ENSC 427: COMMUNICATION NETWORKS Spring 2011 Final Project Presentation

Video Streaming over the 802.11g and the 802.11n WLAN Technologies

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oIntroduction

Objective Background Information Issues and Situation on Video Streaming over WLAN

INTRODUCTION

• Objective :

To simulate wireless local area network (WLAN) based on 802.11g and 802.11n to analyze their limited bandwidth usage for video streaming and overload in data traffic.

o Background Information

802.11g is a third modulation standard of carrying out WLAN computer communication in the 2.4 GHz frequency bands, which operates at a maximum physical layer bit rate of 54 Mbit/s.

802.11n is a recent amendment which improves the 802.11g standard by adding multiple-input multiple-output antennas (MIMO), which can operate on both the 2.4GHz and the 5 GHz bands at a physical layer bit rate over 108 Mbit/s.

INTRODUCTION

Situation and Issues on Video Streaming over WLAN

Most family plus small offices use 802.11g and 802.11n WLAN.

However, 802.11g and 802.11n are not quite suitable for doing **uncompressed** video streaming.

Compressed video format such as H264 AVC supporting Highdefinition video (HD), which achieves 720p and 1080p quality becomes popular.

Thus, I only consider the **compressed** video format for HD YouTube HD video streaming is below 6 Mbit/s.

Implementation Details

OPNET model Scenarios

IMPLEMENTATION DETAILS

o The Overall Description

3 Scenarios (802_11g) simulate video streaming at 2Mbps, 3Mbps, 6Mbps respectively

Another 3 Scenarios (802_11n) simulate video streaming at 2Mbps, 3Mbps, 6Mbps respectively

• Compare their quality of service(QoS) determining factors:

Packet End-to-End Delay Packet Delay Variation Traffic Received/Traffic Sent Throughput

IMPLEMENTATION DETAILS

• **OPNET model :** 10 mobile clients and a video server



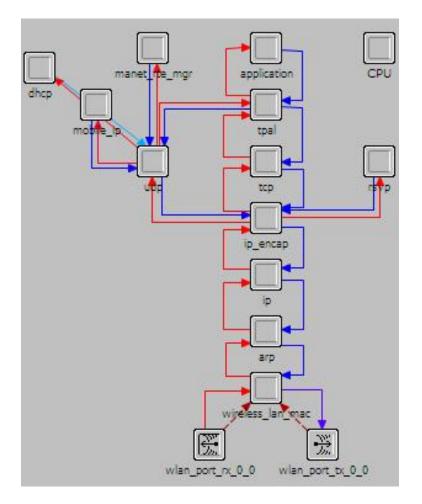
Scale: Office

Size: 100 m x 100 m

Model Family

wireless_lan_adv

IMPLEMENTATION DETAILS OPNET model : the node model of video server



IMPLEMENTATION DETAILS

• Set attributes for the model:

Attribute	Value	-
Frame Interarrival Time Information	30 frames/sec	
Frame Size Information (bytes)	()	
Symbolic Destination Name	Video Destination	
Type of Service	156	
RSVP Parameters	None	
Traffic Mix (%)	All Discrete	
		-1

Wireless LAN Parameters	()		
- BSS Identifier	Auto Assigned		
- Access Point Functionality	Disabled		
- Physical Characteristics	Extended Rate PHY (802.11g		
- Data Rate (bps)	54 Mbps		
Channel Settings	Auto Assigned		
- Transmit Power (W)	0.050		

• Type of Se	ervice (ToS)	
Streaming	g Multimedia (4)	•
<mark>▼ D</mark> elay		
Throug	ghput	
I <u>R</u> eliabi	ility	
C Differenti	ated <u>S</u> ervices Co	de Point (DSCP)
Edit		<u>_</u>
Selected	code point : 10	0011100] = 156
C Unassign	ed (ToS or DSCF	2)
	OK	Cancel

• For the model of 802.11n:

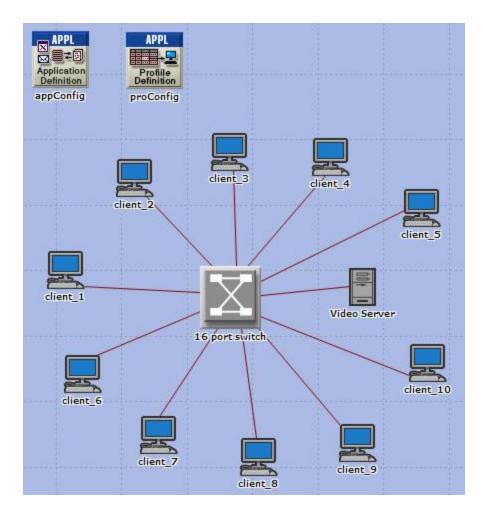
Opnet 14.0 does not declare parameters for 802.11n

Try to include 802.11n standard model into model library , no luck.

Consider other method:

Use 100Mbps Ethernet to build a model for comparison with 802.11g.

OPNET MODEL OF 100MBIT ETHERNET INSTEAD 802.11N:



- 10 clients
- One 16-ports switch
- 1 video server
- wired 100Mbit full duplex connection

Simulation and Results

Simulation Configuration Statistics Analysis

SIM	ULATION	ANI	D RES	ULTS				
Sim	ulation C	onf	igurat	ion				
Sim	ulated Time	e: 1 m	nin (60 s	seconds)				
Seed	l: 128							
Stre	aming Vide	o: co	nstant	distributio	on			
2Mbps			3Mbps		6Mbps			
\star (Frame Size I	nformation) Table	X	📧 (Frame Size Inf	ormation) Table	×	🔣 (Frame Size Inf	ormation) Table	X
Attribute	Value me Size (bytes) constant (1)	*		Value e Size (bytes) constant (1) e Size (bytes) constant (12500)	<u></u>		Value Size (bytes) constant (1) Size (bytes) constant (25000)	*

For this model, Frame size = given Mbps/8bits/30 frames/sec

Promote

Details

OK

Cancel

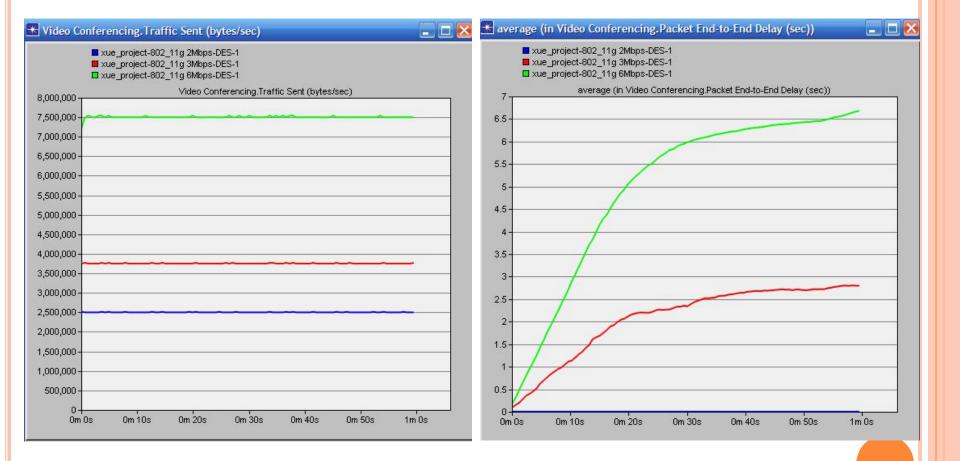
<u>0</u>K

Cancel

<u>0</u>K

Cancel

SIMULATION AND RESULTS Statistics Analysis for 802.11g



SIMULATION AND RESULTS Statistics Analysis for 802.11g



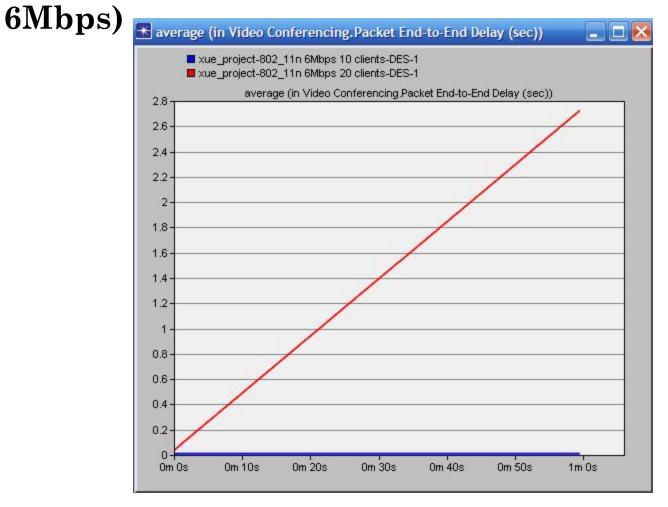
Statistics Analysis for 100Mbit/s Ethernet

xue_project-802_11n 2Mbps-DES-1 xue_project-802_11n 3Mbps-DES-1	xue_project-802_11n 2Mbps-DES-1 xue_project-802_11n 3Mbps-DES-1
xue_project-802_11n 6Mbps-DES-1	xue_project-802_11n 6Mbps-DES-1
8,000,000 average (in Video Conferencing.Traffic Received (bytes/sec))	average (in Video Conferencing.Packet End-to-End Delay (sec))
7,500,000 -	
7,000,000	0.012
6,500,000 -	0.011 -
6,000,000 -	0.010
5,500,000 -	0.009
5,000,000 -	0.008
4,500,000 -	
4,000,000 -	0.007
3,500,000	0.006 -
3,000,000 -	0.005-
2,500,000	0.004 -
2,000,000	0.003 -
1,500,000	
1,000,000	0.002
500,000 -	0.001 -
0	0.000 0m 0s 0m 10s 0m 20s 0m 30s 0m 40s 0m 50s 1m 0s

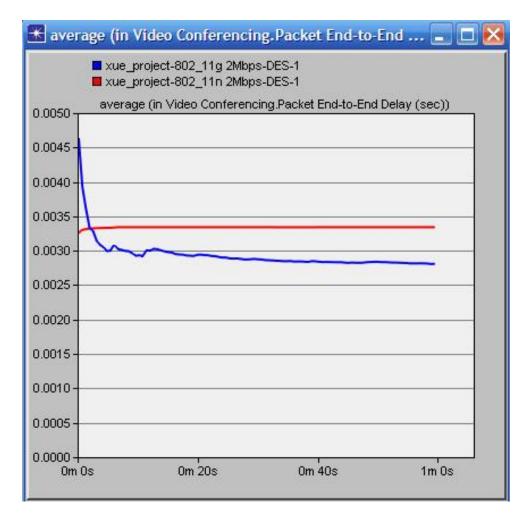
Statistics Analysis for 100Mbit/s Ethernet

🐮 average (in Video Conferencing.Traffic Received (bytes/sec)) 💦 🖃 🔀	📧 average (in Video Conferencing.Packet End-to-End 🖃 🗖 🔀
 xue_project-802_11n 2Mbps-DES-1 xue_project-802_11n 3Mbps-DES-1 xue_project-802_11n 6Mbps-DES-1 	 xue_project-802_11n 2Mbps-DES-1 xue_project-802_11n 3Mbps-DES-1 xue_project-802_11n 6Mbps-DES-1
8,000,000 average (in Video Conferencing.Traffic Received (bytes/sec))	average (in Video Conferencing Packet End.to-End Delay (sec))
7,500,000	0.013
7,000,000	0.012
6,500,000	0.011
6,000,000	0.010
5,500,000 -	0.009 -
5,000,000	0.008 -
4,500,000 -	
4,000,000 -	0.007 -
3,500,000	0.006 -
3,000,000	0.005 -
2,500,000	0.004
2,000,000	0.003
1,500,000	0.002
1,000,000	
500,000 -	0.001 -
0	0.000 + 0m 0s 0m 10s 0m 20s 0m 30s 0m 40s 0m 50s 1m 0s

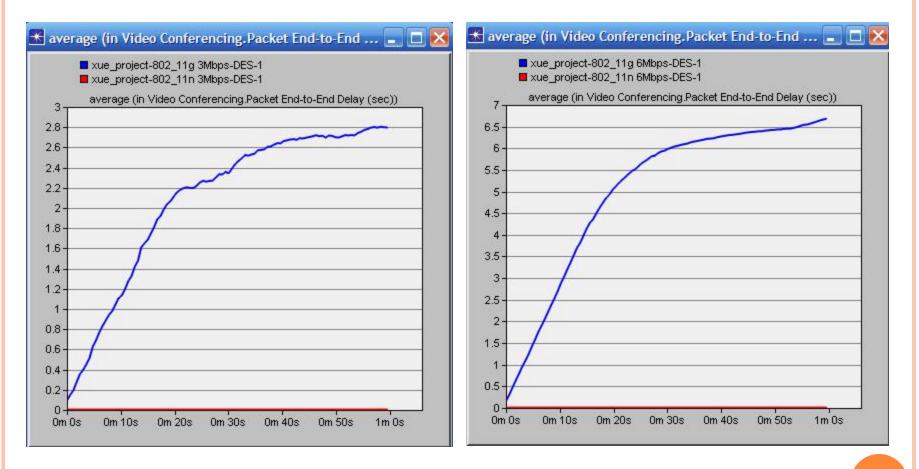
For 100Mbit/s Ethernet (increase clients to 20 at



Compare 802.11g and 100Mbit/s Ethernet :



Compare 802.11g and 100Mbit/s Ethernet :



CONCLUSION AND DISCUSSION

- I. 802.11g is not suitable for HD video streaming, but it's good for SD video below 2Mbps.
- II. 100Mbit/s Ethernet supports compressed HD video streaming, and is much better than 802.11g does in the small group clients , which indicates much lower packet delay variation and packet end-to-end delay.
- III. Although 100Mbps Ethernet should work similarly as 802.11n in some content in theory, they may have some differences. Wireless tends to have congestion issues and suffer from interference signals and blocks. On the other hand, Ethernet works more smoothly for video streaming based on the previous curves.
 Some Enterprise AP testing/benchmarking to read over: http://www.novarum.com/documents/Enterprise802.11nSingleAPBenchmarkTe

stingv1.3.pdf

IV. If I am able to set 802.11n model in Opnet 14.0, the results may be more convinced.

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- [6]http://en.wikipedia.org/wiki/High-definition_video
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