

Technical White Paper

WiLink™8 Use Case Guide



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ABSTRACT

With the growing trends in IoT, wireless connectivity is becoming increasingly important for a multitude of applications including but not limited to industrial, medical, building automation and automotive sectors. There are several connectivity options available including IEEE 802.11 WLAN/Wi-Fi® and *Bluetooth*®/Bluetooth low energy. Due to interoperability of Wi-Fi devices with internet infrastructure and native internet protocol support, Wi-Fi is replacing the other connectivity options in many applications. With a very active technology development ecosystem Wi-Fi is evolving to meet emerging challenges like data security, power management, data throughput and range. These generic requirements along with Wi-Fi specific features make the technology an attractive option for system designers and infrastructure developers. With the cost of Wi-Fi devices becoming more affordable, Wi-Fi is becoming the choice connectivity technology in many applications.

Texas Instruments [WiLink8™ family of devices](#), offer a wide range of solutions that support industry leading features that are required in IoT and related applications to meet the end equipment design needs in the IEEE 802.11 a/b/g/n segment. With the integration of Bluetooth/Bluetooth low energy and Wi-Fi into a single SoC, WiLink™8 devices offer a wide range of choices for end equipment realization and universal connectivity. With a **proven track record and feature rich offering**, WiLink8 devices are a good choice for certain segments that count on long term component availability to support products that will be manufactured for many years. This document is intended to provide an overview highlighting the device supported features that are suited for specific sectors and end equipment. For more information, see the [WiLink8 Getting Started Guide](#) and [WiLink8 NLCP Wi-Fi driver package for Linux OS](#).

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1 Generic Features Desired for Connectivity Applications

The development of connectivity applications often poses multiple challenges for designers. Some of the key challenges and constraints are ease of component use, Wi-Fi security, network topology, design for low power, environmental operating conditions, and network range. The following section details how these are addressed with WiLink8 device family. For a detailed list of features and performance, see the [WiLink™ 8 WLAN Features User's Guide](#).

1.1 Acronyms Used in This Document

Acronym	Description
AP	Access Point
BT	Bluetooth
BLE	Bluetooth low energy
FIPS	Federal Information Processing Standards Publication
MIMO	Multiple Input Multiple Output
MRC	Maximum Ratio Combining
PSK	Pre-Shared Key
P2P	Peer 2 Peer
SoC	System on Chip
STA	Station
WLAN	Wireless Local Area Network
WMM-AC	Wireless Multi-media – Access Categories
WMM APSD	Wi-Fi Multimedia (WMM) Automatic Power Save Delivery
WPA/2	Wi-Fi Protected Access
WMM-PS	Wireless Multi-media – Power Save
WoW	Wake on Wireless LAN

1.2 Ease-of-Use

One of the key challenges to developers is in integrating the Wi-Fi component into the application. This is not just limited to hardware integration challenges but also other requirements like regulatory certifications, co-existence with other 2.4 GHz radios, SW integration and device provisioning, and so forth.

WiLink8 family of devices are offered **in both chip and module** form to meet these challenges. The modules and corresponding evaluation boards are **certified** for various regulatory standards (FCC, CE, IC, TELEC, Bluetooth SIG, and so forth) and these **certificates are transferable** to the end devices with little or no effort. The modules are **pin to pin compatible** with each other and thus offer greater scalability in upgrading the end system for additional functionality based off one PCB design. This makes WiLink8 a good choice for any industry sector for usage and adoption without the risk of complicated certifications and costs associated with them. WiLink8 modules are also certified for AP **DFS** (Dynamic Frequency Selection radar detection) enabling them to operate over most of the 5GHz spectrum. Further, to aid **rapid prototyping**, various evaluation board options are available from Texas Instruments. WiLink 8 modules are **pre-verified for complete functionality** along with corresponding software components. The modules also offer seamless integration with TI Sitara™ microprocessors and other host processors.

Another challenge that is solved through WiLink8 modules is configuration flexibility. The modules are offered both with **consumer and industrial grade temperature ranges**. The modules can support single or multiple antennas for 2.4 GHz, 2.4 GHz 2x2 MIMO and 5 GHz bands. Additionally, the modules support **antenna diversity** in the 5 GHz band. The dual antenna diversity configuration is useful for applications demanding high throughput (up to 100 Mbps UDP) and to improve the quality and reliability of the network. Also, 2.4 GHz band offers Maximum ratio combining (MRC) to increase the range of communication.

WiLink8 chips and modules offer **inbuilt co-existence** mechanisms between the integrated Bluetooth/Bluetooth low energy and Wi-Fi subsystems. This avoids the need for external software or hardware handling of the co-existence mechanism. Further, the same feature is extended to ZigBee devices as well and TI provides a reference design for the same that includes both hardware and software.

WiLink8 solutions offer pre-integrated and tested **royalty free open source stacks** for Wi-Fi drivers and a Linux BlueZ stack for Bluetooth/Bluetooth low energy. The WLAN stack includes the hostap and wpa_supplicant along with the standard IEEE802.11 Linux based stack. The device and software also **supports open IEEE802.11s mesh** protocol for additional network topologies discussed later. The driver solution is also available for Android, Windows, QNX and RTOS platforms through a third party network. The tools required for device certification are integrated with the software package. For standalone evaluation of the device for performance a [WiLink™ Wireless Tools](#) package is provided at no cost to the designer.

The complete WiLink8 solution is tested by Texas Instruments against 200+ Access points and other Wi-Fi equipment for interoperability and compatibility, thus ensuring the robustness of the solution. The software drivers are Wi-Fi Alliance pre-certified.

1.3 Network Topology

WiLink8 solutions are an ideal fit for many applications that need reliable performance and robustness. The number of application areas where the WiLink8 device is being adopted is growing. This combined with excellent support and impressive features, makes it a very attractive solution for multiple end equipment types in many sectors.

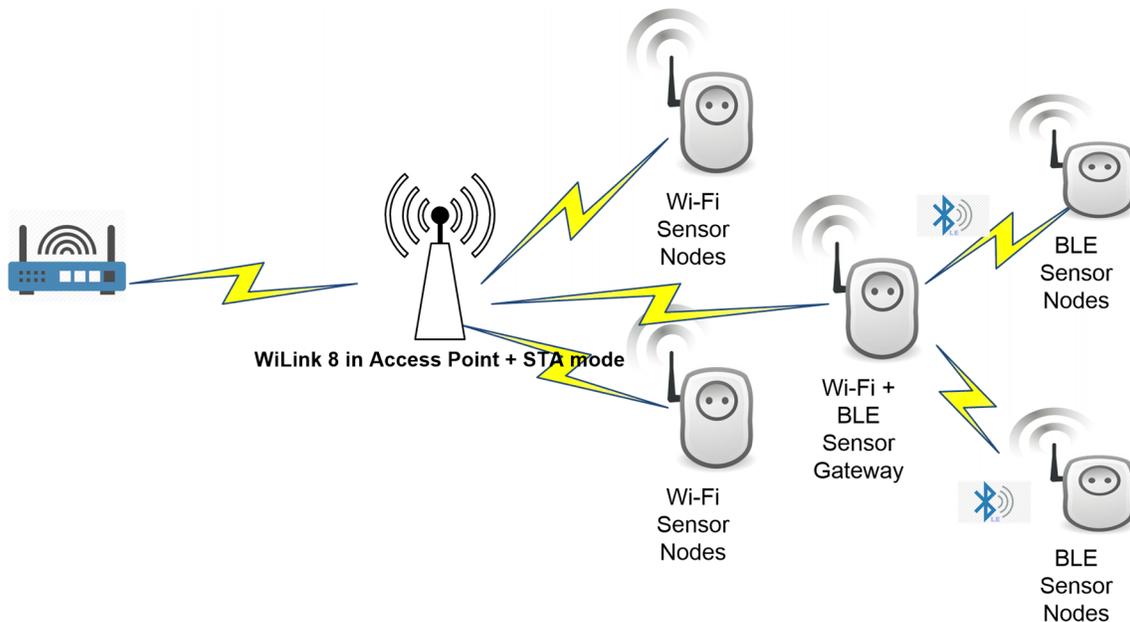


Figure 1-1. Range Extension Using WiLink8 in STA+AP Mode and Wi-Fi + Bluetooth/Bluetooth low energy Use case

WiLink8 also supports IEEE802.11s mesh operating concurrently with AP or STA modes. The mesh topology enables devices to be connected to their own private network. Such a configuration can be used in multiple end equipments like intercoms, sensor networks, smart meter networks, and so forth. Also simultaneous operation in AP or STA enables each node to be connected to the internet (mesh+STA) or other devices connected to it (mesh+AP). Mesh+STA mode enables the mesh network data to be streamed to internet in applications where the mesh network is used for data aggregation from multiple sensor networks. In the Mesh+AP configuration the data from different stations connected to the AP can access the internet through mesh, thus providing redundancy and reduced likelihood of a connection loss. Mesh networks can also be used for range extension. The mesh topology can also be used in applications where a group of Wi-Fi devices needs to be mobile. A typical example could be using the Wi-Fi enabled devices for safety helmets for workers to maintain communication with each other.

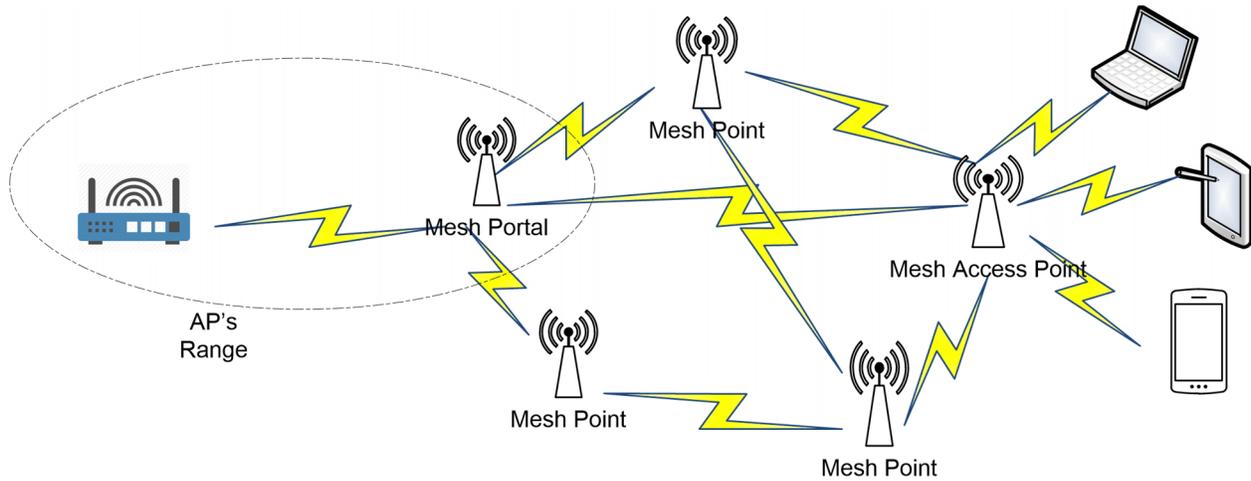


Figure 1-2. Wi-Fi Mesh Network Topology

Wi-Fi Direct/P2P mode enables many use cases that are needed for gaming controllers, wireless remotes, energy meters, connection to printers, smart speakers, and so forth. A P2P network avoids the need to be connected to an end device through a hotspot or AP. This is practically useful in many applications where the connection is required between two peers rather than through the network. In public infrastructure devices like energy meters, direct connection is helpful as this avoids any infrastructure privacy concerns.

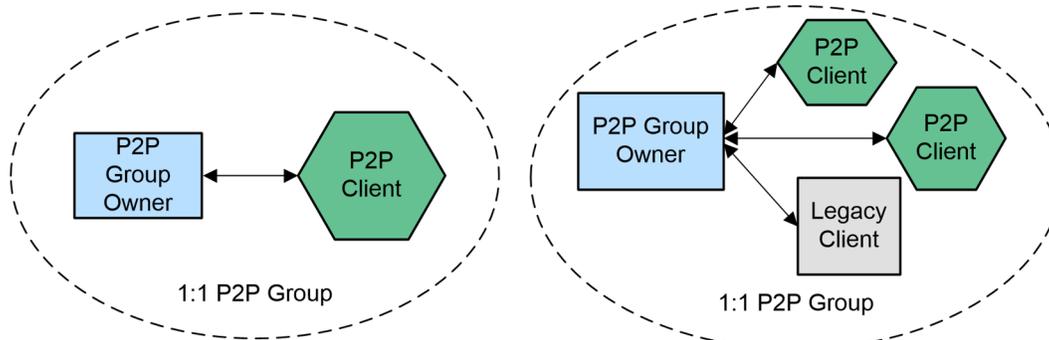


Figure 1-3. P2P Topology

1.4 Security

Security is an important aspect of connected devices. Whether you are building a door lock, wireless camera, or an ultrasound scanner, security is always important in providing a successful product. At TI security is treated with paramount importance and the devices are constantly upgraded to provide the latest security toolkit.

The WiLink8 family of devices support **WPA3**, which is the industry's latest Wi-Fi data security standard. The WiLink8 on-chip encryption engine provides an efficient way to handle encryption of user data. In addition to this WL1837MOD is *FIPS Compliant versus FIPS Validated* certified making it compliant with US Federal Government security standard.

1.5 Low Power

Many of the IoT and other applications that are battery operated demand low power modes. WiLink8 offers multiple features for enabling low power operation. Apart from the Wi-Fi Alliance standard defined WMM APSD, the device offers other features as well. Wake on Wireless (WoW) feature enables power saving for the attached host processor as well. The WiLink8 device can wakeup the host when it detects specific Wi-Fi activity thus enabling system level power saving. Also when the device is not actively transmitting data it can enter into a low power state and wakeup to listen to beacons. The learning algorithms implemented in WiLink8 enable the device to use this feature efficiently with any AP.

The device also supports a power management scheme in AP mode. AP Enhanced Low Power (ELP) mode can put the AP into sleep state when there is no active data transaction from the connected stations thus reducing the idle current consumption to 800 μ A.

1.6 Longer Range

With wireless connectivity devices are being deployed in many applications where the installation spans a large area like shopping malls, industrial areas, grid infrastructure that contain scattered sensor devices. As a result there is a need to have support for better range and reliable communication. WiLink8 Wi-Fi devices address these needs by using maximum ratio combining (MRC) over two antennas in 2.4 GHz mode. Additionally the IEEE802.11s mesh configuration and multi-mode operation (AP + STA) can extend the range further to meet such challenges. Typical applications involve energy meters, connection of multiple HVAC controllers, parking meters, and so forth.

2 Software Offering

Another key advantage of WiLink8 is the ease of system integration. The modules also offer seamless integration with TI Sitara microprocessors and other host microprocessors. The [NLCP drivers](#) that are provided for Wi-Fi are pre-integrated with the TI Sitara microprocessor SDK. These drivers are based on a Linux open-source package. The NLCP driver releases are Wi-Fi Alliance pre-certified and support IEEE: 802.11 a,b,g,n, 2X2 MIMO @ 2.4 GHz and antenna diversity @ 5 GHz, STA, AP, P2P, Wi-Fi Direct, Wi-Fi Mesh. [TI Bluetooth 4.2 Stack Add-On for Linux Platforms with WL183x and CC2564C](#) provides a TI Bluetooth Stack add-on package for Bluetooth and Bluetooth low energy.

Additionally, the MCU-based drivers are provided through a third party network. This provides scalability for application development that need the same connectivity with both microcontrollers and microprocessors, thus reducing the overhead involved with connectivity solution validation.

3 Summary

WiLink8 solutions are an ideal fit for many applications that need reliable performance and robustness. The number of application areas where the WiLink8 device is being adopted is growing. This combined with excellent support and impressive features, makes it a very attractive solution for multiple end equipment types in many sectors.

4 References

- [WiLink™ technology solutions](#)
- Texas Instruments: [WiLink™ 8 WLAN Features User's Guide](#)
- Texas Instruments: [WiLink8 Getting Started Guide](#)
- [WiLink™ 8 Wi-Fi Driver for Linux OS](#)
- Texas Instruments: [WiLink™ Module Hardware Integration Guide](#)
- Texas Instruments: [FIPS Compliant versus FIPS Validated](#)
- [WiLink R8.8 Release notes](#)

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