

Evaluation of load balancing algorithms on overlapping wireless accesspoints

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ABSTRACT

Wireless networks came into the computing world replacing the costlier and more complex wired method of connecting numerous equipment in the same or different location via the use of cables. It provides the user devices a connection to one another and the greater internet via connections to access points. Generally, 802.11 access point products follow a default strongest signal first approach in selecting user devices or nodes to connect to the access point or overlapping access points. This standard does not make provisions for even distribution of load and hence the quality of service and the throughput in areas of congestion would be reduced. This article brings forward two algorithms used in load balancing and they include round-robin technique and the weighted round-robin technique to be used in the simulation of the distribution of the load amongst the access points with the results collated and compared to clearly show which algorithm is best suited to be used as a standard for access point load distribution.

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1. INTRODUCTION

Wireless networking is a method by which households, telecommunications networks and enterprise (business) facilities prevent the expensive process of installing cables in a building or connecting separate infrastructure sites [1-10]. Wireless mobile devices are becoming more and more ubiquitous and popular. Analysing [11-15] wireless networks formed over these devices are becoming an important field of research. The wireless network provides user connection to one another and the greater internet via connection to the access point within the coverage area. The users have the advantage of greater mobility within the area of the network coverage. When a device tries to connect to the network the following takes place as shown in Figure 1.

Hence the device would be connected to the network via the access point. A WLAN makes provision for several Access Points makes available service to clients in an individual topographical region [16, 17]. Clients pick entry outlets centered on the wave power indicator (RSSI) provided the best. Therefore, while multiple APs can offer service to a congested area if clients are grouped, they appear to be linked to a similar AP. The less bandwidth they receive, the extra clients that are coupled to a distinct AP [18, 19]. For example, in the simple scenario shown below, all users are linked to AP B because each user has the highest

signal strength. The users above are clustered in the coverage region of entry outlet B and are therefore connected to access point B with the strongest signal as display in Figure 2. Several factors bring about the congregation of users in a specific on a network these may include the availability of electric sockets for charging their devices, the availability of chairs for the users to sit and also the proximity of the access points to sources of entertainment or refreshment such as eateries [20-25]. Studying human mobility has become a subject of interest among the large community of researchers in the last decade, primarily because of its effect on so many different theoretical and application research [26-30].

This paper is therefore aimed at stimulating the effect of two scheduling algorithms in balancing the load on the network access point. We would be using the weighted round-robin technique in balancing the load on the network.

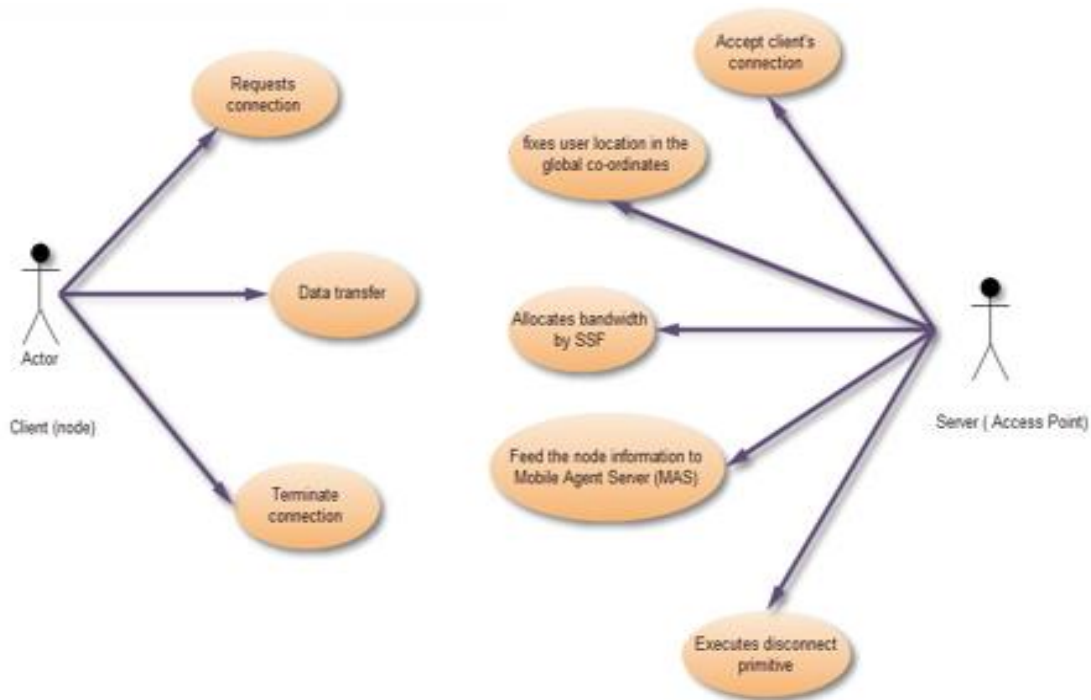


Figure 1. The connection process of a client to an access point

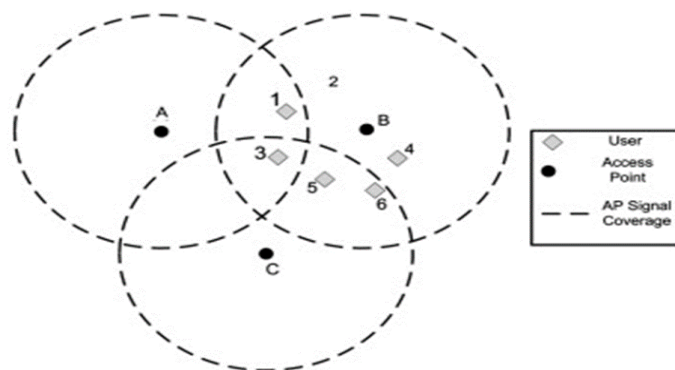


Figure 2. Users clustering in the coverage area of an access point

Weighted Round Robin Queuing Algorithm (WRR) queuing first classifies packets (e.g. instantaneous, collaborative, and file transmission) and then assigns them to a queue committed to serving each class. In the round-robin order, the queue is serviced. Contrary to strict PQ and FQ, there are no empty queues as shown in Figure 3.

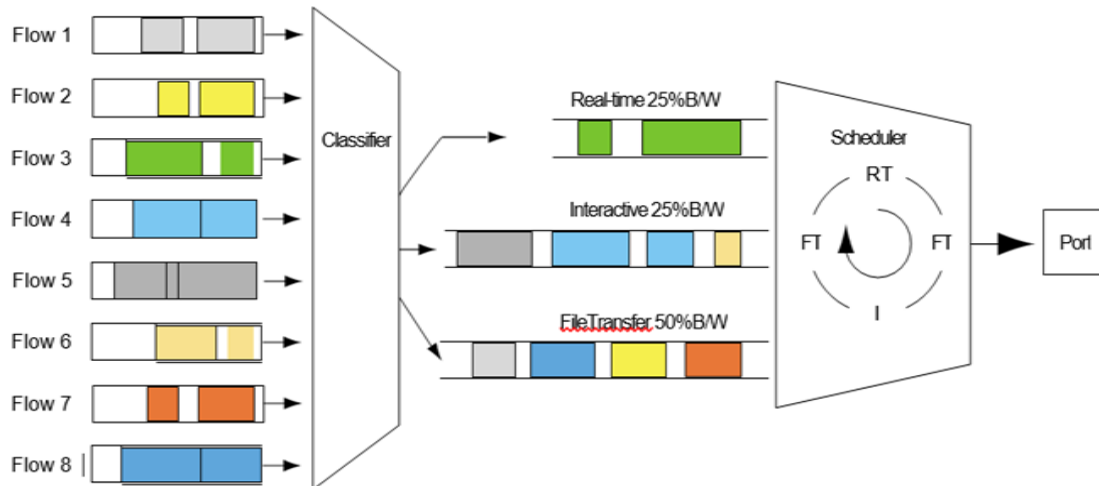


Figure 3. Diagram showing WRR scheduling

WRR queuing enables the allocation of various bandwidth volumes to different service groups either:

- a) Permitting greater-bandwidth queues to dispatch extra packet every time they visit during a service round, or
- b) Permitting every queue to dispatch just one packet every time they visit, thereby visiting numerous greater-bandwidth queues in a distinct service round.

25% of the output port bandwidth is apportioned to the real-time traffic queue, and 25% of the interactive traffic queue is allocated to control the number of network resources apportioned to every service class:

- a) The amount of delay faced by packets in a given queue is determined by a combination of the rate at which packets are placed in the output port bandwidth and the file transfer traffic queue assigned to 50% of the output port bandwidth. WRR queuing meets this weighted bandwidth allocation twice during access to the file transfer queue for each service.
- b) The queue, the queue size, the quantity of traffic withdrawn from the queue in each service round and the number of other service groups (queues) in the output port.
- c) The quantity of jitter experienced by the queue packets depends on the variability of the queue delay, the variability of the delay in all other queues and the variability of the round service duration.

A combination of the rate at which the packets are put in the queue, the size of the queue, the aggressiveness of the RED profiles designed for the queue, and the amount of traffic withdrawn from the queue at each service point determines the amount of packet loss experienced by each queue. You can handle the fill rate by conditioning the traffic at some stage in the upstream network.

2. RESEARCH METHOD

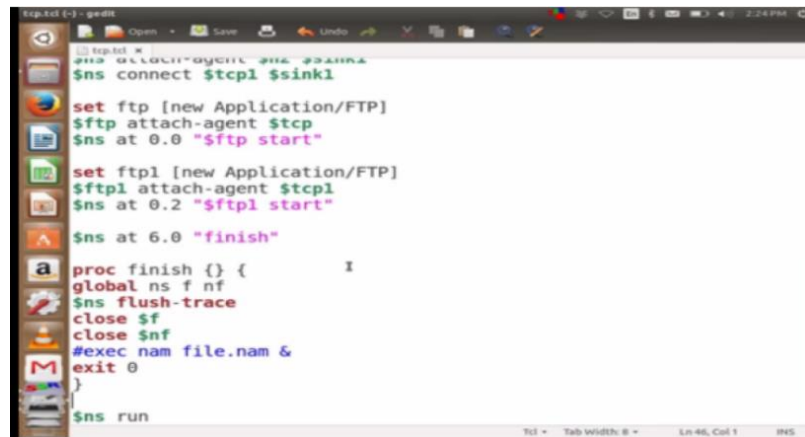
This section entails the methodology used for this paper and a brief description of the network simulator 2 and its components on a Linux operating system platform. The main purpose of this simulator is to simulate local area networks and wide area networks. The network simulator (version 2) is a script interpreter written in OTcl and C++ that contains a simulation event scheduler and a simulation library as some of its major components. The user writes an OTcl script to build and run an event scheduler simulation network, build up the network topology by using the network objects as well as the plumbing functions of the library, instructing traffic sources on when to start and when to finish transmitting packets via the event scheduler. The term "plumbing" is used to set up a network, since setting up a network would plumb possible data paths between network objects by setting an object's "neighbor" point to an appropriate object's address.

Another component of the network simulator is the event scheduler and this is shown in Figure 4. In the event queue scheduled for the current time, the event scheduler keeps the simulation time record filing all events. An event is a packet ID that is unique to a packet with a scheduled time and also an entity that manages the event. The load balancer: The load balancer is a major component which is at the core of the network simulator and it is responsible for the distribution of incoming traffic request and this is done by balancing application request across multiple servers. It improves the overall application responsiveness and availability.

3. RESULTS AND DISCUSSION

3.1. Simulation scenarios

During the simulation, two traffic scenarios were considered. This made it possible to study the behavior of the schedulers under the same and different packet size distributions. The implemented scheduling algorithms simulated are strict weighted round-robin as in Figure 4. Figure 5 and 6 shows the Nam (Network Animator) and the Network Topology to be carried out.



```

top-ed (c) - gedit
top.ed
#ns connect $tcp1 $sink1
$ns connect $tcp1 $sink1

set ftp [new Application/FTP]
$ftp attach-agent $tcp
$ns at 0.0 "$ftp start"

set ftp1 [new Application/FTP]
$ftp1 attach-agent $tcp1
$ns at 0.2 "$ftp1 start"

$ns at 6.0 "finish"

proc finish {} {
    global ns f nf
    $ns flush-trace
    close $f
    close $nf
    #exec nam file.nam &
    exit 0
}

$ns run
  
```

Figure 4. Otcl script to be ran by the network simulator 2

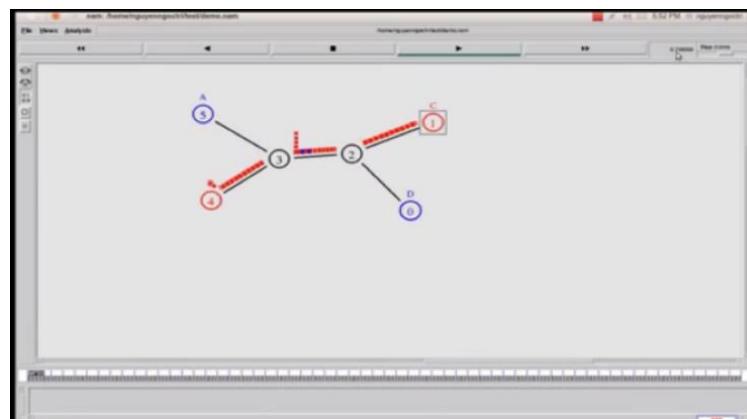


Figure 5. Nam (network animator)

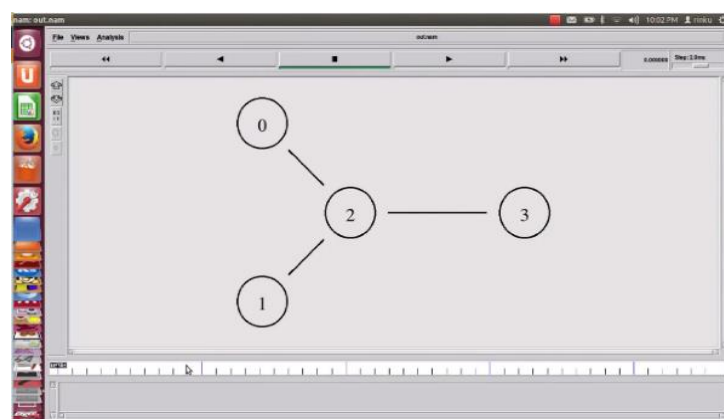


Figure 6. Network topology

In the course of the programming and simulation, movement of packets in and out of core router 2 (c2 to e3) was traced and the scheduling processes after every 30seconds were recorded. Shows sample packet statistics from ns 2. Relevant fields are field 1 which indicates packet status (+ for enqueue, - for dequeue and r for receive), field 2 which shows time, field 5 that indicates the type of traffic (TCP, paroo, expoo or CBR) and field 12 for packet's unique identification. A packet may be enqueued, dequeued at a router or received at the destination as shown in Figure 7. Table 1 and 2 showing the total number of packets transferred after been ran for some time. Table 3 and 4 shows the total number of packets transferred after been ran for some time as well. The total number of loss rate from each of the three tables is as shown in the Table 5 to 9.

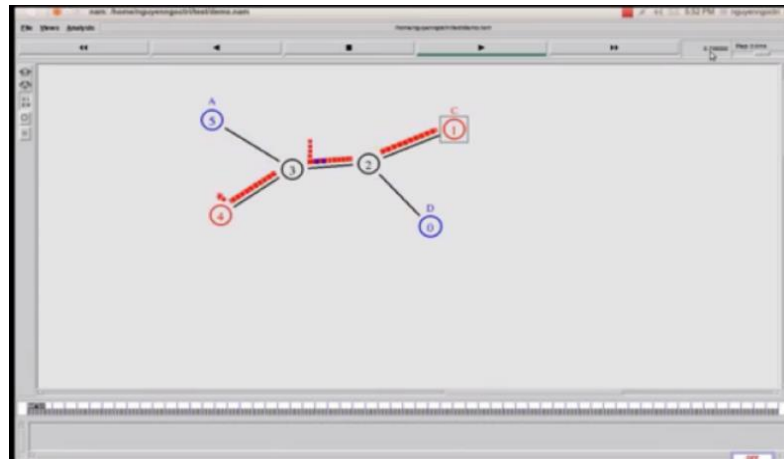


Figure 7. Network animator (nam) showing packets move to and from

Table 1. Total number of packets transferred

DSCP	TOTPKTS	TXTPKTS	LDROP	EDROP
ALL	79989	53782	20475	5732
10	8758	8710	48	0
11	26236	8804	15754	1678
20	11258	11258	0	0
21	33737	25010	4673	4054

Table 2. Total number of packets transferred

DSCP	TOTPKTS	TXTPKTS	LDROP	EDROP
ALL	124989	81906	33633	9450
10	14383	14335	48	0
11	43111	14431	25924	2756
20	16883	16883	0	0
21	50612	36257	7661	6694

Table 3. Total number of packets transferred

DSCP	TOTPKTS	TXTPKTS	LDROP	EDROP
ALL	124989	81906	33633	9450
10	14383	14335	48	0
11	43111	14431	25924	2756
20	16883	16883	0	0
21	50612	36257	7661	6694

Table 4. Total number of packets transferred

DSCP	TOTPKTS	TXTPKTS	LDROP	EDROP
ALL	169989	110030	46806	13153
10	20008	19960	48	0
11	59986	20055	36048	3883
20	22508	22508	0	0
21	67487	47507	10710	9270

Table 5. Table showing the total numbers of loss rate of the simulation

DSCP	TOTPKTS	TXTPKTS	LDROP	EDROP
ALL	34989	25655	7405	1929
10	3133	3133	0	0
11	9361	6428	1624	1309
20	3633	5482	151	0
21	16862	10612	5637	620

Table 6. Total numbers of loss rate of the simulation

DSCP	TOTPKTS	TXTPKTS	LDROP	EDROP
ALL	45000	28123	13151	3726
10	5625	5625	0	0
11	16875	5623	10178	1074
20	5625	5625	0	0
21	16875	11250	2973	2652

Table 7. Total numbers of loss rate of the simulation

DSCP	TOTPKTS	TXTPKTS	LDROP	EDROP
ALL	45000	28124	13158	3718
10	5625	5625	0	0
11	16875	5627	10170	1078
20	5625	5625	0	0
21	16875	11247	2988	2640

Table 8. Total numbers of loss rate of the simulation

DSCP	TOTPKTS	TXTPKTS	LDROP	EDROP
ALL	45000	28124	13173	3703
10	5625	5625	0	0
11	16875	5624	10124	1127
20	5625	5625	0	0
21	16875	11250	3049	2576

Table 9. Total numbers of loss rate of the simulation

	FIRST	SECOND	THIRD	FOURTH
ALL	25655	28123	28124	28124
Q10	3133	5625	5625	5625
Q11	6428	5623	5627	5624
Q20	5482	5625	5625	5625
Q21	10612	11250	11247	11250

The Table 10 shows the total number of throughput with a graphical view of it in Figure 8. Table 10 shows the fairness of the developed system. The summary of the results gotten from the simulation process were also given below so as so make the process easier to understand so the summary of this whole process is given in Table 11.

Table 10. Fairness

FAIRNESS	X	X ²
SOURCE1	40015	1601200225
SOURCE2	70015	4902100225
ADDITION SQUAREADD	110030	12106600900
		6503300450
FAIRNES	0.930804366	93.08043657

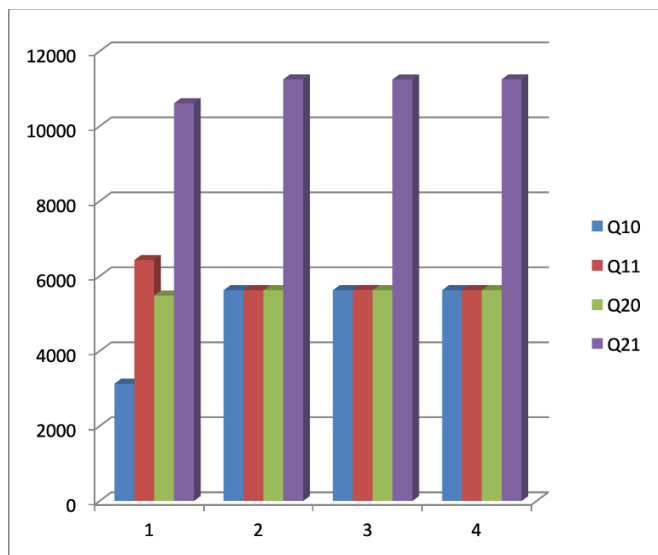


Figure 8. Total number of throughputs

Table 11. Summary of simulation process

SUMMARY OF THE SIMULATION PROCESS	
LOSS RsTE	35.27228232
FAIRNESS	93.08043657
DELAY	0.069675291
EFFICIENCY	64.72771768

4. CONCLUSION

The article brought forward two algorithms used in load balancing and they are round-robin technique and the weighted round-robin technique. The two techniques were used in the simulation of the distribution of the load amongst the access points and the results got were collated and compared to clearly show which algorithm is best suited to be used as a standard for access point load distribution.

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