Channel Utilization Management

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Channel utilization (CU) is one of the most important health metrics for a Meshtastic network, yet it is frequently misunderstood or ignored until problems become severe. Understanding what CU measures, what causes it to rise, and how to bring it back down is essential knowledge for any network operator running more than a handful of nodes.

What Is Channel Utilization?

Channel utilization is the percentage of time the radio channel is occupied by transmissions, measured over a rolling window (Meshtastic uses a 15-minute window by default). A CU of 10% means the channel was actively transmitting for 90 seconds out of every 15 minutes. Meshtastic calculates CU locally on each node by monitoring the time its own radio is keyed up, plus time spent sensing channel activity from other nodes. The reported CU figure is visible in the Meshtastic app under the node detail view and in the device telemetry metrics channel.

Healthy, Warning, and Critical Thresholds

- **Under 15%:** Healthy. The channel has ample headroom for message traffic, routing overhead, and telemetry. Packet loss due to collisions is rare.
- **15-25%:** Warning zone. You may begin seeing occasional packet loss, especially during bursts of activity. Investigate the causes and plan remediation before the situation worsens.
- **Over 25%:** Critical. At this level, the probability of two nodes transmitting simultaneously and causing a collision is high enough to cause significant packet loss on a sustained basis. User-visible symptoms include messages that appear to send but are not received, slow acknowledgements, and missed position updates.

Common Causes of High Channel Utilization

Several factors drive CU up. Understanding which ones apply to your network guides the correct fix:

- **Too many ROUTER nodes in close proximity:** Each ROUTER node retransmits packets it hears, and in a dense cluster, those retransmissions pile on top of each other. Five

ROUTER nodes covering the same area produce five times the retransmission traffic of one - without providing five times the coverage benefit.
- **Hop limit too high for network geography:** A hop_limit of 5 in a network where the farthest node is only 2 hops from the origin means packets are retransmitted up to 5 times unnecessarily. Every extra retransmission is wasted airtime.
- **High message traffic:** Active communities that send many messages, combined with frequent position and telemetry updates from many nodes, can saturate even a well-configured channel.
- **Routing loops:** A misconfigured network can cause packets to cycle through a set of nodes repeatedly. This is rare but produces dramatically elevated CU when it occurs. Check for loops by examining traceroute output - if a node appears twice in the path, a loop is present.

Remediation Strategies

- **Reduce hop_limit:** Set hop_limit to the minimum value that still delivers packets to all nodes in your network. For most community deployments, three to four hops is sufficient.
- **Convert excess ROUTER nodes to CLIENT_MUTE or CLIENT:** Audit your node roles. Nodes in the same area do not all need to be ROUTERs. Designate one or two strategically placed nodes as ROUTER and set the rest to CLIENT or CLIENT_MUTE to suppress retransmissions from densely packed areas.
- **Increase channel_num spacing:** If two active networks share physical proximity, configuring them on different channel numbers reduces interference between the two populations of nodes.
- **Consider MeshCore for large networks:** Meshtastic uses a flooding approach where every ROUTER retransmits every packet. In networks with dozens of active nodes and high message traffic, this flooding behavior is the fundamental cause of high CU. MeshCore uses a different routing architecture that avoids flooding, making it a better fit for large, dense, high-traffic community networks.

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