

Glossary

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Full Glossary A-Z

Full Glossary A - Z

A reference guide to terms used in LoRa mesh networking, covering MeshCore, Meshtastic, hardware, radio concepts, and related protocols. Terms are listed alphabetically.

A

ACK

Acknowledgment. A confirmation packet sent by the destination node to indicate that a message was successfully received. For direct messages, the acknowledgment confirms end-to-end receipt. For channel (broadcast) messages in Meshtastic, the checkmark only means another node was heard rebroadcasting the packet - not that any particular person received it. MeshCore provides delivery reports for direct messages.

AGC (Automatic Gain Control)

A circuit in a radio receiver that automatically adjusts sensitivity based on incoming signal strength. AGC helps receive weak signals but can be desensitized when a very strong nearby transmitter is present - a concern in high-density node environments.

B

Bandwidth (BW)

The width of the radio frequency channel used for transmission - commonly 62.5 - 500 kHz in mesh use (Meshtastic's LongFast default is 250 kHz; MeshCore's recommended US preset uses 62.5 kHz). 125/250/500 kHz are the classic LoRaWAN values. Wider bandwidth increases the data rate but reduces effective range and noise resistance. Narrower bandwidth improves sensitivity but slows transmission.

BLE (Bluetooth Low Energy)

The wireless standard used to connect a phone or computer to a LoRa mesh node for configuration and messaging. BLE consumes minimal power compared to classic Bluetooth and is built into most modern smartphones. Most mesh devices use BLE as the primary interface to the companion app.

C

Chirp Spread Spectrum (CSS)

The modulation method used by LoRa. Data is encoded in frequency chirps - continuous sweeps up or down across the channel bandwidth. CSS is exceptionally resistant to narrowband noise and interference, enabling reception of signals well below the noise floor. This is the core technology that gives LoRa its long-range characteristics.

Coding Rate (CR)

The forward error correction ratio applied to LoRa transmissions, expressed as 4/5, 4/6, 4/7, or 4/8. A higher coding rate (e.g., 4/8) adds more redundant bits per data bit, improving error correction and link reliability at the cost of increased airtime and reduced effective throughput. Most mesh presets use CR 4/5 for efficiency.

D

dBi

Decibels relative to an isotropic radiator. A measure of antenna gain. An isotropic antenna (theoretical, radiates equally in all directions) is 0 dBi. Real antennas focus energy in specific directions - a 5 dBi vertical antenna focuses more energy toward the horizon, increasing horizontal range at the expense of coverage directly above and below. Higher dBi is generally better for ground-level mesh communication but can cause issues if nodes are at very different elevations.

dBm

Decibels relative to 1 milliwatt. The standard unit for transmit power in LoRa systems. Common values: 14 dBm = 25 mW, 20 dBm = 100 mW, 27 dBm = 500 mW, 30 dBm = 1 W. The FCC Part 15 limit for 915 MHz is 30 dBm conducted power (1 W) and 36 dBm EIRP (4 W including antenna gain).

DFU (Device Firmware Update)

The firmware update mode used by nRF52-based devices (T-Echo, T114, RAK4631). Entered by double-tapping the reset button, which causes the device to appear as a USB mass storage drive. Firmware is updated by dragging a .uf2 file onto this virtual drive. No separate flashing tool required.

E

EIRP (Effective Isotropic Radiated Power)

The total radiated power accounting for both transmitter output and antenna gain. $EIRP = TX \text{ power} + \text{antenna gain (in dBm and dBi respectively)}$. FCC Part 15 sets the EIRP limit for 915 MHz at 36 dBm (4 W). A 30 dBm transmitter with a 6 dBi antenna reaches exactly this limit.

ESP32

A popular microcontroller platform from Espressif Systems, used in many LoRa mesh devices including the Heltec V3, LILYGO T-Beam, and T-Deck. The ESP32 includes built-in Wi-Fi and Bluetooth. It consumes more power than nRF52-based platforms but is easier to develop for and generally less expensive. The ESP32-S3 variant is used in newer devices.

F

Flooding

The routing method used by Meshtastic. Meshtastic uses *managed flooding*: when a node receives a message it rebroadcasts it, but it skips its own rebroadcast if it first hears another node relay the same packet. This continues until the hop limit is reached or all nodes have seen the packet. Since firmware 2.6, direct messages use learned next-hop routing instead of pure flooding. Flooding ensures high delivery reliability in sparse networks but creates significant channel congestion in dense networks. Contrast with *Path Discovery* (used by MeshCore).

H

Hop

A single relay from one LoRa node to the next. Each time a message is forwarded by a relay node, it consumes one hop from the message's hop budget. A message that travels from Node A to Node B to Node C has made two hops.

Hop Limit

The maximum number of relay hops a message is permitted to make before being discarded. Prevents messages from circulating indefinitely. Meshtastic's default hop limit is 3 (configurable up to 7). MeshCore supports hop limits up to 64, enabling coverage across very large geographic areas through chains of repeaters.

I

ISM Band (Industrial, Scientific, and Medical)

Radio frequency bands reserved internationally for industrial, scientific, and medical use, available license-free for compliant devices. In the United States, LoRa mesh devices operate in the 902 - 928 MHz ISM band. Operation under FCC Part 15 rules in this band requires no amateur radio license.

L

LiFePO4 (Lithium Iron Phosphate)

A battery chemistry strongly preferred for outdoor and cold-weather LoRa deployments. LiFePO4 tolerates heat and physical abuse far better than LiPo and lasts many more cycles, but both chemistries lose capacity in deep cold and must not be charged below freezing. LiFePO4 has a longer cycle life (2,000 - 5,000+ cycles vs. 300 - 500 for LiPo), and is far more resistant to thermal runaway (onset ~270°C vs ~150-210°C for LiPo/NMC), though not immune - still use a proper BMS and fusing. Note: usable capacity drops sharply below freezing (manufacturers typically rate discharge only to about -20°C), so size winter battery banks with significant headroom. Critical: do not charge any lithium chemistry, including LiFePO4, below 0°C (32°F) - sub-freezing charging causes lithium plating, which permanently damages the cell and can create internal shorts. For winter solar deployments use a BMS or charge controller with low-temperature charge cutoff, or a self-heating/insulated battery.

LiPo (Lithium Polymer)

A common rechargeable battery chemistry used in many consumer electronics and LoRa devices. Energy-dense and lightweight, but sensitive to temperature extremes, overcharge, and physical damage. Not recommended for unattended outdoor deployments in climates with large temperature swings. See *LiFePO4* for a safer outdoor alternative.

LNA (Low Noise Amplifier)

An amplifier placed before the receiver input to boost weak incoming signals while adding minimal noise. Some base station and repeater nodes include an LNA to improve receive sensitivity. Important consideration: an LNA improves reception of distant signals but can be overloaded by very strong nearby transmitters.

LoRa (Long Range)

A proprietary wireless modulation technology developed by Semtech Corporation, using Chirp Spread Spectrum (CSS). LoRa defines the physical radio layer - how bits are transmitted over the air. It is the radio technology underlying both MeshCore and Meshtastic, as well as LoRaWAN. See also: *Chirp Spread Spectrum*, *LoRaWAN*.

LoRaWAN

A centralized network architecture built on top of LoRa radio, designed by the LoRa Alliance for IoT (Internet of Things) deployments. LoRaWAN uses a star topology: devices communicate with gateways that connect to internet servers. It requires internet infrastructure and is **not the same as LoRa mesh networking**. MeshCore and Meshtastic do not use LoRaWAN. See the "LoRa vs LoRaWAN" page for a full comparison.

M

Mesh

A network topology where every node can communicate directly with neighboring nodes and relay messages for other nodes. No central hub or server is required. Mesh networks are

inherently redundant - if one node fails, messages can route around it through other paths. Both MeshCore and Meshtastic implement mesh topologies.

MeshCore

A LoRa mesh networking protocol and firmware developed as an alternative to Meshtastic. MeshCore uses path-discovery routing rather than flooding, making it more efficient in dense networks. It includes features such as Room Servers for store-and-forward messaging and support for large hop limits. MeshCore and Meshtastic are not cross-compatible. See the

[MeshCore vs Meshtastic](#) comparison page.

Meshtastic

An open-source LoRa mesh networking project with a large global user base. Meshtastic uses managed flooding: relay nodes rebroadcast a message unless they already heard another node relay it; since firmware 2.6 direct messages use learned next-hop routing. It has extensive hardware support and a large, active community. Meshtastic and MeshCore are not cross-compatible. See the [MeshCore vs Meshtastic](#) comparison page.

MQTT (Message Queuing Telemetry Transport)

A lightweight publish/subscribe messaging protocol used to bridge Meshtastic nodes to internet services. Nodes with internet connectivity (via Wi-Fi) can publish mesh traffic to an MQTT broker, enabling out-of-area message delivery and integration with dashboards and mapping services. MQTT bridging is optional and requires infrastructure - the core mesh operates without it.

N

nRF52

A microcontroller platform from Nordic Semiconductor, used in lower-power LoRa mesh devices including the LILYGO T-Echo, T114, and RAK4631. The nRF52 does not have Wi-Fi, which reduces power consumption significantly compared to ESP32-based devices. nRF52 devices typically offer better battery life but have fewer connectivity options. Firmware updates use DFU mode (double-tap reset).

O

OTA (Over-The-Air)

Firmware update delivered wirelessly, without connecting a USB cable. Some LoRa mesh devices support OTA updates via Bluetooth or Wi-Fi. OTA capability depends on the specific device and firmware version.

P

Path Discovery

The routing method used by MeshCore. When a message needs to reach a destination, the network is initially flooded to discover a route. Once a path is found, subsequent messages to the same destination use the learned path directly, rather than flooding the entire network each time. This results in significantly less channel congestion than flooding in dense networks. Contrast with *Flooding* (used by Meshtastic).

PSK (Pre-Shared Key)

An encryption key distributed to all nodes that should be able to communicate on a given channel. Both MeshCore and Meshtastic use PSK-based encryption. All devices on the same channel must have the same PSK to send and receive messages. The default channel typically uses a publicly known default key (effectively no privacy); private channels use a custom PSK.

R

Repeater

A node dedicated to relaying messages rather than originating them. Repeaters are typically placed at elevation (hilltops, rooftops, towers) to maximize coverage area. In MeshCore, "Repeater" is a specific firmware variant optimized for this role. In Meshtastic, the Router or Repeater role serves the same purpose. Repeater nodes should have continuous power (solar or mains).

Room Server

A MeshCore-specific node type that functions as a store-and-forward bulletin board on the mesh. A Room Server retains recent messages and delivers them to nodes that connect later - similar in concept to a message board. This is particularly useful for networks where not all nodes are online simultaneously. Room Servers are a MeshCore feature and do not exist in standard Meshtastic.

RP-SMA (Reverse-Polarity SMA)

A variant of the SMA RF connector where the center pin gender is reversed: the RP-SMA female connector has a center pin (male contact), while RP-SMA male has a socket. LoRa mesh devices most commonly use standard SMA (e.g., many LILYGO and Heltec boards), but some use RP-SMA - check your specific device before buying antennas. When purchasing antennas or adapters, verify whether RP-SMA or standard SMA is required - they look nearly identical but are not interchangeable.

S

Scope

In MeshCore, the geographic or group region within which a message is intended to propagate. Scopes allow large networks to partition traffic so that local messages stay local and do not flood the entire regional network.

SF (Spreading Factor)

A LoRa parameter that controls how many chips encode each symbol (2^{SF} chips per symbol; each symbol carries SF bits), commonly SF7 (fastest, shortest range) to SF12 (slowest, longest range) in mesh presets - SF5 and SF6 also exist on newer radios. Higher spreading factors increase range and noise resistance exponentially but also increase time-on-air, battery consumption, and reduce channel capacity. Each step up in SF roughly doubles airtime and adds about 2.5 dB of link budget (about 30% more line-of-sight range).

SMA (SubMiniature version A)

A standard RF coaxial connector used widely in LoRa devices, antennas, and RF equipment. The standard SMA has a center pin on the male connector. Note the distinction between SMA and RP-SMA - they are not interchangeable. See *RP-SMA*.

SWR (Standing Wave Ratio)

A measure of impedance matching between the transmitter and antenna. A perfect match is 1:1; real antennas have some mismatch. SWR <1.5:1 is excellent; SWR <2:1 is acceptable; SWR >3:1 indicates a poor match and may cause reduced range and potential damage to the transmitter over time. Caused by wrong antenna type, damaged cable, or improper installation.

T

TX Power (Transmit Power)

The power output of the radio transmitter, measured in dBm. Higher TX power increases range up to the regulatory limit but also increases battery consumption. Most LoRa mesh devices allow TX power adjustment in firmware settings. The FCC Part 15 limit for 915 MHz is 30 dBm (1 W) conducted power. Operating at 27 dBm (500 mW) rather than 30 dBm reduces battery consumption while sacrificing 3 dB of link budget (roughly 25-30% of line-of-sight range).

Terms added or updated as the community identifies gaps. If a term is missing, please raise it in the community Discord.

LoRa Mesh Networking

Glossary

Quick reference definitions for terminology used throughout this wiki. Terms are organized alphabetically.

A

ACK (Acknowledgment)

A confirmation packet sent by the receiving node to confirm a message was received. Meshtastic uses ACKs for unicast (direct) messages; channel (broadcast) messages do not generate per-recipient ACKs - instead the sender gets an implicit ACK when it hears another node rebroadcast the packet.

Advertisement

MeshCore term for a broadcast packet that announces a node's name, position, and public encryption key (the advert is also signed to prevent spoofing). Client nodes send adverts manually when the user initiates it; repeaters and room servers send them periodically (every 12 hours by default). Similar in purpose to Meshtastic's NodeInfo broadcast.

ARES (Amateur Radio Emergency Service)

A volunteer organization affiliated with the ARRL that provides amateur radio communications support during emergencies. Some ARES groups have begun experimenting with LoRa mesh as a supplemental data layer.

Airtime

The duration a LoRa radio is transmitting a packet. Determined mainly by Spreading Factor, Bandwidth, and message length (coding rate and preamble length also contribute). Longer airtime = more range but lower network capacity. At SF12/BW125, a short message can take 1-2 seconds of airtime; at SF7/BW500, milliseconds.

B

Bandwidth (BW)

The frequency width of a LoRa signal in kHz. Common values: 62.5, 125, 250, 500 kHz. Wider bandwidth = faster data rate, slightly less range. One of the three parameters that define a modem preset.

BMS (Battery Management System)

A circuit that protects a lithium battery from overcharge, overdischarge, overcurrent, and short circuit. Essential for bare lithium cells; many integrated battery packs include a BMS.

Broadcast storm

A network condition where packets are retransmitted indefinitely, consuming all available airtime. Prevented in LoRa mesh by hop count limits and packet deduplication.

C

Channel

In Meshtastic: a named communication group with a shared Pre-Shared Key (PSK). Nodes on the same channel can communicate. Up to 8 channels can be configured on one node. In MeshCore: the public or private channel with shared encryption key.

Channel utilization

The percentage of time the LoRa channel is occupied by transmissions. Displayed in [Meshtastic app](#). Values above 25% indicate congestion; above 50% the network becomes unreliable.

Coding Rate (CR)

A LoRa parameter that adds forward error correction overhead. Common values: 4/5, 4/6, 4/7, 4/8. Higher coding rate provides better noise immunity at the cost of reduced data rate. One of three parameters in a modem preset.

Conducted power

Transmit power measured at the antenna connector of the radio. FCC Part 15 limits this to 1W (30 dBm) for 902-928 MHz spread spectrum.

D-E

dBi

Decibels relative to an isotropic radiator. A measure of antenna gain. Higher dBi means more focused signal in some directions. 0 dBi means gain equal to a hypothetical isotropic antenna that radiates equally in all directions; real antennas always have some directionality.

dBm

Decibels relative to 1 milliwatt. Used to express absolute power levels. 0 dBm = 1 mW; 30 dBm = 1W; -120 dBm = approximate LoRa sensitivity at low spreading factors, while at SF12 sensitivity reaches roughly -137 dBm (BW125) to -148 dBm.

ECDH (Elliptic Curve Diffie-Hellman)

A key exchange algorithm that allows two parties to derive a shared secret over an insecure channel without transmitting the secret. Used by MeshCore for all direct messages, and by Meshtastic DMs in firmware 2.5.0+.

EIRP (Effective Isotropic Radiated Power)

Total radiated power accounting for antenna gain and cable loss. $EIRP = \text{Conducted Power} + \text{Antenna Gain} - \text{Cable Loss}$. FCC 15.247 caps conducted power at 1 W (30 dBm) and requires dB-for-dB power reduction only for antenna gain above 6 dBi - with a 6 dBi antenna this works out to about 36 dBm (4 W) EIRP, though fixed point-to-point links are allowed higher EIRP.

F-H

Flood routing

The routing method used by Meshtastic for broadcasts: it uses managed flooding, where a node rebroadcasts a packet unless it first hears another node rebroadcast it. Since firmware 2.6, direct messages use next-hop routing instead of flooding. Simple but can cause congestion at scale.

Fresnel zone

An elliptical region around the direct path between two antennas. For reliable communication, approximately 60% of the first Fresnel zone should be free of obstructions. Trees, buildings, and terrain within the Fresnel zone cause signal loss even if the visual line-of-sight is clear.

Gateway

A node that connects the local mesh network to the internet (via WiFi, cellular, or wired connection), enabling MQTT uplink/downlink and access to map services and remote monitoring.

Hop

One radio transmission between adjacent nodes. A message that travels from Node A to Repeater B to Node C has taken 2 hops.

Hop limit

The maximum number of hops a packet may take before being discarded. Decrementing at each relay. Default 3 in Meshtastic; prevents broadcast storms.

I-L

ISM band

Industrial, Scientific and Medical radio bands. In the US, license-free communications devices (FCC Part 15) may also operate in these bands. US bands include 902-928 MHz, 2.4 GHz (WiFi), and 5.8 GHz; in Europe, 863-870 MHz is used for LoRa.

LiFePO4 (Lithium Iron Phosphate)

A lithium battery chemistry with superior DISCHARGE temperature tolerance (-20°C to 60°C), long cycle life (2,000-4,000 cycles), and high thermal stability (far more resistant to thermal runaway than LiPo, though not immune). Charging below 0°C damages the cells, so outdoor solar nodes need a low-temperature charge cutoff or a heated/self-heating battery.

Recommended for outdoor LoRa deployments.

Link budget

The accounting of all gains and losses in a radio link. Received power = TX power + TX antenna gain - cable losses - path loss + RX antenna gain. Link margin = received power - receiver sensitivity; a positive margin means a workable link.

LMR-200 / LMR-400

Trade names for low-loss coaxial cable commonly used for LoRa antenna connections. LMR-200 is flexible and low-loss for runs under 10m. LMR-400 is larger, lower-loss, preferred for runs over 10m at 915 MHz.

LoRa

Long Range radio modulation technology using Chirp Spread Spectrum (CSS). Not a network protocol - just the radio layer. Used by Meshtastic, MeshCore, LoRaWAN, and other systems.

LoRaWAN

A centralized IoT network protocol that uses LoRa radio. NOT the same as Meshtastic or MeshCore. LoRaWAN requires gateways connected to a network server; it does not support peer-to-peer mesh networking.

M-P

MeshCore

An open-source peer-to-peer LoRa mesh networking protocol using path-based routing (path discovery/acknowledgment) and ECDH encryption for direct messages. Distinct from and incompatible with Meshtastic.

Meshtastic

An open-source peer-to-peer LoRa mesh networking project using flood-based routing. The most widely deployed LoRa mesh protocol globally.

MPPT (Maximum Power Point Tracking)

A charge controller technique that continuously adjusts load to extract maximum power from a solar panel. MPPT typically harvests 10-30% more energy from the same panel than a PWM controller (vendor data; the exact gain depends on conditions), which matters most for small panel/battery systems.

NodeInfo

Meshtastic packet type that broadcasts a node's name, hardware type, and short name. Sent periodically and when the node first joins the network. Creates entries in other nodes' contact databases.

nRF52840

A Nordic Semiconductor microcontroller with integrated Bluetooth 5 and low-power design. Used in RAK4631, T-Echo, and T114 LoRa boards. Draws substantially less power than ESP32-based boards (sleep behavior and the radio dominate the difference), making it preferred for battery-powered deployments.

PSK (Pre-Shared Key)

A cryptographic key shared among all members of a group before communication begins. Meshtastic channels use PSKs for AES-256-CTR channel encryption (the PSK itself may be 128- or 256-bit). All nodes on a channel must have the same PSK to decrypt messages.

R-Z

RAK4631

A WisBlock LoRa module based on nRF52840 and SX1262 radio. One of the most popular nRF52840-based boards for MeshCore and Meshtastic deployments, valued for its low power consumption and external antenna support.

Room server

A MeshCore node running room-server firmware that acts as a shared message board (BBS): it stores posts and forwards them to clients when they connect, enabling asynchronous delivery. It does not require internet connectivity.

RSSI (Received Signal Strength Indicator)

Measured in dBm (negative values). The power level of a received radio signal. More negative = weaker signal. LoRa can decode signals as weak as -120 to -148 dBm depending on Spreading Factor.

SNR (Signal-to-Noise Ratio)

The ratio of signal power to noise floor, measured in dB. LoRa can decode at negative SNR values (down to about -20 dB), which is why it achieves such long range despite low signal strength.

Spreading Factor (SF)

A LoRa parameter, typically 7-12 (newer SX126x radios support 5-12). Higher SF = longer range, more airtime, lower data rate. Each step roughly doubles airtime. SF12 has roughly 30x more airtime than SF7 (at the same bandwidth) but much greater sensitivity.

T-Beam

A popular ESP32-based LoRa development board by TTGO/LilyGO featuring an integrated GPS module and 18650 battery holder. The antenna connector varies by version (SMA on classic v1.x boards, U.FL on the T-Beam Supreme/S3-Core). Available in 915 MHz (US) and 868 MHz (EU) variants.

T-Echo

A nRF52840-based LoRa device by LilyGO with an e-ink display, integrated GPS, and excellent battery life. Recommended for portable/handheld Meshtastic use.

UART

Universal Asynchronous Receiver-Transmitter. A serial communication interface. Used to connect GPS modules, serial sensors, and external hardware to LoRa boards.