Wireless IoT Network Protocols

Below, we've compiled an extensive—but not exhaustive—list of Internet of Things (IoT) protocols, in no particular order. If you're looking for an IoT network protocols comparison, this is great place to start.

But first, a word of caution: Don't worry so much about the protocol until you know precisely what your application needs. Deciding you need interoperability or a protocol led by a big name industry player before understanding what kind of technology is right for your application simply won't do. Our advice? Get to know these IoT network protocols, but don't get your mind set on any of them until you know what you need to accomplish.

Bluetooth

Bluetooth is a global 2.4 GHz personal area network for short-range wireless communication. Device-to-device file transfers, wireless speakers, and wireless headsets are often enabled with Bluetooth.

See also: **A Bluetooth & ZigBee Comparison For IoT Applications**

BLE

BLE is a version of Bluetooth designed for lower-powered devices that use less data. To conserve power, BLE remains in sleep mode except when a connection is initiated. This makes it ideal for wearable fitness trackers and health monitors.

See also: **Bluetooth Vs. Bluetooth Low Energy: What's The Difference?**

ZigBee

ZigBee is a 2.4 GHz mesh local area network (LAN) protocol. It was originally designed for building automation and control—so things like wireless thermostats and lighting systems often use ZigBee.

See also: **ZigBee Vs. Bluetooth: A Use Case With Range Calculations**

Z-Wave

Z-Wave is a sub-GHz mesh network protocol, and is a proprietary stack. It's often used for security systems, home automation, and lighting controls.

See also: **Z-Wave Vs. ZigBee**

6LoWPAN

6LoWPAN uses a lightweight IP-based communication to travel over lower data rate networks. It is an open IoT network protocol like ZigBee, and it is primarily used for home and building automation.

See also: **6LoWPAN Range: Use Case Calculations**

Thread

Thread is an open standard, built on IPv6 and 6LoWPAN protocols. You could think of it as Google's version of ZigBee. You can actually use some of the same chips for Thread and ZigBee, because they're both based on 802.15.4.

WiFi-ah (HaLow)

Designed specifically for low data rate, long-range sensors and controllers, 802.11ah is far more IoT-centric than many other WiFi counterparts.

See also: **Examining The Future Of WiFi: 802.11ah HaLow, 802.11ad (& Others)**

2G (GSM)
2G is the “old-school” TDMA (usually) cellular protocol. ATMs and old alarm systems used this— and in most parts of the world it is phased out or in the process of being phased out.
3G & 4G
3G was the first “high speed” cellular network, and is a name that refers to a number of technologies that meet IMT-2000 standards. 4G is the generation of cellular standards that followed 3G, and is what most people use today for mobile cellular data. You can use 3G and 4G for IoT devices, but the application needs a constant power source or must be able to be recharged regularly.
LTE Cat 0, 1, & 3
With LTE classes, the lower the speed, the lower the amount of power they use. LTE Cat 1 and 0 are typically more suitable for IoT devices. (You can learn more about them in this Radio-Electronics article.)
LTE-M1
This is the first cellular wireless protocol that was build from the ground up for IoT devices. That being said, it isn’t available yet, so how it performs remains to be seen. With LTE, it’s worth understanding that carriers typically don’t have to modify hardware for their basestations; upgrades can be done entirely through software. This really helps with infrastructure costs, because companies won’t necessarily need new cellular basestations, just new endpoint hardware.

See also: **LTE-M & 2 Other 3GPP IoT Technologies To Get Familiar With**
NB-IoT
NB-IoT, or Narrowband IoT, is another way to tackle cellular M2M for low power devices. It is based on a DSSS modulation similar to the old Neul version of Weightless-W. Huawei, Ericsson, and Qualcomm are active proponents of this protocol and are involved in putting it together.
5G
Though it likely won’t be released for another five years, 5G is set to be the next generation of cellular network protocol. It’s designed for high throughput, and it will probably face the same issues as 3G and 4G in regards to IoT.
NFC
Near field communication is precisely as it sounds—IoT network protocols used for very close communication. When you wave your phone over a card reader to pay for groceries, you’re likely using NFC.
RFID
There are two types of radio frequency identification: active and passive. This protocol was designed specifically so devices without batteries could send a signal. In most systems, one side of an RFID system is powered, creating a magnetic field, which induces an electric current in the chip. This creates a system with enough power to send data wirelessly over and over again. Because of this, RFID tags are used for shipping and tracking purposes.

SigFox
SigFox is a global IoT network operator. It uses differential binary phase-shift keying (DBPSK) in one direction and Gaussian frequency shift keying (GFSK) in the other direction. SigFox and their partners set up antennas on towers (like a cell phone company) and receives data transmissions from devices such as parking sensors or water meters.
See also: **What Is SigFox?**
LoRaWAN
LoRaWAN is a media access control (MAC) layer protocol designed for large-scale public networks with a single operator. It is built using Semtech's LoRa modulation as the underlying PHY, but it is important to note that LoRa and LoRaWAN are two seperate things that are often (mistakenly) conflated.
Ingenu
Ingenu has created something called random phase multiple access (RPMA), which uses Direct Sequence Spread Spectrum (DSSS) and is similar to code division multiple access (CDMA) cellular protocols. Before IoT was a thing, Ingenu (then OnRamp) was selling metering infrastructure that collected low power information from electricity meters. Now, it's rebranded and is trying to become a broader player in the field (like SigFox).
Weightless-N
Weightless-N is an ultra narrowband system that is very similar to SigFox. Instead of being a complete end-to-end enclosed system, it's made up of a network of partners. It uses differential binary phase shift keying (BPSK) in narrow frequency channels and is intended for uplink sensor data.

Weightless-P
Weightless-P is the latest Weightless technology. It offers two-way features and quality of service tiers, which we think is very important.
Weightless-W
Weightless-W is an open standard designed to operate in TV white space (TVWS) spectrum. Using TVWS is attractive in theory, because it takes advantage of good ultra high frequency (UHF) spectrum that's not otherwise in use—but it can be quite difficult in practice.
See also: **What Is Weightless?**
ANT & ANT+
If you have a Samsung device, you probably have a radio with their protocol in it. ANT & ANT+ seem somewhat like another type of BLE system, designed to create networks that piggyback off of existing hardware. A lot of devices have ANT or ANT+ compatible chips in them, and the idea is that if you get enough of these radios added to the world, you can use them together as a mesh.
DigiMesh
DigiMesh is one of a number of proprietary mesh systems. You can learn about the differences between it and ZigBee in this white paper.
MiWi
MiWi is Microchip's proprietary network protocol. It was created for short-range networks and designed to help customers reduce their products' time to market.

EnOcean
EnOcean is a protocol designed specifically for energy harvesting applications that are extremely low power. Thus, its applications are centered around building automation, smart homes, and wireless lighting control.
Dash7
Dash7 is an open-source wireless network protocol with a huge RFID contract with the U.S. Department of Defense.
WirelessHART
WirelessHART is built on the HART Communication Protocol, and is what the company considers "the industry's first international open wireless communication standard."

Questions?

Get in touch with us! We know quite a bit about these IoT network protocols and would love to help you however we can.

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