

CSMA/CD and Ethernet

Ethernet and other medium access mechanisms, including various wireless MAC (Medium Access Control) protocols, are regulated by IEEE (Institution of Electrical and Electronic Engineers) jointly with ISO. Ethernet is IEEE 802.3, and Wireless MAC standards are known as 802.11a, 802.11b, 802.11g etc. These standards are constantly in a state of flux.

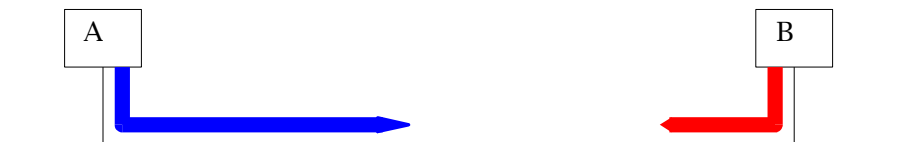
Carrier Sense Multiple Access with Collision Detection (CSMA/CD) is the LAN access method used in Ethernet. When a device wants to gain access to the network, it checks to see if the network is free. If the network is not free, the device waits a random amount of time before retrying. If the network is free and two devices access the line at exactly the same time, their signals collide. When the collision is detected, they both back off and wait a random amount of time before retrying.

The following is an example scenario that illustrates CSMA/CD.

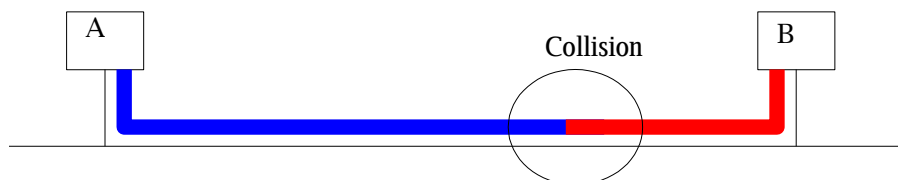
Station A, detecting that the wire has been idle for 9.6 microseconds, begins to transmit its data frame, beginning with the 64 bit preamble. It is also listening for abnormal voltage on the wire.

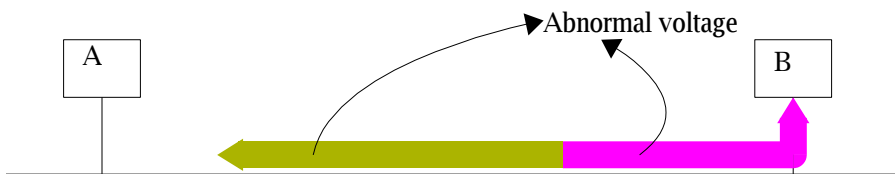


Some time later, but before the signal from station A has had time to propagate down the wire to station B, Station B also detects that the wire has been idle for more than 9.6 microseconds, and begins to transmit its data frame.



At some point on the wire between station A and station B, the electrical signals overlap, creating abnormal voltage. The signals with abnormal voltage travel down the wire towards both station A and Station B.





In this scenario, station B detects the abnormal voltage on the wire first, and realizes that a collision has occurred. It immediately stops transmitting data and starts to send a 32 bit jam signal.



The 32 bit jam consists of any combination of values that is not a valid CRC for the frame that was just interrupted by the collision. The aim of the jam signal is to make the recipient abandon the transmitted signal, and fully populate the wire with abnormal voltage preventing anybody else from beginning to transmit. Most Ethernet cards today just send 32 ones and know that there is only a $1/(2^{32})$ chance that will be checksum.

Station B will then implement what is known as the Binary Exponential Backoff Algorithm, which determines how long it will wait before it attempts to retransmit the frame that was just interrupted.

Eventually the abnormal signal will reach A, and it will also realize that a collision has occurred, and will start its own jamming sequence and implement the exponential back-off algorithm..



Collisions are normal in an Ethernet network, and under most circumstances should not be considered a problem.

For a **Java applet** demonstrating CSMA/CD, see http://media.pearsoncmg.com/aw/aw_kurose_network_2/applets/csmacd/csmacd.html