The DOGE networking protocols are a “Neighbor Protocol” for neighbor discovery and the MAC ALOHA protocol for data transmission.

## Neighbor Protocol

#### Notes

1. Signaling broadcast packets do not require ACKs. A node responds to a signaling broadcast packet with a unicast signaling packet.
2. *tsb* = signaling broadcast period
3. *tsr* = signaling receiving period
4. *tsleep* = node sleeping period

#### Requirements

1. When power is first applied to a sensor node, a node shall continuously broadcast signaling packets for '*tsb*' seconds (signaling broadcast period).
2. After a node's signaling broadcast period elapses, a node shall switch its radio into receiver mode for '*tsr*' seconds (signaling receiving period).
3. Upon receiving a signaling broadcast packet, a node shall:
   1. Check the signaling node's id for neighbor table inclusion
   2. Switch into transmitter mode
   3. Send a unicast signaling packet to the signaling broadcast node.
4. During a node's signaling receiving period, a node shall check received unicast signaling packets for neighbor table inclusion.
5. After a node's signaling receiving period elapses, a node shall count the unicast signaling packets received during the signaling receiving period to determine its next state.
   1. If the number of received unicast signaling packets is non-zero, the node shall switch into a normal receiving mode.
   2. If the number of received unicast signaling packets is zero, the node shall sleep for 'tp' seconds, and then reattempt the signaling broadcast sequence.

## MAC protocol (ALOHA)

#### Notes

1. *tr* = acknowledgement receiving period

#### Requirements

1. When a packet is present in a node's tx packet queue, a node shall check the packet type to determine if this packet requires an acknowledgement receiving period.
   1. If the packet is a signaling broadcast packet, the node shall transmit the packet and remove it from the packet queue.
   2. If the packet is not a signaling broadcast packet, the node shall transmit the packet and immediately switch to rx mode for '*tr*' seconds (acknowledgement receiving period).
2. During an acknowledgement receiving period, a node shall continuously check for an ACK packet.
   1. If an ACK is received, the node shall immediately cancel the current acknowledgement receiving period.
3. After a node's acknowledgment receiving period terminates (timeout or ACK received), a node shall check its rx data packet queue to determine how to process the current tx packet.
   1. If a data packet ACK is present, the node shall remove the current tx packet from the packet queue, and perform no further processing of the tx packet.
   2. If a data packet ACK is not present, the node shall perform the following steps:
      1. If the current contention period is greater than or equal to the max contention period, the node shall remove the current tx packet from the packet queue, and perform no further processing of the tx packet.
      2. If the current contention period is zero, the node shall set the current contention period to the minimum contention period (e.g. 32).
      3. If the current contention period is greater than zero and less than the max contention period, the node shall double the current contention period (exponential backoff).
      4. After assigning new contention periods, a node shall set the current backoff period to a random value between 0 and the current contention period, and then sleep for that amount of time before rechecking the tx packet queue.