



Safety and alarming applications using ISA100 Wireless

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Today's topics

- 1) Motivation of wireless for plant safety
- 2) Benefits
- 3) Key requirements
- 4) ISA100 Wireless solutions
- 5) Applications
- 6) Summary



Motivation of adopting wireless for safety

- **Preventive measures**

- Process condition / status monitoring: Temperatures / Pressures / Flows / Levels / etc.
- Asset condition monitoring: Vibration / Corrosion / Temperature / etc.

- **Accident avoidance / Limit the extent of damages**

- Alarm / Warning: **Gas leak detection** / Safety shower detection / **Tsunami warning**
- Emergency shutoff: **Remote valve control** for safety mode

- **Human safety**

- People tracking on site / Communication to navigate for evacuation / etc.



Gas explosion

→ Plant wide monitoring



Tsunami disaster

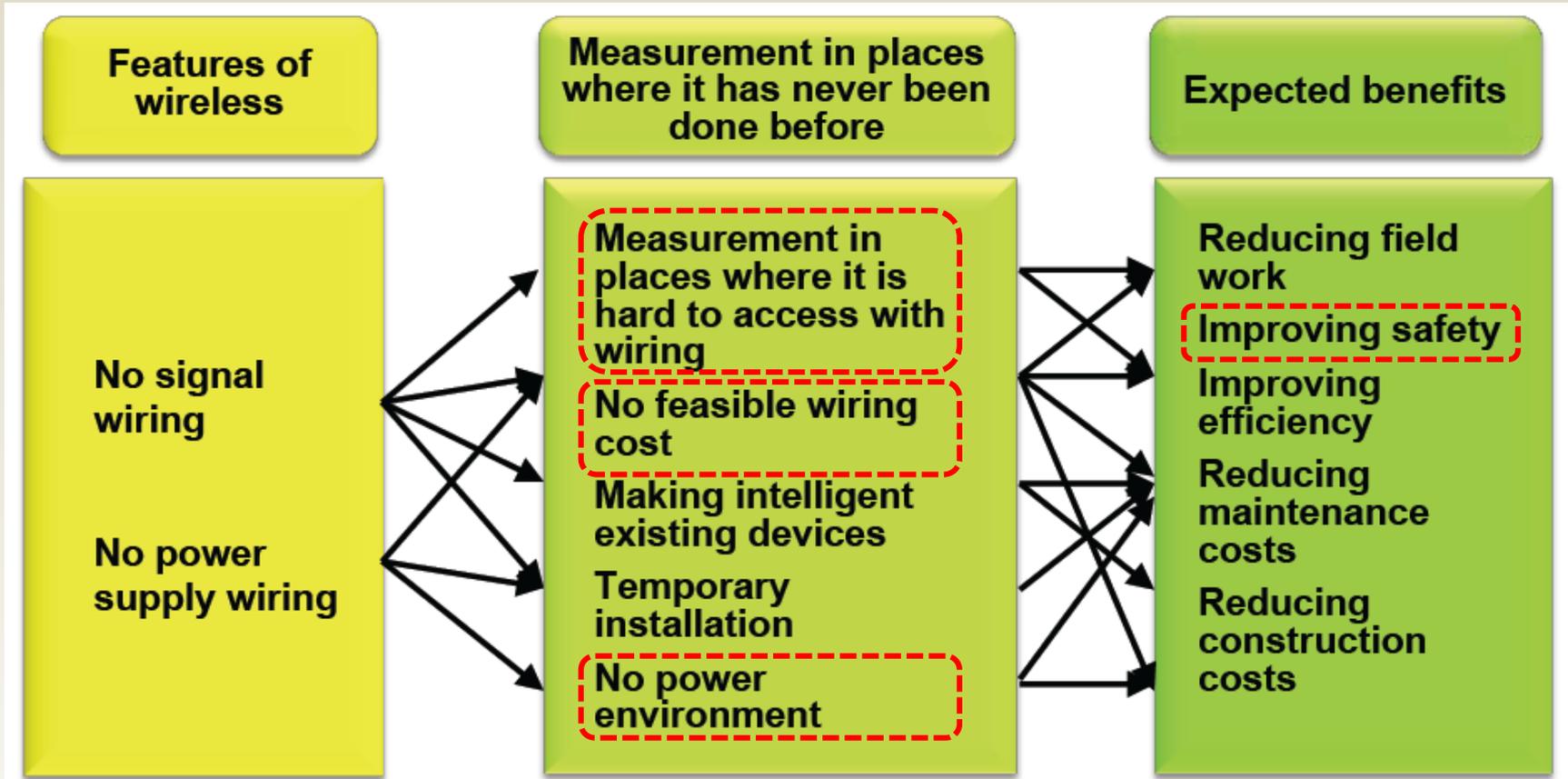
→ Predictive monitoring



Fire of floating-roof tank

→ Emergency shutoff

Unique benefits of wireless



Even more remarkable points are

- Robust to physical damages
- Easy expansion for additional measurement points

Key requirements for safety

- **Robust communication**



- Committed reliability and availability

- Reliable radio / Fault tolerant system

- **Emergency actions**



- Committed deterministic performance

- Timeliness / Rapid response time

- **Plant wide coverage**

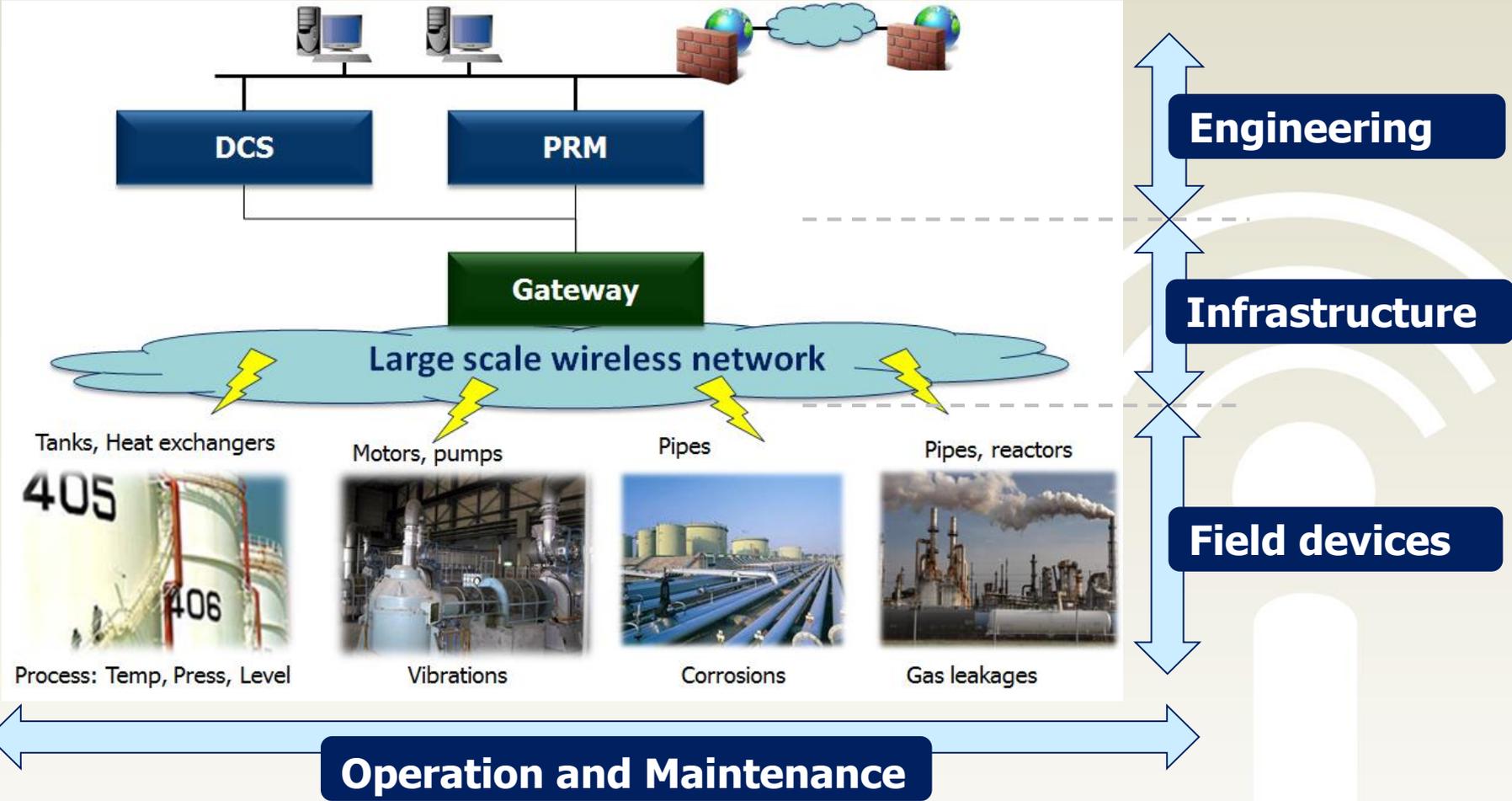


- Committed large scale configuration

- Long range communication / Flexible configuration

Dependable wireless system is required

How to realize dependable wireless system?



ISA100 Wireless solutions

Field devices

- ✓ **Long distance** communication (600m line of sight)
- ✓ **Safety layer** is implemented on the top of ISA100 Wireless stack
- ✓ **Multivendor interoperability** for best in class solution

Wireless Infrastructure

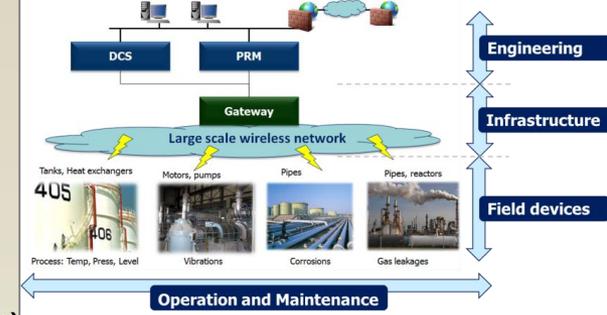
- ✓ **Redundant Gateway** for highest reliability
- ✓ **Multiple access point** for scalable and flexible network
- ✓ **500 devices** can be managed per one Gateway
- ✓ **Coexistence management** with CCA/Ch Black listing

Network Engineering

- ✓ **Sky mesh concept** (Installation guide) for scalable and stable network
- ✓ **Support safety protocol (PROFIsafe)** to connect SIL compliant system

Network Maintenance

- ✓ **Network monitoring tool** for visualize condition of the network
- ✓ **Predictable & Long battery life** by well managed NW

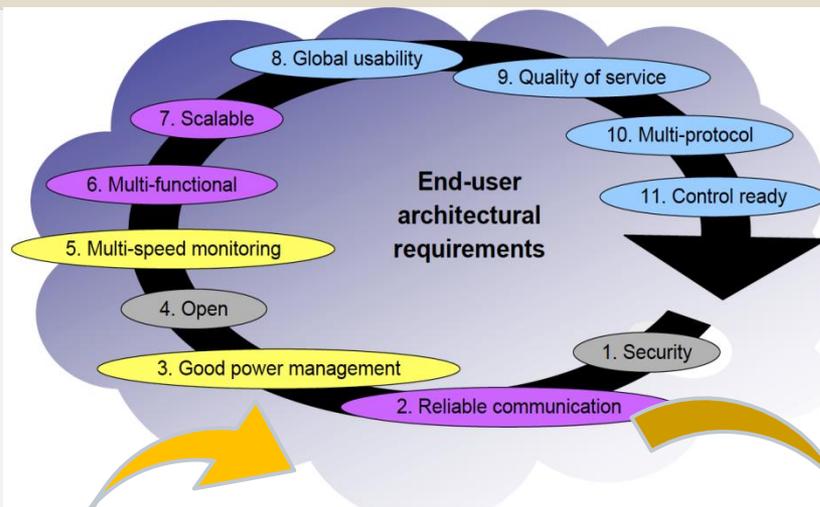


ISA100 Wireless (ISA100.11a / IEC 62734)

Industrial wireless network standard

Plant wide solution :

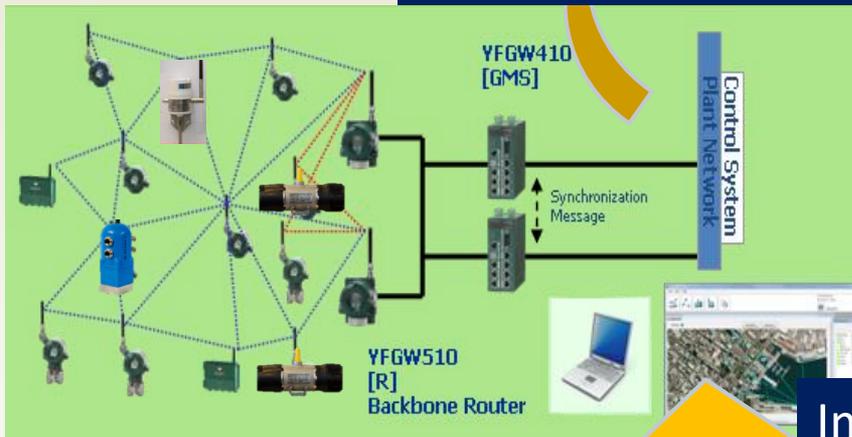
- Industry
- Oil & Gas, Petrochemicals,
- Powers, Metals, etc.
- Applications
- Process monitoring
- Process control
- Asset management
- Safety alarm management
- Energy monitoring
- Environmental
- etc.



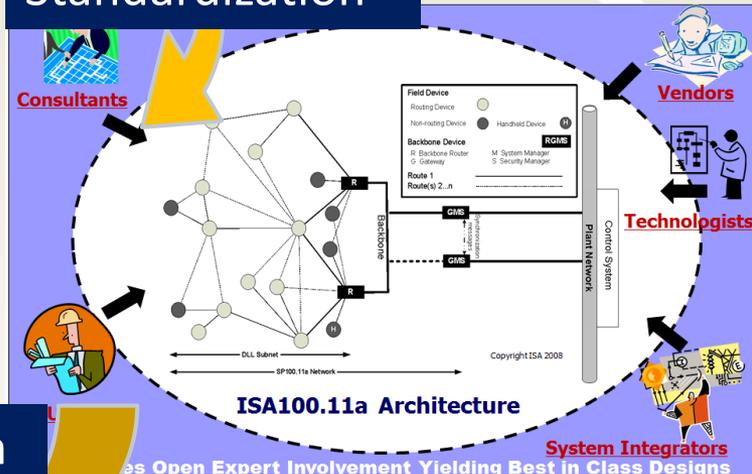
Breakthrough Technologies :

- Two layered Security, OTA
- Mesh / Star / Duocast
- Battery Alert
- Interpretability
- Multiple subnets (co-existing)
- Bandwidth management
- Backbone network (Small-Large)
- Country code
- QoS (contracts)
- Multi-protocols by Tunneling
- Publish / Subscribe

Provide Solutions



Standardization



Implementation

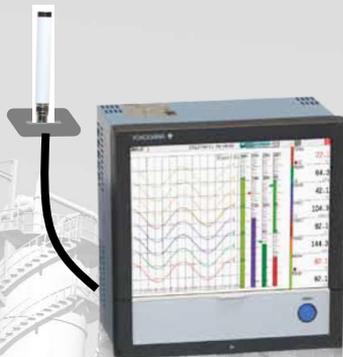
- Assure multivendor interoperability
- ISA100 compliance test
- Developing Implementation specifications



ISA100.11a wireless system



Dual input Temperature Transmitter
YTA510



Field Wireless SMARTDAC+
GX20W



Field Wireless Access Point
YFGW510



Field Wireless Management Station
YFGW410



Field Wireless Access Point
YFGW510



Field Wireless Media Converter
YFGW610



Pressure transmitter
EJX110B/EJX430B/EJX310B



Temperature Multiplexer
YTMX580



Flange mounted Differential Transmitter
EJX210B



Multiprotocol Adapter
FN310/FN110



Multifunction Adapter
FN510/FN110



Differential Transmitter With Diaphragm Seal
EJX118B/EJX438B



Pressure transmitter
EJX510B

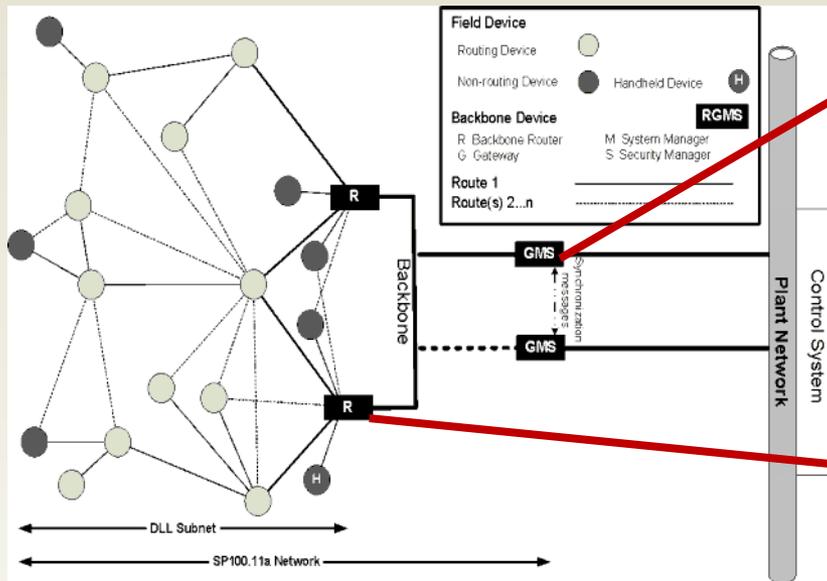
ISA100 Wireless implementations

1. Reliability

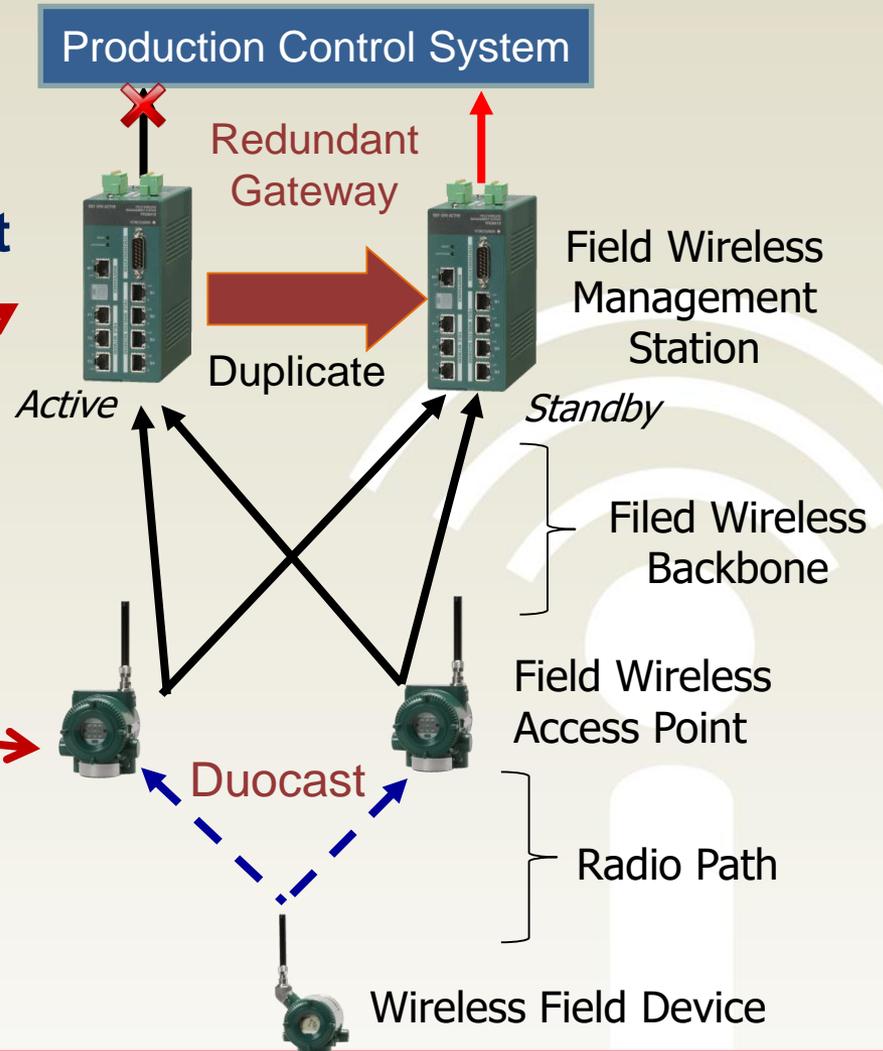
Fault Tolerance



Redundant Gateway and Duocast

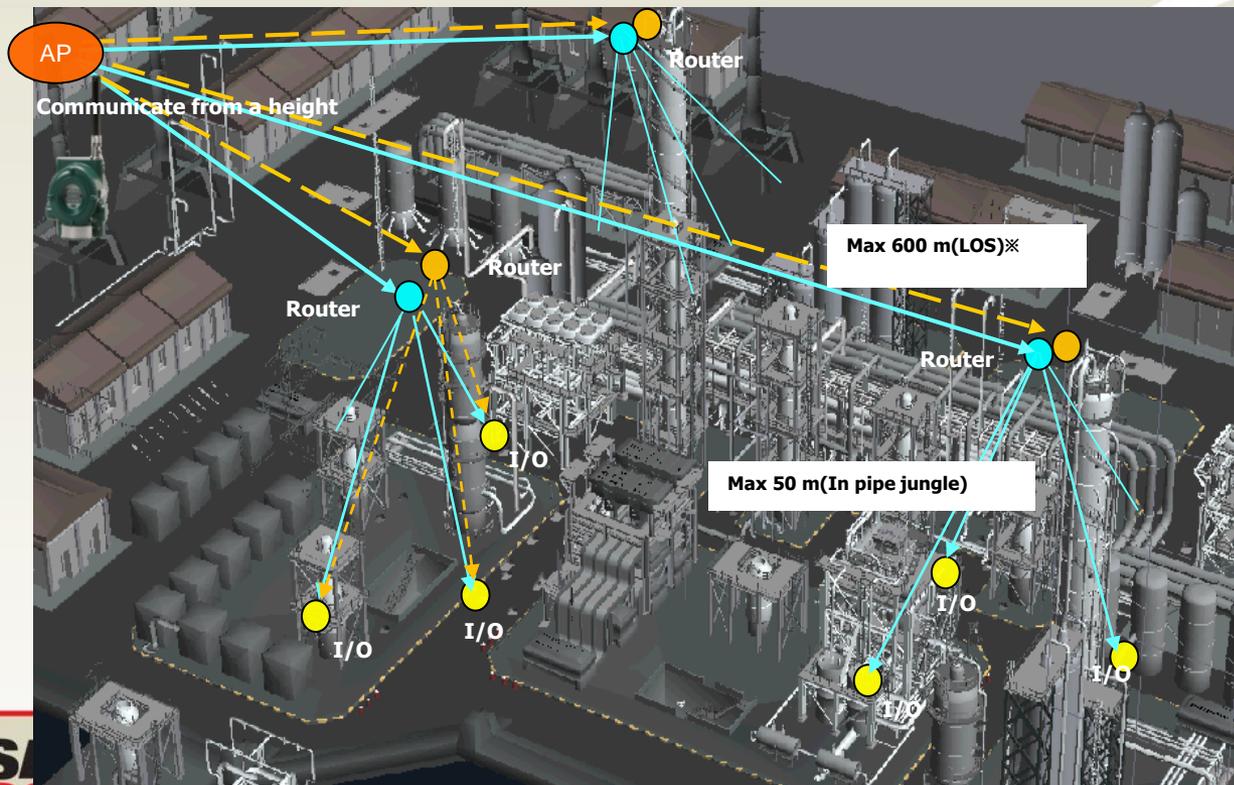


ISA100 Wireless Architecture



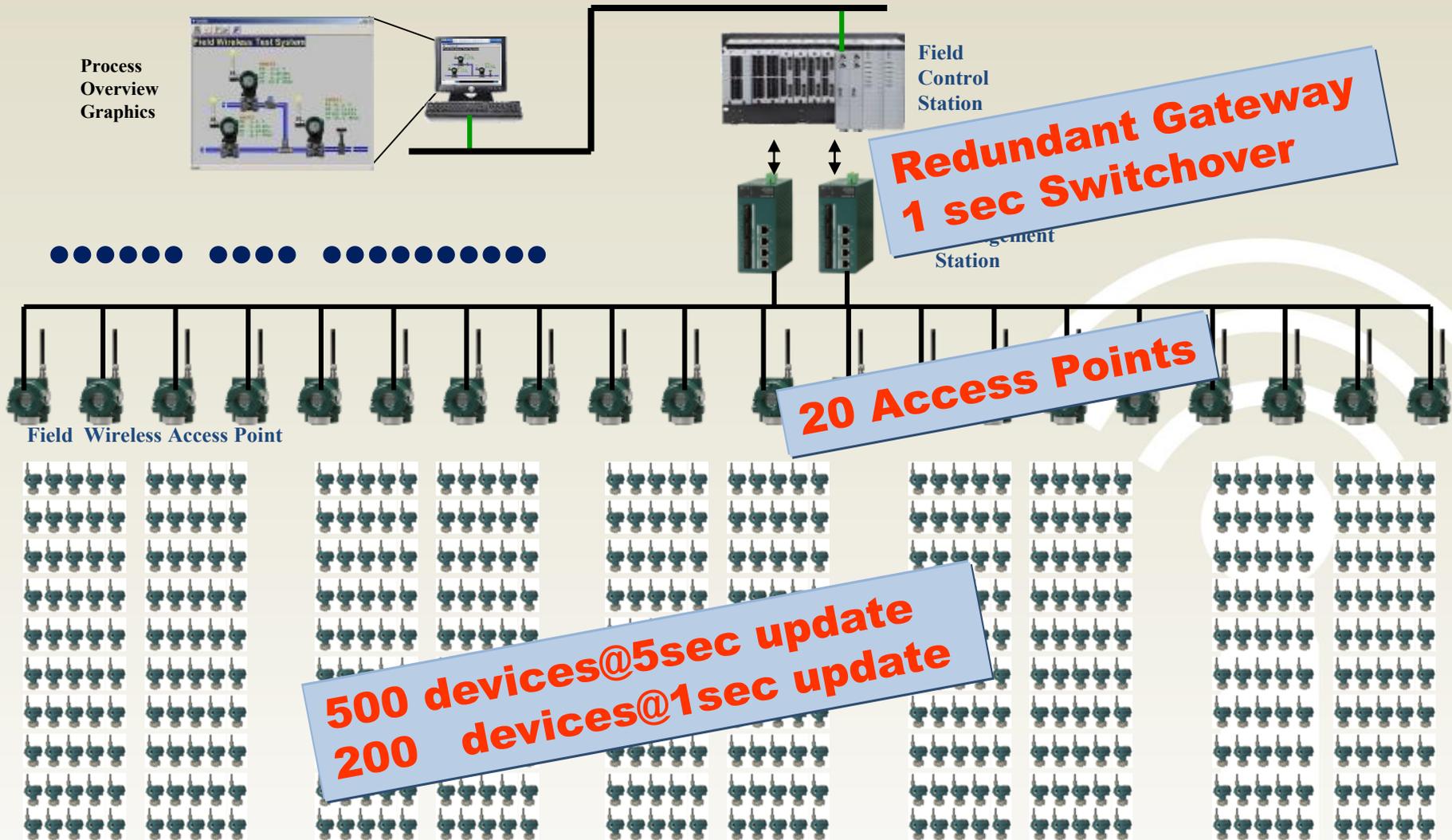
2. Timeliness

- **TDMA:** Time Division Multiple Access / Time slot comm.
- **Publish / Subscribe:** Periodic data transmission
- The **“Sky Mesh”** : Network planning concept
 - 1) **Deterministic communication with short latency** (minimizing hops)
 - 2) Reliable communication with **redundant paths**, Predictable battery life



3. Scalability

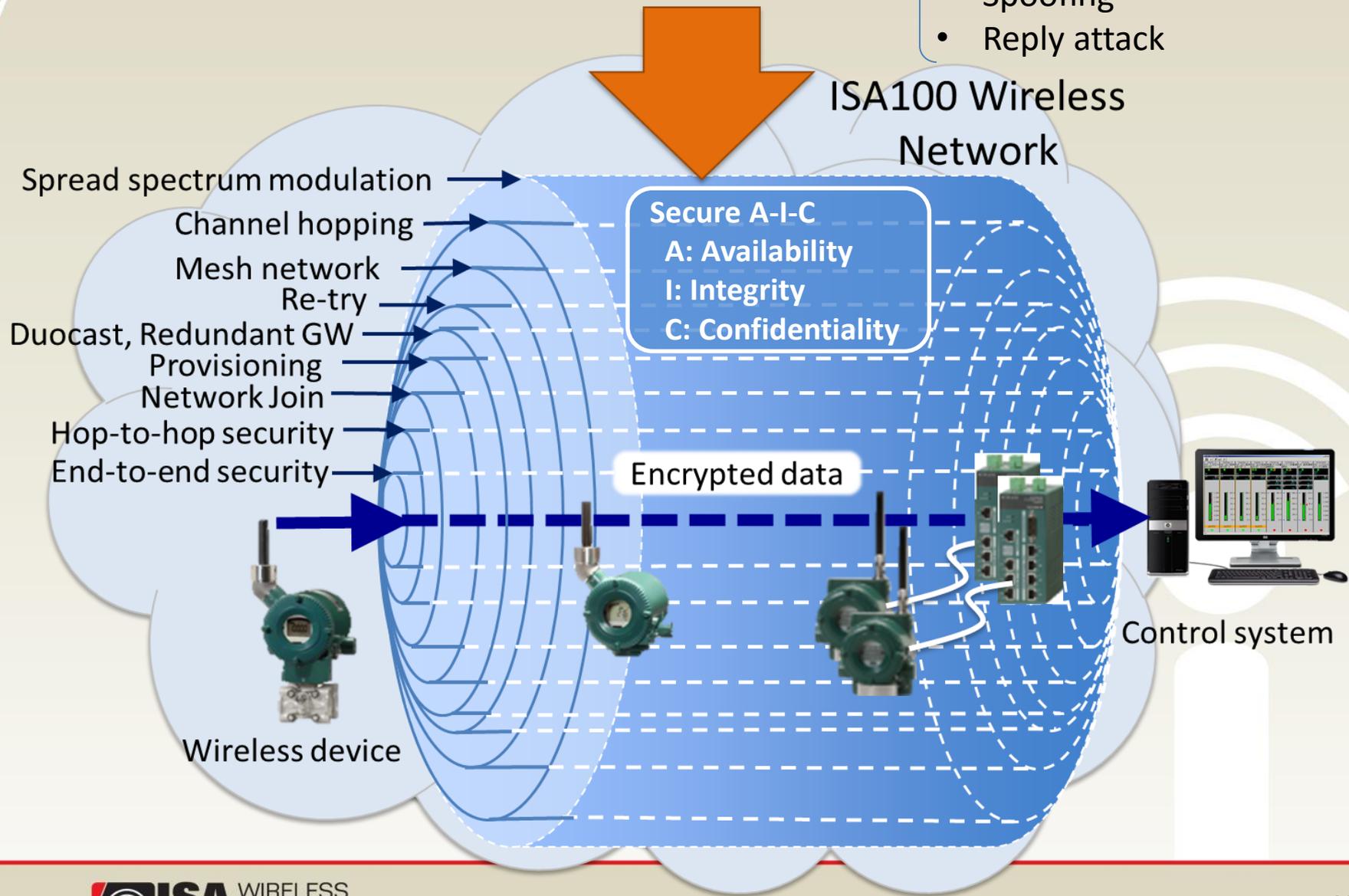
Plant wide large scale wireless infrastructure



4. Security

Security threats

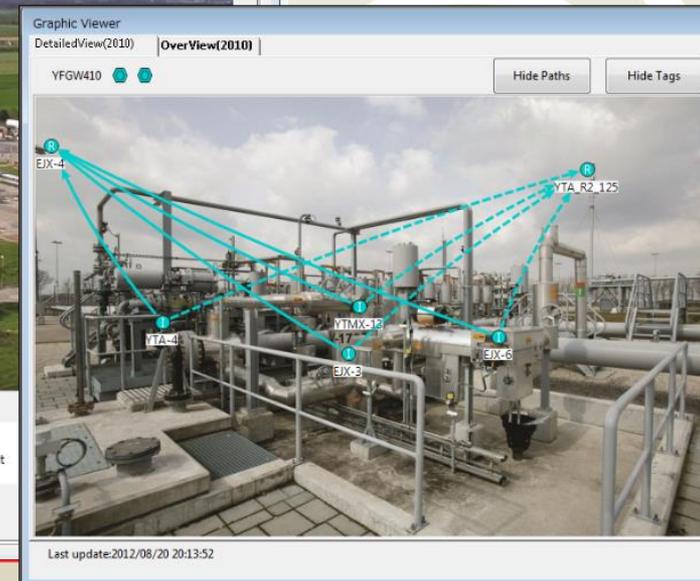
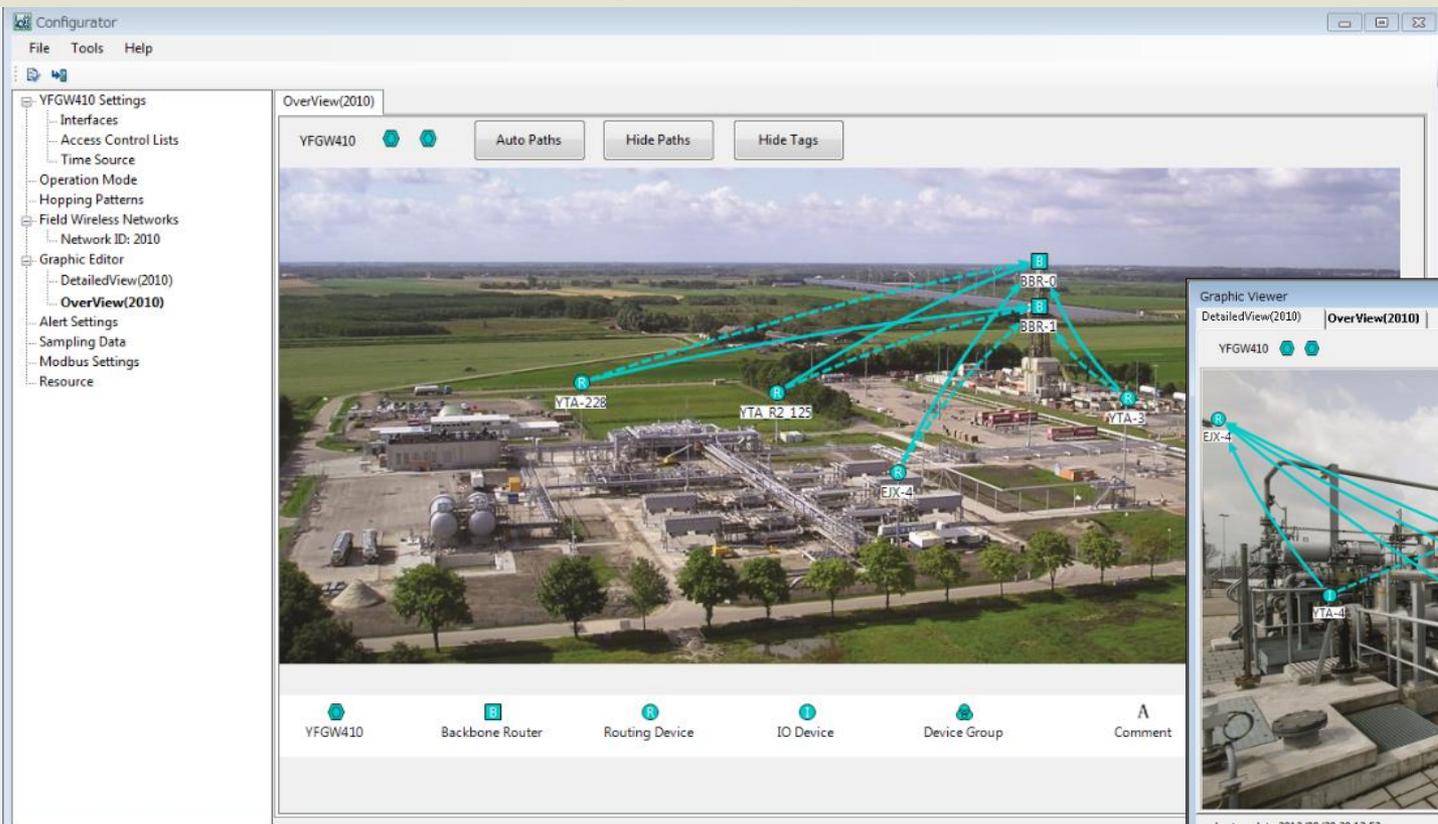
- Sniffing
- Data falsification
- Spoofing
- Reply attack



5. Engineering

RF network planning tool

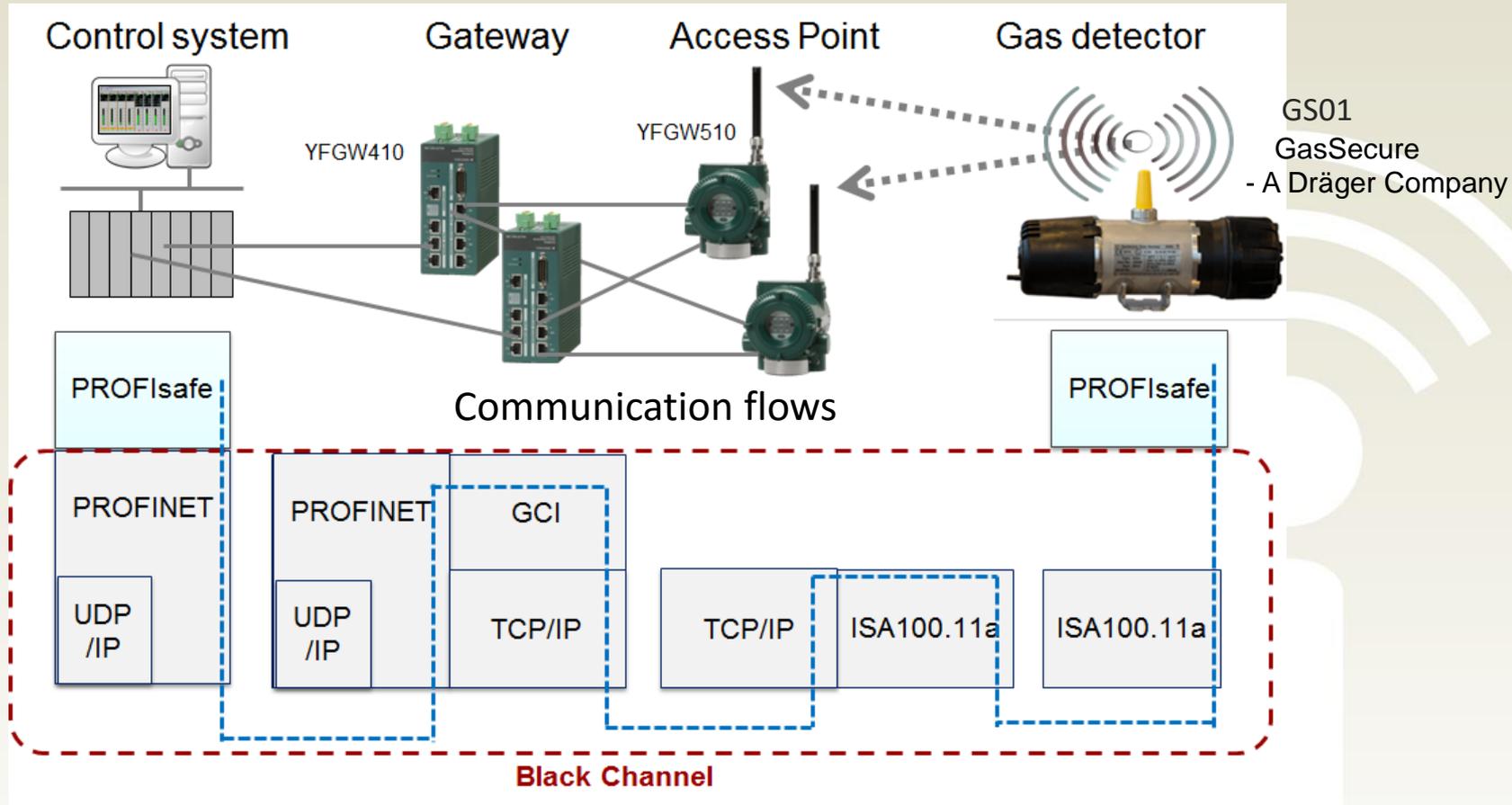
- Fix communication paths visually on graphic display
- Press auto paths button so that communication paths are automatically indicated : Easy engineering



6. SIL2 certification

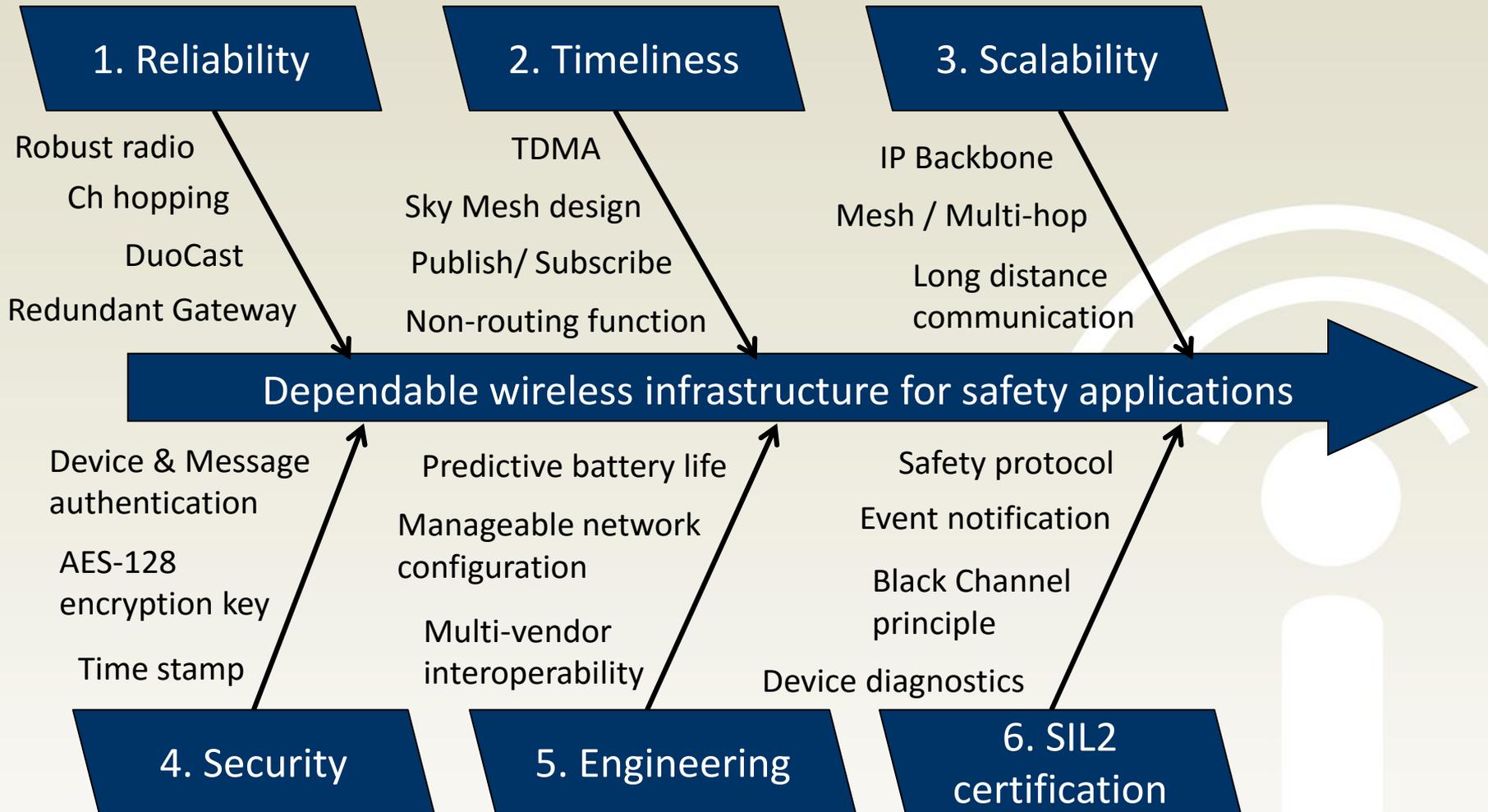
SIL2 Gas detection system

- Wireless protocol: ISA100 Wireless
- Safety protocol: PROFIsafe over PROFINET

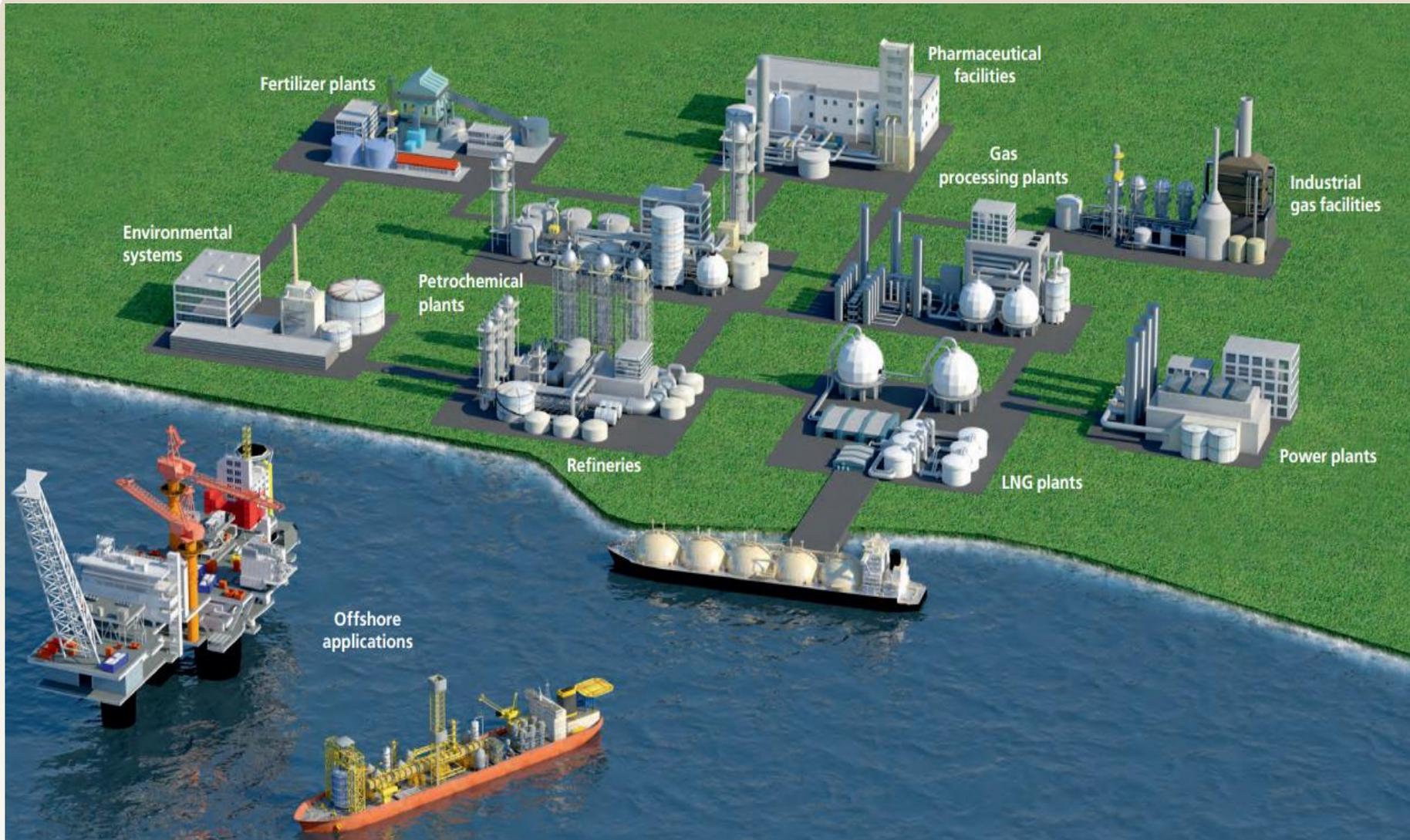


Summary

ISA100 Wireless technologies



Applications



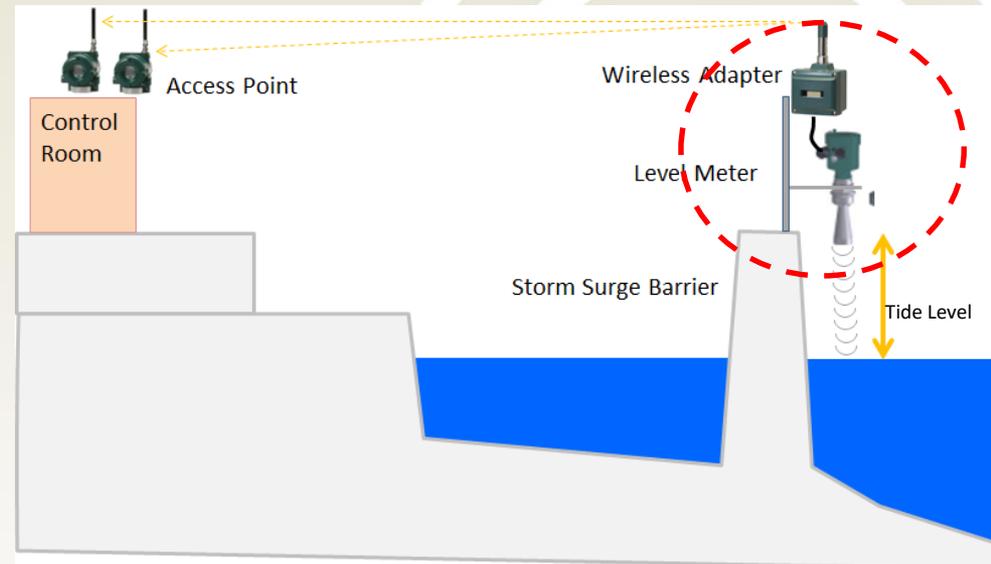
1: Tsunami warning system

Lessons learned from the great east Japan earthquake disaster

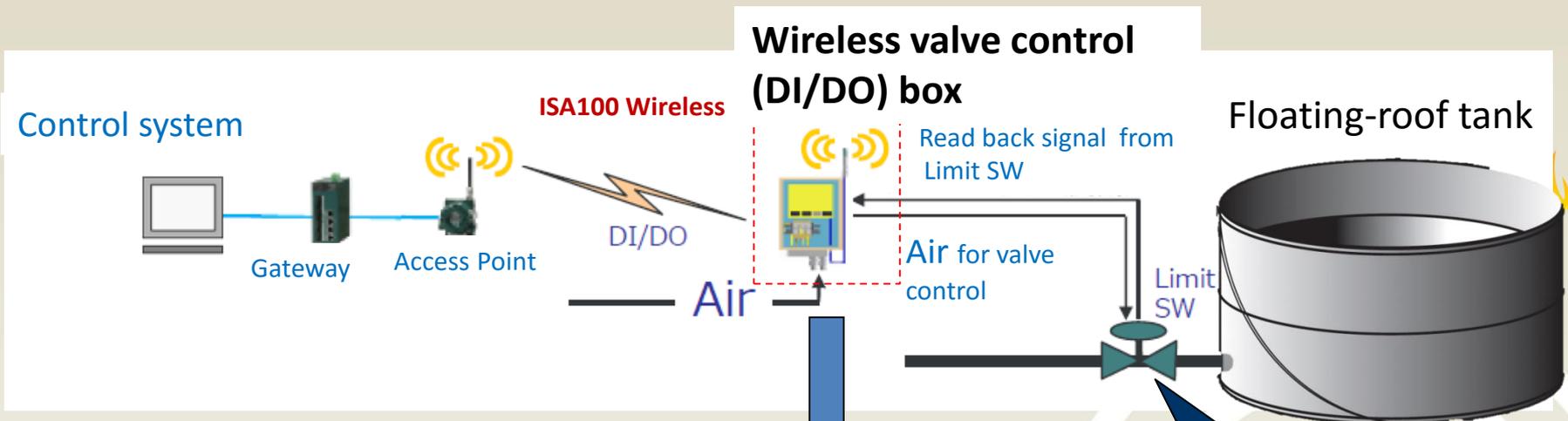
Level meters equipped with the wireless adaptor are installed on a storm surge barrier near the plant to monitor the tide level. Because a tsunami is usually preceded by a sudden ebb tide, detecting a sudden lowering of tide level may indicate a tsunami.

System overview

- Level meter is connected ISA100 Wireless adapter
- Long range communication from field wireless device to Access Point without repeaters (up to 600m)
- Duocast for redundant communication



2: Remote valve control for emergency action



System overview

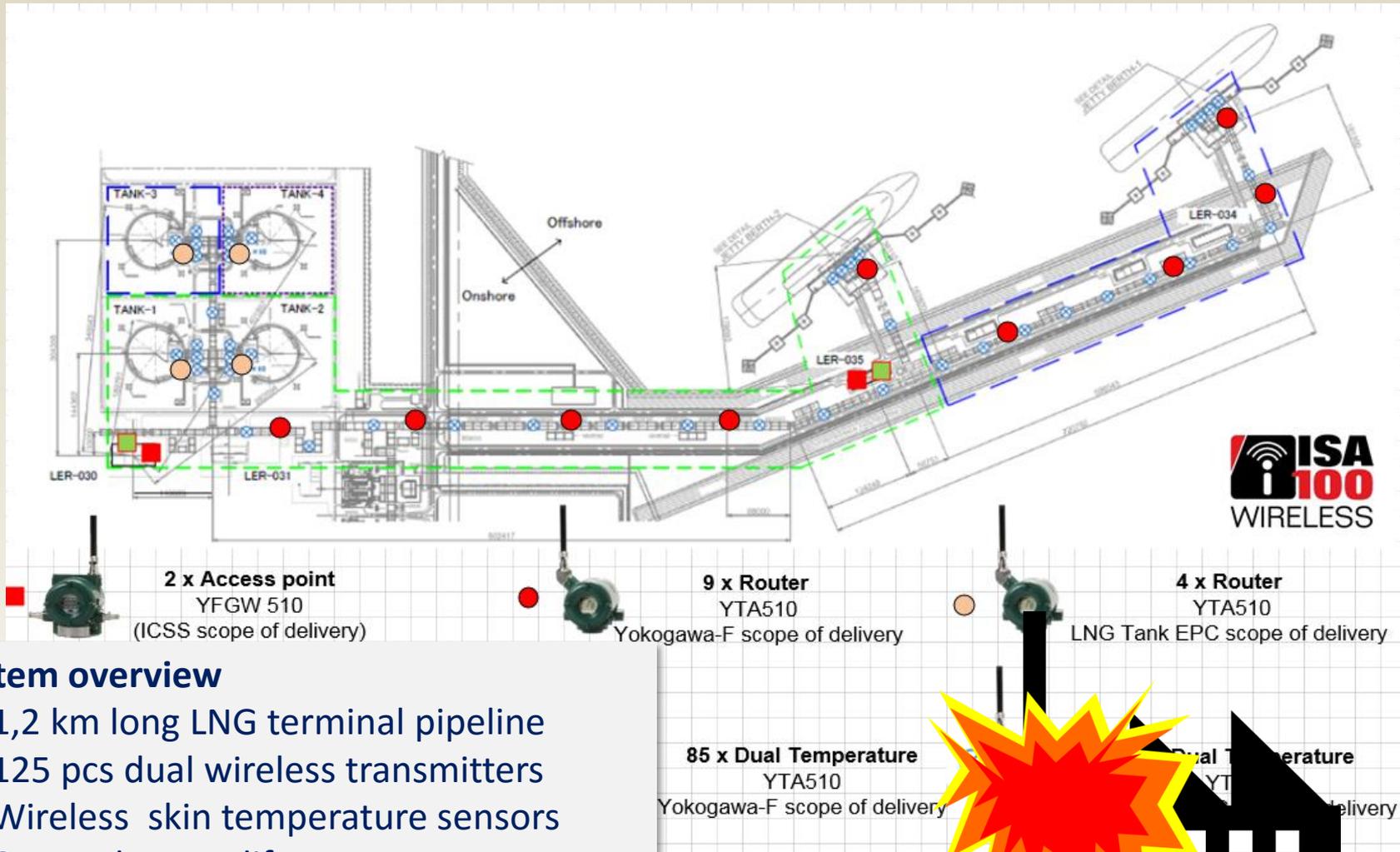
- Rapid response for controlling valve
- Read back status can be monitored
- 10 years battery life
- Compliant to Japanese regulations regarding to the earthquake and tsunami for hazardous materials facilities



Close drain valve to avoid fire accident when big earthquake occurred

Note:
This wireless Tx are certified to use actually in Japan only !

3: LNG terminal pipeline temperature safety monitoring



System overview

- 1,2 km long LNG terminal pipeline
- 125 pcs dual wireless transmitters
- Wireless skin temperature sensors
- 6 years battery life
- In case of leakage temperature drop

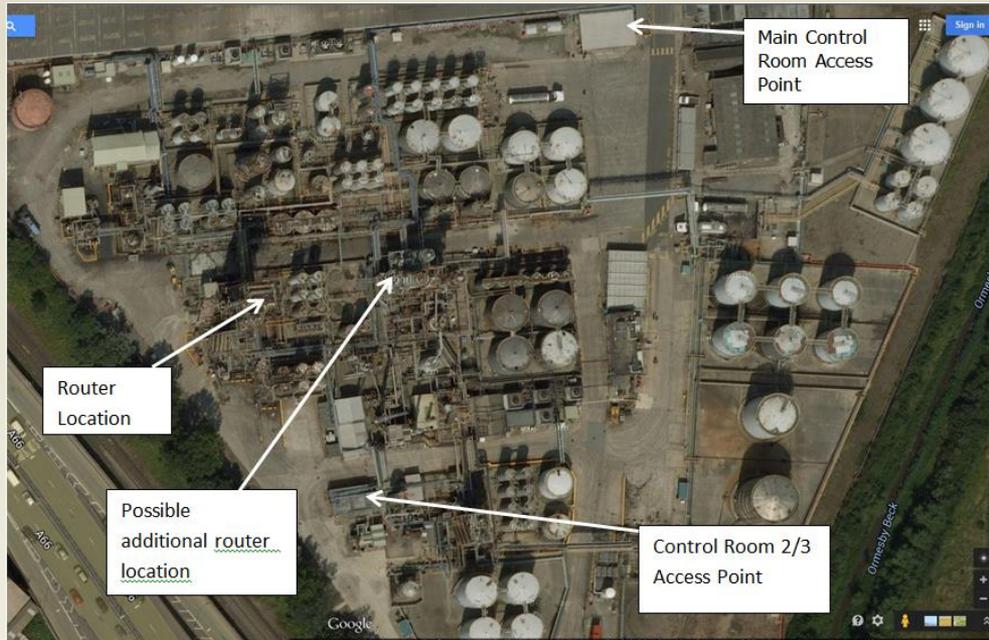
❖ 4: Wireless monitoring by NPP decommissioning

<u>Test</u>	<u>Performance</u>
Test 1 – System Testing	■
Test 2 – Initial Setup	√
Test 3 – Eight Day Running	√
Test 4 – Alarm and Diagnostics Testing	√
Test 5 – Power Brownout Testing	√
Test 6 – Wireless Interference Testing	√
Test 7 – Mesh Network Testing	√

System overview

- Radiation monitors have Modbus comm.
- FN110/310M wireless adapters
- 5 years battery life
- In case of High radiation level alarming

5: SIL2 Wireless HSE safety application in UK



GasSecure – A Dräger Company : GS01 Gas Detector

System overview

- The HSE safety application use 30 pcs of GS01 (GasSecure - A Dräger Company) wireless gas detectors to measure hydrocarbon gas concentrations and Yokogawa ISA100 Gateway and access points.
- Rapid response gas-detecting time & comm. & Low energy consumption
- The gateway has PROFINET comm. to connect with the PROFIsafe based PLC .

Summary

- Industrial wireless technology creates great opportunities to provide new paradigm for plant safety
- **Dependable plant wide infrastructure** must be required to cover variety of wireless safety applications
- **World first SIL 2 wireless gas detection system** has been realized with co-innovation of multiple vendors and multiple breakthrough technologies on the **ISA100 Wireless**



Thank you for your attention



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