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AODV Routing Protocol for Congestion Control Based on Packet Priority

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Abstract

There is a requirement for permitting customer prioritization, in wireless multimedia streaming; so, arrangement of end client can be empowered with a good quality in-coordinate association with other client devices consequence. As of now, a similar priority is given to all clients, autonomous of their attributes, regularly bringing about unfair dispersion of throughput. This paper proposes a need based plan for QoS in MANET by classifying the activity stream into various priority classes, and giving distinctive treatment to stream having a high priority flow and still accomplish most ideal throughput. The aim is to lessen the impact of dependence between routes utilized by high and low priority movement. The shortest path will be chosen by AODV protocol for high priority traffic and divert the route for low priority traffic that will minimally interface with high priority flow, thus decreasing the impact of coupling amongst high and low priority routes.

Keywords: *AODV, MANET, multimedia, priority, QoS, throughput*

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INTRODUCTION

Mobile nodes accumulated can be empowered with claimed quality in-coordinate association to co-operate with each other. Such nodes can be termed as Mobile Adhoc Networks (MANETs). Nodes in the transmission range or line of sight can directly communicate with other nodes. Else they can seek the help of other nodes to send packets (pkts). A utilization of MANET reaches from substantial scale portable systems to little, static systems restricted by the power resources. The fundamental objectives of the MANET routing protocols are: to maximize network lifetime, energy proficiency, network throughput and delay minimization.

MANETs have been classified into three classes of routing protocols: proactive, reactive and hybrid routing protocols. A few difficulties confronted by MANET are dynamic topology, requirements on resources, management of transfer of data and packet broadcast overhead, which makes trouble to configuration routing protocols [1–3].

Congestion occurs in the network when a node or link carries a large amount of data that the network service quality gets degraded. Congestion control is a problem of the network, which occurs when the network cannot control anymore large data flow in it. Congestion is a problem for both wired and wireless networks. Because of congestion problem, packet loss, packet delay or lockout can occur in the network. It takes a long time to overcome that situation. There are number of methods or techniques that can be used to control congestion, such as, exponential back off, congestion control in TCP, priority schemes, and queue management.

An IP will traverse a path from the source to the destination on the internet, potentially traveling over a number of networks and connections. As IP is unreliable, these may get discarded, corrupted or delayed, and any form of “bottleneck" occurring will lead to congestion. The factors for these bottlenecks may be due to insufficient capacity of links to handle the network transmitted traffic and the inability of the routers in forwarding traffic at the rate it is arriving. This will result in data transmitted being lost or delayed leading to congestion. The other factors such as radio interference on wireless links may then generate congestion if packets need to be transmitted again.

Congestion control in TCP consists of slow start, fast retransmission and recovery, and congestion avoidance. In a priority scheme, when congestion occurs in network, it marks the packet with different priorities. When congestion occurs, low priority packet can be dropped when it is needed. For congestion control, there is a queue management which is used to control the queue traffic and to control the queue. In the network, it is a necessity that when several nodes transmit their data to a bottleneck link there needs to be a queue mechanism to avoid the congestion or to better utilize the network. The additional issues such as long delay, high overhead, and packet losses occur only when routing protocols are unaware of the congestion.

LITERATURE SURVEY

Simaya *et al.* introduced an improvement for enhancement of the performance of MANET using Improvement of RED (IRED) algorithm. RED uses an Active Queue Management (AQM) to detect the early stage of congestion and convey this to the end hosts. IRED is a priority queue based AQM scheme. In this, the PKTs are dropped on the basis of PKT arrival rate and the queue length which in turn minimize the effect of network congestion. By using IRED, PKT loss rate is minimized [4, 13].

Sheeja *et al.* introduced an effective congestion avoidance scheme (ECAS) for MANET. Due to movement of nodes in MANET, the PKT loss occurs on large scale. ECAS is a mobility based Congestion Control scheme, that acquires Congestion Control and flow control among nodes. In this scheme, the Cong status is available from Cong monitoring. This scheme obtains a better throughput (TP), PKT delivery ratio (PDR) and low delay [5].

Senthilkumaran *et al.* introduced dynamic congestion detection and control routing (DCDR) in ad hoc networks. In DCDR, AQL is measured at the node level. Simulation shows that DCDR is more desirable in terms of reduction delay and routing overhead. PDR is also improved in DCDR and no wireless losses are considered in this study [6].

Anju *et al.* aim of the congestion control is to ensure that for overload condition also, the system runs at its rated capability. In case of heavy data burden, this path of nodes can easily become power exhausted. To achieve this, author considered the fact that mobile nodes are frequently redundantly and/or densely deployed. In this thesis, authors focus on congestion detection and prevent the congestion using Ad hoc on demand routing protocol (AODV) using MATLAB [7].

Dewariya *et al.* proposed the performance of the existing compound TCP for wireless scenario to give satisfactory results in high speed huge network. Upgrade TCP is a TCP for fast speed and huge network. Upgrade TCP executes congestion control with the help of a combination of open congestion window or delay based method, for transmission data or packet or mutual understanding among all senders or receivers, we apply synchronization in TCP handshaking mechanism. In our proposed work, we explain working of upgraded TCP. The simulation depicts that, the results of proposed approach is better than base approach [8].

SOFTWARE DEVELOPMENT

Software Structure and Mechanism in NS-2

NS-2 is a discrete event network simulator. In ns-2, events are obtained from network physical activities, and then they are queued and processed in the order of their scheduled occurrences. This software tool provides with a view of the network design and helps us simulate nearly all parts of the network. The layered structure of ns-2 is shown in Figure 1. A trace file is provided by ns-2 after the simulation is done. All the events that occurred are recorded in detail. The performance evaluation of the network such as routing protocol, MAC layer load, etc. can then be traced. The layered structure of ns is shown in the Figure 2.

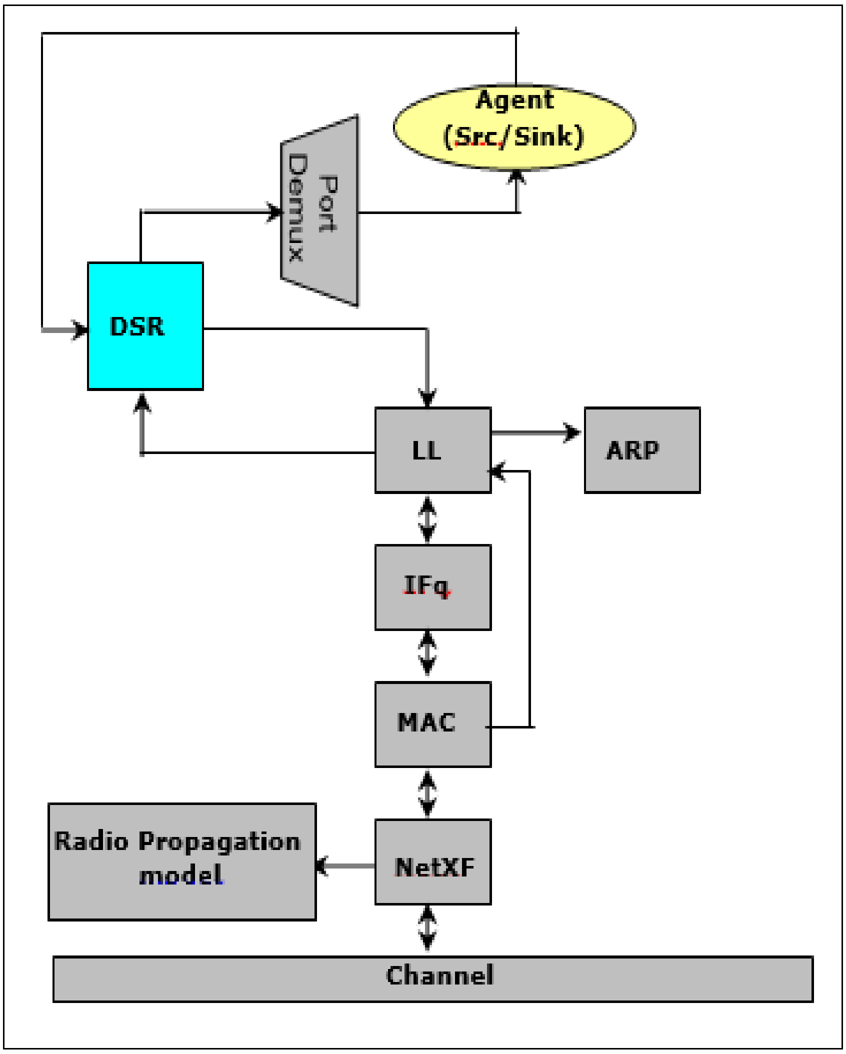

Fig. 1: *ns-2 Simulate Layered Structure of Network.*

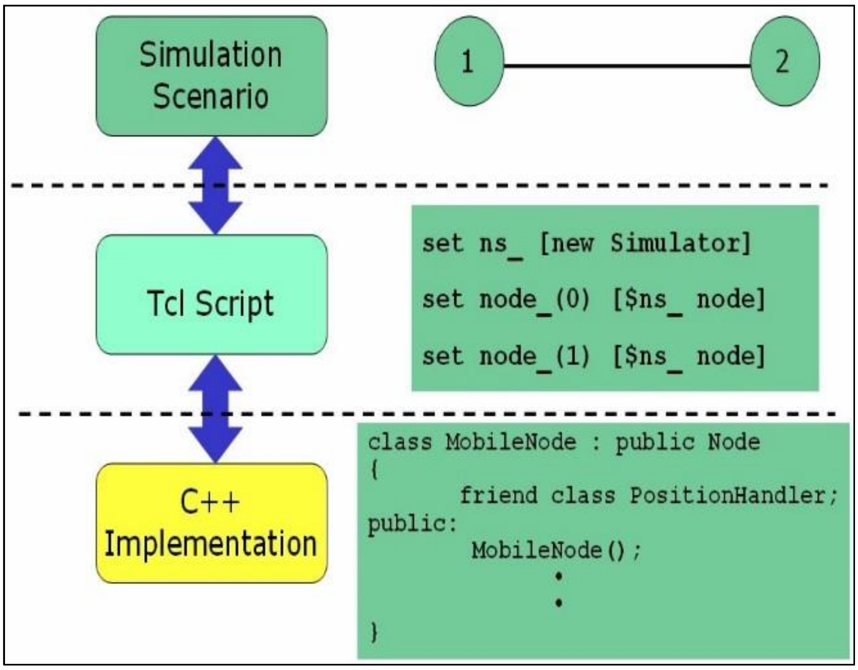

Fig. 2: *Layered Structure from the ns-2 Developer's View.*

Requirements and Steps for Running Simulation in NS-2

To carry out one simulation, we need the following three necessary requirements in the network [9–12]:

- Network topology or appearance,
- Internal of the network, and
- Configuration of each node in the network.

Step 1: Create an instance of the simulator:

"set ns_ [new Simulator]"

Step 2: Setup trace support:

set traceme [open trace xyz.tr w]
$ns_ trace-all $traceme

Step 3: Create a topology object:

"set topo [new Topography]"

Step 4: The topography to be created:

$topo load_flatgrid $val(x) $val(y)

Step 5: To store the global information about the network, the object God is created:

"set god_[create-god $val(nn)]"

Step 6: Configure the nodes by giving the values such as type of link layer, MAC type, queue, length of the queue, antenna type, propagation type, channel type, trace of router, agent and MAC etc.:

$ns_node-config -adhocRouting $val (adhocRouting) \

Step 7: Node creation, node position and movement (speed & direction) directives:

for {set i 0} {$i<$val(nn)} {incr i} {
set node_($i) [$ns_ node]
$node_($i) random-motion 0 # Disable random motion
}

Step 8: Assign nodes positions:

$node_(0) set X_5.0
$node_(0) set Y_2.0
$node_(0) set Z_0.0
$node_(1) set X_390.0
$node_(1) set Y_385.0
$node_(1) set Z_0.0

Similarly the other nodes can be assigned positions.

Step 9: Setup node movement:

$ns_ at 50.0 "$node_(1) setdest 25.0 20.0 15.0"

Step 10: Setup traffic flow between the nodes as follows:

set tcp [new Agent/TCP]
$tcp set class_ 2
set sink [new Agent/TCPSink]
$ns_attach-agent $node_(0) $sink
$ns_ attach-agent $node_(1) $sink
$ns_ connect $tcp $sink
$ns_ at 10.0 "$cbr_0 start"
set f0 [open simple-wireless.out w]
if {$s==1} {
Mac/802_15_4 wpanNam FlowClr –p cbr –s 0 –d 6 –c red;
} elseif {$s==2} {
}

Step 11: Define stop time and finish procedure:

proc finish {} {
global ns_traceme namtrace n1
close $traceme
close $namtrace
exec nam main.nam &
}
$ns_ at 45.1 "finish"

Step 12: Finally, the command to start the simulation:

puts "Video packet---->Red"
puts "Audio packet---->Blue"
puts "Data packet---->Brown"
puts "Enter your priority for Video:"
set s [gets stdin]
puts "Enter your priority for Audio:"
set t [gets stdin]
puts "Enter your priority for Data:"
set u [gets stdin]
puts "Starting Simulation…"
$ns_ run

So, these 12 steps could finish one time simulation. The above mentioned steps can be used to create a wireless network for n number of nodes and the flow of traffic; the packet size, etc. can be specified by the type of protocol used (tcp, udp, cbr). These 12 steps are put into one tcl file and the simulation can be done. However, there exist some problems on such kind of use of typical network performance test situations. Performance testing usually needs to be scalable in the number of nodes and transmitting packets.

RESULTS

A wireless network is created with AODV routing protocol and the following results are obtained using the Network Simulator-2(NS-2.35) (Figures 3–7).

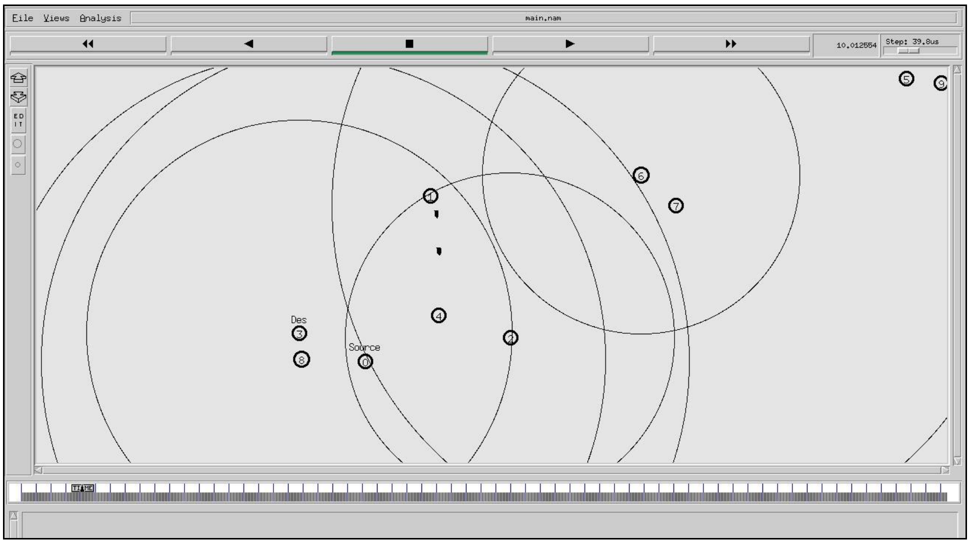

Fig. 3: *Wireless Network Running on AODV Protocol with Source and Destination Indicated.*

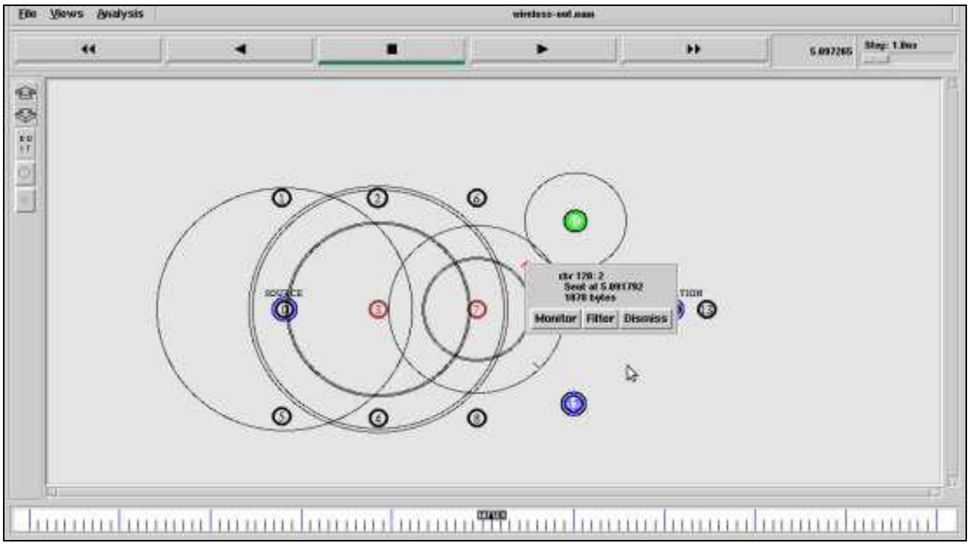

Fig. 4: *Video (Red) and Data (Brown) Transfer Path CBR.*

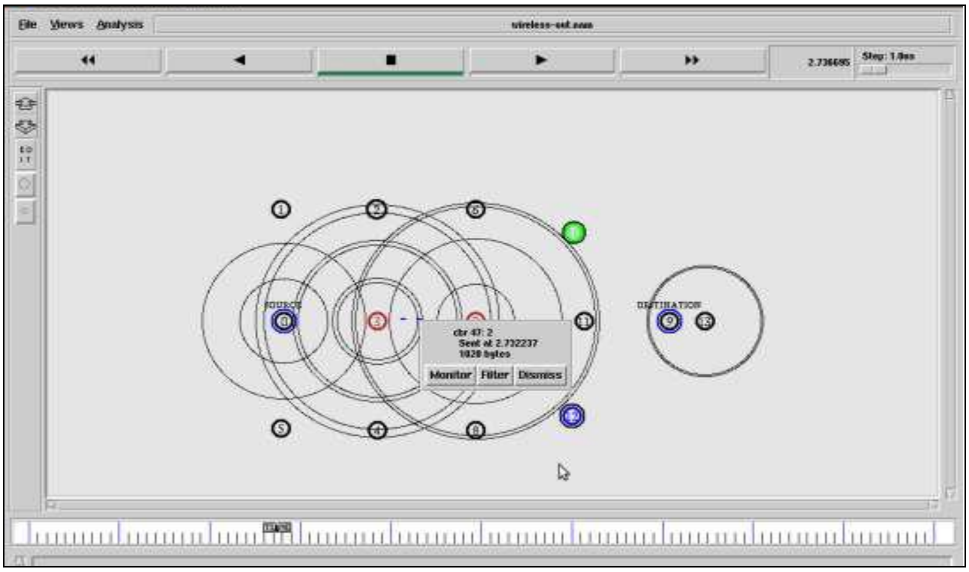

Fig. 5: *Audio (Blue) Transfer Path and CBR.*

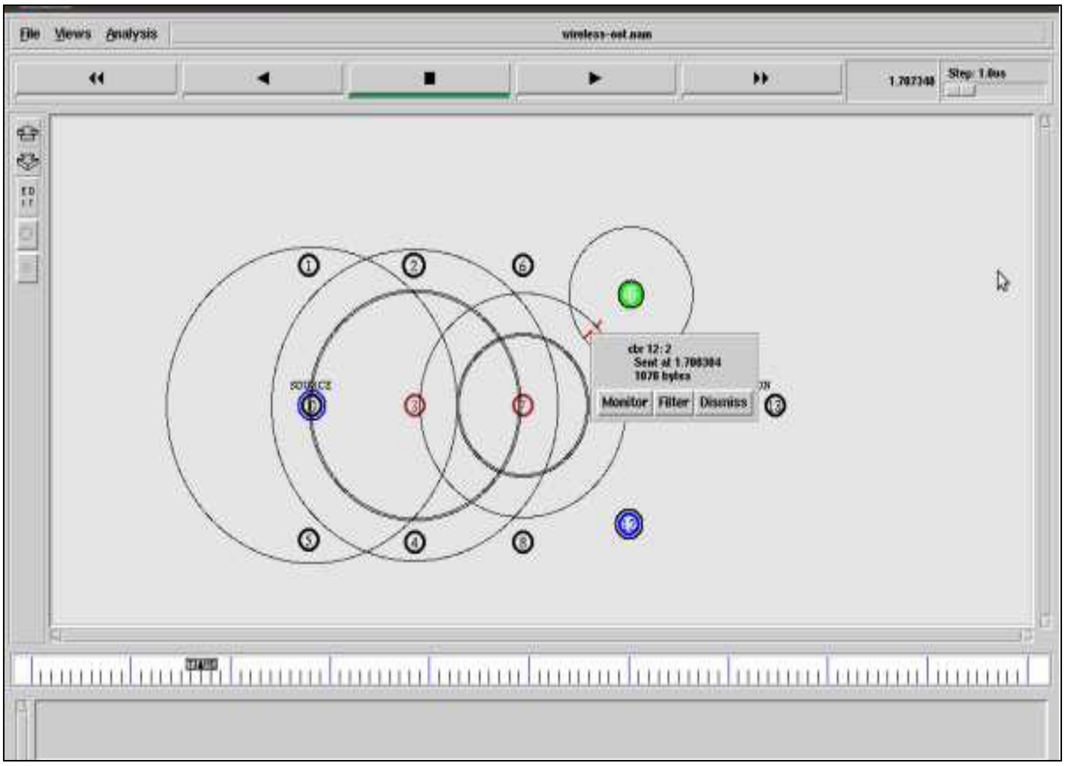

Fig. 6: *Video (Red) Transfer Path and CBR.*

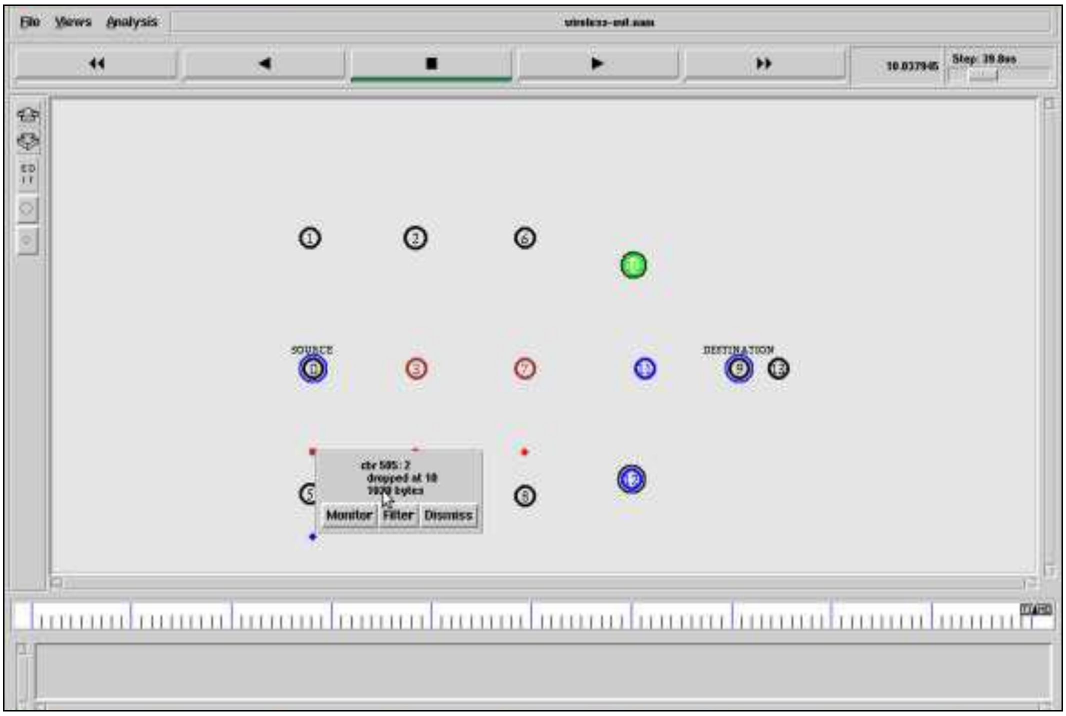

Fig. 7: *Audio Dropped at 10 with CBR.*

The performance of above mentioned network is analyzed by using various parameters like throughput, packet delay, packet loss by means of Xgraph. The following Figure 8 shows the Xgraphs obtained for comparing characteristics of network.

Throughput Analysis

Throughput or network throughput is the rate of successful message delivery over a communication channel. It is measured in bits per second (bit/s or bps), or data packets per second or per timeslot. The throughput

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analysis can be obtained using an Xgraph as shown (Figure 9). The Figure 10 shown is a wireless network obtained by using network simulator with priority based congestion control. Thus, packet loss can be minimized by using AODV routing protocol using priority based congestion control.

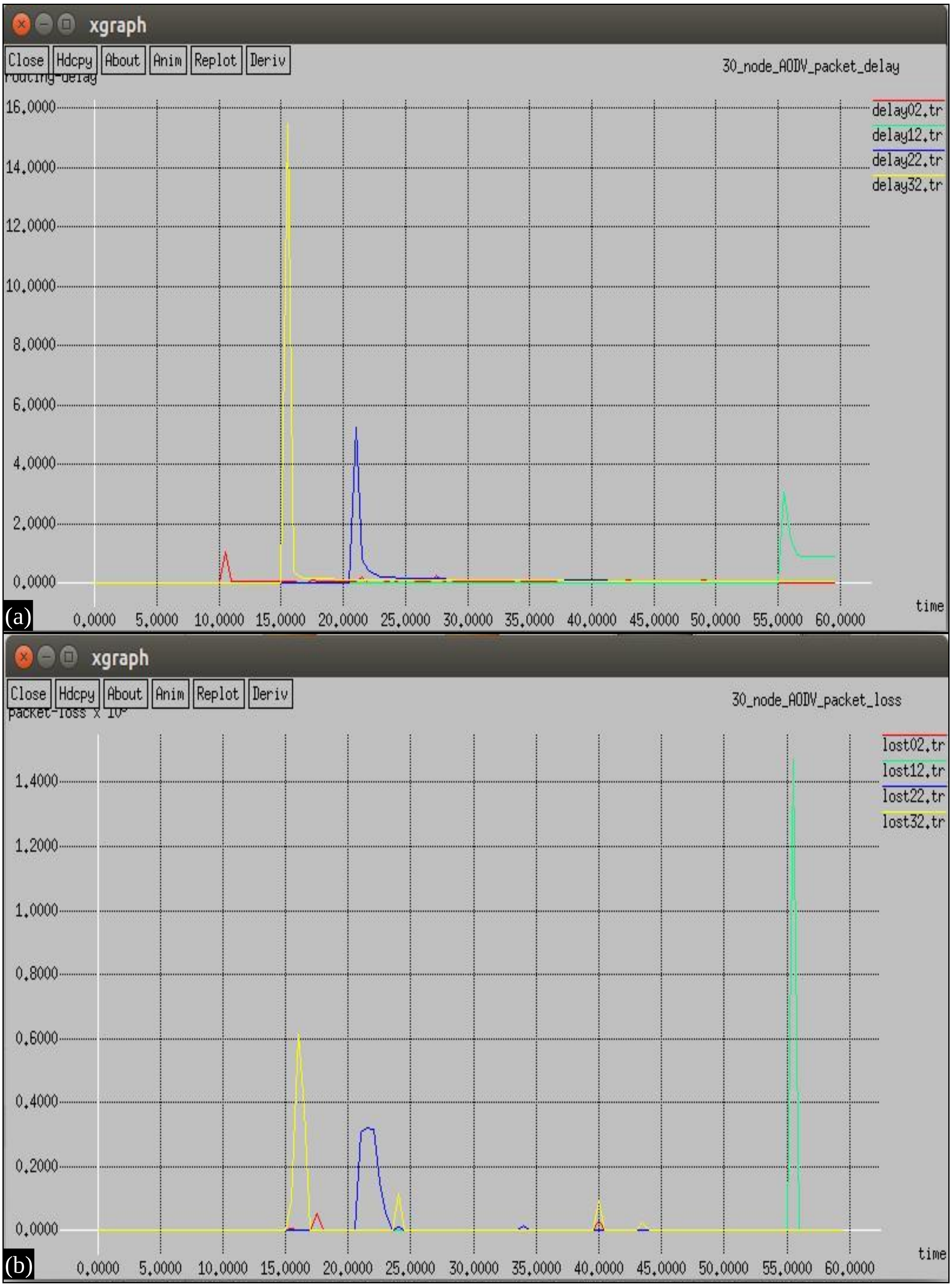

***Fig. 8: (a)** Xgraph Showing Levels of Packet Delay in the Network; and **(b)** Packet Loss in the Network.*

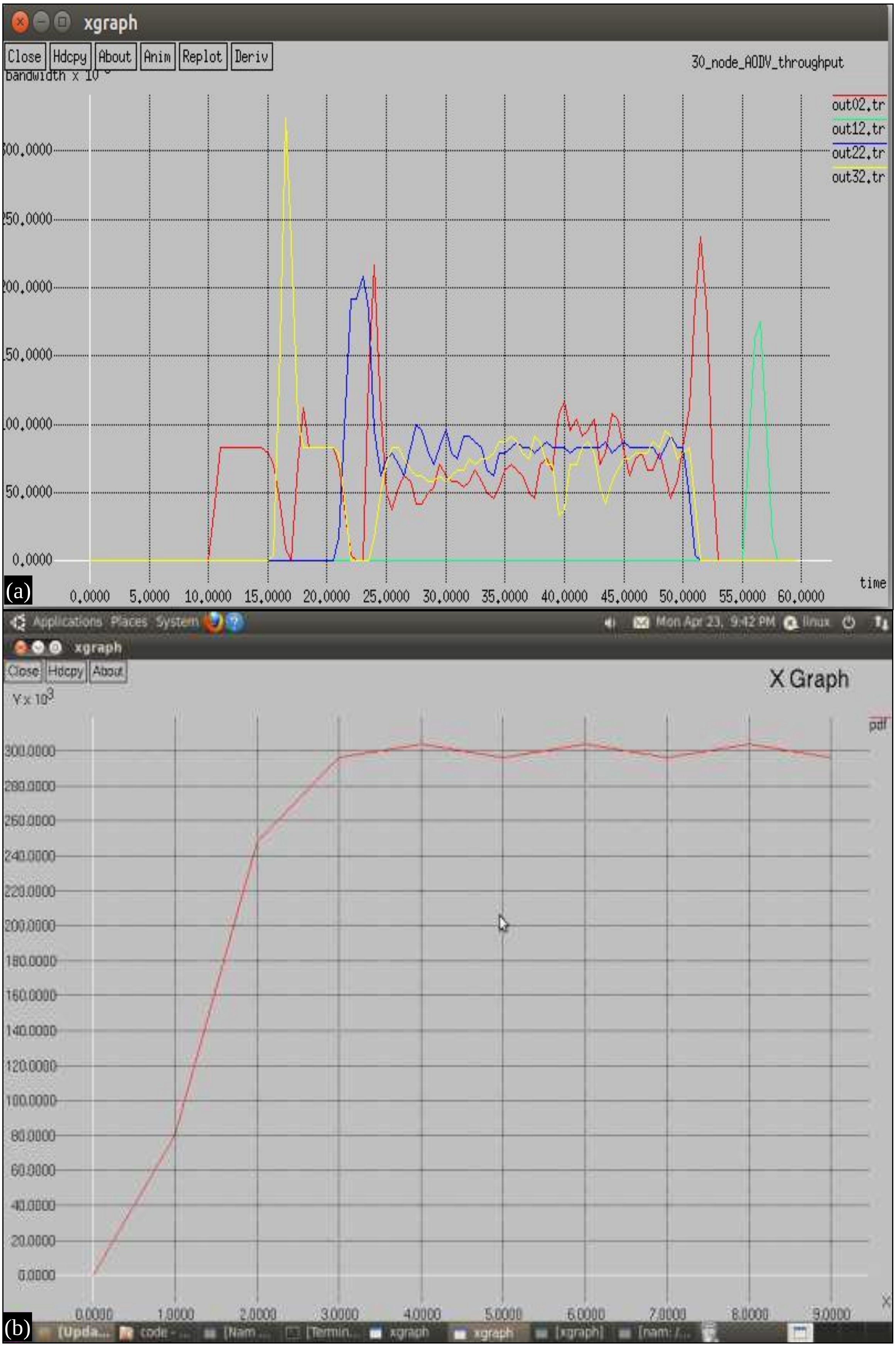

***Fig. 9: (a)** Xgraph Showing Levels of Throughput in the Network; and **(b)** Packet Delivery Over the Network.*

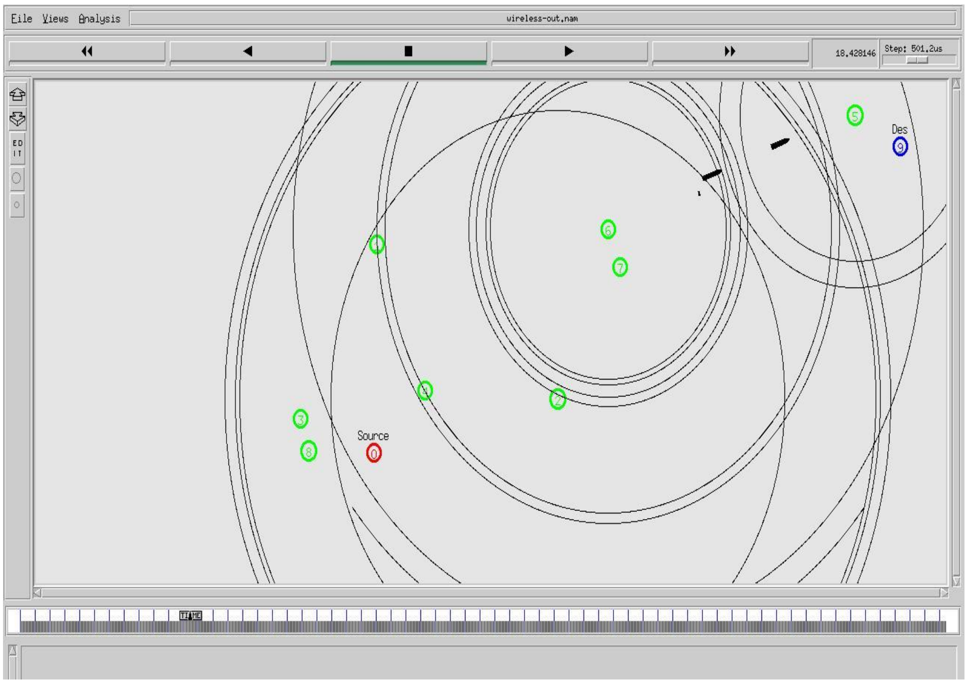

Fig. 10: *Wireless Network with Priority Based Congestion Control.*

CONCLUSION

In this paper, we have proposed a priority based congestion control scheme to address congestion problem in a wireless network. Different priorities are assigned to audio, video and data packets. We provided fair opportunity to nodes to transmit information by means of mobile nodes. In this scheme, nodes only need to collect local information about the queue in the network layer and link quality in MAC layer, which is scalable and practical for large wireless networks. We also discussed the influence of some of the parameters on wireless networks, such as packet delay, packet loss and throughput. Its various components and their interaction were explained. Simulation results, carried out in NS2, were shown and the results show a decrease in loss and at least a 7.9% increase in throughput was obtained using the proposed scheme. The congestion control is achieved based wholly on priority. Following this simulation design, we can control congestion and fully utilize the network. A reduction in throughput fluctuation was also achieved along with a degree of prioritized traffic differentiation. The popular and well defined protocols like AOMDV, AODV, DSR, and DSDV can be applied for the real time multimedia applications to conclude the better protocol in all constrained situations.

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