Wireless Technology in Life Science Manufacturing Facilities

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Connecting a World of Pharmaceutical Knowledge

NEW ENGLAND CONTROLS

Not All Wireless is the Same - Topology is Key to Reliability

Home / Office Wireless

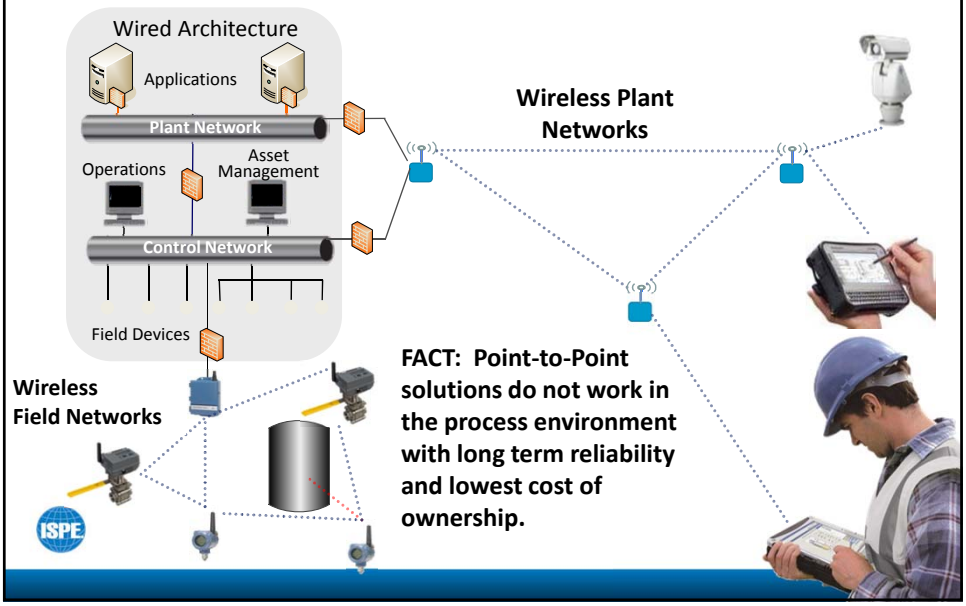
- Star topology (Point to Point)
  - Cordless phone
  - Mobile phone
  - R/C toy car
  - Wi-Fi

Industrial Wireless

- Mesh topology
- Security considerations
  - WirelessHART, ISA100.11a
  - Industrial Wi-Fi

Before mesh topology nobody put wireless IN the plant

Two Categories of Wireless Applications



Wireless Applications Solve Availability, Productivity, HSE, & Energy Challenges

Process / Asset Reliability

- Pump, AHU, Compressor, Centrifuge monitoring
- Valve monitoring
- Filter monitoring

Health/Safety/Environment

- Emissions / discharge monitoring
- Secondary level measurements
- Video
- Personnel Mustering

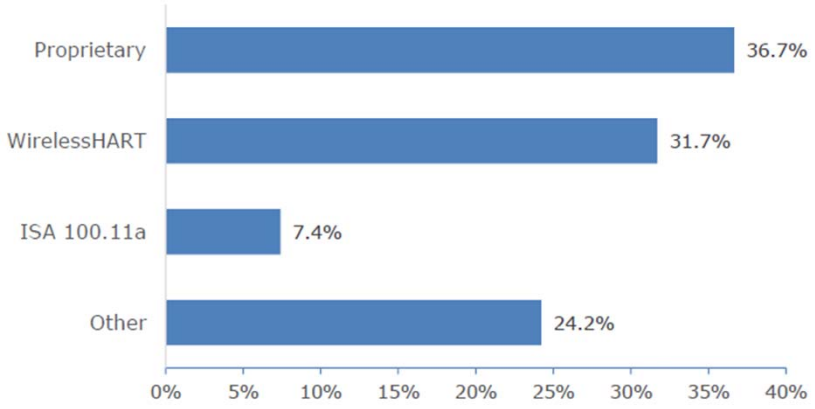
Personnel Productivity

- Manual gauge replacement
- Reduced operator rounds
- Mobile workers

Efficiency / Energy

- Tank level monitoring
- RFID equipment tracking
- Portable skid process monitoring
- Steam trap monitoring
- Energy consumption metering: water, air (compressed), gas/fuel, electricity, and steam

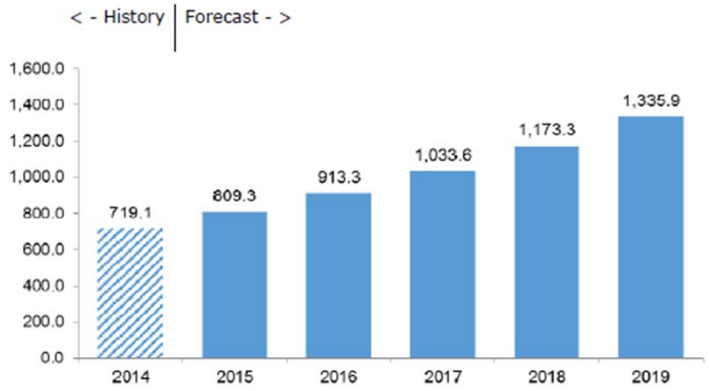
Market Shares of the Leading Wireless Network Protocols in the Process Industries



Percent of 2014 Revenues = $719.1 Million

Source: ARC Advisory Group, Wireless Devices in Process Manufacturing, 2014

Total Shipments of Wireless Devices in Process Manufacturing



Figures in Millions of US Dollars

Source: ARC Advisory Group, Wireless Devices in Process Manufacturing, 2014

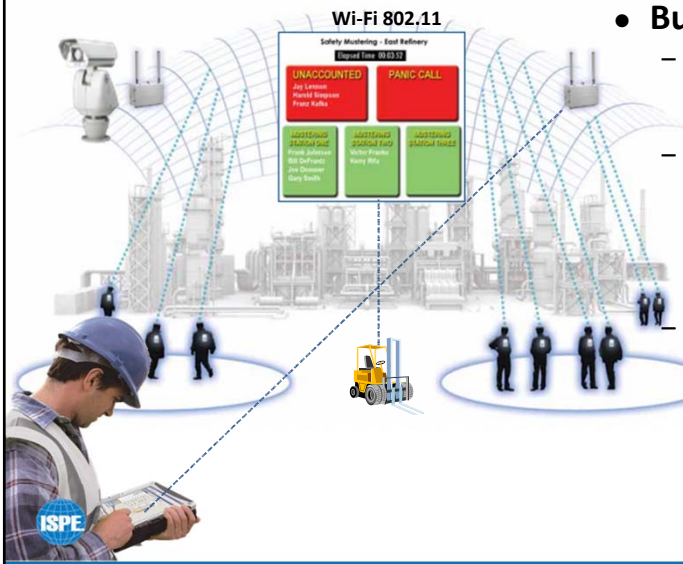
Total Shipments of Wireless Devices in Process Manufacturing by Device Type

	History		Forecast	
Device Type	2014	2014 %	2019	2019 %
Pressure/Flow Transmitter	103.9	17.1%	224.3	19.9%
Level Transmitter/Switch	47.7	7.9%	102.6	9.1%
Temperature Transmitter	45.5	7.5%	96.7	8.6%
pH Transmitter	13.3	2.2%	25.4	2.3%
Valves/Actuators	10.2	1.7%	16.9	1.5%
Vibration Transmitters	15.1	2.5%	31.3	2.8%
Standalone Radios	60.9	10.0%	86.2	7.7%
Remote I/O	59.6	9.8%	94.6	8.4%
Gateways	75.2	12.4%	149.1	13.3%
Bridges/Multiplexers	6.7	1.1%	11.7	1.0%
Wireless Access Points	100.0	16.5%	165.5	14.7%
Other Devices	69.0	11.4%	120.3	10.7%
Total	607.3	100.0%	1,124.6	100.0%

Figures in Millions of US Dollars

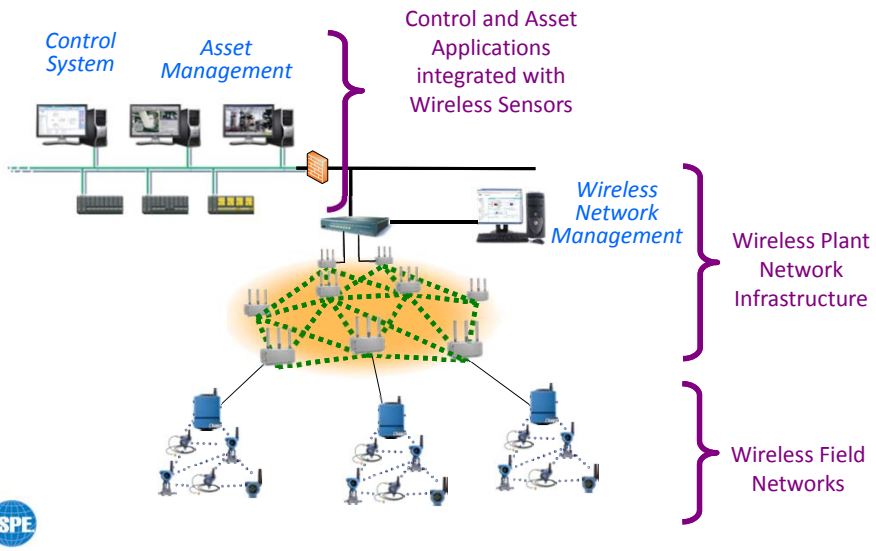
Source: ARC Advisory Group, Wireless Devices in Process Manufacturing, 2014

Wireless Plant Applications: Backhaul, RFID Tracking, Mobile Worker, Security Cameras



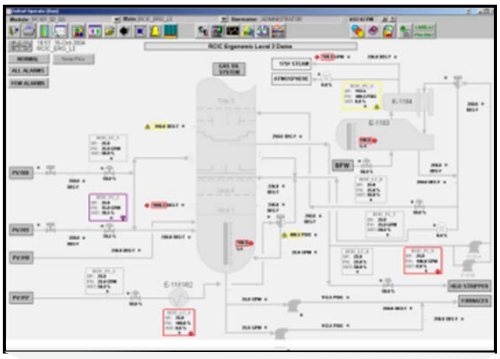
- **Business Drivers**
  - Operator Productivity
    - Remote control client
    - Operator rounds
  - Maintenance Productivity
    - Remote asset management client
    - Maintenance rounds/ procedures
  - Emergency Response
    - Automated Head Counting
    - Real time information in the field

Wireless Backhaul System Architecture



Mobile Operators - Accessing Control Data in the Field

- Utilize operator control displays on mobile devices
- Access operational data and reports in the manufacturing suite
- View historical trends while anywhere in the plant



Mobile Worker System Architecture

- Problem to be solved
  - Mobility of operator workstations within suite
- Typical scope
  - Wireless Site Survey
  - 2 Wireless LAN Controllers (redundant)
  - Access Points and External Antennas
  - System Implementation

Mobile Operator Rounds – Real-time Data Collection and Work Requests

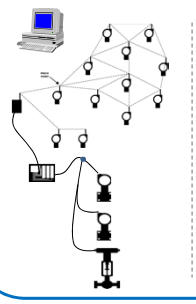
- Real-time mobile applications replace clipboard for data acquisition
- Electronic workflow to enable best practices
- Issue electronic work orders in the field

Mobile Equipment Utilization

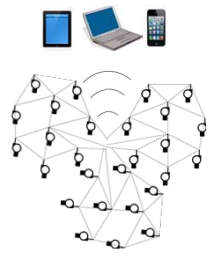
- Real time tracking of mobile equipment (RFID tags)
  - On demand searches
  - Historical location and trail
  - View multiple assets distributed through entire site
- Automated alerts
  - Arrival of equipment to production area
  - Equipment leaving the facility to prevent theft and loss
- Scheduled and on-demand reports
  - Inventory and utilization reports
  - Location, next service date and status of required equipment
  - Departure and arrival reports

Wireless Field Network Applications Help Solve Key Challenges with New Measurements

Pervasive wireless and analytics turn exponential data into high value, accessible and actionable information



Control Loop



High Value Process Information

Safety

Comprehensive Safety Monitoring

Energy

Complete Energy Management

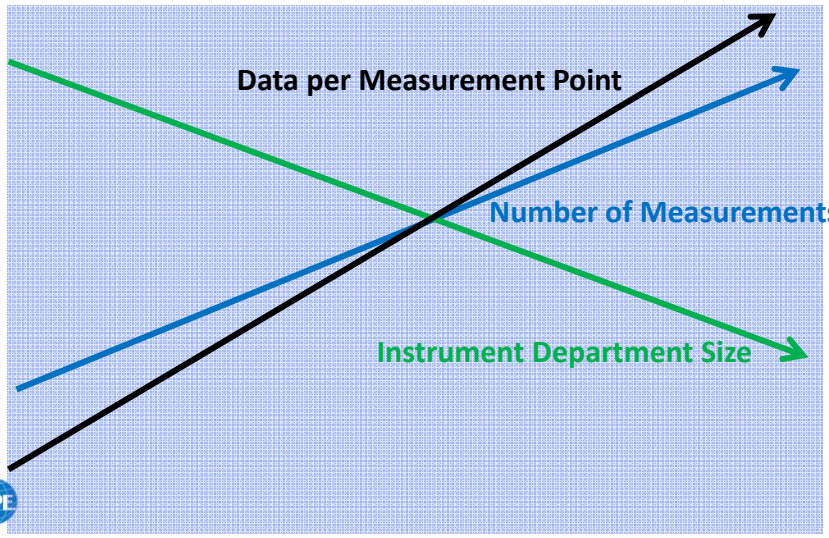
Availability

Total Asset Protection

Wireless Field Network Applications Help Solve Key Challenges with New Measurements

Next 10 Years

Macro Trends in Process Control

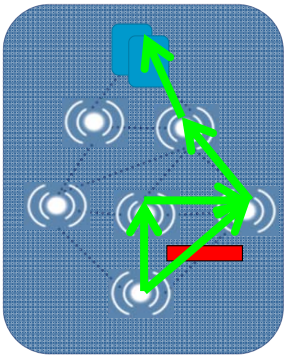


Instrumentation and Control Evolution

Pressure signal	4-20 mA Primary Variable	Multiple Variables + Diagnostic Information	Exponential Data Points
Pneumatic	*Analog*	*Digital*	*Wireless*
1950	1969	1988	2007

Industrial Wireless: Unique Self-Organizing Full Mesh Topology

- Redundant data pathways eliminate single points of failure
- Routing at device-level
  - Unique full-mesh, 7 hop path depth
  - No backbone router infrastructure
- Automatic reconfiguration
  - No manual routing configuration



The difference between a home/office network and an industrial network

Pump Monitoring – Ensure Infrastructure Longevity and Availability

- WFI Pumps
- RO Water Pumps
- CIP Pumps

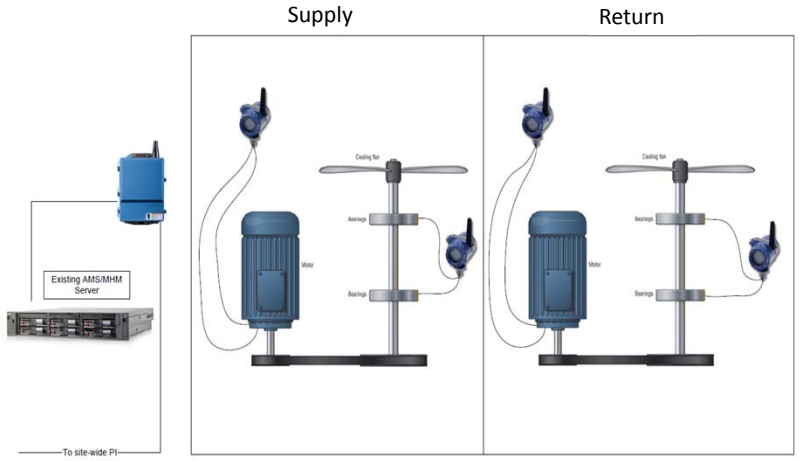
- High vibration levels on pumps and motors indicate developing problems that can be fixed early to ensure equipment longevity and availability
- Suction, discharge pressure indicate cavitation, support additional predictive diagnostics

Centrifuge Monitoring

- Implement condition monitoring to maximize centrifuge availability
- Change from time-based to condition-based maintenance
- Imbalance and bearing degradation identified as failure modes – use vibration to detect

Critical Air Handler Monitoring

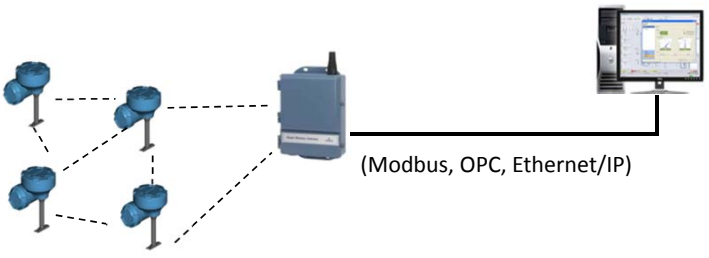
– AHU failures result in loss of product and significant costs associated with cleaning the rooms to FDA standards



– Predictive diagnostics via vibration, differential pressure

Automated Steam Trap Monitoring - Reduce Energy Costs

- Wireless monitoring with acoustic transmitter provides real-time visibility to critical and/or high volume steam traps
- Eliminates time-consuming manual inspections



Portable Skids

- Problem: Measurements not in Original Scope
  - Temperature and level transmitters not part of original scope
- Solution: Wireless
  - Mobility of vessels within suite with high accuracy process measurements

Internet of Things (IoT)

- Development of the Internet in which everyday objects have network connectivity, allowing them to send and receive data

Internet of Things (IoT)

- Here is a little quiz – Who has the:

Pervasive Sensing

Industrial Internet

Industry 4.0

Internet of Your Things

Smarter Planet

Internet of Everything

EMERSON Process Management

Big Data Big Difference

SIEMENS

Microsoft

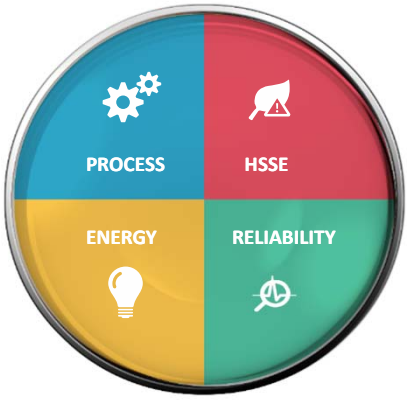
IBM

CISCO

Industrial Internet of Things (IIoT)

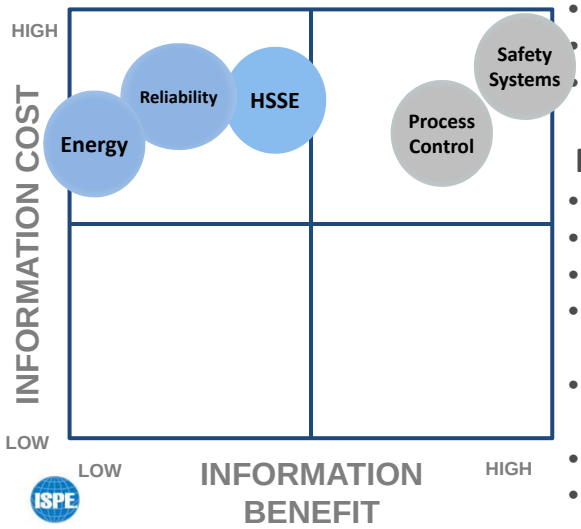
- It's here today
- It's about utilizing the connectivity of industrial sensing technology in new ways
- It's letting automation in sensors do the work for you
- It's utilizing process expertise to effectively analyze data and recommend actions

The More You Sense, the More You Solve



The strategic alignment of applications *everywhere* using **the power of advanced sensing** to gather data and transform it into actionable information.

Now is the Time



Previously:

- Cost was high
- Info benefit was low
- Data was not measurable
- Data was raw
- Technology complex to install

Now:

- Innovative sensors
- Wireless communications
- Non-intrusive installation
- Mobile and location technology
- Advanced analytic capabilities
- Embedded expertise
- Power technology

IIoT Opportunities in Life Science Manufacturing Facilities

- Gas Leak Monitoring
- Steam Trap Monitoring
- Gas Detection
- Remote Monitoring
- Mobile Maintenance
- Compressor Monitoring
- Heat Exchanger Monitoring
- Cooling Tower Monitoring
- Access Awareness
- Pump Health Monitoring
- Air Handler Monitoring
- Tank Overfill/Spill Detection
- Centrifuge Monitoring
- Mobile Operations