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Introduction

Unlike wired communication links, radio communication links are dynamic because they are affected by environmental changes. Changes such as addition of new radios, construction, weather events, and tree foliating are among the many environmental changes that can affect radio communication performance and overall network availability. High network availability and reliability are the building blocks of Honeywell's OneWireless™ Network DNA. This white paper details the features that contributes to the OneWireless Network's wired-like performance and data availability; hence ensuring that no alarms or alerts are caused by potential data packet losses or link degradation.

Honeywell OneWireless Network Overview

The OneWireless Network is a flexible industrial wireless network that can be tailored to meet the wireless coverage requirements of industrial automation applications, from a simple sensor mesh network providing wireless coverage for ISA100 Wireless™ field devices to a plant-wide wireless local area network providing wireless coverage for ISA100 Wireless field devices and Wi-Fi devices.

OneWireless Network's flexibility is based on its rich portfolio of meshing components, i.e. Honeywell OneWireless Wireless Device Manager (WDM), Honeywell OneWireless Field Device Access Point (FDAP), Cisco® Aironet® 1552S Access Point and Cisco Wireless Local Area Network (WLAN) Controller.

Honeywell OneWireless Wireless Device Manager

WDM manages all wireless field devices, including ISA100 Wireless field instruments and network infrastructure devices such as FDAPs and the Cisco Access Points. Assuming the roles of the wireless field instrument network gateway and system and security manager, WDM is used for initial wireless device configuration and storing wireless network system data that is used to configure wireless devices. It also generates, issues, and manages the security keys for all field devices that are required to join the secured network. Keys can be provisioned to a wireless field device via Infrared or over-the-air provisioning methods, as defined by the ISA100 Wireless Standard. Finally, the WDM hosts the required interfaces needed to send ISA100 Wireless data to your control application: Modbus (Serial and TCP/IP), OPC UA, OPC DA, HART, Gateway General Client Interface (GCI), Honeywell Enraf, and Honeywell Experion® PKS CDA.

Honeywell OneWireless Field Device Access Point

The FDAP is a rugged industrial access point for ISA100 Wireless field instruments. Once deployed in the field, FDAPs self-discover and self-organize into a managed, secure and redundant wireless field instrument mesh network. They are the bridge between the sensor network and the wireless or wired infrastructure (backhaul).

Cisco Aironet 1552S Outdoor Access Point

The Cisco Aironet 1552S Access Point is a rugged industrial access point for Wi-Fi (IEEE 802.11 a/b/g/n) clients and ISA100 Wireless field instruments. Once deployed in the field, the Cisco 1552S Access Point self-discovers and self-organizes into a high-speed wireless LAN capable of tunneling data between ISA100 Wireless and Wi-Fi devices and associated host applications such as Honeywell's Experion PKS control system.

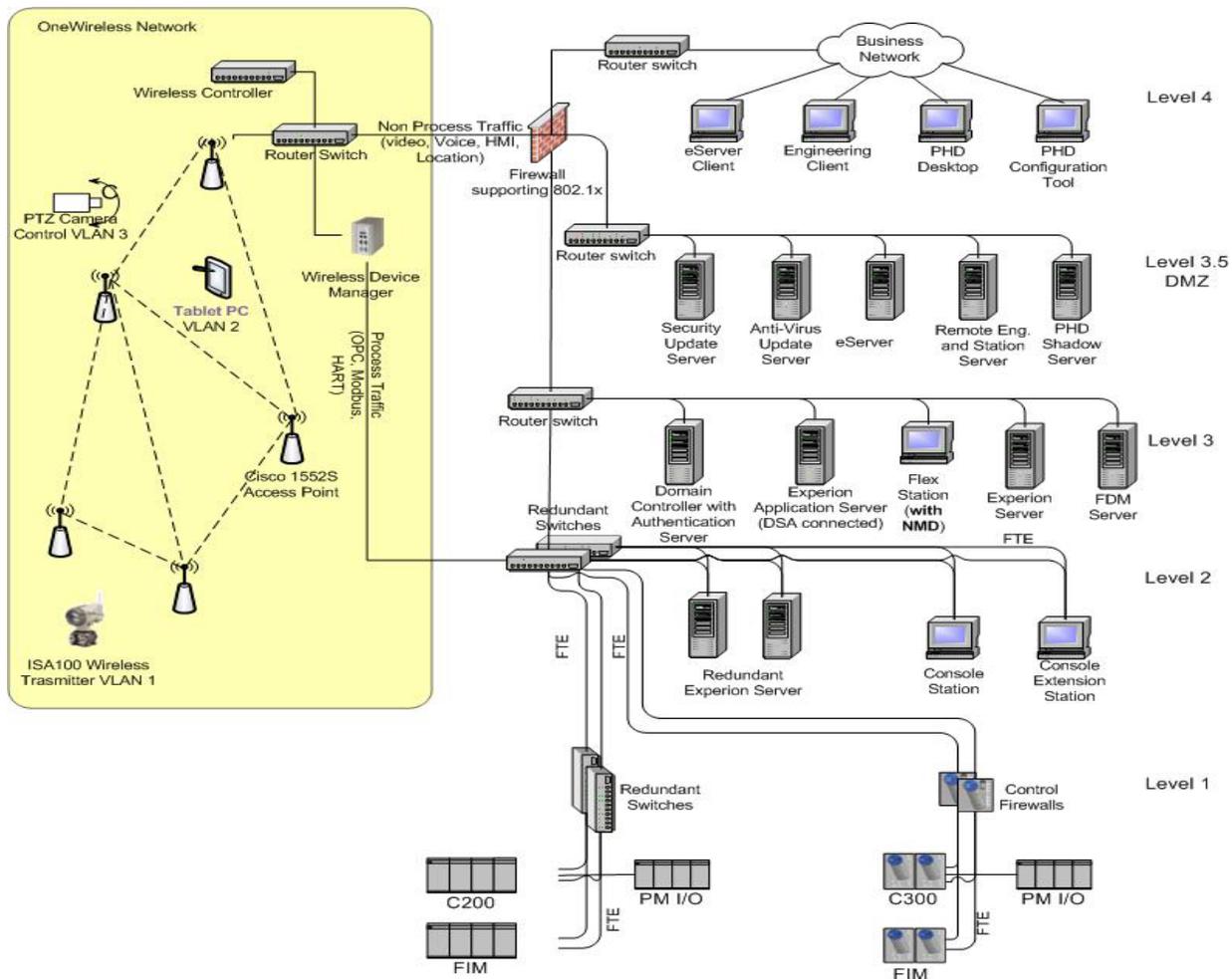


Figure 1: OneWireless Network integrated with Experion PKS

Cisco Wireless Controllers

Cisco Wireless Controllers manage the Cisco 1552S Access Points by extending the network policy and security from the wired network core to the wireless edge.

Honeywell OneWireless XYR 6000 Field Instruments and other ISA100 Wireless devices

Honeywell OneWireless XYR 6000 field instruments let customers capture information from locations where running wire is cost-prohibitive or measurement is in a hazardous location. In addition to its sensing capabilities, Honeywell's ISA100 Wireless compatible field devices can act as routing devices; meaning that they can route data received from neighboring ISA100 Wireless field instruments as well as their own data.

Reliability Features

Meshing Technology

Industrial wireless products have been used within plant facilities for decades. So what technological evolution has triggered the wider adoption and usage of wireless within the process industry? The short answer is wireless meshing. Wireless meshing permits neighboring devices communicating using the same protocol to be interconnected and exchange data amongst themselves, hence significantly increasing the availability and reliability of the data being communicated over a non-deterministic medium.

Honeywell offers a portfolio of meshing access points, FDAPs and Cisco 1552S Access Points, and meshing wireless field instruments including XYR 6000 transmitters and Honeywell OneWireless Adapters. This rich portfolio of products allows the OneWireless Network to function in both mesh and star-mesh topologies.

The earlier wireless sensor system operated in a point-to-point mode with wireless instruments sending data to a base station with gateway capability. Similarly, the earlier wireless local area network access points operated as wired infrastructure nodes routing data packets between a wireless client device and host application via a wired Ethernet connection. These access points have become ubiquitous in today's households and offices due to their ease of deployment, enabling wireless devices like laptops and smartphones to communicate with each other or access the Internet. Today's industrial access points combine the same ease of deployment with enterprise security and industrial grade hardware. An industrial access point can be easily deployed in environments where CAT5e or CAT6 cables or fiber optic cables are readily available or can be made available in a cost-effective manner. One primary difference between industrial access points and the ones available in the consumer market is that industrial access points use outdoor rated enclosures and industrial grade electronic components to ensure reliable and safe operation in an industrial plant.

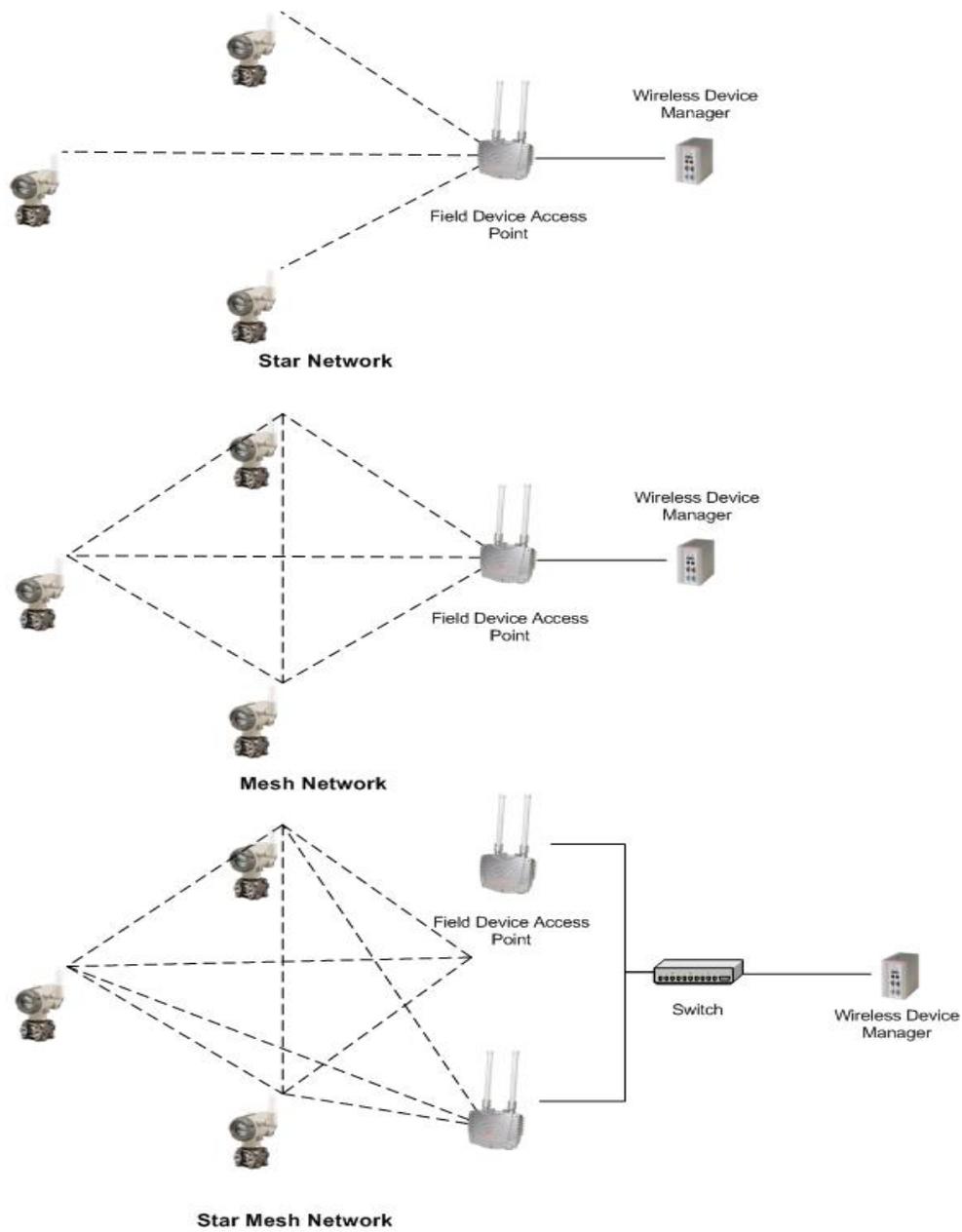


Figure 2: Star, Mesh and Star Mesh Network Topologies

Pulling cables (fiber optics or copper) can be an expensive proposition in a large indoor and outdoor industrial plant, especially in regions with high labor rates. For this reason industrial access points enable distributed wireless networking using meshing access points (MAPs). MAPs are capable of establishing connections with neighboring MAPs wirelessly without the need for cable connection. These MAPs operate as infrastructure nodes, to provide connectivity back to the production network by hopping through intermediate MAPs. Similar to other peer-to-peer router-based networks, a wireless network composed of MAPs offers multiple redundant data communication paths. If one link fails for any reason, the network automatically routes messages through alternative paths until the message reaches a routing access point, i.e. an access point connected to the wired network. MAPs provide the path redundancy needed to achieve high network availability over a non-deterministic wireless medium. The meshing technology represents a significant evolution over the point-to-point wireless system used prior to the introduction of wireless meshing technology.

Optimized Graph Routing for Path Diversity

Although the ISA100 Wireless Standard supports two types of routing – graph and sourcing – Honeywell has opted for graph routing for its ISA100 Wireless meshing algorithm. The graph routing is managed by the system manager and is based on device-generated reports that indicate instantaneously the quality of wireless connectivity to neighboring devices. Honeywell’s graph routing algorithm has been optimized to take into account key link health metrics including the received signal strength indicator (RSSI), received signal quality indicator (RSQI), transmit fail ratio, and hop count. The algorithm also takes into account other parameters such as data throughput, data frequency, individual channel characteristics, power constraints, and latency requirements. Once the system manager makes its routing decisions it configures the optimum routes for each device in the network. The routes are dynamically recomputed automatically to deal with any upsets in the network such as radio interference, path obstructions and node failure, and provide a field device with multiple graph routes to send its data to the Wireless Device Manager.

Wireless Device Manager Redundancy

The WDM is the heart of the ISA100 Wireless network as it manages the routes and hosts the interfaces required to send the data to host applications such as a control system or historian. A WDM failure will result in total loss of the ISA100 Wireless network and the data being sent by the ISA100 Wireless field devices. To improve the network’s availability and eliminate the single point of failure, Honeywell offers redundant WDMs. Two WDMs can be configured as a redundant pair, consisting of a primary and secondary WDM. The primary WDM will constantly synchronize configuration and process data to the secondary WDM in real-time. The secondary WDM will switch to the primary role if a software or hardware failure occurs on the primary Wireless Device Manager.

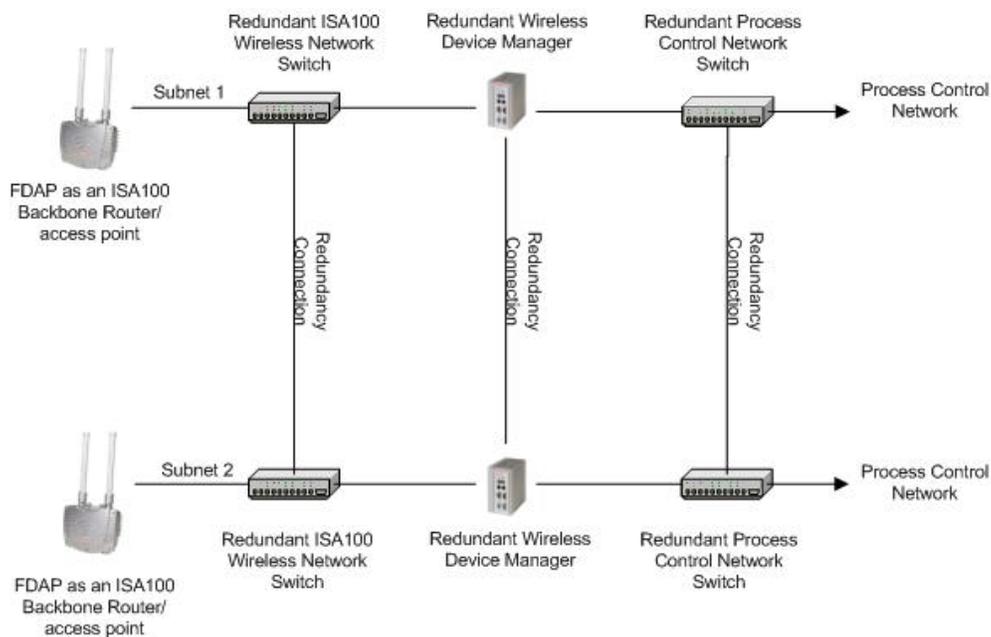


Figure 3: Wireless Device Manager Redundancy

Backbone Routers

OneWireless Network leverages ISA100 Wireless's IPv6 protocols to offer an extremely scalable network. The ISA100 Wireless standard defines an access point as a backbone router (BBR). A backbone router connects the wireless network to a backbone such as a wired Ethernet network or a wireless Ethernet network. In other words, an FDAP connected to the WDM via an Ethernet cable is a backbone router. Similarly, a Cisco 1552S Access Point also contains a backbone router, as within the enclosure there is an ISA100 backbone router connected to a wireless Ethernet bridge. Each ISA100 backbone router embedded in the Cisco 1552S Access Point will have a dedicated IPv6 address.

Honeywell's WDM supports up to 40 access points (FDAPs or Cisco 1552S Access Points) per redundant pair of WDMs, making OneWireless Network the most scalable Industrial wireless network. With 40 access points, a medium-size industrial facility can have full site wireless coverage with a single Wireless Device Manager managing all the devices. The WDM synchronizes the operations across the access points and associated ISA100 Wireless devices.

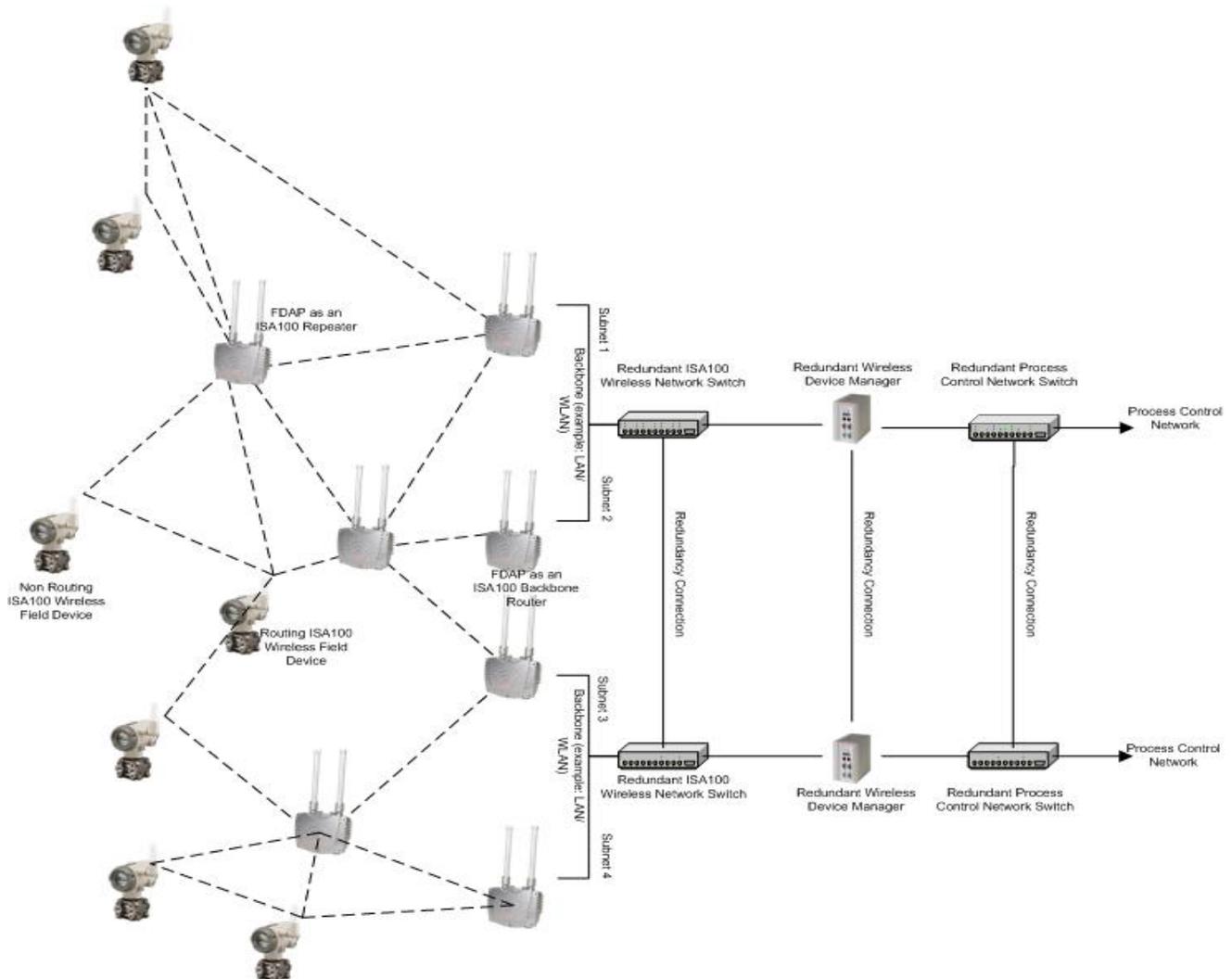


Figure 4: OneWireless Network's support of multiple backbone routers

It is important to note that an ISA100 field instrument is not restricted to a specific access point. It can connect to multiple access points to send its data back to the process control network. Honeywell recommends each ISA100 Wireless field instrument to communicate with at least two access points. Once the wireless infrastructure is in place, the site can install hundreds of wireless field devices within the facility without having to worry about the device association with a specific access point. The device will send its data through the network to the WDM.

The multiple access point feature also improves the reliability of the links between the ISA100 Wireless network and the wired process control network. Users will have to monitor and maintain only two connections to the process control network, i.e. one for each of the redundant WDMs. Unlike a WirelessHART system, there is no need to have multiple gateways or system managers with each gateway having a dedicated connection to the process control network.

Duocast

Duocast is another important foundation block of OneWireless Network's reliability. Duocast allows an ISA100 Wireless field device to send its data simultaneously to two other ISA100 Wireless field devices.

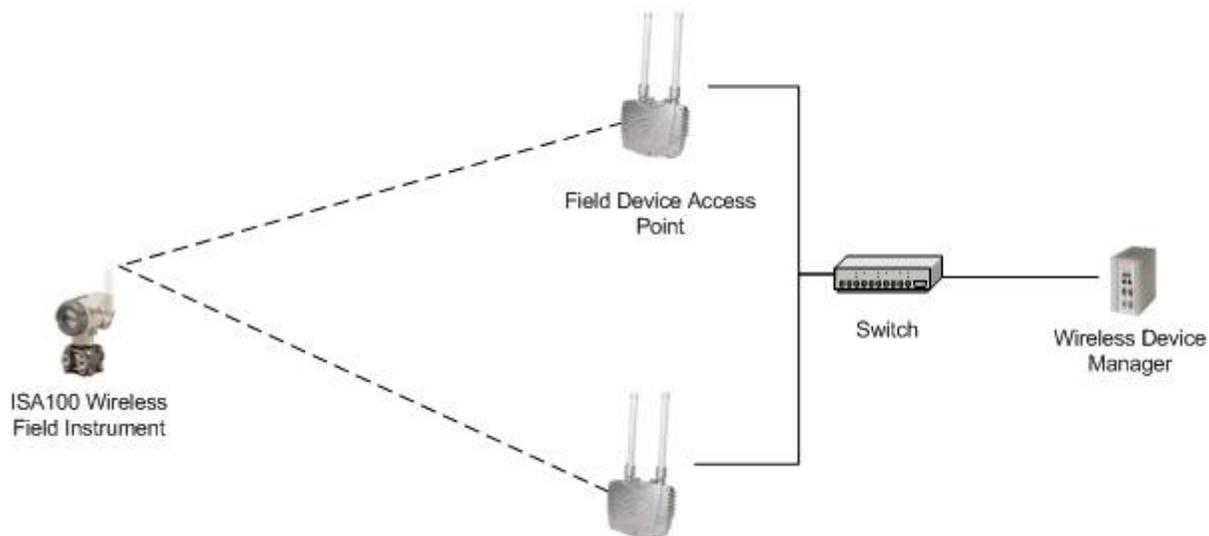


Figure 5: Wireless Duocast configuration

Duocast's reliability benefits include:

- **Increased data availability** – Duocast with backbone routers connected to a mesh backbone is the only way to obtain end-to-end redundancy (i.e. from the field instrument to the host destination), which, in most instances, is redundant (redundant server and redundant controller).
- **Improved latency** – Duocast also provides better latency, especially when a router has more children, as the device does not have to wait until the next scheduled slot to attempt a second transmission if the first transmission fails.
- **Greater scalability** – The network can support more sensor publications from a source node than the next best option, which is graph-based route redundancy with an automatic reroute feature also supported by ISA100 Wireless.
- **Extended battery life** – Battery life can be extended in situations involving intermittent links for the dual-casting node.

Hosting the ISA100 Wireless System Manager in a Control Room

Honeywell's OneWireless Network architecture allows the WDM, which acts as the ISA100 Wireless network's system and security manager and gateway, to be located in a safe and secure environment, i.e. the control room. There are two advantages associated with such topology. The first is reduced risk of hardware failure. Installing the WDM in a control room protects it from outdoor environmental threats such as water intrusion, humidity, and lightning, which could result in hardware failure. The second advantage is ease of access. Plant personnel do not have to climb ladders or get a manlift to troubleshoot the hardware.

Dedicated VLAN and Quality of Service

OneWireless Network uses IEEE802.1Q virtual local area network (VLAN) tagging to segregate the network into different classes of services. By default, process data is assigned to a dedicated VLAN with the highest priority quality of service (QoS), ensuring that critical information from wireless instruments always passes to the process control network. Other VLAN and QoS levels can be created for different network services on the OneWireless Network to optimize network capacity for the different classes of service. Prioritizing data transported across the network results in a high performance network that can better manage network capacity issues due to transient capacity reduction from environmental changes or a burst of data from high bandwidth services like video.

Conclusion

The Honeywell OneWireless Network has been designed by automation professionals for automation professionals. Features such as meshing, graph routing, support of multiple access points, system manager redundancy and dedicated VLAN enhance the network's availability, security and reliability. More than 500 plants have extended their process control network with OneWireless Network and are leveraging its highly reliable ISA100 Wireless network for applications that go beyond non-critical monitoring. They are using wireless field instruments for critical monitoring applications, environmental compliance applications and non-critical control applications.

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For More Information

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