



Safety and alarming applications using ISA100 Wireless

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Presenter

Toshi Hasegawa is a Manager of standard department, Marketing Head quarters. 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.



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 sent 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) 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 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

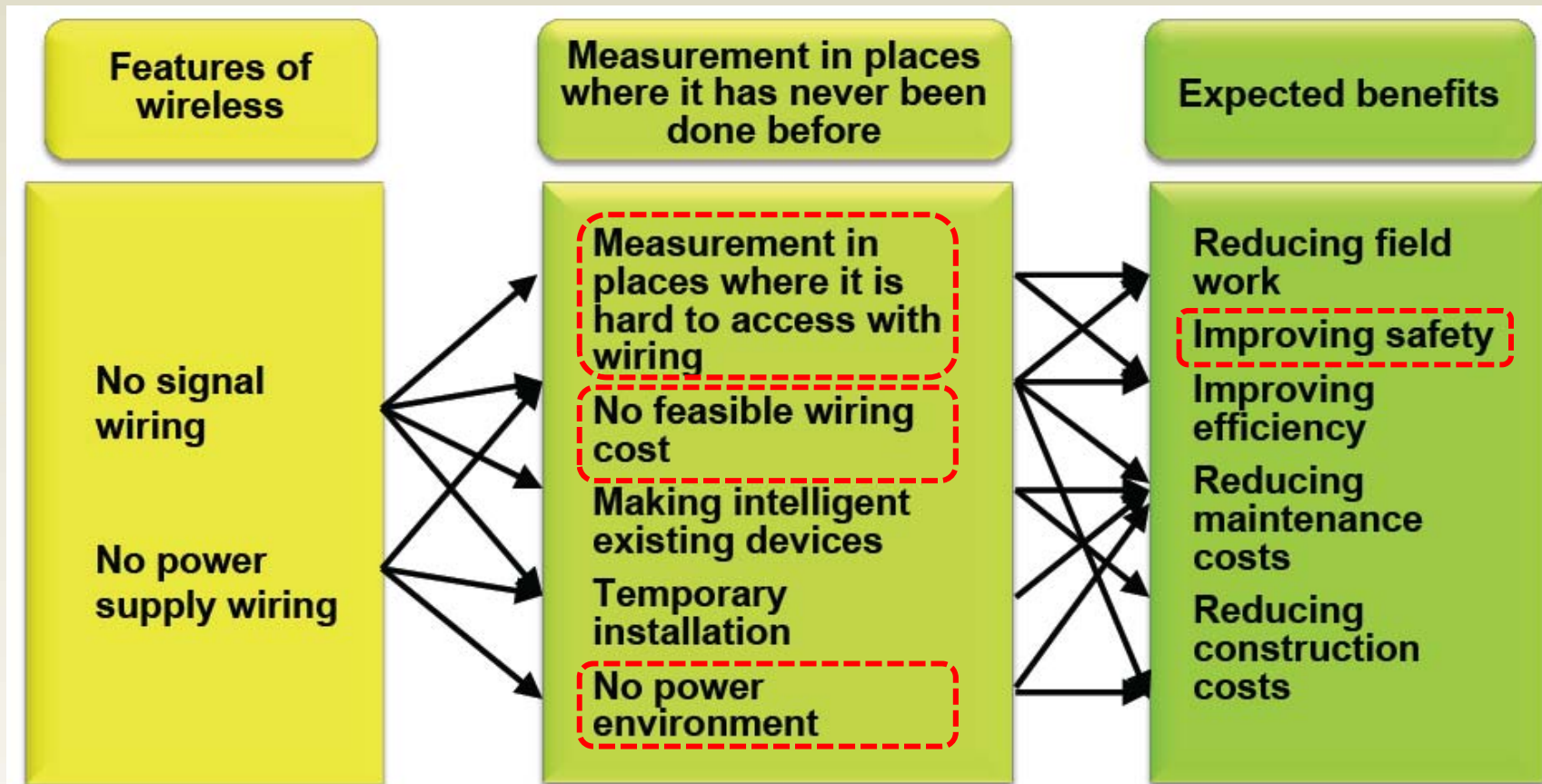


Tsunami disaster
→ Predictive monitoring



Fire of floating-roof tank
→ Emergency shutdown

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**

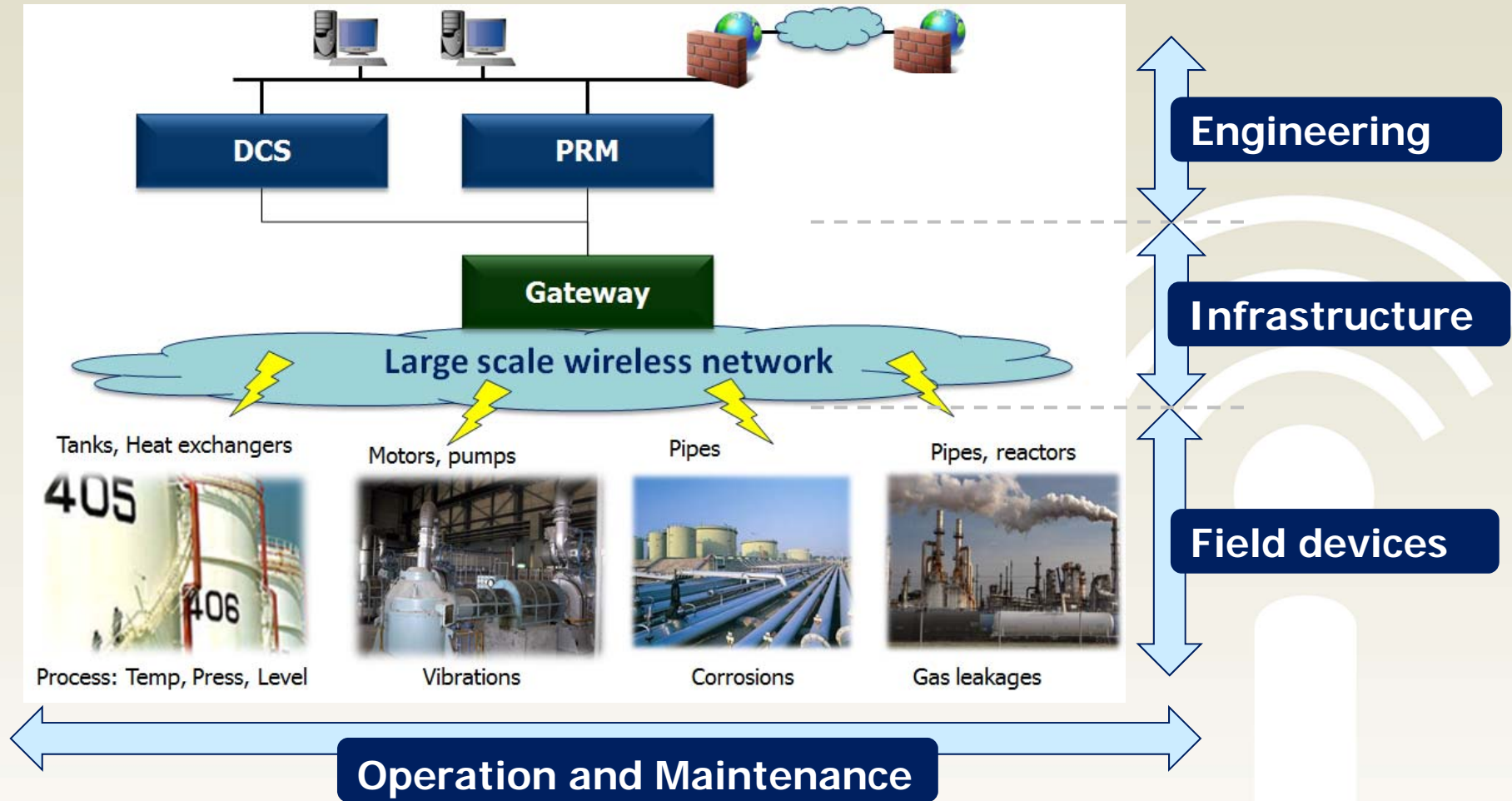


- Committed large scale configuration

- 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

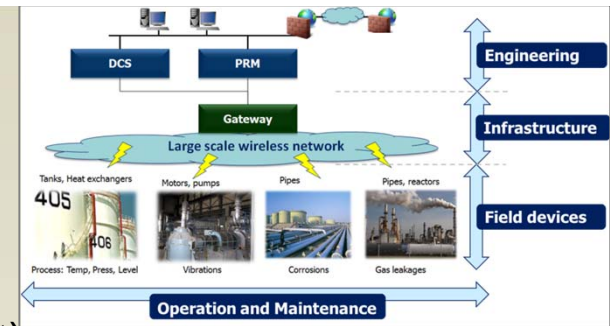
- ✓ **Redundant Gateway** for highest reliability
- ✓ **Multiple access point** for scalable and flexible network
- ✓ **500 devices** can be managed per one Gateway
- ✓ **Coexistence management** with CCA/Ch Black listing

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

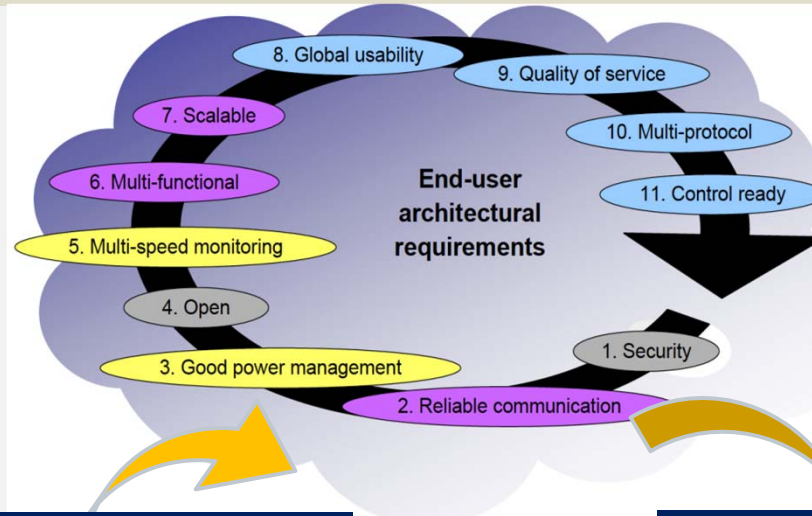


ISA100 Wireless (ISA100.11a / IEC 62734)

Industrial wireless network standard

Plant wide solution :

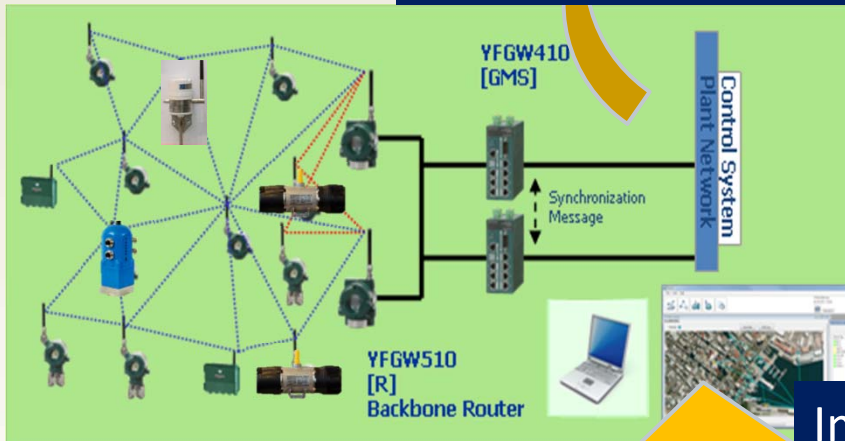
- Industry
- Oil & Gas, Petrochemicals,
- Powers, Metals, etc.
- Applications
- Process monitoring
- Process control
- Asset management
- Safety alarm management
- Energy monitoring
- Environmental
- etc.



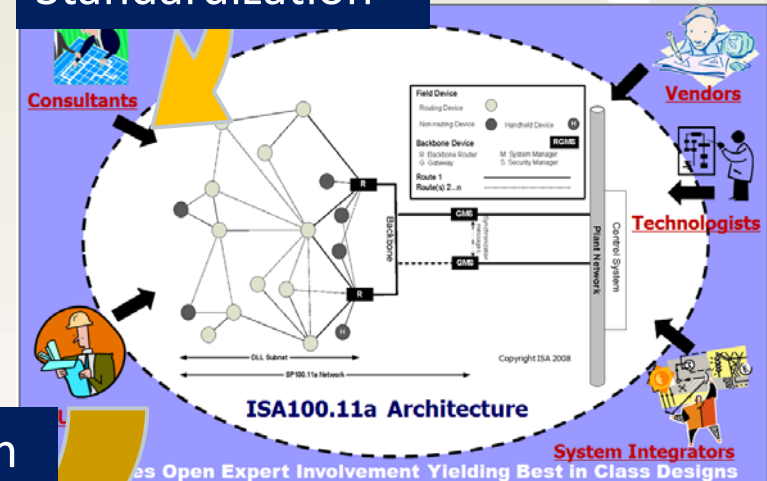
Breakthrough Technologies :

- 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 Wireless System



Temperature Transmitter
YTA510



Field Wireless
Access Point
YFGW510



Field Wireless
Management Station
YFGW410



Field Wireless
Media Converter
YFGW610



Multiprotocol
Wireless Adapter



Field Wireless
Access Point
YFGW510



Pressure transmitter
EJX510B



Pressure transmitter
EJX110B/EJX430B/EJX310B



EJX210B
Flange mounted
Differential Transmitter



Temperature Multiplexer
YTMX580



EJX118B/EJX438B
Differential Transmitter
With Diaphragm Seal



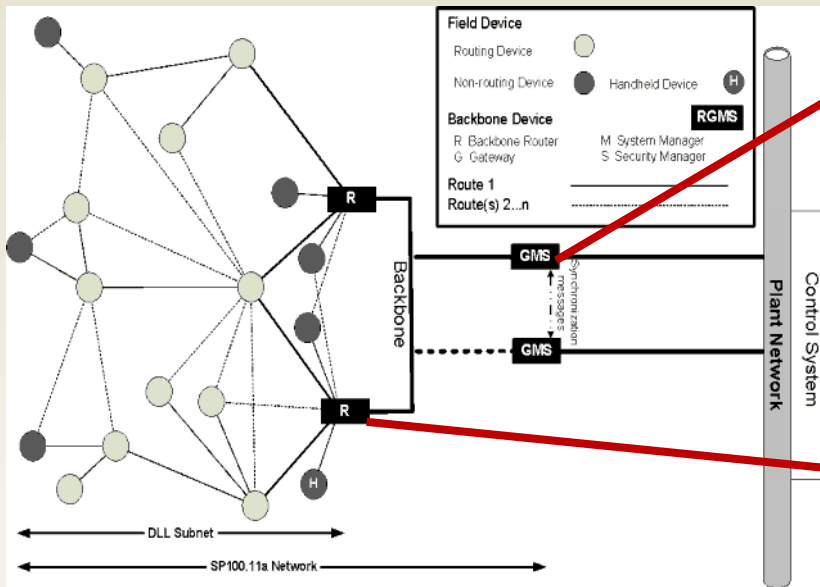
ISA100 Wireless key implementations

1. Reliability

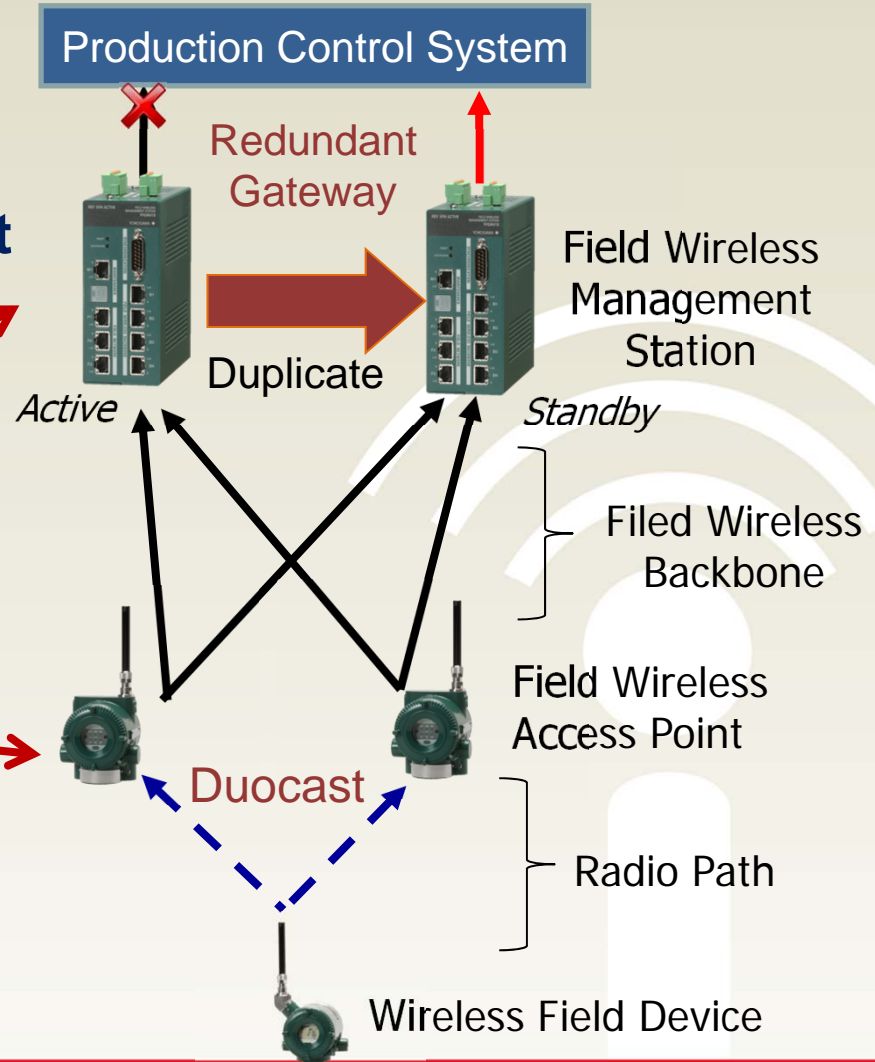
Fault Tolerance



Redundant Gateway and Duocast

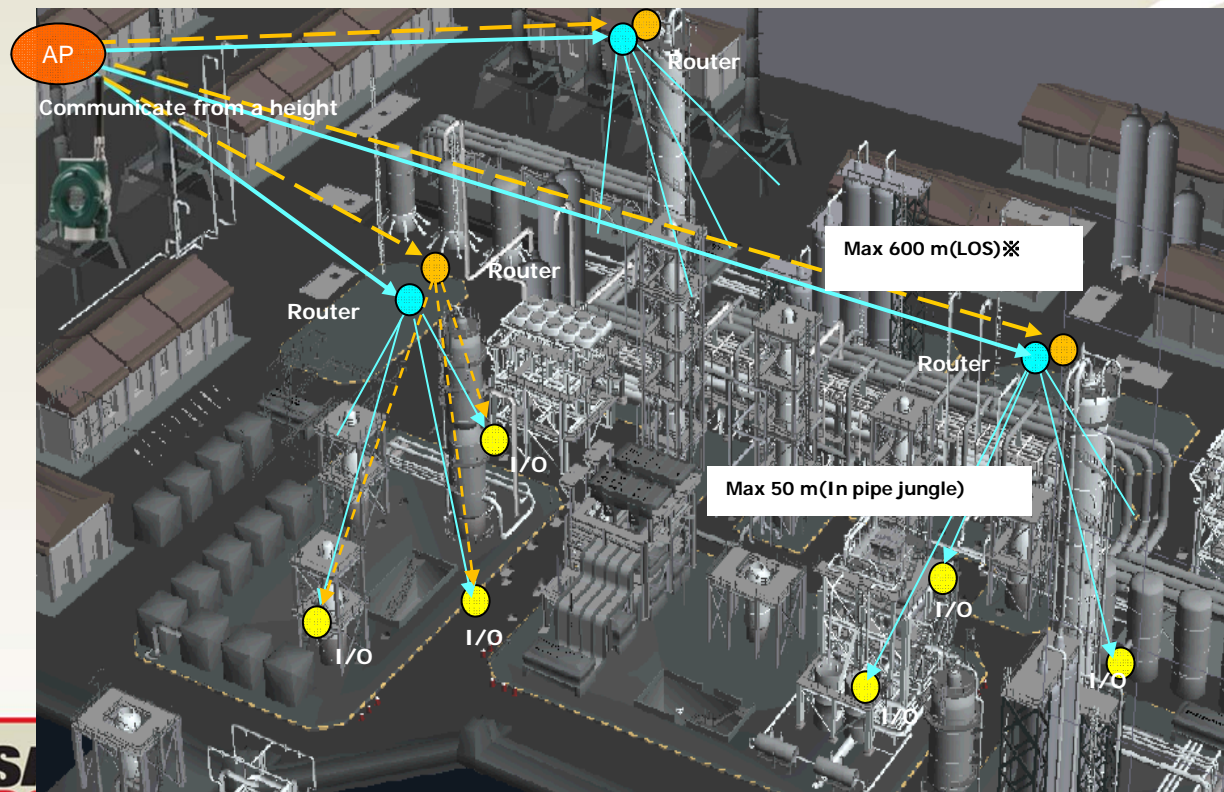


ISA100 Wireless Architecture



2. Timeliness

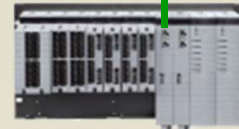
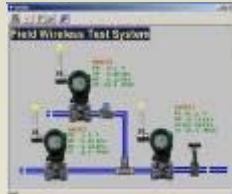
- **TDMA:** Time Division Multiple Access
- **Publish / Subscribe:** Periodic data transmission
- The “**Sky Mesh**” : Network planning concept
 - 1) **Deterministic communication with short latency** (minimizing hops)
 - 2) Reliable communication with **redundant paths**, Predictable battery life



3. Scalability

Plant wide large scale wireless infrastructure

Process
Overview
Graphics



**Redundant Gateway
1 sec Switchover**

Management
Station

ISA100 Full Functional



Field Wireless Access Point

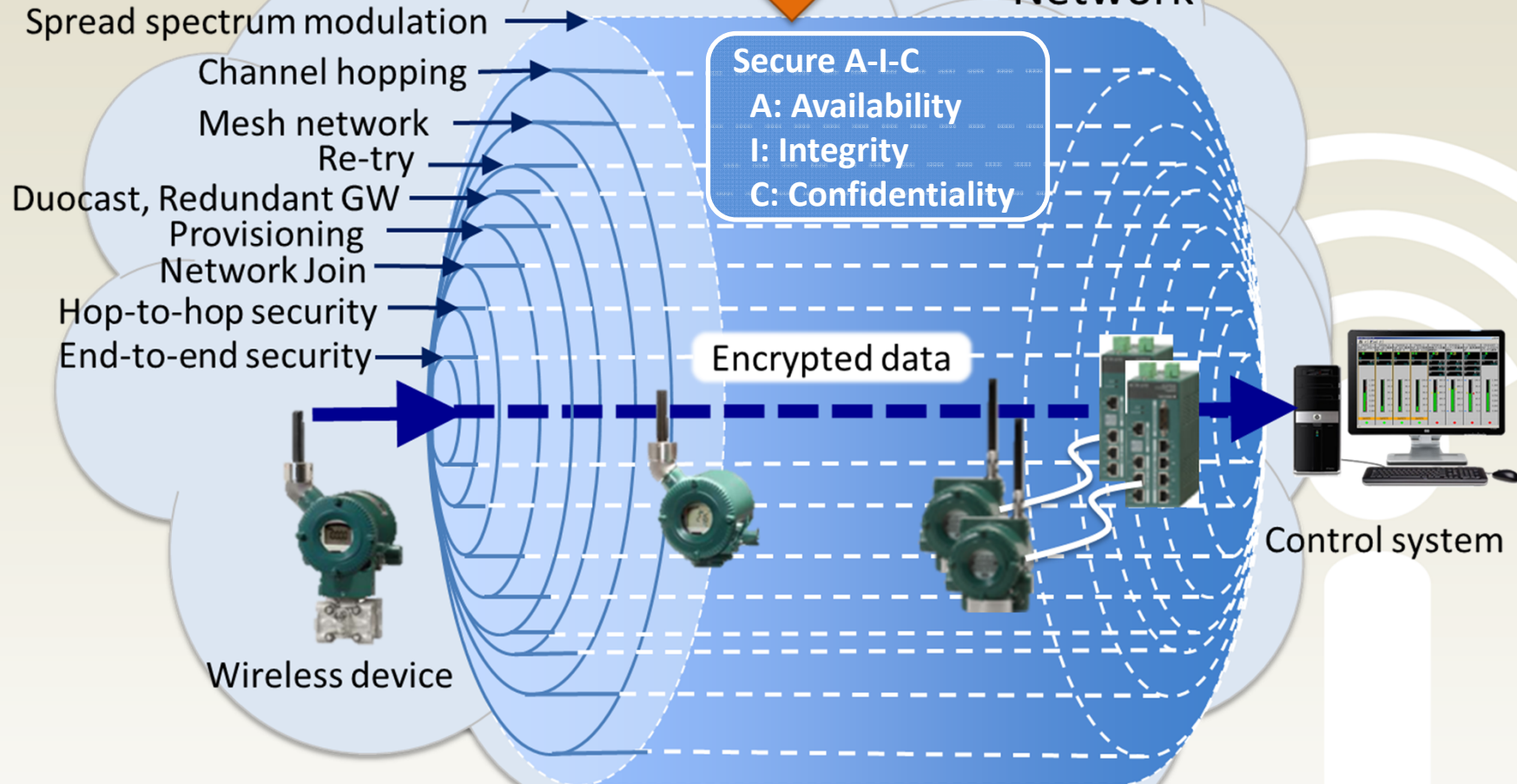
**500 devices@5sec update
200 devices@1sec update**

4. Security

Security threats

- Sniffing
- Data falsification
- Spoofing
- Reply attack

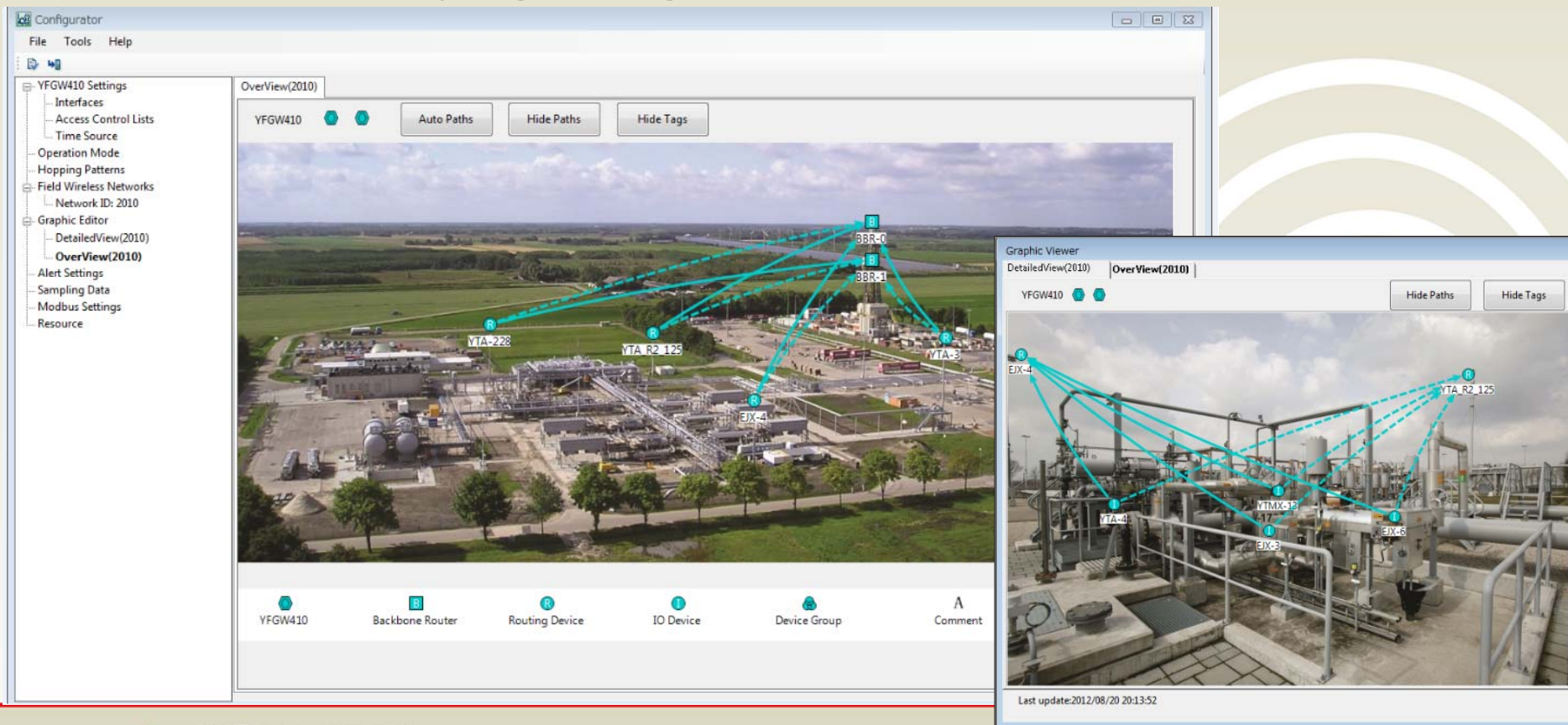
ISA100 Wireless Network



5. Engineering

RF network planning tool

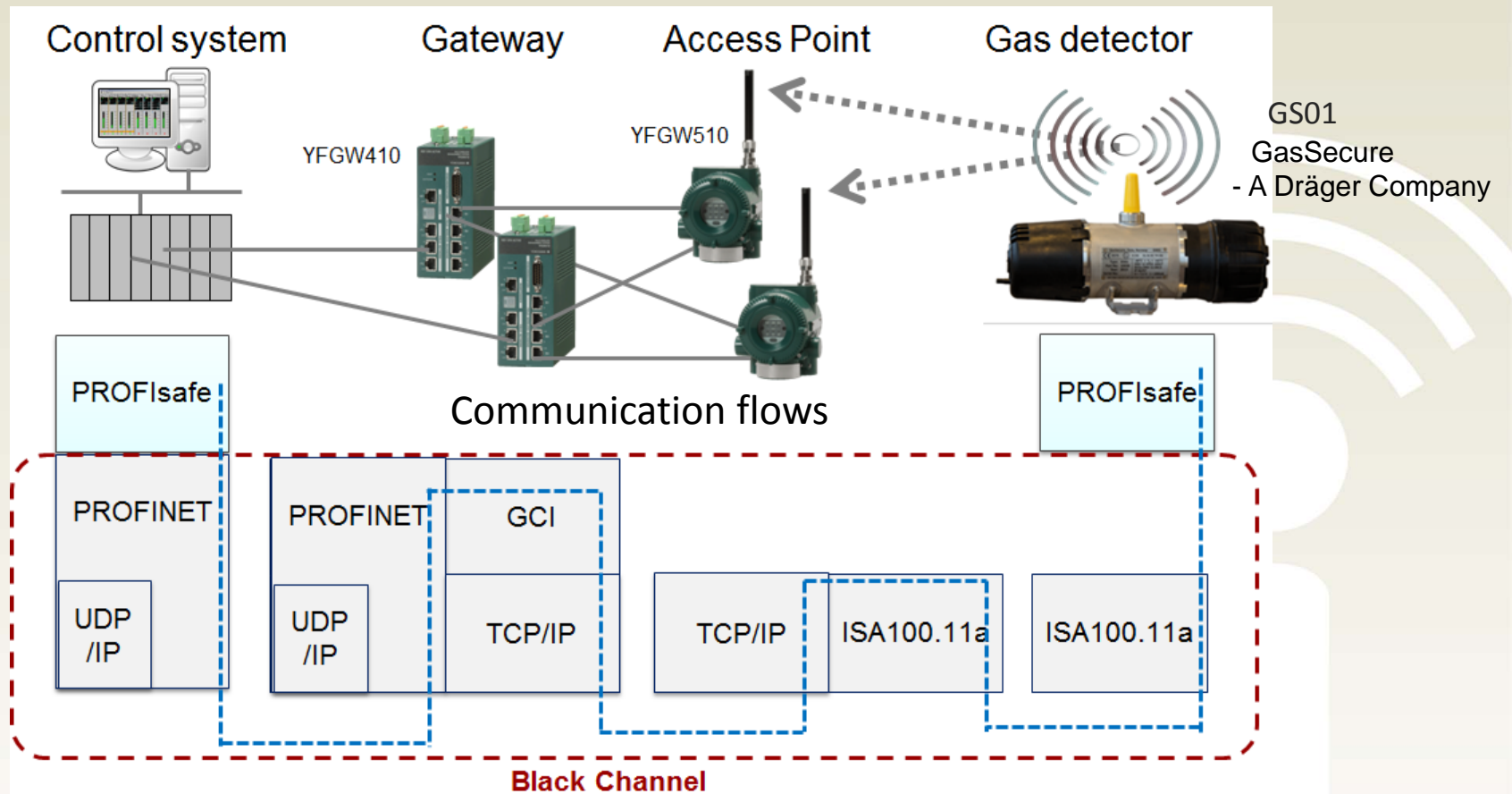
- Fix communication paths visually on graphic display
- Press auto paths button so that communication paths are automatically indicated : Easy engineering



6. SIL2 certification

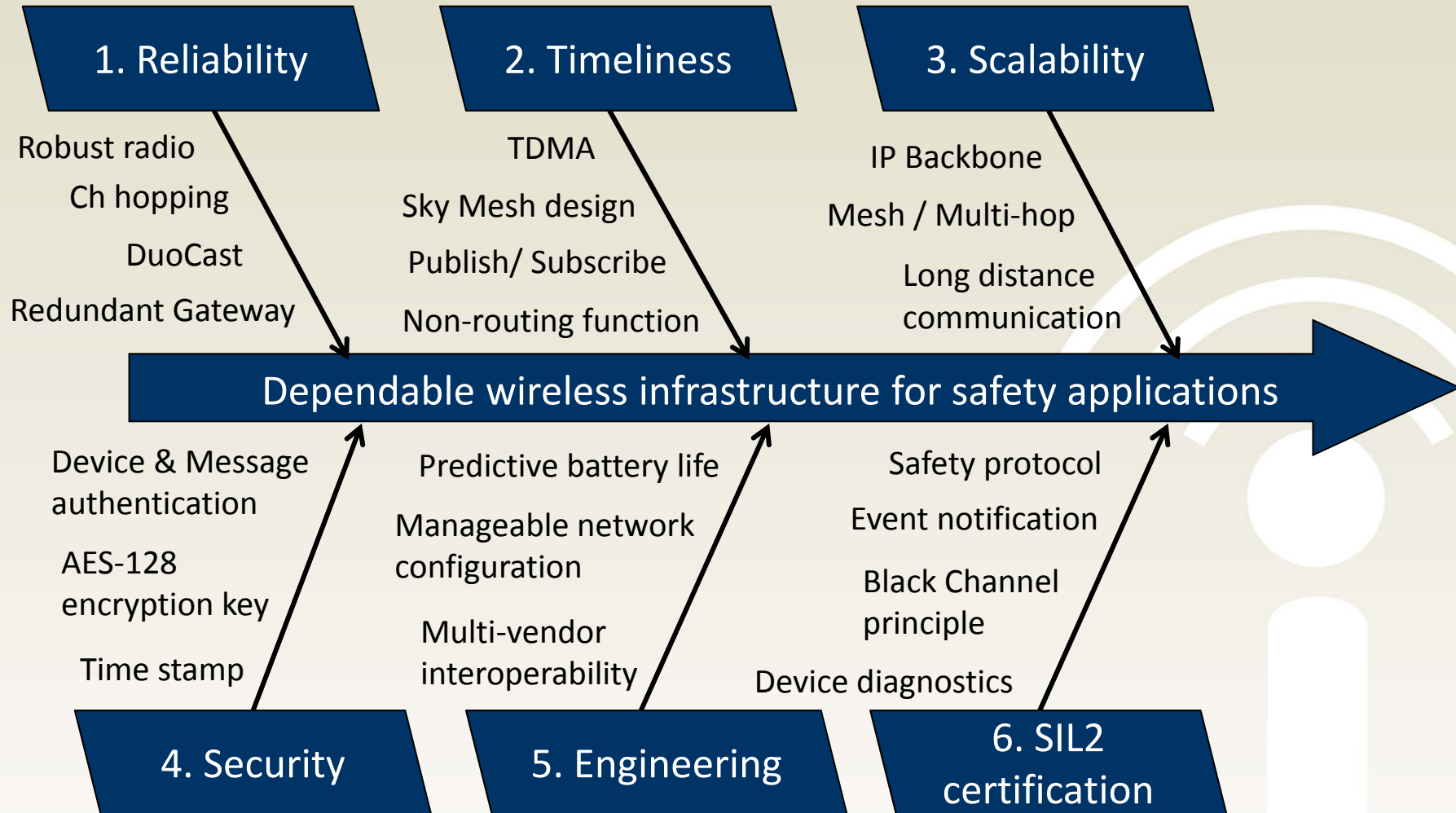
SIL2 Gas detection system

- Wireless protocol: ISA100 Wireless
- Safety protocol: PROFI-safe over PROFINET



Summary

ISA100 Wireless key implementations



Applications

1: World first SIL2 Wireless Gas detector

Press Release

YOKOGAWA

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 .



PETRONAS

RSSI & PER

The ISA100 wireless system reliability, interoperability, and stability were put on test for six (6) months by monitoring the Received Signal Strength Indicator (RSSI) and the Packet Error Rate (PER).

Robust and Reliable Wireless Network of 5km with Received Signal Strength Indicator (RSSI) of approximate 60dbm and Packet Error Rate (PER) of 0%

Field Testing of Long Distance ISA100 Wireless Transmitter and Wireless Gas Detector

Device ID	Network ID	Asset/Field	Device Role	Link Status	Operational Status	Antenna Location	RSSI (dBm)	PER (%)	Security Status	RSSI (%)	PER (%)	Battery Life (%)	Power Supply Status
0501-101	101	0501/101	TX	Full (OK)	Full (OK)	TX0101-1	-60dBm	0%	VT0101-1	60dBm	0%	75%	100-15%
0501-201	101	0501/101	TX	Full (OK)	Full (OK)	TX0101-2	-60dBm	0%	VT0101-2	70dBm	0%	70%	75-20%
0501-301	101	0501/101	TX	Full (OK)	Full (OK)	TX0101-3	-60dBm	0%	VT0101-3	60dBm	0%	70%	75-20%
07-500	101	7001/6000	TX	Full (OK)	Full (OK)	TX0101-4	-60dBm	0%	VT0101-4	70dBm	0%	100%	100-15%
07-501	101	7001/6000	TX	Full (OK)	Full (OK)	TX0101-5	-60dBm	0%	VT0101-5	70dBm	0%	100%	100-15%
07-502	101	7001/6000	TX	Full (OK)	Full (OK)	TX0101-6	-60dBm	0%	VT0101-6	70dBm	0%	100%	100-15%
07-503	101	7001/6000	TX	Full (OK)	Full (OK)	TX0101-7	-60dBm	0%	VT0101-7	70dBm	0%	100%	100-15%
07-504	101	7001/6000	TX	Full (OK)	Full (OK)	TX0101-8	-60dBm	0%	VT0101-8	70dBm	0%	100%	100-15%
07-505	101	7001/6000	TX	Full (OK)	Full (OK)	TX0101-9	-60dBm	0%	VT0101-9	70dBm	0%	100%	100-15%
07-506	101	7001/6000	TX	Full (OK)	Full (OK)	TX0101-10	-60dBm	0%	VT0101-10	70dBm	0%	100%	100-15%

Last updated: 2015/01/27 10:10:21



Field Testing of Long Distance ISA100 Wireless Transmitter and Wireless Gas Detector
DEIC/DE/P&E/TG
Ali Azizan Maamor

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<http://www.isa100wci.org/en-US/Learning-Center/White-Papers>



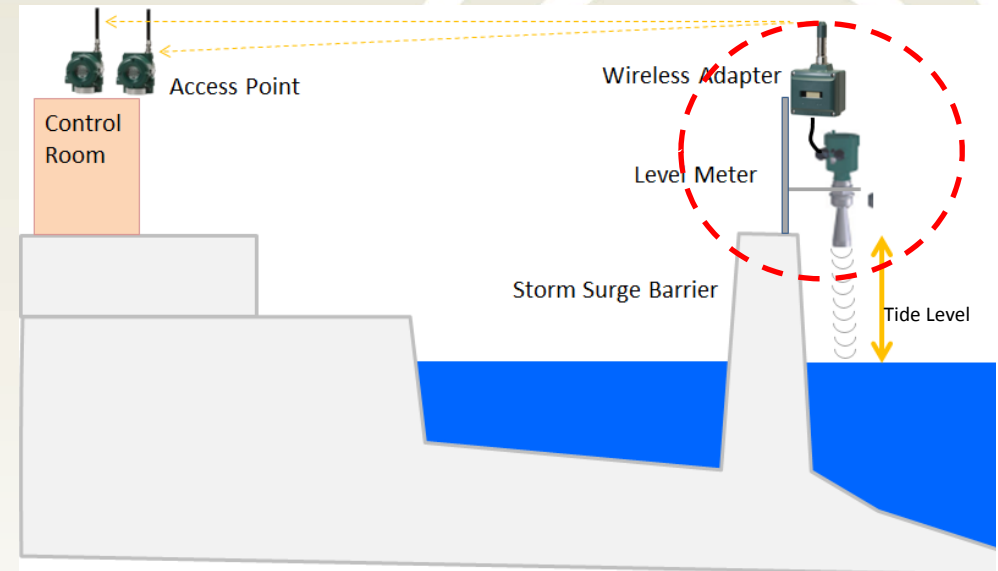
2: Tsunami warning system

Lessons learned from the great east Japan earthquake disaster

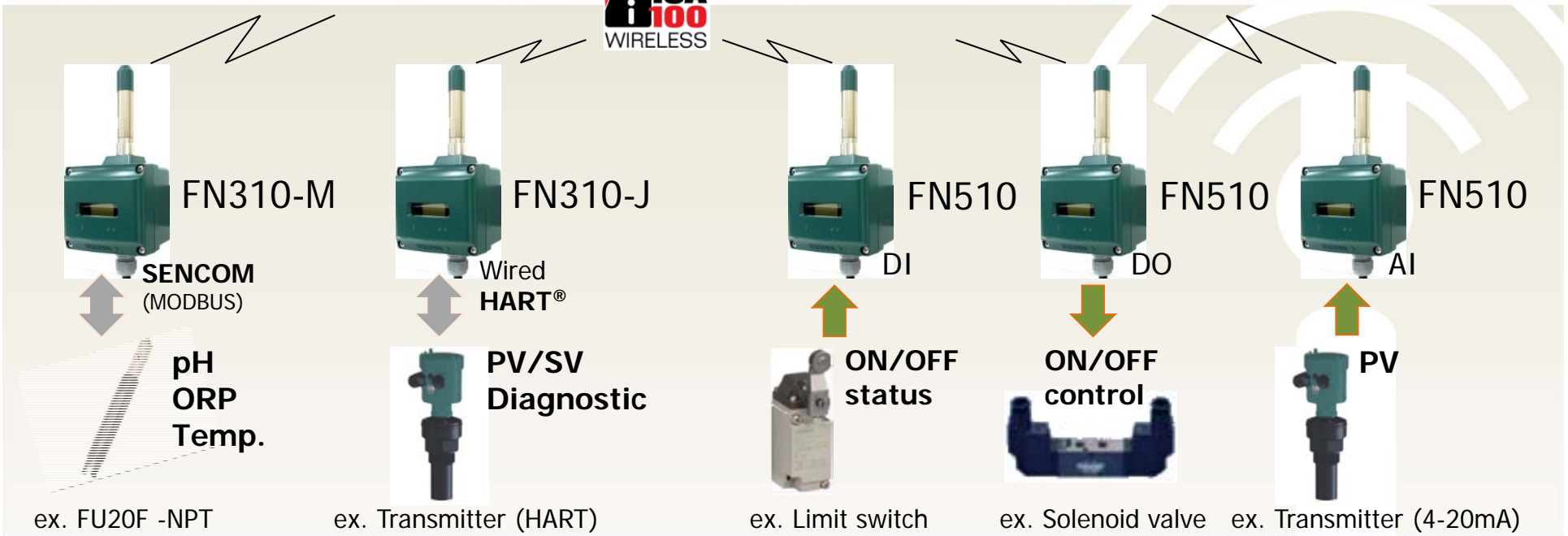
Level meters equipped with the wireless adaptor are installed on a storm surge barrier near the plant to monitor the tide level. Because a tsunami is usually preceded by a sudden ebb tide, detecting a sudden lowering of tide level may indicate a tsunami.

System overview

- Level 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

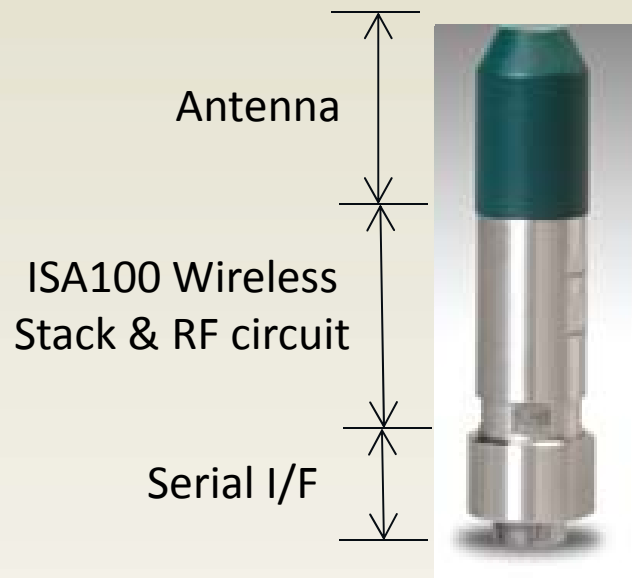


Wireless Adapter - Supports multiple protocols



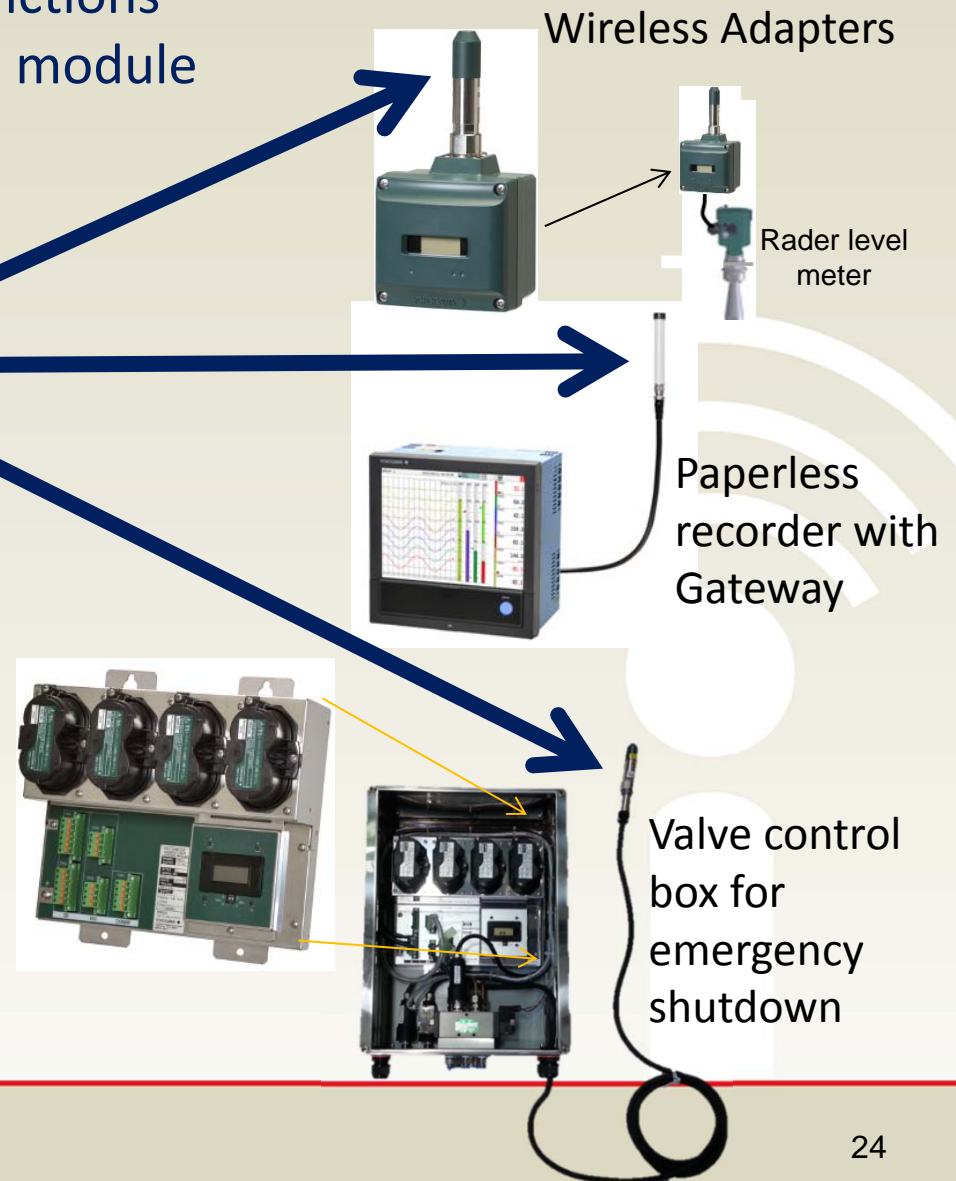
ISA100 Wireless radio module

ISA100 Wireless communication functions are capsulated in the antenna radio module

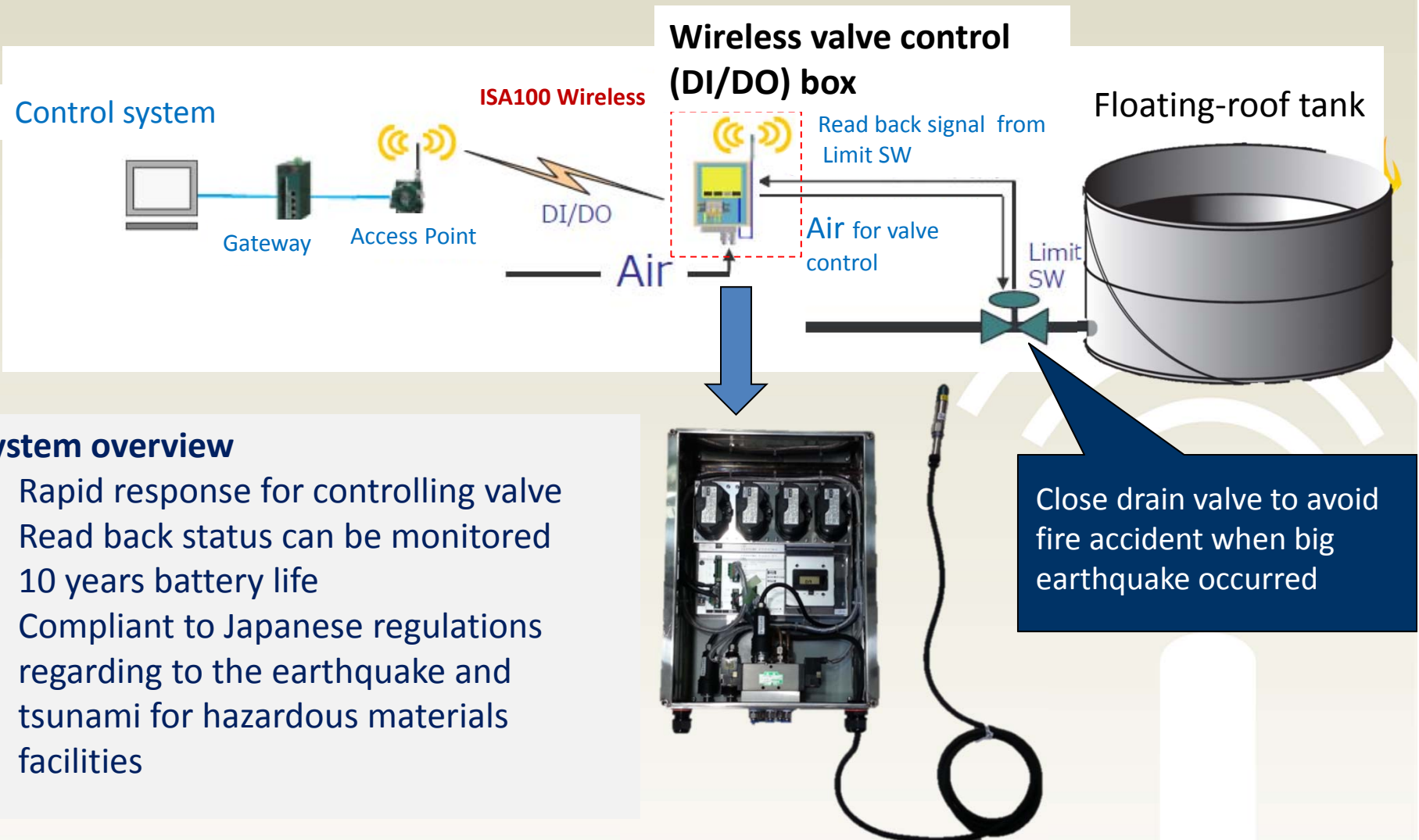


Modularizing wireless components to accelerate product development

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




3: Remote valve control for emergency action




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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