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# SIMULATION AND PERFORMANCE ANALYSIS OF REAL AND NON-REAL TIME TRAFFICS IN IEEE 802.11 WLAN WITH NS2

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**ABSTARCT**
**The IEEE 802.11 WLAN (Wireless LAN) is mainly used for web browsing, but real time applications have also acquired much attention to such networks. The primary aspect of such network is to utilize the radio resources efficiently and optimize network throughput among mobile users. In infrastructured WLAN the association policy between STA and AP plays an important role in the utilization of radio resources. More over the IEEE 802.11 MAC protocol also determines the affects on the QoS. DCF and PCF does not support QoS for real time applications for which IEEE 802.11e MAC protocol has been designed. Here in this paper we study the impact of DCF on the performance of real and non real time traffic in WLAN. We also evaluate the load imbalance issues in such WLAN. The network simulator NSv2.34 has been considered. Simulation has been carried out with various scenarios for voice video and data traffics. For evaluating the performance throughput, packet loss ratio and delay have been considered as control metric. For generation of graphs we have used the xgraph utility of NSv2.34.**

***Keywords:*** *DCF; PCF;VOIP.*

## 1. INTRODUCTION

In this era of digitization, computer network has influenced almost in every aspects of the human society. The increasing popularity of wireless network is because of only the mobility factors and providing networks to those areas where other form of network is not possible. IEEE802.11 [2] WLAN [2] is primarily used for Inter-net access, but real-time[4] applications like VoIP and Video conferencing have become one of the most important and demanding application in such WLAN which needs special attention to few attributes like delay sensitive or bandwidth requirement. The IEEE 802.11 standards specify two operating modes: infrastructure mode and ad hoc mode. Infrastructure mode is used to connect computers with wireless network adapters, to an existing wired network with the help from wireless router or Access Point. The access points compose the backbone for infrastructure network. Ad hoc mode is used to connect wireless clients directly together, without the need for a wireless router or Access Point. In an IEEE 802.11 WLAN, a station (STA) can be within the range of several access points (APs) [2], and may get associated with each one of these at a certain maximum physical bit rate, de-pending on various radio channel conditions. If we do not have dynamic and optimal association policy for association then STAs may associate with one of the APs. As a result, throughput in an AP will drop due to congestion even though radio resource in another AP might be available. More over the Mac protocol has an important affect on the QoS [4] of the various types of traffics. The DCF mode does not guarantees QoS for all kinds of traffics (e.g. Voice, Video, Best effort). In this paper, we present an experimental analysis of load imbalance and performance of DCF in an IEEE 802.11 WLAN. This paper is organized as follows: in section 2, we describe about the related work and MAC protocols of IEEE 802.11 WLAN. In section 3, we outline the experiment features. In section 4, I have explained simulation and result discussions and section 5 includes the conclusion.

## 2. RELATED WORK

In this section am going to discuss the IEEE 802.11 basic MAC protocol and their affect on the performance of QoS in a WLAN.

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The IEEE 802.11 basic Mac protocol operates in two modes: (i) the Distributed Coordination Function (DCF), also known as the basic access method, is a carrier sense multiple access protocol with collision avoidance (CSMA/CA); (ii) the Point Coordination Function (PCF) [2] is a polling-based access method and uses a point coordinator to arbitrate access among stations.

When DCF is employed, 802.11 uses a protocol called CSMA/CA [2] (CSMA with Collision Avoidance). Here both physical carrier sensing and virtual carrier sensing are used. In DCF, all the data traffics are having same priority and thus equal opportunities for all kinds of traffics. In DCF [2] mode, there is no central control, and stations compete for the carrier, just as they do in wired network. Another allowed mode is PCF, where the base station polls the other stations, asking them if they have any data to send. Since transmission order is completely controlled by the base station in PCF mode, no collisions ever occur. The basic mechanism is for the base station to broadcast a beacon frame periodically (10 to 100 times per second). The beacon frame contains system parameters, like hopping sequences and dwell times (for FHSS) [2], clock synchronization, etc. It also asks new nodes to get in polling service. Once a station has signed up for polling service at a certain rate, it is effectively guaranteed a certain fraction of the bandwidth, thus making it possible to give quality-of-service assurance. But PCF has been also failed to provide guaranteed QoS support for real time applications. When the number of stations in a BSS increases, the probability of collisions increases, leading to frequent retransmission and a decrease in the overall throughput and QoS in the WLAN.

## 3. EXPERIMENT OUTLINE

The aim of this paper is to analyse the load imbalance and the performance of IEEE 802.11 Mac protocols. We have used the NSv2.34 for the simulations. I consider awk scripting language and xgraph [3,5] for post simulation analysis. To create wireless topology in NS we need to configure various properties like Propagation model, Antenna, Interface queue length and routing type. Following shows a snippet from the code written for our simulation corresponding to wireless properties [3].

```
set val(chan)        Channel/WirelessChannel
set val(prop)       Propagation/TwoRayGround
set val(netif)        Phy/WirelessPhy
set val(mac)              Mac/802_11
set val(ifq)         Queue/DropTail/PriQueue
set val(ll)               LL
set val(ant)          Antenna/OmniAntenna
set val(ifqlen)           50
set val(nn)               8
set val(rp)              AODV
set val(x)               500
set val(y)               500
```

By default, NS has the data rate for the MAC set at 2 Mbps. But we can change it by the following to the beginning of our simulation script:

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```
Mac/802_11 setdataRate_11Mb/5.5/2/1
```

Since all real life cards 802.11b cards have the RTS/CTS disabled by default. This is because most home and organizational WLAN networks are simple in nature, therefore RTS/CTS [5] just unnecessary overhead. NS by default has this feature turned on, but we can disable this feature by adding this line to the beginning of our script:

```
Mac/802_11 set RTSThreshold_ 3000
```

This means that an RTS will only be sent for packets that are bigger than 3000 bytes.

We can set the Packet size by adding the following

```
Agent/UDP set packetSize_ 100
```

For mixed simulations I have used hierarchical routing [5] in order to route packets between wired and wireless domains. In order to route packets between wireless and wired domain we use a base station node which acts as a gateway between the two domains. I segregate wired and wireless node by placing them in different domains and sub-domains (also known as cluster) as shown in Fig. 1.

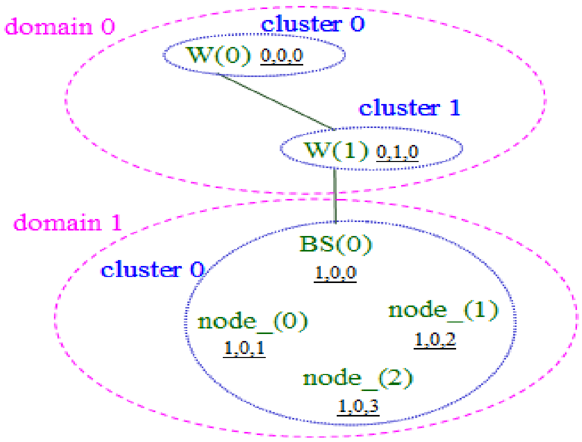


Fig 1: Model for mixed simulation

## 4. SIMULATION AND DISCUSSION

I implement wired and wireless simulation in NSv2.34 [5]. It is assumed that both the APs and STAs operate in IEEE 802.11, basic rate is 1Mbps. The data rate is calculated from the distance between APs and STAs. The STAs near from AP communicates in higher data rate. We place two APs in the simulation and operate in channels so that they do not interfere with each other. In the simulation, association between STA and AP is done on basis of Signal strength. For all simulation cases the resulting graphs are generated using xgraph [3,5] utility of NS 2

Following types of traffics are considered.

```
For voice traffic
Data rate - 83.2 kbps
```

```
Payload size – 1028
Packet interval – 20 ms
```

**For video traffic**

```
Data rate - 770 kbps
Payload size – 1280
Packet interval – 13.33 ms
```

**For data traffic**

```
Data rate - 800 kbps
Payload size – 1024
Packet interval – 10 ms
```

### 4.1. *Simulation Case1*

In Case1 simulation 4 data traffics are considered communicating with AP1in different time slots from 1 to 90 seconds whereas total simulation time is set to 100 seconds. We have shown the result graphs for packet lost, throughput and delay in Fig.2, Fig.3 and Fig 4 respectively

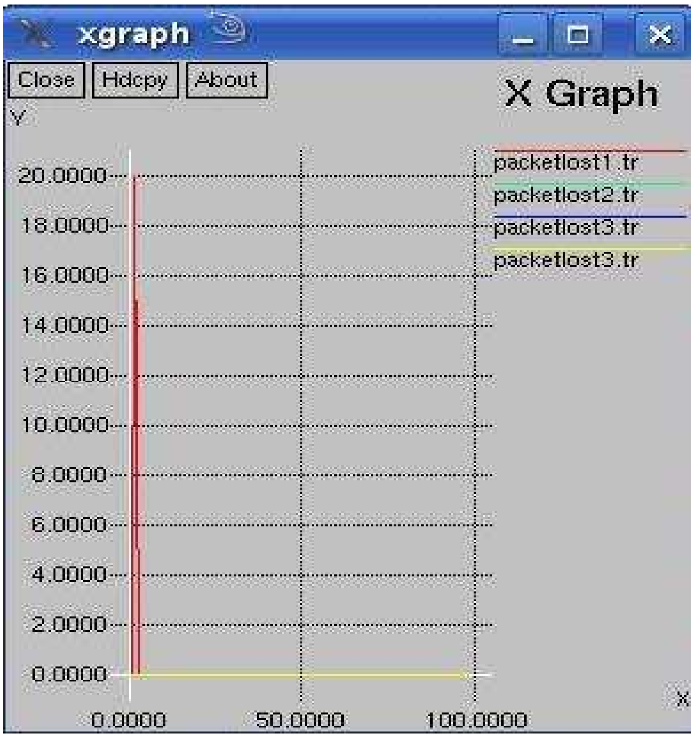


Fig.2 : Packet Loss for case1 simulation

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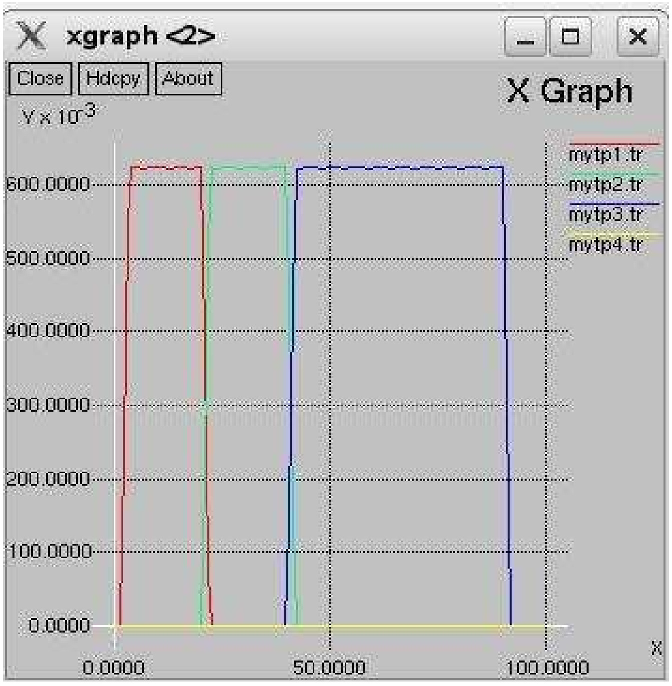


Fig. 3: Throughput for case1 simulation

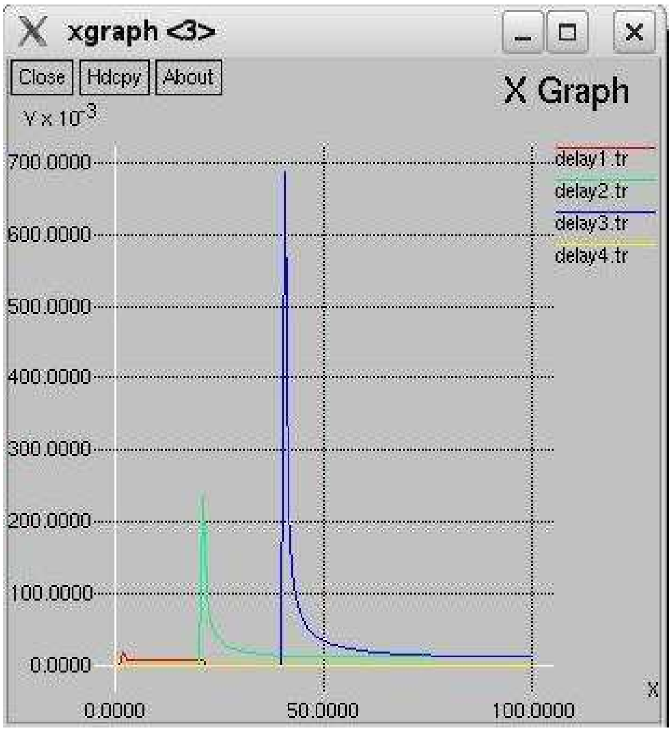


Fig. 4: Delay for case1 simulation

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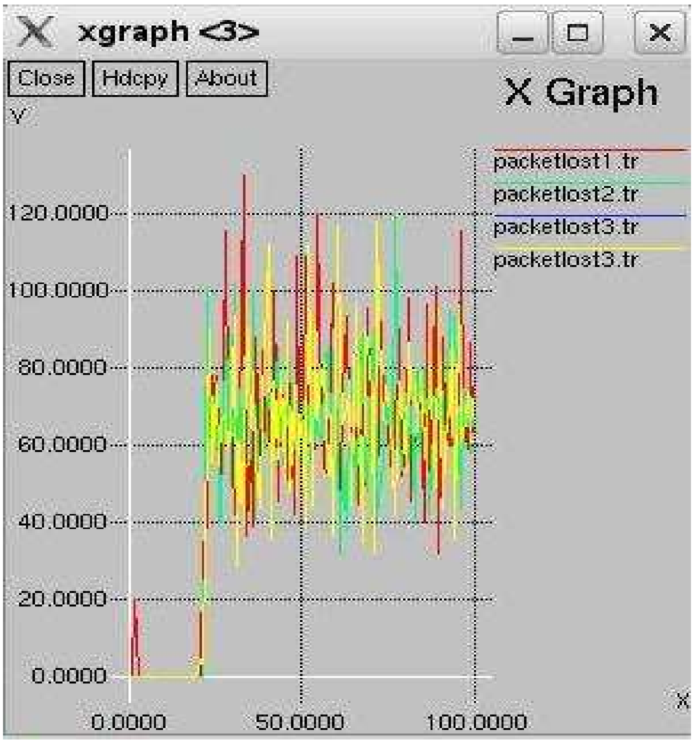


Fig.5: Packet loss for case2 simulation

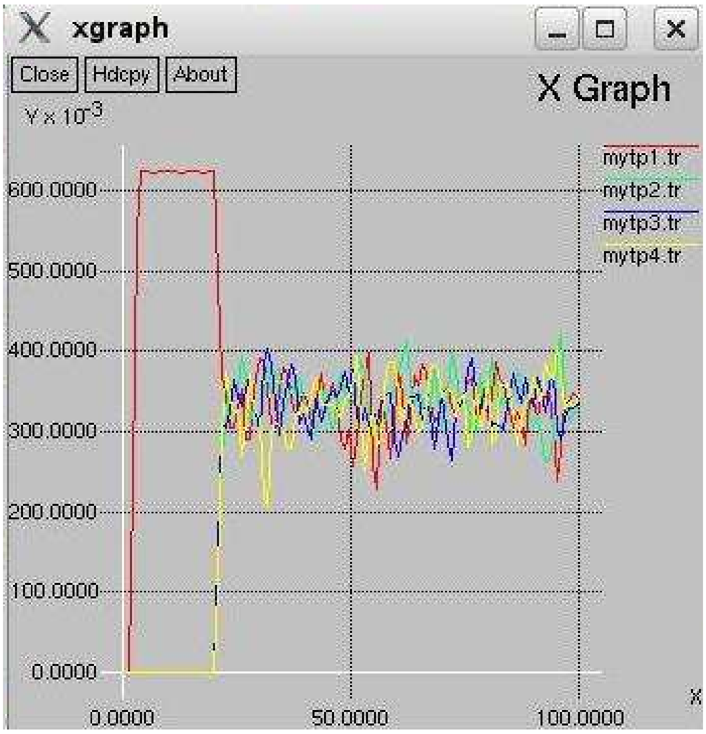


Fig. 6: Throughput for case2 simulation

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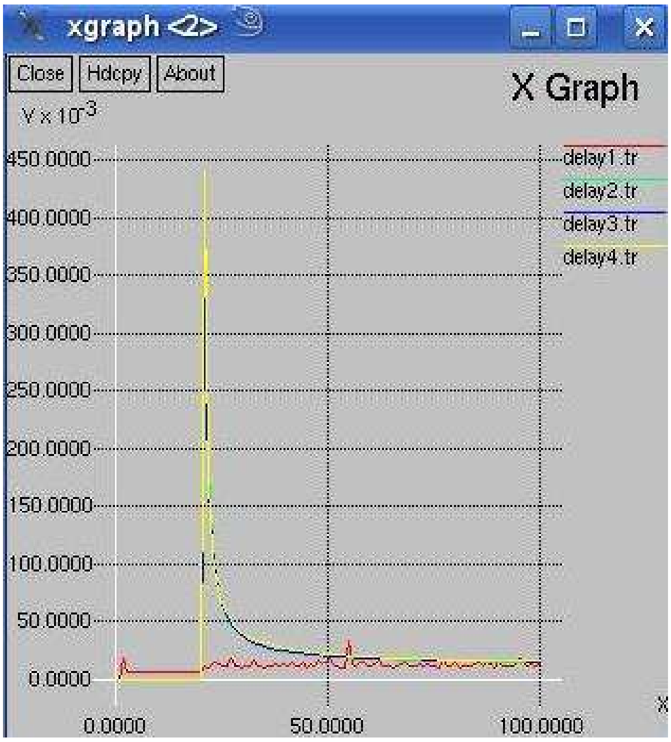


Fig..7. Delay for case2 simulation

***4.2 Simulation Case 2***

In case2 simulation I have attached four real time traffic to AP2 (two voice and two video traffic). The four different traffics were added in different time slots from 1 to 90 secs. The total simulation time is same with the case1 simulation. We have shown the result graphs for packet lost, throughput and delay in Fig.5, Fig.6 and Fig.7 respectively.

## 5. CONCLUSION

In case1 simulations all traffics are belonging to best effort class. From the result graphs shown in Fig.2, Fig.3 and Fig.4 we can see that all most all traffics are having good throughput and negligible amount of packet loss and delay because non-real time traffic has not strict requirements o attributes like delay and bandwidth. But from case2 simulations the all traffics are belonging to real time category which is very much delay and bandwidth sensitive. From the result graphs shown in Fig.4, Fig.5 and Fig.7 we can see significant amount of packet loss and lower throughput performance in AP2. In the result graphs the oscillations reflects heavy loss in the performance of AP2. It is also noticed that DCF does not guarantee QoS for real time traffics in a WLAN but provides adequate performance for best effort traffics. In the above simulations the association of STA-AP was done in the basis of signal strength. STAs communicating from short distances operate in high data rates hence good throughput and QoS. Some service level negotiation must be happened between STA and AP for QoS assurance for the mobile STAs. Moreover by considering only service level negotiation QoS optimization is not possible in a WLAN. Along with service level negotiation some dynamic association policy is also required for efficient utilization of radio resources and enhanced QoS in a WLAN.

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