GAS
SECURE

First wireless, infrared gas detector

Safe Wireless Communications using ISA100 Wireless™ for Infrared Gas Detectors

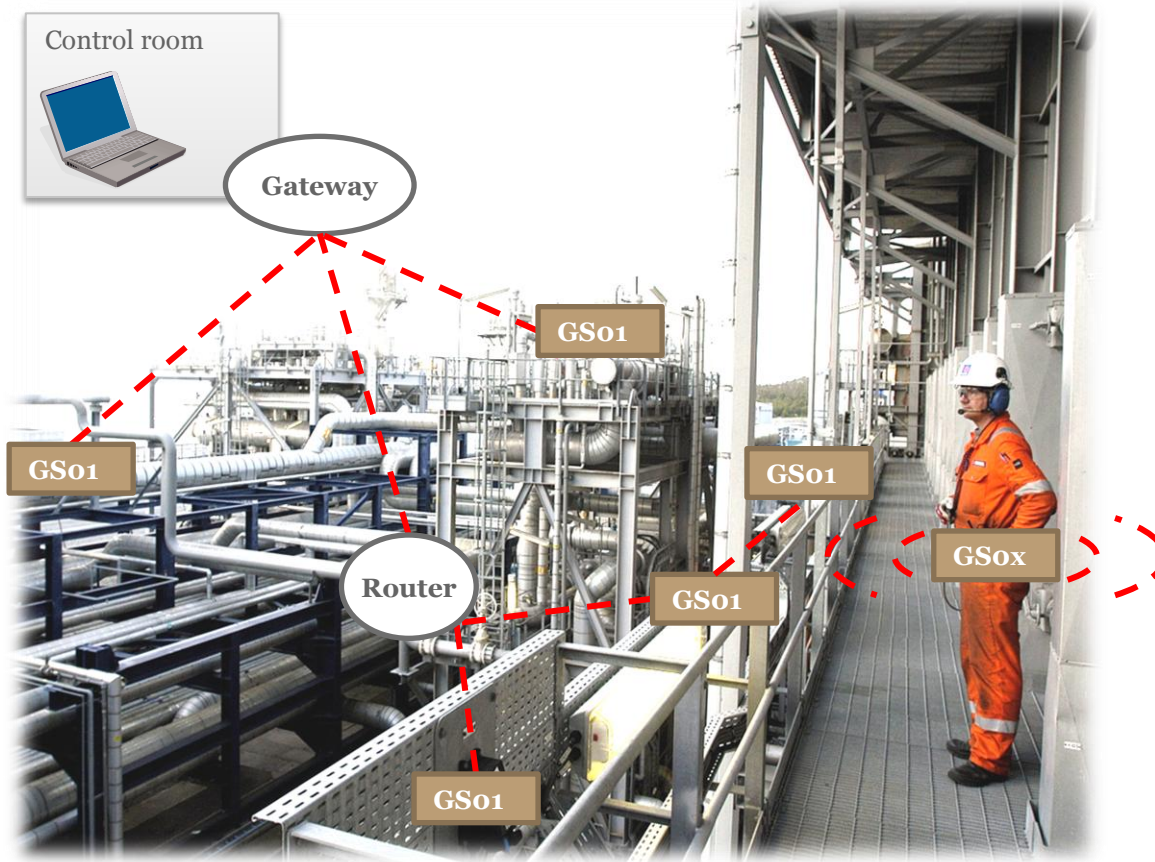Niels Aakvaag, PhD, Senior System Architect, GasSecure

Webcast, July 16th, 2013

Agenda

- Operation of the detector

- SafeWireless ™

- Why ISA100 Wireless

- Higher level protocol support

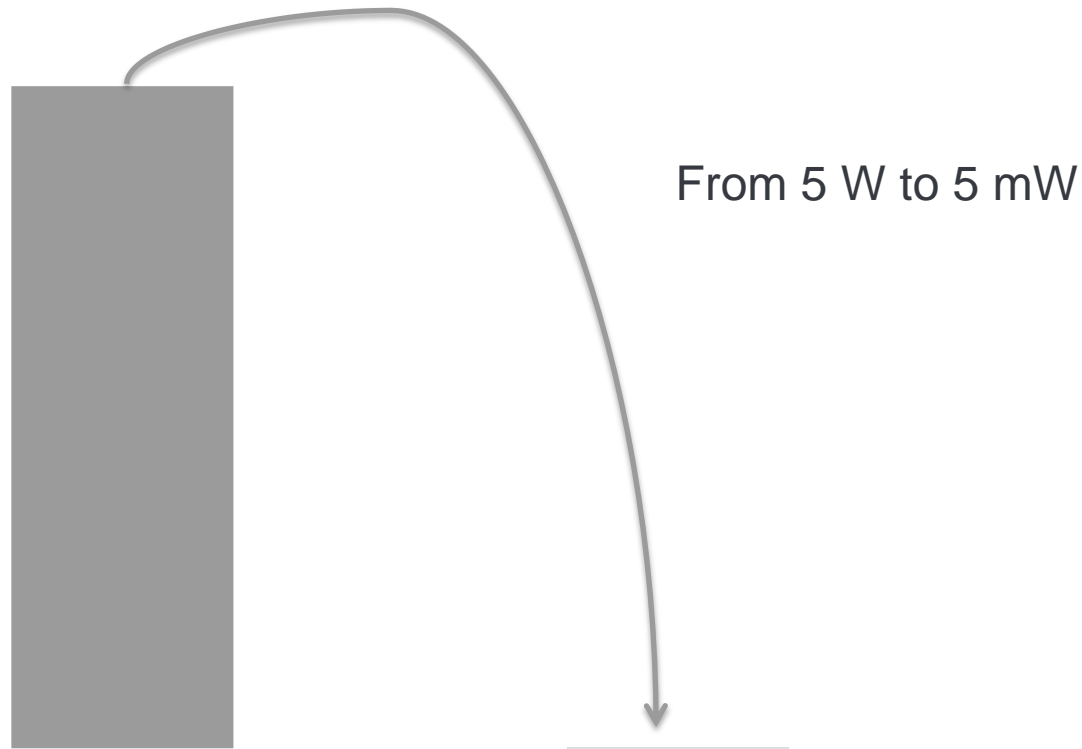# GasSecure has developed the first wireless, infrared hydrocarbon gas detector

Features:

- High reliability – SIL2 incl. SafeWireless™ communication

- Continuous monitoring with two years battery life

- Fast response (5 s)
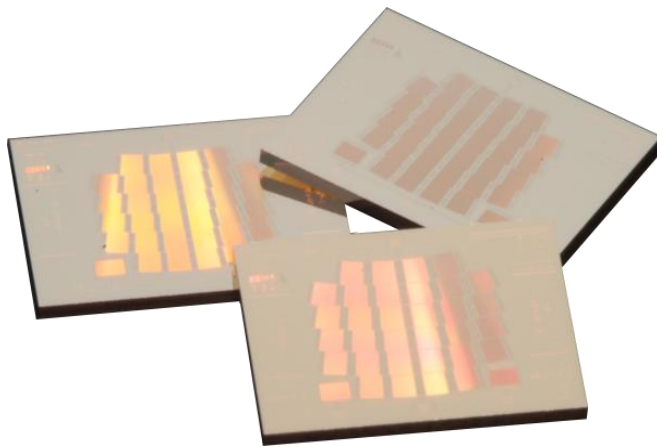
- No recalibration

The technological challenge:

reducing energy consumption

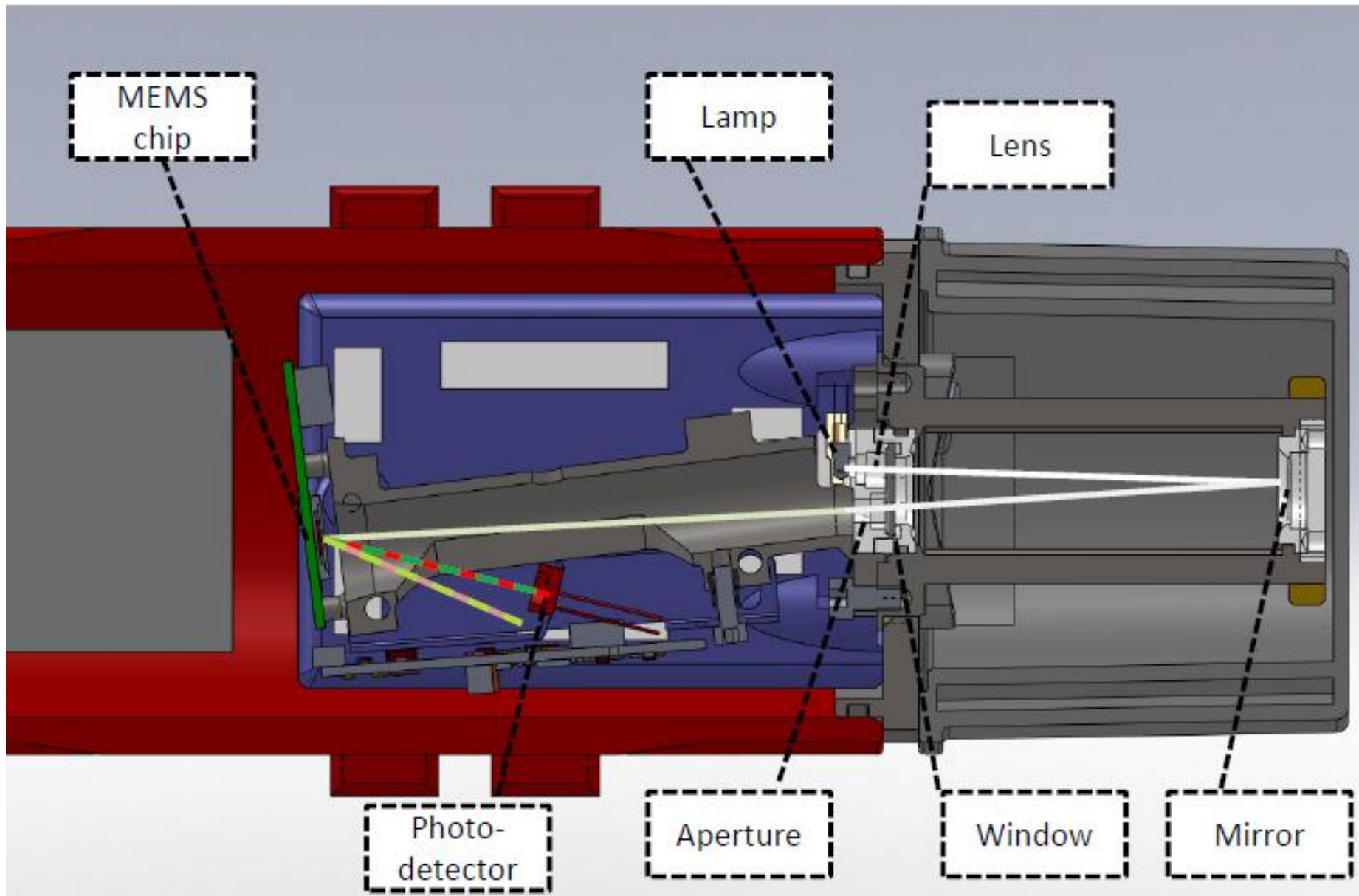From 5 W to 5 mW

GasSecure's design effectively removes all error sources with a configurable MEMS filter

MEMS optical filters

- Low power
- Fast response
- Calibration free
- Compact
  The same component performs:
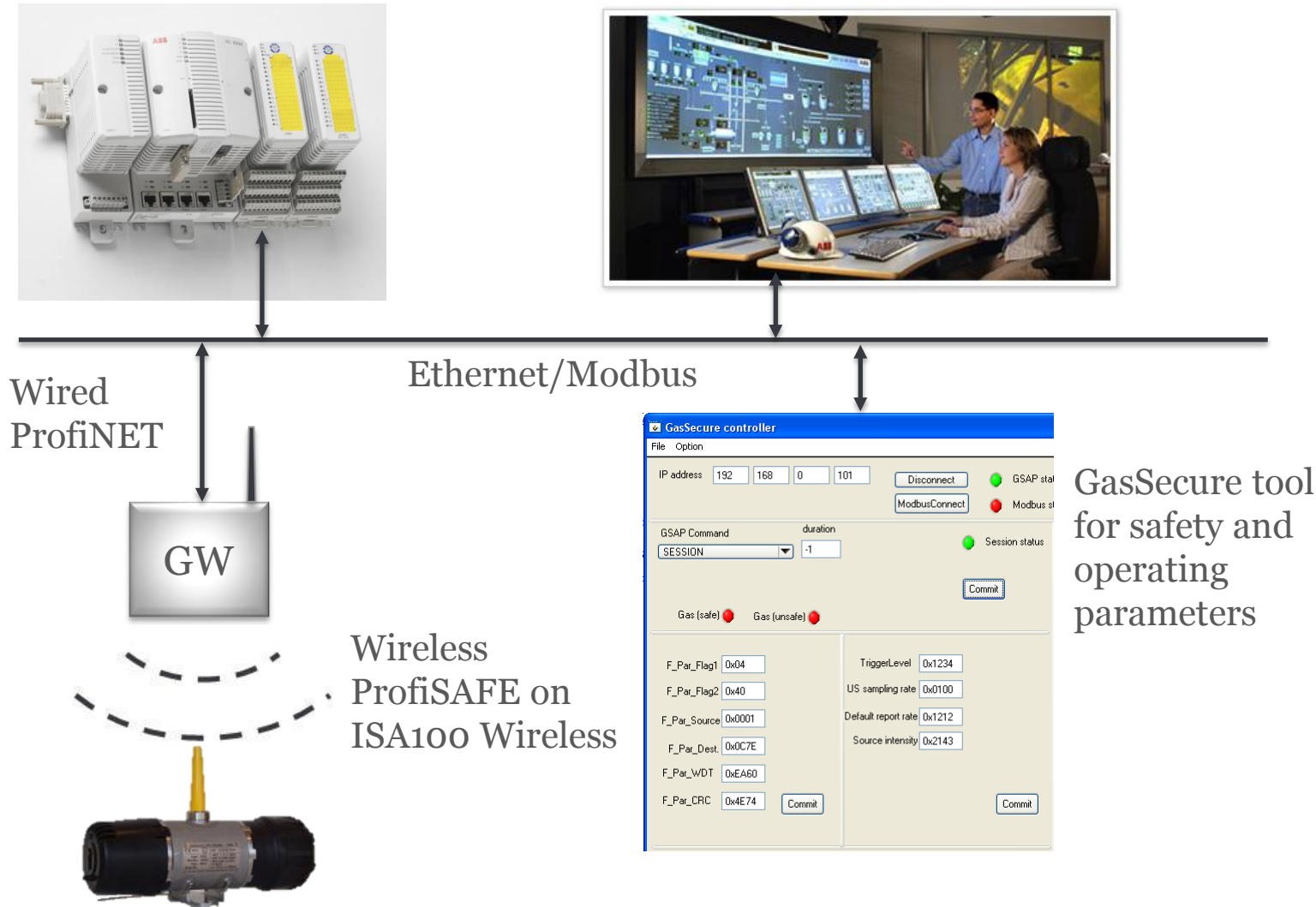 - Focusing
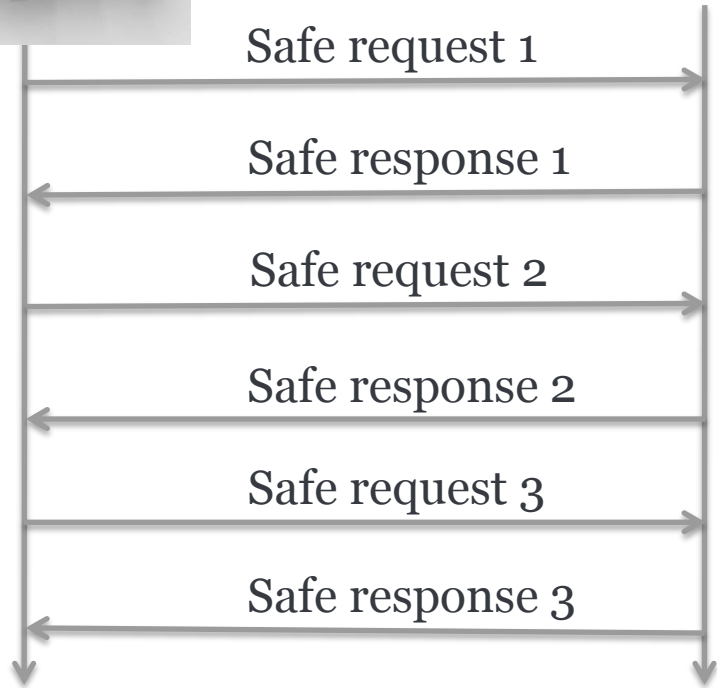 - Filtering
  - Switching

Optical design

Agenda

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- **SafeWireless** ™

- Why **ISA100 Wireless**

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Architecture

Ethernet/Modbus

Wired
ProfiNET

GW

Wireless
ProfiSAFE on
ISA100 Wireless

GasSecure tool
for safety and
operating
parameters

GasSecure controller

File   Option

IP address   192   168   0   101   Disconnect   ● GSAP sta
                                            ModbusConnect   ● Modbus s

GSAP Command   duration
SESSION   ▼   -1   ● Session status

                                                         Commit

Gas (safe) ●   Gas (unsafe) ●

F_Par_Flag1 0x04   TriggerLevel 0x1234
F_Par_Flag2 0x40   US sampling rate 0x0100
F_Par_Source 0x0001   Default report rate 0x1212
F_Par_Dest. 0x0C7E   Source intensity 0x2143
F_Par_WDT 0xEA60
F_Par_CRC 0x4E74   Commit   Commit

SafeWireless™: SIL2-rate safe wireless communication

Safe request 1

Safe response 1

Safe request 2

Safe response 2

Safe request 3

Safe response 3

- Initiated from controller

- Max 2 seconds latency from gas detection to packet at controller

- Max two hops

- Safe communication over grey channel

- Message:

  - Gas concentration

  - Battery status

  - Diagnostic

Additional communication requirements

√ Multihop support

√ Max 2 second latency from node to controller

**Solution:**

Allocate more bandwidth uplink than downlink
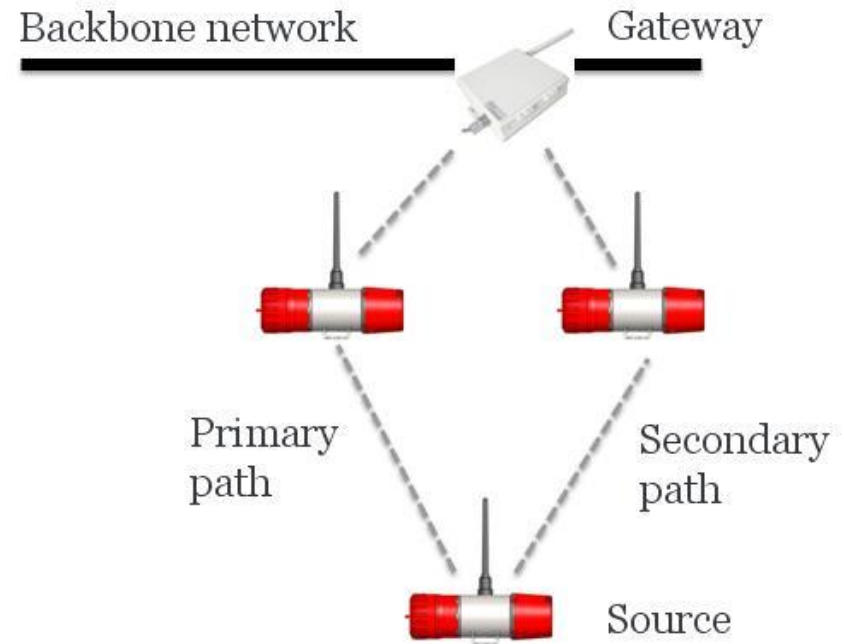
Safe message characteristics

Remedy: / Failure type:	Sequence Number	Time Out with Receipt	Codename for Sender and Receiver	Data Consistency Check
Repetition	X			
Deletion	X	X		
Insertion	X	X	X	
Resequencing	X			
Data Corruption				X
Delay		X		
Masquerade (standard message mimics failsafe)		X	X	X
FIFO failure within Router		X		

– IEC61508 dictates four mechanisms for safe communication

– ProfiSAFE over ProfiNET (or Profibus) supports all

Modes of operation
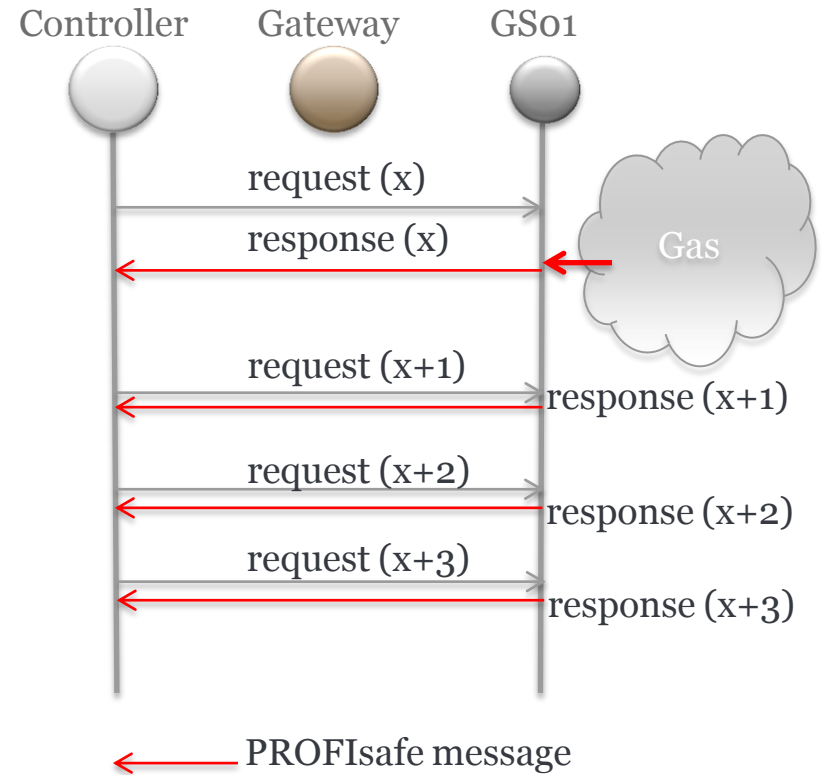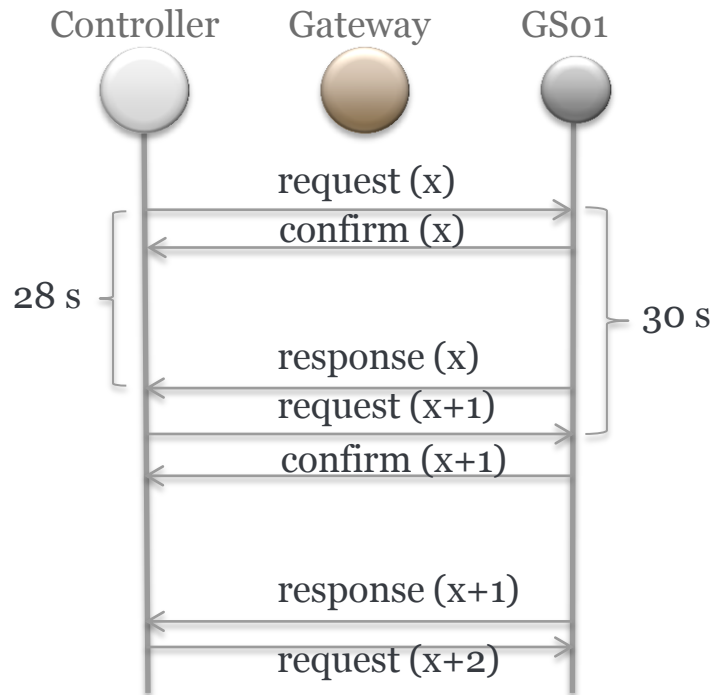
SafeWireless™

- – Non-symmetrical BW allocation

- – 'Arm' detector with safe downlink packet

- – Respond late or when gas detected

Agenda

– Operation of the detector

– SafeWireless ™

– ISA100 Wireless

– Higher level protocol support

Sensitivity

- Definition: received radio signal level where packet error rate

$$P_E \leq 10^{-2}$$

- At the time available ISA100 Wireless module $6dB$ better than WirelessHART => double range in LOS

- Important: this was NOT an issue of protocol but of radio silicon. New WirelessHART modules have same performance as ISA100 Wireless

QoS

– ISA100 Wireless CONTRACTS

  – Gives guaranteed (if no packet loss) time of packet delivery
  – Publish
  – Client/Server
  – **Bi-directional**

– WirelessHART concept of burst channels

  – Correspond to publish mode
  – Command/Response

  – No accurate timing control of downlink packets

Object vs. Command orientation

- ISA100 Wireless
  - Modern Object oriented design
  - Supports tunneling of other protocols
  - Facilitates design of user defined operation

- WirelessHART
  - Command/response oriented
  - No HART command for safe communication

Other differences:

- o ISA100 Wireless supports fragmented packets, in HART this needs to be done by application

- o ISA100 Wireless supports slow hopping

- o ISA100 Wireless supports variable length slots

- o ISA100 Wireless supports star networks (nodes do not have to be routers)

Final notes on the standards

– WirelessHART has no command that supports safety

– But probably could have been done using WirelessHART

– GasSecure in the process of developing support for WirelessHART, but for non SIL systems

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– **Higher level protocol support**

Support for higher level protocols

– Profinet (both safe and regular)
  – GasConcentration
  – Battery status
  – Error status

– Modbus
  – As above and some additional information

– Foundation Fieldbus
  – In the process of being developed

Offshore installation

- *Gullfaks C.*
- Rig operated by Statoil in the North Sea.
- 20 detectors

Summary

Detector
- – The best performing IR detector on the market?
- – Extremely low power

ISA100 Wireless chosen over WirelessHART

SafeWireless™ with asymmetric bandwidth allocation
- – ProfiSAFE

Wired communication
- – ProfiNET
- – FF being developed
- – Integration done with ABB