Setting the Standard for Automation™

Safety and alarming applications using ISA100 Wireless

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Presenter

- Toshi Hasegawa is a Manager of standard department, Marketing Head quarters, particularly with wireless. Toshi has been working for Yokogawa Electric Corporation for 27 years, and he has worked for development of Distributed Control Systems (DCS). His current activity is mainly on standardization and marketing of industrial wireless network. He is a voting member of ISA SP100 Wireless System for Automation. And he is a district leader of the ISA100 Wireless Compliance institute (WCI) Asia Pacific. Toshi is also member of the Japan national committee of IEC/TC65/SC65C/WG17 (Wireless communication network and communication profiles-Coexistence).

YOKOGAWA | 100th ANNIVERSARY 1915-2015

The History of Radio

- Marconi had an early interest in science, and was especially interested in the work of Hertz
- He quickly realized the potential of wireless transmission and filed a British patent
  - Awarded on 2nd July 1897, GB12039
- At 12:00pm on the 12th December 1901 Marconi send and received the first Transatlantic radio transmission

The History of Radio

- On Sunday evening 14th April 1912 the largest passenger ship in the world, Titanic struck an iceberg
- The radio operators onboard were employed by Marconi International Marine
- They sent a distress signal **alerting** the world and the Carpathia "CQD CQD SOS Titanic Position 41.44 N 50.24 W.·····"
- Radio had proven it worth…

Wireless safety application has been started over 100 years ago..

Today's topics

1) Reasons for adopting wireless for plant safety
2) Unique benefits of wireless
3) Key requirements
4) ISA100 Wireless solution
5) Design and implementations
6) Applications using ISA100 Wireless
7) Summary

1) Reasons for adopting wireless for plant 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 detection**
  - Emergency shutdown: **Remote valve control** for safety mode
- **Human safety**
  - People tracking on site / Communication to navigate for evacuation / etc.

Gas explosion

→ Plant wide monitoring

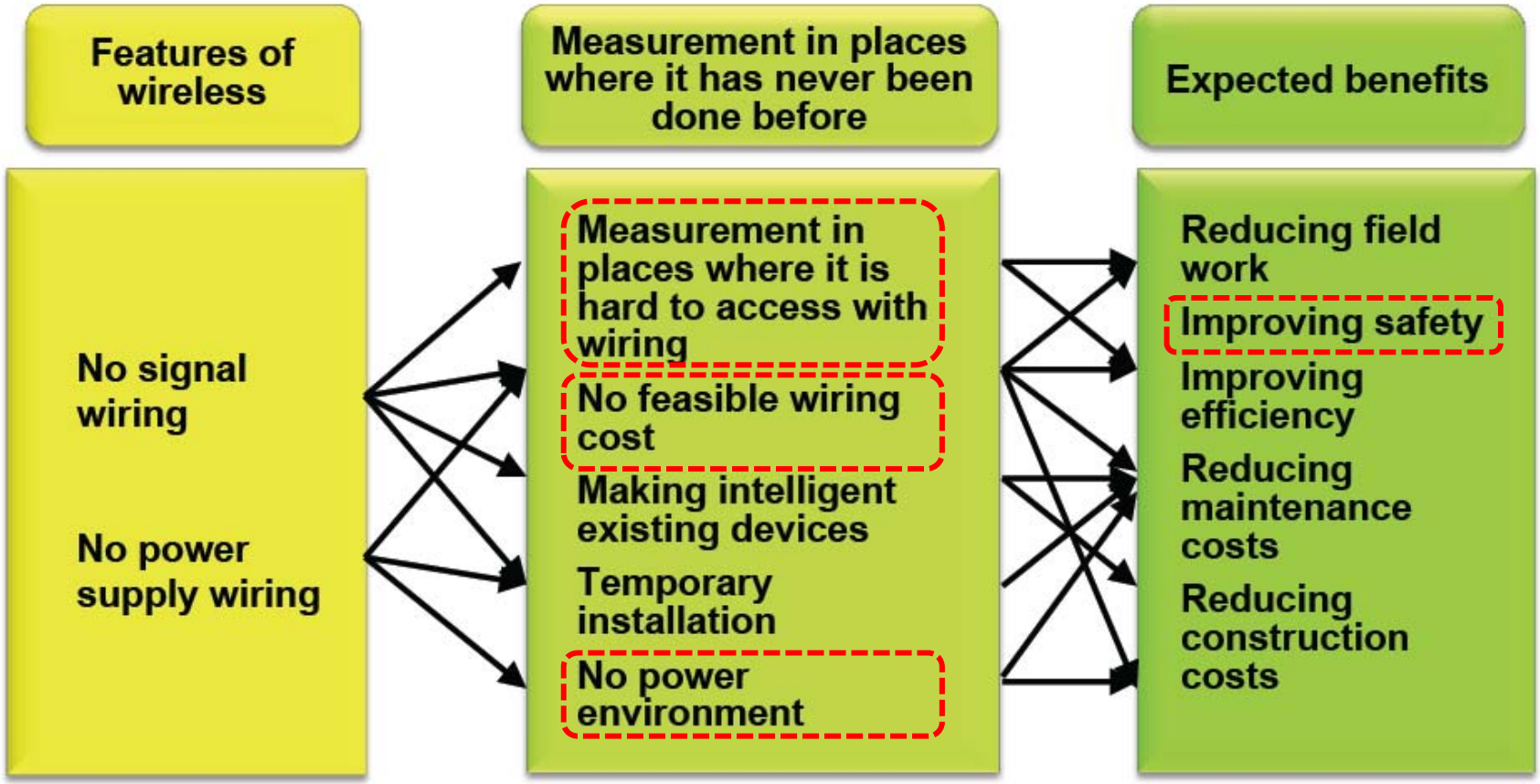
Tsunami disaster

→ Predictive monitoring

Fire of floating-roof tank

→ Emergency shutdown

2) Unique benefits of wireless



Even more remarkable points are

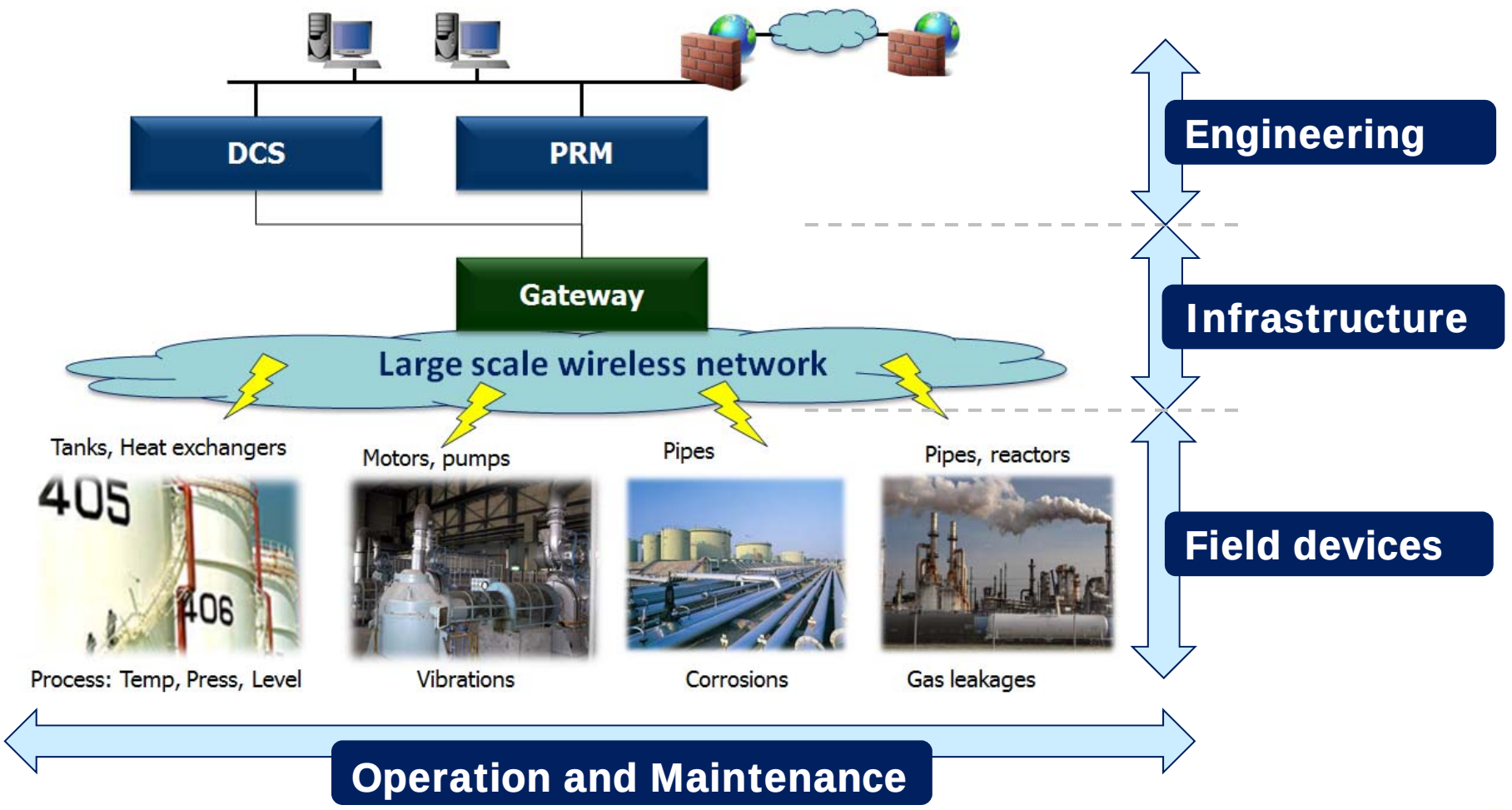
- **Robust to physical damages**
- **Easy expansion for additional measurement points**

3) Key requirements for safety applications using wireless sensor network

- **Emergency actions**
  - Committed deterministic performance
    - **Timeliness / Rapid response time**
- **Robust communication**
  - Committed reliability and availability
    - **Stable wireless communications / Fault tolerant mechanism**
- **Plant wide coverage**
  - Committed large scale configuration
    - **Long range communication / Flexible configuration**

Dependable wireless infrastructure is required

How to realize dependable wireless system for safety applications?

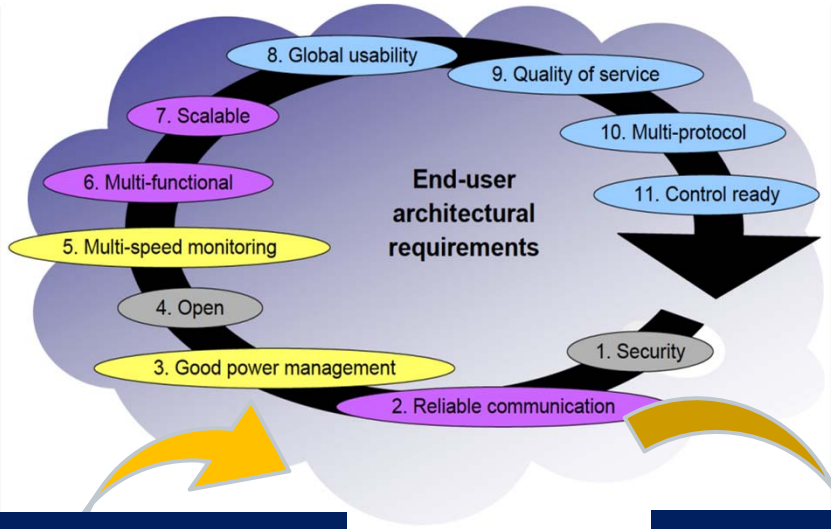


ISA100.11a (IEC 62734)
Industrial wireless network standard

Plant wide solution :

Industry
- Oil & Gas, Petrochemicals, Powers, Metals, etc.

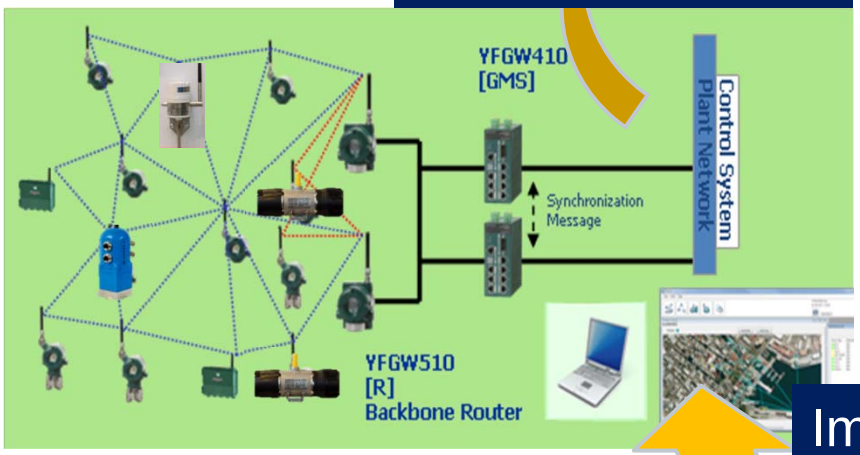
Applications
- Process monitoring
- Process control
- Asset management
- Safety alarm management
- Energy monitoring
- Environmental
- etc.



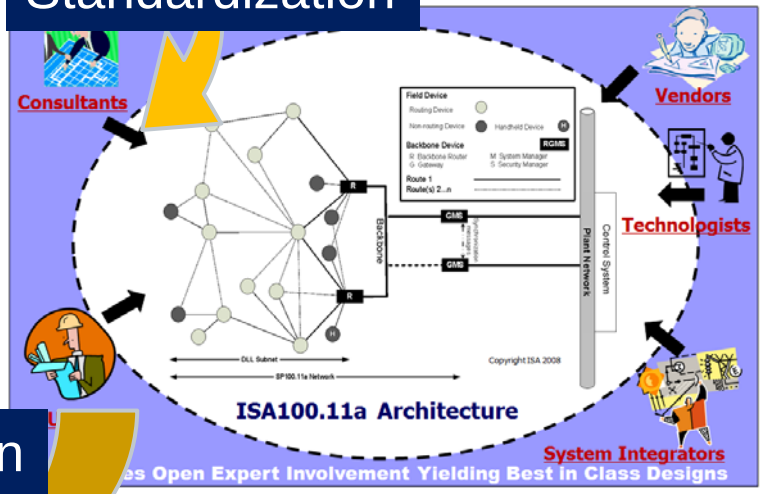
Breakthrough Technologies :

- 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

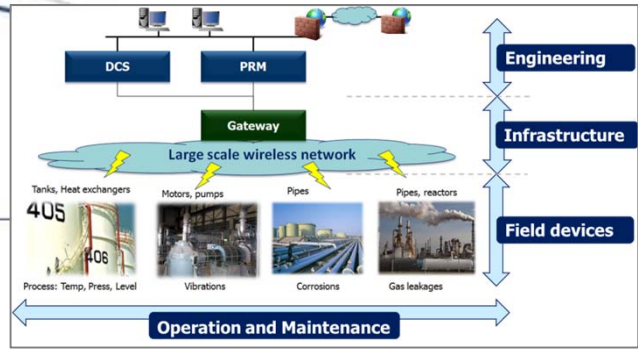


Implementation

Assure multivendor interoperability
- ISA100 compliance test
- Developing Implementation specifications

ISA100 WIRELESS COMPLIANCE INSTITUTE

4) ISA100 Wireless solutions

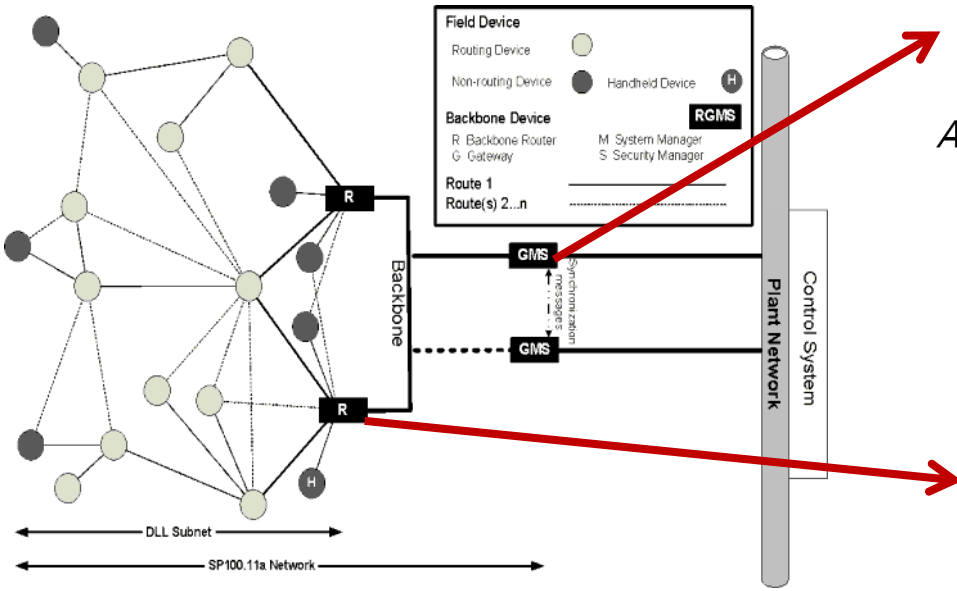


- ✓ **Wireless device**
  - ✓ **Long distance** communication (600m line of sight)
  - ✓ **Safety layer** is implemented on the top of ISA100.11a stack
  - ✓ **Multivendor interoperability** for best in class solution
- ✓ **Wireless infrastructure**
  - ✓ **Redundant Gateway** for highest reliability
  - ✓ **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

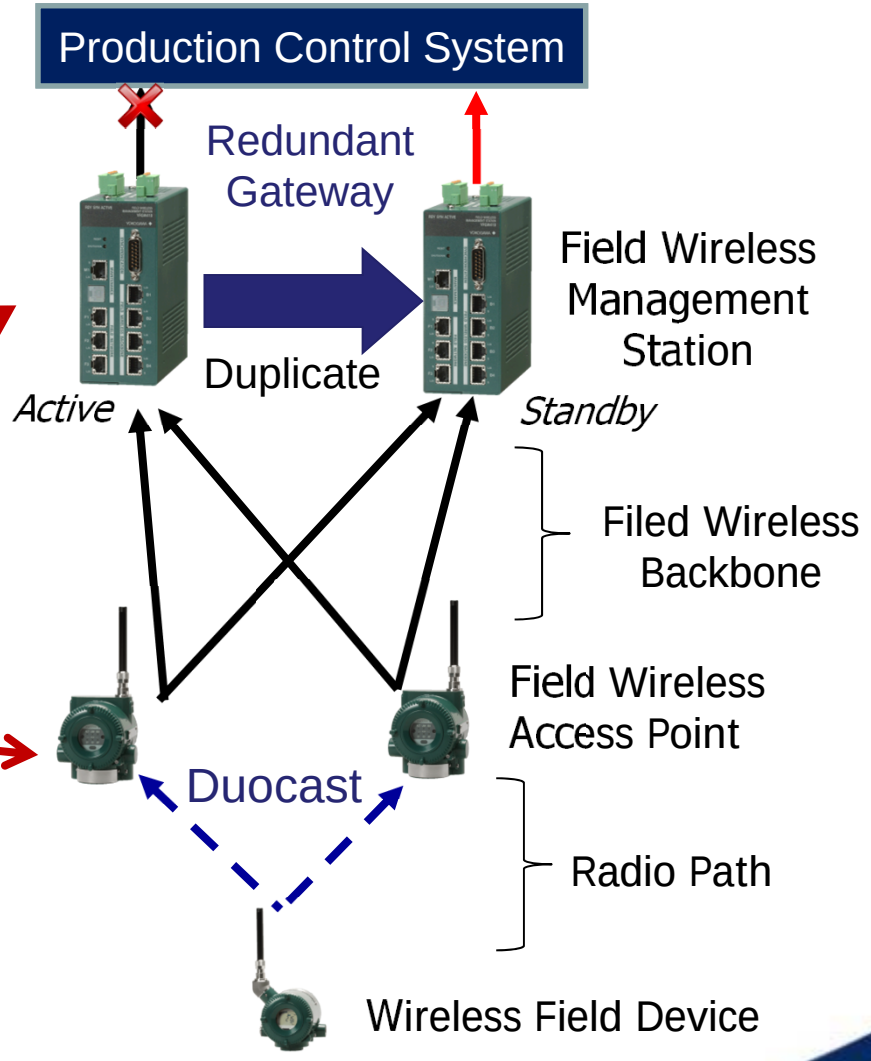
5) Design and implementations
1. ISA100 Wireless technology : Reliability

Redundant architecture for dependable wireless infrastructure

Redundant Gateway and Duocast

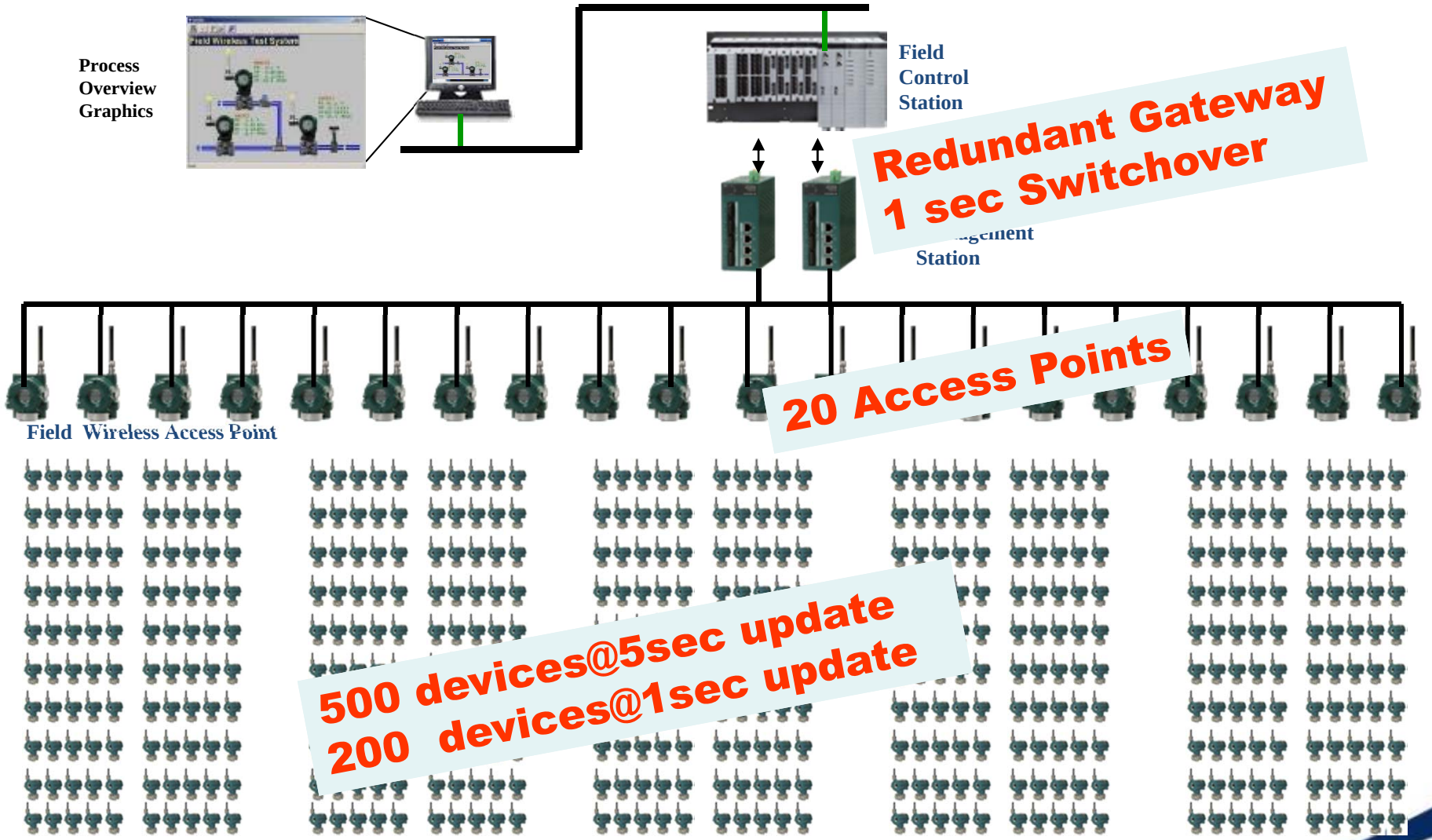


ISA100 Wireless architecture



2. ISA100 Wireless technology: Scalability

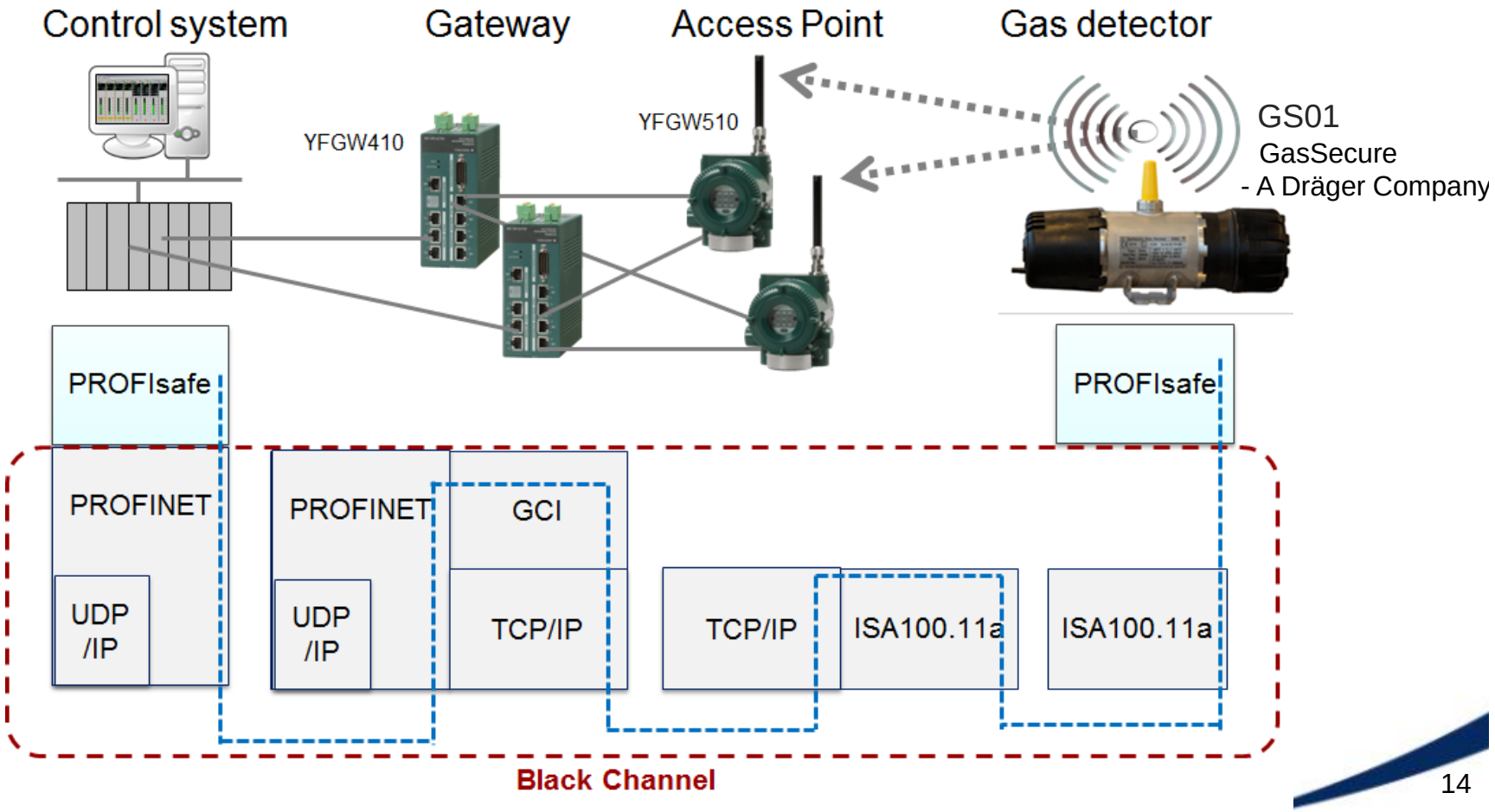
Plant wide large scale wireless infrastructure



Implementations
SIL 2 certified wireless gas detection system

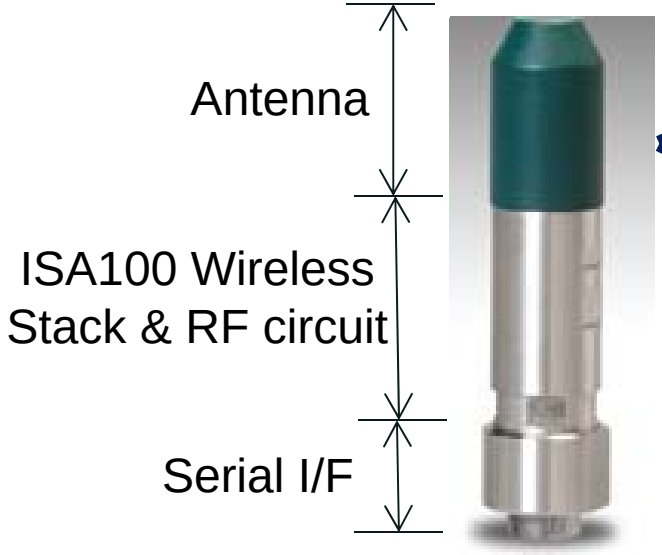
Communication flows

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



Implementations
Wireless module enables expanding of solutions

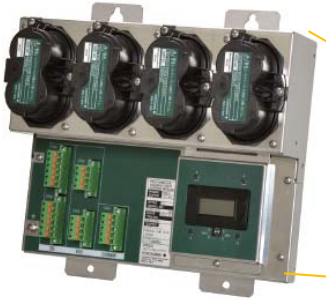
ISA100 Wireless communication functions are capsulated in the antenna radio module



Wireless Adapters

Rader level meter

Paperless recorder with Gateway



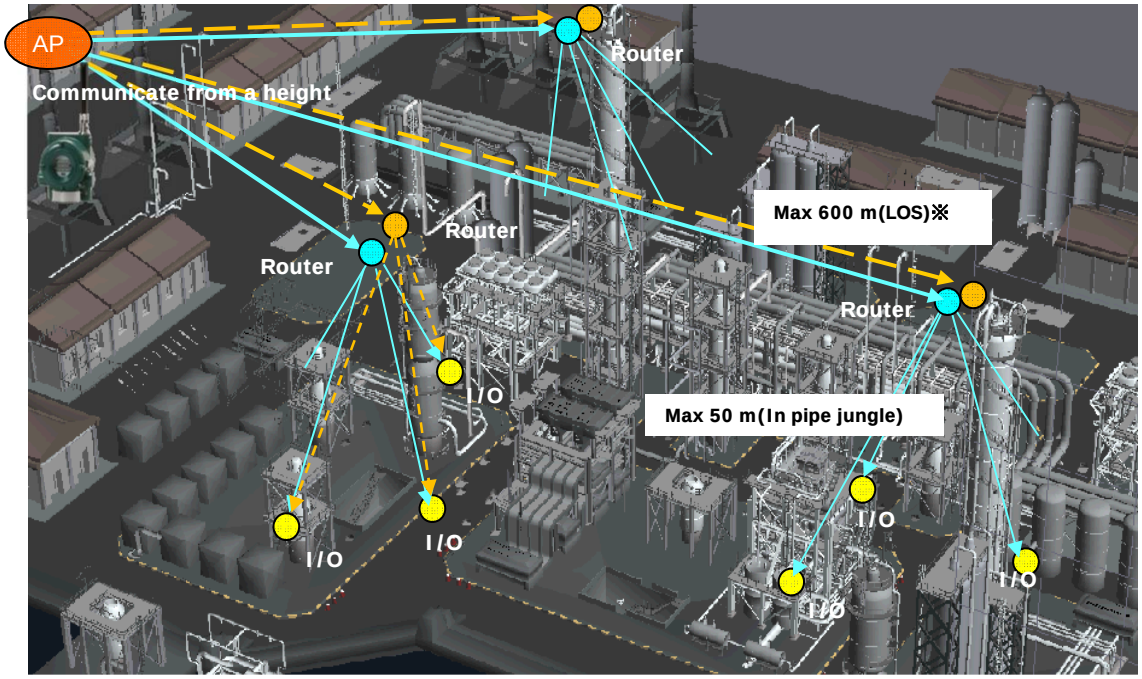
Valve control box for emergency shutdown

Modularizing wireless components accelerate product development

- **Certified radio regulations**
- **Certified Intrinsically Safety**

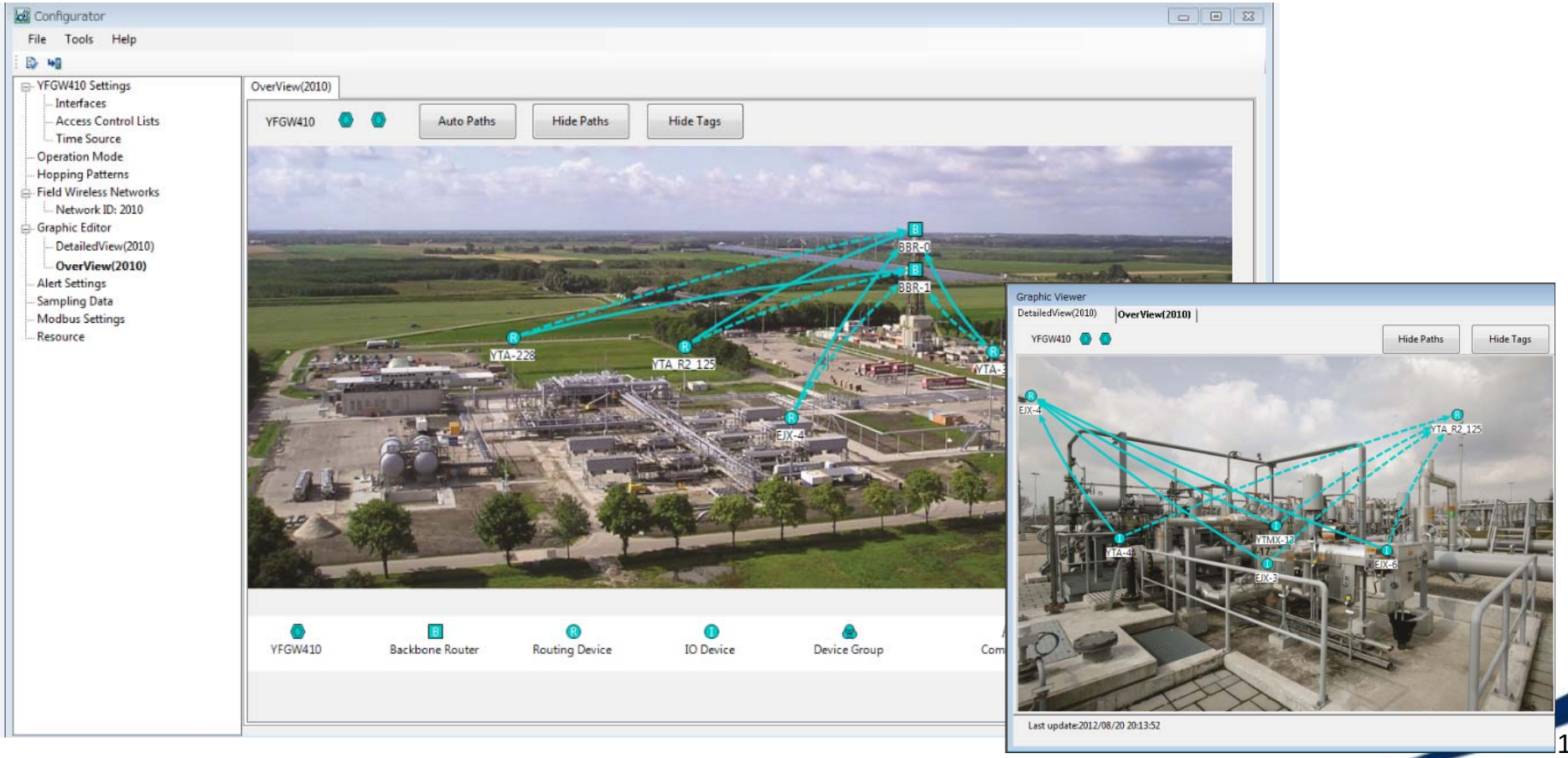
Implementations
Network design for stable communication

- The **“Sky Mesh” concept** for wireless installation enables plant wide wireless infrastructure
  1) Deterministic communication with **short latency** (minimizing hops)
  2) Reliable communication by **redundant communication** paths
  3) Scalable wireless infrastructure for future expansion
  4) Predictable and long battery life by minimizing number of routers
  5) Easy engineering of wireless network by configuration tool, not ad-hoc

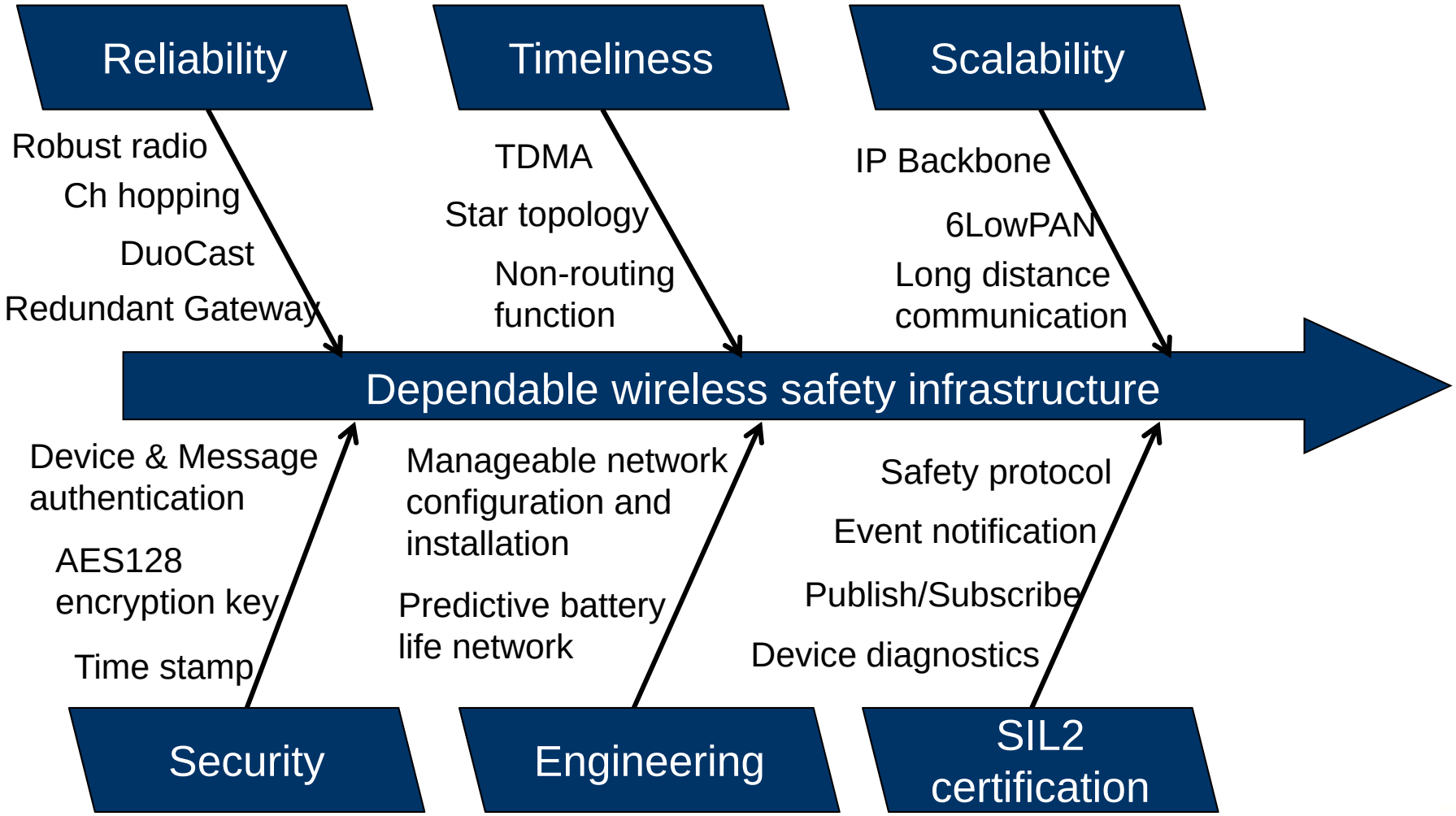


Implementations
RF planning tool

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



Summary of design and implementations for wireless safety system



6) Applications using ISA100 Wireless
1: World first SIL2 Wireless Gas detector

Use for LNG production facility in Northern Europe

Press Release

Tokyo, Japan–July 23, 2015

Yokogawa and GasSecure Provide

SIL2-certified Wireless Gas Detection System for LNG Facility

Yokogawa Electric Corporation and GasSecure AS, a Dräger owned company, announce the delivery of the world's first SIL2[*1]-certified wireless gas detection system for use at an LNG facility in Northern Europe. On this date, the two companies will begin promoting the unique capabilities of this system solution to companies that have a strong interest in maintaining safe and secure operations.

GasSecure – A Dräger Company : GS01 Gas Detector

System overview

- The system uses GS01 wireless gas detectors (GasSecure - A Dräger Company) to measure hydrocarbon gas concentrations and Yokogawa ISA100 Gateway.
- Rapid response including gas-detecting time & communication
- Low energy consumption
- The gateway has PROFINET implemented in order to communicate with the controller which has PROFIsafe .

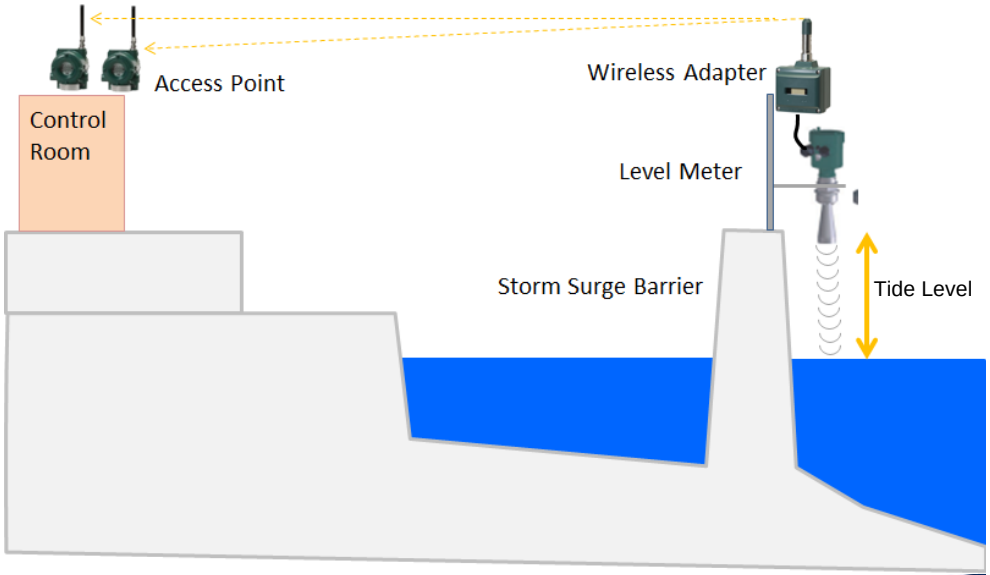
2: Tsunami warning system

Lessons learned from the great east Japan earthquake disaster

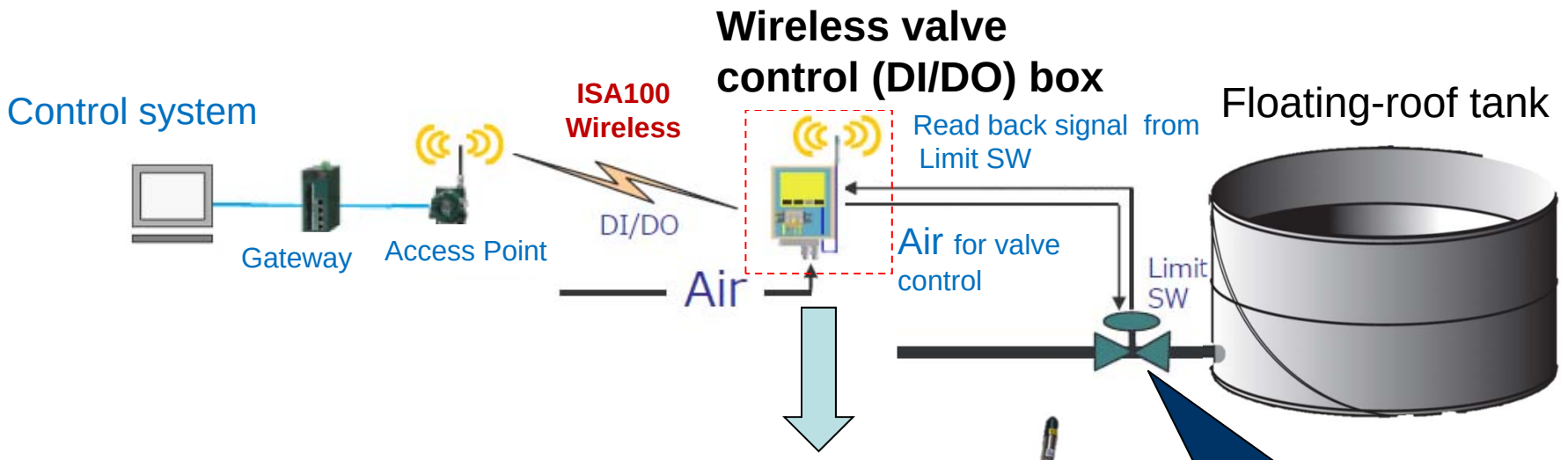
Level meters equipped with the wireless adaptor are installed on a storm surge barrier near the plant to monitor the tide level. Because a tsunami is usually preceded by a sudden ebb tide, detecting a sudden lowering of tide level may indicate a tsunami.

System overview

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



3: Remote valve control for emergency action



Close drain valve to avoid fire accident when big earthquake occurred

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

Conclusion

- Industrial wireless technology creates big opportunities to provide new paradigm for plant safety
- Dependable plant wide infrastructure must be required for 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