

Chapter 2

What Is Highly Critical Wireless Networking (HCWN)

A Highly Critical Wireless Network (HCWN) may consist of several interconnected communications devices used to support a critical function. HCWN are commercial wireless systems that use the TCPIP digital protocols, which are beginning to dominate our communications infrastructure and reshape our industrial base. Variations on these TCPIP communications protocols, using high or low power signals, have names such as Wi-Fi, Bluetooth, ZigBee, Z-Wave, cellular mobile radio, or mesh networks. Highly Critical Wireless Networks are now part of every industry, and are fast becoming required features in our new cars, airplanes, utilities, and work environments. HCWN technology can also be found in widespread use throughout developing countries in Africa and Asia where construction of a wired infrastructure was skipped in favor of deployment of mobile equipment and other digital devices that connect wirelessly to the Internet [1].

2.1 ZigBee

ZigBee is a wireless communications technology that is relatively low in power usage, data rate, complexity, and cost of deployment. It is an ideal technology for smart lightning, energy monitoring, home automation, and automatic meter reading, etc. ZigBee has 16 channels in the 2.4 GHz band, each with 5 MHz of bandwidth [2]. ZigBee is considered as a good option for metering and energy management and ideal for smart grid implementations along with its simplicity, mobility, robustness, low-bandwidth requirements, low cost of deployment, its operation within an unlicensed spectrum, and easy network implementation.

2.2 Z-Wave

Z-Wave is another wireless communications technology, considered as an alternative to ZigBee. Z-Wave was developed by the Z-Wave Alliance, an international consortium of manufacturers. The simple, modular, and low-cost features make Z-Wave one of the leading wireless technologies in home automation. Z-Wave can be easily embedded to consumer electronic appliances, such as lighting, remote control, and other systems that require low-bandwidth data operations.

2.3 Cellular Network Communication

Existing cellular networks can also be a good option for communicating between smart meters and the utility and between far nodes. The existing communications infrastructure avoids utilities from spending operational costs and additional time for building a dedicated communications infrastructure. Cellular network solutions also enable smart metering deployments spreading to a wide area environment.

2.4 Wireless Mesh Networks

A mesh network is a flexible network consisting of a group of nodes, where new nodes can join the group and each node can act as an independent router. A mesh network will add flexibility and efficiency to the Internet-of-Things, where all household devices will be connected for two-way communication to power suppliers. Mesh networks allow power meters or connected devices to act as signal repeaters. Adding more repeaters to the network can extend the coverage and capacity of the network. Mesh networks rely on HCWN, and can be used for complex metering infrastructures and home energy management. For example, T-Mobile's Global System for Mobile Communications (GSM) network is chosen for the deployment of Echelon's Networked Energy Services (NES) system. An embedded T-Mobile SIM within a cellular radio module will be integrated into Echelon's smart meters to enable the communication between the smart meters and central utility. Mesh networking systems are highly complex, and are self-organization, self-healing, self-configuring, and offer high scalability. A mesh network has a self-healing characteristic which enables the communication signals to find an alternate transmission route if any node drops out of the network. Each meter or device on a mesh network acts as a signal repeater until the collected data reaches the electric network access point. Then, collected data is transferred back to the electric utility through the power lines, or via the HCWN communication network.

Mesh networking improves network performance, balances the transmission load on the network, and extends the network coverage range. These features make it suitable for supporting the Internet of Things and the Smart Grid [2].

References

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