



Applying Wireless Technologies to Industry Automation

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Outline

- Introduction
- Business drivers for wireless
- Wireless application in Industry Automation (IA) today
- Key challenges for applying wireless for IA (focus on Industrial Control Systems)
- Recent direction of wireless standard - International Society of Automation (ISA)
 - Wireless Sensor Network
 - Wireless Backhaul Backbone Network
 - Security Standard (ISA99)
- Vision of wireless application in IA

Yokogawa – “GE” of Japan

Corporate Management (ERP*)
Integrated business operation systems

Integration

SAP, Oracle etc.

Production Management (MES*)
Systems for advanced control, simulation, production management, and scheduling

APC & AOA Advanced Process Control & Advance Operation Assistance

PIMS Process Data Acquisition & Management

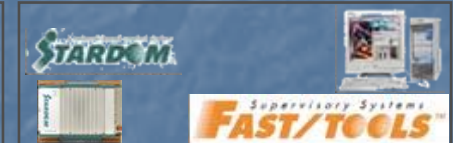
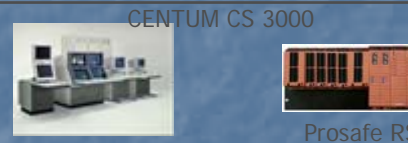
Exa Series, Trainer

Exaquantum

Production Control System
Production control systems

DCS/SIS Integrated Production Control-Safety Instrumented System

Hybrid RTU/SCADA System



Fieldbus Networks

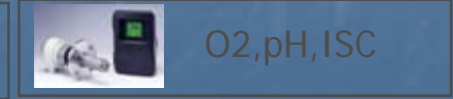
Instrumentation

FF, Profibus-DP
DeviceNet, Ethernet/IP



Gas Chromatography

Analytical Instruments



Field Instruments

Field instruments, sensors, measuring instruments, analyzers and other equipment

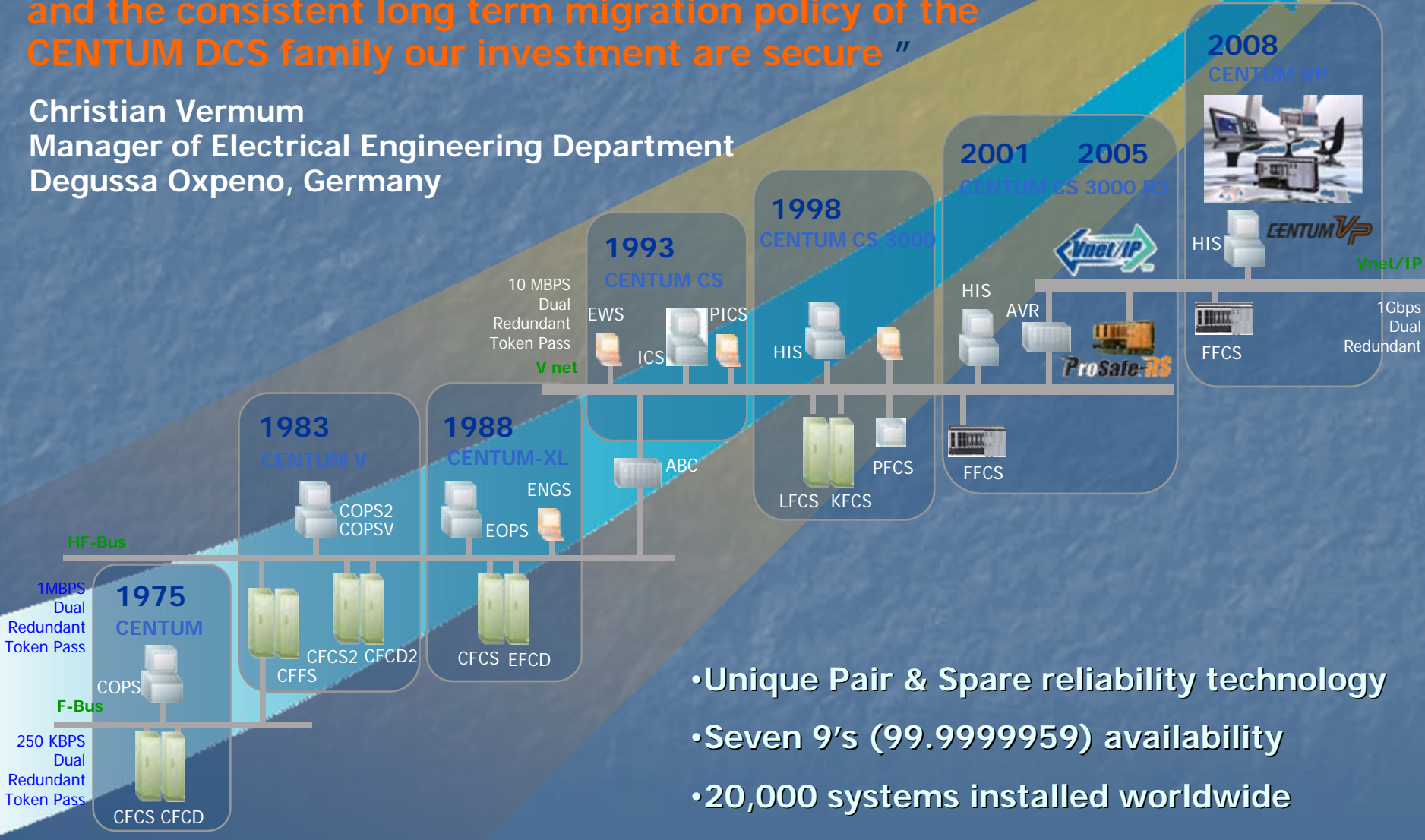
* ERP = Enterprise Resource Planning

* MES = Manufacturing Execution System

Reliable Distributed Control Systems

“ As a result of Yokogawa’s high R&D investment and the consistent long term migration policy of the CENTUM DCS family our investment are secure ”

Christian Vermum
 Manager of Electrical Engineering Department
 Degussa Oxpeno, Germany



- Unique Pair & Spare reliability technology
- Seven 9's (99.9999959) availability
- 20,000 systems installed worldwide

Why Wireless for Industry Automation?



Because I always know where my signals are going!

Installations



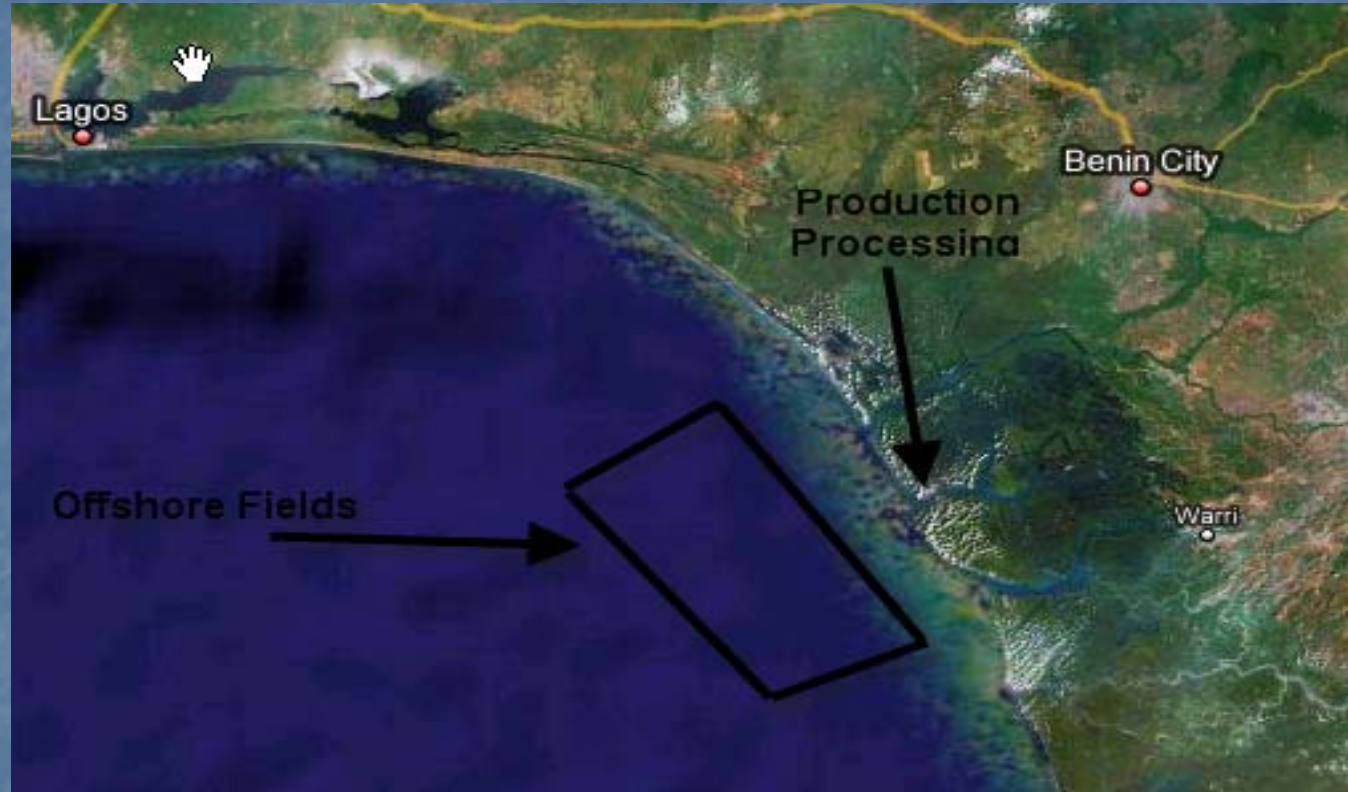
Simple starting point, Open space

Installations



Middle of no where, Unmanned

Installations



Small world that miles away from coast

Case Study



Mountain provides challenge as well as opportunity

Case Study



Many high points available above the congestion

Case Study



Large tank farm covers hundreds of miles

Case Study



Longest shot, wharf to mountain-top tower

Business Drivers for Wireless

- Staying competitive in digitalization is essential
- Industrial wireless drives down the cost of digitalization (e.g. design cost, material cost, installation cost, maintenance cost, etc.)
- Industrial wireless opens new opportunities, new demands, new angle to do business
- Lots of successful wireless application stories, lots of tangible benefits



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Wireless Opens New Opportunities – Wireless Measurements

- Enhanced Plant Asset Management (PAM)
 - Cost effectively increase process and asset monitoring
 - Freeing up cable resource for higher priority measurements
 - Allows measurements that could not be justified before
- Reduction of “blind spots” – higher visibility into operations
 - Allows measurements on rotating and/or moving equipment
 - Wiring difficult - no power available
 - Allows measurements in remote locations
 - “Unlock” remote processing units in general –well heads, tank farms, loading bridges e.g.
 - Temporary measurements for process diagnostics and optimization

Wireless Opens New Opportunities – Wireless Camera & Mobility

- Field inspection data gathering and sharing using mobile devices anywhere anytime
 - Bring global virtual field environment to control center
 - Video stream bring field virtually -- Pipeline Facilities
 - Local indicator measurement data collection
 - Historic process data trend (last 8 values)
 - Visual inspection & repair management of any equipment in the field
 - Valves, pumps, leakages, dangerous situations in general
 - Time stamping & reporting



Wireless Opens New Opportunities – Wireless Location Aware & Asset Management

- RTLS/RFID
 - Location Aware Safety System (LASS™)
 - Provider Safety alarm for field personnel
 - Mobile warehouse & mobile maintenance
 - Fuel trucks tracking
 - RFID tag based remote workforce management
 - RFID concept is guiding mobile worker – Task Tracker



Industrial Requirements

Characteristics

- **Mission Critical**
 - Continuous Operation
 - Large Energy
 - Extraordinary Incident
- **Harsh Environment**
 - Ambient Condition
 - Explosive Gas
 - Strong EM Noise
- **System Attribute**
 - Wide Area
 - Large Scale
 - Complex
 - Long Plant Life Time

Requirements

- **Reliability**
- **Robustness**
- **Quick Response**
- **Regulatory Compliance**

- **Scalability**
- **Flexibility**
- **Maintainability**

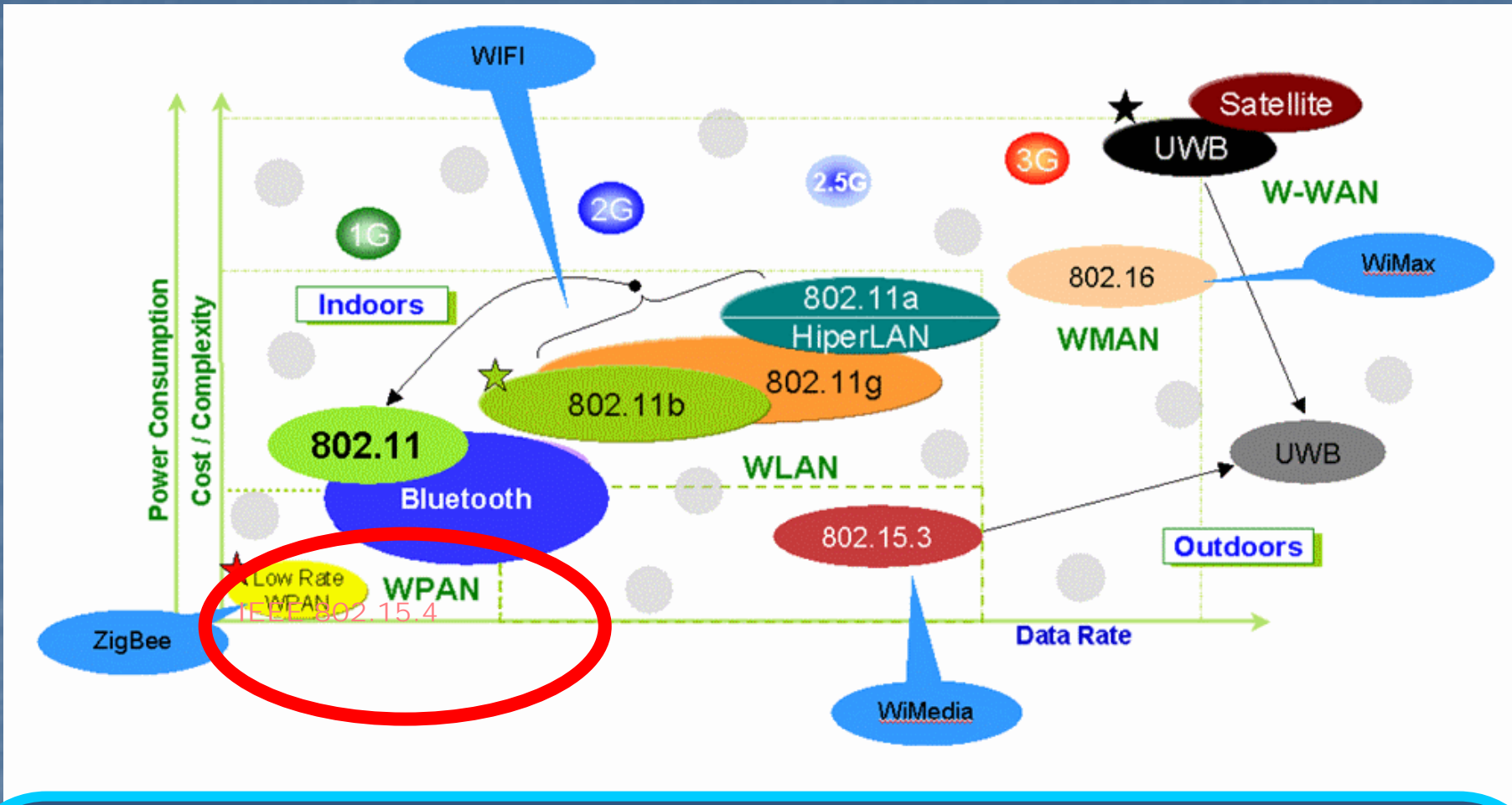
- **+ Wireless Property**



Outline

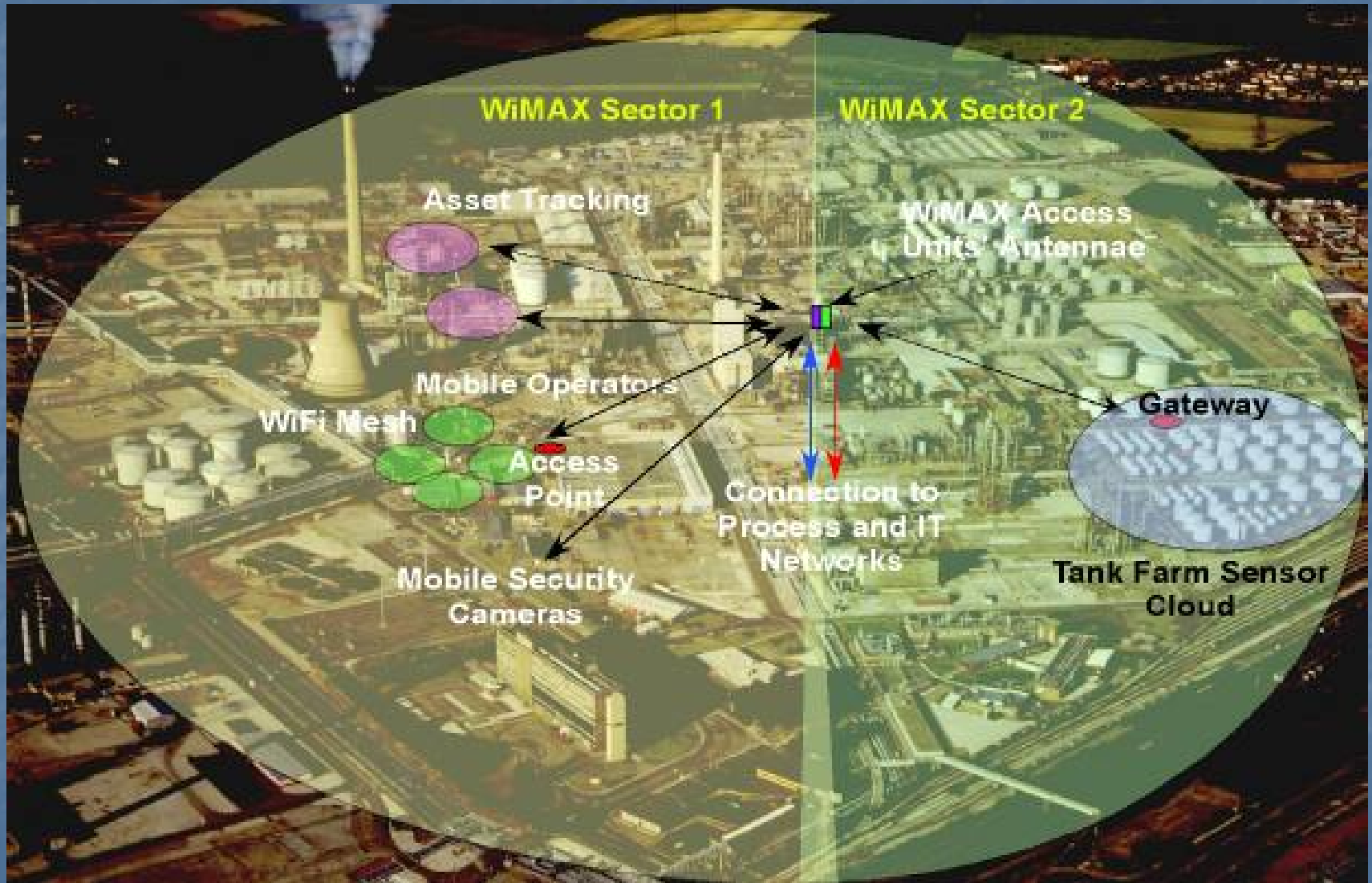
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Landscape of Wireless Technologies



Different wireless technology has its characteristics that can be best suited for particular applications

Blanket the Facility with RF Energy



Current Challenges for Wireless Application

- Implemented as silos
 - Inconsistent common security - Authentication, Authorization, Encryption
 - Inconsistence network service
 - Spotty support
 - Lacks end-to-end data support
- No uniformed implementation
 - Unable to leverage scale, difficult to replicate success
 - Higher support cost
 - Unreliable
- Entry cost is high – first application pays the toll for backbone
- Approached as infrastructure solution rather than overall integrated system solution

Technical Issues

Reliability

Security, Robustness,
Fault tolerance,
Co-Existence, ...



**Multi-
function**



Scalability

Small & Large,
Radio range,
Throughput, ...

Individual Tech. is ready,
but **Balance** is needed

**Easy
Deployment**



Openness

Installation, Management,
Maintenance, Power, Lifetime...

Interoperability,
Global Standardization, ...

Security Issues in ICS

■ Characteristics

- Poor Authentication and Authorization
- Many field devices lack crypto support
- Many unmanned field sites can be easy backdoor to the control center

■ Availability, Integrity and Confidentiality

- Enterprise networks require C-I-A
 - Confidentiality of intellectual property matters most
- ICS requires A-I-C
 - Availability and integrity of control matters most
 - Control data has low confidentiality
 - Many ICS vendors provide Five to Seven 9's of availability

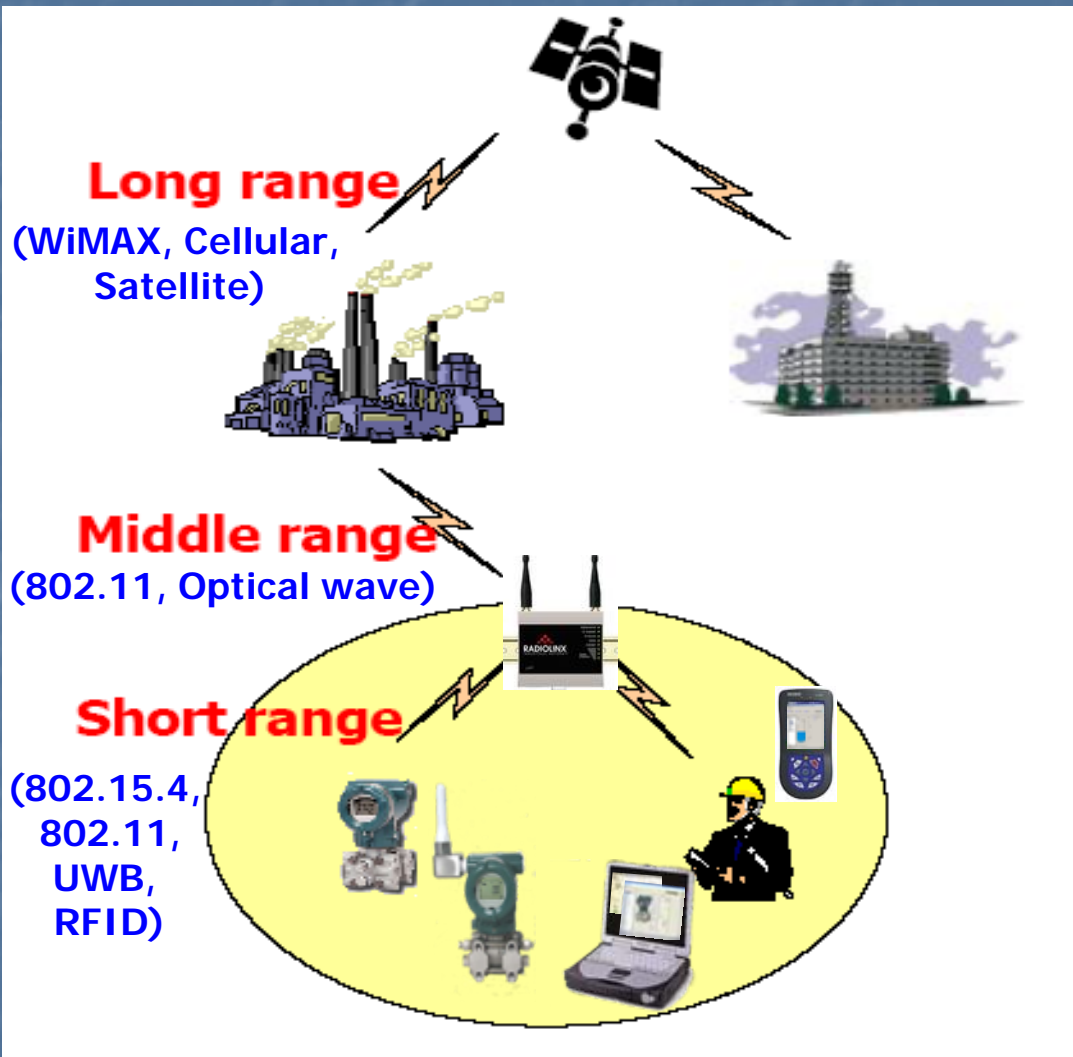
QoS & Priority of Service (PoS)

- QoS are determined by a traffic class's tolerance to:
 - Delay -- How much delay in packet delivery can be tolerated?
 - Loss -- To what degree can packet loss be tolerated?
 - Jitter -- How much variability in packet delay be tolerated?

- PoS

Application	L3 Classification		IETF RFC
	PHB	DSCP	
Network Control	CS6	48	RFC 2474
VoIP Telephony	EF	46	RFC 3246
Call Signaling	CS5	40	RFC 2474
Multimedia Conferencing	AF41	34	RFC 2597
Real-Time Interactive	CS4	32	RFC 2474
Multimedia Streaming	AF31	26	RFC 2597
Broadcast Video	CS3	24	RFC 2474
Low-Latency Data	AF21	18	RFC 2597
OAM	CS2	16	RFC 2474
High-Throughput Data	AF11	10	RFC 2597
Best Effort	DF	0	RFC 2474
Low-Priority Data	CS1	8	RFC 3662

Emerging Wireless Requirements



A variety of wireless technologies have been or is going to be deployed for different type of applications in mix environment.

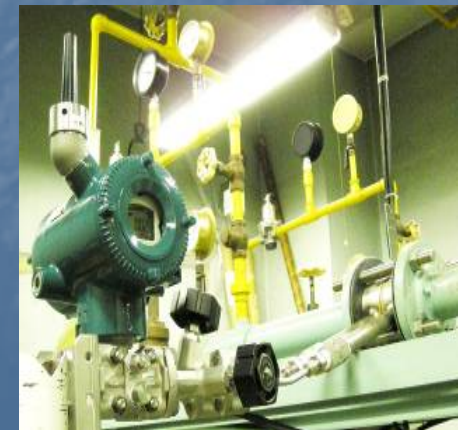
- RFID, UWB – asset tracking and location awareness
- ISA100.11a, Wireless HART – field sensor wireless
- 802.11a/b/g/n – multimedia applications for data , video, VoIP
- WiMAX, Cellular, Satellite – middle and long range data carrier

The key successful elements for wireless solutions are:

- Interoperability
- End-to-End Security
- End-to-End QoS

Success Criteria for Wireless

- **Common Backbone** infrastructure supporting all wireless applications
- **Appropriate Prioritization and QoS** for application classes
- Works with **Many Transports Medias**
- **Common Support Services** such as Authentication, Authorization, Administration
- **Common Management** backhaul with one HMI
- **Provide Robust, Secure** communications for all wireless applications
- **Low Initial Entry Cost**
- **Cost Effectively** support of less dense applications (Tank Farms, Perimeter Security, Gate Systems)
- **Future Approve**



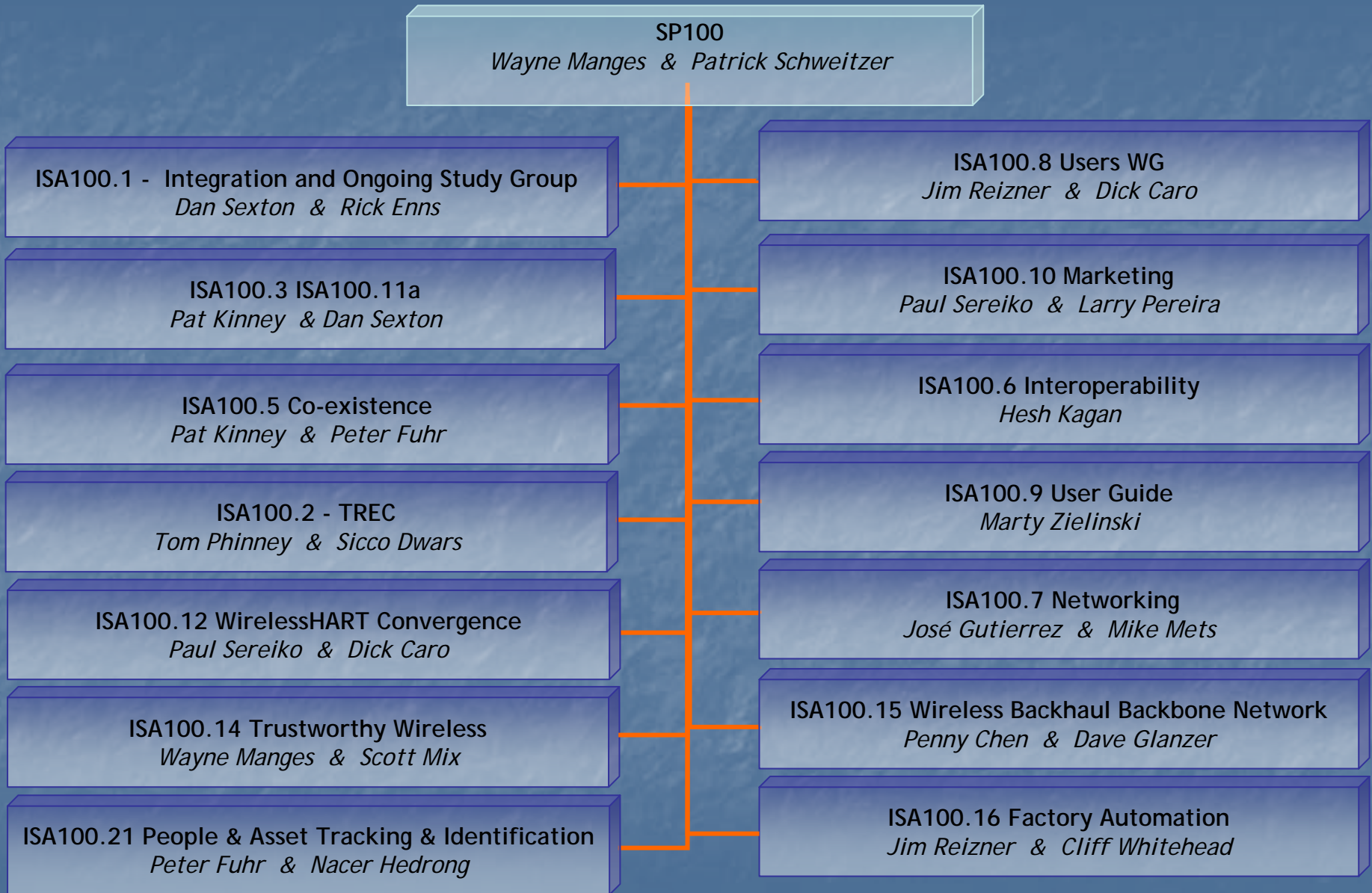
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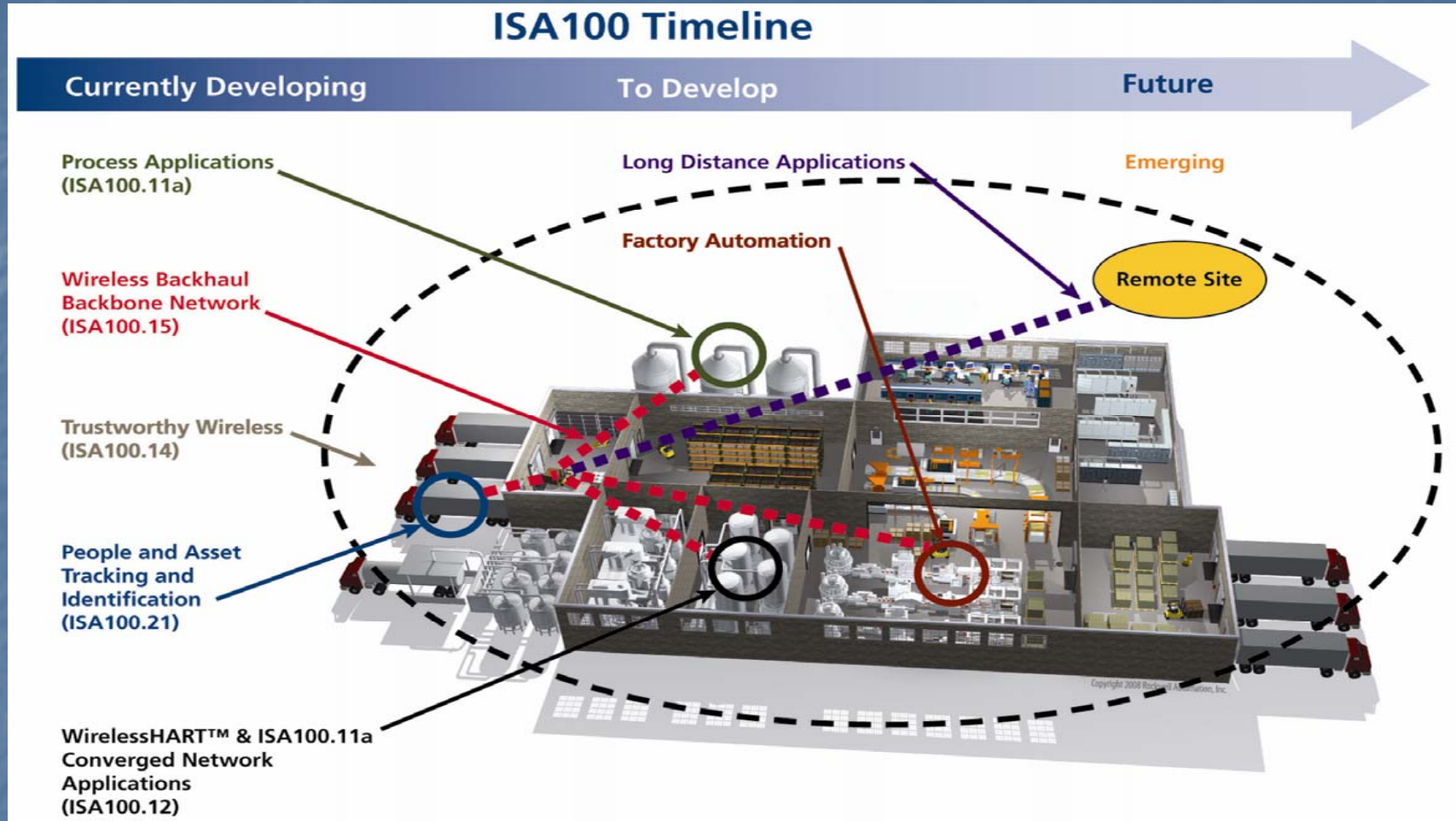
Why Standard?



Because somebody will always invent an adapter



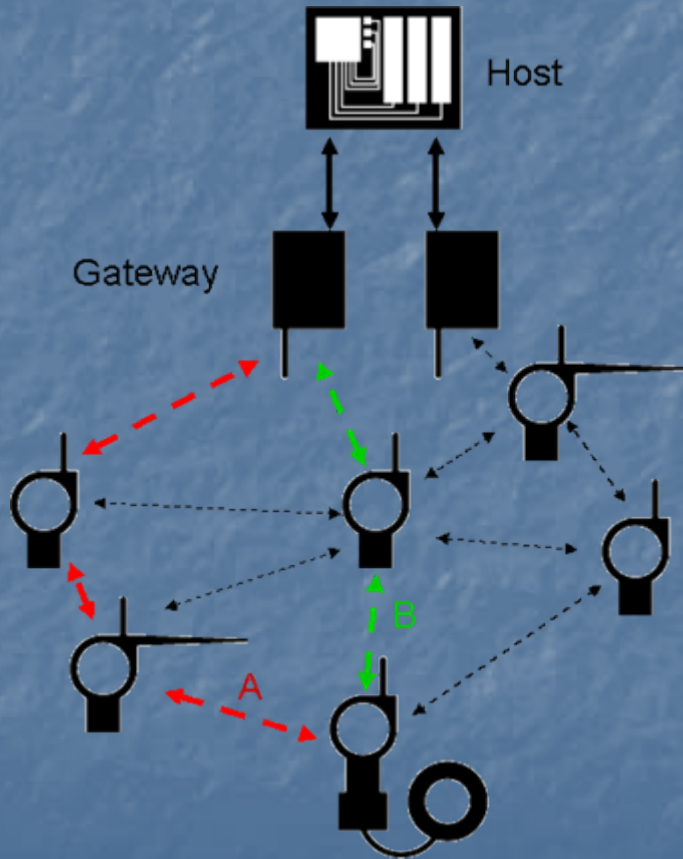
ISA100 Overview



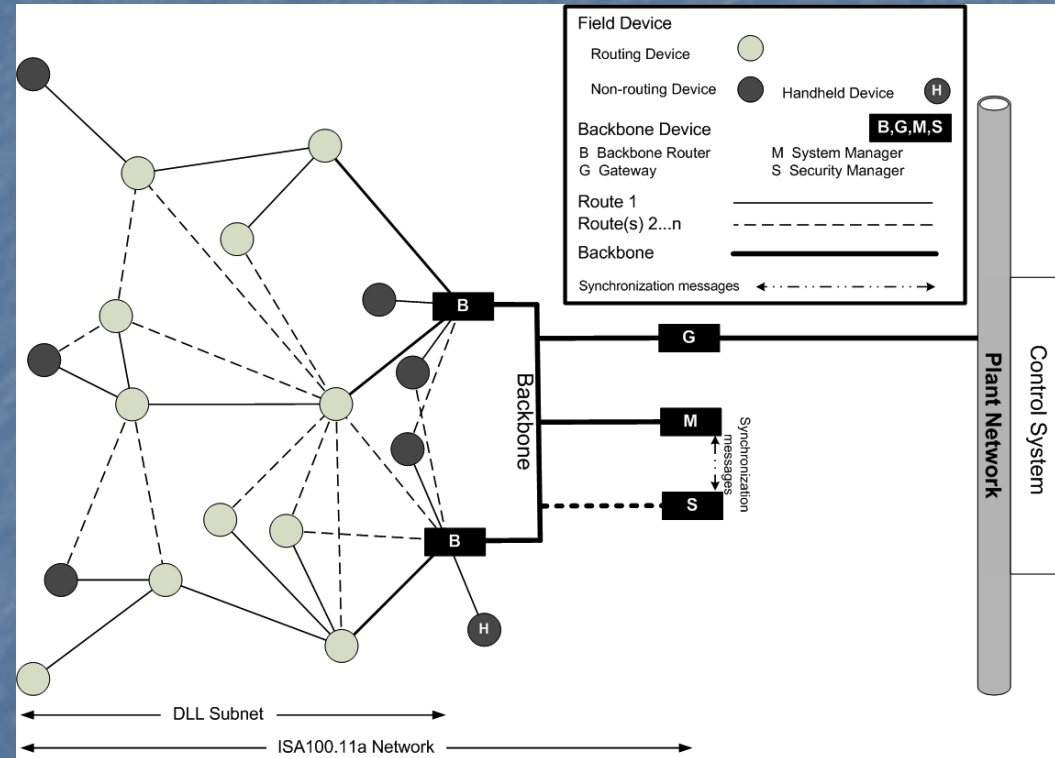
**A Complimentary Family of Standards
that Accommodate your Plant-wide Needs**

Two major field sensor wireless solutions

WirelessHART



ISA100.11a



ISA100.15 Wireless Backhaul Network WG

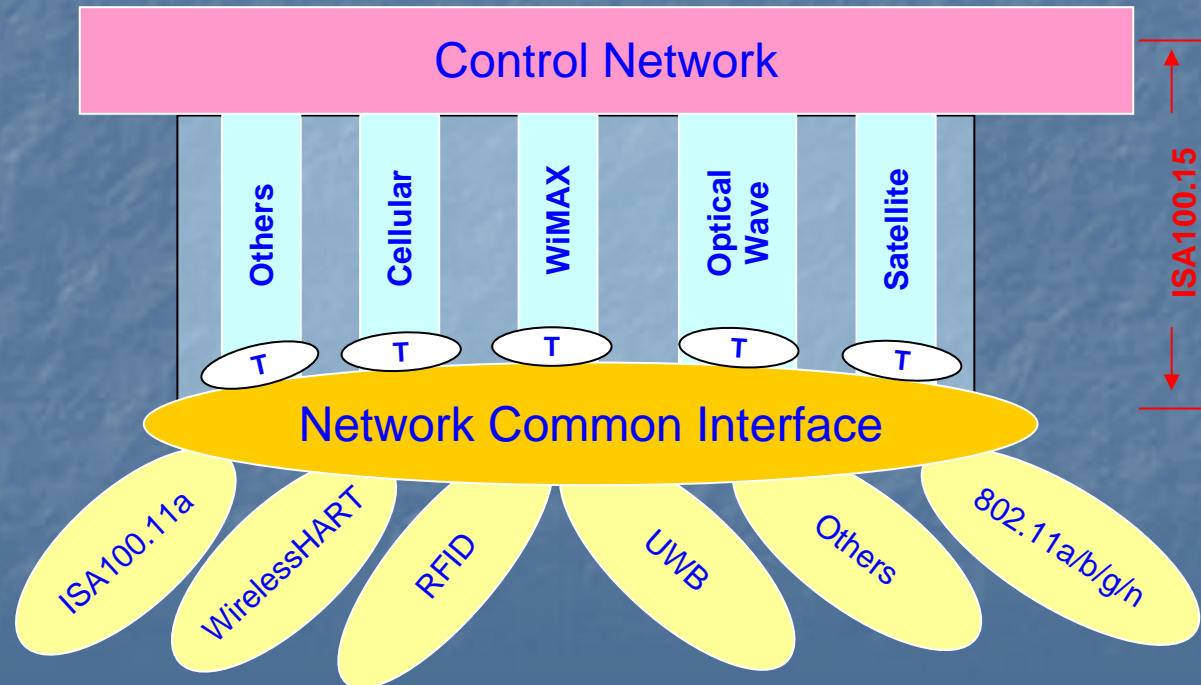
- **Mission:**

The ISA100 Wireless Backhaul Backbone Network Working Group will develop and maintain a standard to address one or more dedicated or shared wireless backhaul backbone to support one or more technologies, running multiple applications.

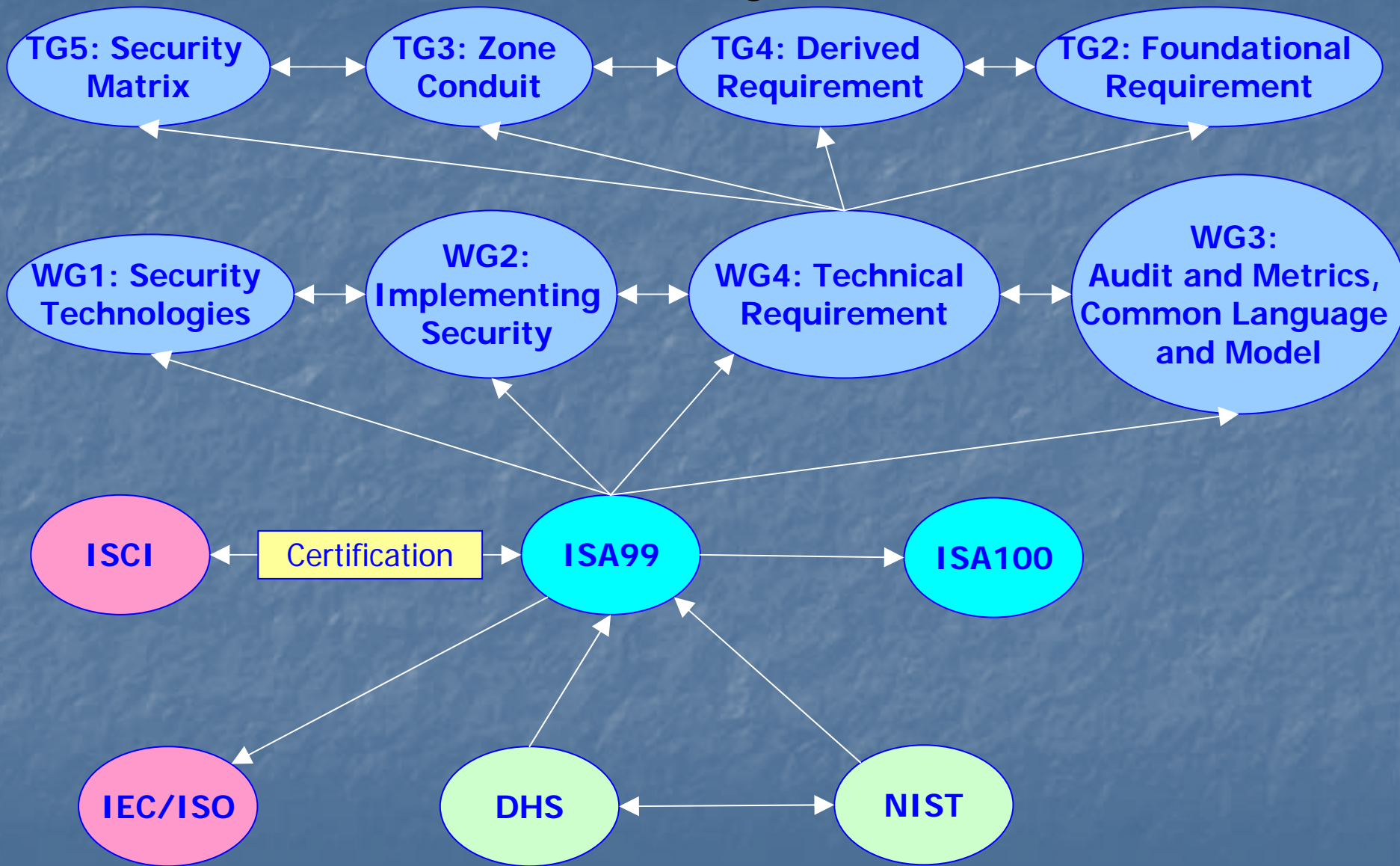
- **Focused on:**

- *Interoperability*
- *End-to-End Security*
- *End-to-End QoS*

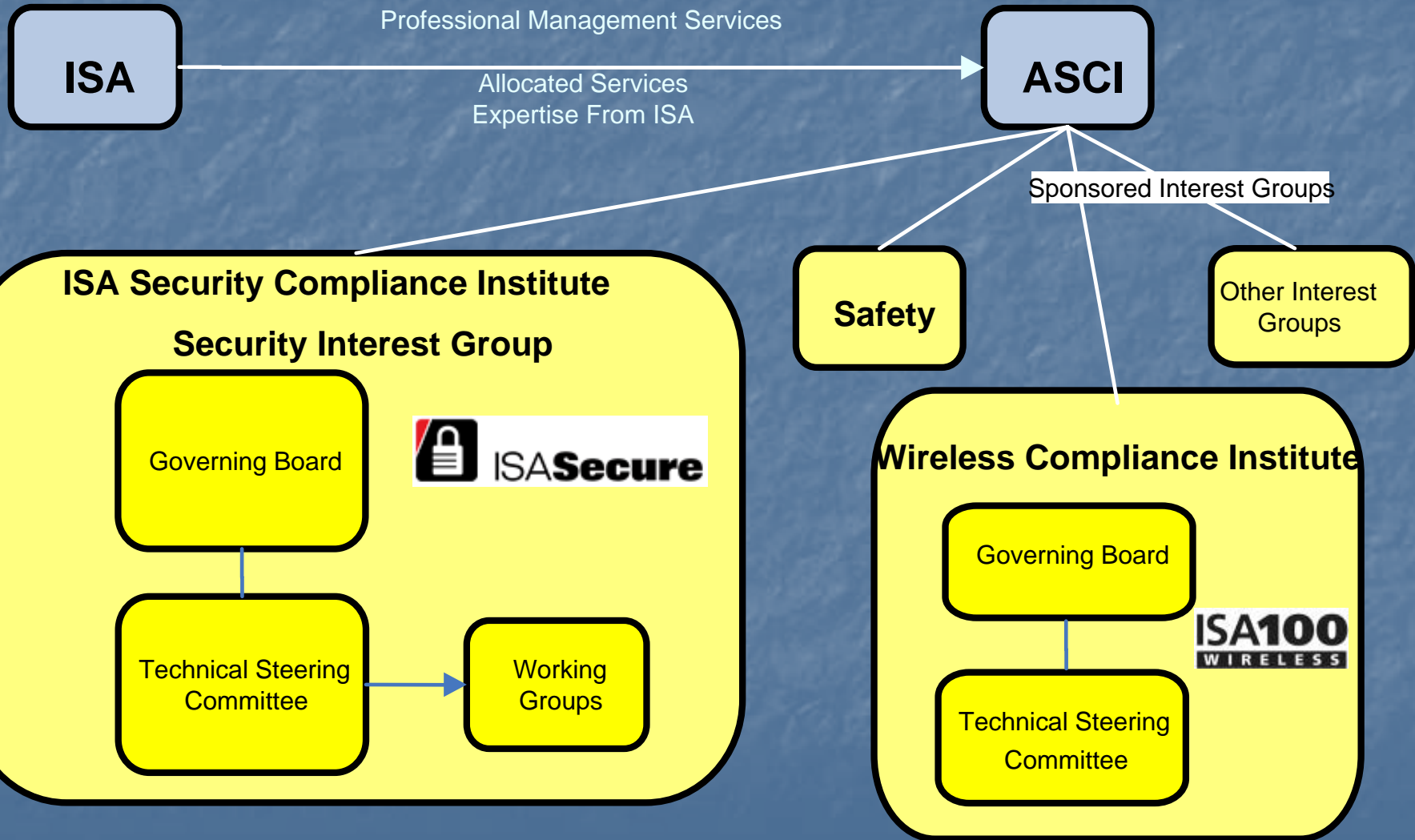
- **Cooperation with FF**



ISA99 Security Standard



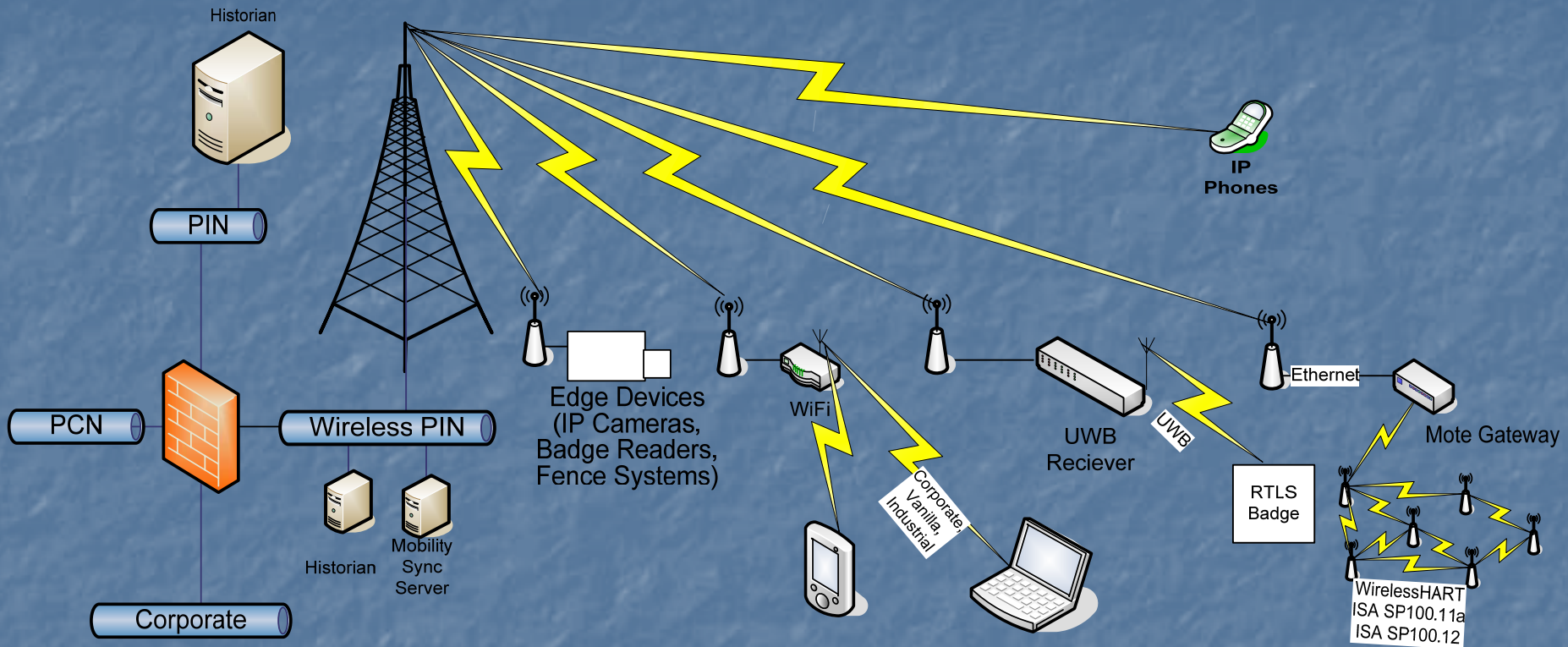
ISA Compliance Institutes



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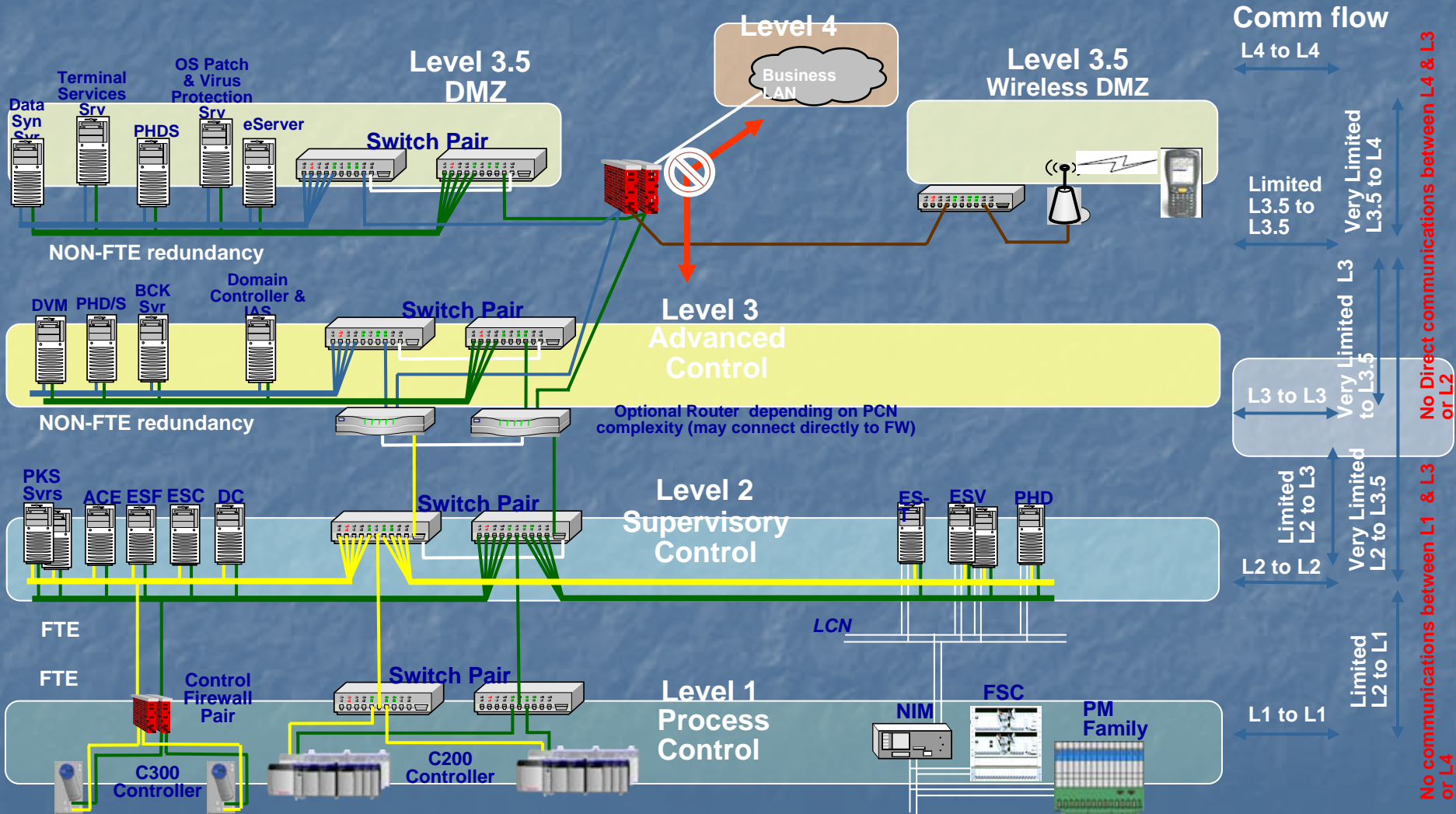
Wireless Digital Umbrella Vision



Integrated Solution to Provide Common Service for All Wireless Applications

High Security Network Architecture

•DMZ = Demilitarized Zone



Lots of Issues ==
Lots of Opportunities

vigilantplant.TM
The clear path to operational excellence



Thank you!

For more information, please contact:
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