

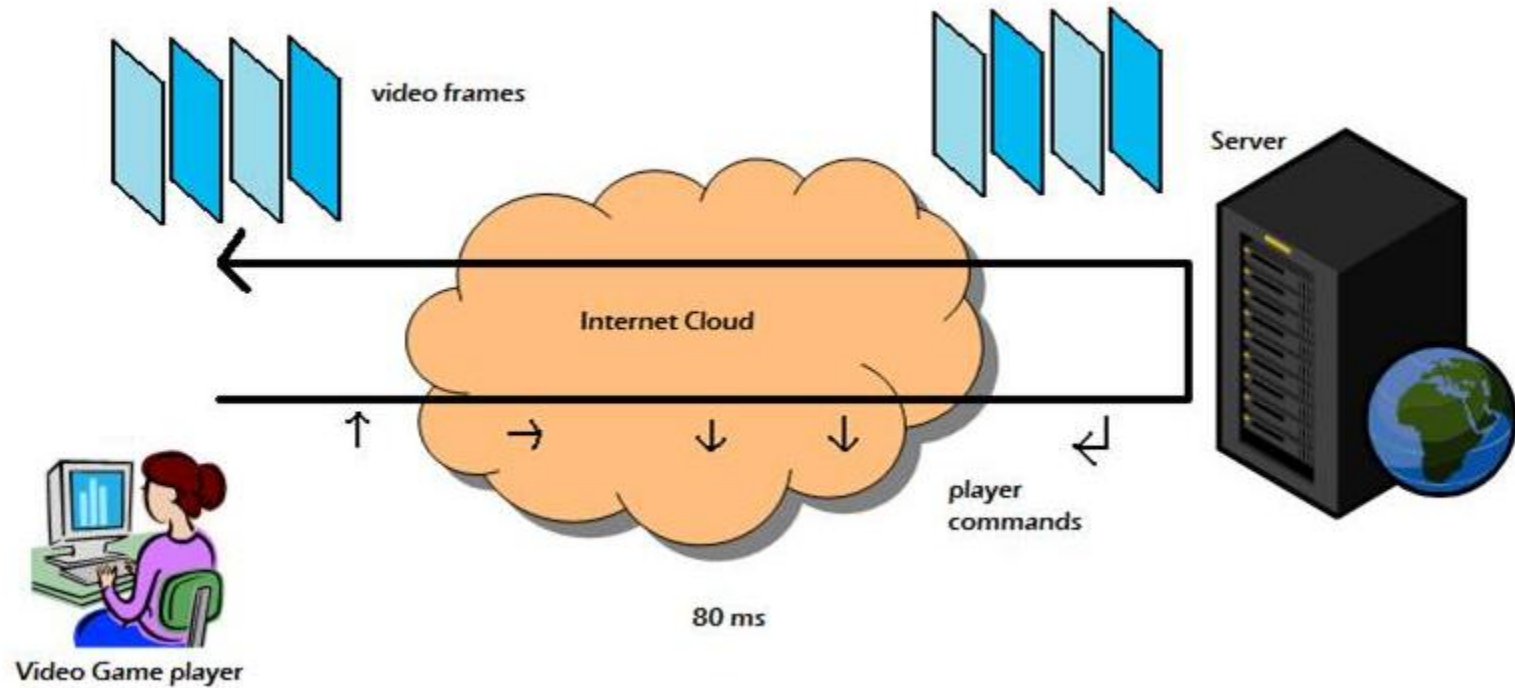
# **On the feasibility of Video Games on Demand over WLAN/WiMAX**

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Ensc 895 Project

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# Video Games on Demand



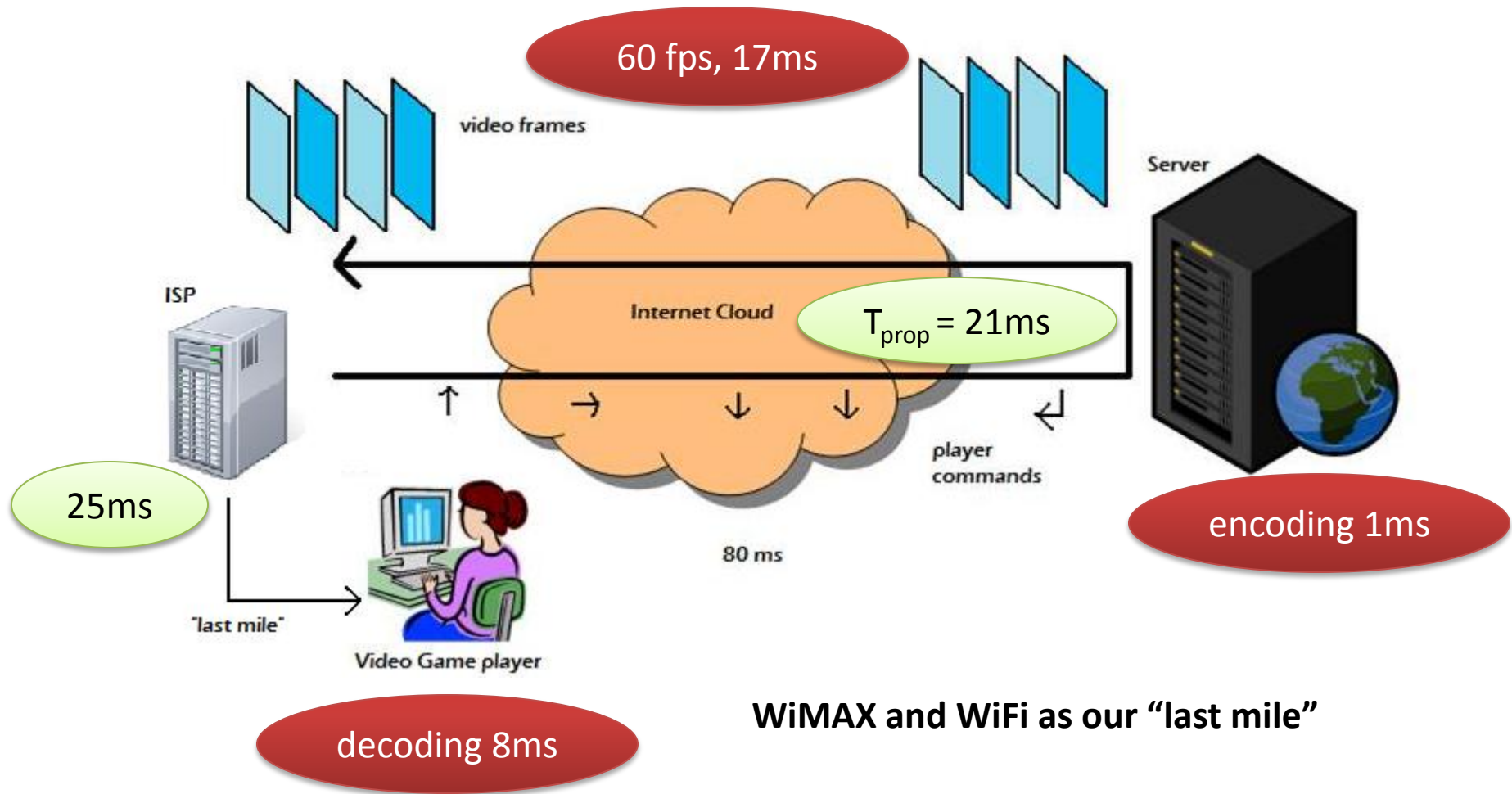
# Presentation Overview

- Motivation - Video Games on Demand (VGoD)
- Project Goals
- Technical Description, with protocols
- Scenarios Design and Simulation Model
- Q & A

# Why Video Games on Demand?

- Cloud computing trend
  - Advanced network infrastructure
  - Increase use of mobility
- New business model
  - Remove the middle man (channels)
  - Developers have more control of their games
- Healthy ecosystem
  - Remove piracy and reselling
  - You can stream music , video, and now “stream” games

# What Happens in 80 ms?



# Why WiMAX and WiFi

- Mobility and popularity
  - Wireless is the trend
- New Technologies (protocols)
  - Research and Improvements
- IEEE Standards
  - Non-proprietary

# Project Goals

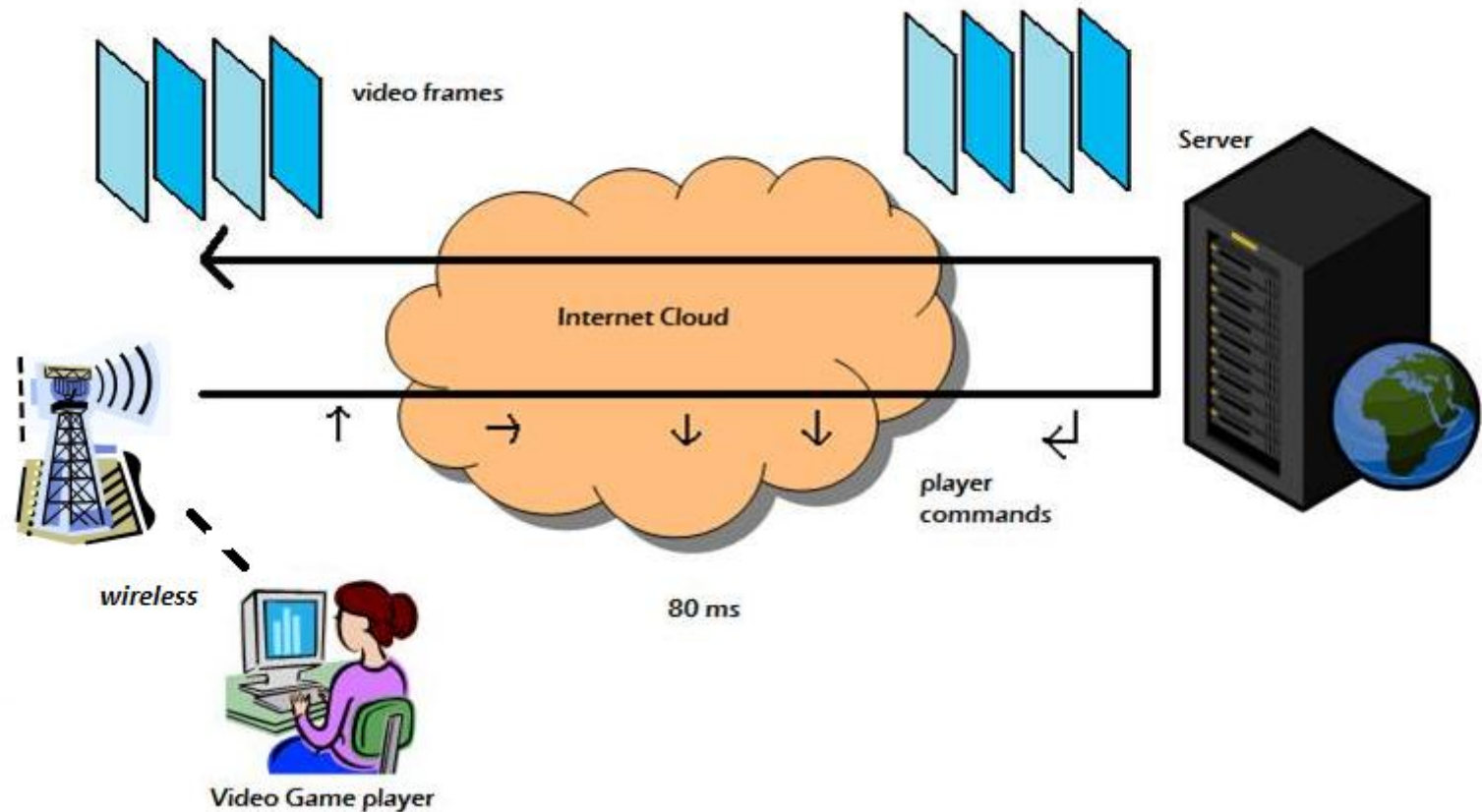
- Create a model and verify the feasibility of this concept
- What effect does a wireless “last mile” have on VGoD?
  - Latency, scalability, distance coverage
- Can we improve the performance?
  - Better routing
  - Modifying standards
- Learn about OPNET simulation tools
- Study WiMAX and WiFi

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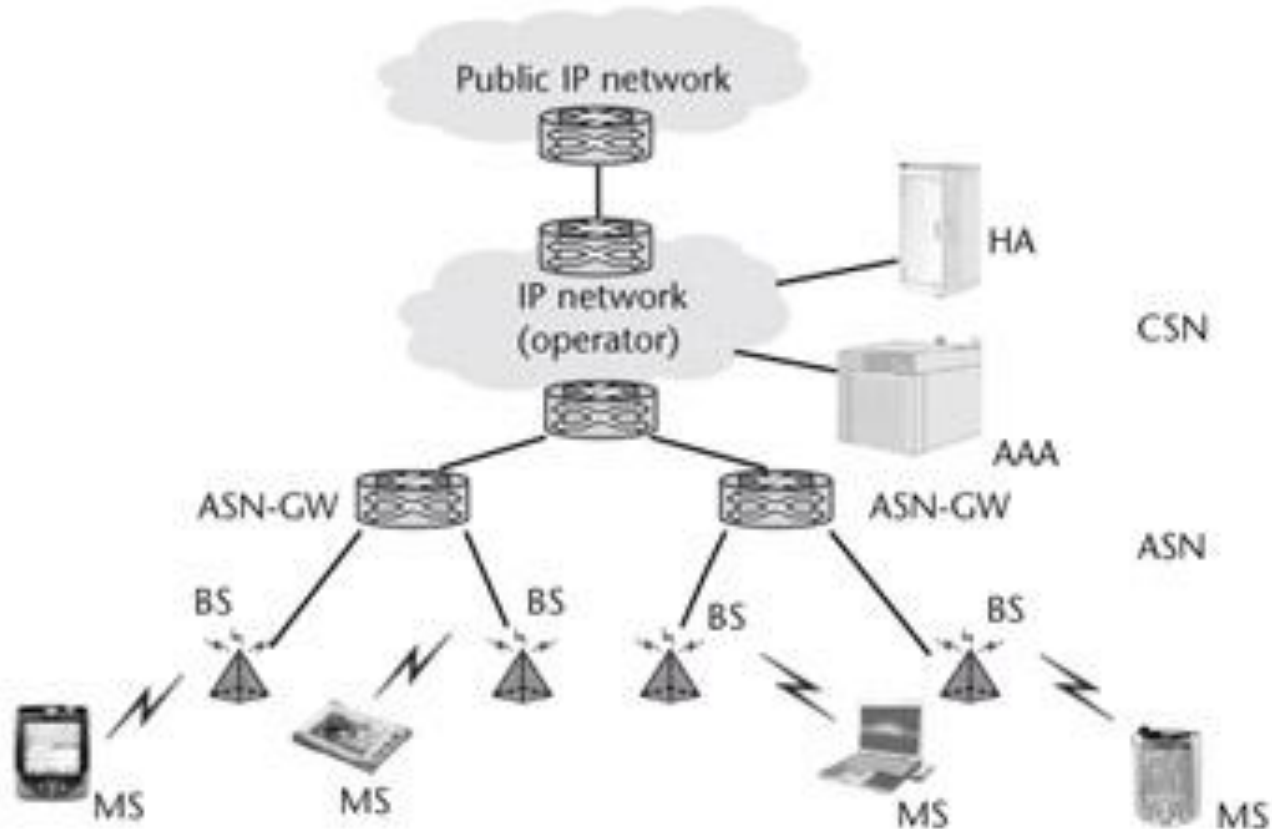
# Video Games on Demand over WiMAX



# Mobile WiMAX 802.16e

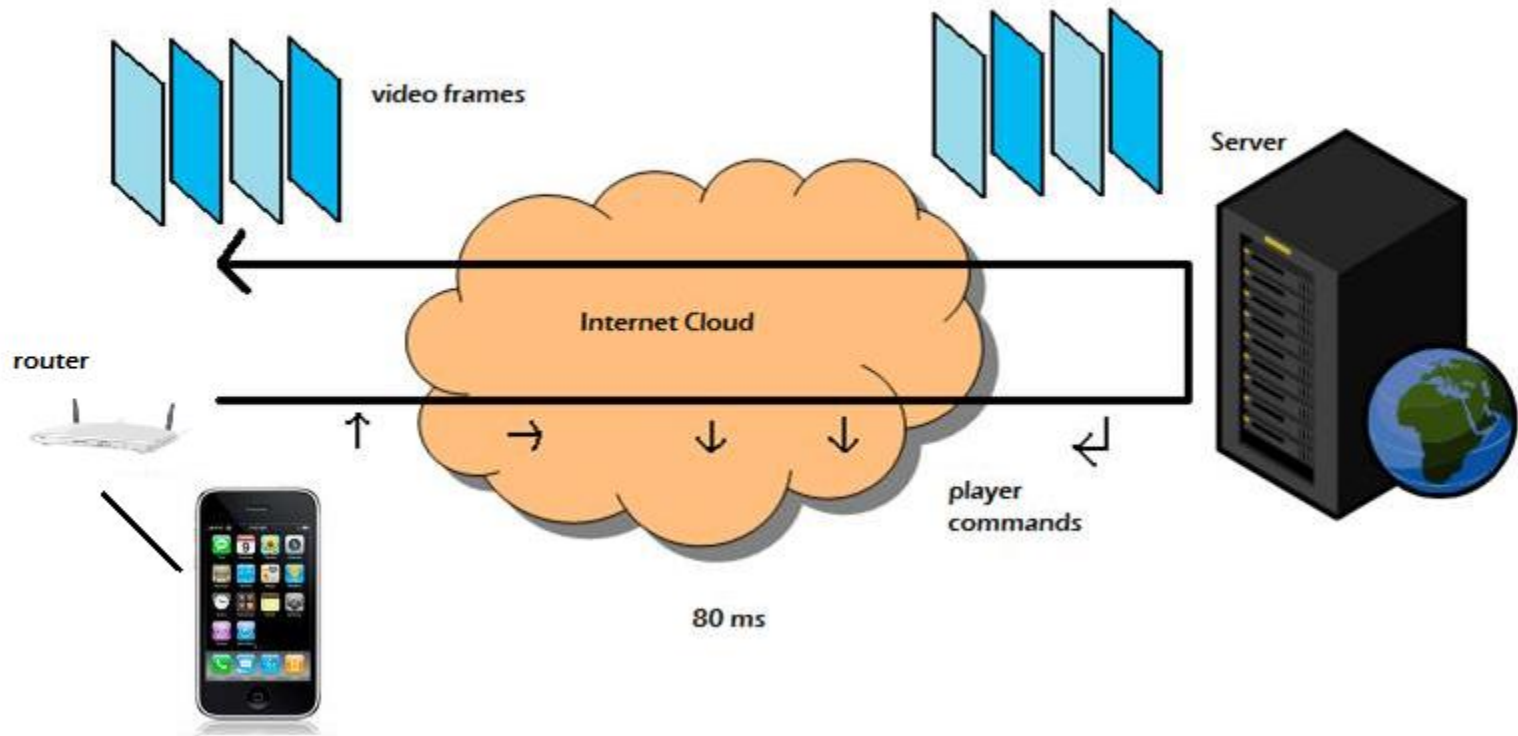
- 8 (NLOS) - 15km (LOS) range, -> high DBP
- 1.5-75 Mbps
- Connection-oriented, uses cell coverage
- High mobility and low-latency
- Deployment
  - Canada: Rogers and Bell
  - US: Clearwire, Sprint Nextel, NextWave

# WiMAX Network Configuration



***“Broadband wireless access and local networks: mobile WiMax and WiFi”***  
by Byeong Gi Lee, Sunghyun Choi.

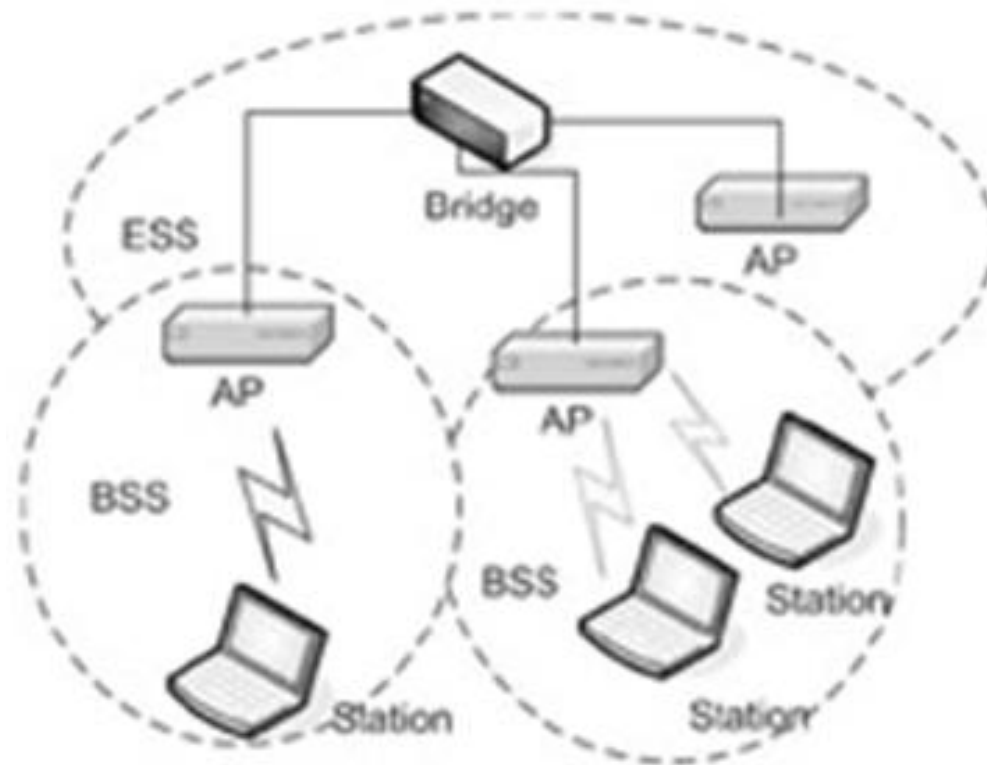
# Video Games on Demand over WiFi



# WiFi 802.11g

- Range of 100m, or less -> low DBP
- Average about 22 Mbps, up to 54 Mbps
- Low mobility
- Backwards compatible with a/b
- Noncommercial/hot spots
- Available for most mobile devices
  - iPhone 3G, most laptops

# WiFi Network Configuration



# Comparing WiMAX/WiFi

	WiMAX	WiFi
Objective	WAN coverage	Wireless extension of LAN
Delay-bandwidth product	High	Low
Distance coverage	8-15 km	< 100m
Setup	Connection-based	Connectionless, contention-based
\$	Commercial	Non-commercial
Mobility	High	Low
Latency	Low	High

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# Model Assumptions and Simplifications

- We use movie frames to model video game frames
  - Terminator 2, MPEG-2, GoP = 12

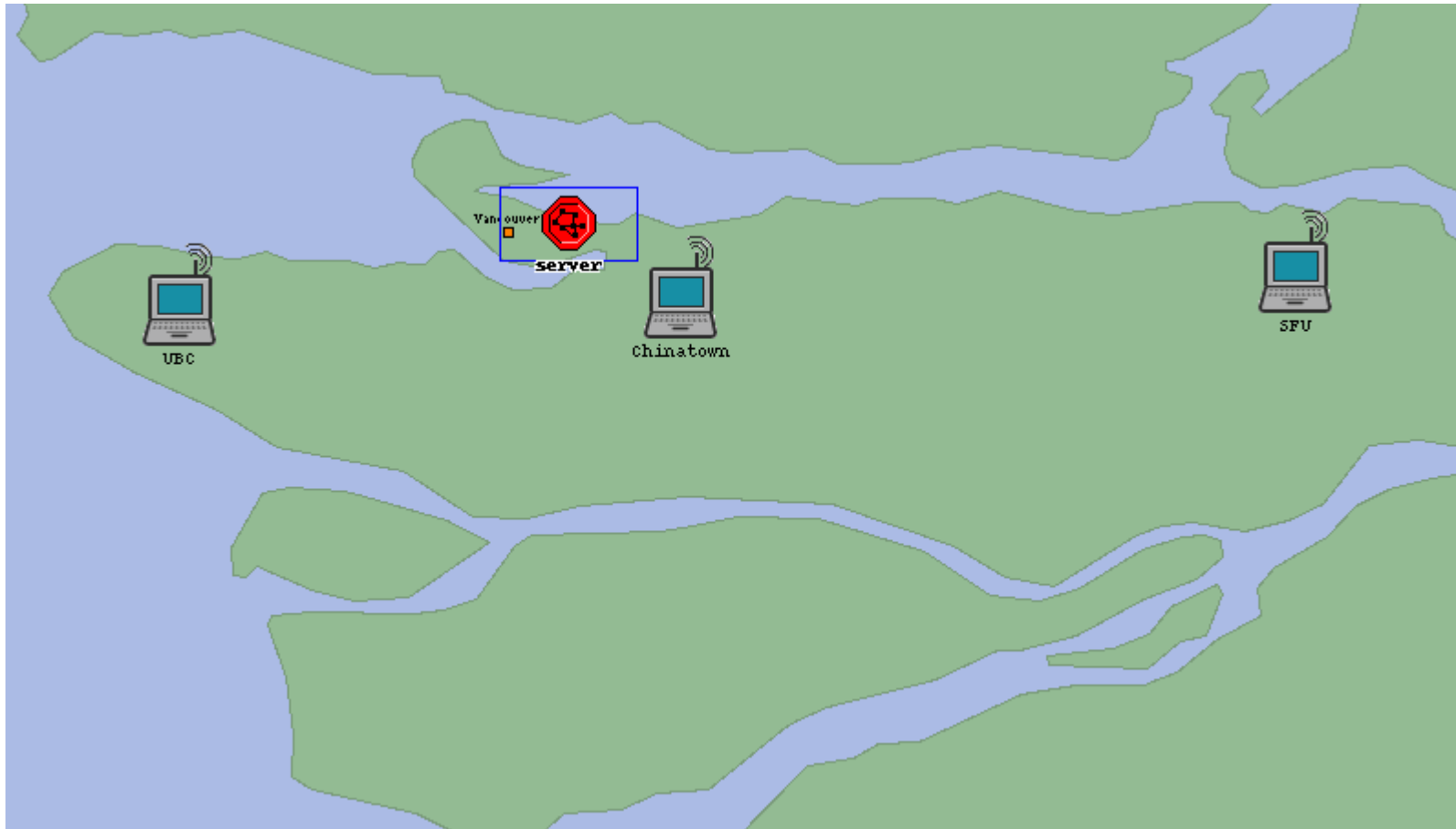
Video games video	Movie frames *
5.0 Mbps for HDTV 60fps, 1080x1920	Terminator 2, QP = 5 5.27 Mbps mean bitrate
1.5 Mbps for SDTV 30fps, 480x720	Terminator 2, QP = 30 1.76 Mbps mean bitrate

- Compression/Decompression time fixed
- Video game traffic is light during the day, and busy during the evenings
  - Opposite to email traffic

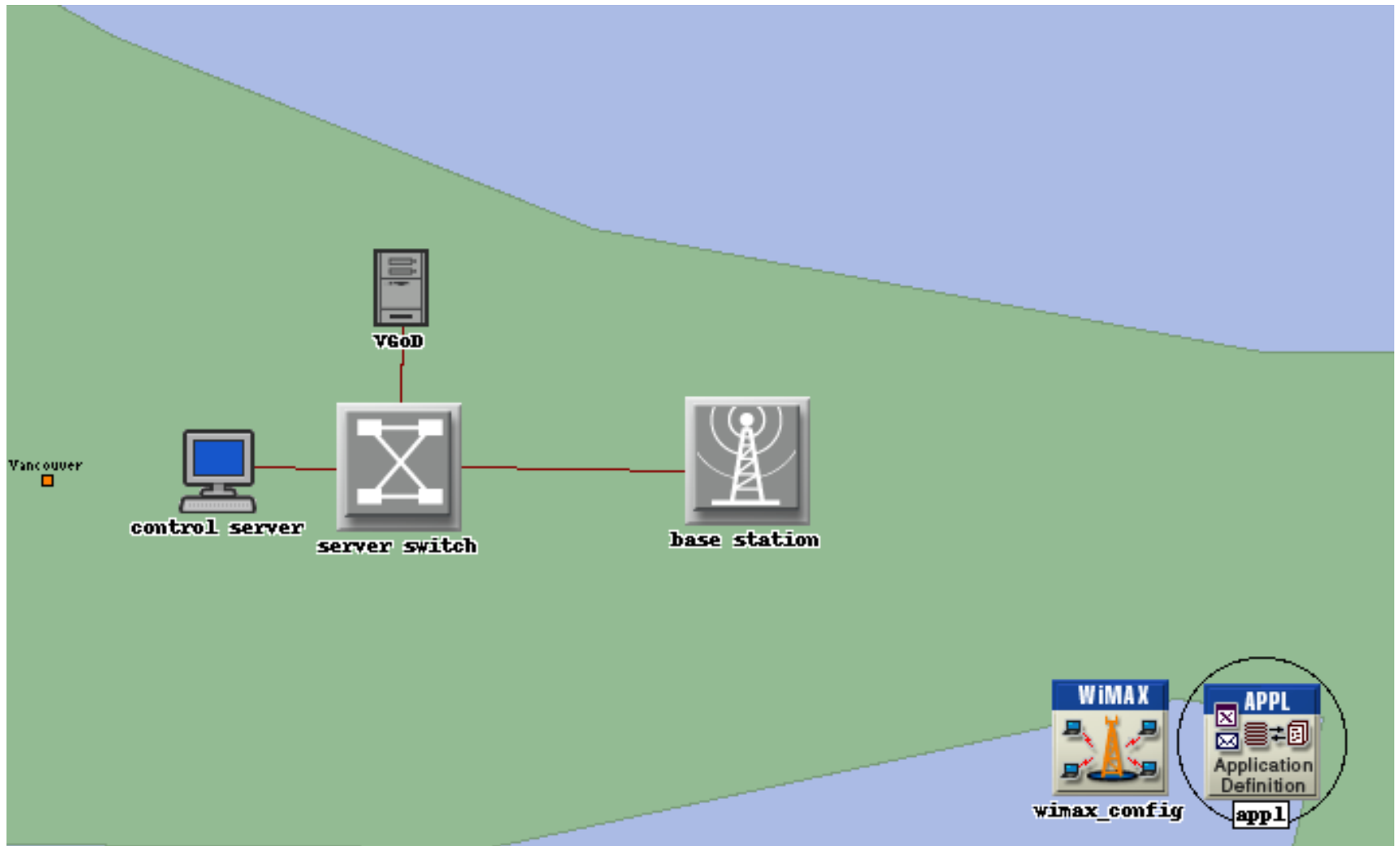
# WiMAX - Scenario 1

- Servers @ Peer 1 Hosting, Harbour Centre
- Base tower installed in downtown Vancouver
- WiMAX mobile user playing video games on the bus at various locations
  - Chinatown, ~ 1km
  - UBC Vancouver, ~10 km
  - SFU Burnaby, ~15km
- Can we sustain throughput for to reach QoE?
- Is end-to-end delay acceptable?

# OPNET Model – Scenario 1



# Server subnet



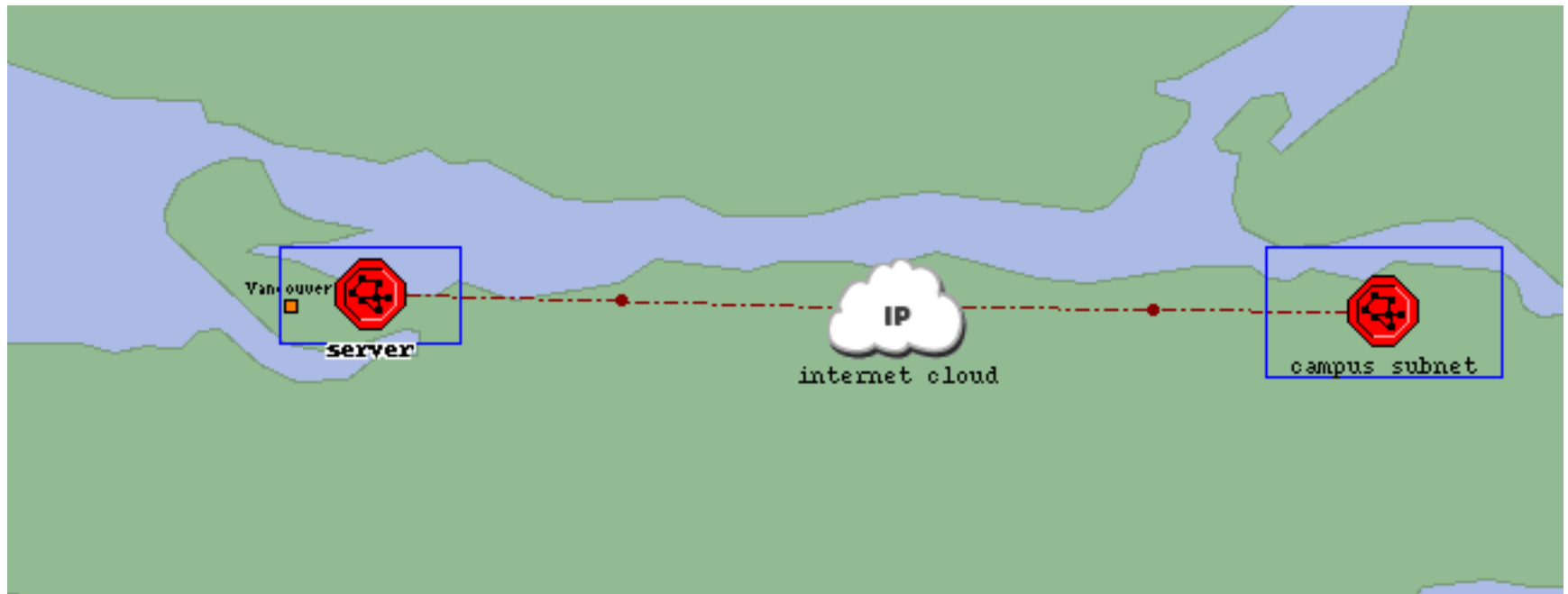
# WiMAX - Scenario 2

- Servers @ Peer 1 Hosting, Harbour Centre
- Base tower installed in downtown Vancouver
- WiMAX mobile users playing video games @ SFU, 15km LOS from base tower
  - One user
  - Few users
  - Many users
- Can we sustain throughput for to reach QoE?
- Is end-to-end delay acceptable?

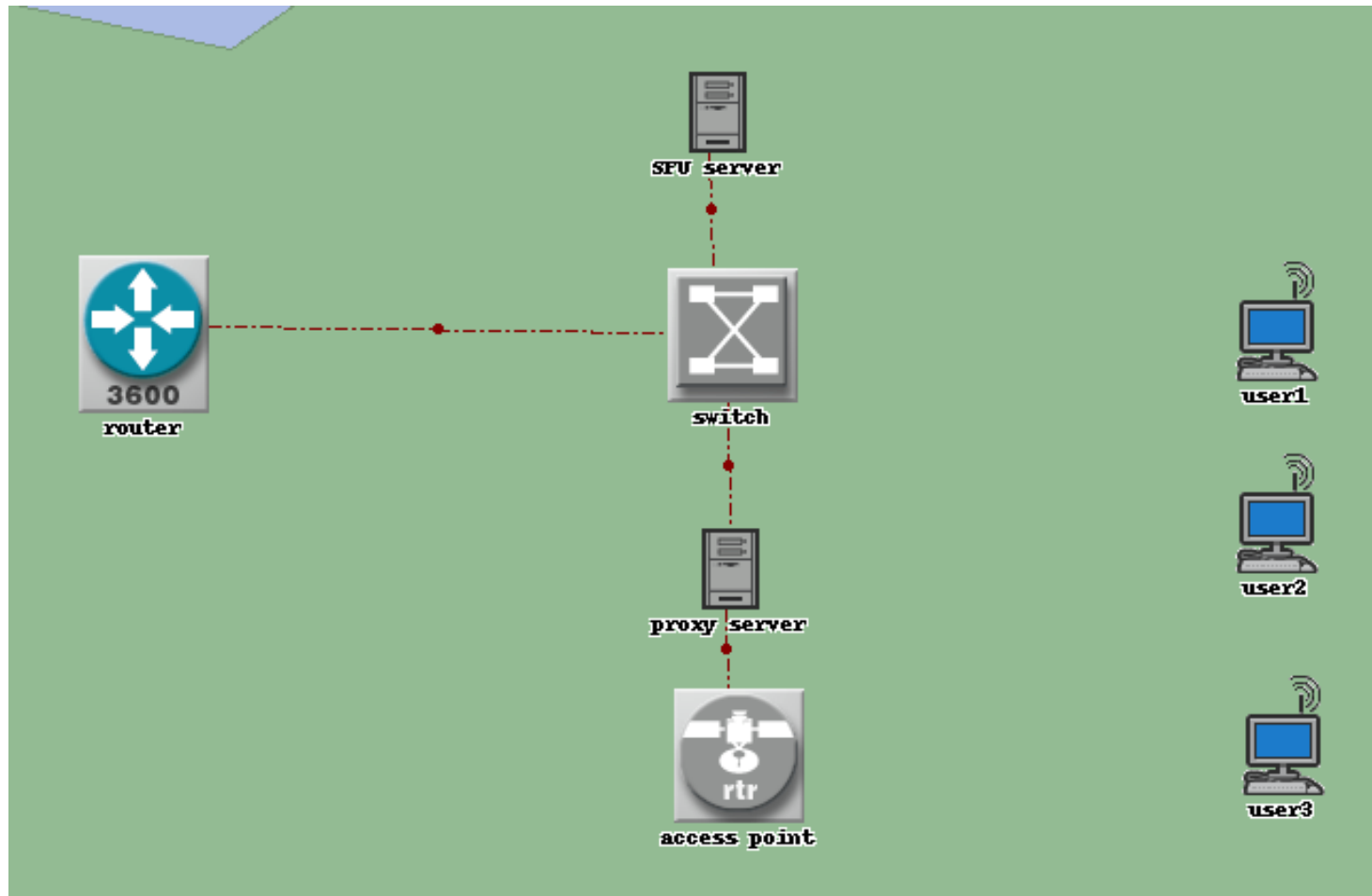
# WiFi - Scenario 3

- Servers @ Peer 1 Hosting, Harbour Centre
- P-P to SFU Burnaby Campus router
- Through proxy server and routers
- APs across campus
  - One user
  - Few users
  - Many users
- Can we sustain throughput for to reach QoE?
- Is end-to-end delay acceptable?

# OPNET Model – Scenario 3



# Campus Subnet





# Discussions

- What conclusions do we want to make?
  - How far can we reach the from base station to user for acceptable QoE?
  - How many users can be sustained?
  - How does moving users affect performance?
- For simulation results, refer to our final report...

# Summary

- VGoD is a revolutionary concept to “stream” video games
- We study mobile WiMAX and WLAN as “last mile” to provide VGoD
- We designed a few scenarios to simulate the effect of delays and scalability of VGoD

# The End

## Questions?

# References

- “Broadband wireless access and local networks: mobile WiMax and WiFi” by Byeong Gi Lee, Sunghyun Choi.
- “WiMAX Tutorial”, Luca Dell’Anna, Nov. 22, 2006
- “Computer Networks: A Top-Down Approach 4/e”. Boston, MA: Pearson/Addison-Wesley, 2008
- OnLive website, [www.onlive.com](http://www.onlive.com)
- “Streaming video content over IEEE 802.16/WiMAX broadband access,” W. Hruday and L. Trajkovic, *OPNETWORK 2008*, Washington, DC, Aug. 2008
- And more ...

# Extra Scenarios – if time permit

- Two servers located at Van. and Tor.
- Base tower chooses best server depending on load to provide best QoE to users
  - Load balancing
- If Tor. Server has a high load, switch to Van. Server, vice versa
  - Fixed load at both server, but 3hr diff.
  - Random loads at both server