Monitoring Channel Utilization

Channel utilization is the single most important metric for diagnosing a congested Meshtastic network. High channel utilization causes missed messages, failed relays, and poor network performance.

What Channel Utilization Measures

Channel utilization (reported as a percentage in device metrics telemetry) measures the fraction of time that the radio channel is occupied by any LoRa transmission audible to a given node, averaged over a rolling 1-minute window (the firmware sums on-air milliseconds across six 10-second sub-windows). This includes:

- The node's own transmissions
- Relay transmissions from neighboring nodes
- Position and telemetry broadcasts from all nearby nodes

The 25% Warning Threshold

A commonly used community rule of thumb is to treat **25% channel utilization** as a warning threshold — it also matches the firmware's own behavior, which starts delaying transmissions above roughly 25% utilization (the app's green/orange band boundary). Above this level:

- Packet collision probability increases significantly
- Message delivery reliability decreases
- Effective network throughput drops despite higher raw utilization

Diagnosing High Channel Utilization

If channel utilization is above 25%, work through these checks:

1. **Count Router/Repeater nodes** - Too many infrastructure-role nodes in one area creates excessive relay traffic. Audit whether all Router/Repeater nodes are genuinely needed.
2. **Check telemetry intervals** - Frequent device metrics, position, or environment telemetry from many nodes adds up quickly. Increase intervals across the network.
3. **Identify high-traffic nodes** - Look at air utilization (the TX percentage) in device metrics. A node with very high air utilization is generating a disproportionate share of traffic.
4. **Switch dense-area personal nodes to Client Mute** - Each non-Mute client node attempts relay, multiplying traffic.

Switching to a Faster Modem Preset

LoRa modem presets trade range for throughput. A faster preset carries the same data in less airtime, directly reducing channel utilization:

```
meshtastic --set lora.modem_preset LONG_FAST # default; good range, moderate speed
meshtastic --set lora.modem_preset MEDIUM_FAST # shorter range, faster; less airtime
meshtastic --set lora.modem_preset SHORT_FAST # short range, maximum speed
```

Switching from LONG_FAST (SF11, ~1.07 kbps) to MEDIUM_FAST (SF9, ~3.52 kbps) increases the data rate roughly 3×, cutting per-packet airtime to roughly a third for the payload portion (less once fixed preamble/header overhead is included), substantially reducing channel utilization. The trade-off is reduced range. **Important:** changing the modem preset must be coordinated across the entire network — a single node on a different preset goes deaf to the rest of the mesh. Use this when you have good node density and congestion is the problem.

Viewing Channel Utilization

In the Meshtastic app: **Node Details → Device Metrics** shows the reported channel utilization from each node's perspective. Check several nodes across the network to understand the overall picture - a node at the center of a dense cluster will see higher utilization than one on the fringe.

Via CLI:

```
meshtastic --info
```

The output includes current channel utilization and air utilization for the connected node (under `deviceMetrics.channelUtilization`). Note that channel utilization is a live telemetry metric read via `--info`, not a config key — `meshtastic --get channel_utilization` will not return it.

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