Setting the Standard for Automation™

Control Over Wireless

Current Applications and Future Opportunities

Automation Week 2012

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Presenters

- Jay Werb
  - ISA100 Wireless Compliance Institute: Technical Director
  - ISA100.11a: Editor, Data Link Layer (mesh networking)

Presentation Overview

- Simple Use Cases
- Wireless Requirements for Control
- Network Design for Control

Control Over Wireless Use Cases

Wireless Control
General Benefits

Benefit	Description
1. Improved reliability	Troublesome wired sensors replaced by wireless counterparts. Wireless may serve as a backup for wired technology.
2. Improved control	Add wireless devices to existing processes for more optimal control.
3. Cost savings	Up to 90% of installed cost of conventional measurement technology can be for cable conduit and related construction. New and existing applications are now economically feasible.

Wireless Control Example
Refining

A petroleum refiner uses wireless for fuel/air controller for furnace units

- **Background:** Furnace for cracking units requires uniformity and reliability of temperature control. The wiring from the temperature transmitters is not reliable due to wear and tear caused by the application, resulting in frequent replacement of the wiring, furnace inefficiency, and production scrap.

- **Solution:** Implement ISA100 compliant network & field transmitters to eliminate the wiring. PV input from wireless temperature transmitters feeds into the fuel/air controller which controls the temperature of the furnace.

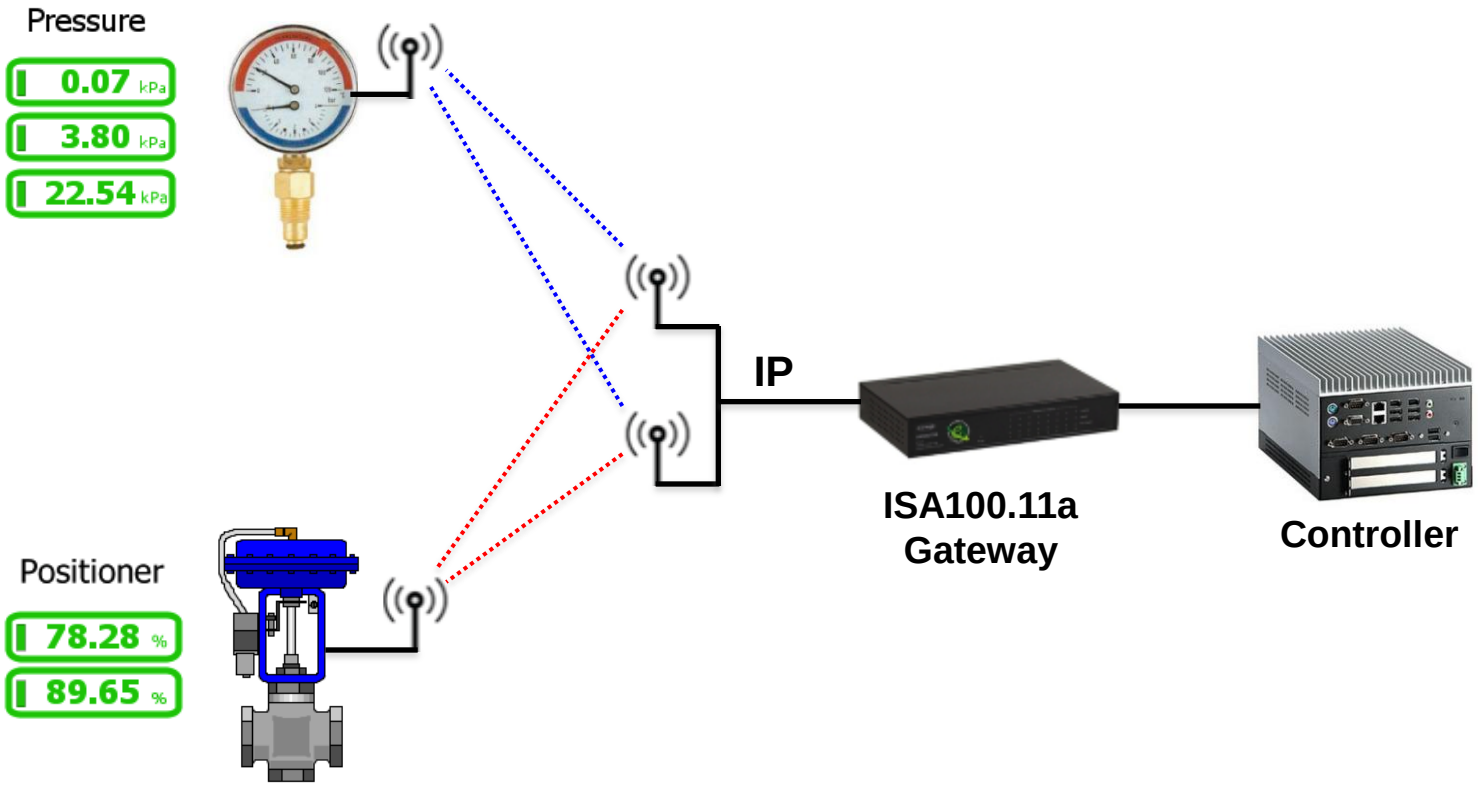
- **Benefits:** a) Maintain high accuracy temperature control, with higher reliability; b) Improved fuel optimization of the furnace.

Wireless Control Example
Chemical

A chemical manufacturer deploys wireless for better bitumen level control

- **Background:** Holding tanks need to maintain appropriate level of bitumen at any given point of time for processing usage. Not having insight to the fill levels leads to inefficient inventory management.
- **Solution:** Implement ISA100 compliant network & field transmitters enabling continuous level monitoring and control of the bitumen level.
- **Benefits:** Avoid over fueling of the holding tank & efficient bitumen inventory management.

Wireless Control Example
Full Control Over the Air



Wireless Control Example
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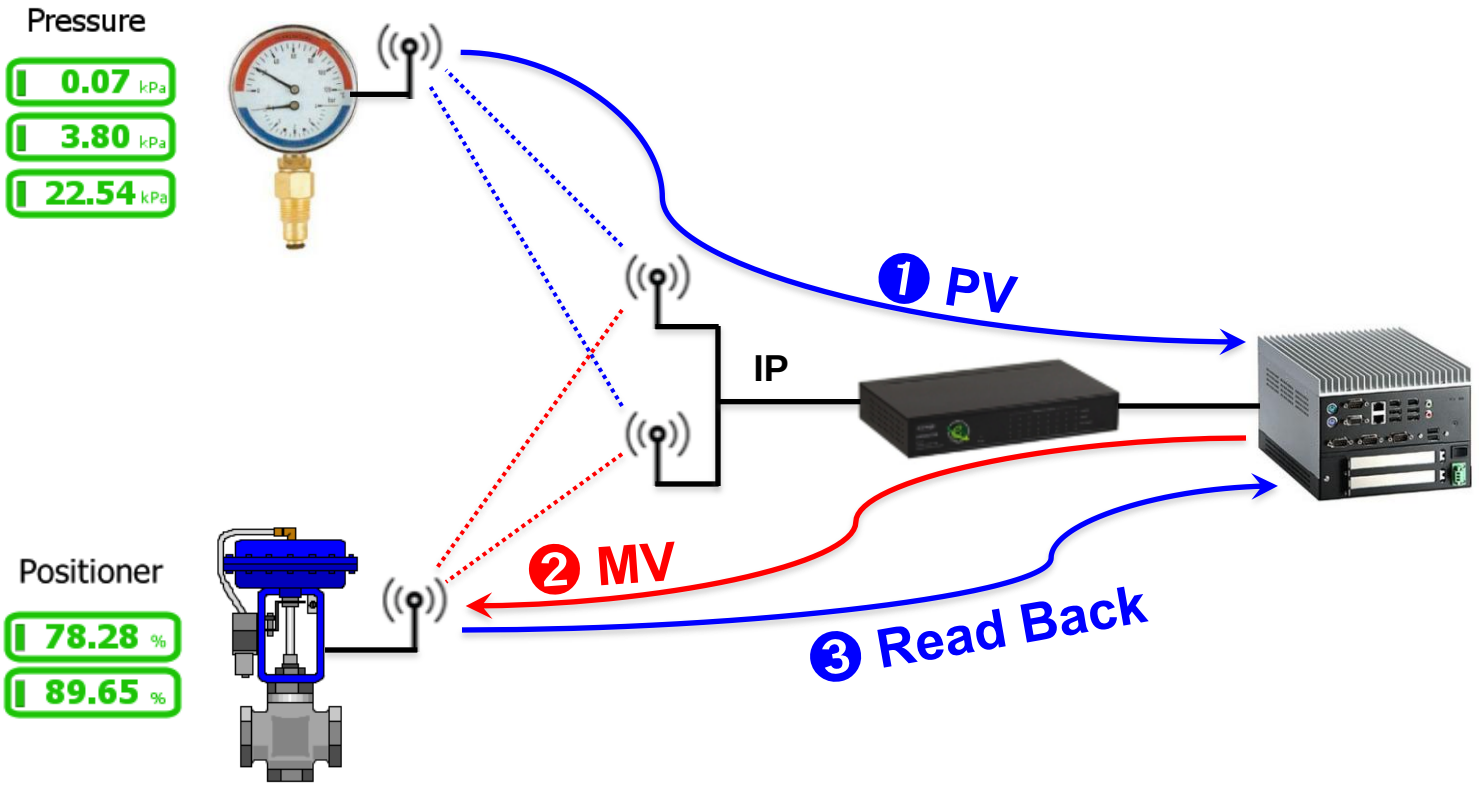
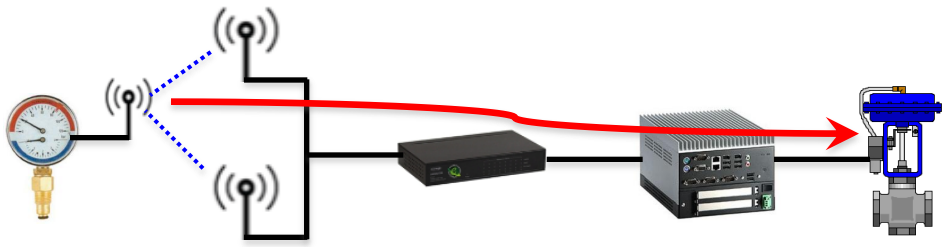
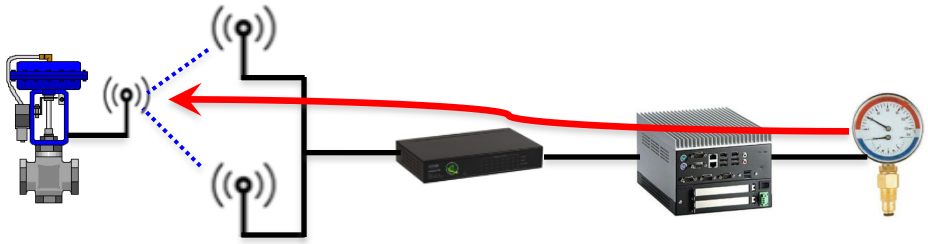
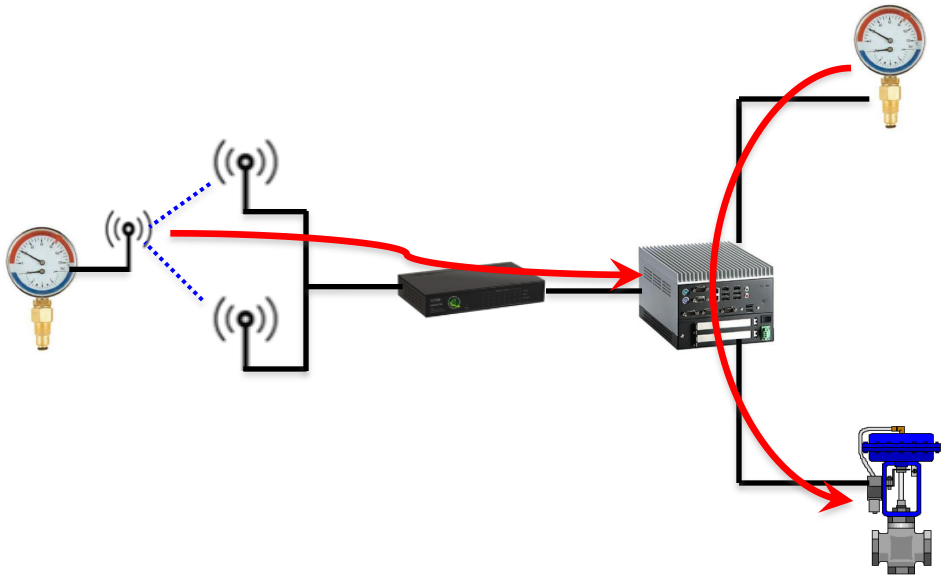


Hybrid Wireless Control
Combine Wired and Wireless





Hybrid Wireless Control
Wireless Secondary Input



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General Benefits

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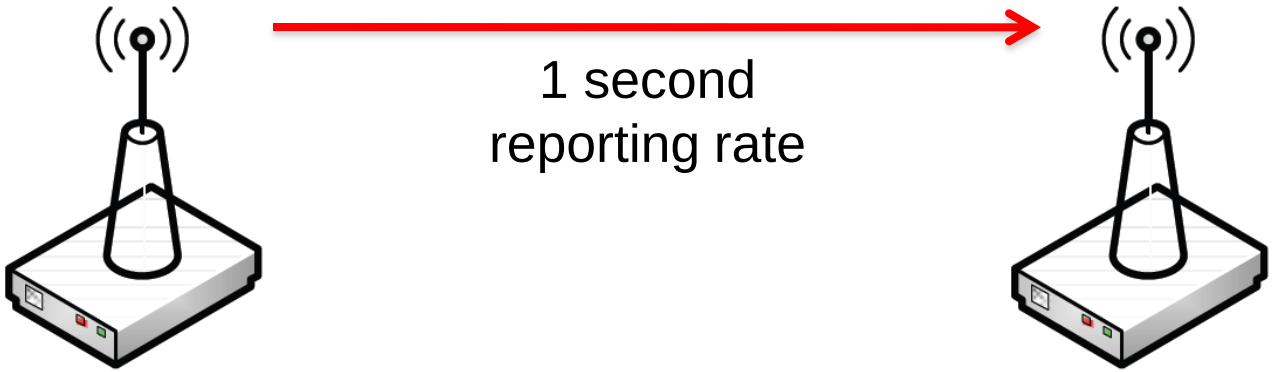
Control Over Wireless Requirements for Control

ISA100.11a
Baseline Control Scenario



ISA100
Usage Classes

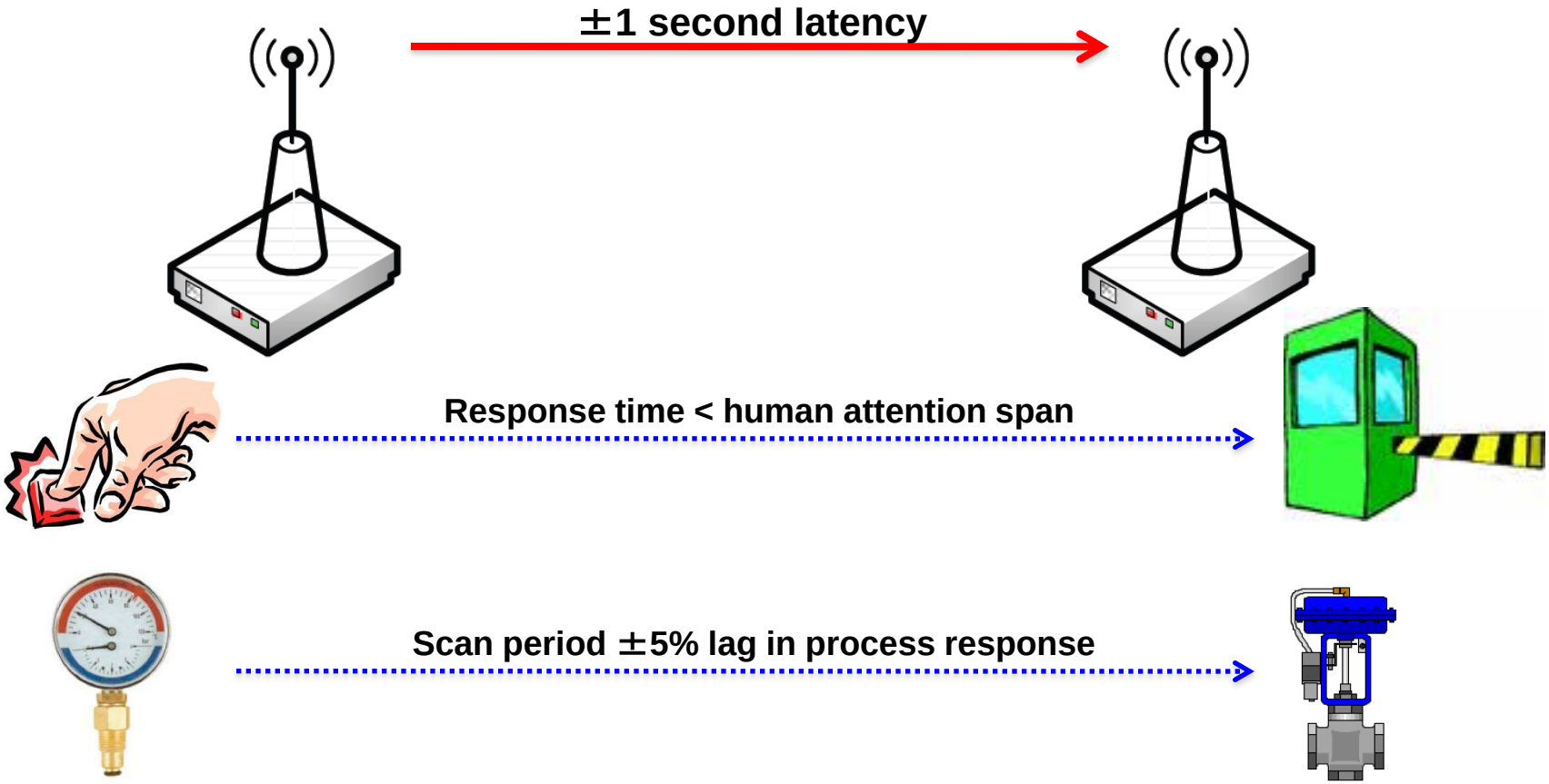
Safety	0	Emergency action	Always critical
Control	1	Closed loop Regulatory control	Often critical
	2	Closed loop Supervisory control	Usually non-critical
	3	Open loop control	Human in the loop
Monitoring	4	Alerting	Short-term consequences
	5	Logging Downloading/uploading	No immediate consequences

ISA100.11a
Usage Classes, Examples from the Standard

Control	**1**	**Closed loop Regulatory control**	**Often critical**	**Control of primary actuators High frequency cascades**
	2	**Closed loop Supervisory control**	**Usually non-critical**	**Low frequency cascade loops Multivariable controls Optimizers**
	3	**Open loop control**	**Human in the loop**	**Manual flare Remote opening of security gate Manual pump/valve adjustment**

Source: ISA100.11a-2011, C.2.2

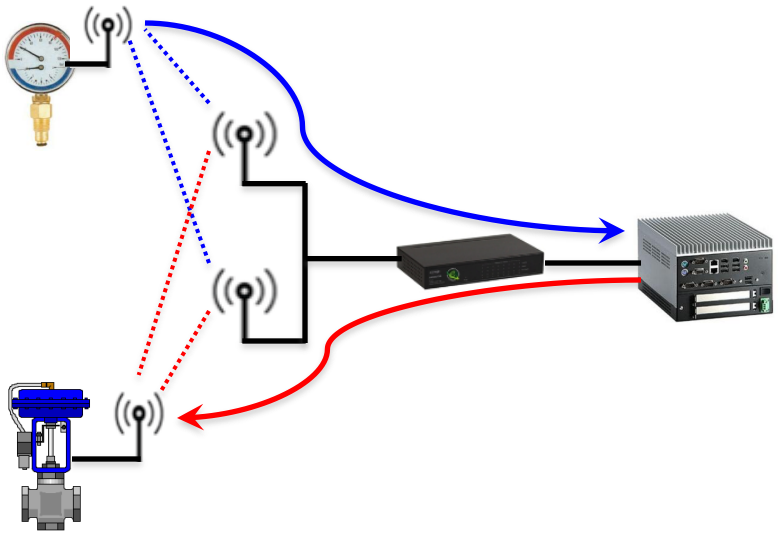
Reference Wireless Control Performance



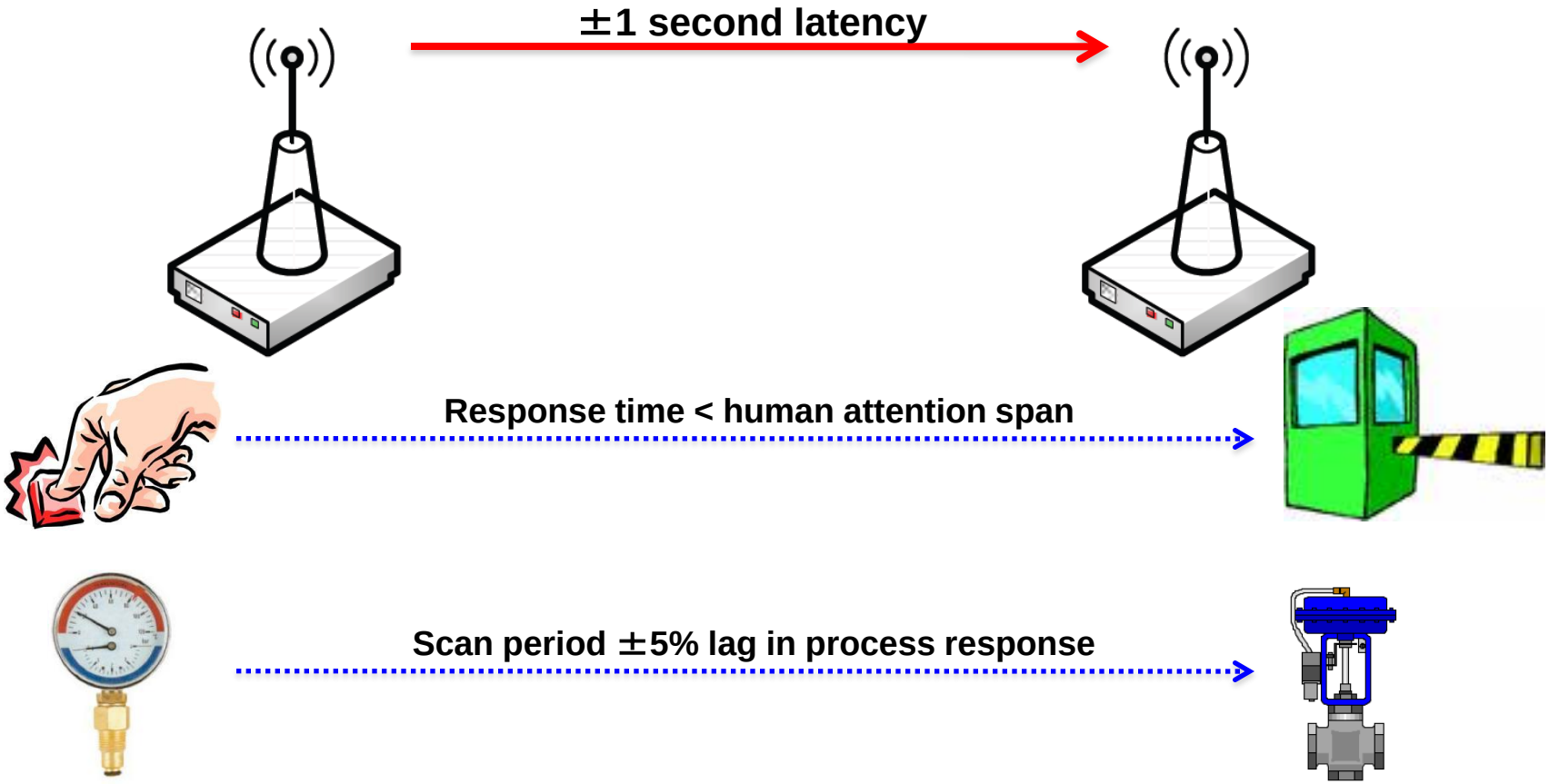
Five System Requirements For Wireless Control

1. Rate and Latency	**Publication rates 1-2 seconds** **Controlled latency, ~50% publication rate** **4 Hz publication in constrained configurations**
2. Flexible System Architecture	**Engineered and scalable IP backbone**
3. Mesh Networking	**Interoperable peer-to-peer connections** **Function blocks at the device level** **Battery life is deterministic**
4. Reliability	**Wireless transmission is deterministic** **Wireless transmission is received** **Wireless transmission is accurate**
5. Security	**Wireless transmission has not been hacked**

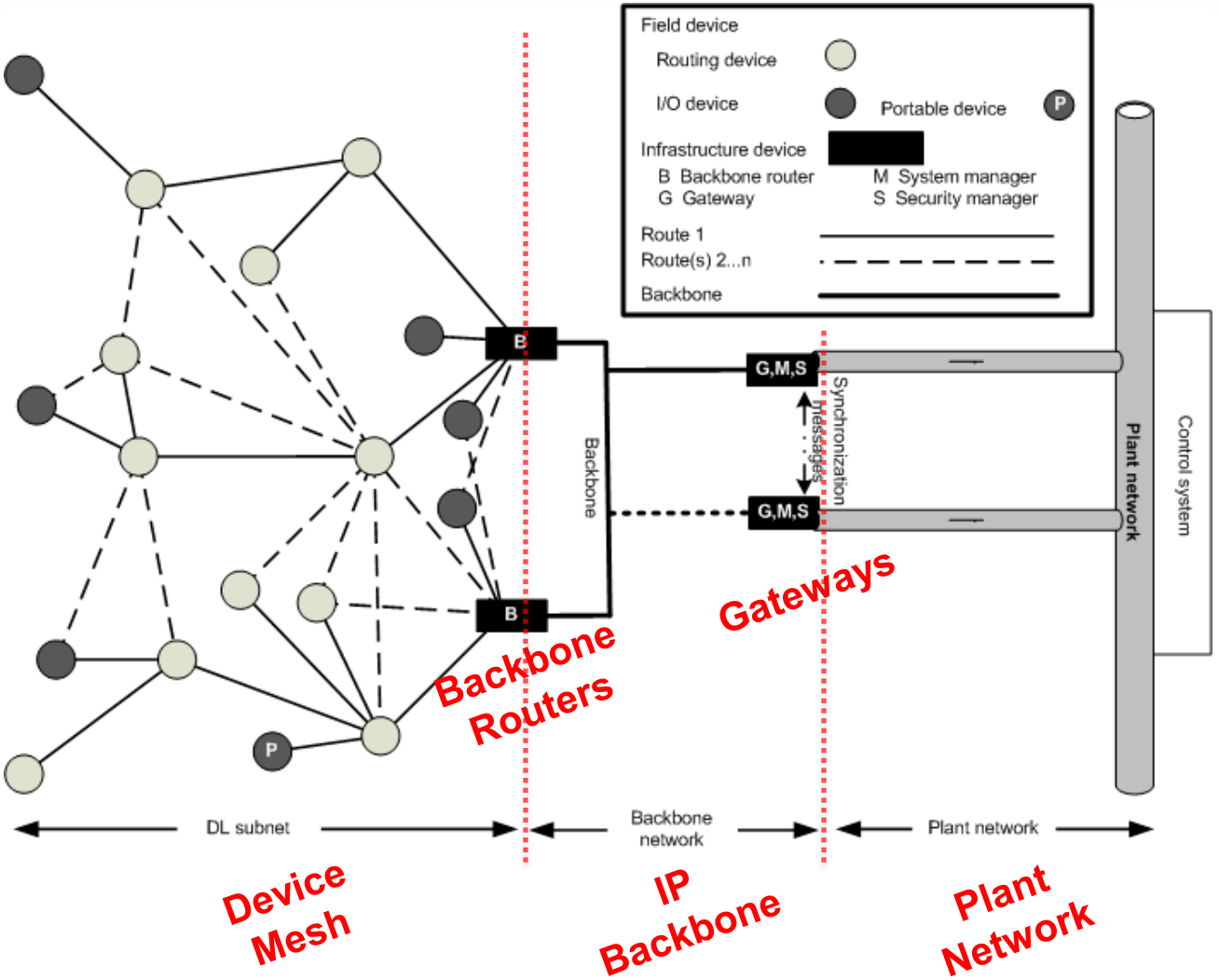
Control Over Wireless
ISA100.11a Network Design for Control



Reference Wireless Control Performance

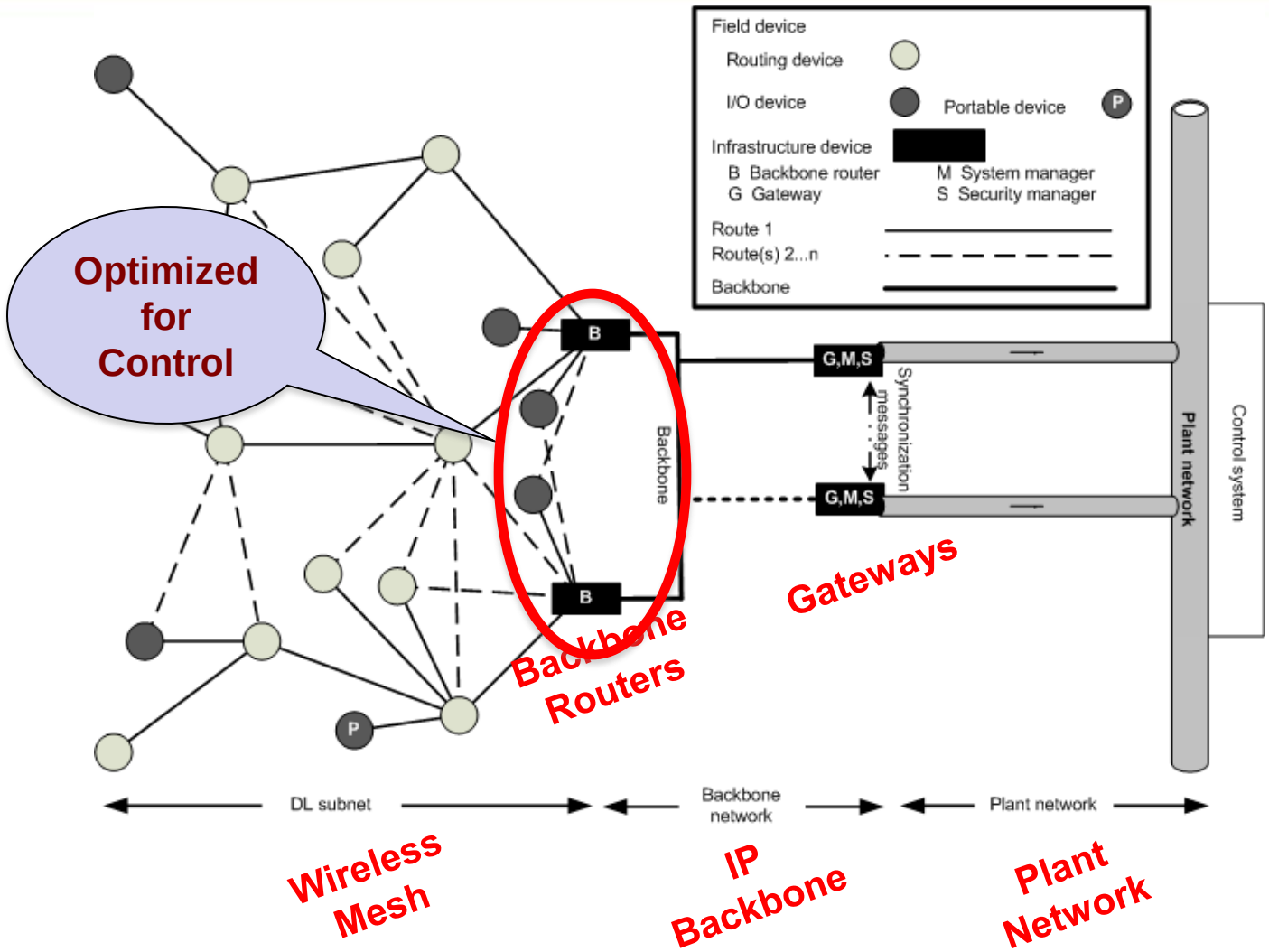


ISA100.11a
Network Architecture



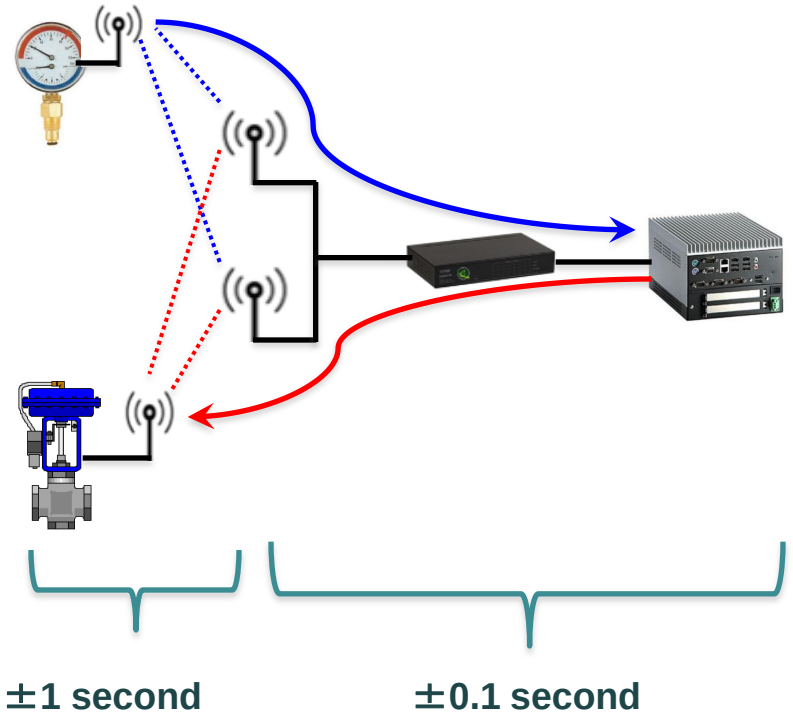
Refer to:
ISA100.11a-2011 5.3

ISA100.11a
Network Architecture

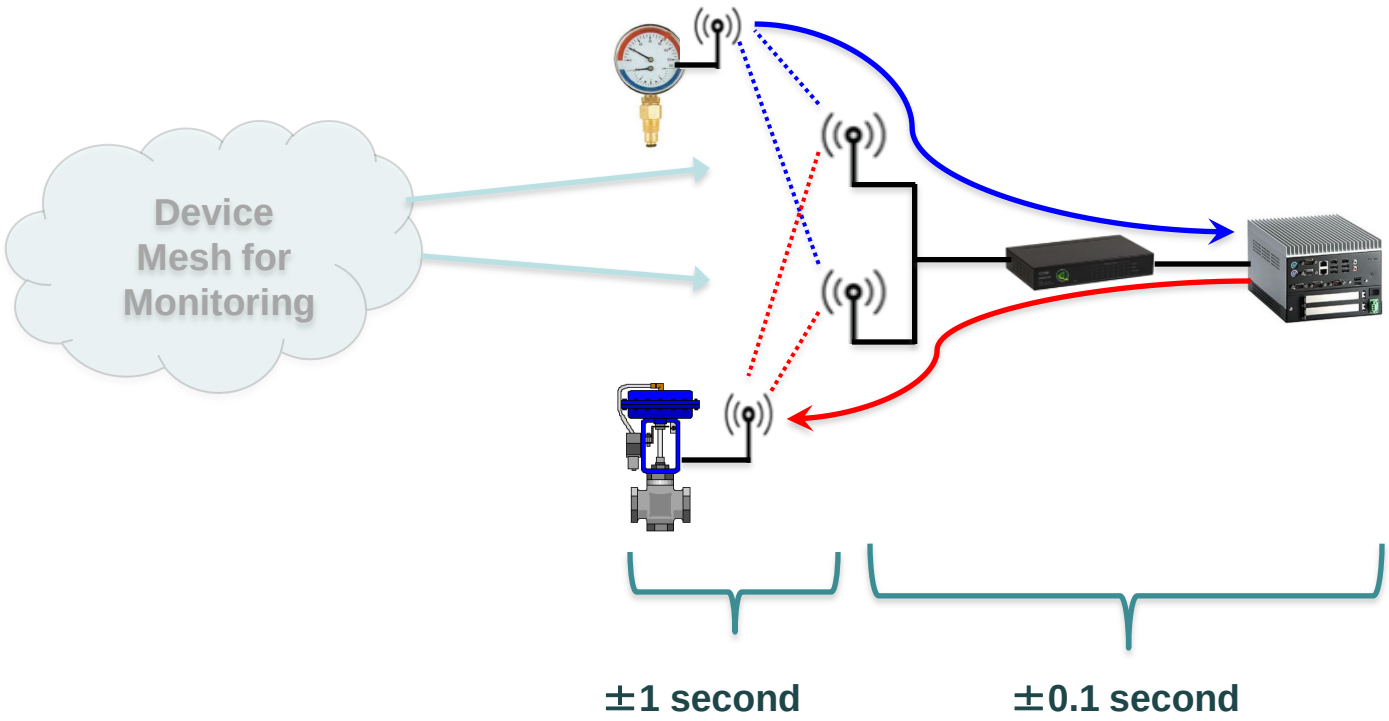


Refer to:
ISA100.11a-2009 5.3

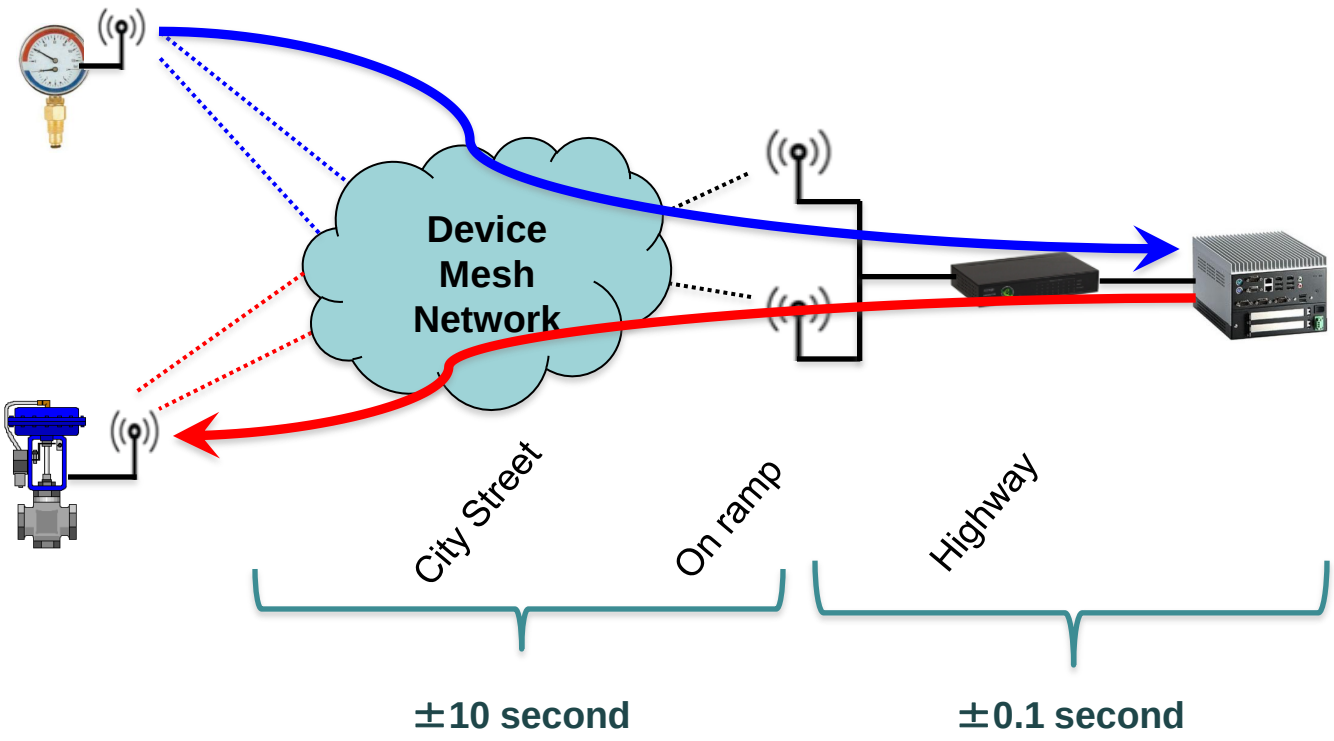
Wireless Control
Latency Expectations



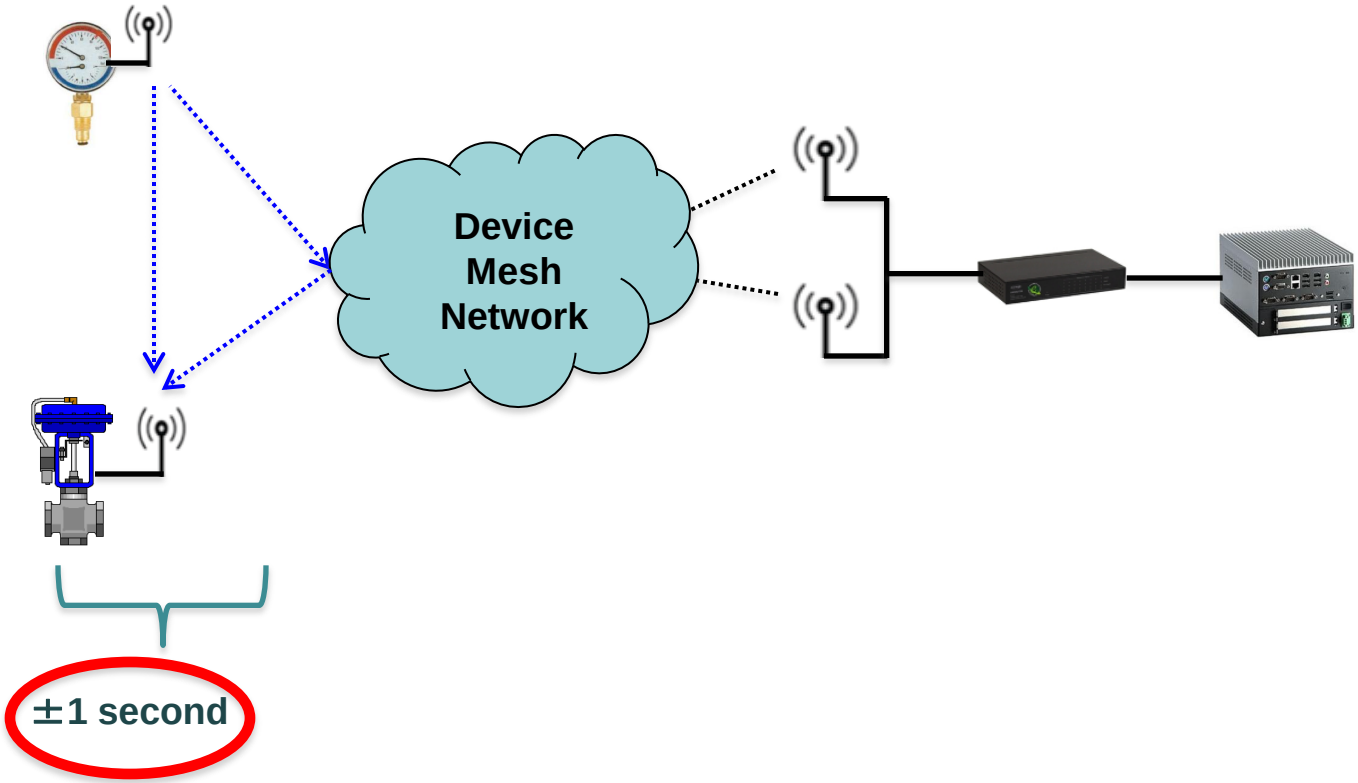
Wireless Control
Latency Expectations



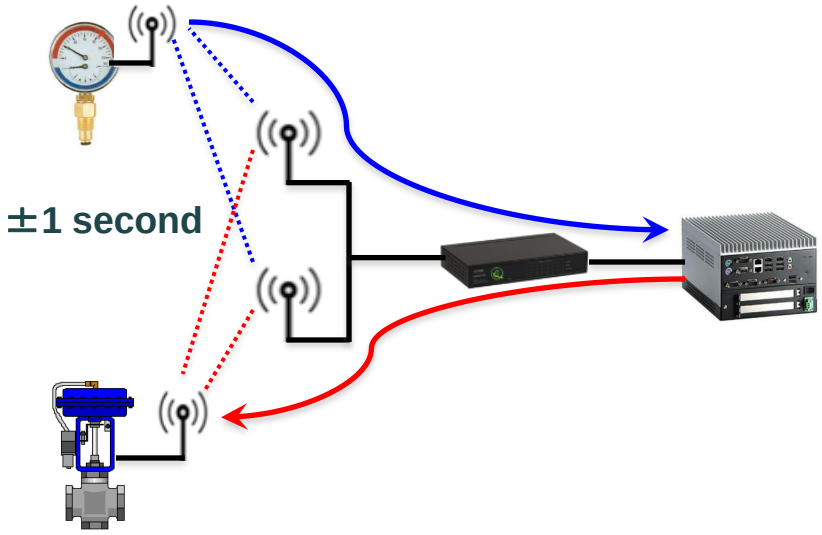
Wireless Control Through the Mesh

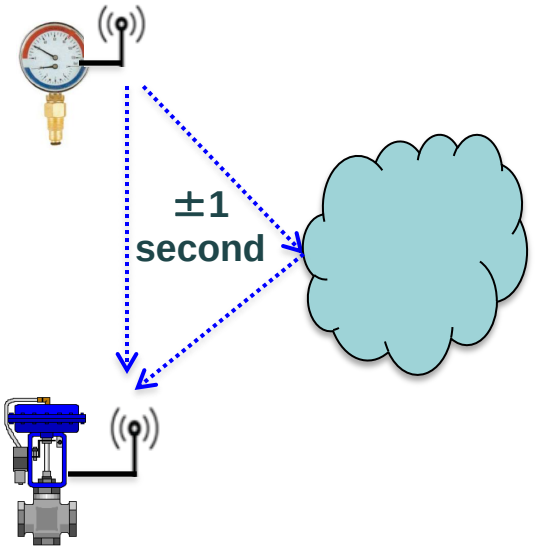


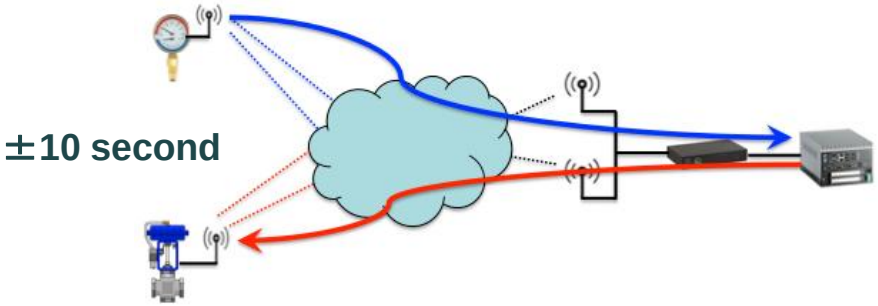
Wireless Control
In the Mesh



Three Basic ISA100.11a Networking Options For Control







Thank you!