



# ENSC 835: Communication Networks Spring 2011

Final Project Presentation  
Simulation and performance evaluation of WiFi and  
WiMAX using OPNET  
[www.sfu.ca/~rpa28/](http://www.sfu.ca/~rpa28/)

Sukhchandani Lally ([lally@sfu.ca](mailto:lally@sfu.ca))  
Ravinder Paul ([rpa28@sfu.ca](mailto:rpa28@sfu.ca))

# Roadmap

- **Introduction**
- WiMAX and WiFi
- Motivation
- Project Setup
- Results
- Conclusion
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# Introduction

- **Project Idea**

How does WiMAX differ from WiFi in a small scale network?

- **Issues to Analyze**

- Video conferencing
- Throughput
- Load
- Voice
- HTTP
- FTP
- Traffic sent/Traffic received

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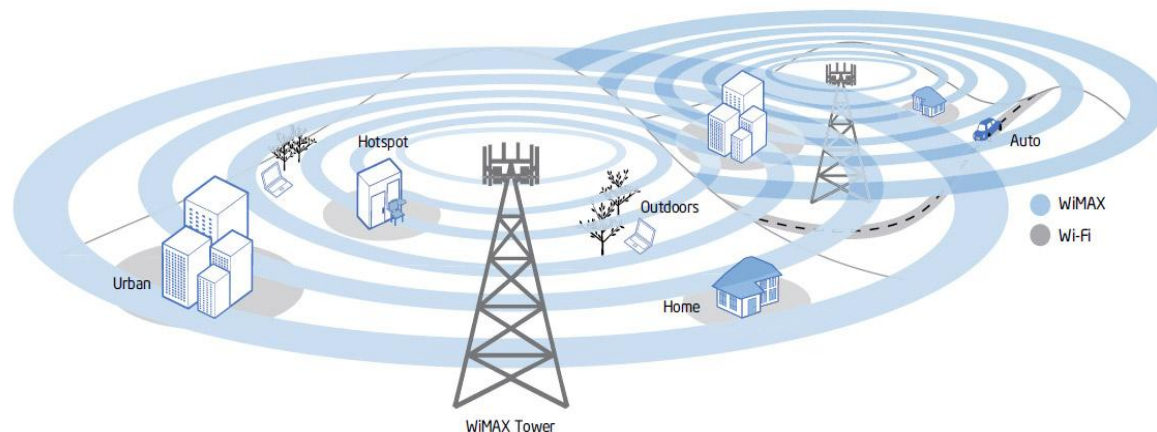
# What is WiMAX?

- Worldwide Interoperability for Microwave Access
- Based on IEEE 802.16 standard
- Point-to-Multipoint (PMP) mode
- Connection oriented
- Flexible QoS supports voice and video
- Channel bandwidths from 1.2-20MHz
- Provides fixed, nomadic, and mobile usage
- Provides wireless broadband access to large areas
- WiMAX uses Time Division Duplexing (TDD) and Frequency Division Duplexing (FDD)

QoS-Quality of Service

# What is WiFi ?

- Wireless Fidelity
- Based on the IEEE 802.11 standard
- Wi-Fi signal occupies five channels in the 2.4 GHz band
- WiFi has two types of components, one is a wireless client station and the other one is an access point (AP).



# Comparison between WiMAX and WiFi

- WiFi range is in order of tens of meters while WiMAX range is in order of kilometres.
- There are few WiMAX enabled devices and majority have WiFi capability.
- WiMAX provides the last mile of internet access; it can connect WiFi hotspots to the Internet.
- WiMAX provides multi-media and telecommunication services.

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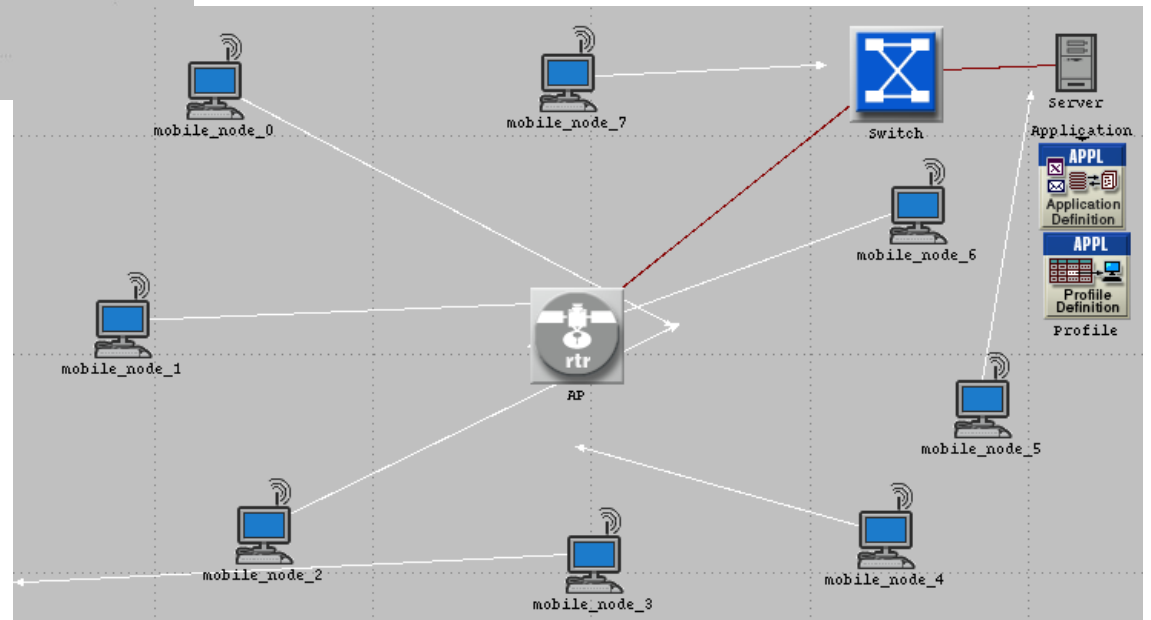
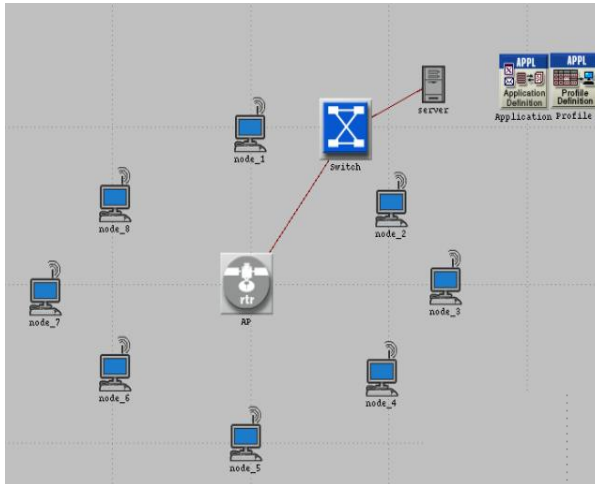
# Motivation

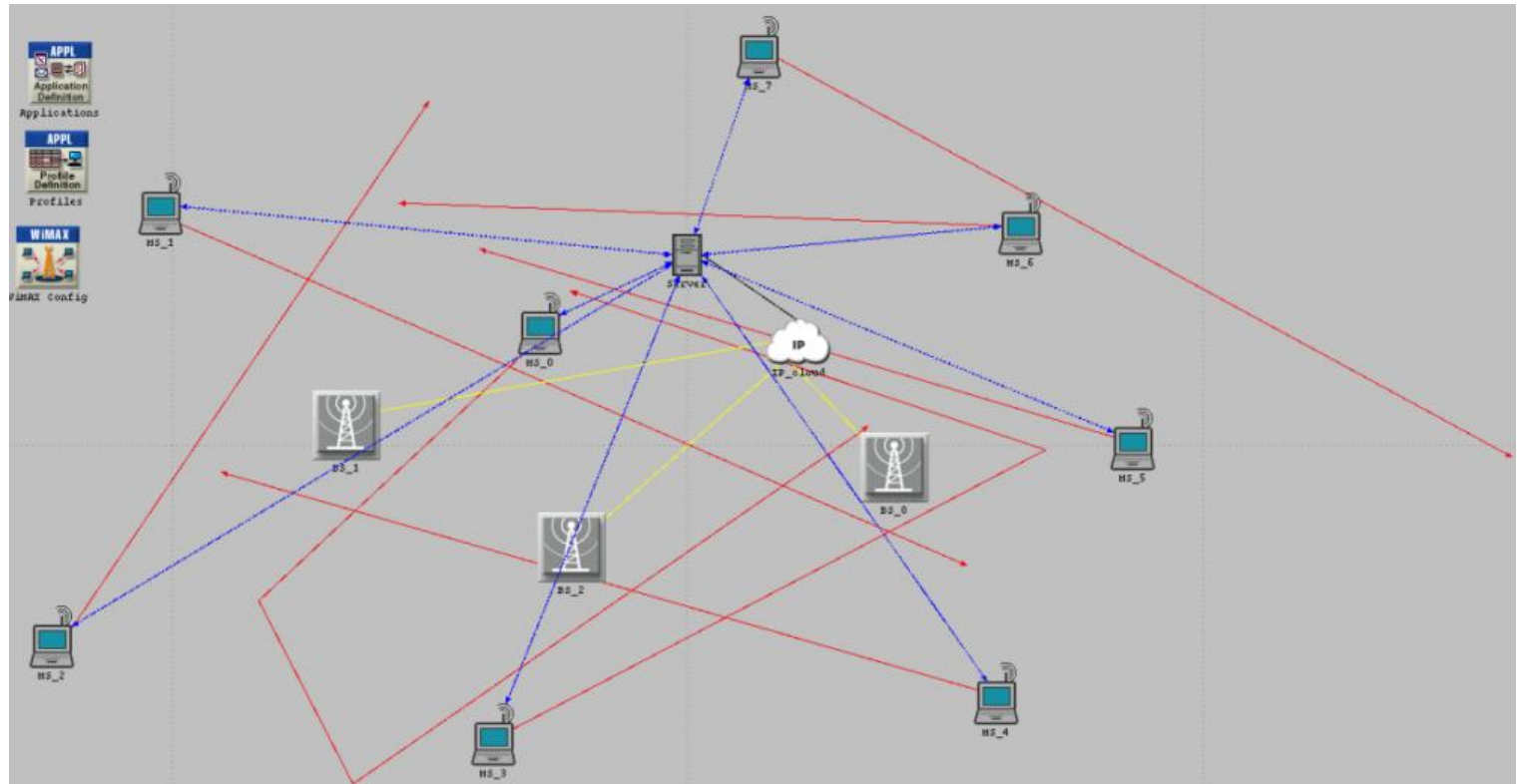
- WiMAX is readily available. As of April 2011, WiMAX forum claims there are over 582 WiMAX networks deployed in over 147 countries.
- Today, in every continent, one in ten people around the world use Wi-Fi at home, at work, and in countless ways.
- Video conferencing is becoming very popular, which enables face-to-face and real-time communications.

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# Project Setup





We created two scenarios for WiFi, first with eight fixed WS and second having eight MS's and one scenario for WiMAX with eight MS's and three BS's where MS's are randomly located.

MS- Mobile Station  
 WS- Work Station  
 BS- Base Station

# Parameter Setup

(MS\_1) Attributes

Type: workstation

Attribute	Value
trajectory	ms_1
AD-HOC Routing Parameters	
ARP	
WIMAX Parameters	
Antenna Gain (dBi)	-1 dBi
Classifier Definitions	(...)
Number of Rows	1
Row 0	
MAC Address	Auto Assigned
Maximum Transmission Power (W)	0.5
PHY Profile	WirelessOFDMA 5 MHz
PHY Profile Type	OFDM
Receiver Sensitivity	-200dBm
SS Parameters	(...)
Applications	
H323	
CPU	

Filter

Exact match

Apply to selected objects

OK Cancel

(node\_1) Attributes

Type: workstation

Attribute	Value
Application: Destination Prefere... (...)	
Number of Rows	4
File Transfer (Heavy)	
Video Conferencing (Heavy)	
Voice over IP Call (GSM Qua...)	
Web Browsing (Heavy HTTP1...)	
Application: Multicasting Specifi... (...)	
Application: RSVP Parameters (...)	
Application: Segment Size	64,000
Application: Source Preferences (...)	
Application: Supported Profiles (...)	
Number of Rows	4
Video	
VoIP	
File Transfer	
Web Browsing	
Application: Supported Services	All
Application: Transport Protocol ...	Default

Filter

Exact match

Apply to selected objects

OK Cancel

(BS\_0) Attributes

Type: router

Attribute	Value
ATM-IP Interface	
ATM	
Address	Auto Assigned
WIMAX Parameters	
Antenna Gain (dBi)	15 dBi
BS Parameters	(...)
Classifier Definitions	(...)
MAC Address	0
Maximum Transmission Power (W)	2.0
PHY Profile	WirelessOFDMA 5 MHz
PHY Profile Type	OFDM
PermBase	0
Receiver Sensitivity	-200dBm
VPN	
Reports	
CPU	
Performance Metrics	
MPLS	

Filter

Exact match

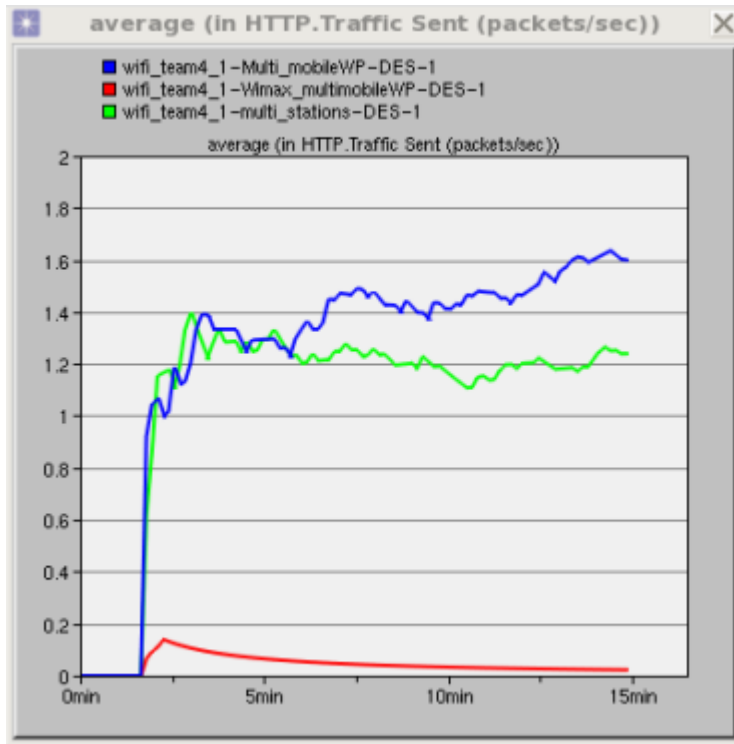
Apply to selected objects

OK Cancel

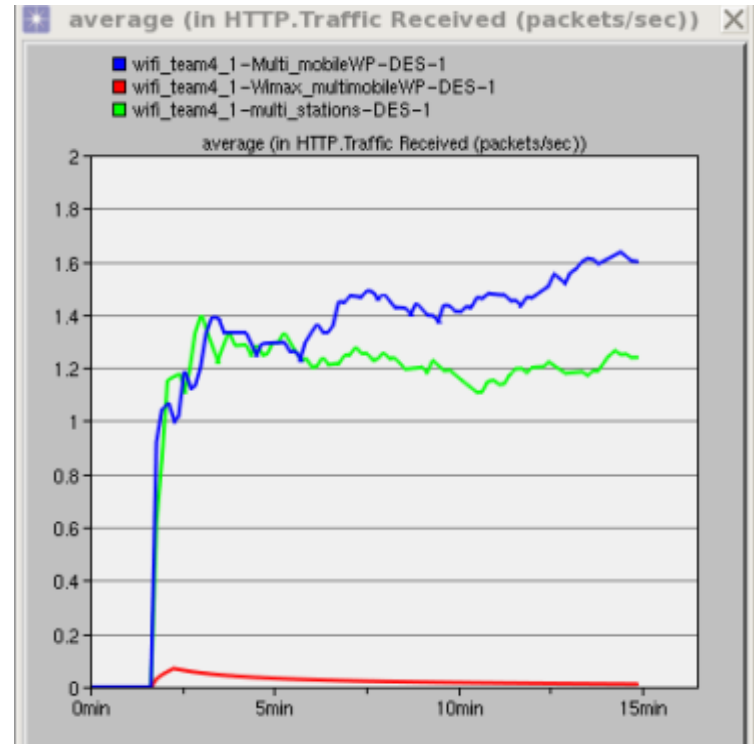
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# Results

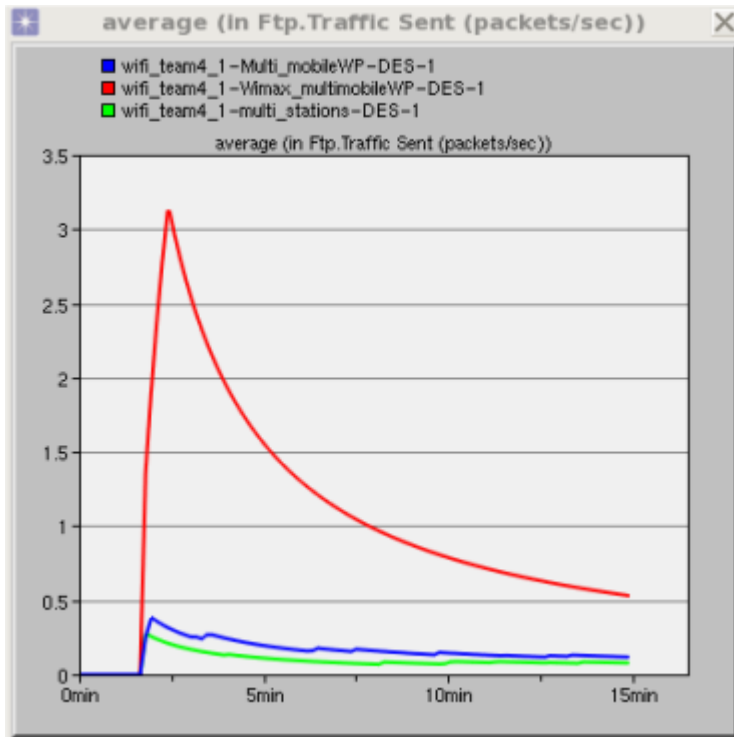


HTTP traffic sent

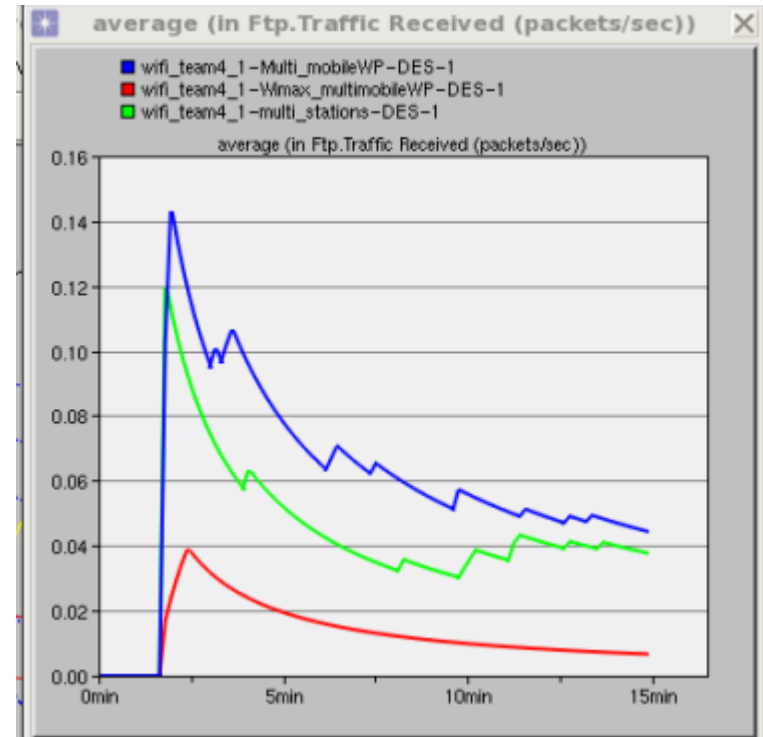


HTTP traffic received

# Results



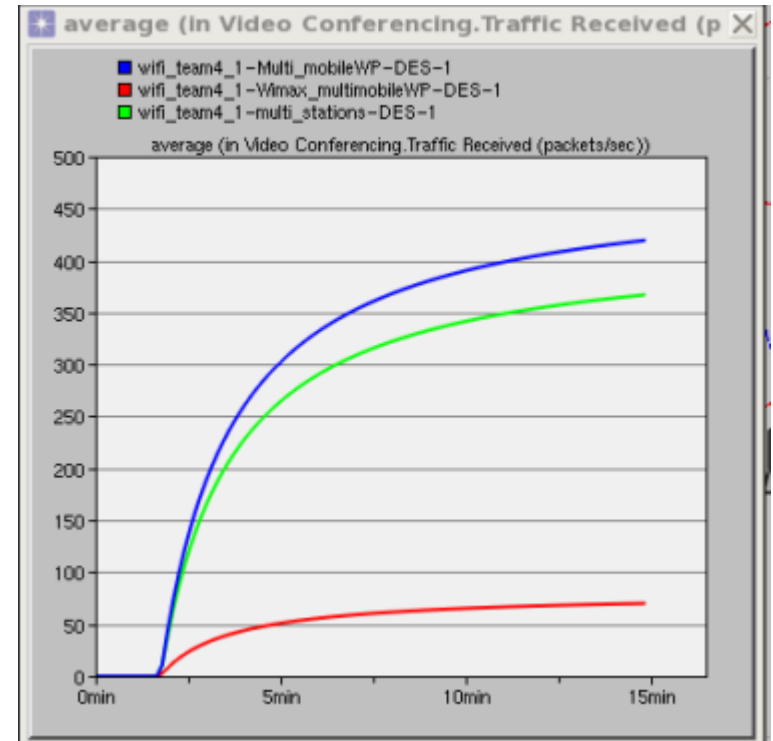
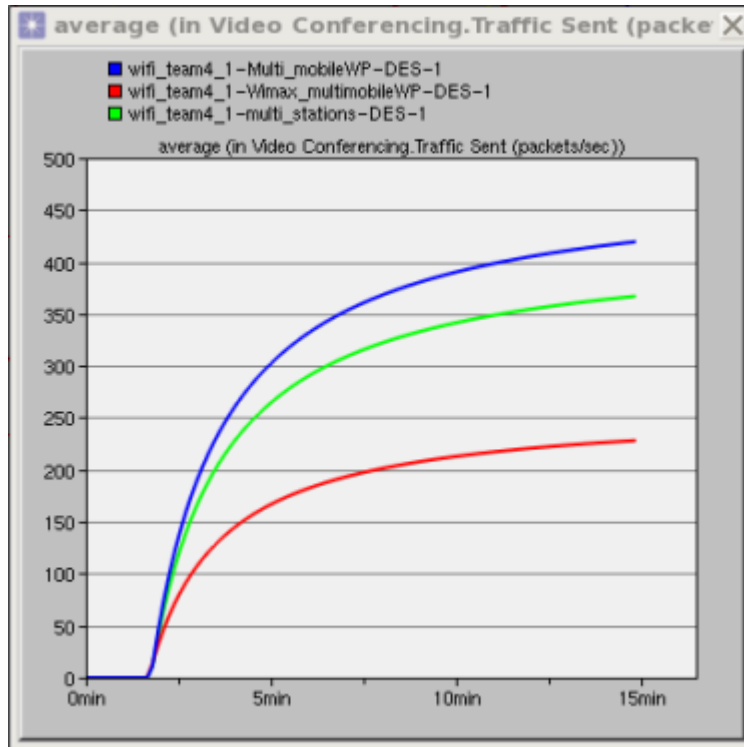
FTP traffic sent



FTP traffic received

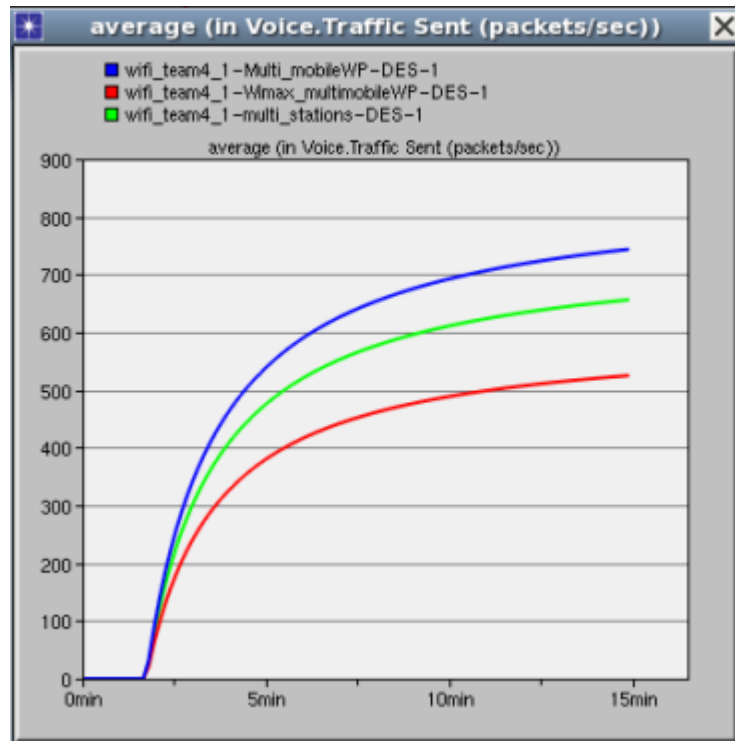


# Results

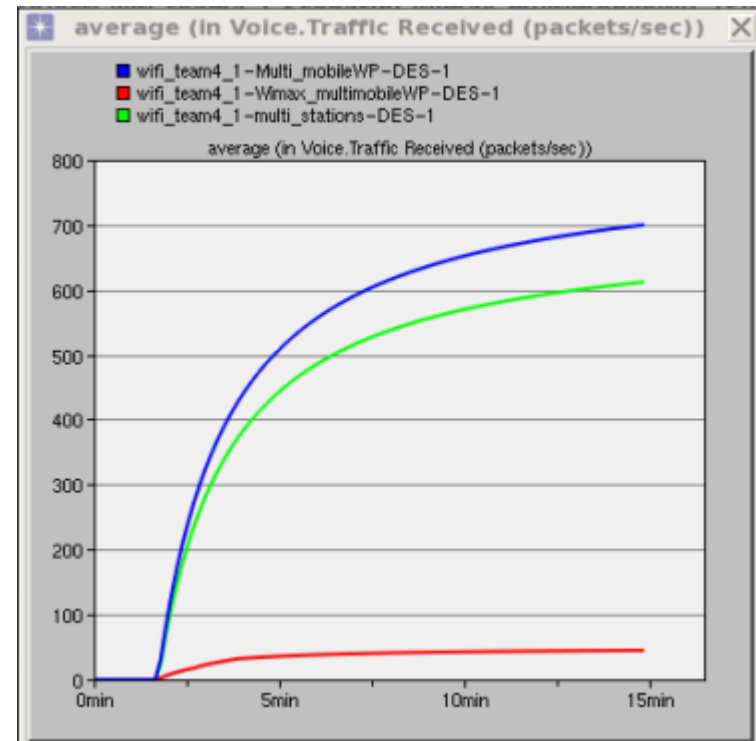


Video Conferencing: There is no loss in packets in WiFi

# Results

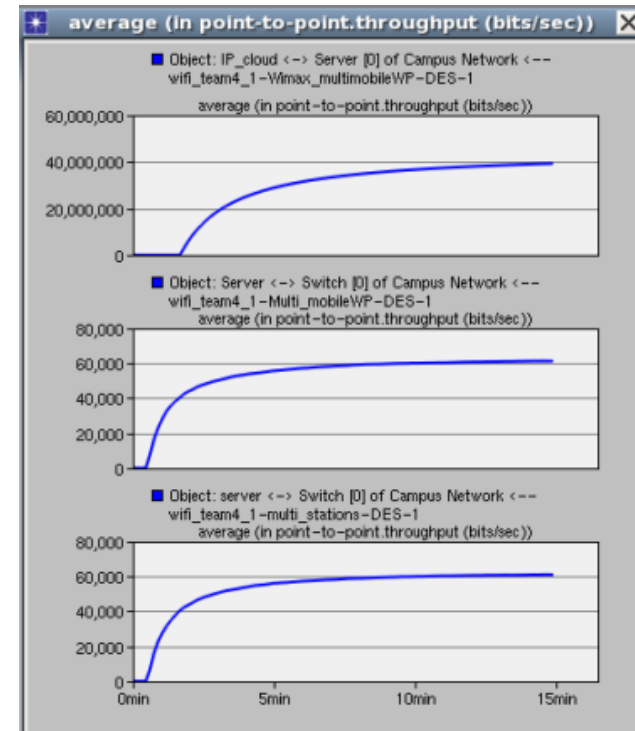
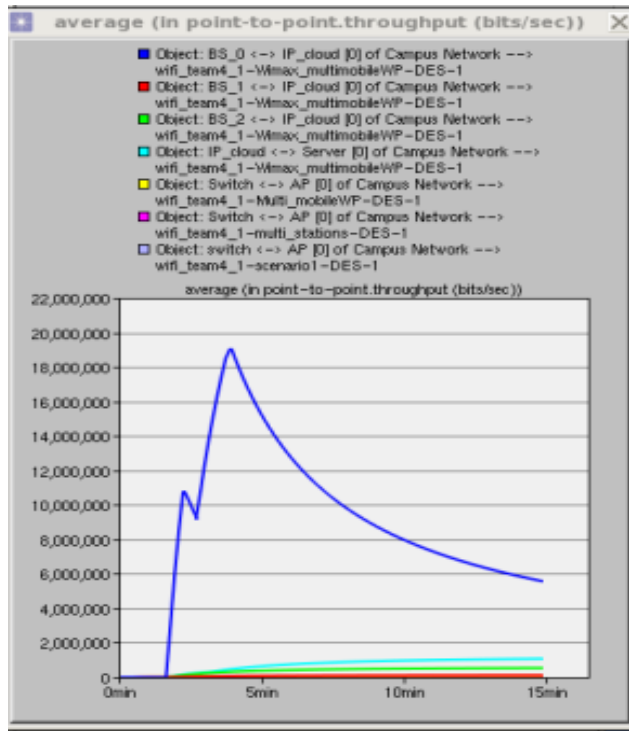


Voice traffic sent



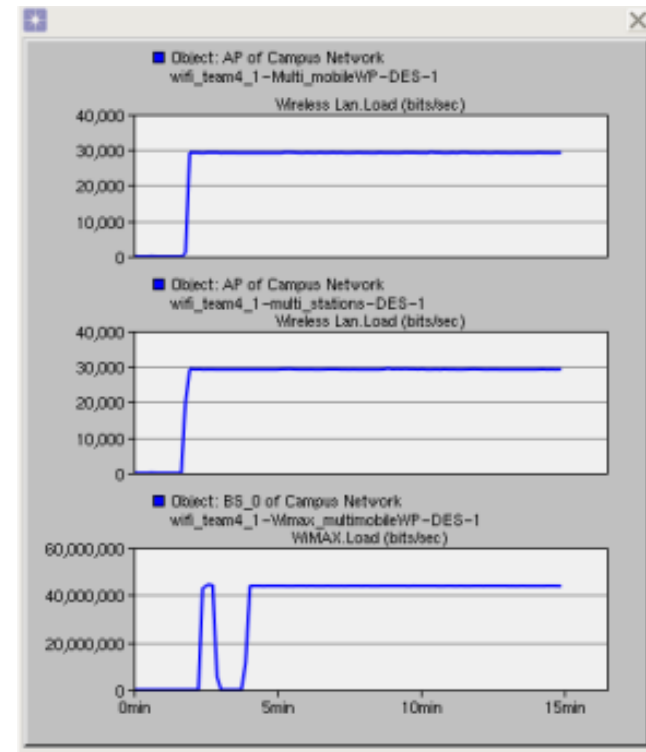
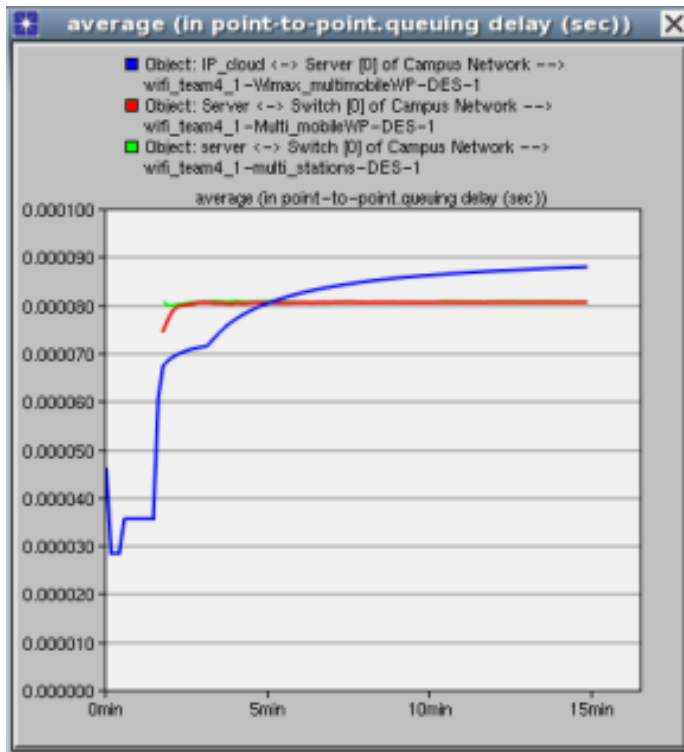
Voice traffic received

# Results



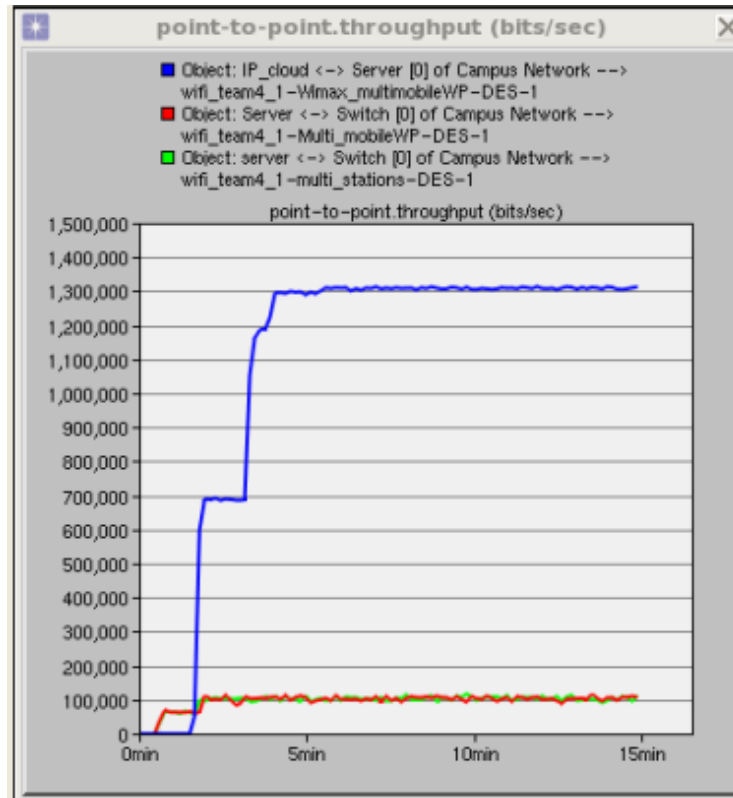
Average throughput of BS of WiMAX scenario and Access point (AP) of two WiFi scenario is shown on left and server Throughput received of campus network is on the right.

# Results



Queuing delay in WiFi scenarios is almost identical but for WiMAX it increases with the time as the mobile station starts to move in the area. Load of AP in WiFi and BS in WiMAX is shown on right.

# Results



Throughput is the average rate of successful message delivery over a communication channel. It is much larger for WiMAX as compared to WiFi.

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# Conclusion

- Throughput of WiMAX is better incase of larger traffic and wide area range.
- WiFi have less packet loss in small area network.
- Queuing delay in WiFi does not depend on mobility of the MS but in case of WiMAX it increases as MS start moving.
- There is packet loss in WiMAX when MS start moving with trajectory.
- WiMAX can handle more load as compared to WiFi.

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# Future Work

- Comparison of WiFi and WiMAX can be done on a larger network.
- Handoff comparison of small network vs. large network can be done.
- QoS of WiFi and WiMAX can be compared.
- Performance optimization with Request-to-Send (RTS) and fragmentation.

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# References

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Questions????

Thank You!!!!