New movement of the field wireless solutions to realize the "Wireless Anywhere"

7th October, 2014
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Toshi Hasegawa is a Manager of industrial automation technology marketing, particularly with wireless. Toshi has been working for Yokogawa Electric Corporation for 26 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. He is a voting member of ISA SP100 Wireless System for Automation. And he is a district leader of the ISA100 Wireless Compliance institute (WCI) Asia Pacific. Toshi is also member of the Japan national committee of IEC/TC65/SC65C/WG17 (Wireless communication network and communication profiles-Coexistence). He is a chairman of Wireless working group of Japan Electric Measuring Instruments Manufacturers’ Association (JEMIMA).
Today’s topic

The goal of this presentation is to introduce our technical approaches to realize "Wireless Anywhere". This our new concept is to expand and utilize the ISA100 Wireless in the field.

Contents

• Why industrial wireless?
• Why ISA100 Wireless?
• How to realize ISA100 wireless solutions?
• What are the advanced technology and solutions?
• How to utilize ISA100 Wireless technology?
• What is the “Wireless Anywhere” concept and its components?
• What are the benefits for vendors and end-uses?
• Summary
Why industrial wireless?

Reduce blind spots: Avoid guesswork, instability, sub-optimization.

We are confident to the industrial wireless technology that will help customers to achieve Lifecycle Excellence over long-term. Industrial wireless is a key technology of the Field Digital Innovation to realize Vigilant Plant of our vision.

Increase Productivity

Improve Flexibility

Reduce Costs

New Applications
Why ISA100 Wireless?

- User driven standard
- **Future proof, Scalable, Reliable and Flexible**
- Wide range of applications from monitoring to control
- **Multivendor interoperability** for best in class solution
- IEC approved as an international standard, IEC 62734.
ISA100 provides wide range of applications:

**Wireless Control** (Committed highest reliability and availability)

- Update rate 1 second with DUO cast
- PID on DCS
- Redundant gateway
- Redundant BBR
- Wireless pressure device for water level measurement
- Wireless positioner device
- FDT/DTM technology for positioner setting
ISA100 provides wide range of applications: Wireless Gas detector (Committed deterministic performance)

**Challenge**
- Deterministic performance
- **Rapid response: 5~7sec** including gas-detecting time and communication
- Low energy consumption

**Solutions by ISA100**
- Quality of services to manage bandwidth and latency
- Time slot communication (TDMA) for deterministic response
- Star topology / Backbone routing for short latency
- Object-oriented application layer with protocol tunneling not limited to HART (SIL-certified safety protocols included)
- Multiple coexistence mechanisms, e.g. detection of general energy level in channel (including Wi-Fi)

http://www.gassecure.com
ISA100 provides wide range of applications:
Monitor many points (Committed large scale configuration)

ISA100 Full Functional

Redundant Gateway
1 sec Switchover

20 Access Points

500 devices@5sec update
200 devices@1sec update
ISA100 meets end user requirements

53% of our customers are required high speed monitoring from 1 sec to 10 sec update period.

End user require high speed update time and number of devices

End user require large scale network
- The number of devices per one project are increasing in Asian market.
- Recently there are more than one thousand devices on several projects.

End user require large scale network

The trend of enquiries which require more than ten devices

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How to realize ISA100 Wireless solutions?

We are taking bottom-up approach.
(1) Radio Level

Long range: 600m

Coexistence with Wi-Fi: 5.5% PER

Robust in pipe jungle: Almost 0% PER

REAL Benefits

Application versatility

Stable Network

(1) Radio Level

Reliable Physical Layer

Reliable radio is basis for stable network
(2) Network Level

Reliable Physical Layer

Stable Network

Application versatility

REAL Benefits

Stable network is basis for application versatility

Scalability: IEEE1588 synchronization
(3) Operation Factor

(2) Network Level

(1) Radio Level

Application versatility provides real user benefits
Breakthrough for High Reliability and availability
Duocast and Redundant Gateway

Evaluation of Redundancy

**Redundant Gateway**
Switch over time is less than one second without any data losses of wireless network

**Duocast**
Duocast provides reliable radio communication with short latency
Breakthrough for large scale network
IP base backbone network

ISA100 Full Functional

Redundant Gateway
1 sec Switchover

20 Access Points

500 devices@5sec update
200 devices@1sec update
Performance of ISA100 Wireless Network

Maximum # of devices with No collision

Update Time (Second)
Breakthrough for stable and scalable network
“Sky Mesh” concept for wireless installation

Sky mesh enables **Scalable network, low latency, minimized number of routers, deterministic battery life and reliable wireless link**

Communicate from a height

Max 50 m (in pipe jungle)

Max 600 m (LOS) ※

Simple topology is easy for network management
How to utilize ISA100 Wireless technology?

- Widen adaptation of ISA100
- Support 3rd vendors with ISA100WCI
- Realize “Best in class solution”

“Wireless Anywhere” concept is to expand to utilize the ISA100 Wireless network in the field
Wireless Anywhere

Next initiative: To utilize the “ISA100 Full Functional”

Three initiatives of Wireless Anywhere

① Support 3rd vendors with ISA100WCI
   → Modularizing wireless components to accelerate product development

② Widen adaptation of ISA100
   → Promoting adoption of the ISA100.11a standard

③ Realize “Best in class solution”
   → Facilitating host connectivity for both wired and wireless field networks
Wireless Enabler for 3rd party development

→ Modularizing wireless components to accelerate product development

This is a new movement of industrial wireless
# Specifications of ISA100 Wireless module

## Wireless configuration
- **Communications protocol**: ISA100.11a (IEEE802.15.4 compliant)
- **Frequency range**: 2,400 MHz to 2483.5 MHz (max. 16 channels)
- **Output**: Max. +12 dBm (+2 dBi omni-directional antenna)

## Sensor interface
- **Connection speed**: 9,600 bps (RS485 compliant)
- **Cable length**: Max. 20 m
- **Input voltage**: 3.3 V (2.9 ~ 4.8V)

## Operational configuration
- **Enclosure class**: IP66, NEMA4x
- **Operating temperature**: Standard model: –40°C to +85°C
  Intrinsic safety and explosion protection model: –40°C to +70°C

Note: Specifications may differ depending on when the module is provided. The names of companies, products, and brands in this text are registered trademarks or trademarks of the respective holders.
Benefits for field device manufacturers

1. **Speeds up development and neglected investments**
   This module is comprised of an antenna and wireless communications circuitry. By installing this module on a field device that includes components such as an interface circuit and power supply, a field device manufacturers can speed up the process of developing an ISA100 Wireless sensor.

2. **RF designs are not required**
   Thus the sensor interface uses serial interface normally used with a plant because the both of antenna and the communication circuitry are installed in the wireless communications module with a built-in antenna, expensive RF cable and connector are not needed.

3. **Complies with radio regulations and explosion protection standards**
   Based on its wealth of technologies and expertise in the development of field wireless devices, Yokogawa has been able to design a module that complies with over 100 countries’ radio regulations as well as all the major explosion protection standards. Field device manufacturers thus do not need to certify that their sensors meet such regulations and standards, drastically shortening development time.

This wireless module can help field device manufacturers significantly shorten the time needed for developing wireless field products.
Neglected investments & 4-20mA like interoperability

Yokogawa provides a built-in antennae with the followings

- ISA100.11a Communication stack
- RF design + assembling circuit board
- Certification of Radio regulations
- Certification of Explosion proof
- Maintenance of radio module

Neglected investments ($)

+ 4-20mA like interoperability of field devices

Field device manufacturers are easy to provide ISA100 Wireless solution, and focus on their investment to core competence business
Multi-Protocol wireless adapter utilizes wired field instruments to function as ISA100 Wireless devices for various applications

• **Features**

  When the multi-protocol wireless adaptor is mounted on a wired field instrument or analytical sensor, the instrument or sensor is able to function as an ISA100 Wireless device. It may be used with any type of wired field instrument or analytical sensor commonly used in plants
  - **Support of multiple standards**
  - **Battery power source for field instruments and analytical sensors**
  - **Environmental resistance**
Benefits for end uses

1. **Provide 4-20mA like interoperability**
   Greater range of field instruments and analytical sensors to choose from.

2. **Enable best in class solution**
   Multi-protocol wireless adaptor will greatly facilitate the introduction of field wireless systems with best in class solution.

3. **Minimize risk for wireless network management**
   ISA100 Wireless infrastructure provide large scale, high speed and reliable wireless network to support plant wide applications.

4. **Easy to use wireless**
   In plants, enabling wired field instruments and analytical sensors to function as ISA100 Wireless devices.
Prototype of ISA100 wireless adapter for SENCOM communication
Easy to support any legacy devices and expand the wireless solution portfolio

- HART devices
- SENCOM devices Modbus/RS485
- Any vendor’s devices redesigned using ISA100.11a “in the stick”
- FF devices
- PROFI devices

Available

Paining

Wired HART Communication
SENCOM Communication
Serial Communication
FOUNDATION fieldbus
PROFIBUS PA

Field Wireless Access Point

Field Control Station
Field Wireless Management Station

CENTUM VP

Modbus/RS485
FF devices PROFI devices HART devices SENCOM devices
Wireless Anywhere is an enabler to gather variety of field data

Field data

- Process Control
- Safety monitoring
- Asset Mgmt.
- Environmental monitoring
- Other Solution

Monitoring Control
- Gas
- Vibration
- Corrosion
- Steam Trap
- pH
- Others

ISA100 Wireless™

Field Devices

Wireless Anywhere
Summary of our approach (1)
To commit to Reliable Radio

We evaluated reliable radio thoroughly without compromise
Summary of our approaches (2)
To provide dependable infrastructure

Plant wide ISA100 Wireless Network

Reliability
Duocast and Redundant Gateway

Scalability
500 devices per Gateway with 5 sec update

Flexibility
Multi-media Comm. for Backbone network
- Ethernet
- Optical fiber
- Wi-Fi

Deterministic
Low latency Comm. based on “Sky Mesh” concept

Openness
Integration into existing control system

Stability
In-depth evaluation for large scale network

Plant wide Wireless is an accumulation of many innovations
Summary of our approach (3)
To utilize ISA100 Wireless technology

Wireless Anywhere

**Control**
Object oriented application supports
Publish /Subscribe Communication

**Safety**
Rapid response for Gas detection

**Monitoring**
- Process monitoring
- Temperature
- Pressure
- Level
- etc.

**Legacy device**
ISA100 Wireless adapter support wired Legacy devices

**Multi-vendor**
Assure

**Asset Mgt.**
- Vibration
- Corrosion
- Steam Trap
- etc.

“Wireless Anywhere” facilitates multi-vendor interoperability for best in class solution. Why don’t you join the ISA100 wireless network!!
February 18, 2014 - Frost & Sullivan recognizes Yokogawa with the 2014 Global Frost & Sullivan Award for Enabling Technology Leadership. The concept of a connected industry is increasingly becoming a reality as industries such as oil and gas, chemicals, power, pharmaceuticals, steel, water, mining, food, and beverage move towards a digital operating environment for better connectivity, productivity, and cost effectiveness. This wave of digitization has driven Yokogawa to focus on the concept of "Wireless Anywhere" by fusing openness, interoperability, and reliability into a total wireless solution.
VigilantPlant – Our Vision for the Ideal Plant

“A well managed plant is quiet and boring”
- Peter F. Drucker

Reduce blind spots
Avoid surprises
Preempt bottlenecks

We believe this new movement of “Wireless Anywhere” is a key enabler to realize VigilantPlant
Thank you for your attention