Analysis of Voice over IP performance on Wi-Fi Networks

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Overview

- Background Information
- Motivation
- Overview of Related Work
- Scenarios and Test Criteria
- Results
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- Future Work
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Background Information: VoIP

- Digitization of voice streams in a packet-switched network
- Transmission of packets over IP-based packet networks
- Quality of VoIP needs to be compared to cellular networks
- Determine if it has same advantages
- Parameters affecting a VoIP call include:
  - Packet end-to-end delay
  - Jitter
  - Packet loss
  - MOS (Mean Opinion Score)

Background Information: Wi-Fi

- Allow for wireless local area networks (WLAN)
- IEEE 802.11 protocols:
  - 802.11b: 11(Mbps), range up to 140m
  - 802.11g: 54(Mbps), range up to 140m
  - 802.11n: 160(Mbps), range up to 250m
- Benefits:
  - Mobility
  - Speed
  - Availability
- Issues:
  - Packet loss
  - Performance proportional to distance from access point
  - Requires multiple access points

Background Information: Wi-Fi Devices

- Wireless Access Point (WAP)
- Wireless Repeaters
- Wireless Routers
- Wireless Network Bridges
- Laptops
- Mobile phones

Background Information: VoIP over Wi-Fi

- Delay characteristic and quality of VoIP changes considerably
- Packets transmitted over a 802.11g network
- The new IEEE 802.11n technology can increase the covered range

Motivation

- Mobiles use expensive restrictive plans
- Wi-Fi increasing in availability
- Mobile phones with embedded Wi-Fi
- Free Wi-Fi Hotspots vs. paid data plans
- Low cost VoIP services
- Long distance and local calling



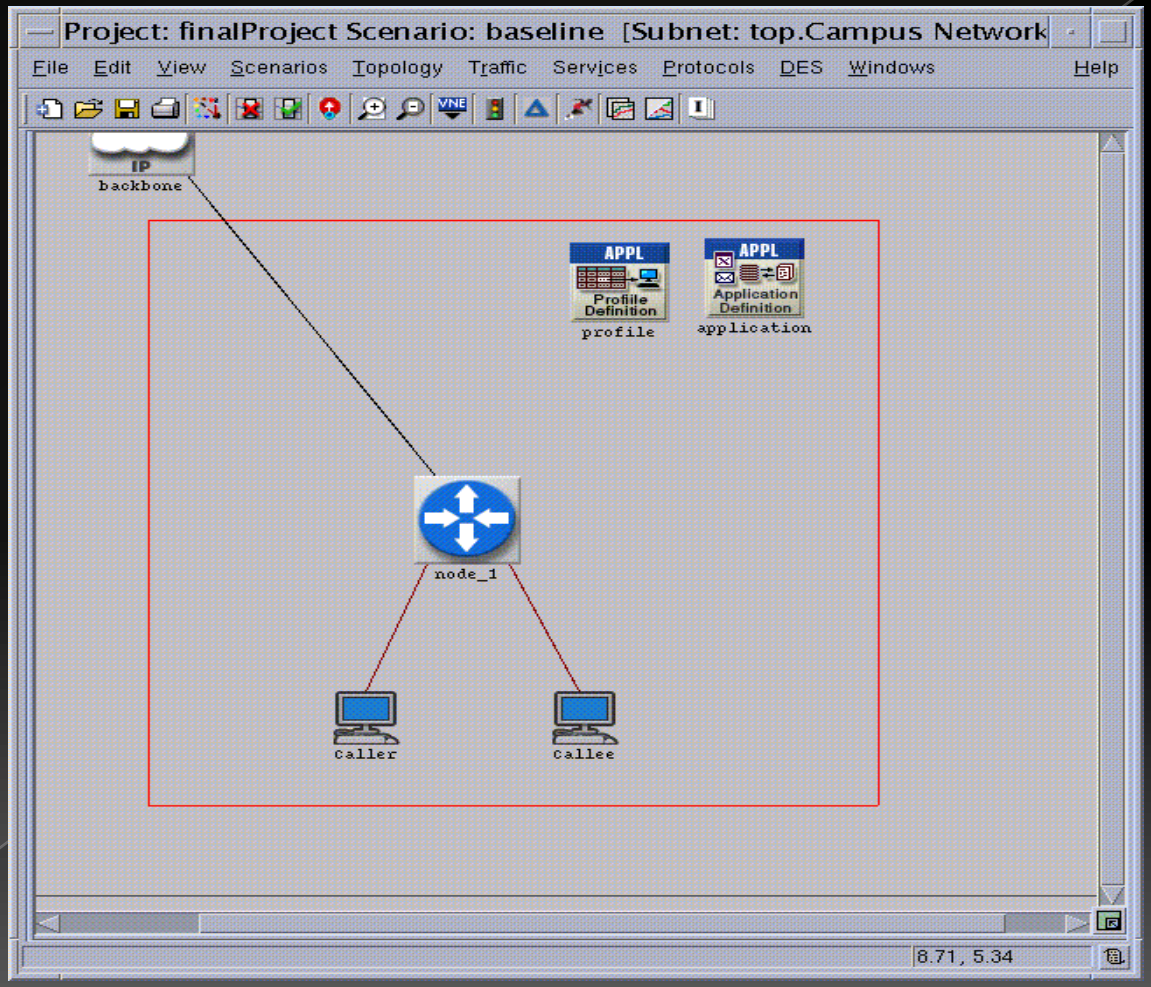

Overview of Related Work

- VoIP used worldwide
- Commercial services widely available:
  - Skype
  - Vonage
  - Voip.com
  - and more…
- Large user base

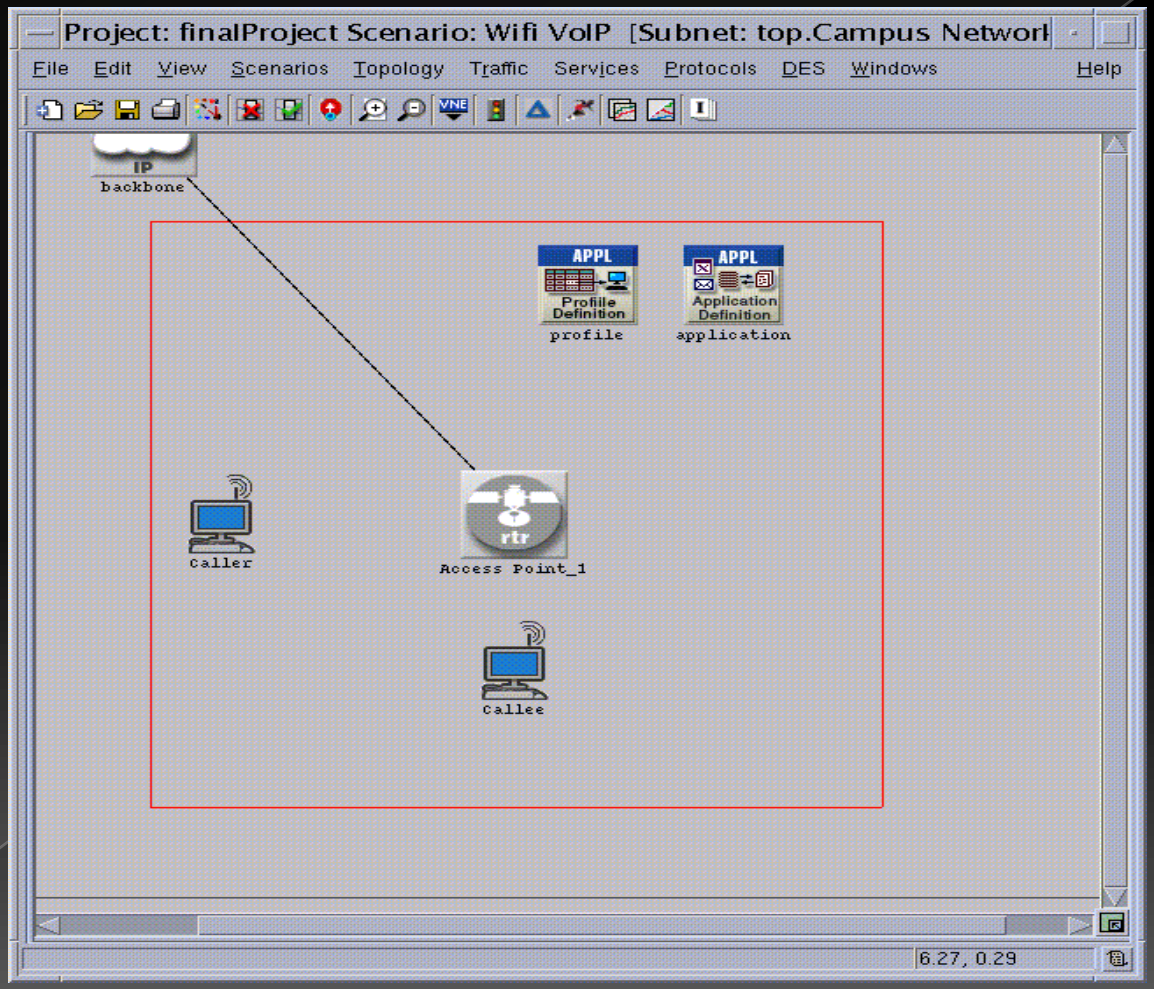
Scenarios and Test Criteria

- Three Scenarios:
  - Baseline Ethernet
  - Wi-Fi
  - Wi-Fi two subnets
- Four Test Criteria:
  - Jitter
  - End-to-End delay
  - Packet Loss
  - MOS (Mean Opinion Score)

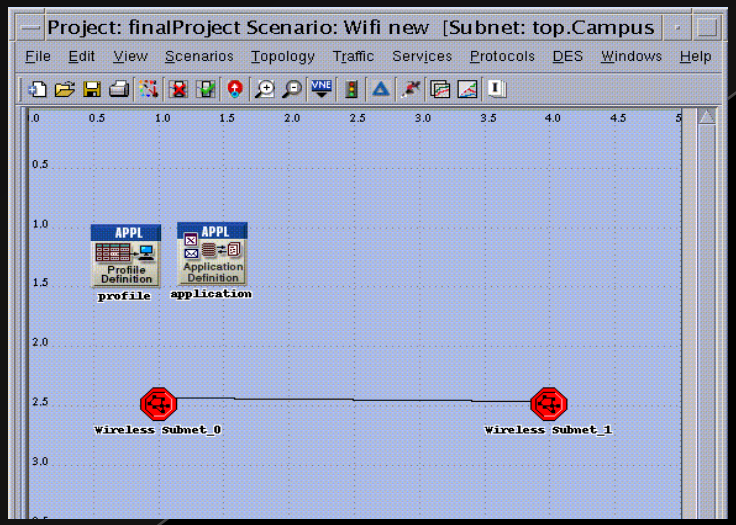
Scenario: Baseline

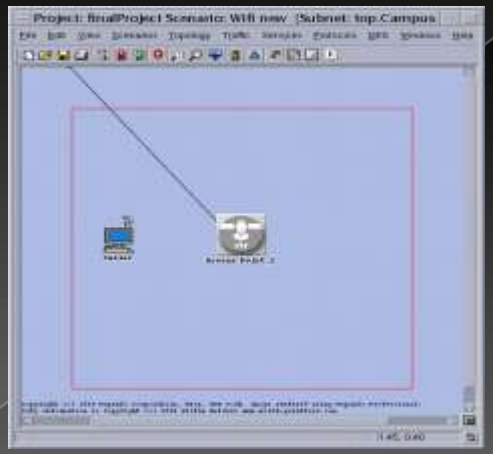


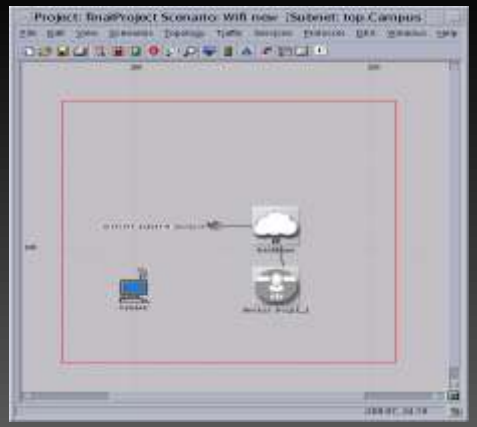
Scenario: Wi-Fi (fixed nodes)



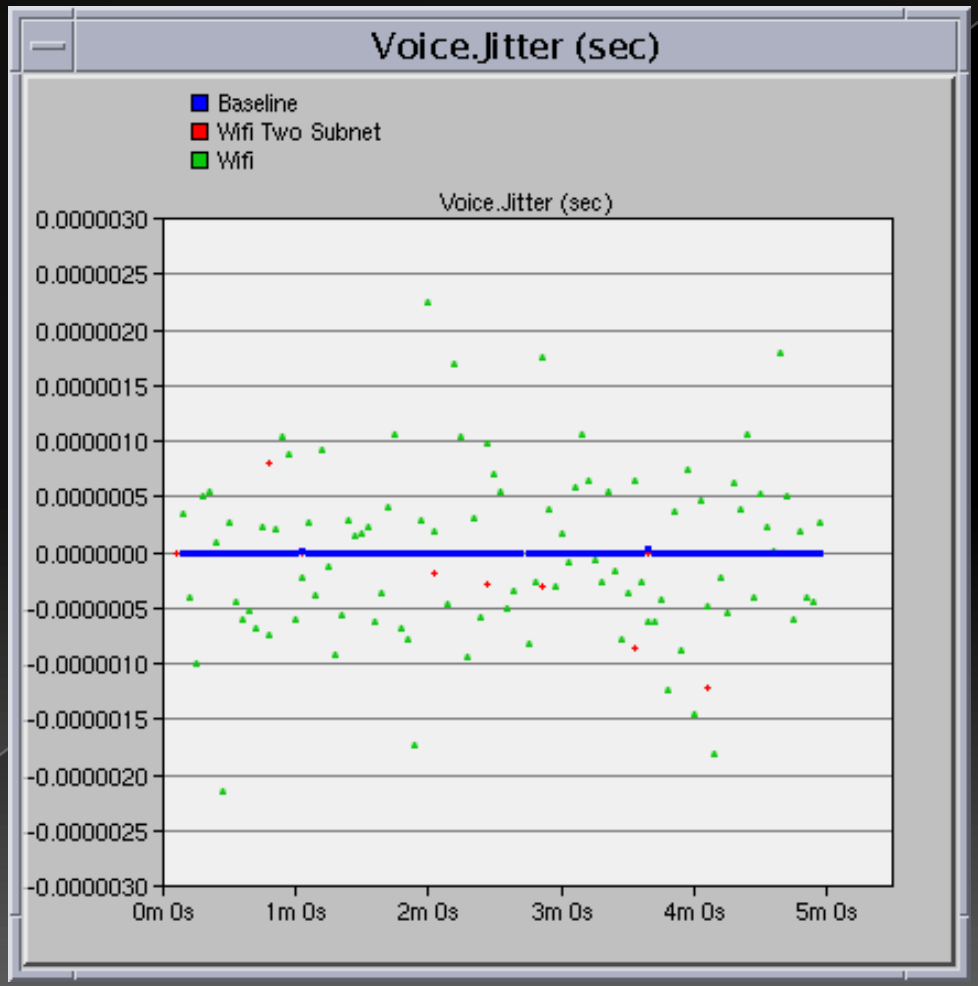
Scenario: Wi-Fi (two subnets)



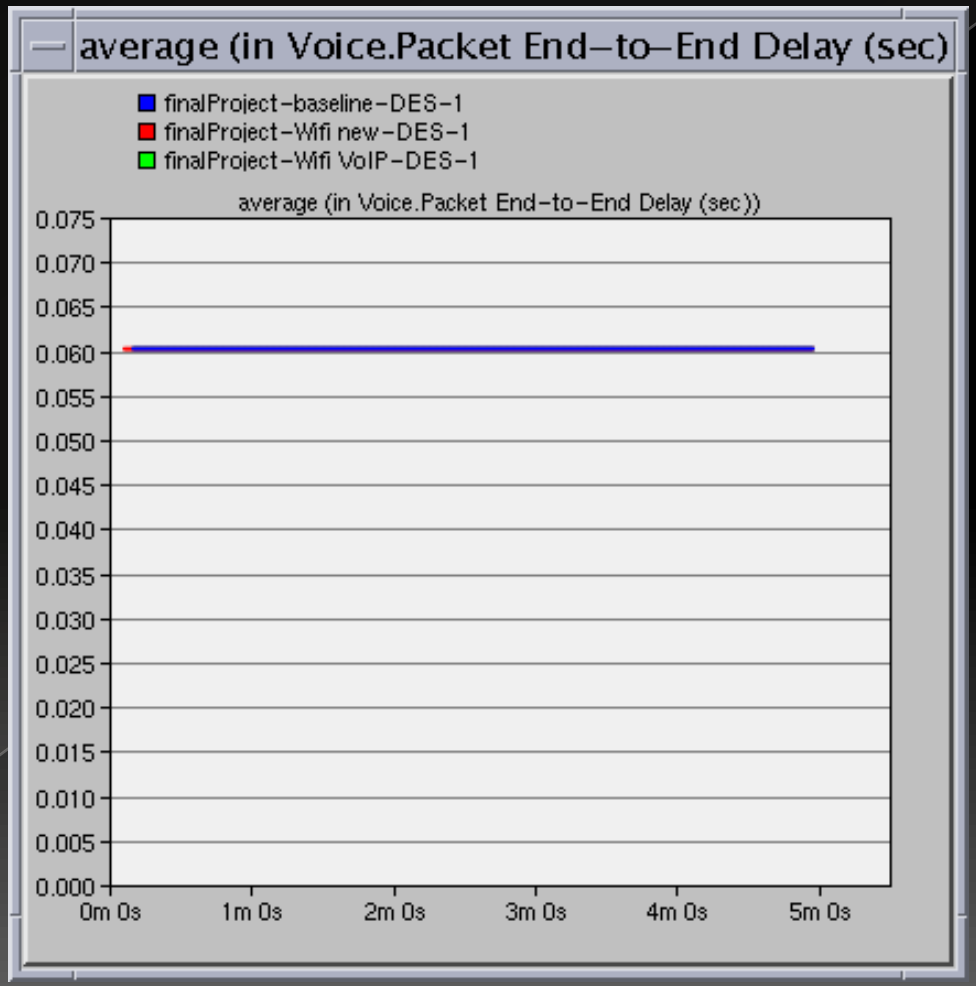




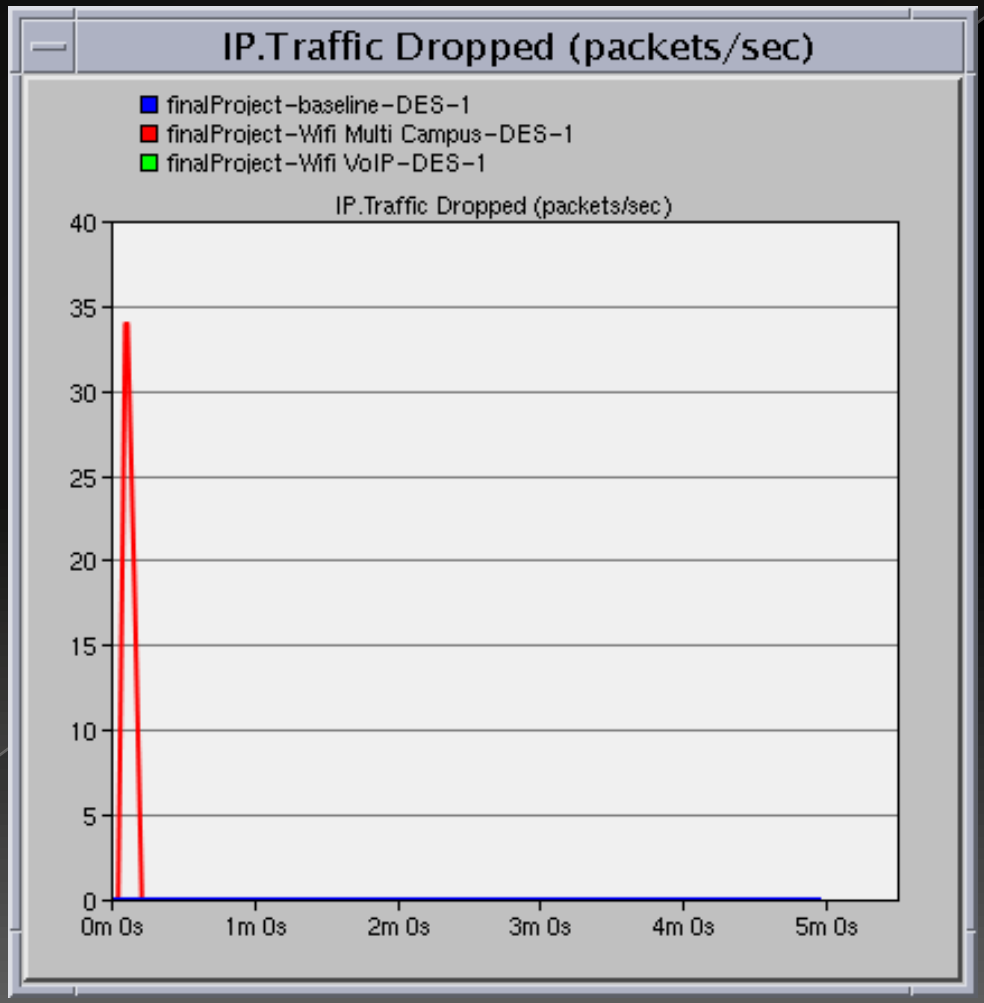
Results: Jitter



Results: End-to-End Delay



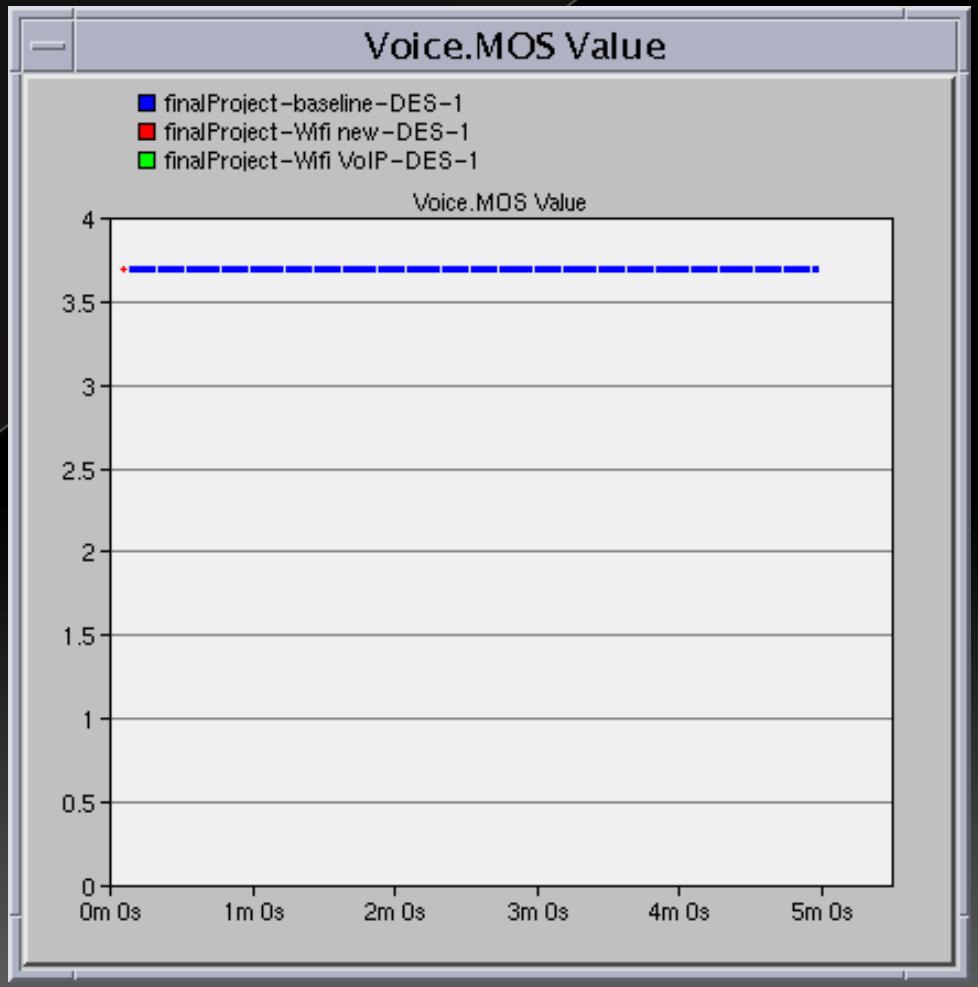
Results: Packet Loss



Results: MOS

MOS	Quality	Impairment
5	Excellent	Imperceptible
4	Good	Perceptible but not annoying
3	Fair	Slightly annoying
2	Poor	Annoying
1	Bad	Very annoying

MOS Values [7]



Conclusion

- Setup typical Wi-Fi VoIP scenarios
- Measured VoIP quality parameters
- Wi-Fi scenario had:
  - Same end-to end delay as baseline
  - More jitter than baseline
  - Similar packet loss as baseline
  - Same MOS value as baseline

Future Work

- Mobile nodes
- Traffic congestion
- VoIP on Wi-Fi mesh networks
- 802.11n protocol implementation

References

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Questions