ **LoRaWAN establishes a better learning atmosphere, reduces costs and staff**

How DIGIMONDO uses LoRaWAN® to ensure shaft control



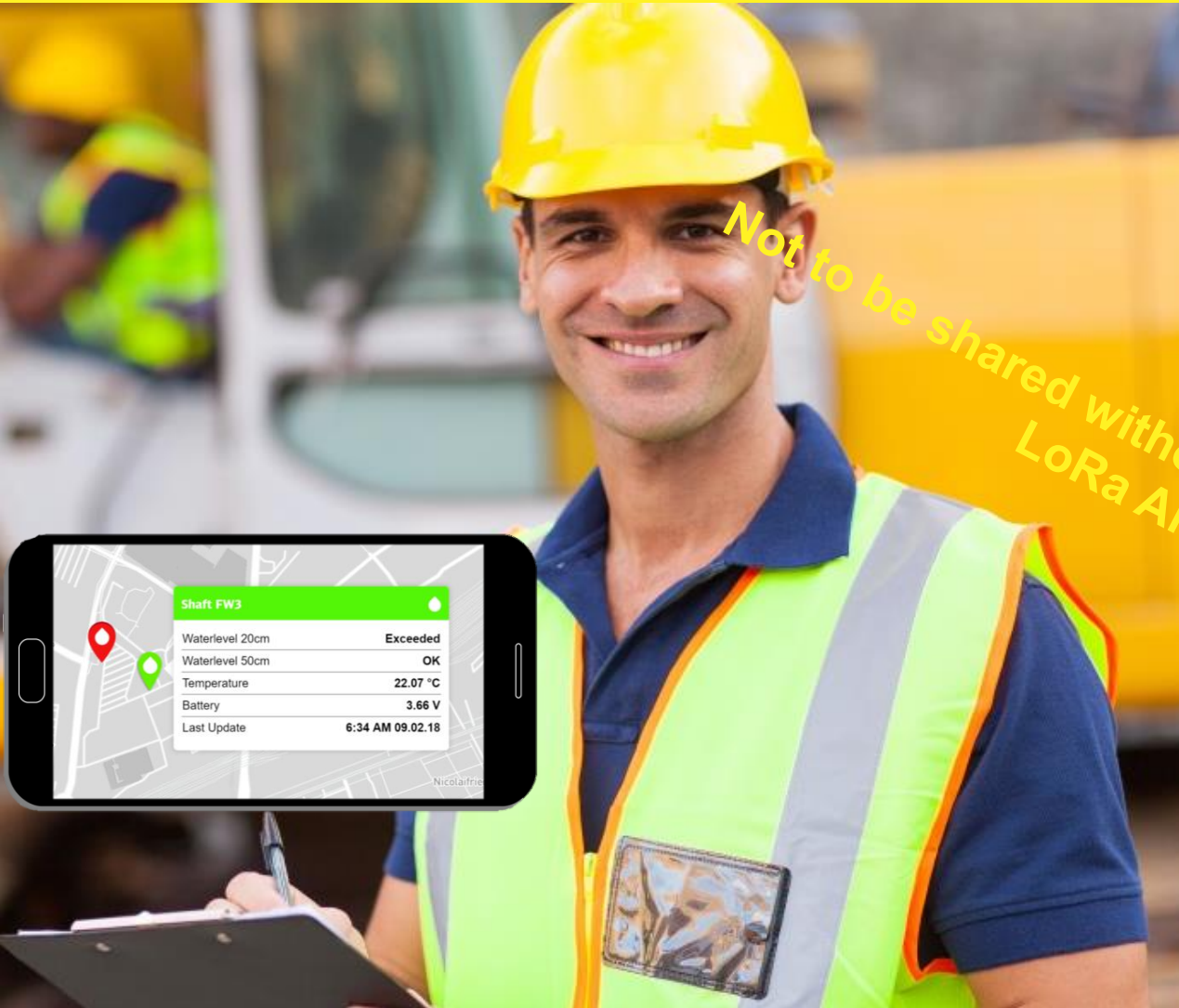
- Andreas, father of 2 children, works at a local municipality
- Every week, he has to climb down shafts
- Shaft control is necessary and unpredictable for the workers
- Opening is narrow and slippery
- Just recently, a colleague fell and was badly injured

The solution: NO MORE UNNECESSARY CHECK-UPS!



- ✓ Wireless monitoring of shafts with LoRaWAN®
- ✓ Integrated 3D app to show alarms in real time
- ✓ Battery operated
- ✓ Easy installation

How local municipalities benefit from LoRaWAN®



- Damages on pipes are difficult to detect and cost-intensive
→ **LoRaWAN® simplifies monitoring, gives warning before the damage and reduces costs**

Workers at local municipalities need to conduct shaft inspections regularly
→ **LoRaWAN reduces personnel costs and worktime**

LoRaWAN[®] as a SmartCity enabler

The Digitalstadt Darmstadt case study



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BITKOM Contest „Digitale Stadt“

- In November 2016 BITKOM (Germany's Telco and IT industry association) initiated the contest „Digitale Stadt“
- The Goal: The model city of the future sponsored by BITKOM companies
- The Prize: Two-digit million amount worth of goods and consulting services
- All cities with a population of up to 150.000 inhabitants could participate
- Darmstadt emerged successful from this contest



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Digitale Stadt
Darmstadt

URKUNDE
Wettbewerb Digitale Stadt
Darmstadt

A SPECIAL ECOSYSTEM FOR THE DIGITAL MODEL CITY

LOCAL ECONOMY

HeAG

+ >150 ADD. COMPANIES

YOUNG CITY
20-35 YO. CITIZENS

COMPANIES

MERCK

Frankfurt Airport

LOCATION

METROPOL REGION
FrankfurtRheinMain

DIGITAL HESSEN STRATEGY

digitales.hessen

SUSTAINABILITY
100% climate neutral



software AG

Deutsche Telekom

STARTUPS

LORIO T

DE-CIX

DIGITAL HUB
DARMSTADT

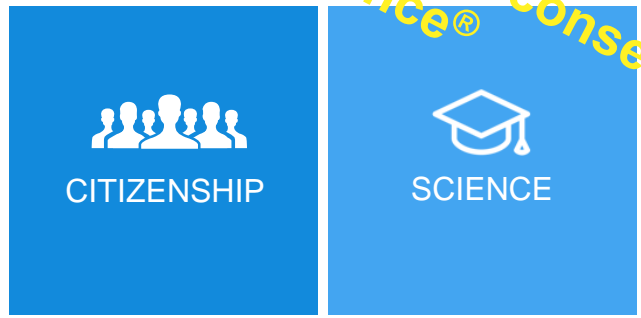
cesah
Centrum für Satellitennavigation Hessen

HIGH EST



INTERNATIONALITY

CULTURE



STRATEGIC FEDERAL PROJECTS

UNIVERSITIES

IUNO

INDUSTRY 4.0

TECHNISCHE UNIVERSITÄT DARMSTADT

h_da
HOCHSCHULE DARMSTADT
UNIVERSITY OF APPLIED SCIENCES

INTER-DISCIPLINARITY

esa

CRISP
Center for Research in Security and Privacy

FORUM
INTERDISZIPLINÄRE FORSCHUNG

EUROPEAN ORGANISATIONS

RESEARCH INSTITUTES
DIGITIZATION

Fraunhofer SIT
Fraunhofer IGD
Fraunhofer LBF

CYBER SECURITY
VISUAL COMPUTING
ELECTROMOBILITY



Darmstadt bleibt weltoffen.

WILLKOMMENSKULTUR

STEM-ORIENTED



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PROJECT OVERVIEW

Highly innovative, high-visibility projects

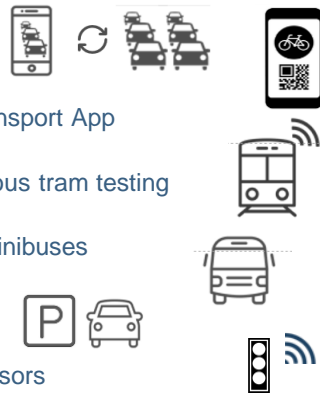
Administration:

- Community service account
- On-line application management
- Introducing „E-Akte“
- GovBot (Chatbot)



Mobility:

- Smart Traffic
- Multimodal Transport App
- Semi-autonomous tram testing
- Autonomous Minibuses
- Smart Parking
- Traffic light sensors



Commerce:

- Location-based Services / Marketing
- Online trading platform with Same-Day Delivery
- Connection / Expansion via Ebay on-line trading platform
- City Logistics



Education:

- Model Project „Digitale Schule 2020“
- „Haus der Digitalen Medienbildung“ education portal
- Digital education map



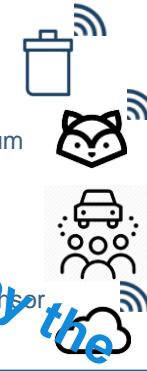
Society:

- Digital City Lab
- District App / Digital Neighborhood Support
- Data visualization
- Expansion of citizen participation platform
- Live Streaming of City Council meetings and other city events



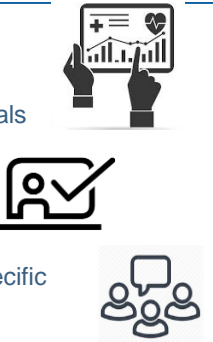
Environment:

- Smart Waste
- Smart Zoo Vivarium
- Mobility portal – city control
- Environmental sensor network



Health:

- Digital patient records
- Data cross-link between hospitals and healthcare providers
- On-line Check-In to Klinikum Darmstadt
- Chatrooms for target group-specific on-line consultation and help



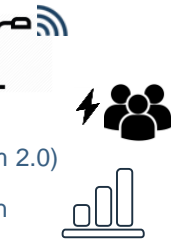
Safety / disaster control:

- Drones and cameras for situation control
- Digital mobile mission data collection for emergency services
- Digital control center setup



Energy:

- Smart Lighting / Intelligent Street Lighting
- Area concepts for building stock / local power generation (Mieterstrom 2.0)
- Smart Grid / Smart Meter expansion



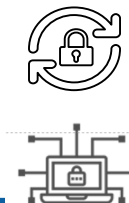
IT Infrastructure:

- Setting up LoRaWAN as basis for IoT Applications
- Test field 5G
- Expanding Darmstadt Wi-Fi



Cyber Security:

- Encryption between city administration and local economy
- Intelligent virus detection through artificial intelligence (Working title)
- High security data platform



Data platform:

- Creation of an overarching data platform
- Core aspects of Internet of Things, E-Administration, Open Data
- Connection / Interface between different companies' IT systems



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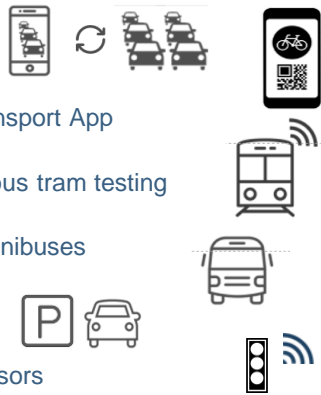
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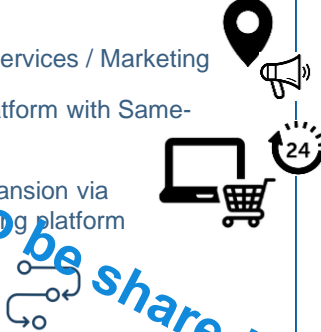
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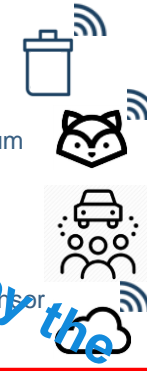
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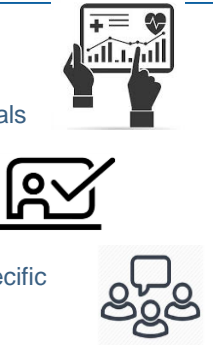
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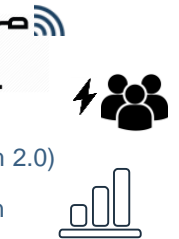
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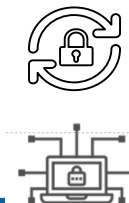
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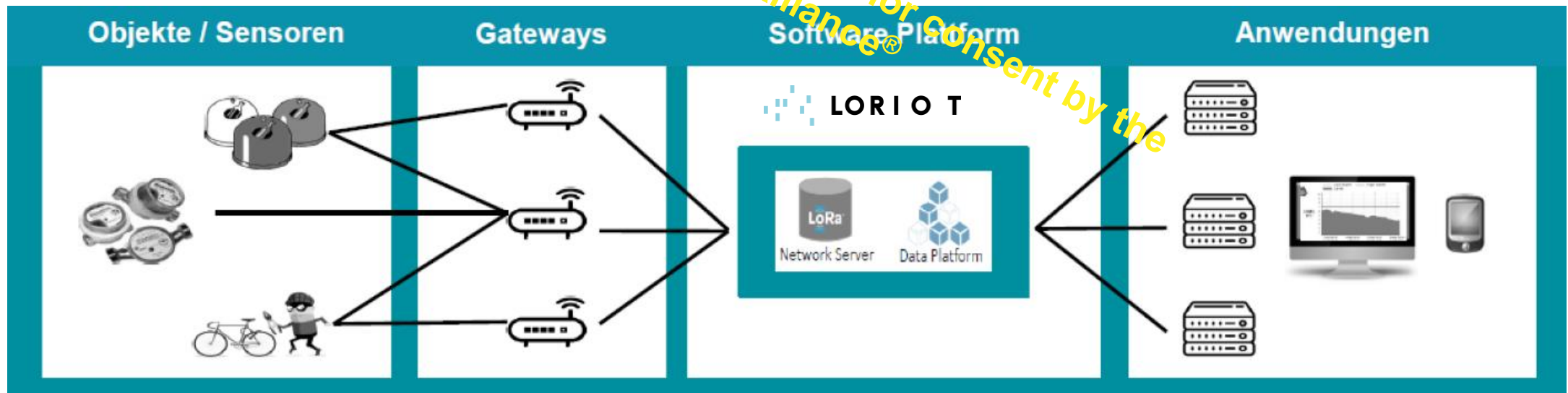
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LoRaWAN® as SmartCity foundation

- 7 out of 10 projects include IoT & LoRaWAN®
- Network coverage in the city area, regionwide roll-out in planning
- High importance on data security, scalability and reliability
- Partnership with **LORIoT** for on-premises network server operation and consulting in the Smart Cities field

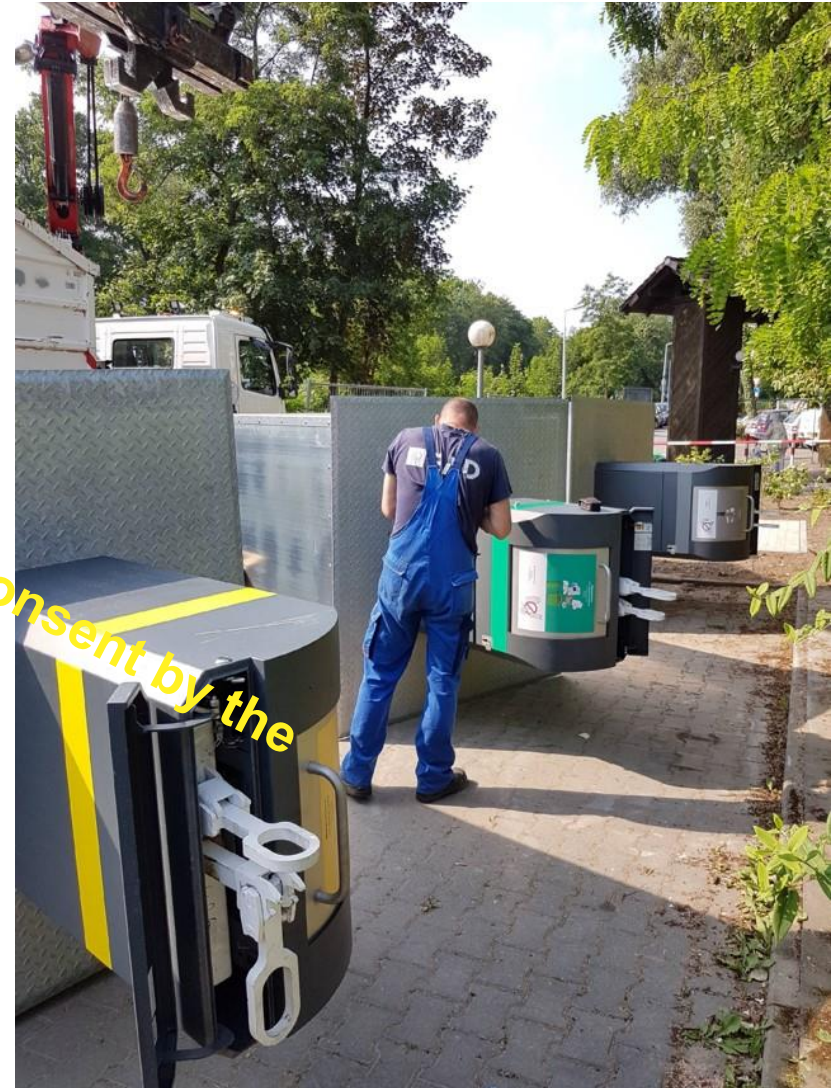




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Smart Waste

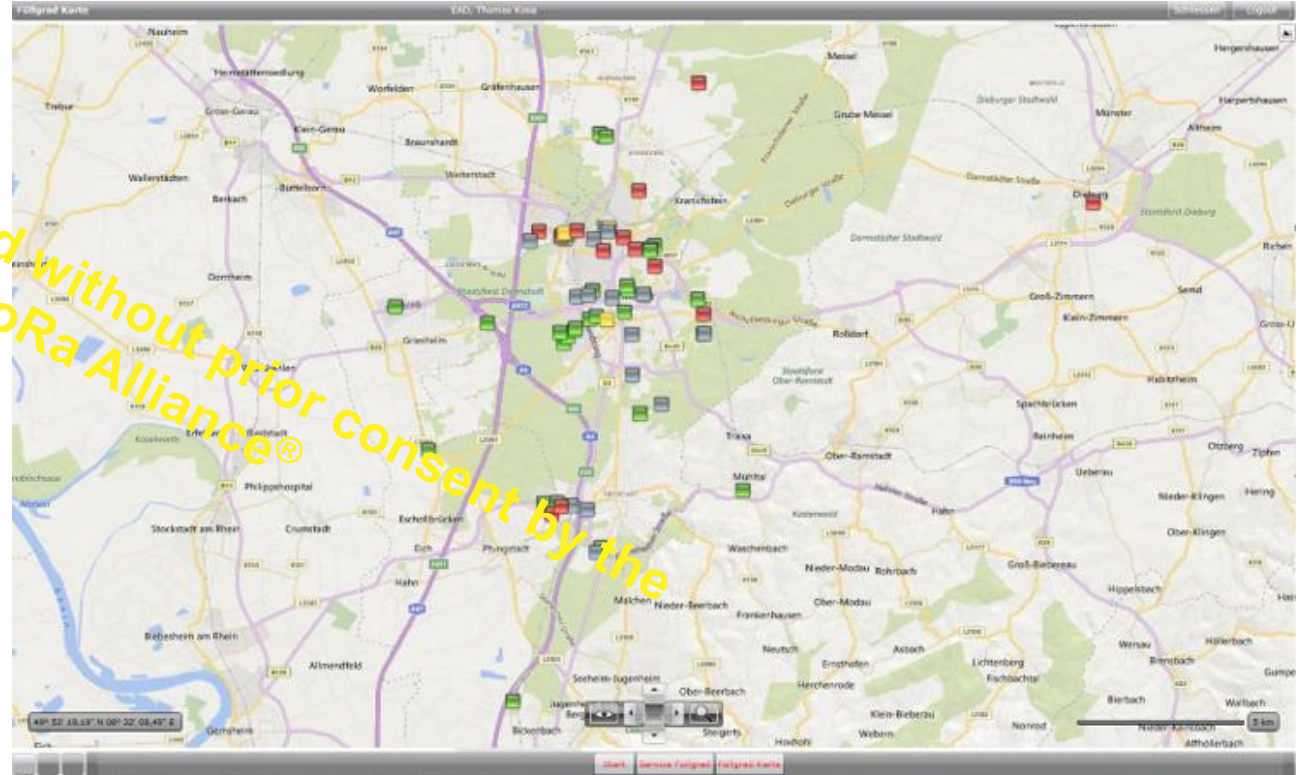


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Smart Waste



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IoT and LoRaWAN® Education

- Two times a month the Digitalstadt Darmstadt visits schools and universities to do workshops about IoT and LoRaWAN®
- Participants come up with their own use cases or work on existing projects
- The age range of the participants is between 12 and 20



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BUSINESS TRACK 2.00PM – 6.00PM**

BERLIN, JUNE 13, 2019



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Real-time occupancy information in 400 offices for 200.000 users

H.W. Scholten Capgemini



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Capgemini

Capgemini's Corporate Real Estate Services (CRES) wanted to monitor 1.6 million sqm of office space and measure the usage (400 offices, 200000 employees, 60 countries, 10000 meeting rooms)

Space Optimization

- Reducing no-shows in meeting rooms (used to be 30%)
- Show availability of meeting rooms and desk in real-time

Comfort

- Measure CO2, noise, light, humidity and temperature
- Real time dashboard for users showing area specifics

SQM Rightsizing

- Increase space utilization from 65% to 75% by reducing SQM at contract renewals

Sustainability

- Less SQM results in less Carbon footprint
- Less travel (plane/car) by investing in communication equipment

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Why we have chosen LoRaWAN®?



Easy installation



Low maintenance



Minimum infrastructure



Retrofitting



Global scalability



Agnostic



Secure






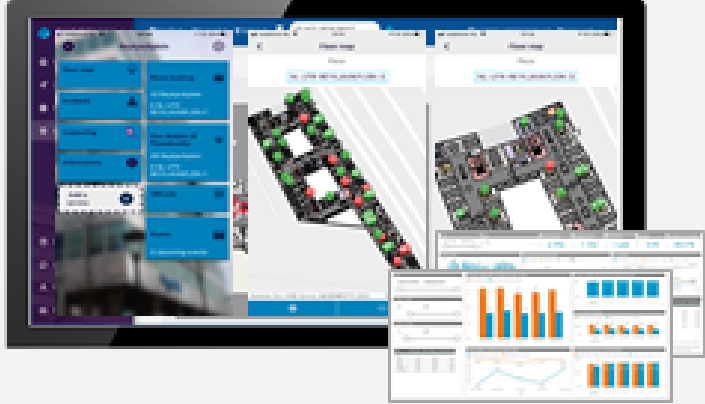
GDPR compliant



Data efficient

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Capgemini Smartoffice solution

Sensors	Gateway	Infrastructure	App and/or Dashboard
		<p>XIOT</p> 	
<p>IR motion detection sensor. Wireless, Battery powered (>7 yrs lifecycle)</p>	<p>LoRaWAN gateway</p>	<p>The X-IoT solution connects the devices. The data is processed by Azure cloud</p>	<p>Customized iOS/Android App can be developed based on needs</p>
<p>Connect any sensor</p> <ul style="list-style-type: none"> > Easy installation > Low maintenance > Scalable sensor solution 	<p>Low Power Tech</p> <p>Less infrastructure required</p> <p>15000 m² per gateway</p>	<p>IOT Middleware</p> <p>Infrastructure & back-end</p> <p>Managing Sensor Network Solution</p>	<p>End-user mobile application</p> <p>Manager mobile application</p> <p>Dashboard for building owners</p>

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Smartoffice User App

Sensors

Gateway

Infrastructure

App / Dashboard

- Meetings
 - Find and book meeting rooms on-the-fly
- Report anomalies
 - Broken furniture
 - Missing remote control
- Find office location facilities
 - Restaurant information
 - Public transport
 - Events



An app for end user functionalities

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Capgemini Business Case

Install IoT devices in:

- **400 offices**
 - **10.000 meeting rooms**
 - **150.000 desks**
- for 200.000 users**

Invest in:

- **Mobile Apps**
- **Desktop Apps**
- **BI & Analytics**

Total investment:

- **6 M€ Capex (One-time)**
- **5 K€ Opex (Yearly)**
- **Less than 4€ per SQM**

Savings:

- **10% of CRES Budget**
- **More than 20M€ yearly**

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Fine-Tuning Your LoRaWAN® Deployments

Becky Oh, President and CEO PNI Sensor



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IoT

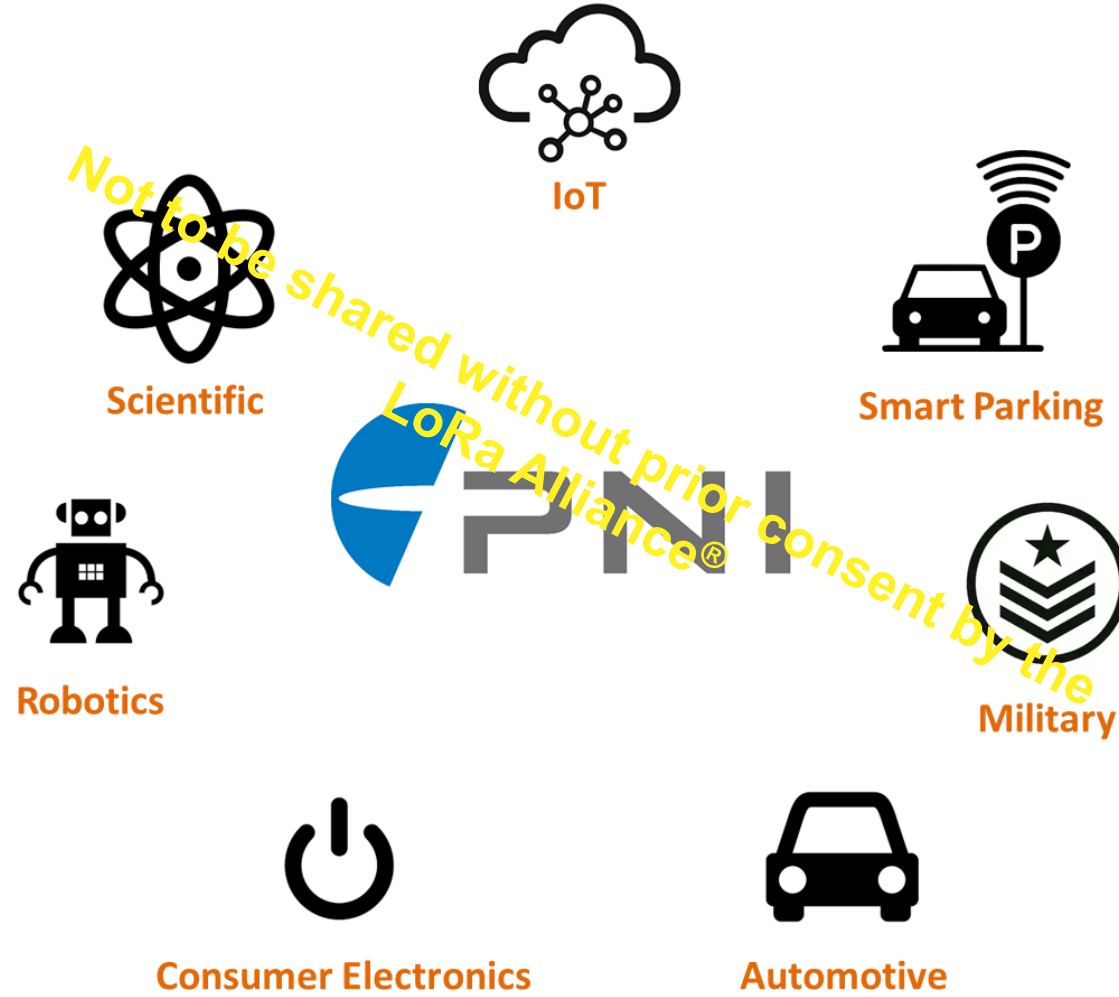
Connections



Who we are

- PNI is the world's foremost expert in precision location, motion tracking, and fusion of sensor systems into real-world applications
- Founded in 1987 out of Stanford University with the invention of Magneto-Inductive sensor technology
- PNI's products and technologies are used by leading, global companies in applications where a high degree of accuracy, continuous reliability, and low power consumption are required
- Products include:
 - High-performance geomagnetic sensors
 - Location and motion coprocessors
 - Military-grade sensor modules
 - Sensor fusion algorithms
 - Complete sensor systems

Applications



What you will learn

- How to effectively trouble-shoot nodes and network deployments
- Benefits of using the proper device to test network signal strength
- How to effectively solve difficult corner cases
- Best practices from successful LoRaWAN® Smart Parking deployments



Best case scenario

- LoRaWAN[®] network successfully deployed
- End nodes are functioning according to spec and communicating to the LoRaWAN
- Proof of concept is live
- Customer is happy

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But sometimes...

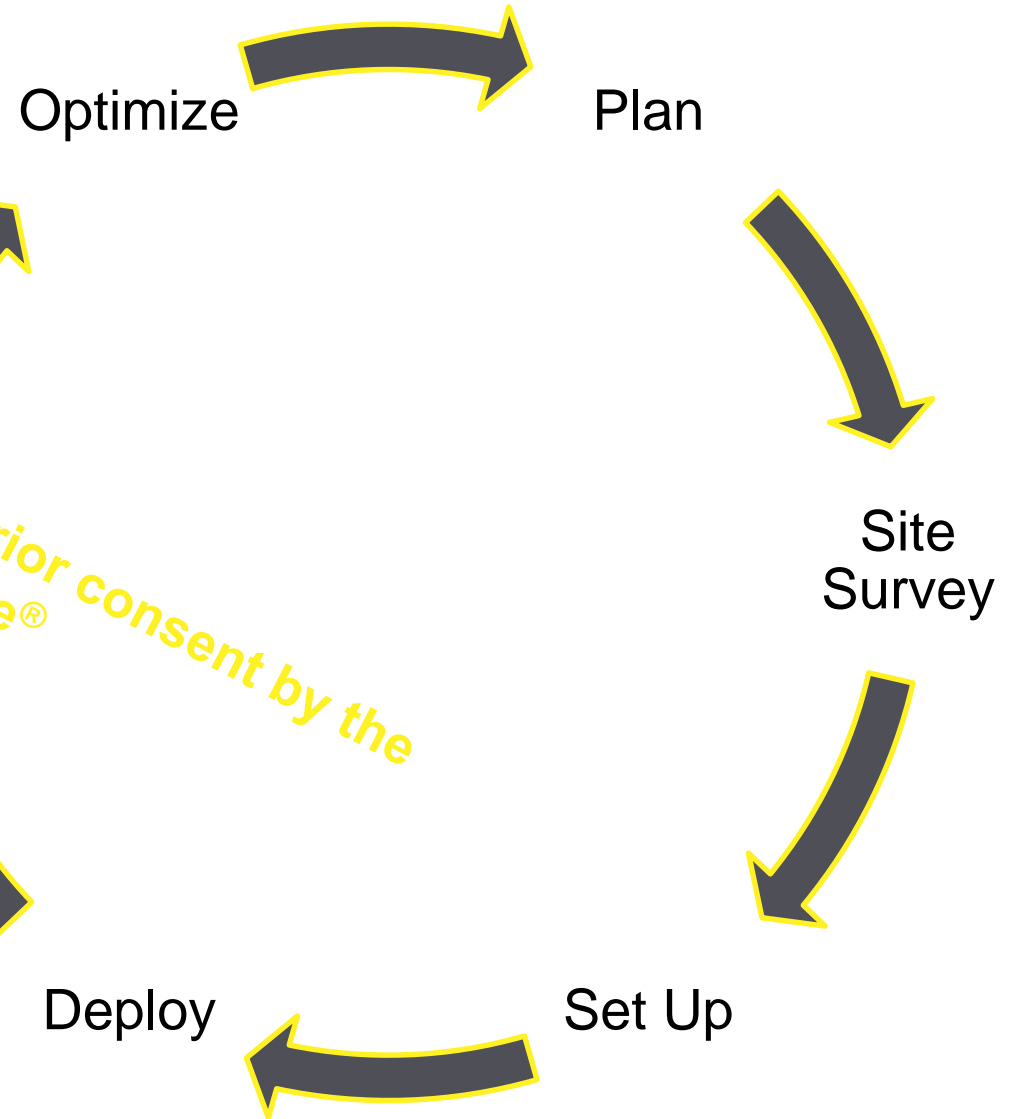
- Data stops flowing
- Nodes are not functioning
- Network is inoperable
- IoT project fails

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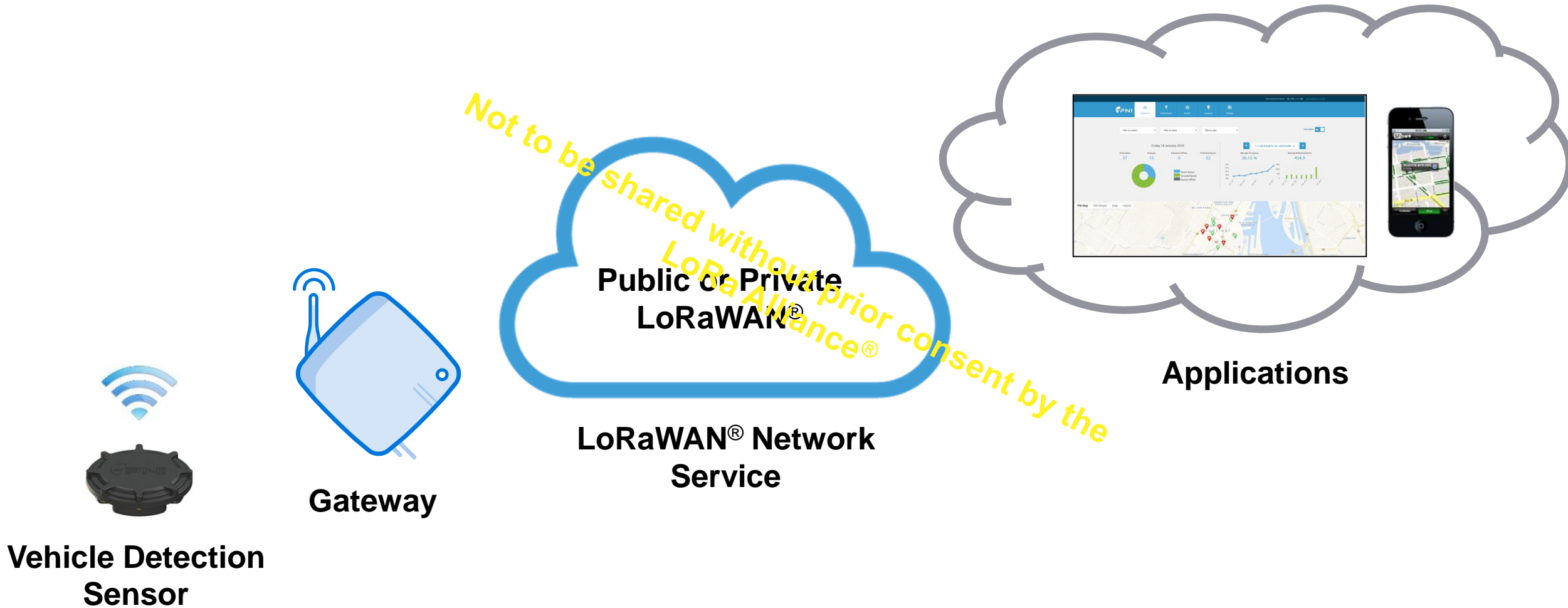


Best practices for LoRaWAN® deployments

- Perform a site survey *prior* to installation
- Test for RSSI with the actual end device vs. a generic testing tool
- Test for the device manufacturer's recommended RSSI values
- Troubleshoot issues and make improvements



Use Case – Smart Parking



Use Case: City of Montréal

- **Need:** Monitor on-street parking spaces in business district to reduce traffic congestion and manage enforcement
- **Situation:** Smart parking managed on a public LoRaWAN®
- **Challenge:** Sensor must function reliably in harsh weather; installation sites are in deep “urban canyons”

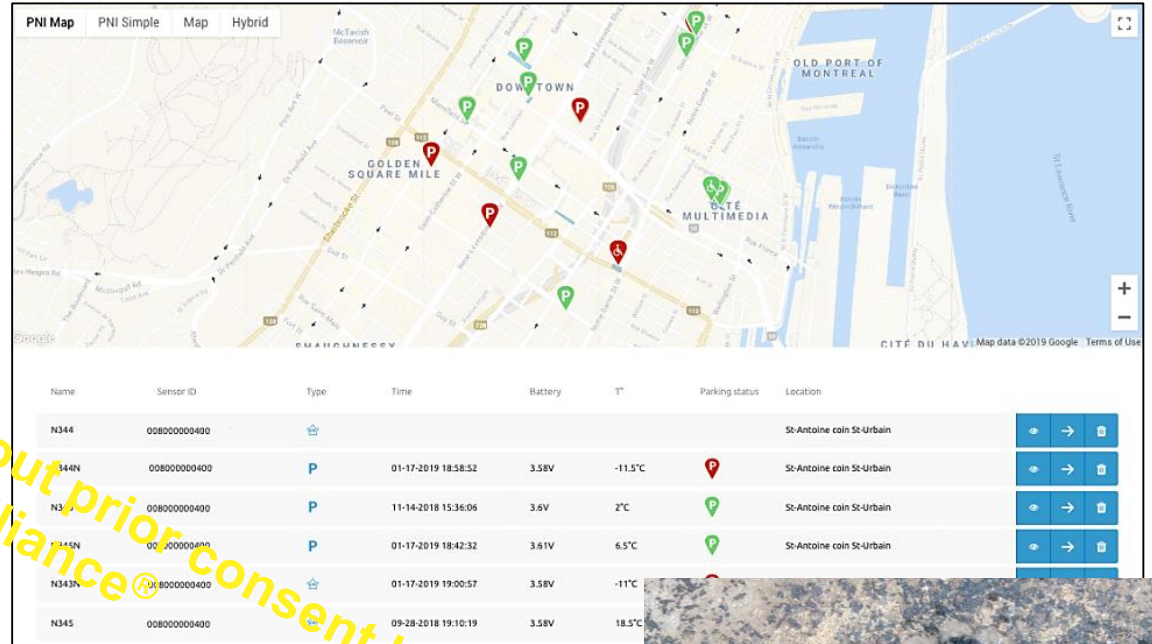


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Use Case: City of Montréal

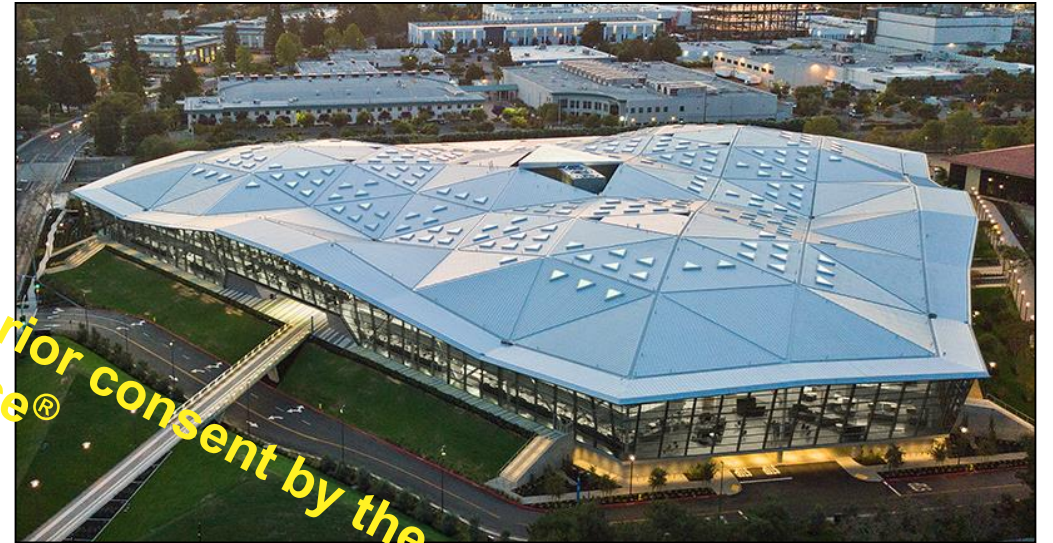
- **Solution:**

- Tested parking sensors for -90dBm in spaces without car present
- Recommended adding more gateways to optimize network performance
- Deployed gateways in a higher location based on RSSI results
- Parking sensors buried in-ground
- Sensors reliably filter interference from passing traffic



Use Case: Nvidia Corporate Headquarters

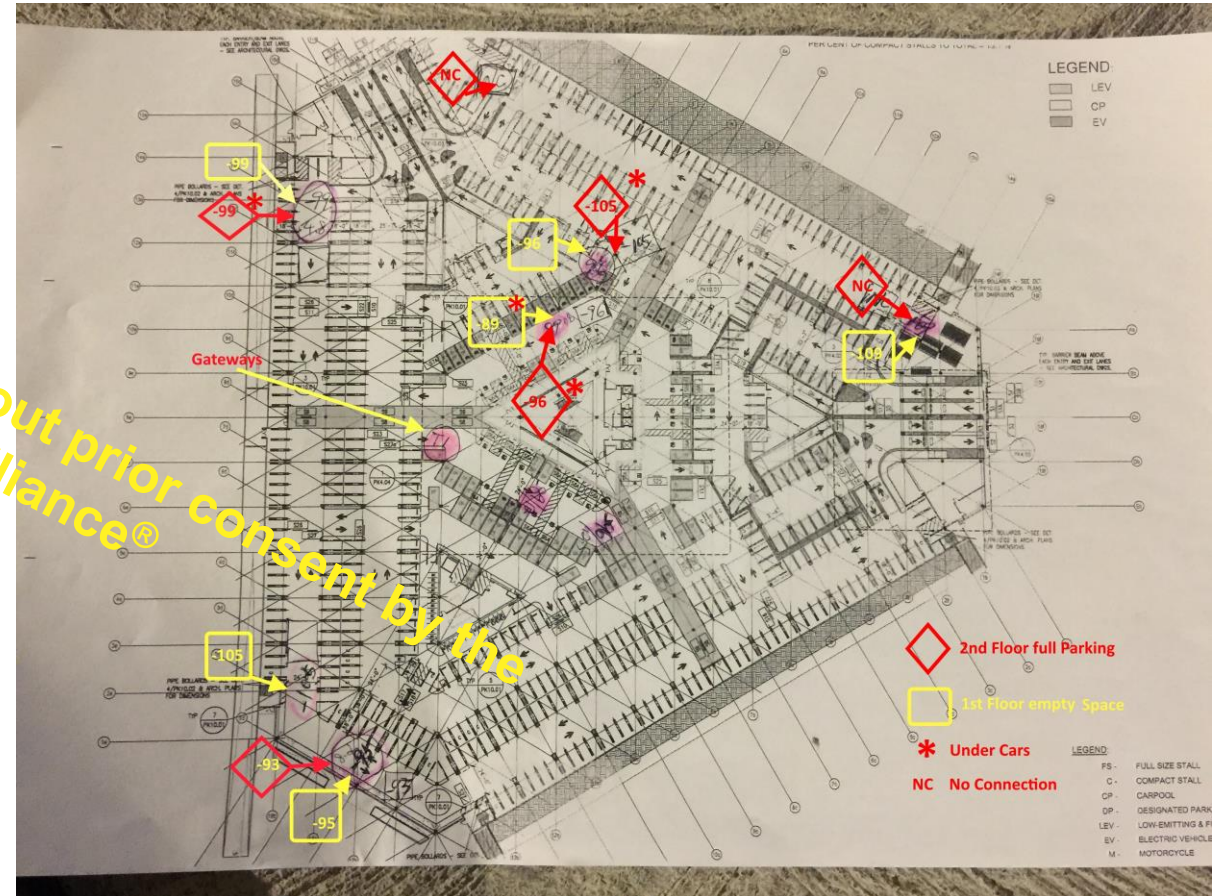
- **Need:** Monitor space availability in parking garage of new, state of the art corporate campus in Silicon Valley
- **Situation:** Nvidia uses a private, on-premise LoRaWAN®
- **Challenge:** Garage has multiple stories; contains rebar-reinforced concrete obstructions; signal “dead zone” in center of garage



Use Case: Nvidia Corporate Headquarters

• Solution:

- Tested parking sensors for -90dBm in spaces without car present
- Added two gateways per level to account for the unique layout/shape of garage
- Used more powerful gateway antennas
- Installed surface-mount sensors in each parking space



Use Case: City of El Monte, California

- **Need:** Monitor space availability in city-managed parking lot and direct drivers where to park
- **Situation:** City uses a public LoRaWAN®
- **Challenge:** Large parking lot with an alley; integration with digital sign



Case Study: City of El Monte, California

• Solution:

- Tested parking sensors for -90dBm in spaces without car present
- Mounted gateway high on light pole in center of lot to reach edge devices
- Used more powerful gateway antenna
- Installed in-ground sensors in each parking space
- Integrated with digital sign to guide drivers to rows with available parking



Factors to consider

- Density of gateways for **RELIABLE** network performance
- Placement of gateways
- Nearby buildings and obstructions
- Antenna size
- Device performance characteristics



Prepare for success!

