Analysis of Video Surveillance over WiMax Networks

Marish Lalwani (mla17@sfu.ca)
Sajith Kulasekare (isk2@sfu.ca)
Website: www.sfu.ca/~mla17/ENSC427.html
Roadmap

- Introduction
- Background information
- Network Topology
- Simulation Scenarios
- Simulation results
- Conclusion
- References
Introduction

➢ Project Idea

Considering WiMAX for video surveillance

➢ Motivation

• Fast growing demand for video surveillance technology in urban areas
• United States alone installs 2-3 million new surveillance cameras every year
• Video surveillance cameras will sky rocket to $6.48 Billion in 2012 up from $435.8 million in 2005
• Wi-Fi and other network technologies restrict the wireless coverage to about 100m
Roadmap

- Introduction
- Background information
- Network Topology
- Simulation Scenarios
- Simulation results
- Conclusion
- References
Background information

What is WiMAX?

- Stand for Worldwide Interoperability for Microwave access also known as IEEE 802.16
- WiMAX can provide broadband wireless access up to 30 miles (50 km) for fixed stations, and 3 - 10 miles (5 - 15 km) for mobile stations
Background information

Why use WiMAX for Video Surveillance?

- WiMAX provides higher throughput of up to 72Mbps and longer wireless coverage
- WiMAX uses scheduling algorithms to provide QOS (Quality Of Service) for time sensitive traffic such as videos
- Unlike WiFi and other wireless technologies that offer little or no data security, WiMAX has a built in data encryption to tighten security of data being transferred
- High end WiMAX systems provide 99.9% availability, with only 5 minutes of downtime per year allowing practically non-stop monitoring and surveillance
Background information

Why use WiMax for Video Surveillance? (Cont.)

- WiMax enables mobile video monitoring which can be used by authorities to monitor crime scenes.
- Video cameras need not be fixed and can be moved and reconnected within minutes, offering higher scalability and flexibility.
Why use WiMax for Video Surveillance?(Cont.)

- WiMax enables mobile video monitoring which can be used by authorities to monitor crime scenes.
- Video cameras need not be fixed and can be moved and reconnected within minutes, offering higher scalability and flexibility.
Background information

• **WiMax Quality of Service (QoS)**
  Measures the capability of a network to provide high value services such as voice and video. The main detractors from good QoS are

  • Packet loss: number of packets dropped
  • Delay: average time of transit
  • Jitter: variation in packet arrival time
  • Throughput: minimum end-to-end transmission rate
# QoS Service Classes

<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
<th>QoS Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>UGS</td>
<td>Support for real-time service flows that generate fixed data packets</td>
<td>Maximum sustained rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum latency tolerance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jitter tolerance</td>
</tr>
<tr>
<td>rtPS</td>
<td>Support for real-time service flows that transport variable size data packets on a periodic basis</td>
<td>Minimum reserved rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum sustained rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum latency tolerance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Traffic priority</td>
</tr>
<tr>
<td>ertPS</td>
<td>Extension of rtPS to support traffic flows such as variable rate VoIP</td>
<td>Minimum reserved rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum sustained rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum latency tolerance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Traffic priority</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jitter tolerance</td>
</tr>
<tr>
<td>nrtPS</td>
<td>Support non real traffic services that require variable size data grants</td>
<td>Minimum reserved rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximum sustained rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Traffic priority</td>
</tr>
<tr>
<td>BE</td>
<td>Support for best-effort traffic</td>
<td>Maximum sustained rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Traffic priority</td>
</tr>
</tbody>
</table>
Roadmap

• Introduction
• Background information
• **Network Topology**
• Simulation Scenarios
• Simulation results
• Conclusion
• References
Network Topology
Roadmap

- Introduction
- Background information
- Network Topology
- Simulation Scenarios
- Simulation results
- Conclusion
- References
Simulation Scenarios

- **Scenario I:**
  1 work station, 1 base station

- **Scenario II:**
  5 work stations, 1 base station

- **Scenario III:**
  1 work station, 1 base station (Uplink modulation scheme changed from 64 QAM to QPSK 3/4)

- **Scenario IV:**
  1 work station, 1 base station (Workstation distance increased from 1km to 30kms)
Roadmap

- Introduction
- Background information
- Network Topology
- Simulation Scenarios
- **Simulation results**
- Conclusion
- References
Simulation Results

- End-to-end Delay for the 4 scenarios

The graph depicts higher delay is achieved as the users are increased from one to five.
Simulation Results

- End-to-end Delay

The graph depicts similar delay is achieved as the distance of the mobile stations is increased from 1km to 30kms and the modulation scheme is set to QPSK for the mobile stations. This implies that QPSK is Robust in nature.
Simulation Results

- Throughput

  - Curves are averaged across a 1 min duration
  - 10kbps – 5Mbps
Simulation Results

• Packets Dropped

The graph depicts the uplink packets dropped when the modulation scheme for the Mobile Station changes from 64-QAM(baseline) to QPSK.
Simulation Results

- Packets Dropped

The graph depicts the uplink packets dropped when the modulation scheme for the Mobile Station is QPSK and the distance is increased to 30km. As we increase the increase not even QPSK being robust is not able mitigate the uplink packets dropped.
Simulation Results

• Jitter – Defined by Packet Delay Variation

• Actual reception time – expected reception time
• Ideal < 20ms
Conclusion

• Various factors affect the QoS of WiMAX
• Packet Loss is a big issue in Video Surveillance
• Modulation scheme does not affect the Packet Loss if the distance of Mobile Station from Base Station is large
• Trade-off between the quality of the application and the delay
References


