Wireless Standards Convergence
– The Inside Story
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  - Wireless Networks for Industrial Automation
  - Automation Network Selection
  - User Guide to Fieldbus Network Equipment for Process Control
The Problem With Standards

Too many wireless instrumentation standards:

1. ISA100 Wireless (ISA100.11a-2011, IEC 62734)
2. WirelessHART (IEC 62591)
3. WIA-PA (IEC 62601)

All directed at the same application:
Process control field instrumentation
Standards Are Incompatible

- Networks may co-exist
  - Messages are not coordinated, they may collide
  - Positive acknowledgment requires retransmission
  - Some probability message will be delayed
- Cannot share messages between networks
  - Data sharing must be processed by store & forward at the host level
    - Message travels on its own network to the host
    - A host function is required to deliver the message to the target device
Problem For the User

DCS suppliers support only one of the wireless networks

- ISA100 Wireless
  Honeywell, Yokogawa, Invensys, General Electric, Masoneilan, Yamataki, Fuji, S3

- WirelessHART
  Emerson, ABB, Siemens, Endress+Hauser

- WIA-PA
  Unannounced Chinese supplier
ISO/IEC 61850 Open Systems Layer Model

Data communications is defined in formal layers.

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Standards organizations:
ISO – International Standards Organization
IEC – International Electrotechnical Commission
IETF/RFC – Internet Engineering Task Force / Request For Comments
Compatible Physical Layer

ISA100 Wireless
WirelessHART
WIA-PA

All use IEEE 802.15.4 – 2006 chips with its Medium Access Control and a 16-channel direct sequence spread spectrum radio with 128-bit AES security encryption.

All use the same channel hopping logic
- WirelessHART uses a fixed channel hopping table
- ISA100 Wireless and WIA-PA have multiple channel hopping tables including the one used by WirelessHART.
Slot Time

Wireless instruments are off 97% of the time and “wake up” to send/receive. The “awake” period is called the Slot Time.

WirelessHART slot time is fixed at 10ms

ISA100 Wireless uses variable slot time, but defaults to 10ms

WIA-PA uses a variable slot time, but defaults to 10ms

Identical slot timing is necessary for networks to interoperate
Meshing

- Mesh networks use multiple paths and relay messages from one node to another
  - overcome obstacles
  - reach longer distances
  - create resilient paths for increased reliability
Meshing Protocol

ISA100 Wireless: meshing protocol of IEEE 802.15.4e

WirelessHART: proprietary meshing protocol

WIA-PA: proprietary meshing protocol

Mesh protocol must be identical for nodes to communicate.
Time Synchronization

Time slots must be synchronized between nodes to schedule awake time data communications.

ISA100 Wireless: same method as IEEE 802.15.4e
  Method defined by IEEE 1588
  Distributed network time

WirelessHART: Derives network time by counting time slots

WIA-PA: Proprietary protocol
Network Addressing

Each network node must have a unique address:

ISA100 Wireless
- Each node has an IPv6 address
- Uses RFC 4944 6LowPAN protocol
- Nodes are Internet addressable

WirelessHART
- Proprietary address in the HART domain

WIA-PA
- Proprietary
Transport Layer

Protocol to assure end-to-end delivery of messages

ISA100 Wireless
Confirmed service using UDP/IP (RFC 768) protocol
Network is capable of running TCP/IP but not used for real-time communications

WirelessHART
Proprietary confirmed service

WIA-PA
Proprietary confirmed service
Conclusion

Convergence would require agreement among all parties to adopt the same protocols for:

- Slot timing
- Meshing protocol
- Clock synchronization
- Slot timing
- Addressing
- Transport protocol

Unlikely to occur due to lack of compatibility with the installed base of instruments.