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Guidelines for Asset Monitoring Deployments

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Asset Monitoring Motivation and Goals

- Many assets are spread over large areas
 - Failure or unavailability of critical assets may lead to delayed operations, monetary losses, and poor service
-
- Goal is to drive efficiencies and reduce cost by:
 - Real time visibility of critical assets
 - Alarms, Alerts for fast recovery of failures
 - Retrieve Information for Preventive Maintenance
 - Retrieve Information for Predictive maintenance
 - Analytics to improve efficiency
 - Asset protection and security



Verticals Benefiting from Asset Monitoring



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Power Utilities

- Smart Grid
- Re-closers
- Load breakers
- RTUs/SCADA
- Substations
- Smart Meters



Oil & Gas Utilities

- Flow meters
- Pressure & level
- Safety sensors
- Vibration, temperature, and moisture sensors



Water Utilities

- Water leak detectors
- Pump/valve control
- Pipe Pressure
- Tank Levels
- Smart Meters



Connected Industry

- Factories
- Production floor monitoring
- Warehousing and Logistics
- Wearables on the shop floor
- Remote control (cranes, forklifts,..)
- Mines



Healthcare

- Heart-rate monitoring
- Hand hygiene monitoring
- Body temperature
- Automated check-In/Out
- Compliance tracking and recording



Safe City/Smart City

- Smart Parking; electric car charging
- Traffic management and control
- Fleet Management
- Smart bus lanes
- Info boards/Digital Signage
- Air quality monitoring
- Waste management



Smart Agriculture

- Soil Irrigation and Moisture Monitoring
- Autonomous Irrigation
- Smart Soil Sensors
- Cattle tracking



Mobile Service Providers

- Cell Tower asset monitoring



Connected Building/Remote Monitoring

- Building Automation/Generators
- Building Security/Surveillance
- HVAC/Heating/Cooling
- Water leaks
- Elevators



Transportation

- Real-time vehicle tracking
- Monitoring of vehicle load
- Vehicle Weight Monitor
- Distance traveled and fuel consumption
- Container Management

Technology Drivers for Asset Monitoring



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Edge/Cloud
Compute



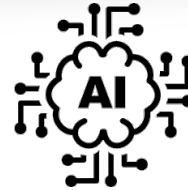
IoT GWs



Sensors



Cellular Network
coverage



AI SW

Combination of Technologies:

- New IoT Cloud services (AWS, Azure, etc.)
- Availability of new sensor technologies
- Flexible IoT GWs
- GWs with Edge compute
- Reliable cellular coverage
- Flexible Dashboard / Analytic technologies
- Artificial Intelligence software

Asset Monitoring

Smart Buildings



GWs



Sensors

LEAK DETECTION



Water Utilities



Power Utilities

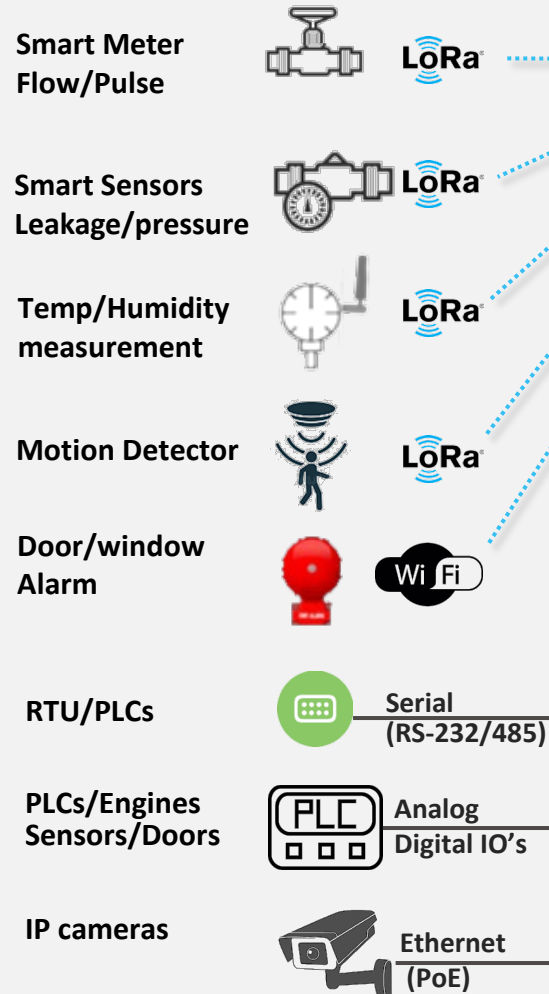


Asset Monitoring Components

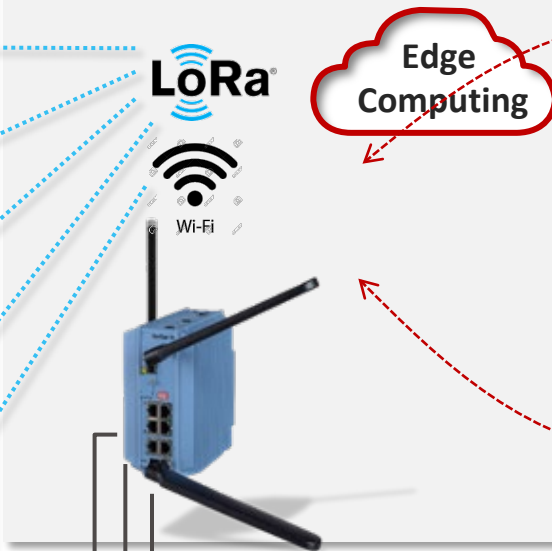


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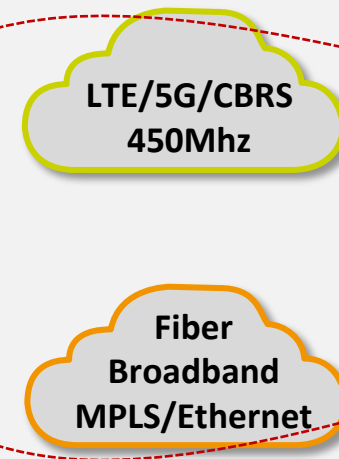
1 Sensors/Devices



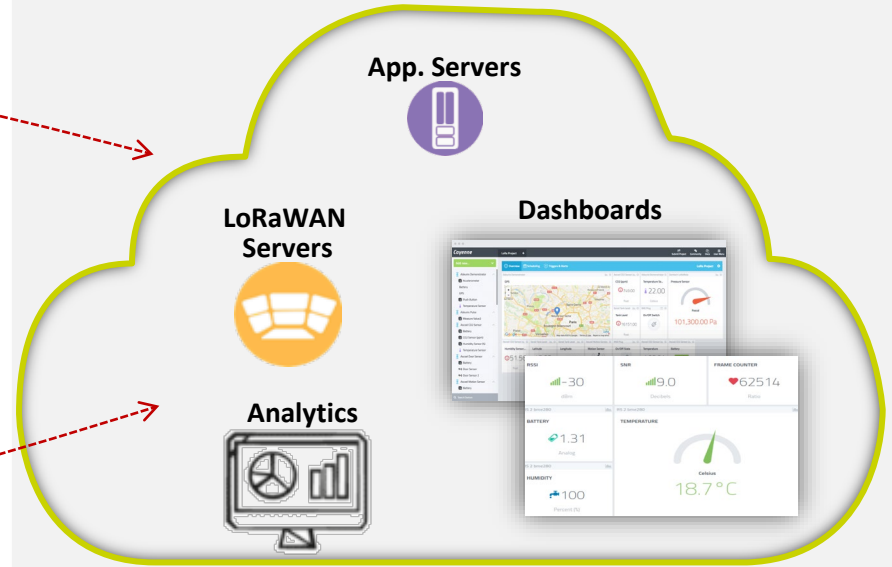
2 Multi-function Gateways



3 Connectivity



4 Cloud IoT Platform / Dashboard



1. Sensors, PLC/RTUs, IP Cameras
2. Gateways with Edge Compute: Router, FW, Protocol converter, Secure VPNs,
 - LAN Interfaces: Ethernet, Wireless LoRaWAN, WiFi, DI/DO/AI, PLC
 - WAN Interfaces: Fiber, Copper, Wireless (LTE, 5G, CBRS, 450MHz)
3. Connectivity: Fiber, LTE or 5G with 1 / 2 SIMs or 1 / 2 modems
4. Applications / Dashboards: Historical data base, Analytics, Visual display of data

Considerations Selecting Sensors

Sensor functionalities

- Temperature sensors
- Pressure sensors
- Motion sensors
- Level sensors
- Image sensors
- Proximity sensors
- Water quality sensors
- Chemical sensors
- Gas sensors
- Smoke sensors
- Infrared (IR) sensors
- Acceleration sensors
- Gyroscopic sensors
- Humidity sensors
- Optical sensors

Sensor technologies in the market

Digital wired sensors



Example

RS-232/RS-485 based fuel level sensor
RS-232 max cable length is 50m, RS-485 1200m

Analog wired sensors



Example

Analog temperature sensor with 0-10 VDC or 4-20 mA
Max cable length for 0-10VDC 15 m, 4-20mA up to 150m

Wireless WiFi



Example

WiFi magnetic sensor alerts when a window or door is opened. Distance up to 100 meter

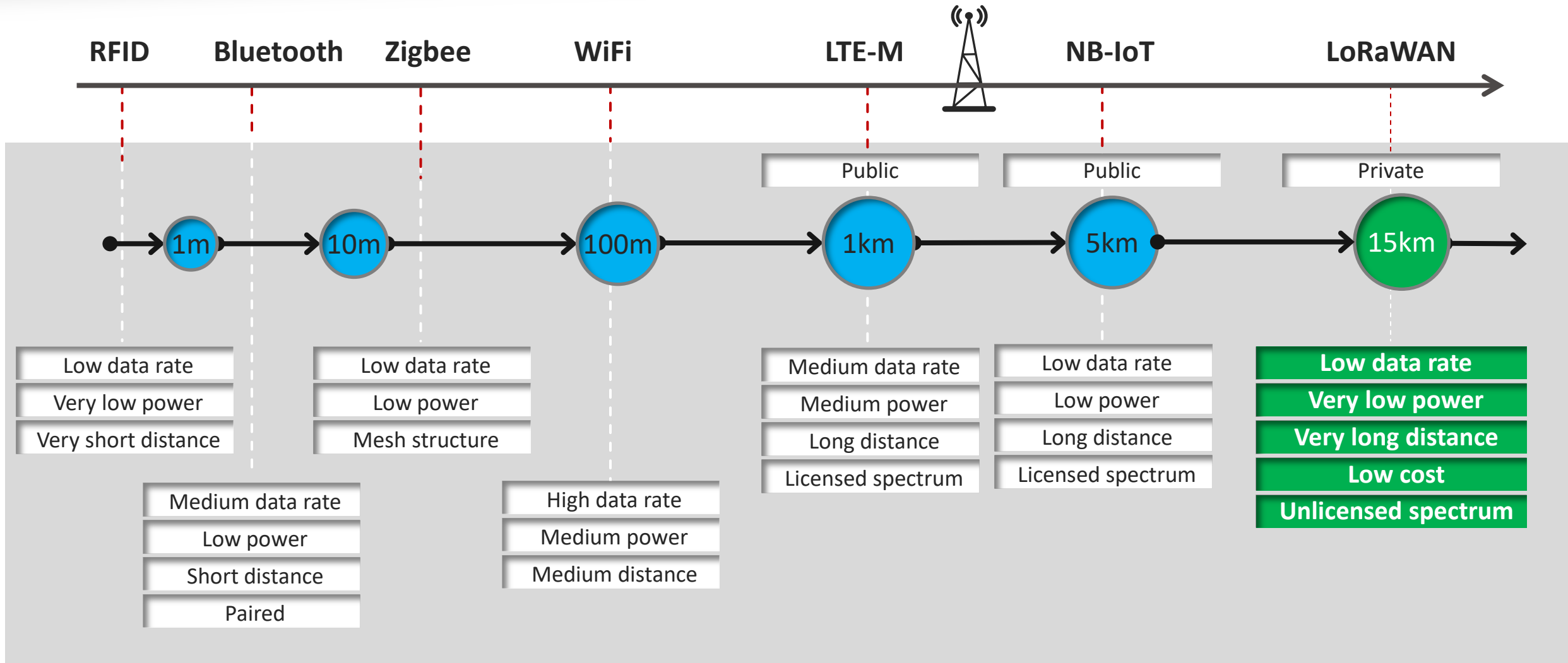
Wireless LoRa sensors



Example

LoRaWAN sensor, distance up to 15 km unobstructed line of sight. Long battery life up to 5 years

Wireless Sensor Choices



Protocol Conversion Considerations



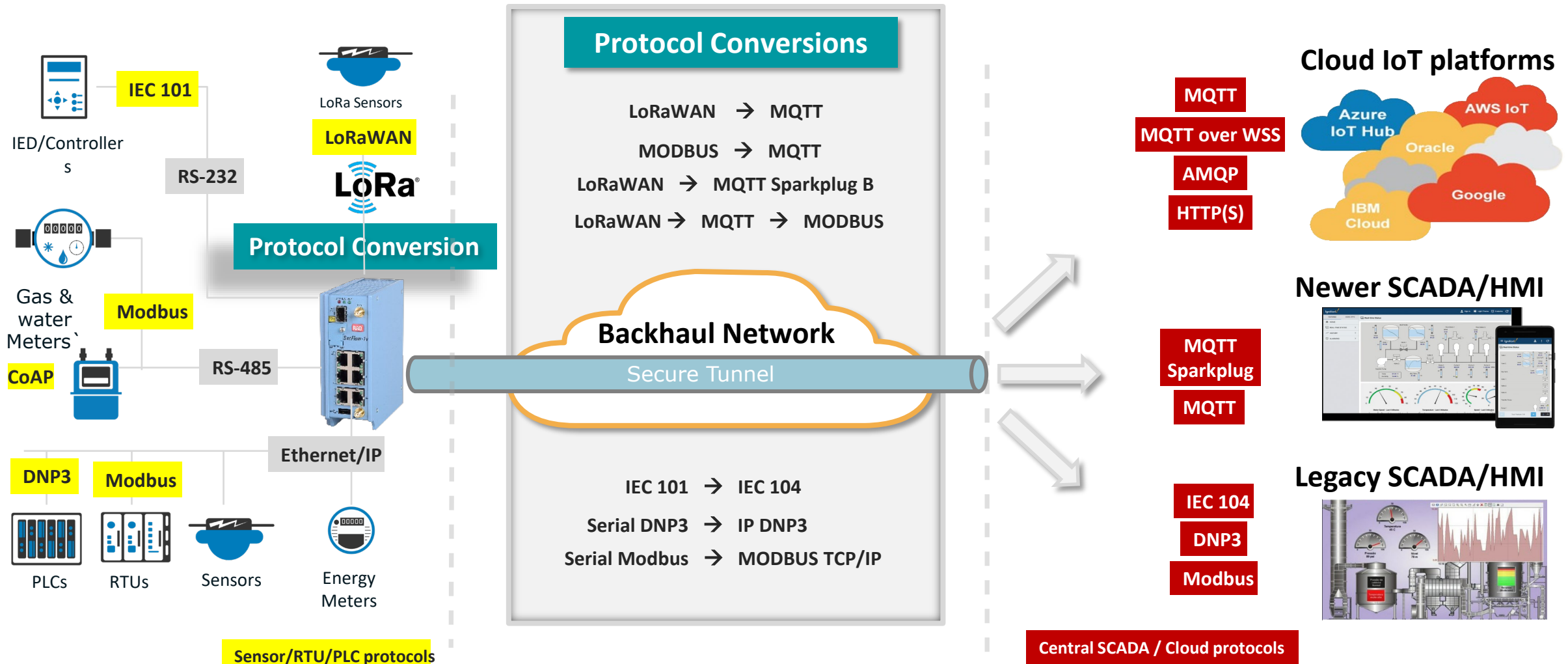
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Sensors/Devices

Gateway

Mainstream protocols

Applications



Importance of Edge Computing

Support of Edge compute provides openness and flexibility needed for today's solutions.



Open Architecture – No HW constraints

Distributed Applications

Data pre-processing, Filtering, Conversion

Edge Analytics

Fast response when required

Consolidated workload

Dynamic Security Implementation

Fast & easy adoption of new SW technology

SecFlow 360° Flexibility – Any Use Case



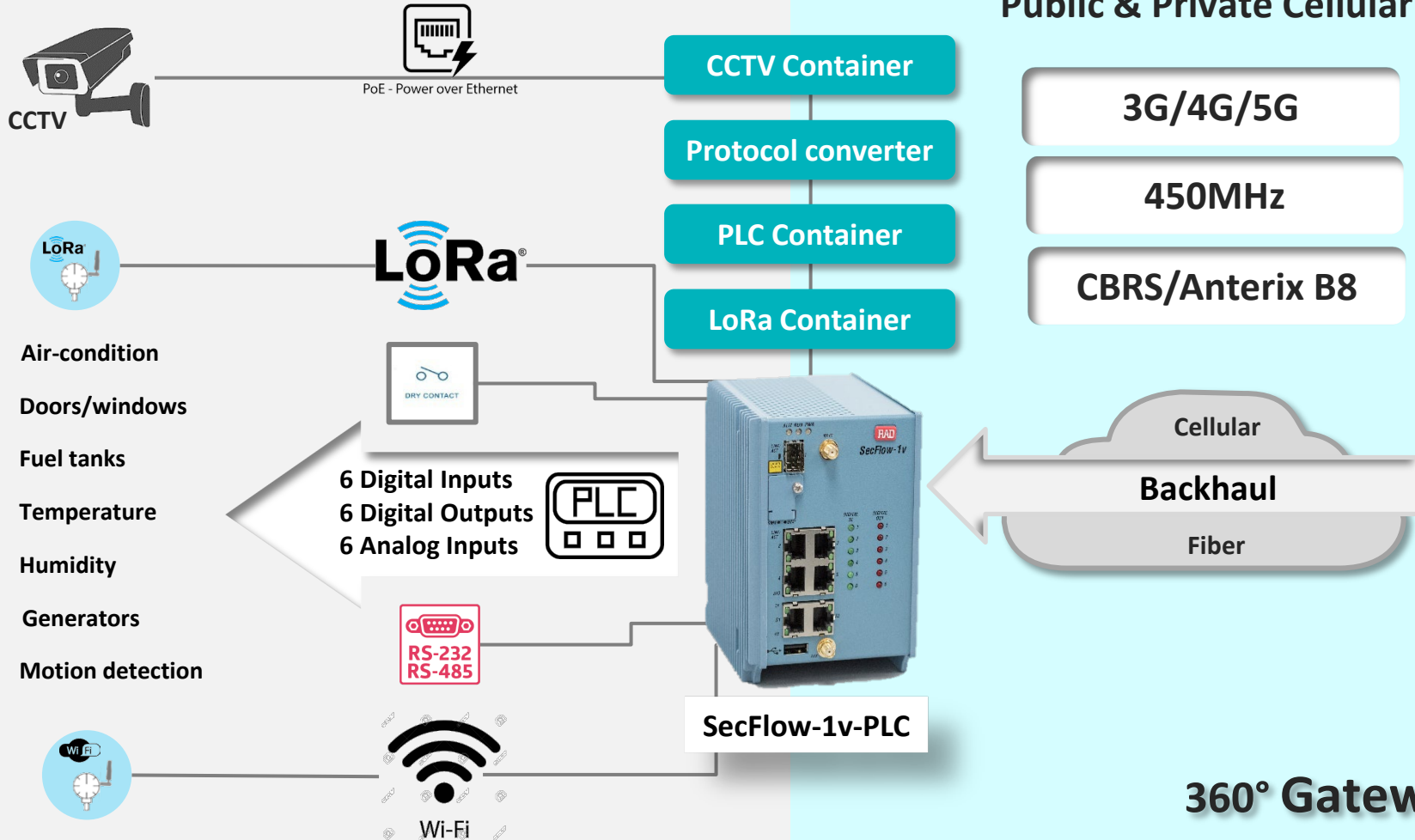
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Remote Monitor & Control / Automation

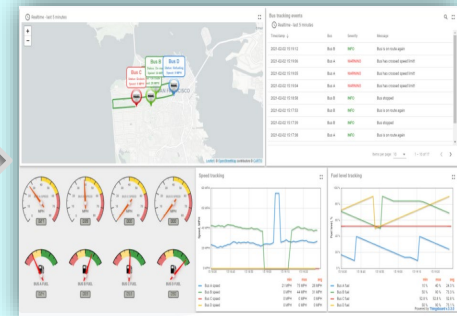
Edge Compute

Backhaul Technologies

IoT Platform



Applications/Dashboard



360° Gateway Flexibility

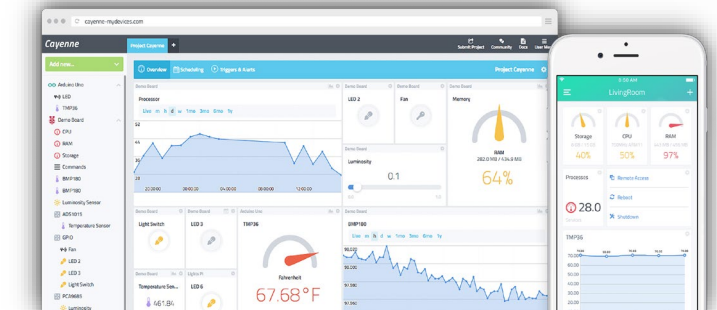
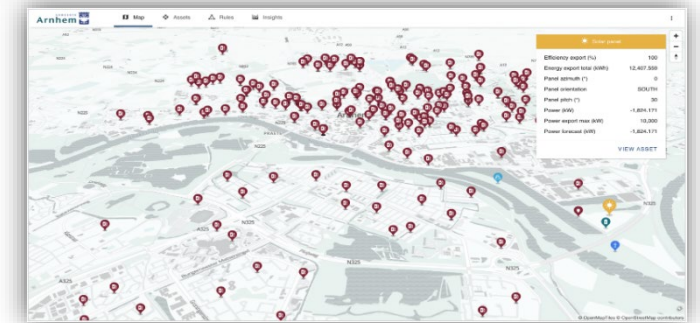
Application & Dashboard Considerations



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IoT solutions requires IoT platform - Dashboard - Analytics

- **Selection of Applications and Dashboards**
 - **Opensource Dashboard options:**
 - Thingsboard, Thingsworx, Thingstream, Thinger.io, Openremote, Cayenne, many more
 - **Cloud provider IoT platforms (examples):**
 - Azure, Amazon, Google, Oracle IoT platforms
 - **Companies providing E2E Integration and application support:**
 - Rayven, Telit, Blynk.io, IBM, AT&T, Orange
 - **Customized vertical applications (examples):**
 - Parking Management, Agriculture, Fleet management, Building Management, etc.



Considerations: Flexibility – Cost – Time to market – Customization



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Use Case Examples



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Mobile Cell Site Monitoring Needs



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Power System:

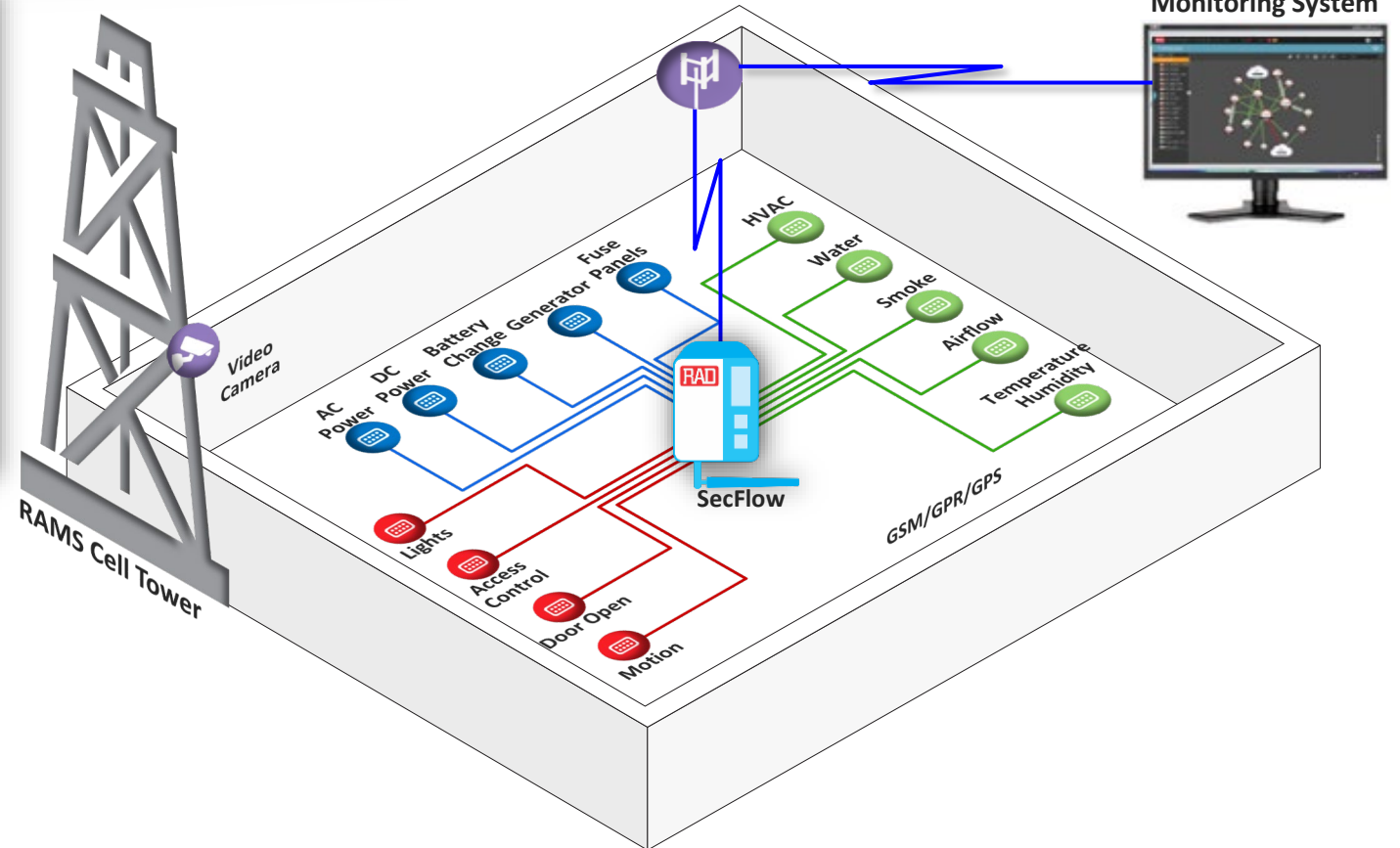
- DC Voltage & Current
- Battery Bank DC Voltage & Current
- Generator Status
- Fuse Panels
- Status of the Utility Power

Environment:

- Air Condition status
- Temperature & Humidity Monitoring
- CO2 Monitoring
- Smoke Detector
- Water leak Detection

Security:

- CCTV Camera
- Access / Proximity Control
- Fence and Door open Status
- Motion Detector
- Fuel Theft Detection
- Panic Switch
- Tower Aircraft Warning Light



Use-case 1: Measure temperature and turn on / off air-condition

Use-case 2: Motion detection outside scheduled time – turn on and send alarm

Use-case 3: Fuel level is low – send fuel truck

Utility Substation Monitoring & Automation



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Substation

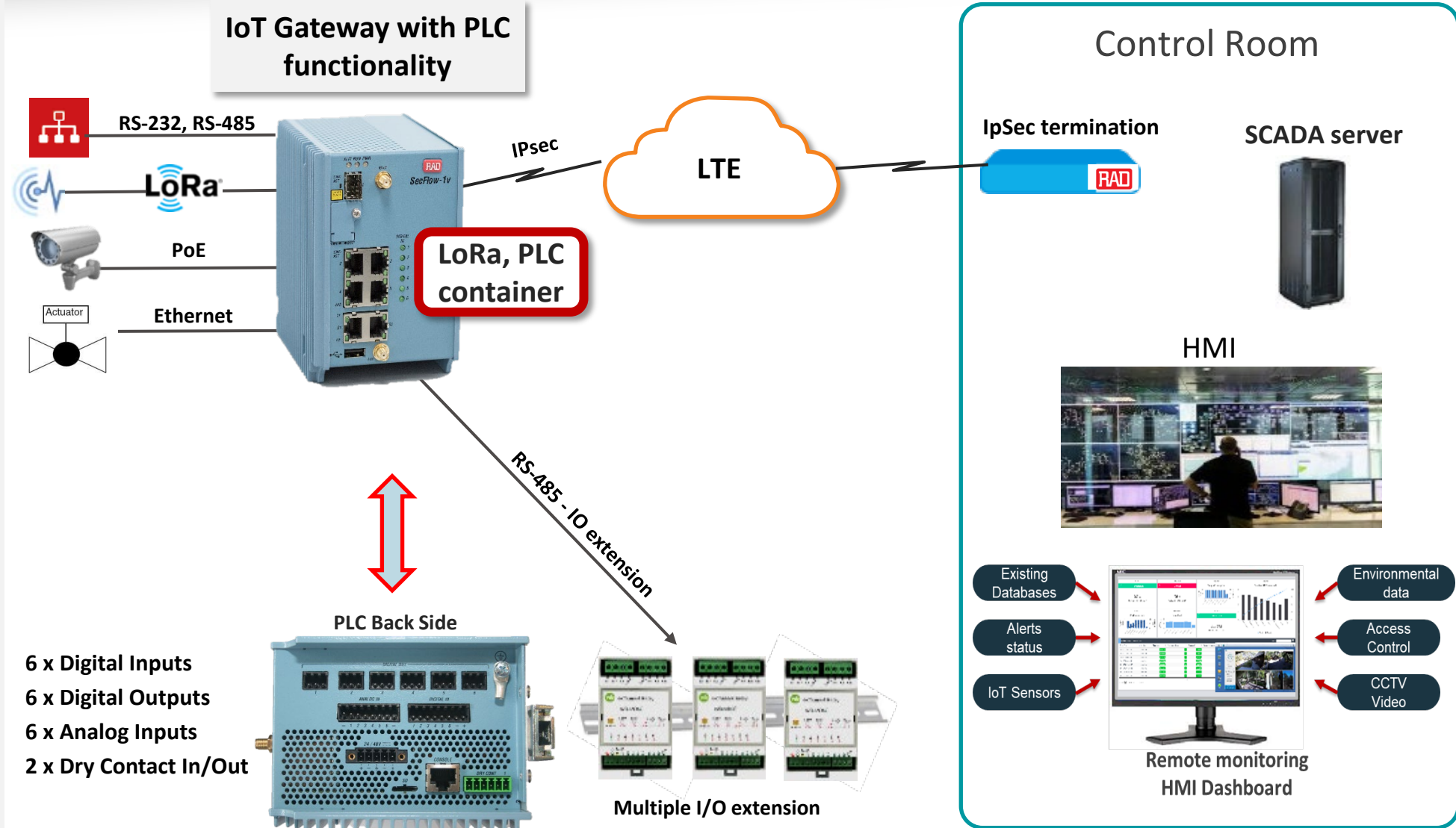


Modbus RTU
Environment
Sensors
CCTV CAM
Actuator

Electrical Substation Building



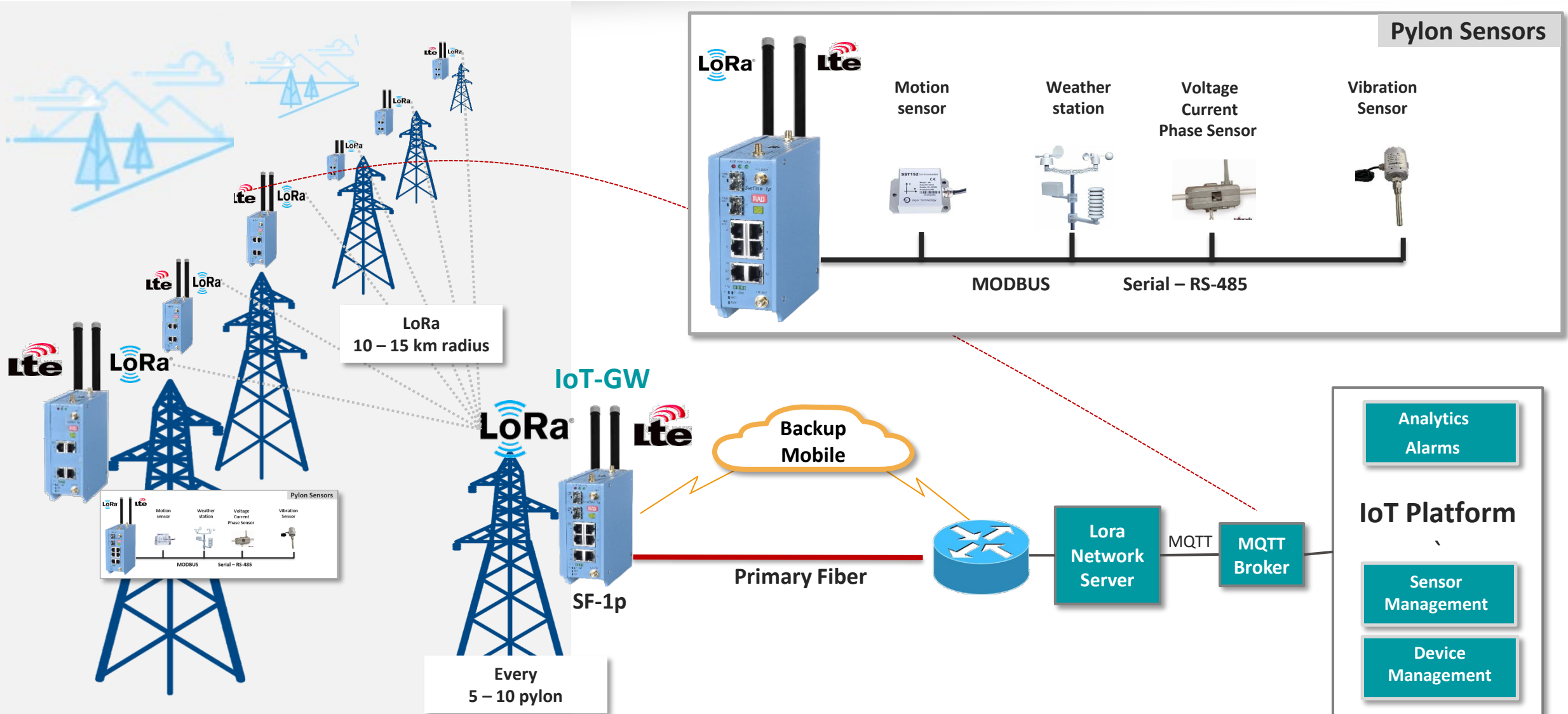
Air-condition
Door/window
Fuel tank
Temperature
Humidity
CCTV on motion



Power Grid Monitoring Solution Example



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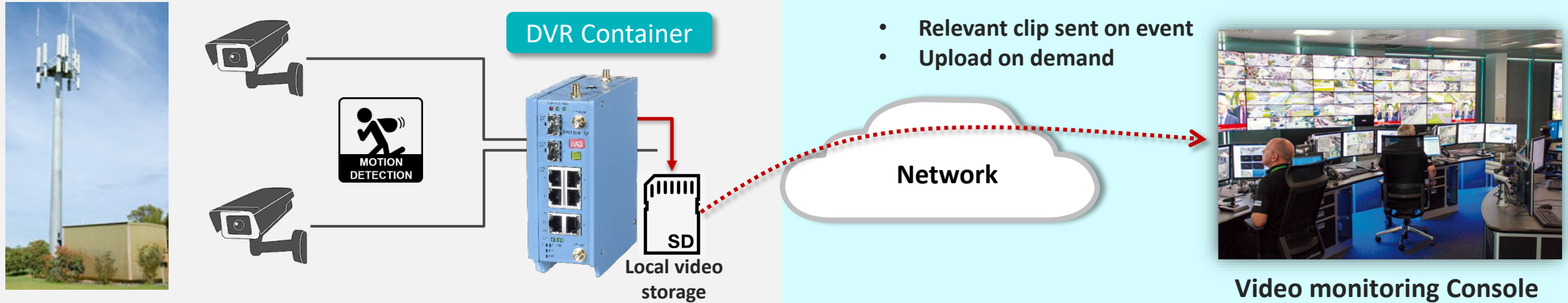
Remote Site Video Surveillance

Remote Video Monitoring

IoT GW/Edge Compute

Backhaul Technologies

Monitoring Center



Motivation and Value

- SecFlow flexible container technology can support advanced Video Surveillance, e.g.
 - Local AI – Messages when motion detected
 - Extract relevant video snippet
 - Storage efficiency – control number of frames/sec
- DVR - reduces cost of continuous video over LTE
- Local video storage in case network fails or camera is vandalized

Solution Benefits

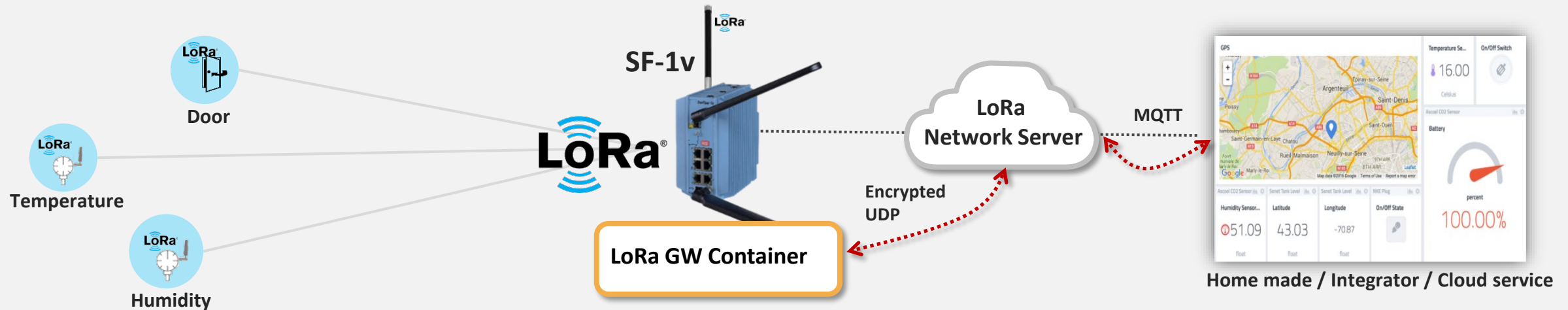
- Network Data consumption only per event and on-demand
- Local video recording on SD-Card/HDD
- Video Backhaul on demand
- CCTV location based on GPS
- Secure mgt. (IPsec and stateful Firewall)
- Redundant network connectivity
- Complementary IIoT Capabilities

Asset Monitoring Blueprint Demo using LoRa

LoRa Sensors

LoRaWAN Gateway

Application/ Dashboard



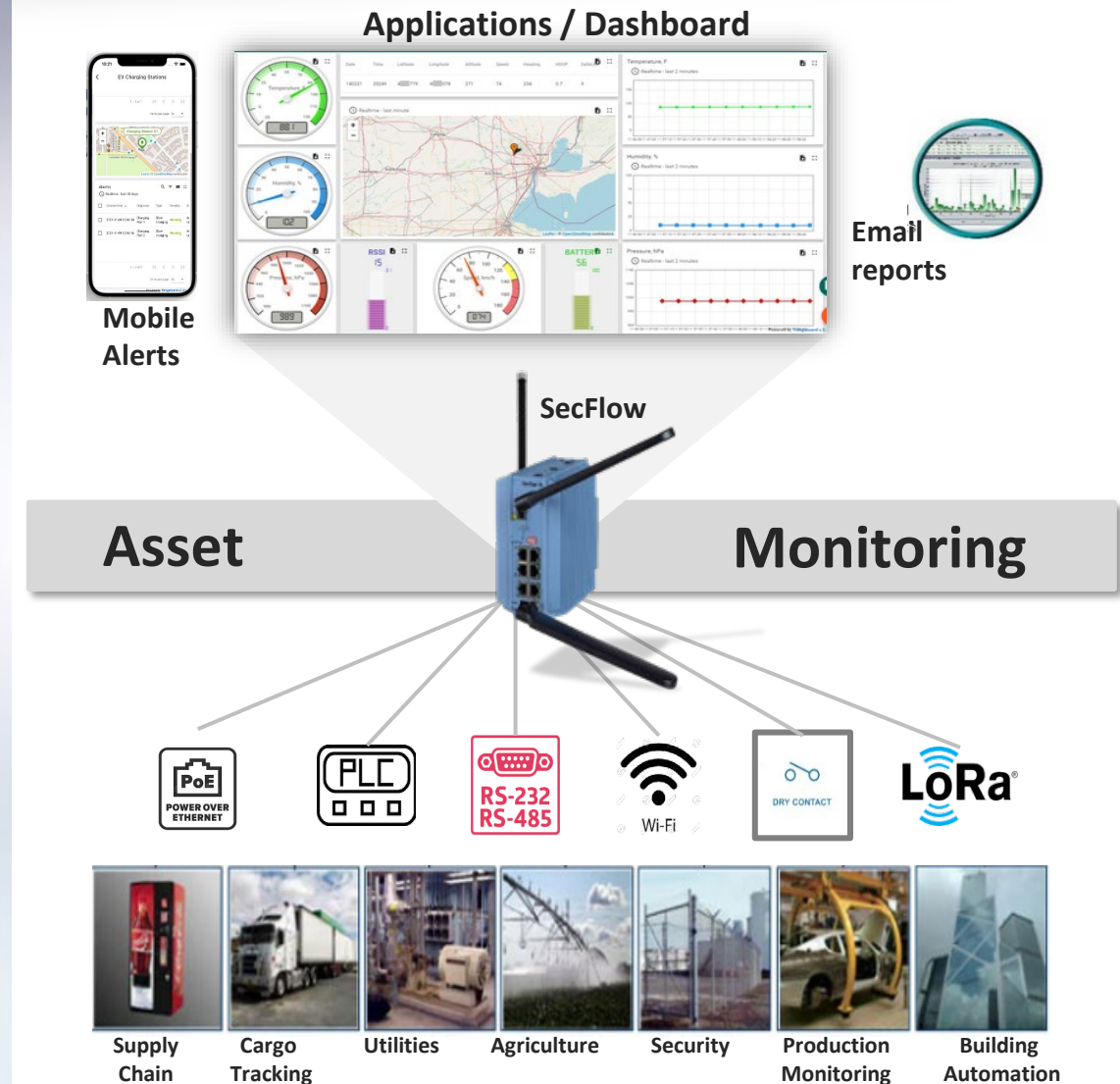
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Guideline Takeaways



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- Important factors deploying Asset Monitoring:
 - Select sensor technology that fit your needs
 - Select flexible IoT Gateway that support the sensor technologies & IIoT protocols
 - Evaluate need for Edge computing flexibility
 - Data aggregation to reduce transport cost
 - Distributed protocol conversion when required
 - Fast local response when required
 - Select optimal backhaul technology
 - Select flexible Application / Dashboard platform





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Thank you

For your attention

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