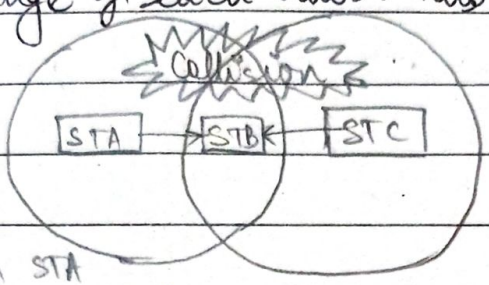
Q. What are hidden & exposed station problems? what are the methods to prevent them?

A. Hidden Station Problem.

Suppose that there are 3 stations: STA, STB & STC, where STA & STC are transmitting while STB is receiving. The stations are in a configuration such that the 2 transmitters STA & STC are not in the radio range of each other. This is shown in the foll fig:



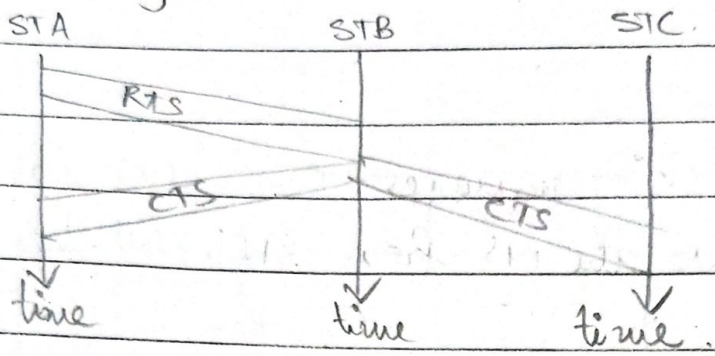
The above diagram shows that STA starts transmitting to STB. Since STC is out of radio range of STA, it perceives that the channel is free & starts transmitting to STB. The frames received by STB are garbled & collision occurs. This situation is known as the hidden station prob.

Solution:

- It can be solved by the MAC layer protocol IEEE 802.11 RTS/CTS, with the condition that the stations are synchronized and frame & data speeds are the same. RTS stands for request to send & CTS stands for clear to send
- A transmitting station sends a RTS frame to the receiving station. The receiving " replies by sending a CTS frame. On receipt of CTS frame, the transmitting station begins transmission.
- The RTS message from STA reaches STB, but not STC. However,

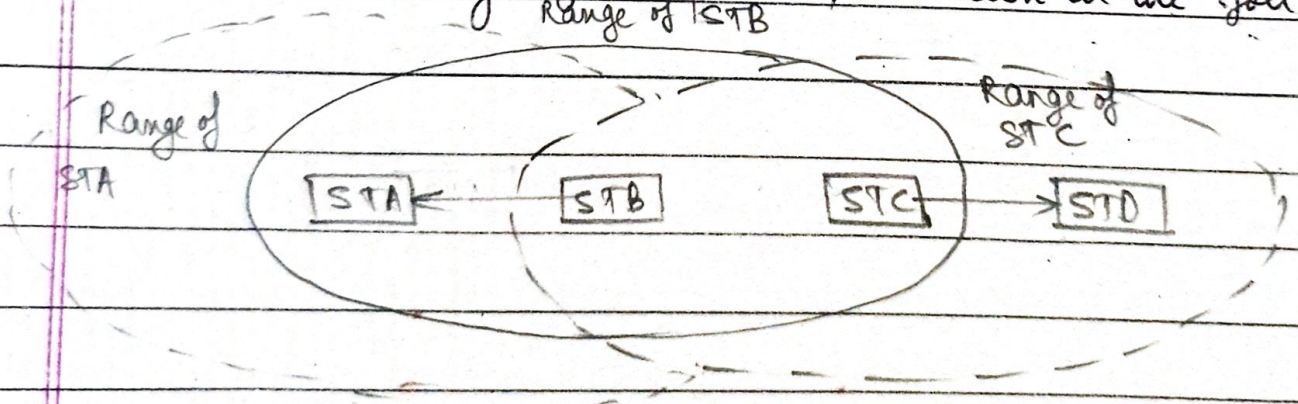
because both STA & STC are within the range of STB, the CTS message, which contains the duration of data txn from STA to STB reaches STC.

STC knows that some hidden station is using the channel & refrains from transmitting until that duration is over.



Exposed station problem

Suppose that there are 4 stations labelled STA, STB, STC, STD where STB & STC are transmitters which STA & STD are receivers. The stations are in a configuration such that the 2 receivers STA & STD are out of radio range of each other, but the 2 transmitters are in radio range of each other, as shown in the foll. fig:



This is the inverse of the previous one. In this problem, a station refrains from using a channel when it is, in fact, available.

In the fig, STB is transmitting to STA. STC has some data to send to STD, which can be sent without interfering with the transmission from B to A. However, C is exposed to tx from B; it hears what B is sending and refrains from sending. In other words, C is too conservative & wastes the capacity of the channel.

Solutions

The handshaking messages RTS & CTS cannot help in this case STC overhears the RTS from STB, but does not hear the CTS from STA.

IEEE 802.11 mechanism helps to solve this problem only if the nodes are synchronized and packet sizes and data rates are the same for both the transmitting nodes. When a node hears an RTS from a neighboring node, but not the corresp. CTS, that node can deduce that it is an exposed node & is permitted to transmit to other neighboring nodes.