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

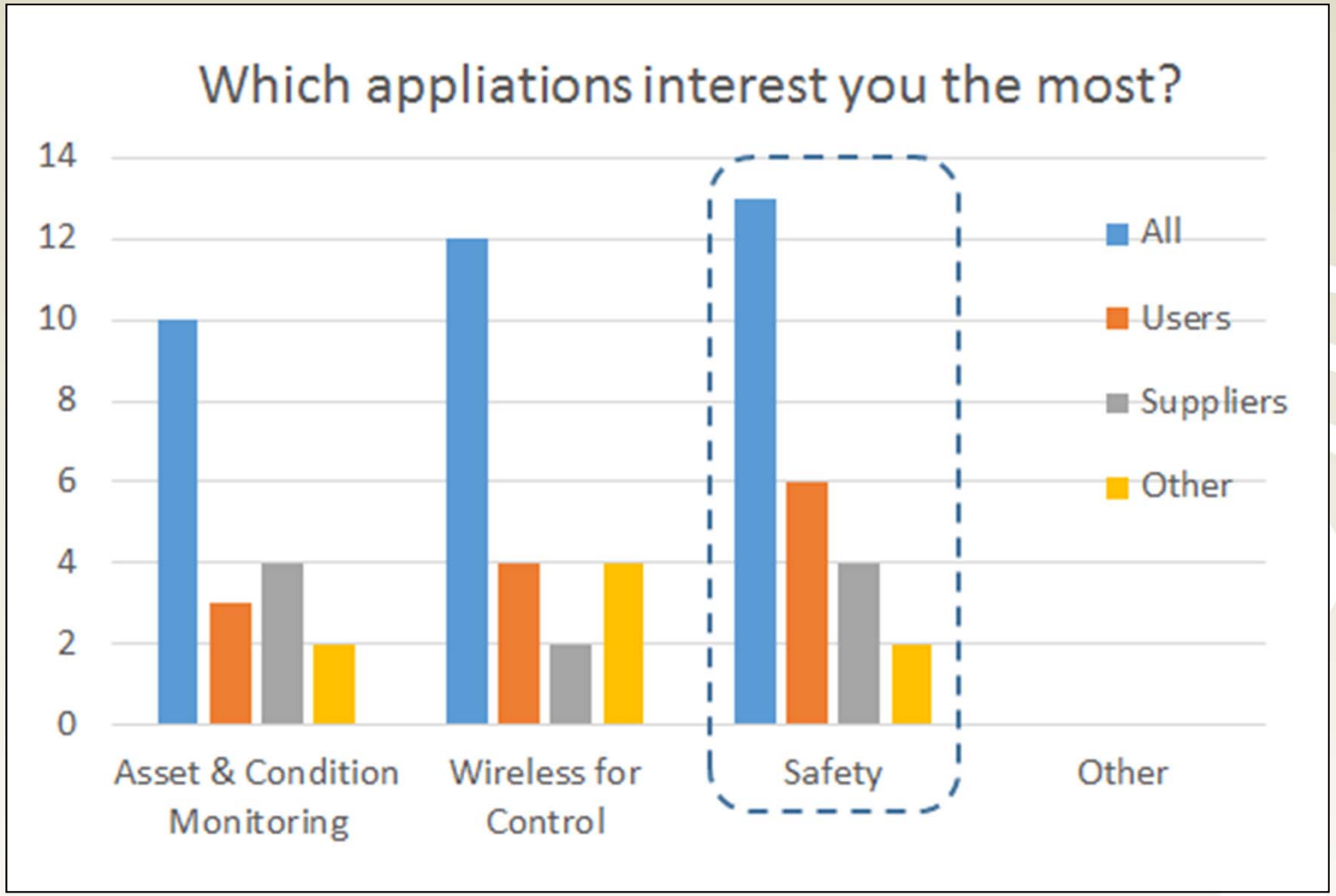
- On Sunday evening 14th April 1912 the largest passenger ship in the world, Titanic struck an iceberg
- The radio operators onboard were employed by Marconi International Marine
- They sent a distress signal **alerting** the world and the Carpathia "CQD CQD SOS Titanic Position 41.44 N 50.24 W.·····"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

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

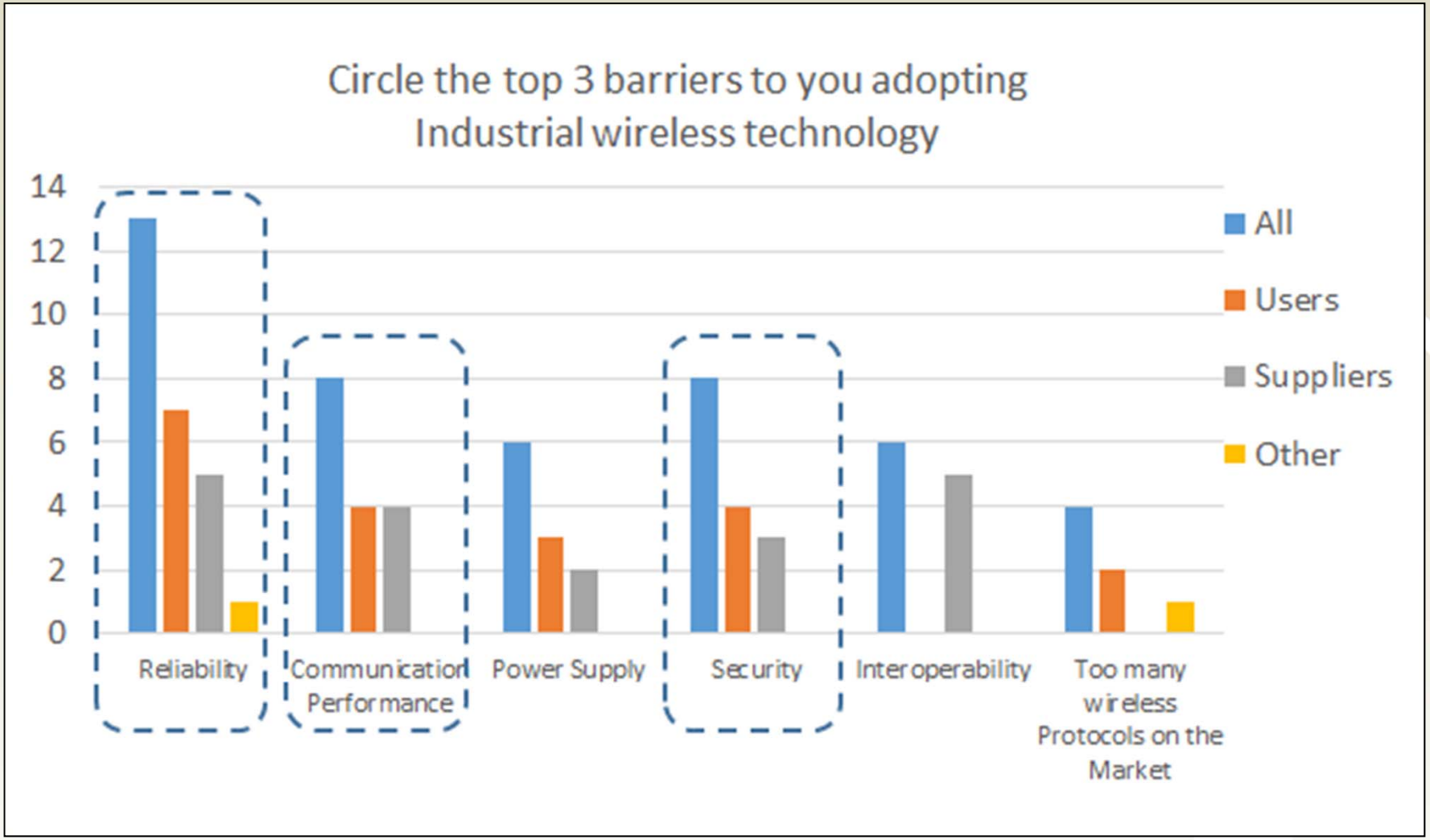
Today's topics

1) Review WCI end use seminar Mar 1st survey
2) Motivation of wireless for plant safety
3) Benefits of wireless
4) Key requirements
5) ISA100 Wireless solutions
6) Applications
7) Summary

Review WCI end use seminar Mar 1st survey -1

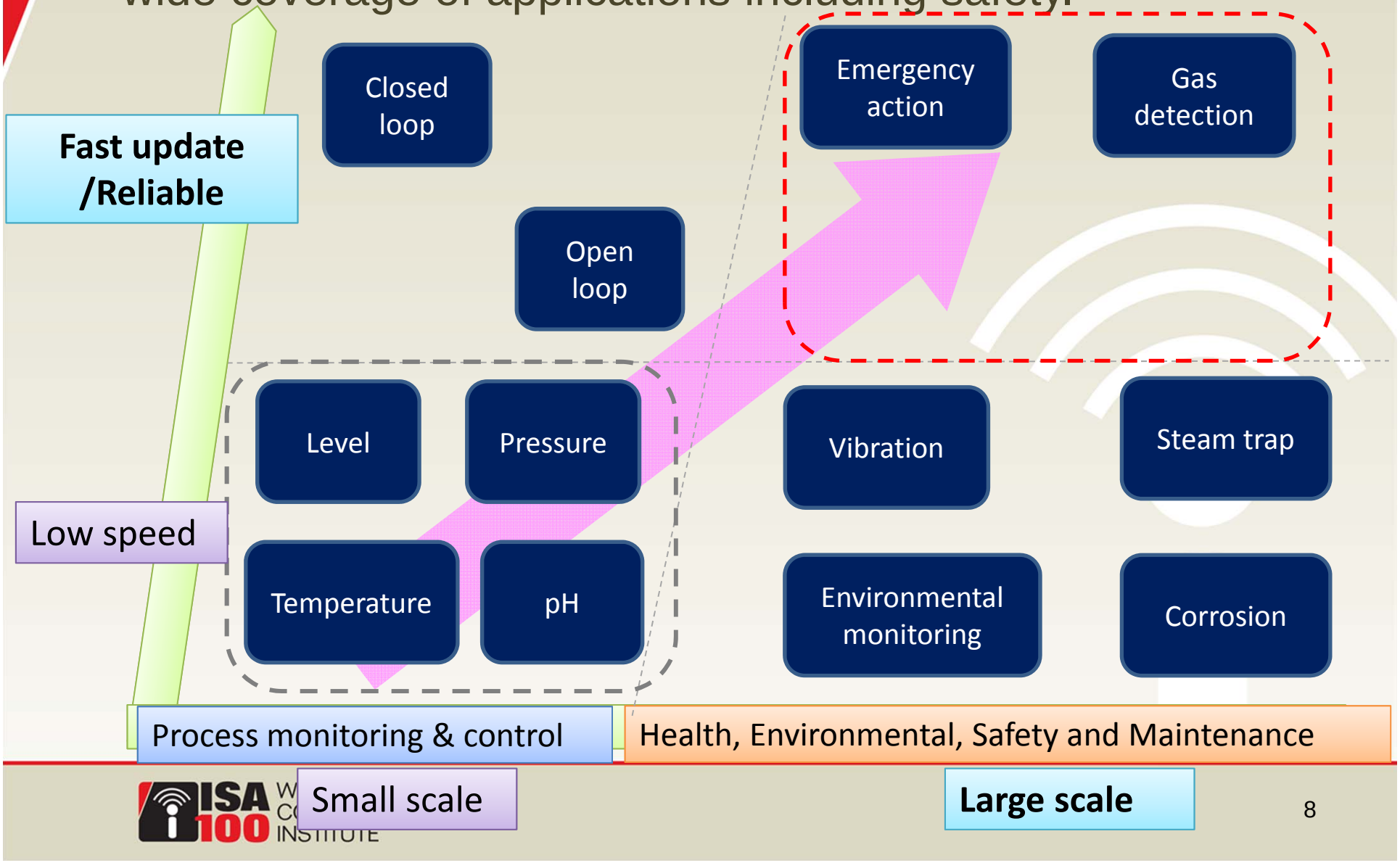


Review WCI end use seminar Mar 1st survey -2



Wireless application map

End users are expecting industrial wireless to adapt to more wide coverage of applications including safety.



Motivation of adopting wireless for safety

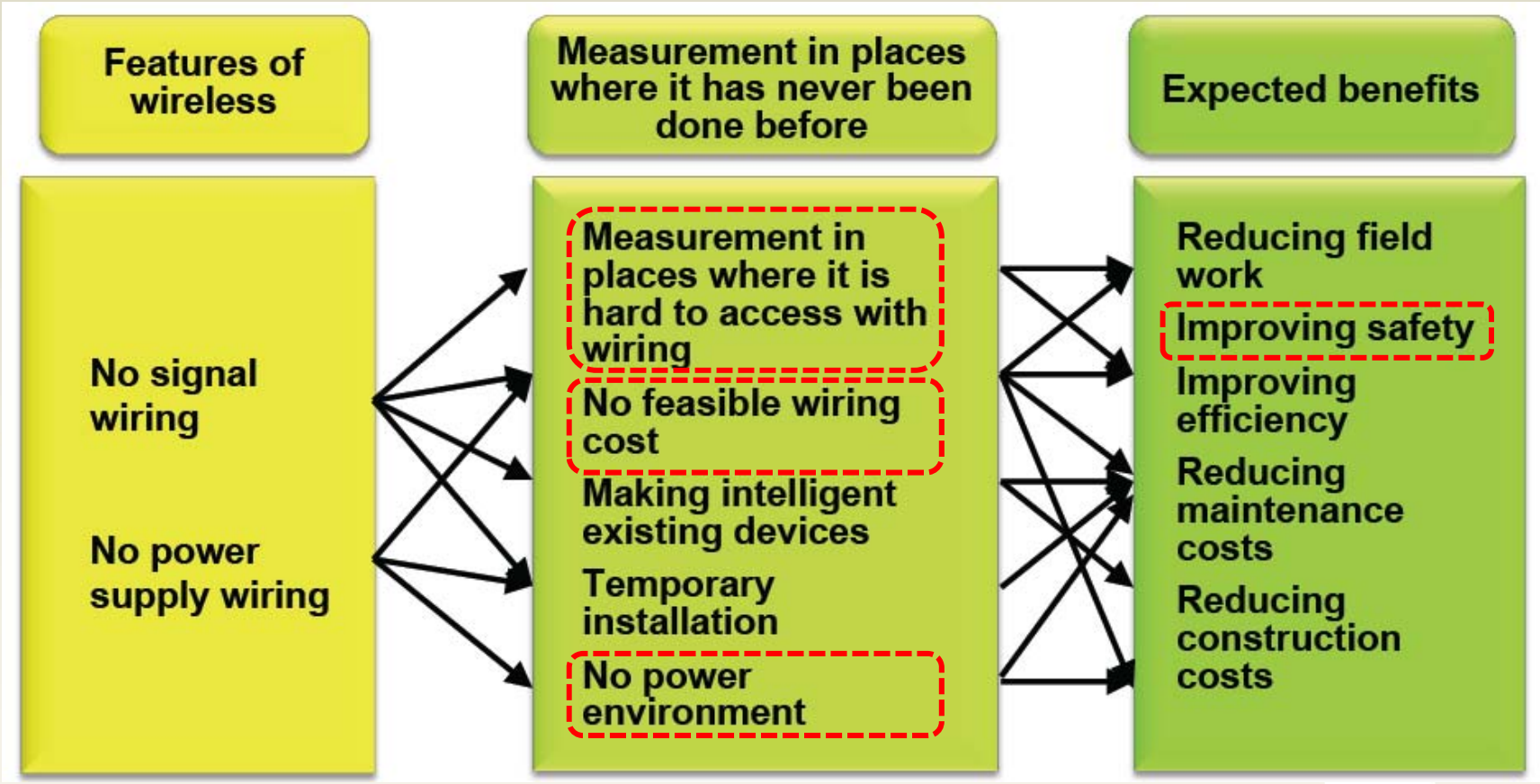
- **Preventive measures**
  - Process condition / status monitoring: Temperatures / Pressures / Flows / Levels / etc.
  - Asset condition monitoring: Vibration / Corrosion / Temperature / etc.
- **Accident avoidance / Limit the extent of damages**
  - Alarm / Warning: **Gas leak detection** / Safety 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



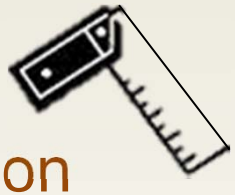
Even more remarkable points are

- **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**

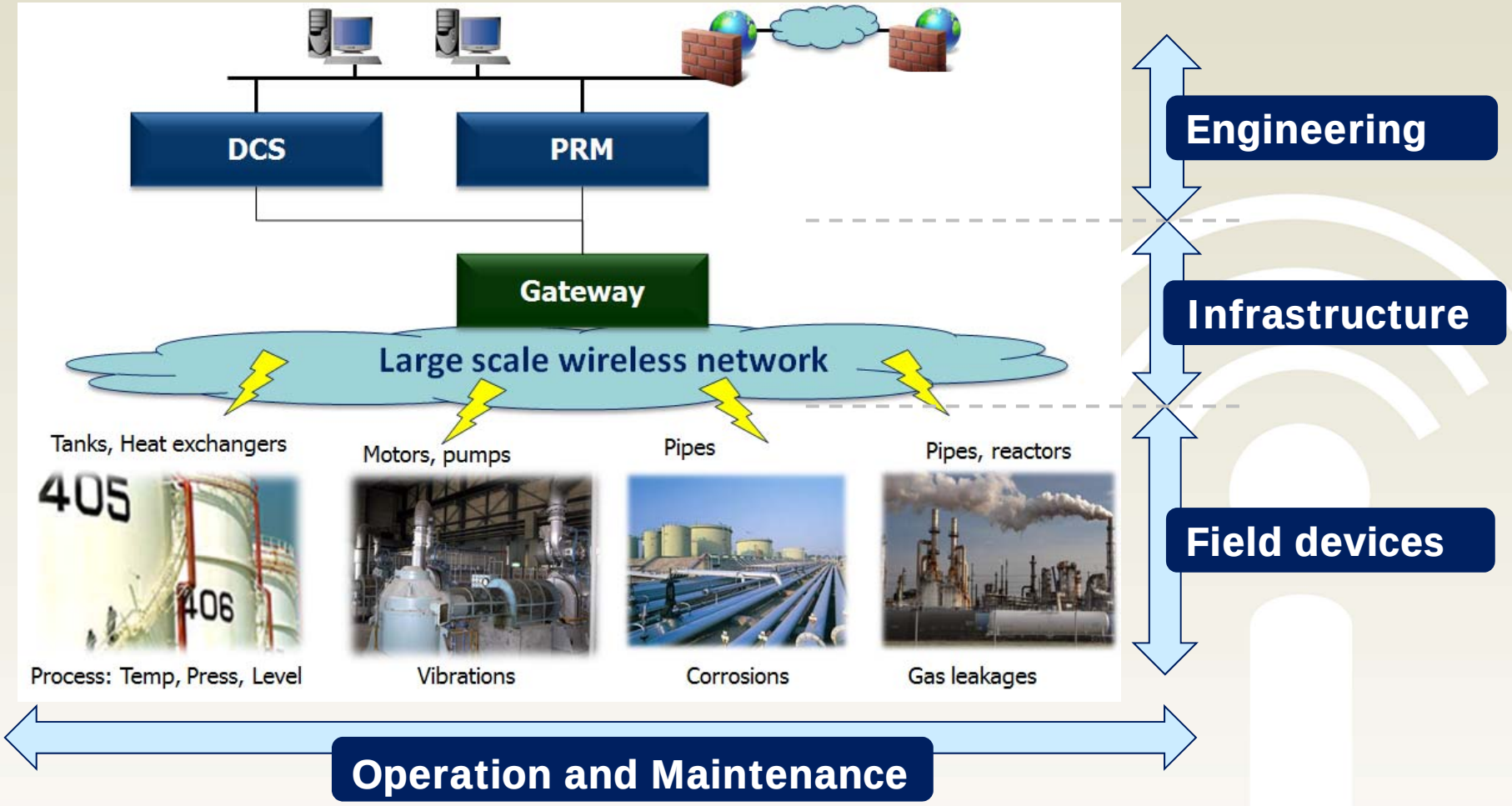
- **Emergency actions**
  - Committed deterministic performance
    - **Timeliness / Rapid response time**



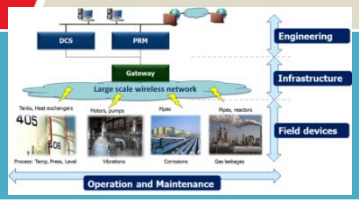
- **Plant wide coverage**
  - Committed large scale configuration
    - **Long range communication / Flexible configuration**

Dependable wireless system is required

How to realize dependable wireless system?



ISA100 Wireless is ready for safety applications

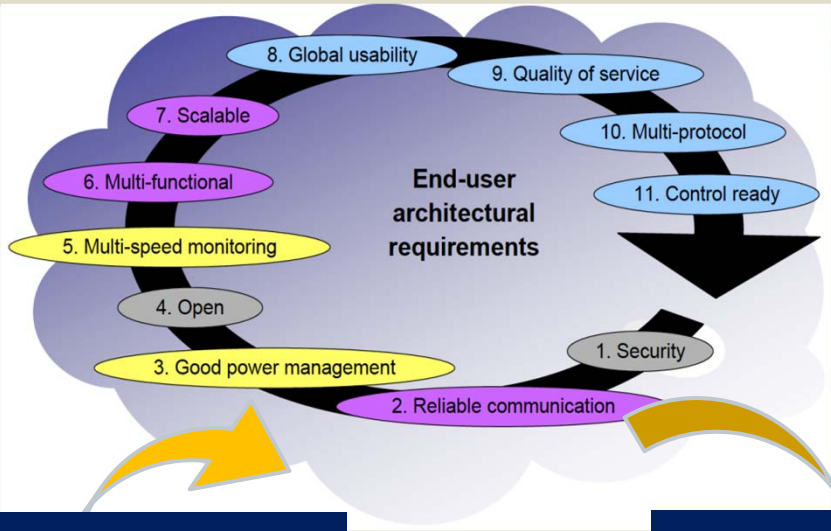


	Robust communication	Emergency action	Plant wide coverage
Field devices	-Channel hopping -**DuoCast** com -Mesh network -Retry -CCA compliant to EN 300 328 v.1.8.1. -AES 128 encryption	-TDMA: Time slot com -**Publish/Subscribe** -**QoS management** Uplink / Downlink -Star topology -Safety layer on the top of ISA100 stack	-**Long range** com 600m (line of sight), 5km with 15dBi Ant -Remote antenna -Multi hopping
Wireless Infrastructure	-**Redundant Gateway and Access point** -Ch Black listing for coexistence with Wi-Fi	-**Backbone highway** Ethernet, Wi-Fi, Opt-F -Sky Mesh NW to **minimize latency**	-**Multiple access points** for scalable NW -500 devices /GW -**Interoperability**
Engineering	-**Fixed mesh network engineering** for **deterministic com**	-GW high side I/F to **support Safety protocol**	-**Flexible NW design** -Sky Mesh NW planning concept
Operation & Maintenance	-**Monitoring PER/RSSI** and com routes -**Predictable Battery life**	-**Satisfy IEC60079-29-1** performance requirement	-**Easy expansion of sub networks** by adding access points

ISA100 Wireless (ISA100.11a / IEC 62734) was developed by end users voice

Plant wide solution :

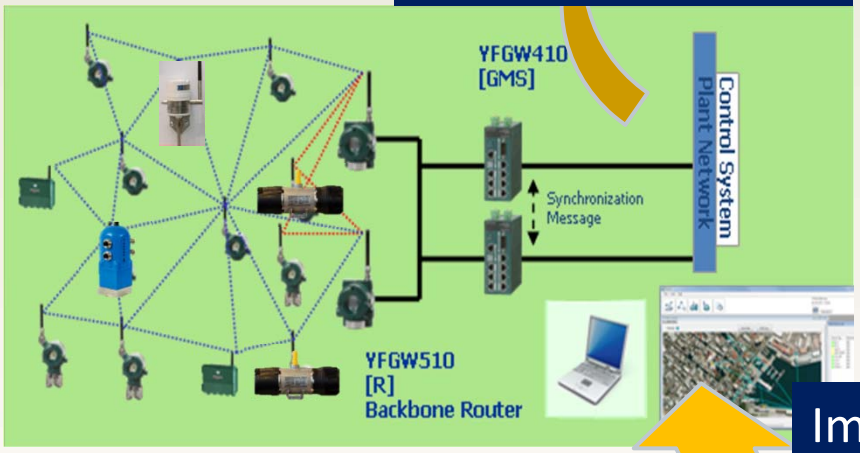
- Industry
- Oil & Gas, Petrochemicals,
- Powers, Metals, etc.
- Applications
- Process monitoring
- Process control
- Asset management
- Safety alarm management
- Energy monitoring
- Environmental
- etc.



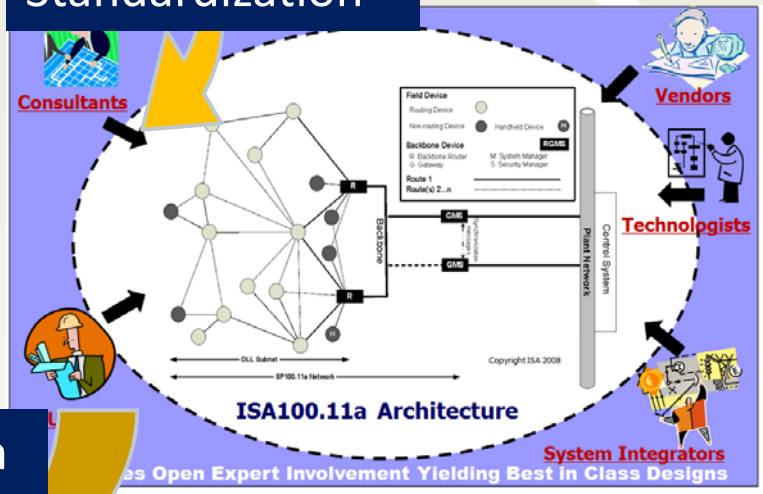
Breakthrough Technologies :

- 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

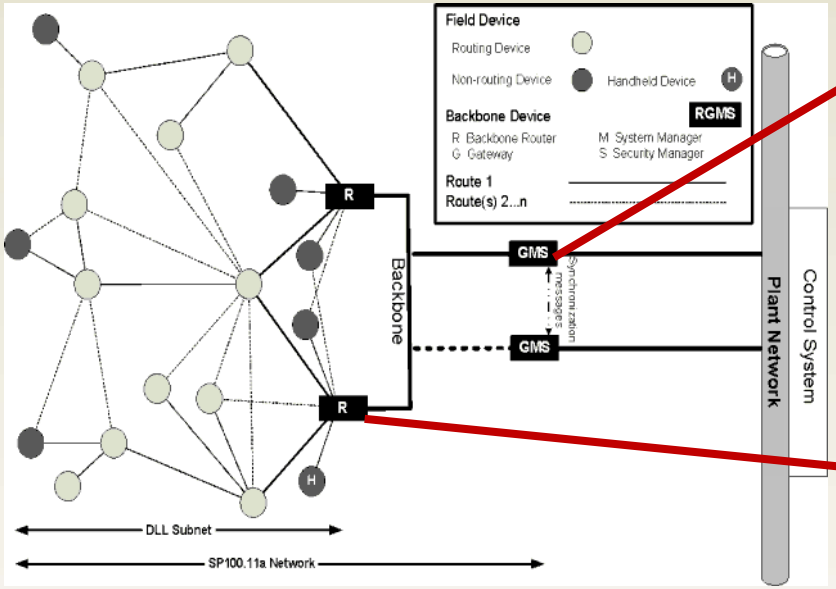
ISA100 INSTITUTE

ISA100 Wireless key implementations

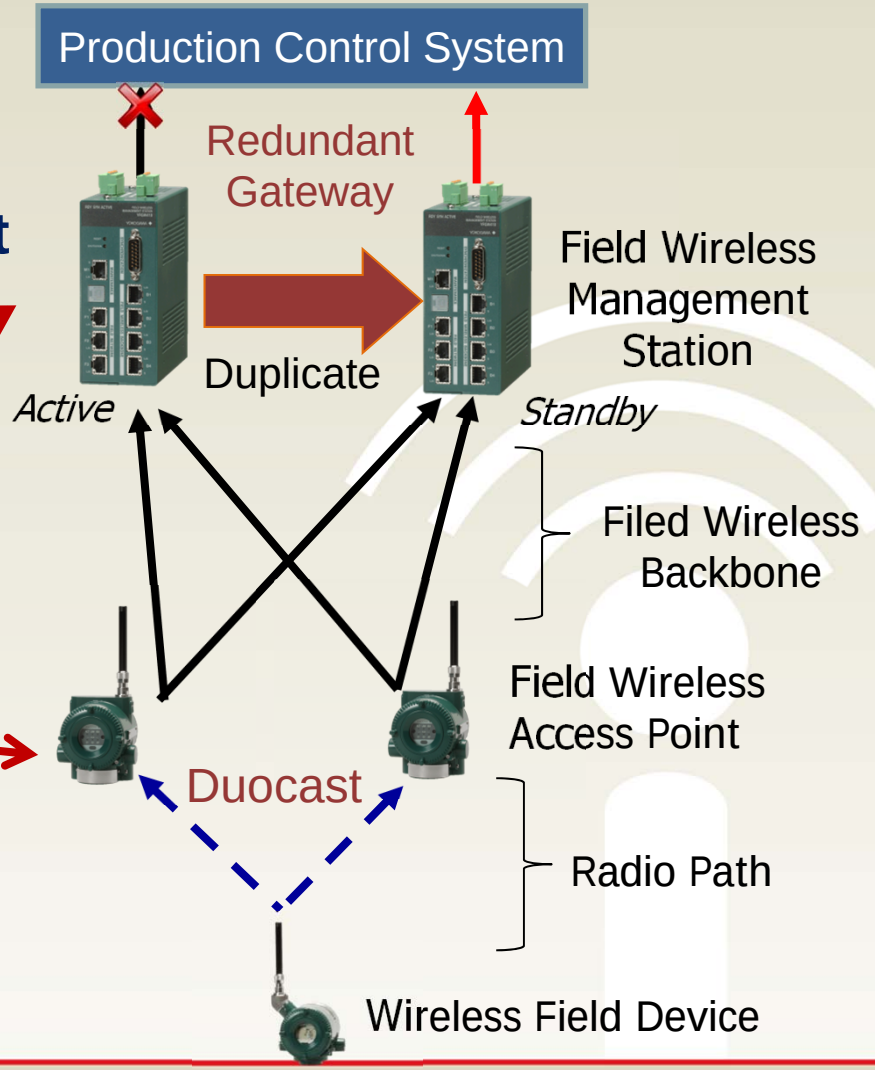
Reliability

Fault Tolerance

Redundant Gateway and Duocast

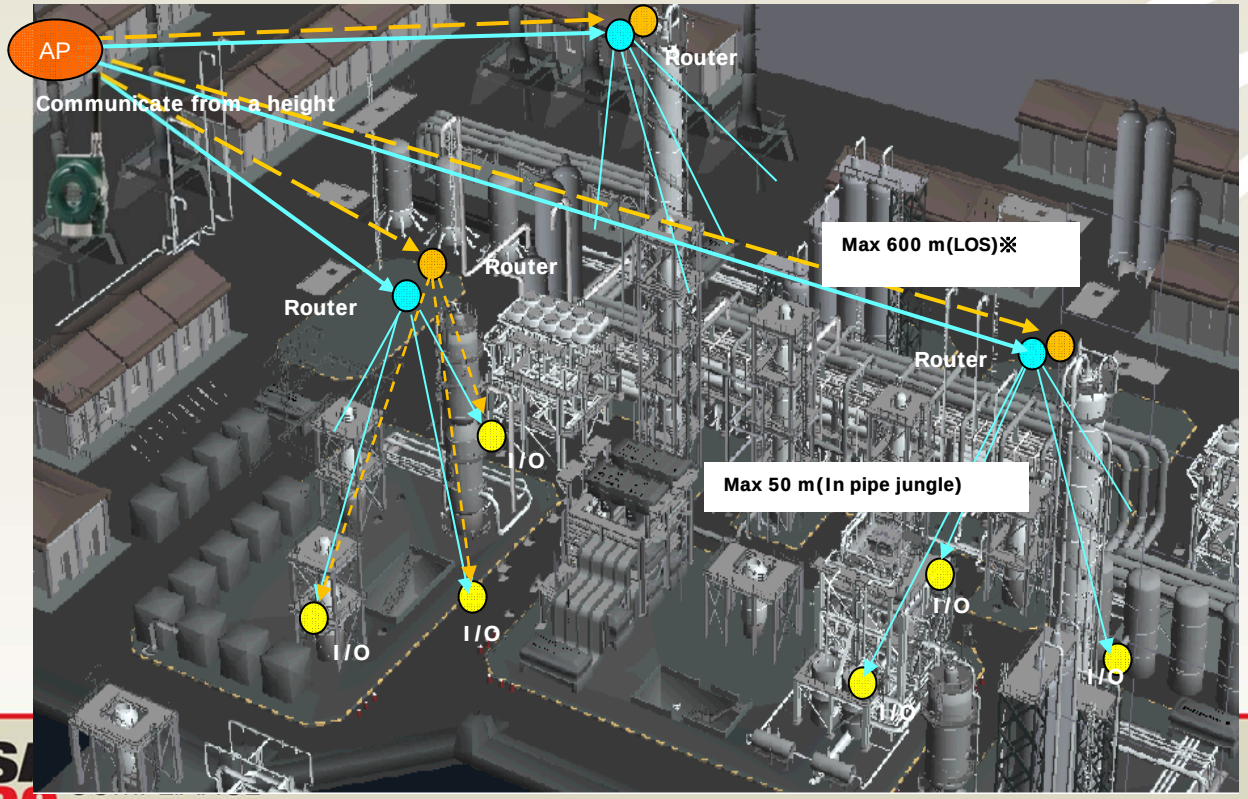


ISA100 Wireless Architecture



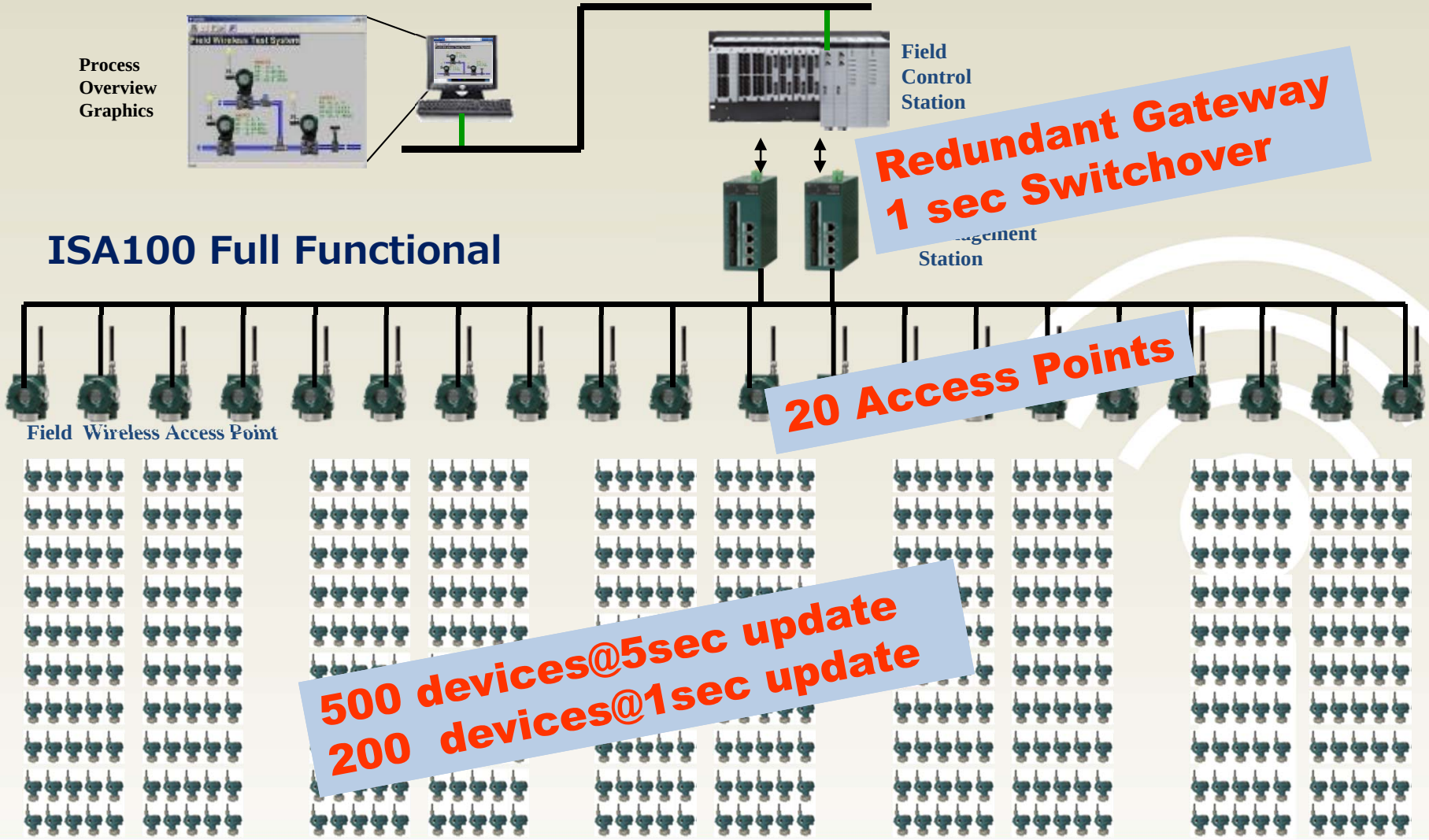
Timeliness

- **TDMA**: Time Division Multiple Access / **QoS Management**
- **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



Scalability

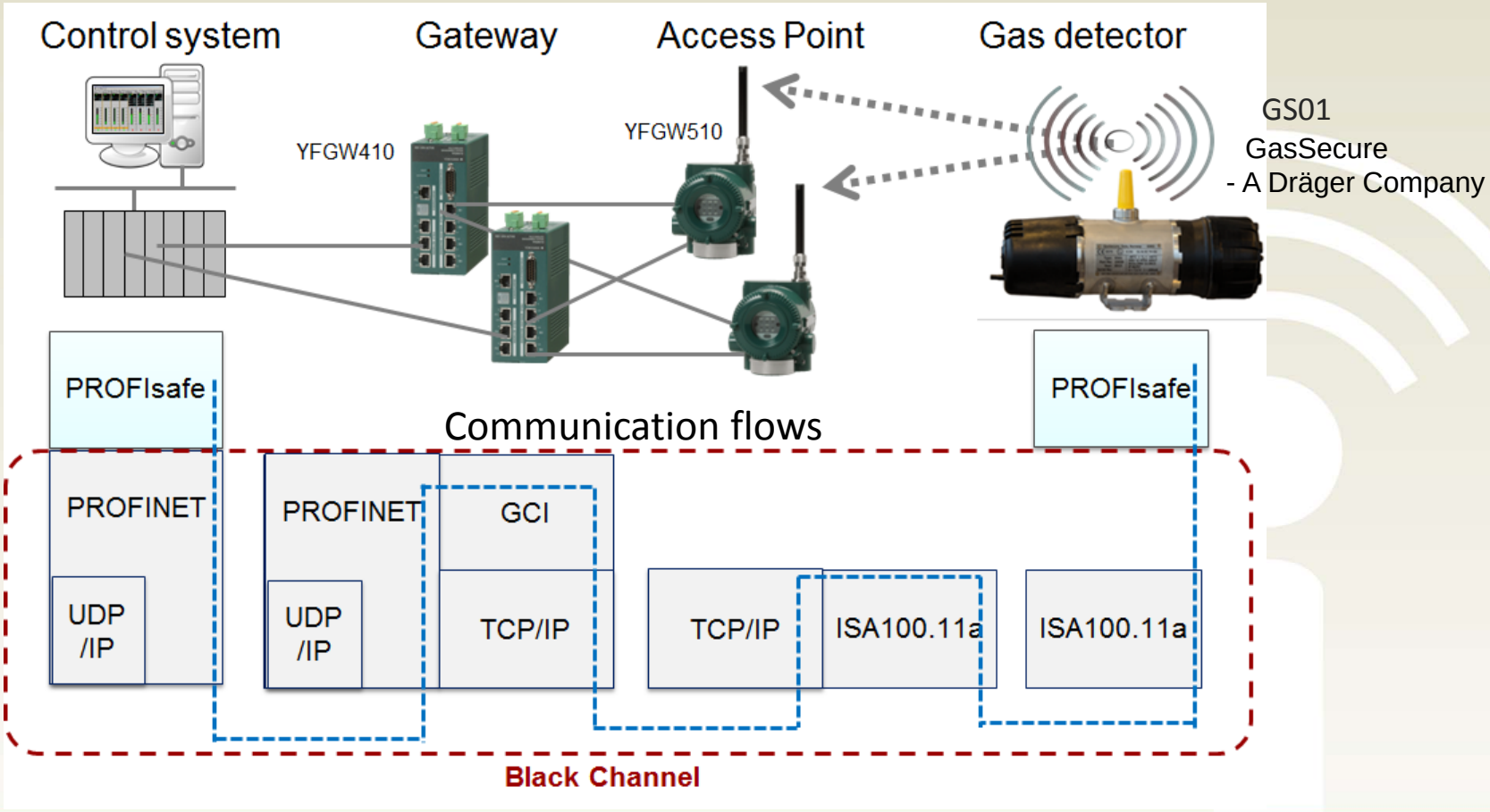
Plant wide large scale wireless infrastructure



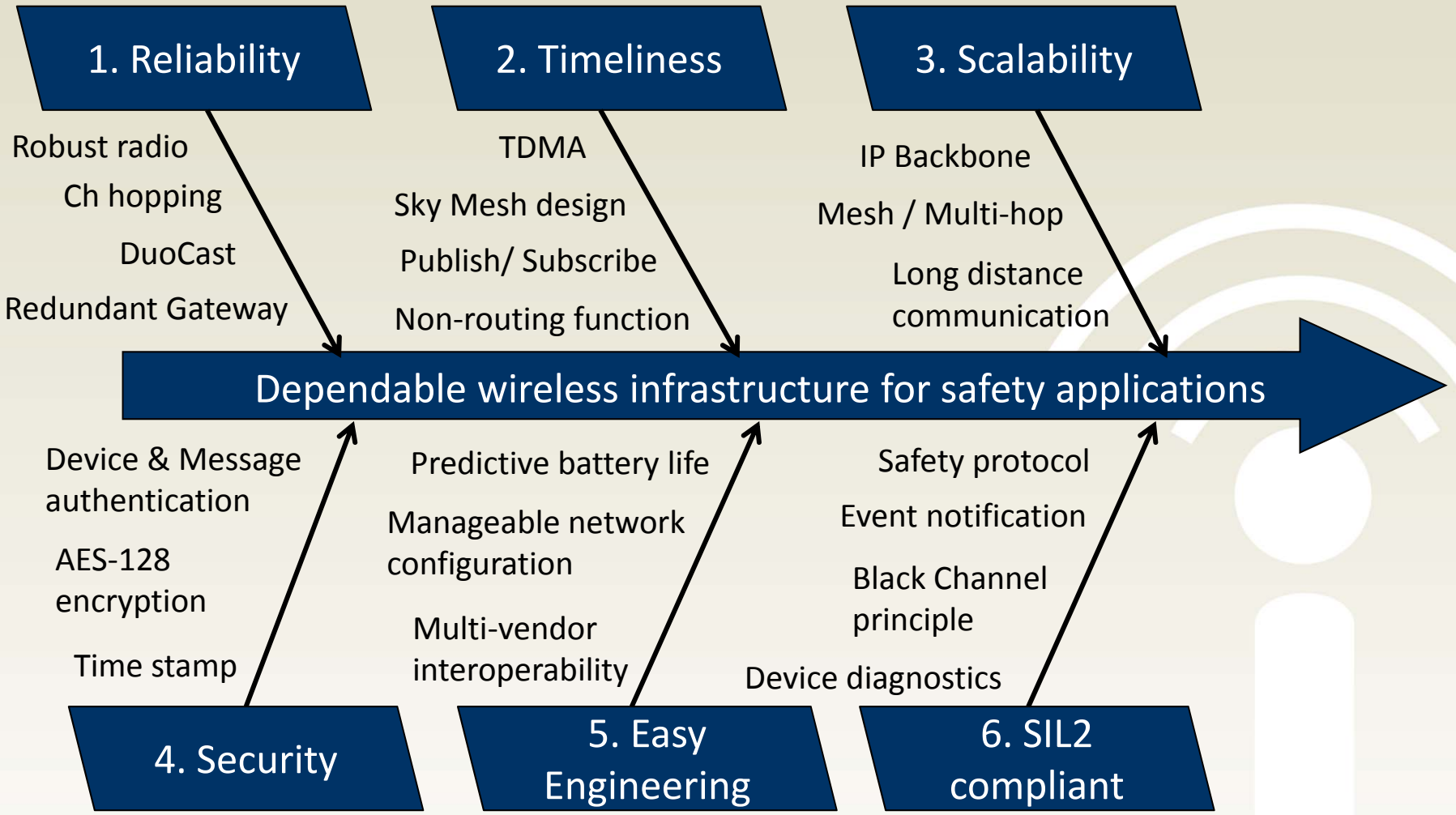
SIL2 compliant

World first SIL2 Gas detection system

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



Key implementations for dependable wireless infrastructure

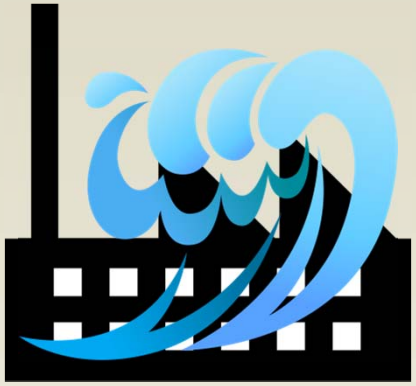


Applications

Gas explosion
→ Plant wide monitoring

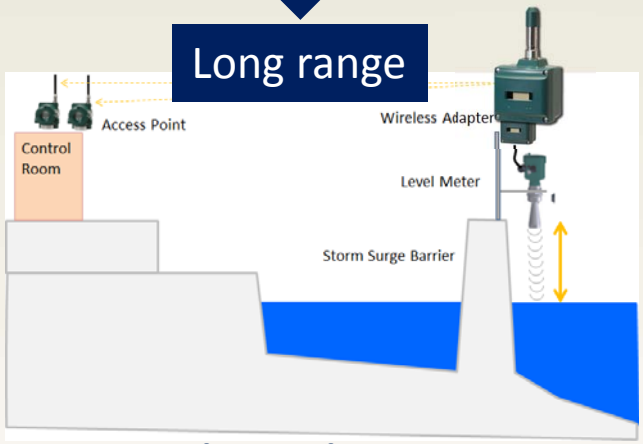
Short latency

World first SIL2 compliant
ISA100 Wireless Gas detector



Tsunami disaster
→ Predictive monitoring

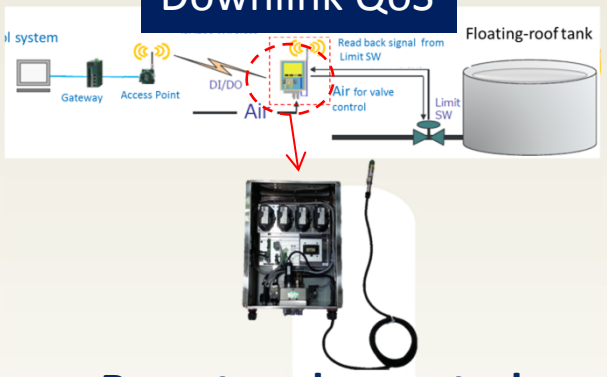
Long range



Tsunami warning system
ISA100 adapter + level meter

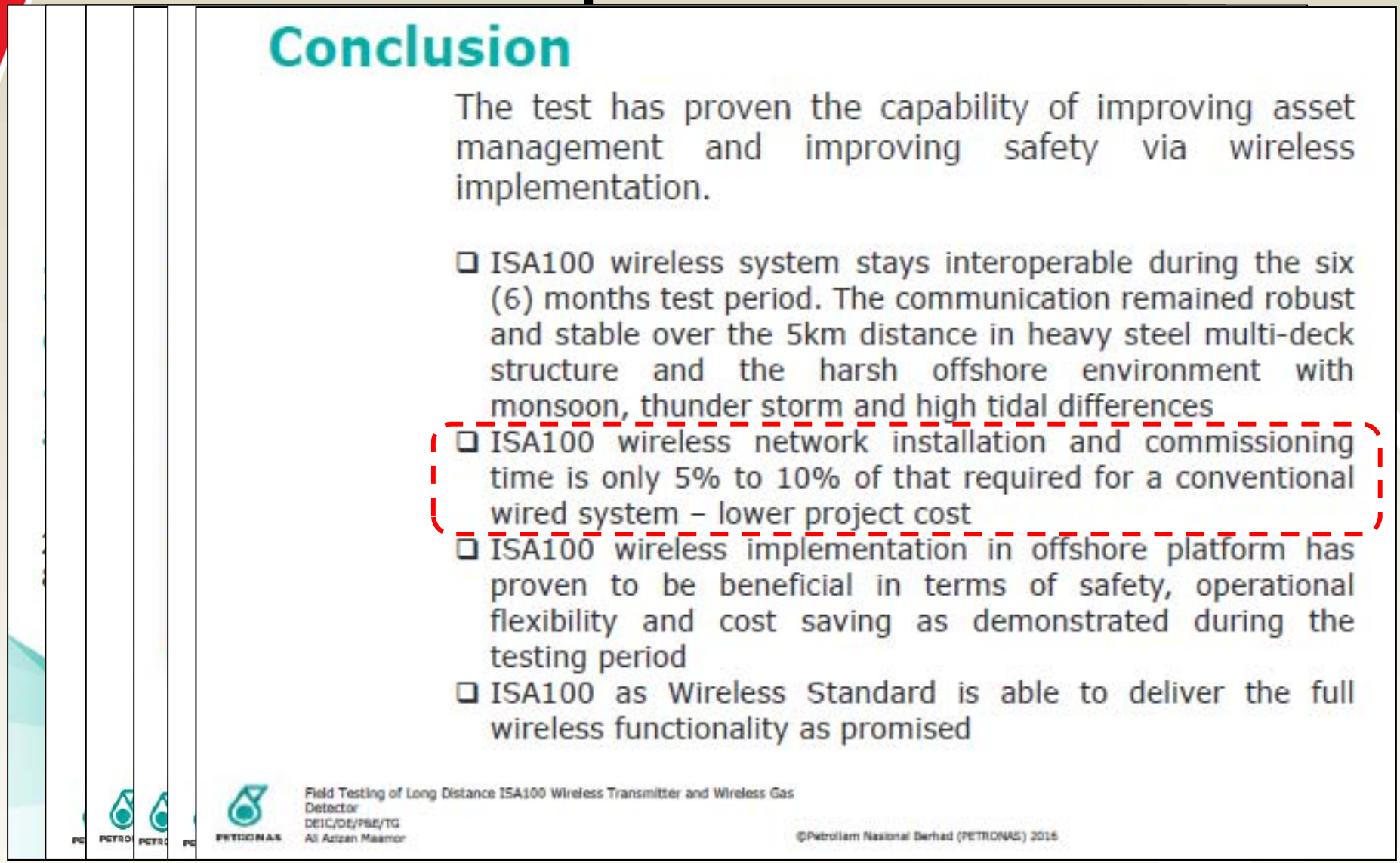
Fire of floating-roof tank
→ Emergency shutdown

Downlink QoS



Remote valve control
ISA100 DI/DO box

Use cases – 1: Upstream



Conclusion

The test has proven the capability of improving asset management and improving safety via wireless implementation.

- ISA100 wireless system stays interoperable during the six (6) months test period. The communication remained robust and stable over the 5km distance in heavy steel multi-deck structure and the harsh offshore environment with monsoon, thunder storm and high tidal differences
- ISA100 wireless network installation and commissioning time is only 5% to 10% of that required for a conventional wired system – lower project cost
- ISA100 wireless implementation in offshore platform has proven to be beneficial in terms of safety, operational flexibility and cost saving as demonstrated during the testing period
- ISA100 as Wireless Standard is able to deliver the full wireless functionality as promised

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

Use cases – 2: Downstream

Fit for purpose solution

Benefits

- Reduction in overall project risk. No cables; hence no excavation and working at height.
- Installation can be done quickly, safely and seamlessly while plant is online.
- Simplifies engineering and drawing updates.
- Significant reduction in overall project cost.

Lessons Learned

- Good stakeholder management
  - Client, principal, local business partner and vendors were involved right from the beginning.
- Good communication plan
  - Good support and collaboration between all parties involved ensured the system was tested successfully to the client's requirements.
- Need to pay attention on future upgrades of hardware that may affect the network.

http://www.isa100wci.org/en-US/Documents/Presentations/PETRONAS-ARC-Orlando-Gas-detector-Wireless-Experie

WCI assures multi-vendor interoperability for best in class solution.

GasSecure
- A Dräger Company

Riken Keiki

New Cosmos

Multiple suppliers are providing ISA100 Wireless Gas detector products

Summary

- **Dependable plant wide infrastructure** must be required to cover variety of wireless safety applications
- **Multi-vendor devices and interoperable wireless network** provide the best-in-class solution.
- **World first SIL 2 wireless gas detection system** has been realized with **co-innovation** of multiple vendors and multiple breakthrough technologies of the **ISA100 Wireless**

Thank you for your attention