

Triple Play Services over Mobile WiMAX



Raj Jain
Washington University in Saint Louis
Saint Louis, MO 63130
Jain@cse.wustl.edu

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These slides are available on-line at:

<http://www.cse.wustl.edu/~jain/wimax/3play.htm>

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Contributors

- ❑ Kemal Ozdemir, Francis Retnasothie,
Logus Broadband Wireless
- ❑ Raj Jain, Chakchai So-In,
Washington University in St. Louis
- ❑ Shyam Parekh, Alcatel-Lucent
- ❑ Alan Moskowitz, MobiTV
- ❑ Krishna Ramadas, Venturi Wireless
- ❑ Mano Vafai, Wichorus

Service Providers, Equipment Vendors, Academic Institution Team

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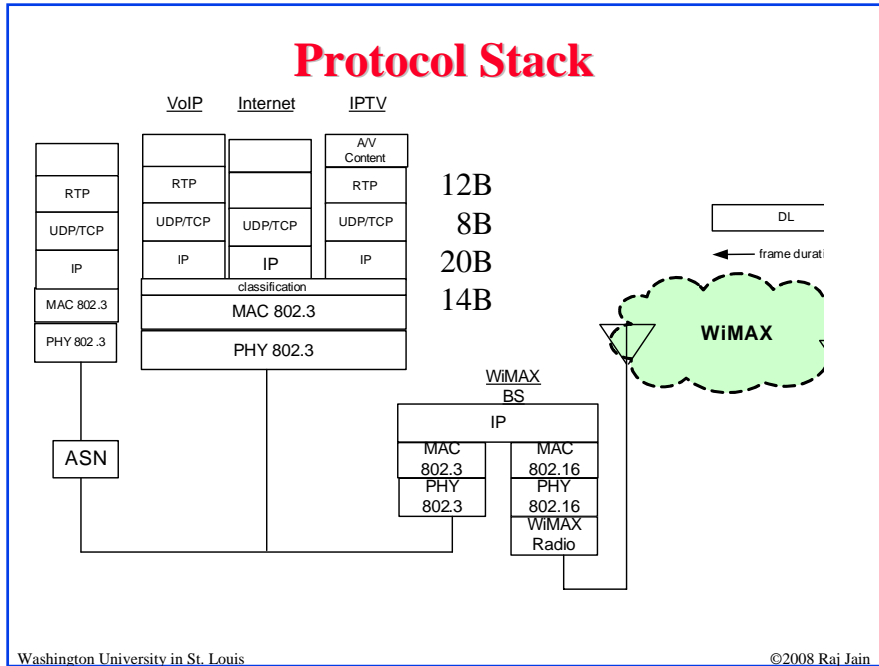
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- ❑ Triple Play: What and Why?
- ❑ Protocol Model and Parameters
- ❑ Factors Affecting Capacity
- ❑ Capacity Estimation

Why Triple Play?

- ❑ Three Key Mobile Services:
 - Voice, Video, and Internet
- ❑ Video and entertainment are key to future growth of broadband – key revenue generators
- ❑ Legacy mobile technologies, designed for voice, have difficulty managing video workload
- ❑ WiMAX Operators need analytical data to plan their capacity and justify their investments



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- ## System Parameters
- Channel width: 10 MHz
 - OFDMA Frame Size: 5 ms
 - Duplexing: TDD
 - DL:UL Ratio = 2:1
 - Subchannelization: PUSC
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Factors Affecting Capacity

- ❑ Location: Terrain, foliage, buildings
 - ⇒ Signal to interference and noise ratio (SINR)
 - ⇒ Modulation and coding schemes
- ❑ Urban/Sub-urban/Rural Regions:
 - Urban ⇒ Higher capacity
 - Rural ⇒ Longer reach
 - Suburban
- ❑ Mobile Speed: High speed
 - ⇒ Doppler shift ⇒ Inter-carrier interference
 - ⇒ Lower MCSs



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Factors Affecting Capacity (Cont)

- ❑ Frequency Band:
 - Lower frequencies have longer reach
 - 700 MHz provides provides larger coverage area than 2.5 GHz ⇒ Good for rural deployments
 - Lower frequencies require larger antenna and antenna spacing ⇒ MIMO difficult
 - Lower frequencies ⇒ Smaller channel width
- ❑ Handoffs: 50 ms for real time applications, 3-10 seconds for non-real-time

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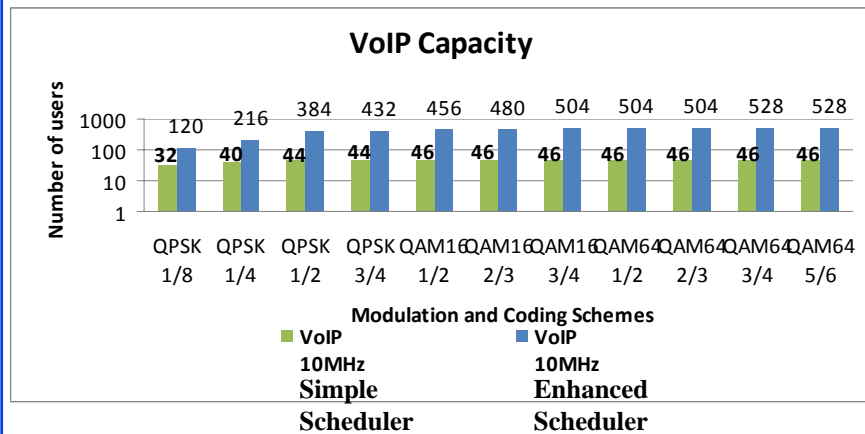
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Factors Affecting Capacity (Cont)

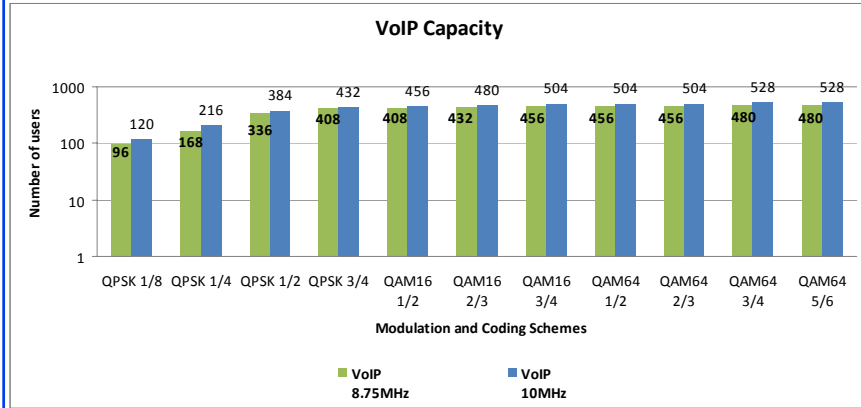
- ❑ Scheduling
 - Key to WiMAX performance and QoS
 - Vendor specific
 - Aggregating small payloads can increase the capacity by an order of magnitude
- ❑ Header compression:
 - Robust Header Compression (RoHC)
 - Header suppression
- ❑ Silence suppression
- ❑ ARQ/HARQ

Effect of Scheduler



- ❑ Proper aggregation and scheduling can increase the performance by an order of magnitude

VOIP Capacity



□ Limited by UL capacity

Video Displays



42" 16x9 SDTV (1 Mbps)



26" 4x3 SDTV (850 kbps)

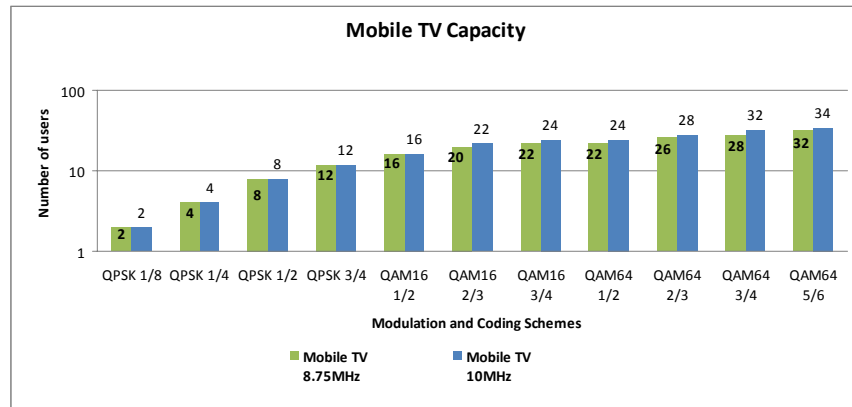


Laptop (700-800 kbps)



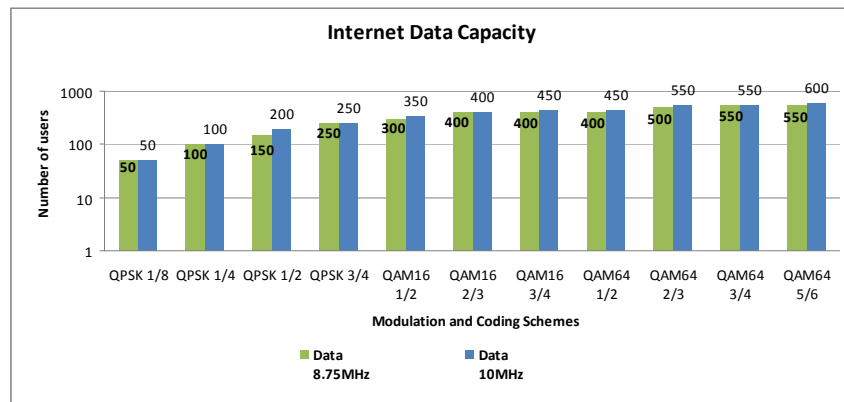
Palmtop (324 kbps)

Mobile TV



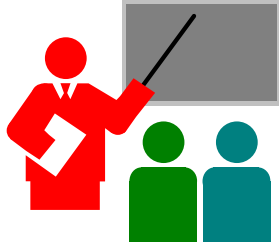
□ H.264 MPEG-4

Internet Data Access



□ 3GPP HTTP workload

Summary



- ❑ WiMAX systems provide a good performance on Voice, Video, and Data
- ❑ Voice traffic generates small packets.
10X performance with Aggregation and scheduling
- ❑ Video throughput distinguishes WiMAX from other legacy mobile networking technologies

References

- ❑ WiMAX Forum White paper, “Triple Play Services including Mobile TV, VoIP, and Internet over Mobile WiMAX Networks,” April 2008.
- ❑ C. So-In, R. Jain, A. Tamimi, “Capacity Estimation of IEEE 802.16e Mobile WiMAX Networks,” Submitted to IEEE Communications Magazine, April 2008.
- ❑ C. So-In, R. Jain, A. Tamimi, “Seasonal ARIMA Models of Video Traffic for Mobile WiMAX and Other Wireless Broadband Access Technologies,” Submitted to ACM Multimedia 2008 conference, April 2008.