ISA WIRELESS COMPLIANCE INSTITUTE

ISA100 Wireless Adoption for Safety

(Updated 2021)

The presentation will start at 11:00 am Eastern EDT

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Presenters

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ISA100 Wireless Adoption for Safety Agenda

1. Case Study
2. Wireless Usage Classes and Safety
3. Technical Requirements
4. Best Practices

Case Study

ExxonMobil FPSO Balder

Applications

ExxonMobil FPSO Balder

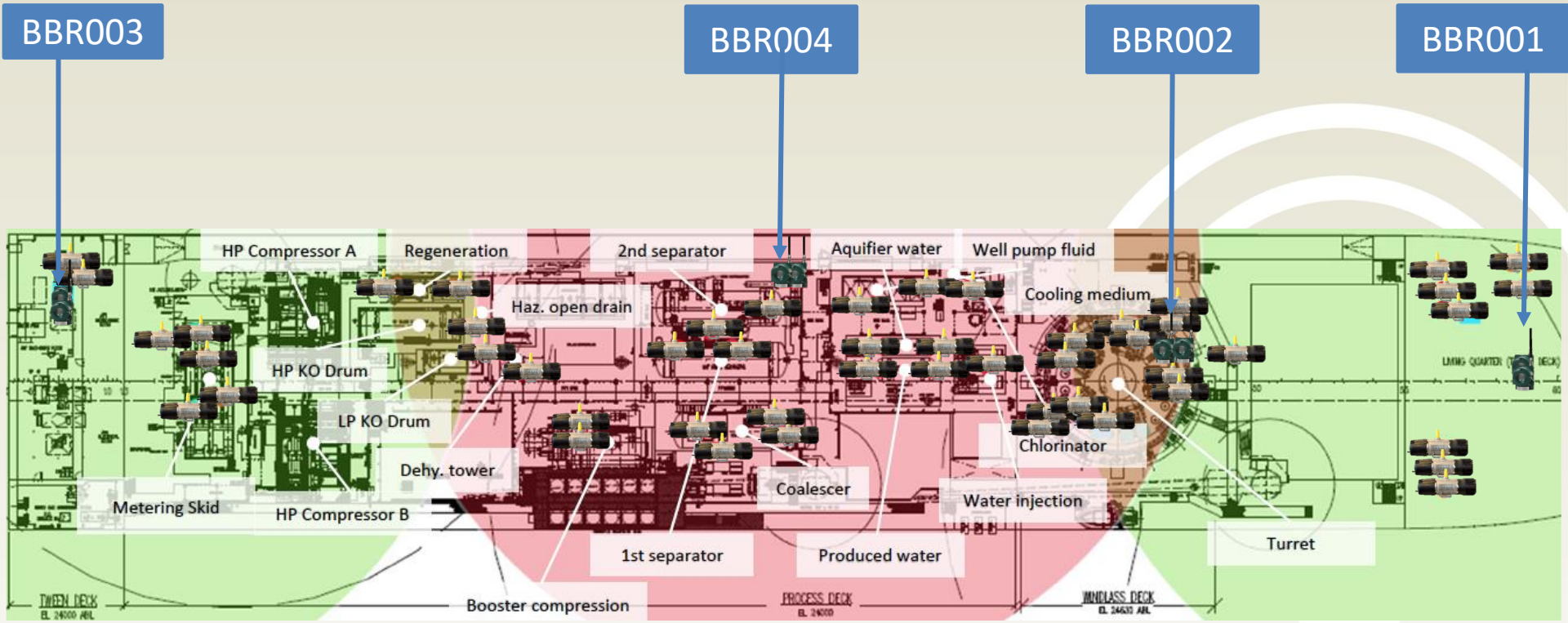
Client / Country	ExxonMobil / Norway
Project / Facility	FPSO Balder
Additional Equipment / Infrastructure	59 GS01, 8 Access Points, 2 Management Stations
SIL or Non-SIL	Non-SIL, with SIL 2 design for future upgrade
Services / Integration / Support	GasSecure and ABB
Executive Action	Yes. Shutdown of FPSO with zoned 2ooN, HH alarm at 30%LEL

Applications

ExxonMobil FPSO Balder

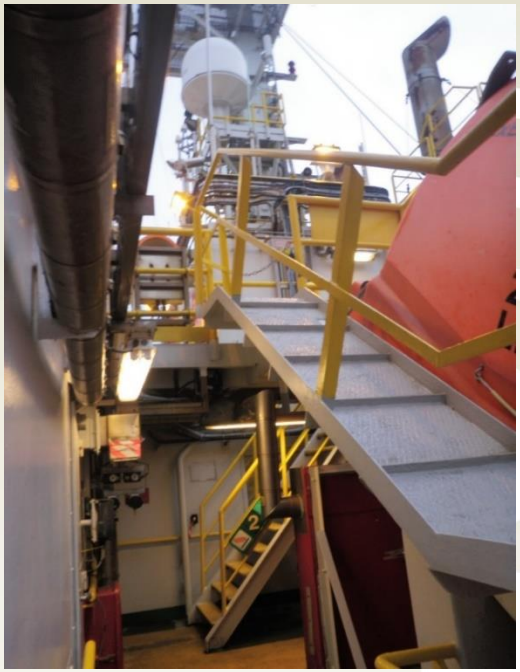
Applications

ExxonMobil FPSO Balder



GasSecure GS01 Applications
ExxonMobil FPSO Balder

GS01 detector placements



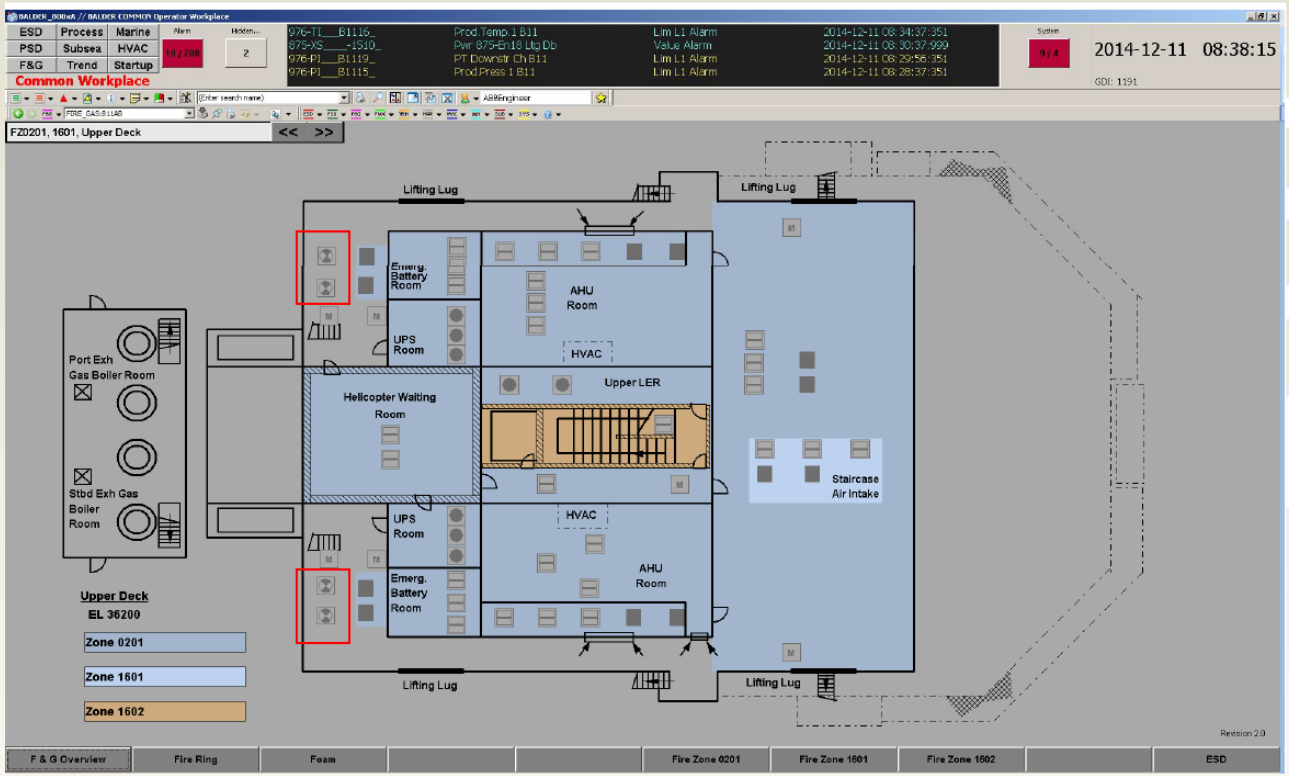
GasSecure GS01 Applications
ExxonMobil FPSO Balder

Management Stations and Access points

GasSecure GS01 Applications

ExxonMobil FPSO Balder – Trial / Phase 1

Control room



GasSecure GS01 Applications
ExxonMobil FPSO Balder

Results from Balder

- System in operation now for almost 3 years
- Proven to be reliable and extremely cost effective
- Wireless technically approved by ExxonMobil for worldwide use
- Full executive action taken by the gas detection system
- ABB 800XA waiting to be upgraded to a SIL system

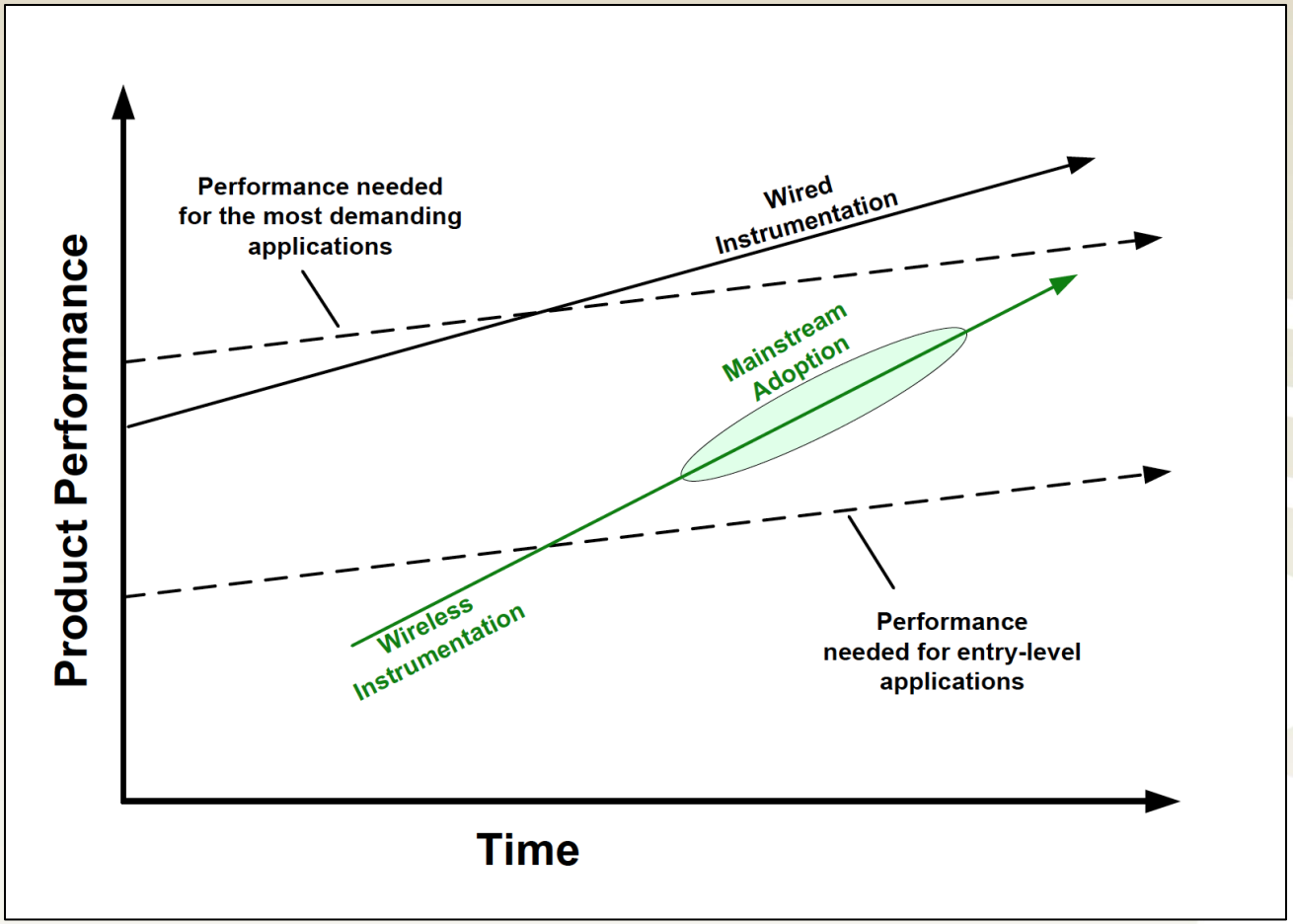
Client / Country / Project	ExxonMobil / Norway / Balder FPSO
Final Equipment / Infrastructure	59 GS01 detectors, 8 Access Points, 2 Management Stations
SIL or Non-SIL	Pending, awaiting new ABB SIL control system
Executive Action	Yes. Shutdown of FPSO with zoned 2ooN, HH alarm at 30%LEL

Wireless Usage Classes & Safety

Commonly Cited Benefits of Wireless Instrumentation

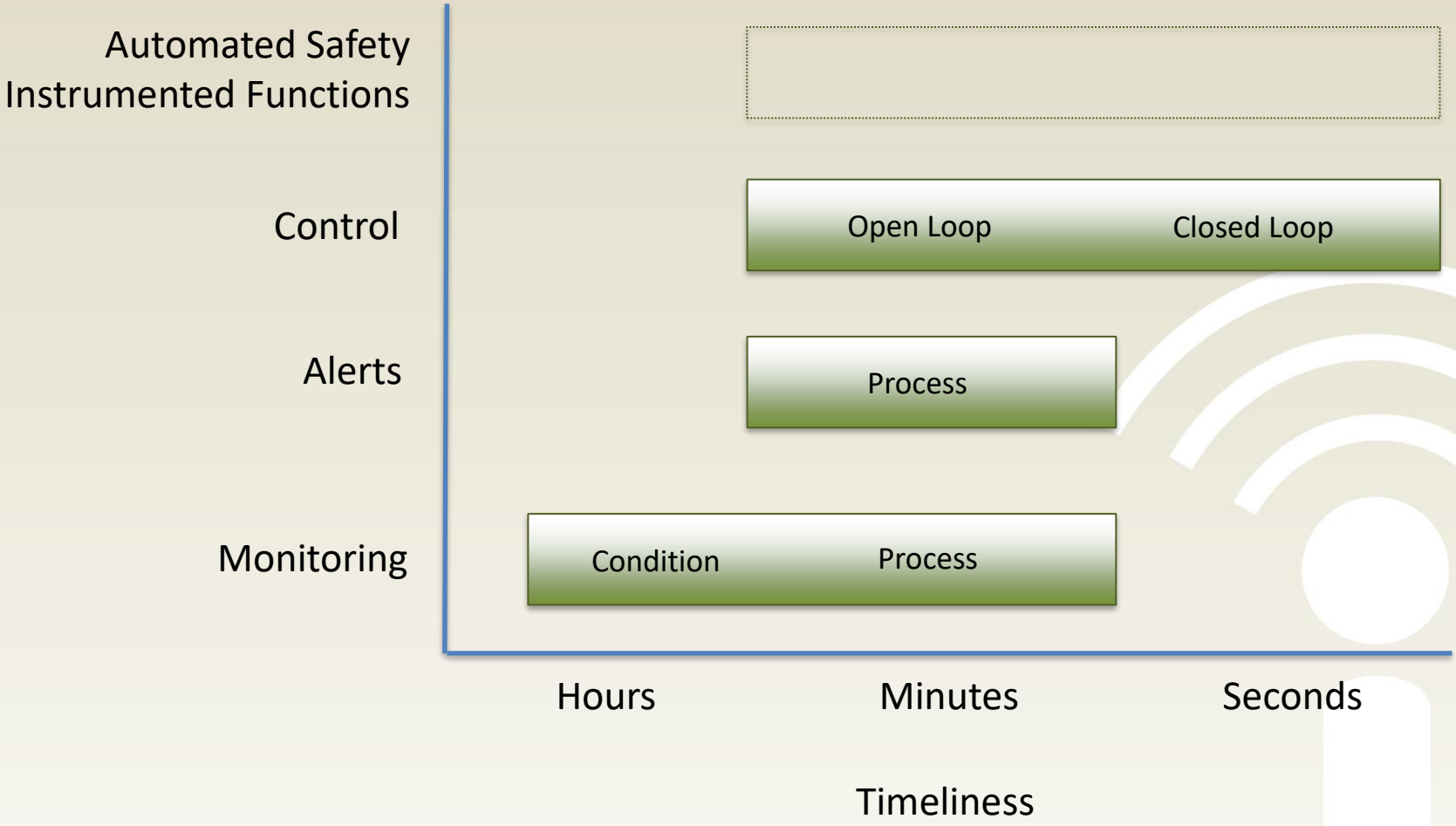
Cost Savings	• Up to 90% of installed cost of conventional measurement technology can be for cable conduit and related construction. • Typically: 1/5 the time, 1/2 the cost. • New and scaled applications are now economically feasible.
Improved Reliability	• Wired sensors may be prone to failure in difficult environments. • Wireless can add redundancy to a wired solution.
Improved Visibility	• Condition monitoring (equipment) • Process monitoring
Improved Control	• Add wireless to existing processes for more optimal control.
Improved Safety	• Compliance logging • Safety related alarms • Simple automated action

Adoption of Industrial Wireless

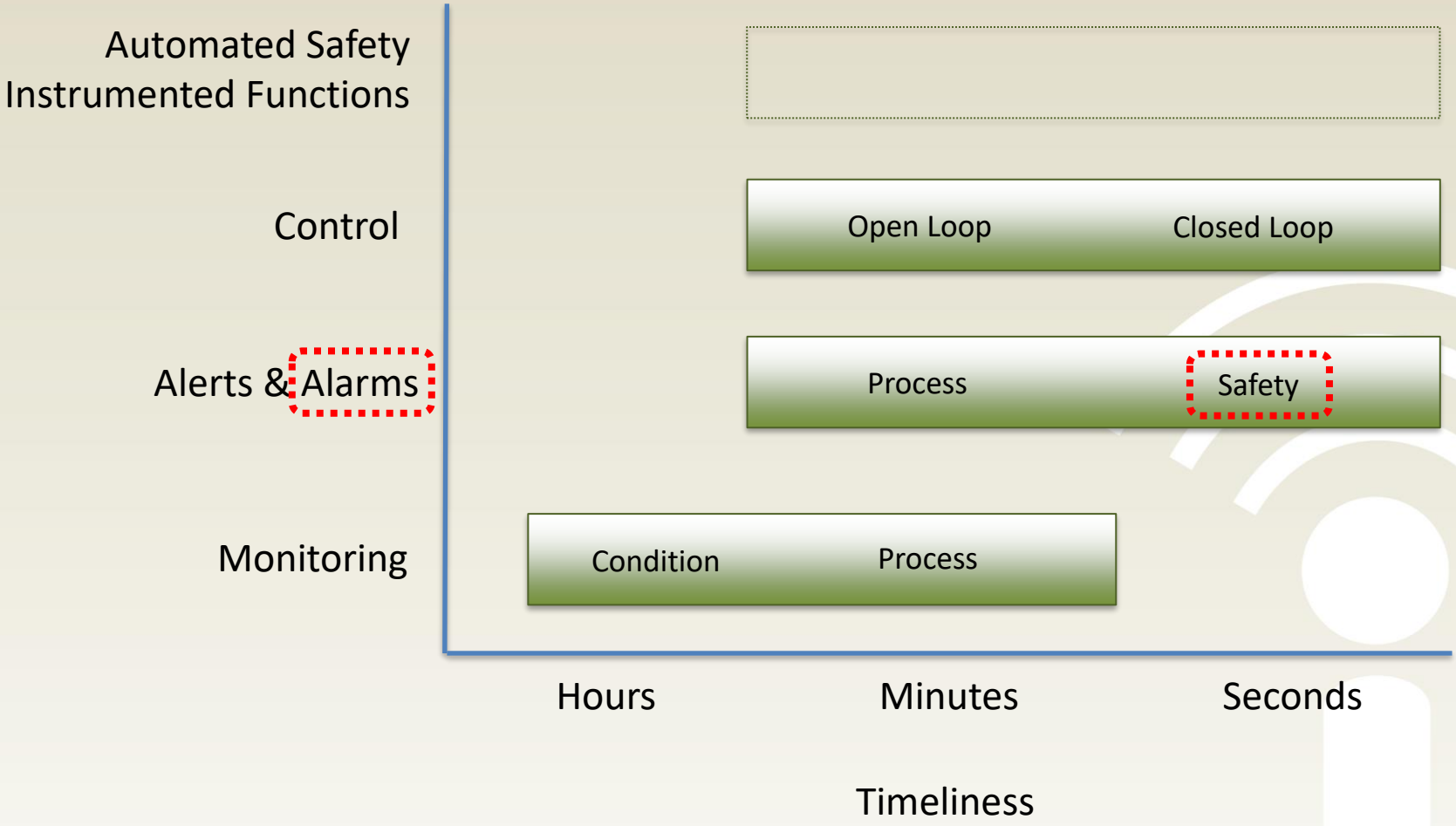


Christensen innovation model adapted for industrial wireless

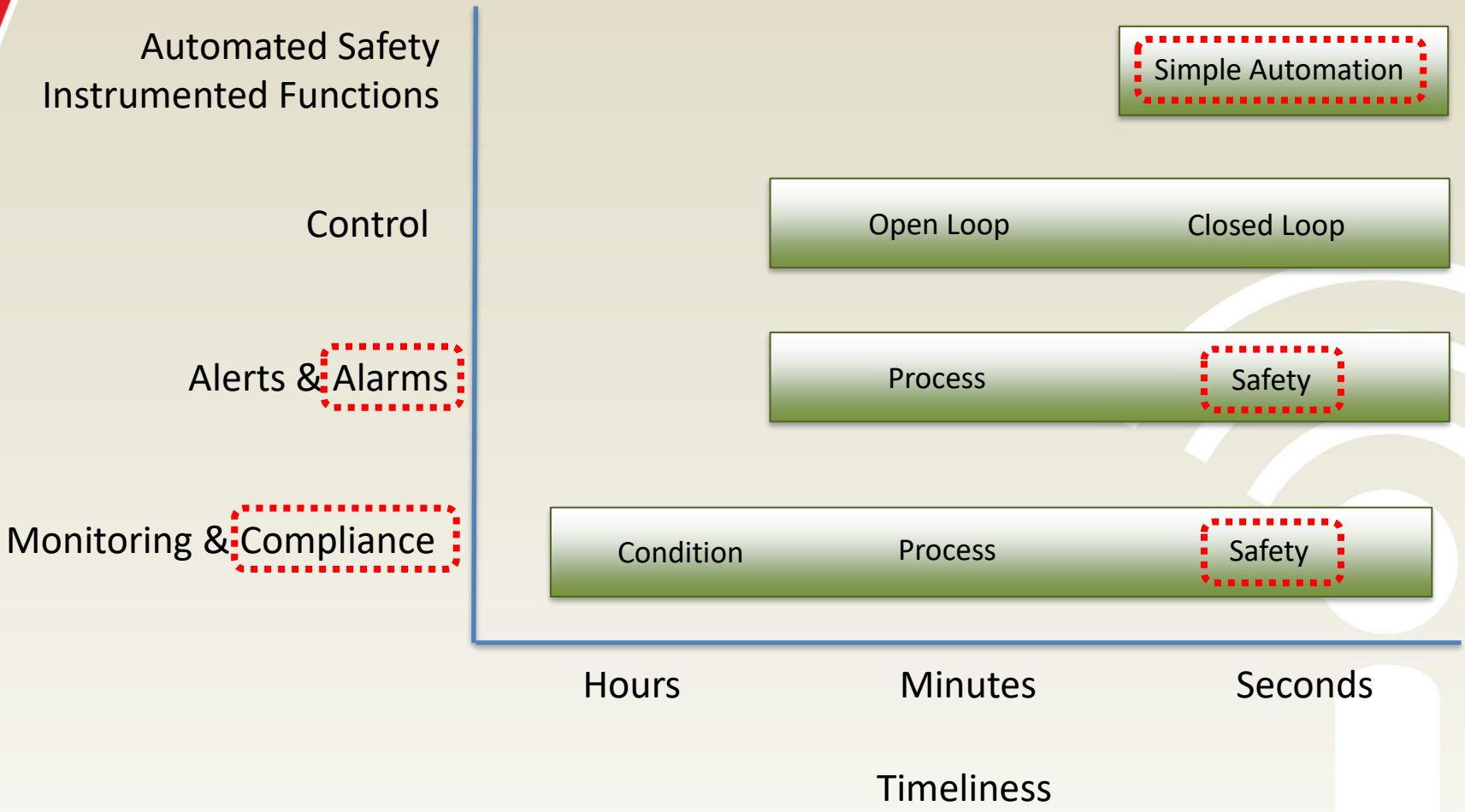
Usage Classes for ISA100 Wireless 2007



Usage Classes for ISA100 Wireless 2014



Usage Classes for ISA100 Wireless 2021



Technical Requirements

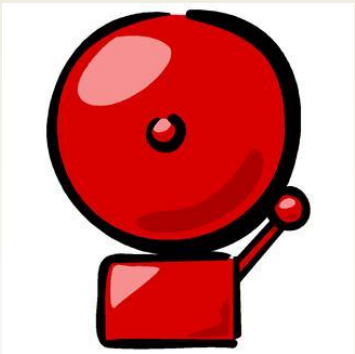
Technical requirements for Industrial wireless sensing & control (Voice of the customer, ~2005)

1. Rate and Latency	• Publication rates 1-2 seconds • Capable of 100 ms latency • Controlled latency, ~50% publication rate • 4 Hz publication in constrained configurations
2. Mesh Networking	• IP Backbone: Engineered and scalable • Mesh and non-mesh topology; access points and field devices • Peer-to-peer communication • Objects = Function blocks at device level • Long and deterministic battery life
3. Reliability	• Wireless transmission is deterministic • Wireless transmission is received • Wireless transmission is accurate • Redundant communication paths to process control network
4. Security	• Wireless transmission is secure; prevention & detection

Technical Requirements For Safety Over Wireless

Applications

- Gas Detection
- Fire Prevention
- Level Detection
- Safety Showers
- Etc…



Requirements

- Controlled Quality of Service
  - Diagnostics!
- Controlled Latency
  - Seconds
- Layered Open Architecture
  - e.g. PROFIsafe

Wireless for Safety
Best Practices

- Latency and Availability
- Network Design Common Best Practices
- Security Matrix
- Denial of Service
- Some Other Considerations

(Some of what follows was loosely derived from ISA84 WG8)

Latency, Availability

Latency

- Wireless data latency can be defined as is the time between the acquisition of a measurement value and the delivery of that data via the wireless network to a gateway.

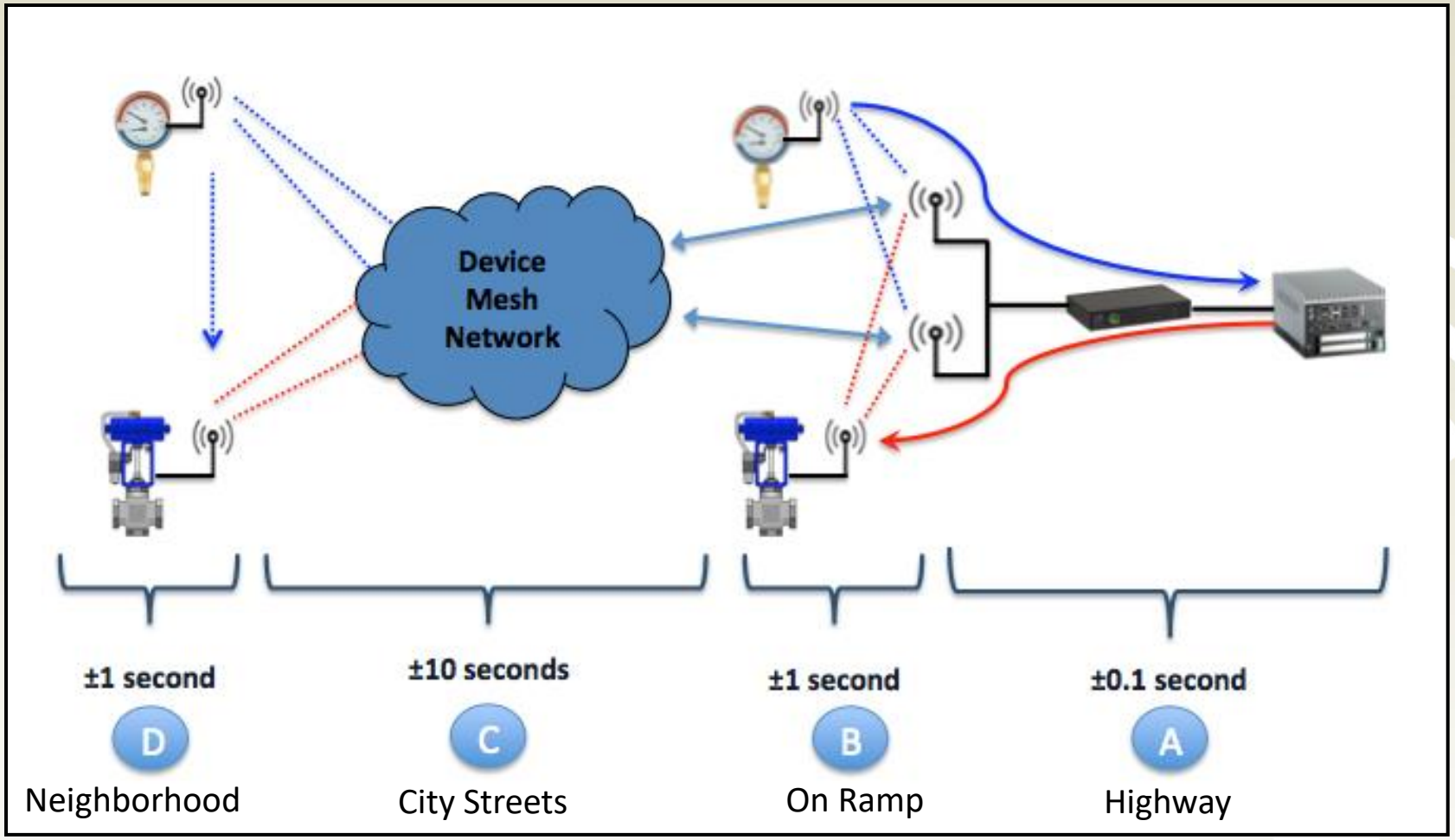
Availability

- Percentage of values received within the required response time.
- Can be measured per device or for an overall system.

Sidebar

- An exception may be a late-arriving alarm, or a stale state.
- Be alert for freshness requirements at times when there is no alarm.

Mesh Networks
Latency Considerations



Network Design
Common Best Practices

*It is critical to closely **adhere to manufacturer's best practices** when designing and laying out a wireless sensor network.*

- Conservative communication range
- Reporting Rates
  - *Device and router battery capacity*
  - *Wireless channel capacity*
  - *Infrastructure capacity*
- Centrally located infrastructure
- Control hop depth
- Path redundancy (Infrastructure and/or mesh)
- Avoid bottlenecks
- Use network layout and simulation tools
- Documentation!!!

Design network with plenty of margin, and monitor that margin carefully.

Security Matrix

	Authentication	Verification		Encryption	Access Control	Key Management
		Integrity Check	Time			
Sniffing			✓	✓		✓
Tampering		✓	✓			✓
Spoofing	✓		✓	✓	✓	
Replay Attack		✓	✓			✓
Routing Attack	✓			✓	✓	✓
DoS Attack	See Next Slide					

Authentication, Integrity Check, TAI, and Encryption are generally features of an interoperable communication standard such as ISA100 Wireless. User should not be able to disable or mis-apply these features.

Access Control and Key Management generally involve adherence to manufacturer's best practices.

Denial of Service

Radio standards and implementations should apply a variety of techniques to operate reliably in the presence of interference.

- *Unintentional interference ≈ coexistence*
- *Intentional interference ≈ denial of service attack*

Common strategies

- *Spread spectrum modulation*
- *Redundant routing*
- *Channel blacklisting*
- *LBT Disable (Listen Before Talk)*
  - *LBT may be required due to regulations, policies, or coexistence with other systems*
  - *LBT is configurable in ISA100 Wireless*
  - *Regulations and/or policies may allow LBT to be disabled at reduced power*
- *Diagnostics!!!*
  - *For example, LBT backoff counts*
- *Proven in Use*

Some Other Considerations

Gateway-Host Communications

- *Use well-known standards for Gateway-Host communications*
- *Security considerations for Gateway (ISA99)*

Alarm Management

- *General ISA18 considerations apply*
- *Large numbers of wireless devices may raise concerns about alarm floods*

Battery Management

- *Battery life should exceed instrument's natural service interval*
- *Avoid network configurations and processes that randomize battery life*

Data Quality Diagnostics

- *Early detection and prevention of stale data conditions*
- *Include information about health & timeliness of wireless sensor data*
- *General device diagnostics*

Network Diagnostics

- *Include ample margin in the wireless design.*
- *Real-time recovery from reduced margin, while meeting availability targets.*
- *Diagnostics, HMI, processes for systematic loss of margin.*

Adoption of Wireless for Safety Summary

Cost savings from wireless enable scaled adoption of safety applications

ISA100 Wireless is a mature technology for safety

- Compliance Monitoring, Alarms, and Automated Action

Proven in use, following manufacturer best practices

Questions?