ENSC427: Communication Networks
Spring 2014
Final Project Presentation

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# Analysis of VoIP performance

LAN vs.WAN

WLAN vs. WWAN

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# Road map:

➢Introduction /Motivation

➢QoS for VoIP

➢Project design and standards specification

➢Simulation results and discussion

➢conclusion

# Motivation:

➢To discuss parameters that effect voice quality

➢To analyze VoIP performance in wired and wireless connections

# Introduction:

➢ Alternative to Public Switch Telephone Network or PSTN

➢Implements on Internet Protocol therefore uses Packet-switched protocol[1]

➢Advantages:

- Cheaper
- more call options such as group conversations and video calling and file transfer

➢Disadvantages:

- Dependent on Internet connection
- Less reliable: higher package drop rate compare to circuit-switched telephone network

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# Quality of Service:

➢Jitter: The variation of the delay in the voice packages reaching destination

➢End-to-End Delay: is the time passed from the moment that the signal is sent to the moment that the signal arrives at the destination

➢MOS: Mean Opinion Score- Subjective assessment of the voice quality, the values are from 1 to 5, 5 being the highest score

➢Packet Loss: the difference between the number of packets sent and number of packets arrived at the destination[2].

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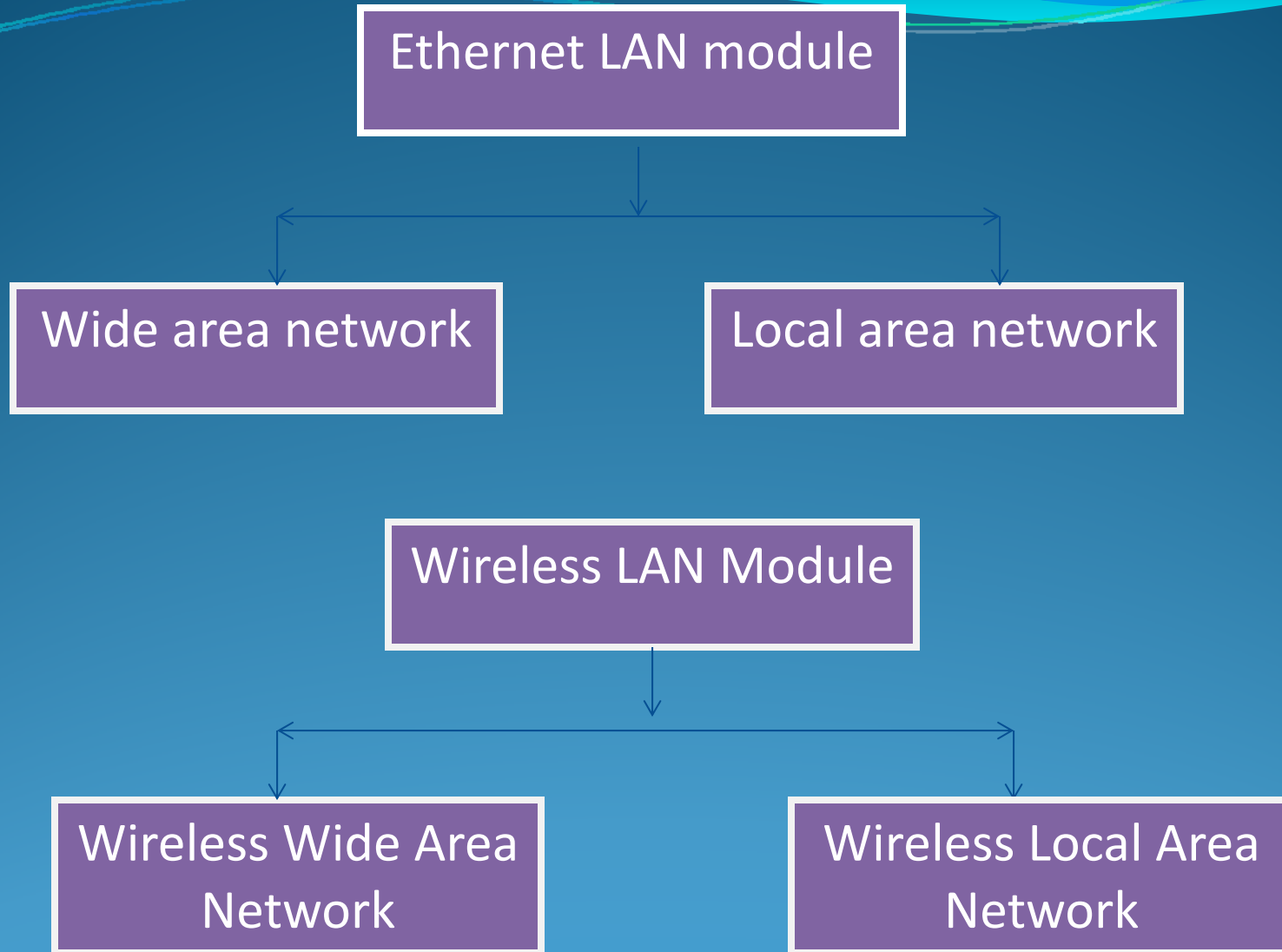
Figure 1 Project Scenario Flowchart

|  | Average Quality | Ideal Quality |
| --- | --- | --- |
| Jitter | <60ms | <20ms |
| End-to-end delay | <150ms | <50ms |
| Packet loss | <5% | <1% |

Table 1 ITU Standards for VoIP on IEEE 802.11g Protocol[3][4]

| Quality Scale | Mean Opinion Score (MOS) |
| --- | --- |
| Excellent | 5 |
| Good | 4 |
| Fair | 3 |
| Poor | 2 |
| Bad | 1 |

Table 2 MOS Scale

# LAN setup:
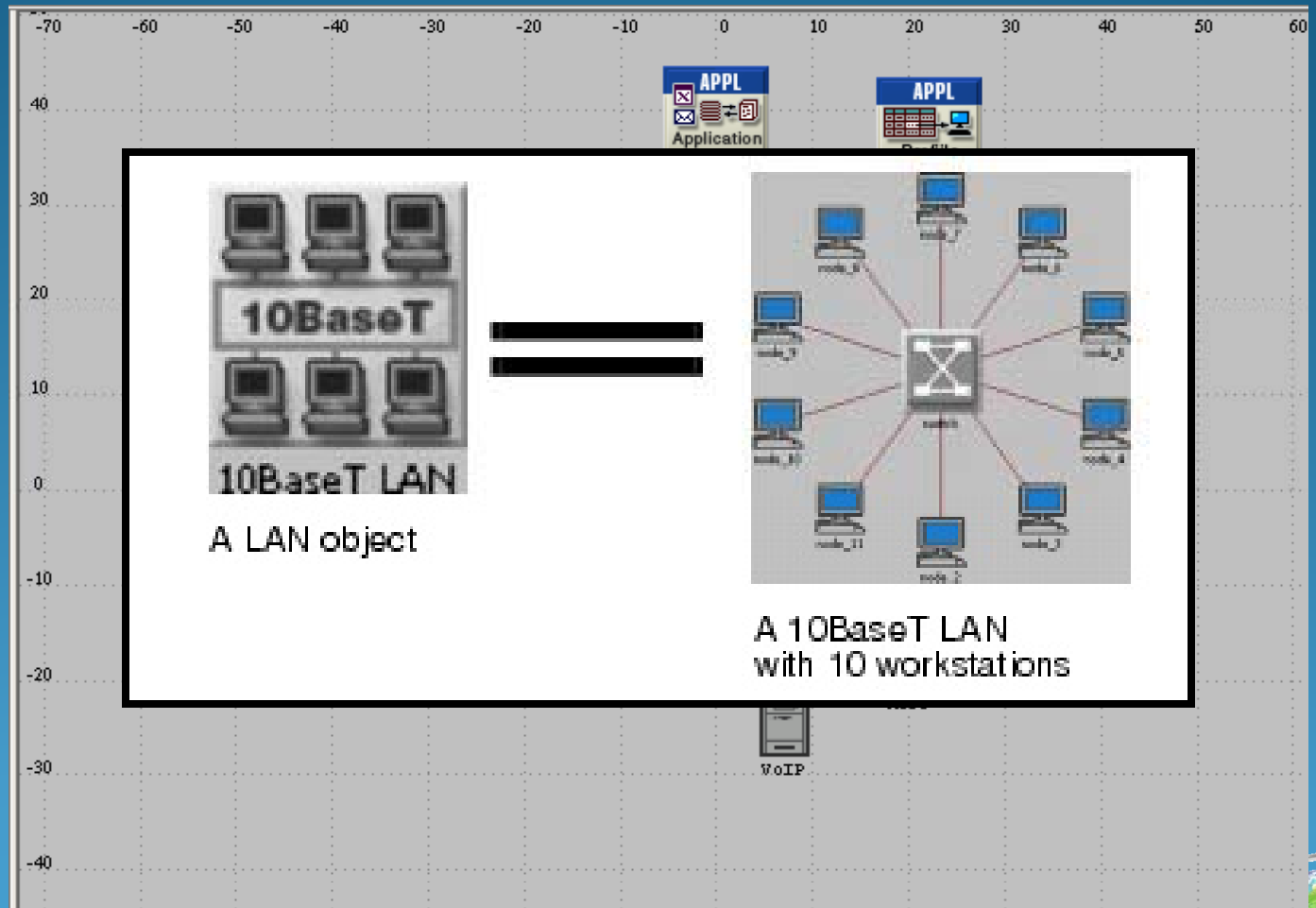


Figure 2 LAN configuration setup- Office 10 client

# WAN Setup:
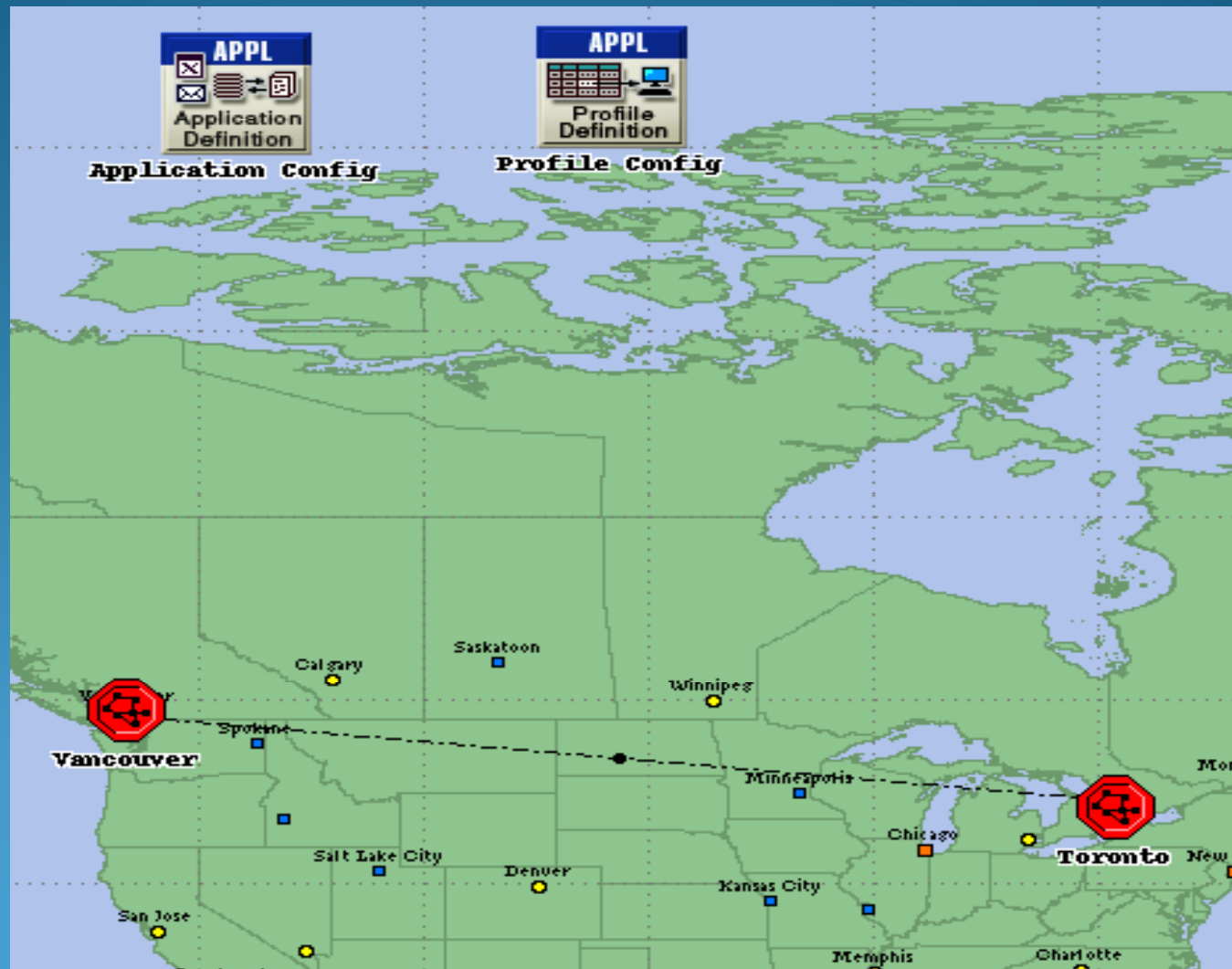


Figure 3 WAN configuration

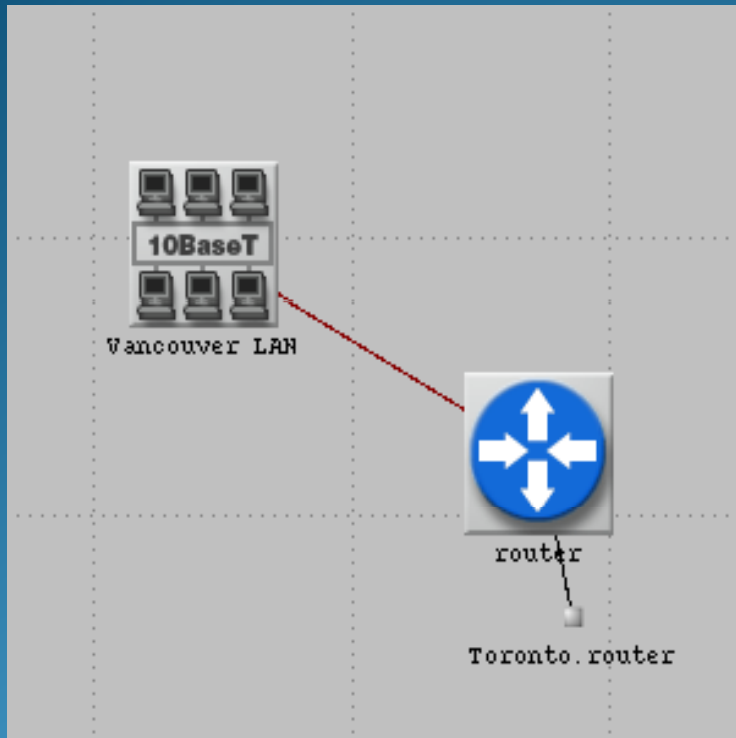# Vancouver Subnet                    Toronto Subnet
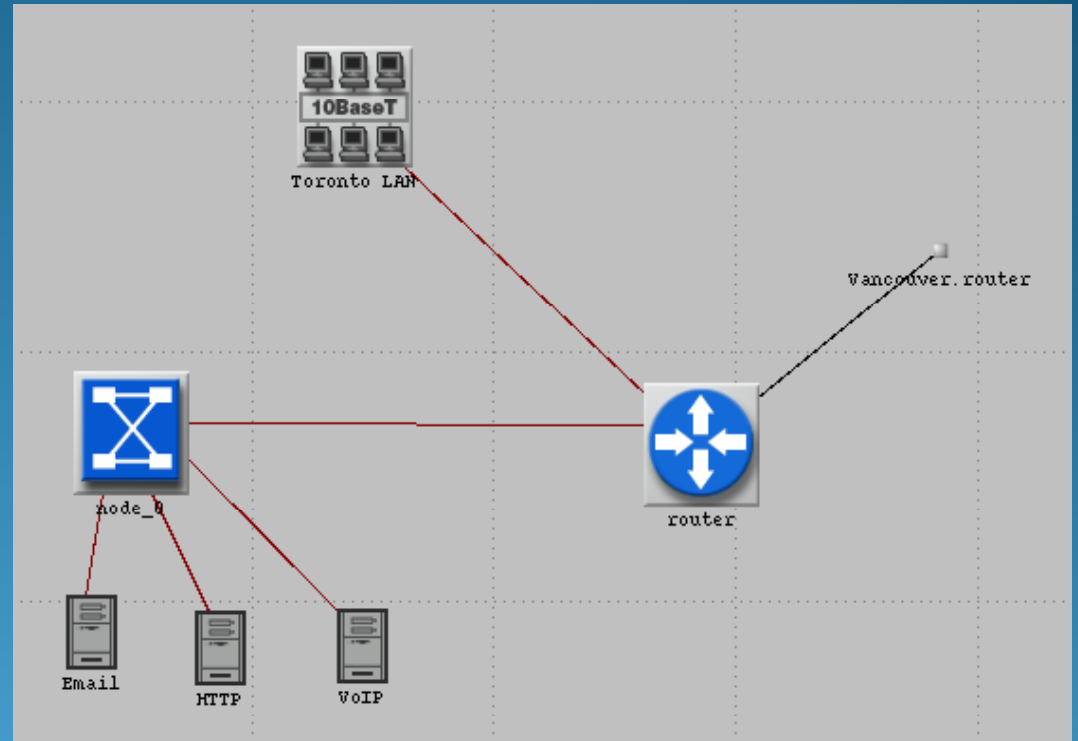

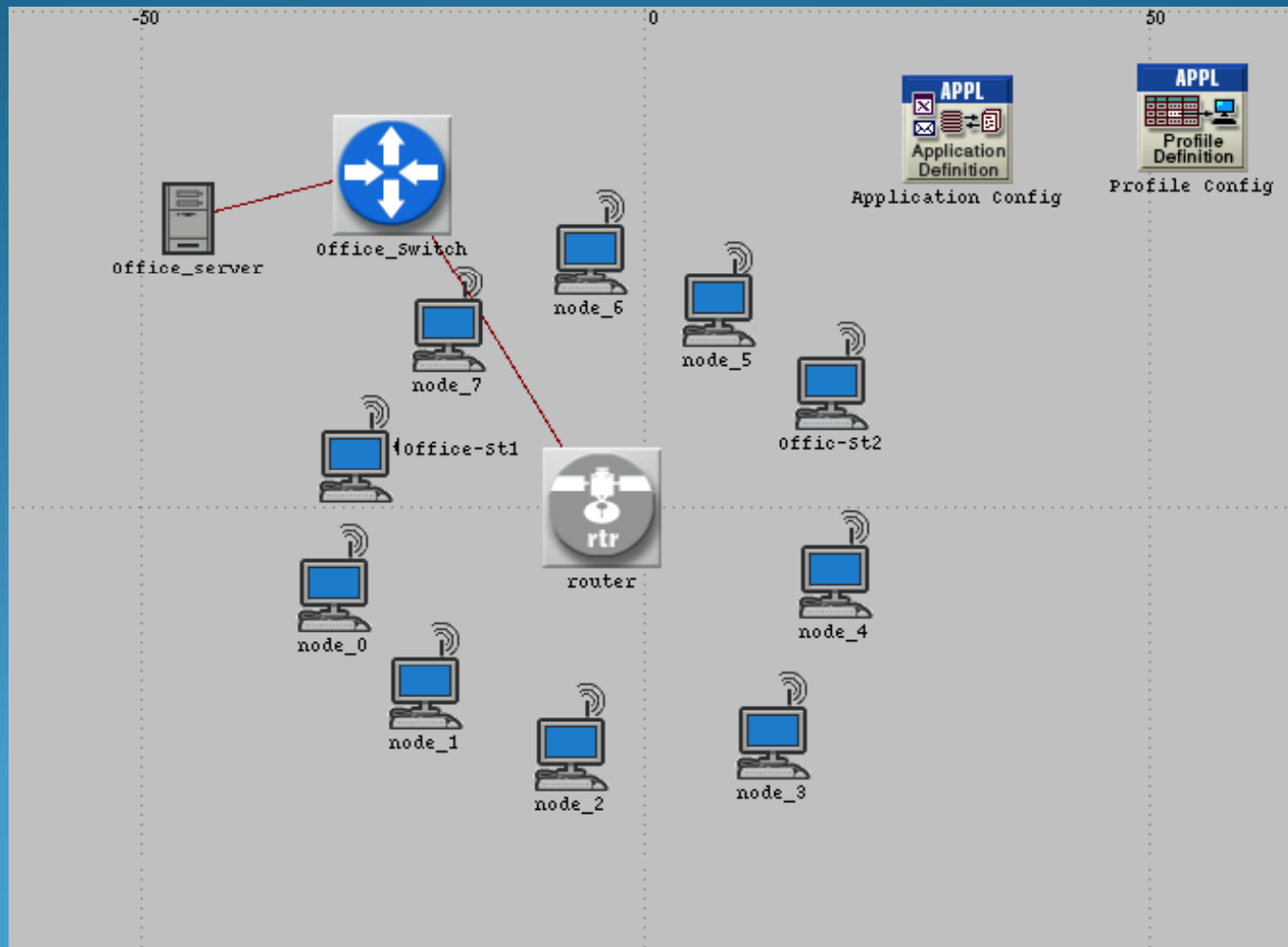
Figure 4 Vancouver Subnet



Figure 5 Toronto Subnet

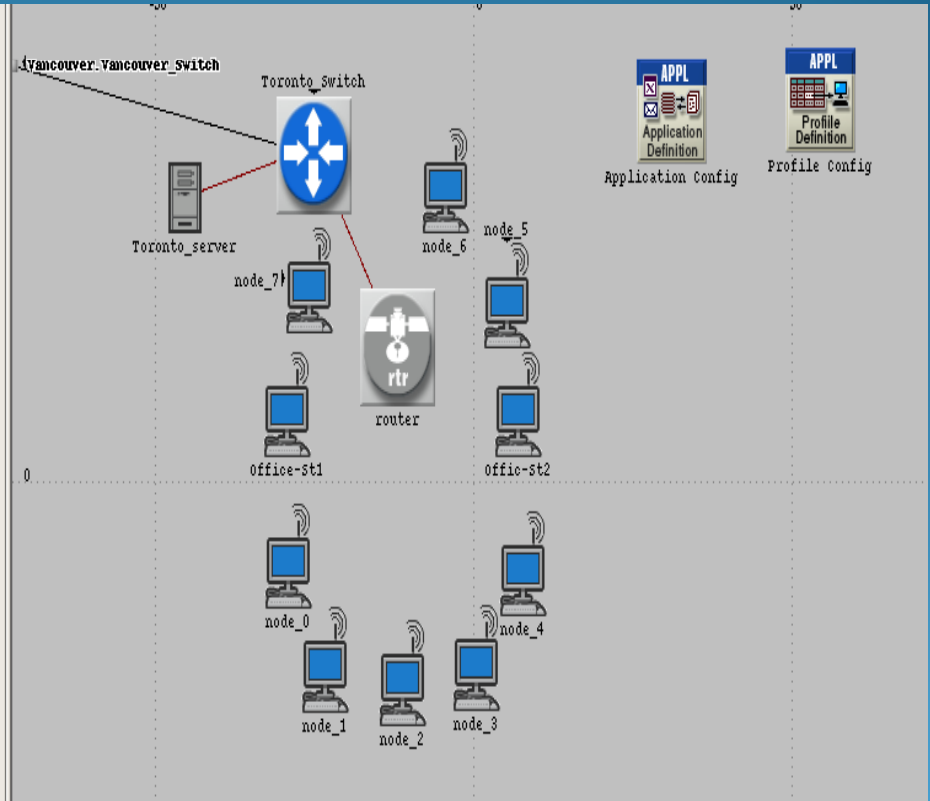# WLAN Setup:



Figure 6 WLAN configuration

# WWAN Setup:

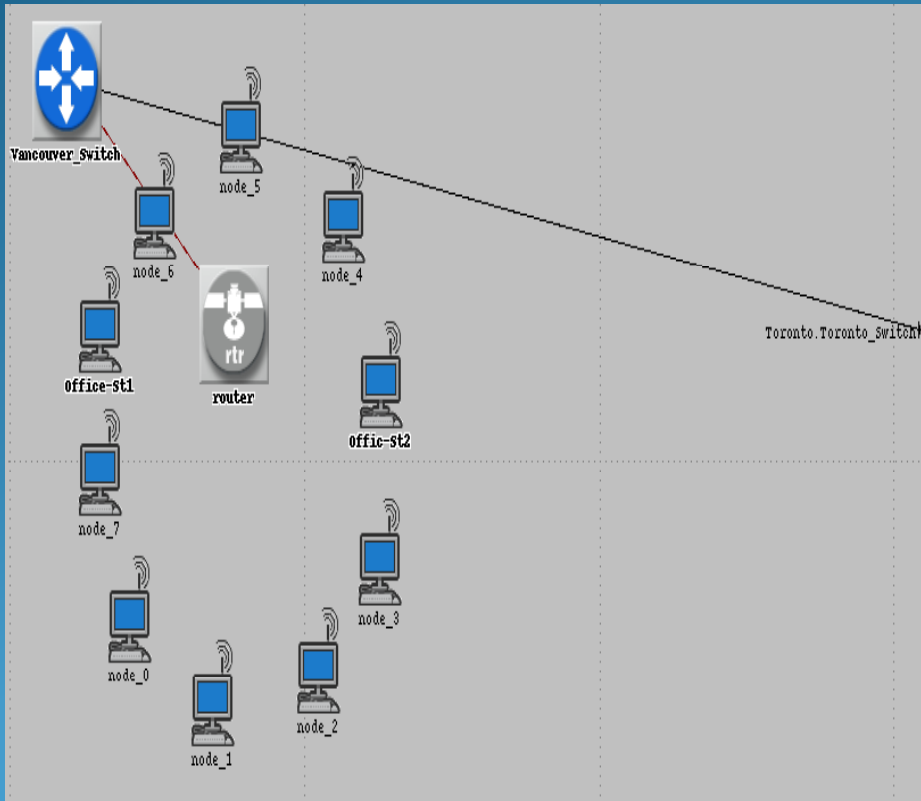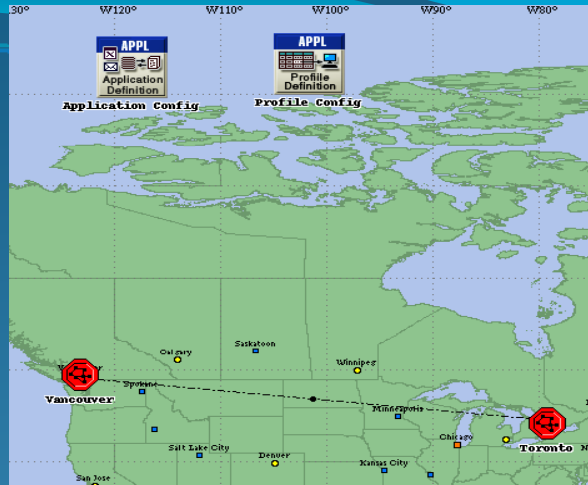

Figure 7 WWAN configuration

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# I. Wired Connections: LAN vs. WAN

➢Jitter

LAN ≈ 0 ms
WAN: Max=13ms
         Min=3ms

Ideal =20 ms
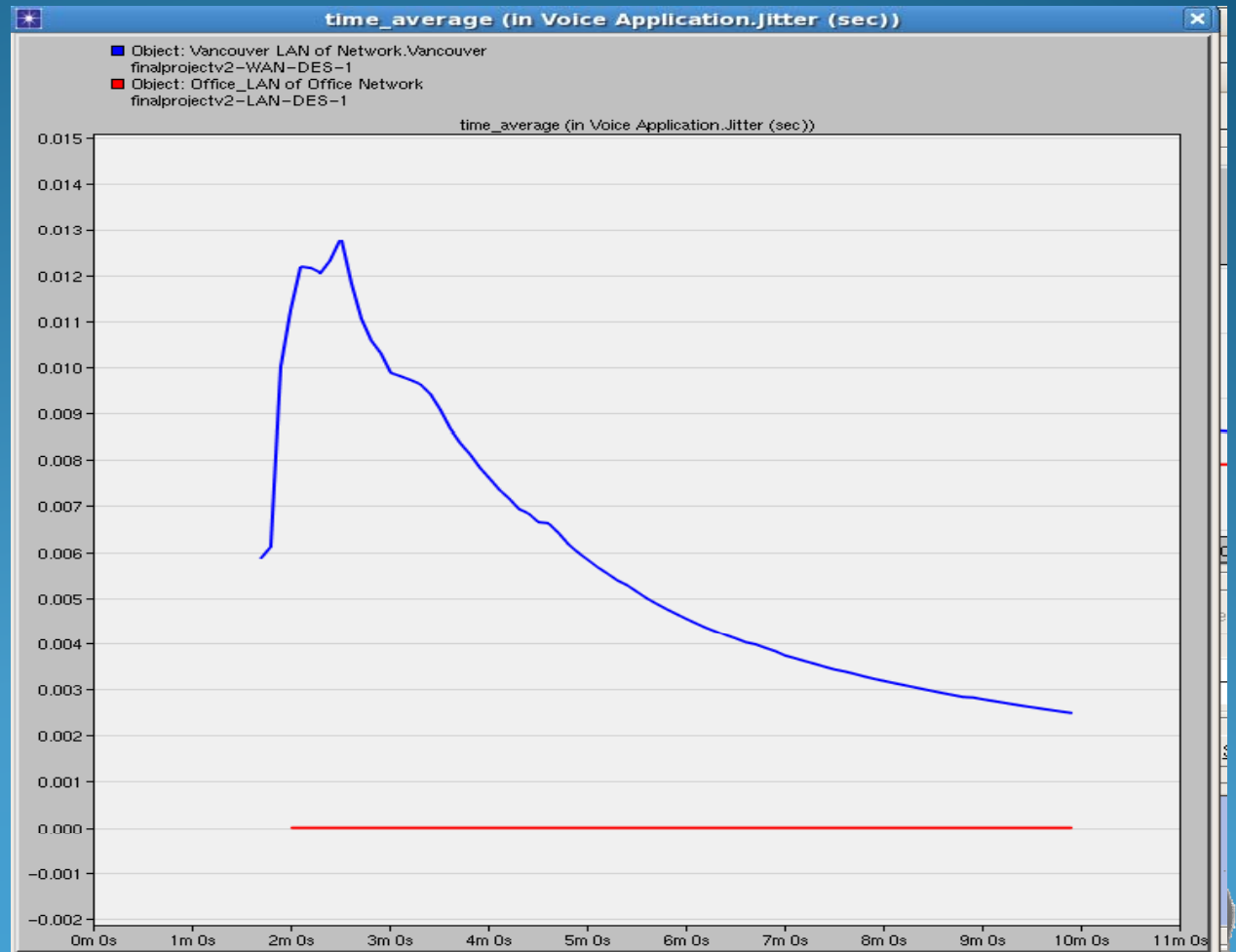
-> Both are considered ideal connection.



Figure 8 LAN Vs WAN Jitter

# I. Wired Connections: LAN vs. WAN

➢ End-to-End Delay

LAN ≈ 300ms
WAN: Max=4.2s
        Min=3.8s

Average= 150 ms

-> Both are higher than average voice quality.



**time_average (in Voice.Packet End-to-End Delay (sec))**

- finalprojectv2-LAN-DES-1
- finalprojectv2-WAN-DES-1

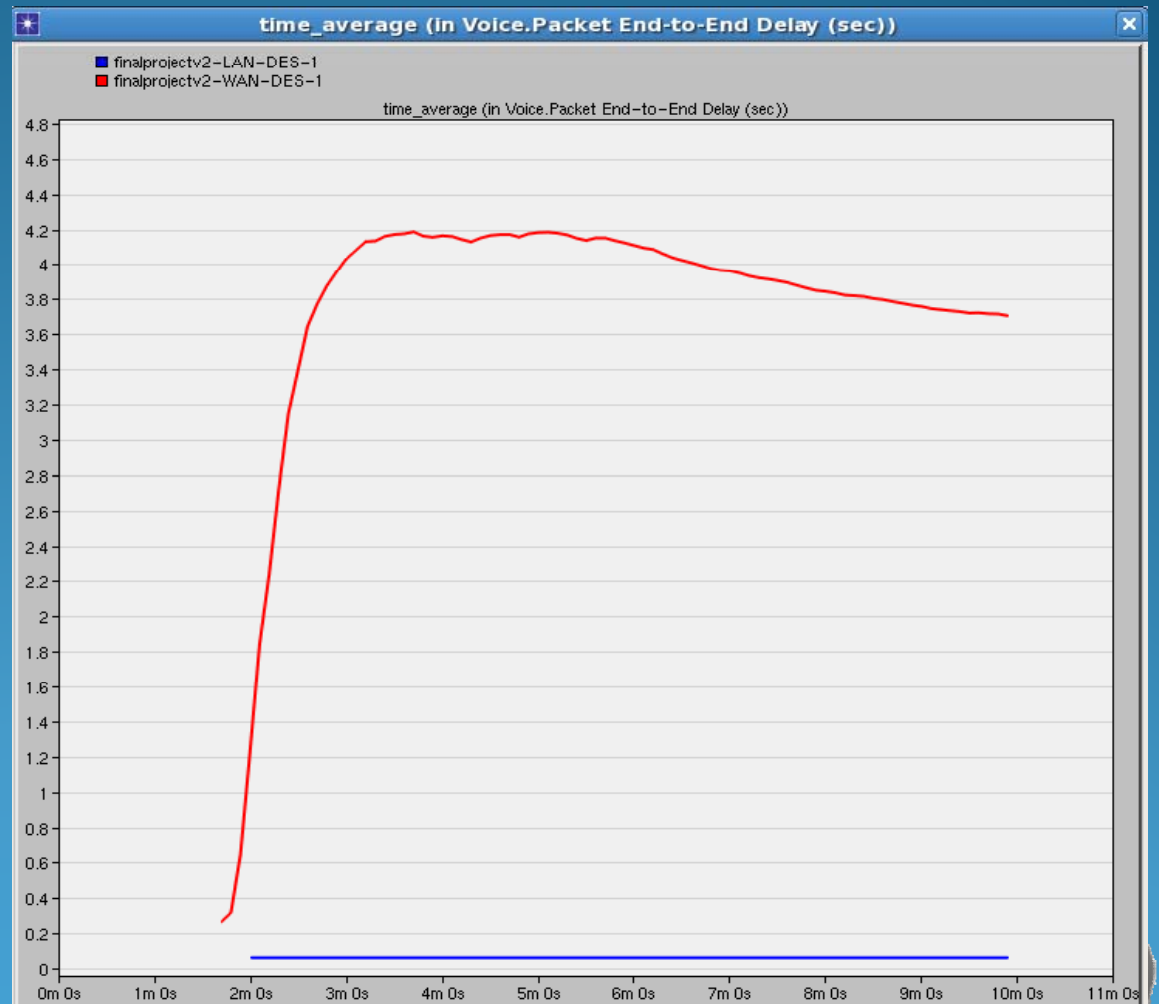time_average (in Voice.Packet End-to-End Delay (sec))

Figure 9 LAN Vs WAN ETE Delay

# I. Wired Connections: LAN vs. WAN

➢ MOS

LAN=3.69
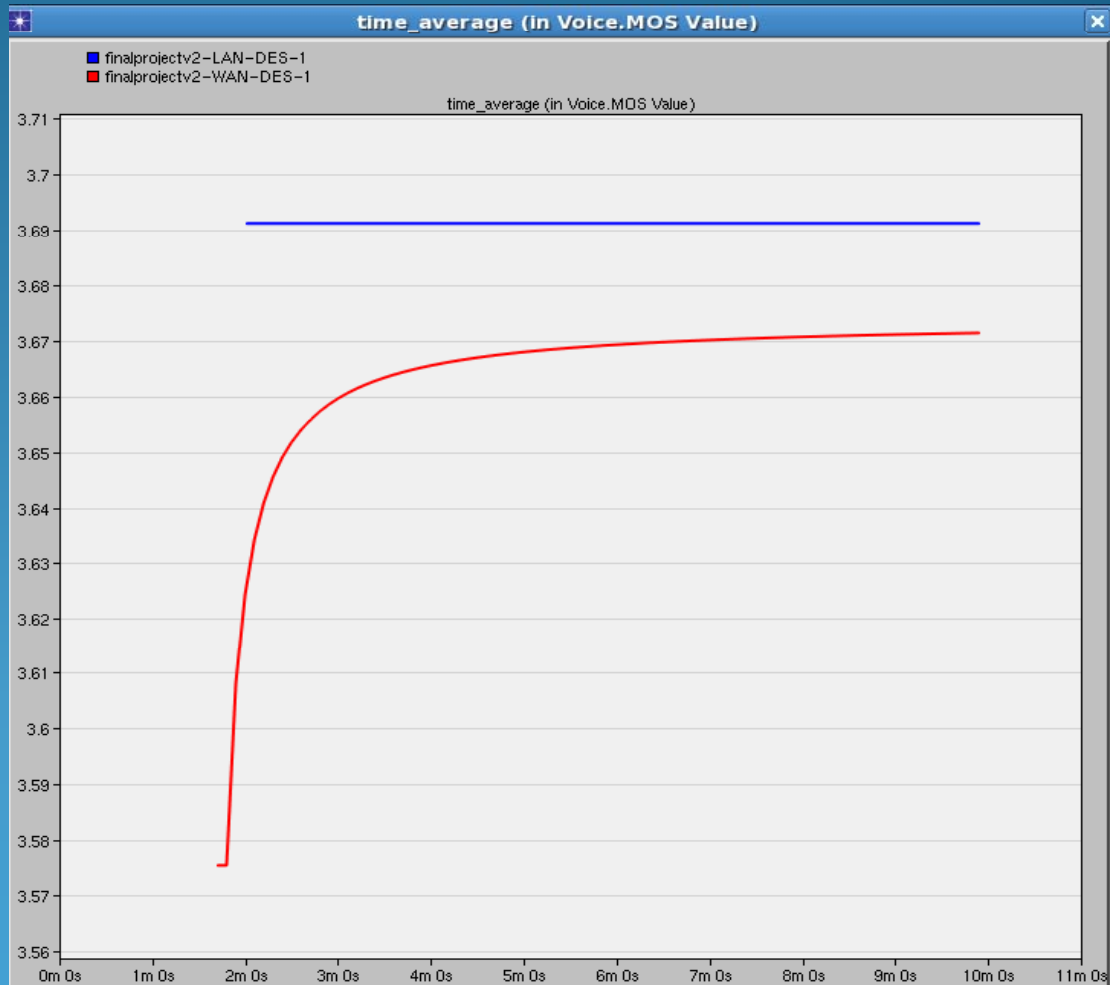WAN=3.67

Fair = 3-4

-> Fair
connection!



Figure 10 LAN Vs WAN MOS

# I.   Wired Connections: LAN vs. WAN
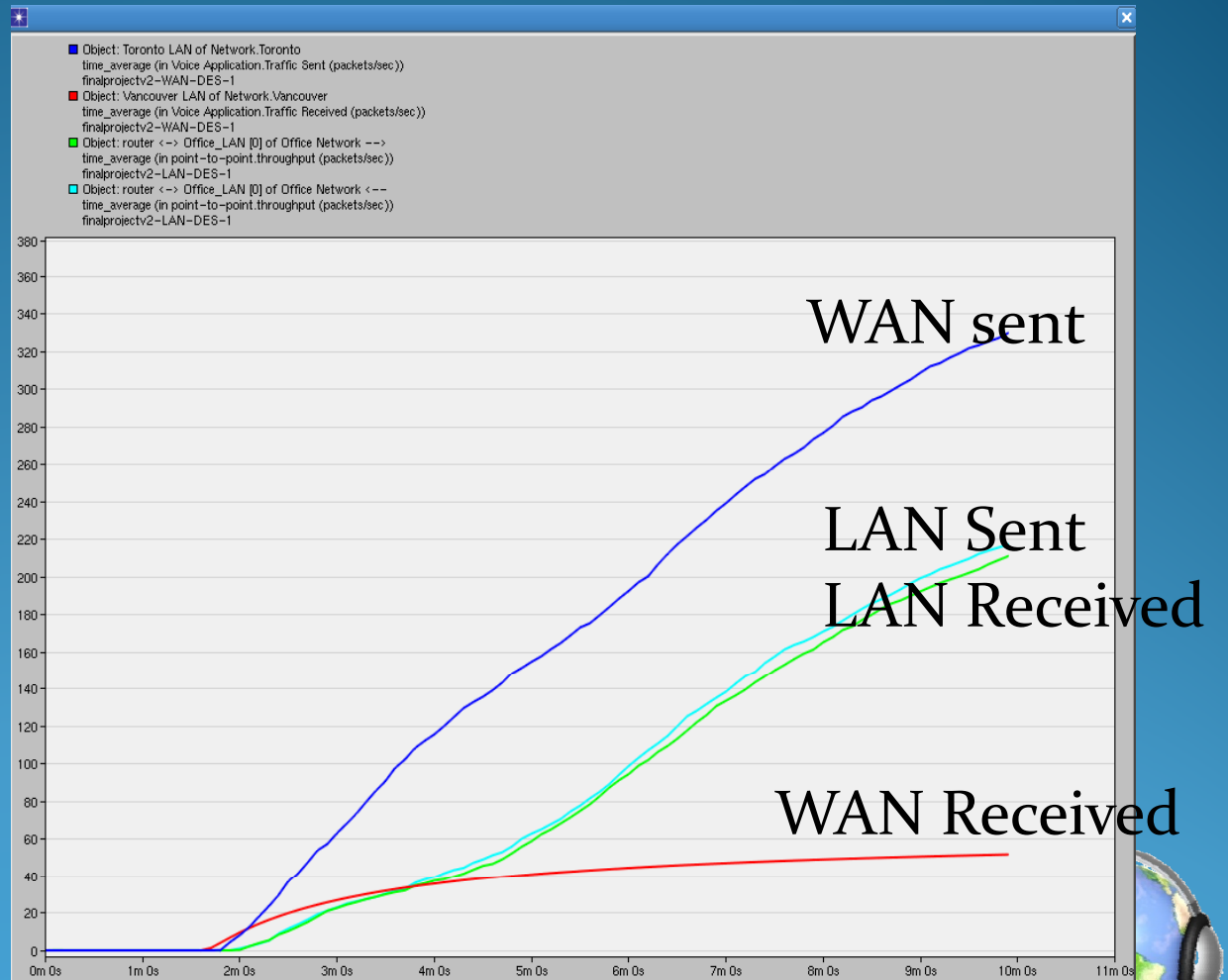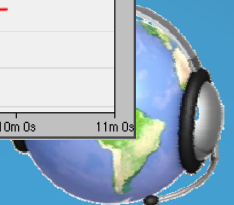
➢Packet Loss

WAN >LAN



Figure 11 LAN Vs WAN Packet Loss

# II. Wireless Connection: WLAN vs. WWAN

➢Jitter

WLAN ≈ 0 -2 ms
WWAN: Max=16ms
        Min=4ms

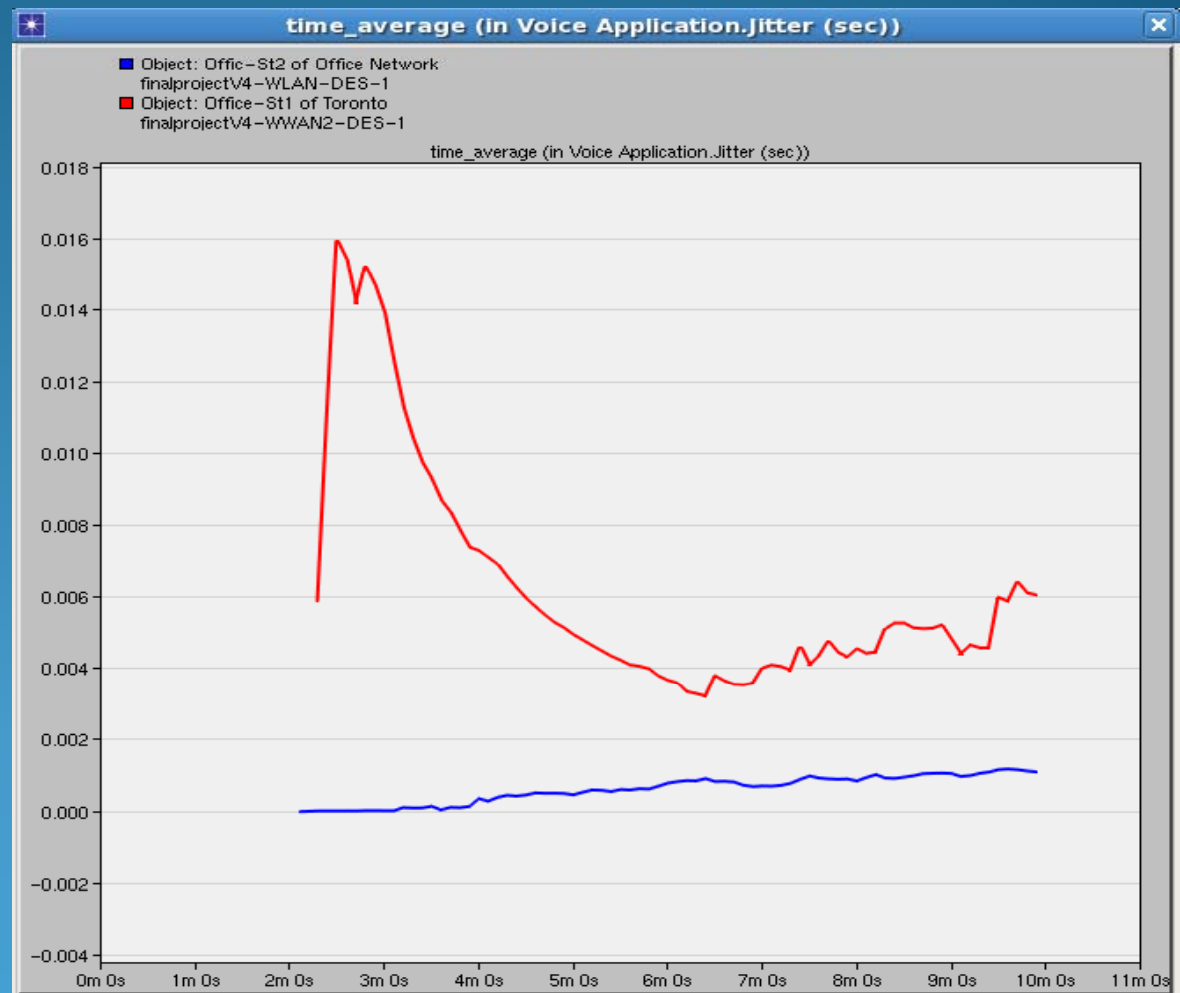Ideal =20 ms

-> Both are
considered ideal
connection.



Figure 12 WLAN Vs WWAN Jitter

# II. Wireless Connection: WLAN vs. WWAN

➢ End-to-End Delay

WLAN ≈ 300-400ms
WWAN: Max=5.2s
        Min=4.8s

Average= 150 ms

-> Both are higher than average voice quality.
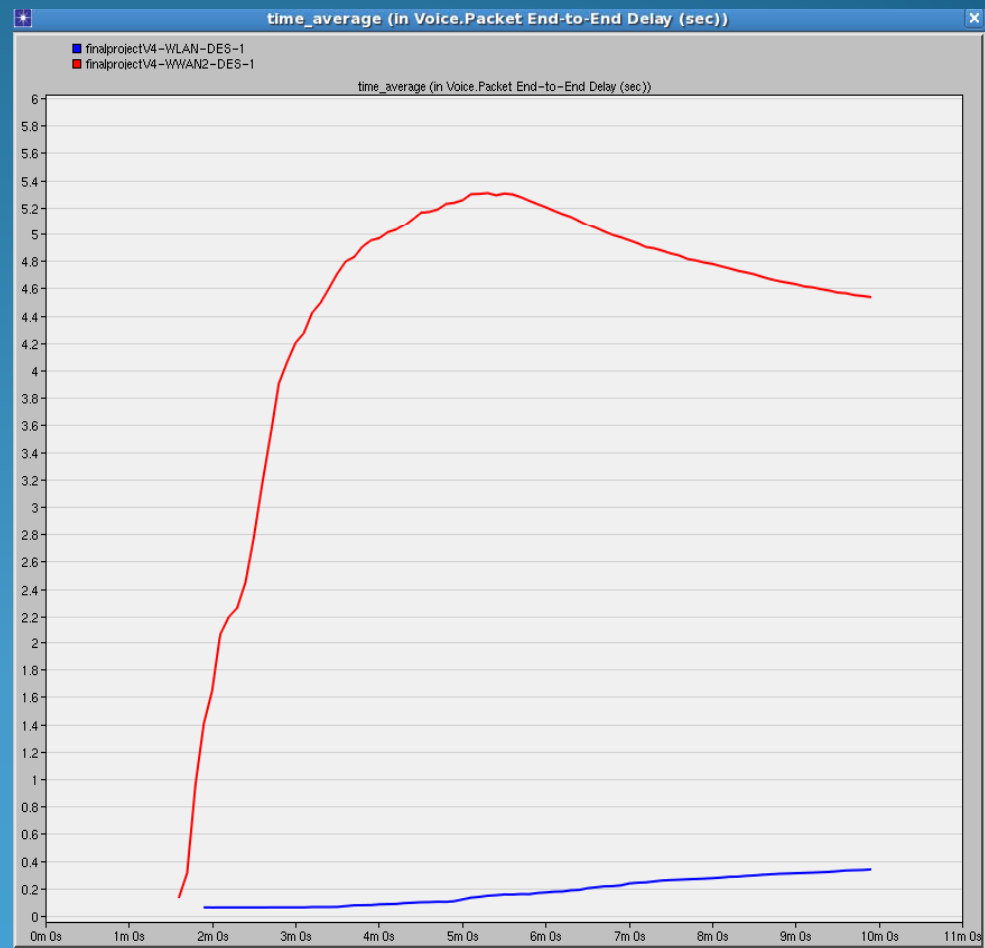


Figure 13 WLAN Vs WWAN ETE Delay

# II. Wireless Connection: WLAN vs. WWAN

➢MOS

WLAN=3.7
WWAN=3.6

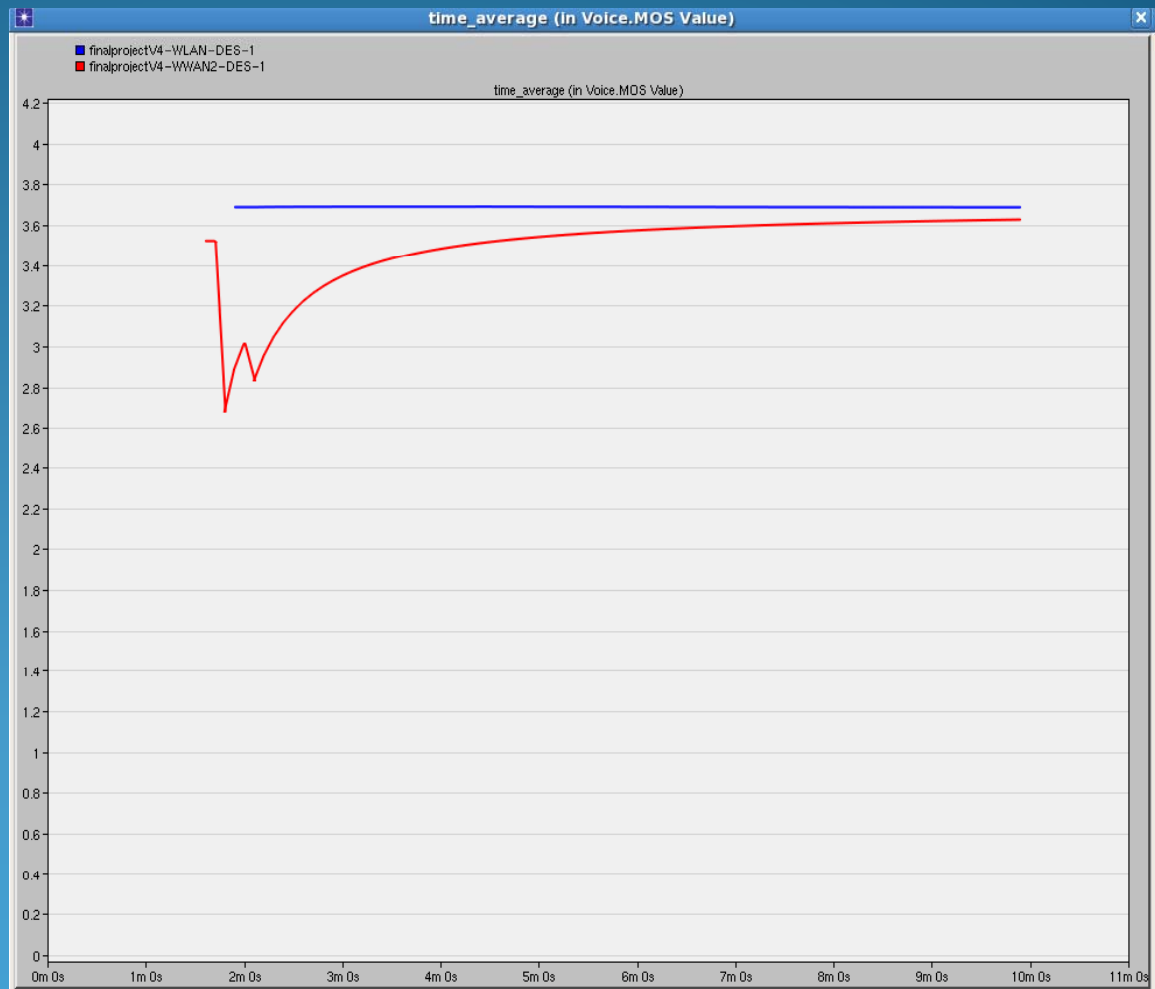Fair = 3-4

->    Fair
connection!



Figure 14 WLAN Vs WWAN MOS

# II. Wireless Connection: WLAN vs. WWAN

➢Packet Loss
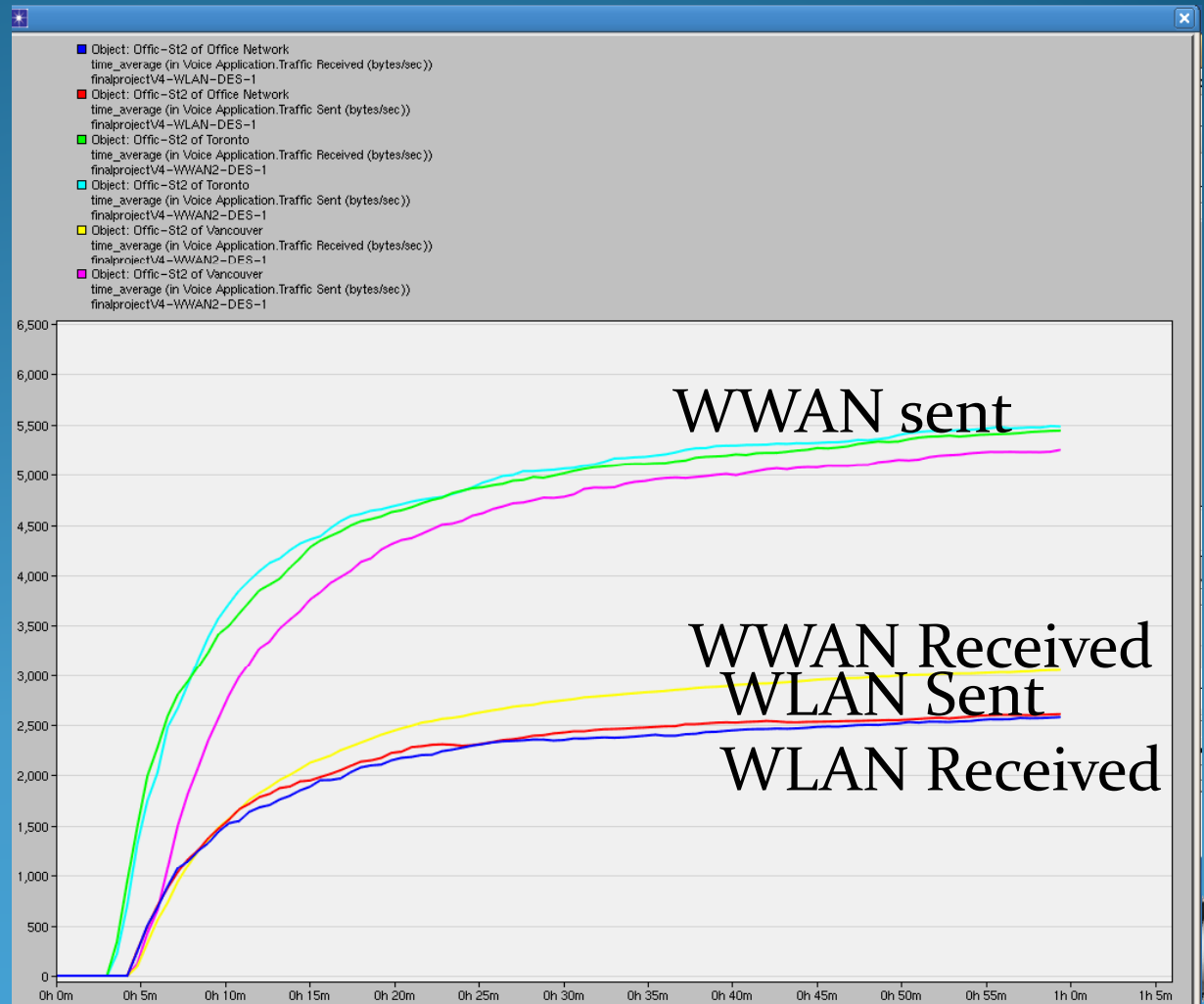
WWAN>WLAN



Figure 15 WLAN Vs WWAN Packet Loss

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# Conclusion

➢The quality of voice (in terms of packet loss, end-to-end delay, and jitter ) aggravates as the distance over which the connection is established increases

➢We observed that, the quality of voice over wired connections is better than wireless connection

➢PSTN connections are more reliable than VoIP

➢VoIP reduces cost significantly

# Future Work

➢ Investigate effects of background load on wireless connections

➢Investigate effects of  having different types of connection links (high speed links)

➢Compare various VoIP protocols

# References:

1. Mehta, Princy, and Sanjay Udani. "Voice over IP." *IEEE Potentials* 20.4 (2001): 36-40.
2. Ghencea, Adrian, and Floriana Gerea. "QoS and Voice Over IP." *Journal of Knowledge Management, Economics & Information Technology* 2.4 (2012).
3. CisCo IOS Quality of service for Voice over IP, Retrieved from http://www.cisco.com/c/en/us/td/docs/ios/solutions_docs/qos_sol utions/QoSVoIP/QoSVoIP.html, Spring 2014
4. E. Chi-Pong Chan, "Performance Analysis of Voice Communications in a Private802.11 Network", Ensc 835: High-Performance Networks, 2003, pp. 8
5. J. Davidson, J. Peters, M. Bhatia, S. Kalidindi and S. Mukherjee, Voice over IP Fundamentals. Indianapolis: Cisco press, 2007

# Questions?