1. Overcome Channel Saturation by Using 5-GHz

Overcome Channel Saturation by Using 5-GHz Channels

In standard Wi-Fi communication, all Wi-Fi radios configured with the same channel setting and operating in the same Wi-Fi area share the same transmission medium. So, you need to take into account all radio devices in that area when evaluating the utilization of a channel. For example, while checking the 2.4-GHz channel 6 for frequency saturation, you need to consider all access points in the area that use this channel as well as other devices that use non-802.11 communication, such as microwaves, ZigBee, and Bluetooth, on the same channel. A even further challenge is that 2.4 GHz only has 3 non-overlapping channels 1,6,and 11. If the channel is saturated, switch to a channel that is less crowded. The 2.4-GHz frequency can easily be crowded, and is generally not recommend for industrial applications.. On the other hand, 5-GHz frequency provides a wide range of channels and usually has more non-overlapping channels available. However, 5-GHz channels are also used by radar systems. Most countries require wireless devices to support the dynamic frequency selection (DFS) function to legally operate in the 5-GHz frequency. Therefore, in an industrial environment, deploying devices with a 5-GHz radio along with the DFS function allows you to choose the cleanest communication medium and provides you with the best overall communication quality..

Credit: Moxa

http://www.automation.com/library/white-papers/eight-tips-to-optimize-your-industrial-wireless-network

2. Achieve Maximum Signal Reach Long-Distance

Achieve Maximum Signal Reach in a Long-Distance Connection through Scientific Distance Calculation

A high 802.11 wireless transmission rate requires a strong radio signal. Insufficient radio signal strength results in low throughput or disconnection. There are several ways to improve the signal reach; for example, installing high-gain antennas or switching to a lower frequency, such as 900 MHz, to reduce the effects of free space path loss. Use a wireless distance calculator to estimate the communication distance and the bandwidth requirement for the area. A wireless distance calculator can provide you with a theoretical model of the area in question, which you can confirm by performing a physical site survey. So, plan the long distance communication parameters for your network using a distance calculator and verify the results through an actual site survey to gain more control over the wireless bandwidth and capacity of your network..

3. Maximize Link Uptime Using

Maximize Link Uptime Using Wireless Redundancy Technology

Even if you have a clean communication environment and sufficient signal reach, there are still other factors that could cause instability in a wireless network. Setup-related issues such as Hidden Nodes can lead to connection problems even in a well-designed network. In addition, if the deployment location is not under your control, unexpected wireless interference from unknown sources might also affect a well-setup network. You can use wireless redundancy technologies such as dual RF redundancy, RSTP, or Moxa's Aerolink to recover from any unexpected failures, especially in the case of critical applications, to ensure maximum connection uptime..

4. Achieve Sufficient AP Coverage

Achieve Sufficient AP Coverage for Mobile Equipment in Your Network

Wireless APs have limited coverage. To allow wireless clients to roam smoothly between APs, you need to have coverage overlap.

- Use site planning software, such as Ekahau or AirMagnet, to simulate a wireless coverage heat map to visualize the AP distribution in your network and then plan the number and location of the APs.
- Wireless coverage can also be extended by altering the antennas, but users often overlook an antenna's vertical coverage.
- Most 802.11-based antennas are passive components that do not amplify the signal strength. The only way you can extend the signal reach is by compressing the radiation pattern generated by the antenna signal.

5. Enhance Mobile Operation Using MIMO

Enhance Mobile Operation Using MIMO Client Antennas

Both 2.4 GHz and 5 GHz based wireless communication require a clear Line of Sight (LoS) between the AP and its client(s). You can maintain a wireless connection using signal-penetration and obstacle-reflection techniques, but signal strength reduction can still affect the stability and overall throughput of your network. One way to avoid connection sheltering by obstacles is to increase the distribution of APs, which can be quite expensive. Extending the client radio's antenna installation to achieve proper line-of-sight between the APs and client can also provide tangible benefits. By using the 802.11n 2x2 MIMO technology you can install two antennas, one on the front and one on the back of a mobile device, to increase the device's wireless coverage..

6. Optimize Roaming Performance for Mobile

Optimize Roaming Performance for Mobile Operations

■Deploy an advanced wireless roaming technology to achieve millisecond-level roaming break time. Even though there are standards such as 802.11r that can optimize roaming performance, most wireless M2M vendors still tend to rely on their own roaming technologies. Advanced roaming technologies enable a wireless client to automatically search for a new AP when the current AP connection is weak.

■Configuring the correct roaming threshold parameter is critical in this setup to avoid downtime. Adopting a roaming technology that allows operators to tweak roaming parameters based on different environment and application scenarios will help optimize network performance and eliminate downtime.

7. Overcome Protocol Compatibility Issues

Overcome Issues Related to Protocol Compatibility

Certain characteristics of the standard 802.11 protocol prevent transparent communication between a wired Ethernet and a wireless link. Even though most of the TCP/IP-based automation protocols can transmit data without problems, there are cases where the 802.11 functionality needs to be tweaked in order to make it compatible with the industrial-automation protocols. The 802.11 AP/Client communication address protocol was designed with the assumption that wireless clients, such as smart phones, are the endpoints of the network. This is why only a limited number of addresses are reserved in a wireless packet for this purpose. When the wireless client is not the actual endpoint, but a device that is used to connect to additional Ethernet-based endpoints (for example, a PLC and the field devices connected to it), the standard 802.11 protocol will not be able to forward data packets correctly using just the MAC address of the endpoint device. Moxa solves this layer 2 Ethernet communication limitation using Moxa MAC Clone technology. The MAC Clone technology allows the MAC address for the additional endpoint devices to be transparent across the wireless links, enabling wireless communication for layer-2 based automation protocols such as PROFINET..

8. Handheld Device Interoperability

Handheld Device Interoperability Ensured by the Wi-Fi Alliance Logo

Smart handheld devices such as smart phones and tablet PCs are widely used in industrial operations. Many different smart device vendors, including Apple, HTC, Samsung, and Sony, sell smart devices with different operating systems (iOS, Android, and Windows, for example).

8. Handheld Device Interoperability (cont)

One thing that all of these handheld devices have in common is that they can all communicate well with factory APs via the 802.11 standard. Only devices that conform to certain standards of interoperability can carry the Wi-Fi logo. The Wi-Fi logo is issued by the Wi-Fi Alliance, which is a nonprofit organization that promotes Wi-Fi technology and certifies Wi-Fi products. Not every IEEE 802.11-compliant device is submitted for certification to the Wi-Fi Alliance because of costs associated with the certification process. However, the lack of the Wi-Fi logo does not necessarily imply a device is incompatible with Wi-Fi devices, but having the Wi-Fi logo provides a certain level of confidence regarding the device's level of Wi-Fi interoperability..