What Is a Mesh Network?

If you have ever used Wi-Fi at home, you are already familiar with the most common type of wireless network: the **star topology**. Every device in your house - your phone, your laptop, your smart TV - talks to one central access point (your router), and the router connects everything to the internet. It is simple, it works well indoors, and it is fine as long as that one router keeps working.

But what happens if the router goes offline? Every device loses connectivity at the same instant. The whole network collapses around a single point of failure. Now imagine you are in a disaster zone, or deep in a national forest, or at a community event with no cellular service. A star network is useless. There is no router to plug in, and even if there were, its failure would silence everyone.

A **mesh network** solves this by making every single device both a *user* and a *router*. Instead of everyone talking through one hub, every node talks to the nodes near it, and those nodes pass the message onward, hop by hop, until it reaches its destination. Remove any one node - or even several - and traffic finds another path around the gap, provided another path exists - in a sparse mesh, losing a single well-placed relay can still partition the network. There is no central authority and no central server that can take the whole network down; however, a sparse mesh can still depend on individual relay nodes.

How a Message Travels in a Mesh

Picture five hikers spread across a mountain trail, each carrying a LoRa radio. Alice is at the trailhead; Echo is at the summit. Between them, out of direct radio range of each other, are Bob, Carol, and Dave.

1. Alice wants to send Echo a message: "*Summit still clear?*"
2. Alice's radio broadcasts the packet. Bob and Carol can both hear it.
3. Bob rebroadcasts it. Carol rebroadcasts it. (Duplicate suppression logic prevents infinite loops - each packet carries a unique ID that nodes remember and discard if seen again.)
4. Dave hears one of those rebroadcasts and passes it along.
5. Echo receives the packet, having never been able to hear Alice's original transmission directly.
6. Echo's reply travels back by whatever path is available at that moment.

This is called **multi-hop packet forwarding**. Each intermediate node is sometimes called a *relay* or a *repeater*. The exact path a message takes is not fixed - it depends on which nodes are currently powered on and within radio range of each other. The network continuously *self-heals*: if Dave's battery dies mid-hike, messages between Carol and Echo simply reroute through whoever is

still on the air.

Self-Healing Topology

The term **self-healing** means the network does not need a human administrator to reconfigure routes when a node disappears. Routing happens automatically. The flooding-based protocols this wiki covers (Meshtastic, MeshCore) do not maintain explicit routing tables - nodes simply rebroadcast and the surviving nodes carry traffic along whatever paths remain. When a node disappears, the mesh stops depending on it without any user intervention; how quickly traffic reroutes depends on the protocol and how the network is configured.

This is why mesh networks are so valuable for emergency communications, outdoor adventures, festivals, and anywhere you cannot rely on existing infrastructure.

Star Topology vs. Mesh Topology at a Glance

Feature	Star (Wi-Fi, cellular)	Mesh (LoRa mesh)
Central hub required?	Yes - everything depends on it	No - every node is equal
Single point of failure?	Yes	No central one (but a sparse mesh can still hinge on one key relay)
Range extension	Buy another access point, manually configure	Add any node; routing is automatic
Works off-grid?	Only if you have power and hardware	Yes - battery-powered nodes, no internet needed
Works during infrastructure failure?	No	Yes - if nodes have independent power and remain in radio range
Setup complexity	Plug in the router and done	Flash firmware, configure - slightly more involved

Why Mesh Is Ideal for Off-Grid Communications

In situations where commercial infrastructure is unavailable or unreliable - wildfires, earthquakes, backcountry recreation, sailing, amateur radio events - a mesh network can be a useful supplemental option for short- to medium-range text communications, alongside (not instead of) proven tools like two-way radios or satellite messengers with SOS for life-safety use. Here is why:

- **No subscription fees.** There is no carrier, no monthly bill, no account needed.
- **No internet connection required.** The mesh works entirely peer-to-peer. The nodes themselves are the network.
- **Incrementally deployable.** Even two nodes form a functioning (if very small) mesh. Every node you add extends the network further.
- **Low power.** LoRa radios can run for days or weeks on a small battery. Nodes can be solar-powered for permanent outdoor deployment.
- **Long range.** A single LoRa hop can span several kilometers in open terrain. With a few well-placed elevated relay nodes a multi-hop mesh can cover a county - though each added hop consumes shared channel capacity, and Meshtastic's default hop limit (3, configurable up to 7) must be considered.

The next page explains the radio technology that makes all of this possible at such low power and over such long distances: LoRa.

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