



Emerging Network Technologies

NetSim

Exercise 12 (Optional)

Faculty of Architecture, Computing and Engineering

School of Applied Computing

Mount Pleasant Campus

Swansea

SA1 6ED

12. To determine the optimum persistence of a p-persistent CSMA / CD network for a heavily loaded bus capacity.

12.1 Theory:

Carrier Sense Multiple Access Collision Detection (CSMA / CD)

This protocol includes the improvements for stations to abort their transmissions as soon as they detect a collision. Quickly terminating damaged frames saves time and bandwidth. This protocol is widely used on LANs in the MAC sub layer. If two or more stations decide to transmit simultaneously, there will be a collision. Collisions can be detected by looking at the power or pulse width of the received signal and comparing it to the transmitted signal. After a station detects a collision, it aborts its transmission, waits a random period of time and then tries again, assuming that no other station has started transmitting in the meantime.

There are mainly three theoretical versions of the CSMA /CD protocol:

1-persistent CSMA / CD: When a station has data to send, it first listens to the channel to see if anyone else is transmitting at that moment. If the channel is busy, the station waits until it becomes idle. When station detects an idle channel, it transmits a frame. If a collision occurs, the station waits a random amount of time and starts all over again. The protocol is called 1-persistent because the station transmits with a probability of 1 whenever it finds the channel idle.

Ethernet, which is used in real-life, uses 1-persistence. A consequence of 1-persistence is that, if more than one station is waiting for the channel to get idle, and when the channel gets idle, a collision is certain. Ethernet then handles the resulting collision via the usual exponential back off. If N stations are waiting to transmit, the time required for one station to win the back off is linear in N .

Non-persistent CSMA /CD: In this protocol, before sending, a station senses the channel. If no one else is sending, the station begins doing so itself. However, if the channel is already in use, the channel does not continually sense it for the purpose of seizing it immediately upon detecting the end of the previous transmission. Instead, it waits a random period of time and then repeats the algorithm. Intuitively this algorithm should lead to better channel utilization and longer delays than 1-persistent CSMA

p-persistent CSMA / CD: This protocol applies to slotted channels. When a station becomes ready to send, it senses the channel. If it is idle, it transmits with a probability of p . With a probability $q=1-p$ it defers until the next slot. If that slot is also idle, it either transmits or defers again, with probabilities p and q respectively. This process is repeated until either the frame has been transmitted or another station has begun transmitting. In the latter case, it acts as if there had been a collision (i.e., it waits a random time and starts again). If the station initially senses the channel busy, it waits until the next slot and applies the above algorithm.

How does the performance of LAN (throughput) that uses CSMA/CD protocol gets affected as the numbers of logged in user varies:

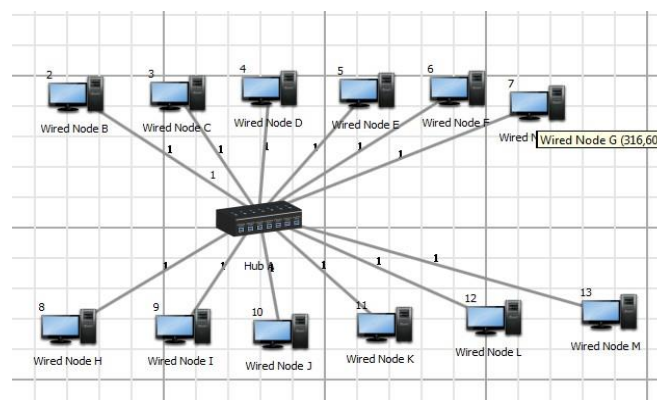
Performance studies indicate that CSMA/CD performs better at light network loads. With the increase in the number of stations sending data, it is expected that heavier traffic have to be carried on CSMA/CD LANs (IEEE 802.3). Different studies have shown that CSMA/CD performance tends to degrade rapidly as the load exceeds about 40% of the bus capacity. Above this load value, the number of packet collision raise rapidly due to the interaction among repeated transmissions and new packet arrivals. Collided packets will back off based on the truncated binary back off algorithm as defined in IEEE 802.3 standards. These retransmitted packets also collide with the newly arriving packets.

12.2 Procedure:

How to create a scenario and generate traffic:

- **Create Scenario:** –Simulation → New → Legacy Networks → CSMA/CD.

Scenario:



Sample Input:

In this Sample experiment 12 Nodes and 1 Hubs need to be clicked and dropped onto the Environment Builder.

Input for the Sample experiments (i.e. Totally 11 Samples) are given below,

Sample Input 1:

In the first sample for each Node the following properties have to be set,

Node Properties	Values to be Selected
Persistence	1

Vary persistence from 1/2, 1/3, 1/4, 1/5... 1/10, 1/11 to generate other experiments.

Create broadcast application for all nodes and set the properties as follows:

Application Properties		
Packet Size	Distribution	Constant
	Application Data Size (bytes)	1472
Inter Arrival Time	Distribution	Exponential
	Mean Inter Arrival Time(μ s)	1000

Wired Link Properties:

Link Properties	Values to be Selected
Uplink bit error rate	0
Downlink bit error rate	0

Simulation Time - 10 Sec

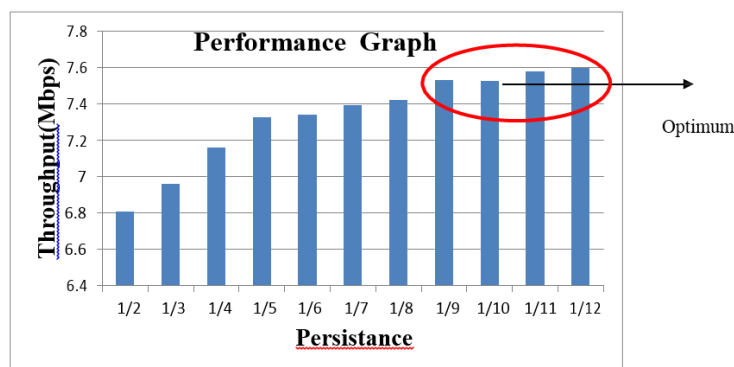
(Note: The Simulation Time can be selected only after the following two tasks,

- Set the properties for the Nodes & The Hub*
- Click on Run Simulation button).*

12.3 Output:

After simulation of each experiment, click on the network statistics and note down the user level throughput values. Open an excel sheet and plot a graph for these noted values against their respective persistence values.

Comparison Chart:



12.4 Inference:

As the number of logged in users is quite large in this experiment, the performance of a p-persistent CSMA/CD network with large p, is not optimal because of a large number of collisions. Therefore, we have minimum throughput when the persistence was 1/2. But as persistence is decreased (lower and lower probabilities), the likelihood of collisions reduce and hence throughput starts to increase. However, beyond a certain limit, in this case 1/11 the probability of transmitting packets becomes very low and hence there aren't many transmissions. Therefore, throughput starts to decline. In this experiment with 12 nodes generating traffic, we notice that the maximum throughput is at a persistence value lying between 1/9 and 1/12.