Carrier-sense multiple access

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Carrier-sense multiple access (**CSMA**) is a media access control (MAC) protocol in which a node verifies the absence of other traffic before transmitting on a shared transmission medium, such as an electrical bus or a band of the electromagnetic spectrum.

A transmitter attempts to determine whether another transmission is in progress before initiating a transmission using a carrier-sense mechanism. That is, it tries to detect the presence of a carrier signal from another node before attempting to transmit. If a carrier is sensed, the node waits for the transmission in progress to end before initiating its own transmission. Using CSMA, multiple nodes may, in turn, send and receive on the same medium. Transmissions by one node are generally received by all other nodes connected to the medium.

Variations on basic CSMA include addition of collision-avoidance, collision-detection and collision-resolution techniques.

Contents

Protocol modifications

CSMA with collision detection

CSMA/CD is used to improve CSMA performance by terminating transmission as soon as a collision is detected, thus shortening the time required before a retry can be attempted.

CSMA with collision avoidance

In CSMA/CA collision avoidance is used to improve the performance of CSMA. If the transmission medium is sensed busy before transmission, then the transmission is deferred for a random interval. This random interval reduces the likelihood that two or more nodes waiting to transmit will simultaneously begin transmission upon termination of the detected transmission, thus reducing the incidence of collision.

Virtual time CSMA

VTCSMA is designed to avoid collision generated by nodes transmitting signals simultaneously, used mostly in hard real-time systems. It uses two clocks to prioritize messages based on their deadline.[1]

CSMA access modes

1-persistent

1-persistent CSMA is an aggressive transmission algorithm. When the transmitting node is ready to transmit, it senses the transmission medium for idle or busy. If idle, then it transmits immediately. If busy, then it senses the transmission medium continuously until it becomes idle, then transmits the message (a frame) unconditionally (i.e. with probability=1). In case of a collision, the sender waits for a random period of time and attempts the same procedure again. 1-persistent CSMA is used in CSMA/CD systems including Ethernet.

Non-persistent

Non persistent CSMA is a non aggressive transmission algorithm. When the transmitting node is ready to transmit data, it senses the transmission medium for idle or busy. If idle, then it transmits immediately. If busy, then it waits for a random period of time (during which it does not sense the transmission medium) before repeating the whole logic cycle (which started with sensing the transmission medium for idle or busy) again. This approach reduces collision, results in overall higher medium throughput but with a penalty of longer initial delay compared to 1–persistent.

P-persistent

This is an approach between 1-persistent and non-persistent CSMA access modes. [2]When the transmitting node is ready to transmit data, it senses the transmission medium for idle or busy. If idle, then it transmits a frame with probability *p*. If busy, then it senses the transmission medium continuously until it becomes idle, then transmits with probability *p*. If the node does not transmit (the probability of this event is *1-p*), it waits until the next available time slot. If the transmission medium is still not busy, it transmits again with the same probability *p*. This probabilistic hold-off repeats until the frame is finally transmitted or when the medium is found to become busy again (i.e. some other node has already started transmitting). In the latter case the node repeats the whole logic cycle (which started with sensing the transmission medium for idle or busy) again. p-persistent CSMA is used in CSMA/CA systems including Wi-Fi and other packet radio systems.

O-persistent

Each node is assigned a transmission order by a supervisory node. When the transmission medium goes idle, nodes wait for their time slot in accordance with their assigned transmission order. The node assigned to transmit first transmits immediately. The node assigned to transmit second waits one time slot (but by that time the first node has already started transmitting). Nodes monitor the medium for transmissions from other nodes and update their assigned

order with each detected transmission (i.e. they move one position closer to the front of the queue).[3] O-persistent CSMA is used by CobraNet, LonWorks and the controller area network.

When broadcasting over vehicular ad hoc networks, the original 1-persistence and p-persistence strategies often cause the broadcast storm problem. People developed three modified techniques -- weighted p-persistence, slotted 1-persistence, and slotted p-persistence -- to give better performance.[4][5]

See also

- Local collision
- Remote collision
- Pure ALOHA and Slotted ALOHA

References

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General

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