Document type: Contributions

Title: Industrial IoT Standards, Technology and Solutions

Status: This contribution will be presented at workshop on IoT in the 1st SWG5 meeting.

Date of document: 2013-02-15

Source: Chongqing University of Posts and Telecommunications, CHINA

Expected action: INFO

No. of pages: 28

Email of secretary: khi@etri.re.kr

Committee URL: http://isotc.iso.org/livelink/livelink/open/jtc1swg5
Industrial IoT Standards, Technology and Solutions

Workshop and First Face-to-Face Meeting of ISO/IEC JTC1 SWG on IoT
6th-8th March, 2013
Berlin, Germany

Presenter: Wei Min
weimin@cqupt.edu.cn
Key Laboratory of Industrial IoT & Networked Control, Mini. of Education, China
Chongqing University of Posts and Telecommunications
Speaker Background

- Wei Min
- Key Laboratory of Network control & Intelligent Instrument (Chongqing University of Posts and Telecommunications), Ministry of Education, China
- Drafter of WIA-PA standard (IEC 62601)
- Technical leader in several Chinese National Science and Technology Major Projects, including Chinese 863 program - "The Wireless Industry Measurement and Control System"
- Heathrow Group Member (Industrial wireless convergence standard)
- weimin@cqupt.edu.cn
- +086-023-62487845
• Outline
  – Introduction
  – WIA-PA (IEC 62601)
  – ISA-100 and ISA-100.11a (IEC 62734)
  – Wireless HART (IEC 62591)
  – Solutions
  – Conclusion
Introduction

• An industrial IoT that can solve today's problems and meet our needs . . . .

• There are many different application requirements for wireless.
• There are many frequencies and protocols for a number of good reasons.
• Some requirements are for high bandwidth – and long distance other are for low power short range.
• These different needs dictate different technologies.
Why Develop Global Industrial IoT Standards?

1. Wire-substitute
2. Routing is never an issue
3. Application Driven
Introduction

Standard Analysis

Nowadays, several wireless industrial standards have appeared in the market place. They are

- IEC 62591 WirelessHART™,
- IEC 62601 WIA-PA, and
- IEC 62734 ISA100.11a.

All of these standards essentially address the same physical space where wireless can be used for industrial applications.
• **WIA-PA (Wireless Networks for Industrial Automation-Process Automation)**

  - WIA-PA has been listed as a key project of the National High-tech Research and Development Programs of China (the 863 Programs);
  - was approved by IEC as publicly available specifications (IEC/PAS 62601) in 2008;
  - has been unveiled as the national standard of the People’s Republic of China (GB/T26790.1-2011);
  - was approved by IEC as international standard (IEC 62601) on Nov. 2011;
• WIA-PA Key Technology

◆ A hierarchical network topology that combines star and mesh

➢ The first level of the network is in mesh topology, where routing devices and gateway devices are deployed.

➢ The second level of the network is in star topology, where routing devices, field devices, and handheld devices (if they exist) are deployed.
• **WIA-PA Key Technology—superframe**

WIA-PA is based on TDMA by using superframe

- The CAP period defined in the IEEE STD 802.15.4-2006 superframe is used for device joining, intra-cluster management and retry in the WIA-PA superframe;
- The CFP period defined in the IEEE STD 802.15.4-2006 superframe is used for communication between handheld devices and their cluster head in the WIA-PA superframe; and
- The inactive period defined in the IEEE STD 802.15.4-2006 superframe is used for intracluster communication, inter-cluster communication, and sleeping in the WIA-PA superframe.
• WIA-PA applications
  ● Industrial application
  ● Environment monitor
  ● Smart grid
• ISA-100 and ISA-100.11a (IEC 62734)

◆ Founded in 1945, The Instrumentation, Systems, and Automation Society (ISA) is a leading, global, nonprofit organization that is setting the standard for automation by helping over 30,000 worldwide members and other professionals solve difficult technical problems, while enhancing their leadership and personal career capabilities.

◆ Based in Research Triangle Park, North Carolina, ISA develops standards; certifies industry professionals; provides education and training; publishes books and technical articles; and hosts the largest conference and exhibition for automation professionals in the Western Hemisphere. ISA is the founding sponsor of The Automation Federation.
The ISA100 committee is part of ISA and was formed in 2005 to establish standards and related information that will define procedures for implementing wireless systems in the automation and control environment with a focus on the field level.

The committee is made up of:
- Over 400 automation professionals
- From nearly 250 companies around the world,
- Representing end users, wireless suppliers, DCS suppliers, instrument suppliers, PLC suppliers, technology suppliers, system integrators, research firms, consultants, government agencies, and consortiums,
- Lending their expertise from a variety of industrial backgrounds

A Large, Diverse Group of Professionals Designing Industrial Wireless Standards with and for End Users
ISA100 Overview

• Backed by ISA Expertise, Heritage and History
  – Nearly 30,000 Members with 140 Standards Committees using an Open Standards Development Process **Accredited by ANSI**
  – Estimated at ~1 Billion Products Using ISA Standards Technologies
  – ISA 100 **Designed by Experts** in Wireless, Security, and Instrumentation Technologies with Direct End Users Involvement on Committee

• Family of Standards: Single-Stop Standardization Effort
  – Designed to **Accommodate all your Plant Needs**
  – Areas of Coverage Identified to Date: Process Automation (Process Focus), Factory Automation (Discrete Focus), Transmission and Distribution (Long Distance Focus), RFID (Industrial Tagging Focus)

• Multi-Protocol Capability: The Power of a Single Network
  – Allows **Deployment of a Single, Integrated Wireless Network**
  – Bring Simplicity to your Work with:
    o Single Technology to Learn, Maintain and Operate
    o Single Security System to Manage
    o Single Set of Infrastructures

• Co-Existence: Providing Peace of Mind
  – Designed with Co-existence features
  – **Ensures Best Possible Performance**

Wireless Systems for Industrial Automation
*Developing a Reliable Family of Wireless Standards*
Sample of Supporting Companies

Lots of Industry Expertise & Support for the ISA100 Standard
ISA100 Standards Plan

ISA100 Time Schedule

Currently Developing
- Process Apps (ISA100.11a)

To Develop
- Discrete Apps
  - Long Distance Apps
  - Location & Tracking
  - Industrial Facility Apps

Future
- Emerging Apps

ISA100 Family of Standards:
One-Stop Standardization Designed to Accommodate all Your Plant Needs
May, 2009: the ISA100 standards committee voted to approve ISA100.11a, "Wireless Systems for Industrial Automation: Process Control and Related Applications".

September 9, 2009: ISA officially released ISA100.11a

2010: the ISA100 committee approved a major corrigendum to the 2009 edition of the standard reflecting comments received from organizations implementing the standard, and other commentors seeking clarification.

The 2010 edition of the standard was submitted to the IEC SC65C in the form of a PAS (Publicly Available Specification) and as a New Work Item for international standardization. In this form, it has been numbered as IEC 62734.
ISA100.11a Architecture

A Robust, Flexible, and Scalable Architecture to Meet Various Plant Needs
ISA100.11a Reference Model

Key Technology:
- Time Slot communication;
- Time Synchronic;
- Channel Hopping;
- Graph and Source Routing;
- Special SuperFrame

ISA100.11a reference model
CQUPT and ISA100 began to cooperate from 2006, we have a good relationship:

◆ On 2006, CQUPT submitted the industrial wireless whitepaper to ISA100.

◆ On Apr. 2008, International Conference on Industrial Wireless was host by CQUPT (China), ISA (United States), WINA (United States) and CONTROL ENGINEERING (The United States), Chongqing, China. CQUPT was recognized as a voting member by ISA100.

◆ On Oct. 2008, CQUPT was invited to show their industrial IoT systems in ISA EXPO, Houston, USA.

◆ On 2009, CQUPT became ISA WCI member. CQUPT began to work closely together with ISA WCI.

◆ On Oct. 2009 and Oct. 2010, CQUPT was invited to show their industrial IoT systems in ISA EXPO, Houston, USA again, which received, and attracted a large number of experts in the area.

◆ On May 2011, International Technology & Standard Forum on the IoT in Industry” and ISA100 committee meeting were hosted by CQUPT, ISA100 and ISA WCI, Chongqing, China.

◆ 2013 ISA WCI Technology Education and Training in China (Planed). Beijing, Shanghai and Chongqing are binding to be the host city.
Wireless HART (IEC 62591)

WirelessHART technology provides a robust wireless protocol for the full range of process measurement, control, and asset management applications. Based on the proven and familiar HART Communication Protocol, WirelessHART enables users to quickly and easily gain the benefits of wireless technology while maintaining compatibility with existing devices, tools, and systems;

WirelessHART was approved by IEC as international standard (IEC 62601) on 2010.
• CQUPT Solutions
  – WIA-PA system
  – ISA100.11a system
  – A heterogeneous coexistence architecture for industrial IoT based on IPv6
  – An industrial IoT chip UZ/CY2420
WIA-PA Wireless System

Gateway & Redundancy gateway

Monitor interface

Real-time data

Network topology monitoring

Router
ISA 100.11a system

Network topology monitoring

Application management
• Heterogeneous Coexistence Wall

- WIA-PA network
- ISA100.11a network
- IEEE802.15.4e network
- IEEE802.15.4 based meter system
- 6LowPAN system

Monitor and control
CQUPT Solutions

6LoWPAN WSN/3G System

- The WSN/3G (TD/SCDMA, CDMA2000, WCDMA) gateway and the series of sensor network nodes are developed in the system.
CQUPT Solutions

- A wireless chip UZ/CY2420
  - It is for industrial environment
  - It is based on IEEE802.15.4 and
  - It makes a convergence of the DLL core technologies of the three standards.
- We will push the work more in the future.
Relevance to IoT

- Industrial Application is a large and important part of IoT applications.
- Define reference model and protocols including PHY, MAC, NWK, APP layers.
- Cooperation Potential Area
  - Requirements Analysis,
  - Routing,
  - Security,
  - Network Management,
  - Interoperability and,
  - Performance Testing.
Thanks!