

5G

Bands: Below 6 GHz, 24-86 GHz (mmWave)
Range: Very high, Global



- Brings efficiency to cellular based IoT networks
- Can provide very low latency and connect a million IoT devices per square kilometer
- Can address outdoor IoT in ways other technologies cannot (low latency and high sensor density)
- Lots of friendly IoT features, but will be difficult to unseat Wi-Fi as undisputed indoor IoT network provider

Bluetooth (IEEE 802.15.1)

Bands: 2.4 GHz
Range: Short, 10 meters



- Proprietary technology (Ericsson)
- Operates in Master-Slave configuration
- Ideal for small devices
- Used in medical devices and industrial sensors
- Real time location systems
- Low power, ideal for wearables
- Three different classes of BT radios:
 - 0-20 dBm power
 - 1-30 meter range
 - Up to 2 Mb/s

LoRa

Bands: Below 1 GHz
Range: High, 10 to 25 km (depending on line-of-sight)



- Proprietary technology, owned by Semtech (France)
- Secure, can transmit encrypted data at different frequencies and bit rates
- Indoor / outdoor coverage
- Specifically built for IoT
- LoRaWAN is the network on which LoRa operates
- Low power
- Industrial and offshore usage, Smart Cities

NB-IoT (Narrowband IoT)

Bands: 452 MHz to 2200 MHz
Range: High, 35 km



- Focused on indoor coverage
- Uses subset of LTE
- Low cost and low power, high battery life
- Deeper penetration in-building but more complex to implement

LTE-M

Bands: Below 1GHz / 4G-LTE
Range: Very high, Global



- Ideal for tracking moving objects over long distances
- Indoor / outdoor coverage
- High security provided through SIM chip
- Can use legacy 2G-3G networks if LTE is unavailable
- Location services provided through cell tower positioning, cheaper than GPS
- Works during power failures

Sigfox

Bands: 868 MHz (Europe), 902 MHz (US)
Range: High, 3-10 km in urban settings, 30-50 km in rural areas, up to 1,000 km in line-of-site applications



- Ultra narrow band with minimal interference
- Low power, high battery life
- Requires a mobile operator to carry the generated traffic
- Star network topology (using base stations)

Wi-Fi (IEEE-802.11)

Bands: 2.4 GHz and 5 GHz
Range: Medium, 100 meters



- High adoption; majority of indoor IoT operate on Wi-Fi
- Easy to implement, easy to use short-range wireless connectivity with cross-vendor interoperability
- Zero spectrum cost
- A lot of old IoT sensors (802.11b/g) are still operational
- Outdoor: 802.11ah: Range up to 1 km
- Indoor: 802.11ax: A lot of IoT friendly features
 - Targeted wake time
 - Up to 18 clients can send data at the same time

Zigbee (IEEE 802.15.4)

Bands: 2.4 GHz
Range: Low, 10 to 100 meters



- Industrial applications and some home products
- Low transmit power
- Low data rate (250 kb/s)
- Low battery consumption
- Secure 128-bit encryption
- Cheaper alternative to Bluetooth and Wi-Fi (home energy monitoring, wireless light switches, Traffic management)

Z-Wave

Bands: Below 1 GHz
Range: 30 meters



- Popular with IoT devices
- Applications in home automation (used by Amazon Echo)
- Most open development environment for smart products (using ITU-T G.9959 global radio standard)