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Experiment No 15

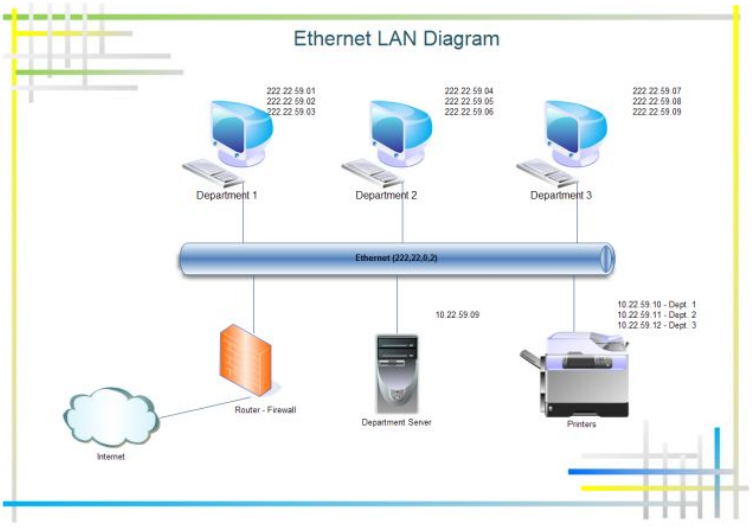
Title:
Simulate an Ethernet LAN using n nodes (6-10), change error rate and data rate and compare throughput

Theory:
Local Area Networks (LANs)

A network is any collection of independent computers that exchange information with each other over a shared communication medium. Local Area Networks or LANs are usually confined to a limited geographic area, such as a single building or a college campus. LANs can be small, linking as few as three computers, but can often link hundreds of computers used by thousands of people. The development of standard networking protocols and media has resulted in worldwide proliferation of LANs throughout business and educational organizations.

Ethernet

Ethernet is the most popular physical layer LAN technology in use today. It defines the number of conductors that are required for a connection, the performance thresholds that can be expected, and provides the framework for data transmission. A standard Ethernet network can transmit data at a rate up to 10 Megabits per second (10 Mbps). Other LAN types include Token Ring, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, Fiber Distributed Data Interface (FDDI), Asynchronous Transfer Mode (ATM) and Local Talk.

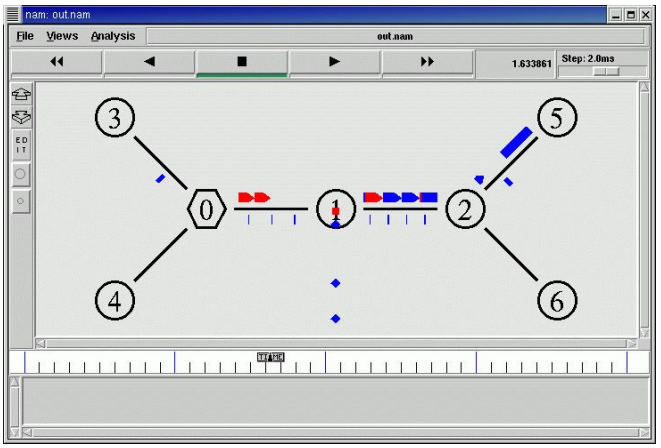


Ethernet is popular because it strikes a good balance between speed, cost and ease of installation. These benefits, combined with wide acceptance in the computer marketplace and the ability to support virtually all popular network protocols, make Ethernet an ideal networking technology for most computer users today.

CODE:

```
#Create Simulator
set ns [new Simulator]

#Use colors to differentiate the traffic
$ns color 1 Blue
$ns color 2 Red
```




```
#Open trace and NAM trace file
set ntrace [open prog5.tr w]
$ns trace-all $ntrace
set namfile [open prog5.nam w]
$ns namtrace-all $namfile

#Finish Procedure
proc Finish {} {
global ns ntrace namfile

#Dump all trace data and close the files
$ns flush-trace
close $ntrace
close $namfile

#Execute the nam animation file
exec nam prog5.nam &

#Calculate the throughput = (number of packets received/time taken for simulation)
set TcpSize [exec grep "^r" prog5.tr | grep "tcp" | tail -n 1 | cut -d " " -f 6]
set numTcp [exec grep "^r" prog5.tr | grep -c "tcp"]
set tcpTime 123.0
set UdpSize [exec grep "^r" prog5.tr | grep "cbr" | tail -n 1 | cut -d " " -f 6]
set numUdp [exec grep "^r" prog5.tr | grep -c "cbr"]
set udpTime 124.4
puts "The throughput of FTP is"
puts "[expr ($numTcp*$TcpSize)/$tcpTime] bytes per second"
puts "The throughput of CBR is"
puts "[expr ($numUdp*$UdpSize)/$udpTime] bytes per second"
exit 0
}

#Create 6 nodes
for {set i 0} {$i < 6} {incr i} {
set n($i) [$ns node]
}

#Create duplex links between the nodes
$ns duplex-link $n(0) $n(2) 2Mb 10ms DropTail
$ns duplex-link $n(1) $n(2) 2Mb 10ms DropTail
$ns simplex-link $n(2) $n(3) 0.3Mb 100ms DropTail
$ns simplex-link $n(3) $n(2) 0.3Mb 100ms DropTail

#Node n(3), n(4) and n(5) are considered in a LAN
set lan [$ns newLan "$n(3) $n(4) $n(5)" 0.5Mb 40ms LL Queue/DropTail MAC/802_3 Channel]

#Orientation to the nodes
```

```
$ns duplex-link-op $n(0) $n(2) orient right-down
$ns duplex-link-op $n(1) $n(2) orient right-up
$ns simplex-link-op $n(2) $n(3) orient right

#Setup queue between n(2) and n(3) and monitor the queue
$ns queue-limit $n(2) $n(3) 20
$ns simplex-link-op $n(2) $n(3) queuePos 0.5

#Set error model on link n(2) and n(3) and insert the error model
set loss_module [new ErrorModel]
$loss_module ranvar [new RandomVariable/Uniform]
$loss_module drop-target [new Agent/Null]
$ns lossmodel $loss_module $n(2) $n(3)
#Setup TCP Connection between n(0) and n(4)
set tcp0 [new Agent/TCP/Newreno]
$tcp0 set fid_ 1
$tcp0 set window_ 8000
$tcp0 set packetSize_ 552
$ns attach-agent $n(0) $tcp0
set sink0 [new Agent/TCPSink/DelAck]
$ns attach-agent $n(4) $sink0
$ns connect $tcp0 $sink0
#Apply FTP Application over TCP
set ftp0 [new Application/FTP]
$ftp0 set type_ FTP
$ftp0 attach-agent $tcp0
#Setup UDP Connection between n(1) and n(5)
set udp0 [new Agent/UDP]
$udp0 set fid_ 2
$ns attach-agent $n(1) $udp0
set null0 [new Agent/Null]
$ns attach-agent $n(5) $null0
$ns connect $udp0 $null0
#Apply CBR Traffic over UDP
set cbr0 [new Application/Traffic/CBR]
$cbr0 set type_ CBR
$cbr0 set packetSize_ 1000
$cbr0 set rate_ 0.1Mb
$cbr0 set random_ false
$cbr0 attach-agent $udp0
#Schedule events
$ns at 0.1 "$cbr0 start"
$ns at 1.0 "$ftp0 start"
$ns at 124.0 "$ftp0 stop"
$ns at 124.5 "$cbr0 stop"
$ns at 125.0 "Finish"
#Run Simulation
$ns run
```

Output:

```
#ns prog5.tcl
The throughput of FTP is
72556.097560975613 bytes per second
The throughput of CBR is
37363.34405144694 bytes per second
```