

# Networks Coursework

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## 1 Topology

The area in the left circle is the coverage of A, and the area in the right circle is the coverage of B.

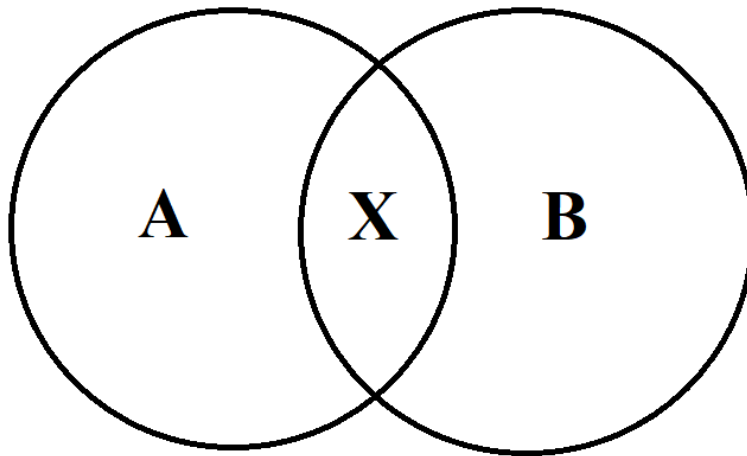


Figure 1: The described topology

## 2 Network Analysis

The network uses CSMA/CA to avoid collisions. At time  $0\mu s$ , X is sending a packet, and the channel is busy. Neither A nor B have a packet to send, so are not sensing the channel.

At time  $30\mu s$ , A has a packet to transmit, and senses the channel. X is still transmitting, so the network is busy. A starts its backoff timer ( $40\mu s$ ).

At time  $70\mu s$ , B has a packet to transmit, and senses the channel. X is still transmitting, so the network is busy, and B starts its backoff timer ( $60\mu s$ ). Also at time  $70\mu s$ , A's backoff timer finishes. A senses the channel, but it is busy as X is still transmitting so A restarts its timer.

At time  $100\mu s$ , X finishes transmitting. The channel is now idle.

At time  $110\mu s$ , A's backoff timer finishes. A senses the channel, which is idle. A transmits its packet to X.

At time  $130\mu s$ , B senses the channel. The channel is idle (A and B cannot sense each other's transmissions), so B transmits the packet to X.

At X, the packets collide. Neither A nor B detect the collision, and do not attempt to retransmit the packets.

### 3 Protocol Design

My protocol is going to address the issue of hidden nodes (the hidden node problem) in a network which may potentially arise in the above wireless transmissions. The issue occurs when two nodes cannot hear each other's transmissions, but can both transmit to a third node. The basic idea of the protocol is there is another node whose sole purpose is to keep up to date with which nodes are transmitting in the LAN, by keeping a table containing the nodes and their state. When a node wants to transmit, it asks this node if the receiving node is free. If the node returns CLEAR then the node is free to transmit. Otherwise, the sending node starts its back off timer.

Below are the detailed protocol steps.

Step 1: Node Y contains a table with each node in its range, and their state (idle or busy).

Step 2: Node A has a packet it wants to transmit to node X. It asks Y the state of X by sending a request frame. If X is busy, A starts its backoff timer. Otherwise Y returns a CLEAR frame.

Step 3: If X is idle, then A sends a frame to Y saying it is going to transmit to X.

Step 4: Y marks both A and X as busy.

Step 5: A transmits the packet to X.

Step 6: X sends an ACK to A on receipt of the packet.

Step 7: A sends a frame to Y saying it has finished transmitting.

Step 8: Y marks A and X as idle again.

If there are multiple node Ys that A is in range of, it sends the request to all of them, in case X has different states. If this inconsistency occurs, it is assumed that X is busy. Any nodes wishing to transmit to X at the same time as A will be told X is busy, so they can't transmit. This solves the hidden node problem.