On Improving Voice Capacity in 802.11 Infrastructure Networks

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May 2005

Capacity of 802.11?

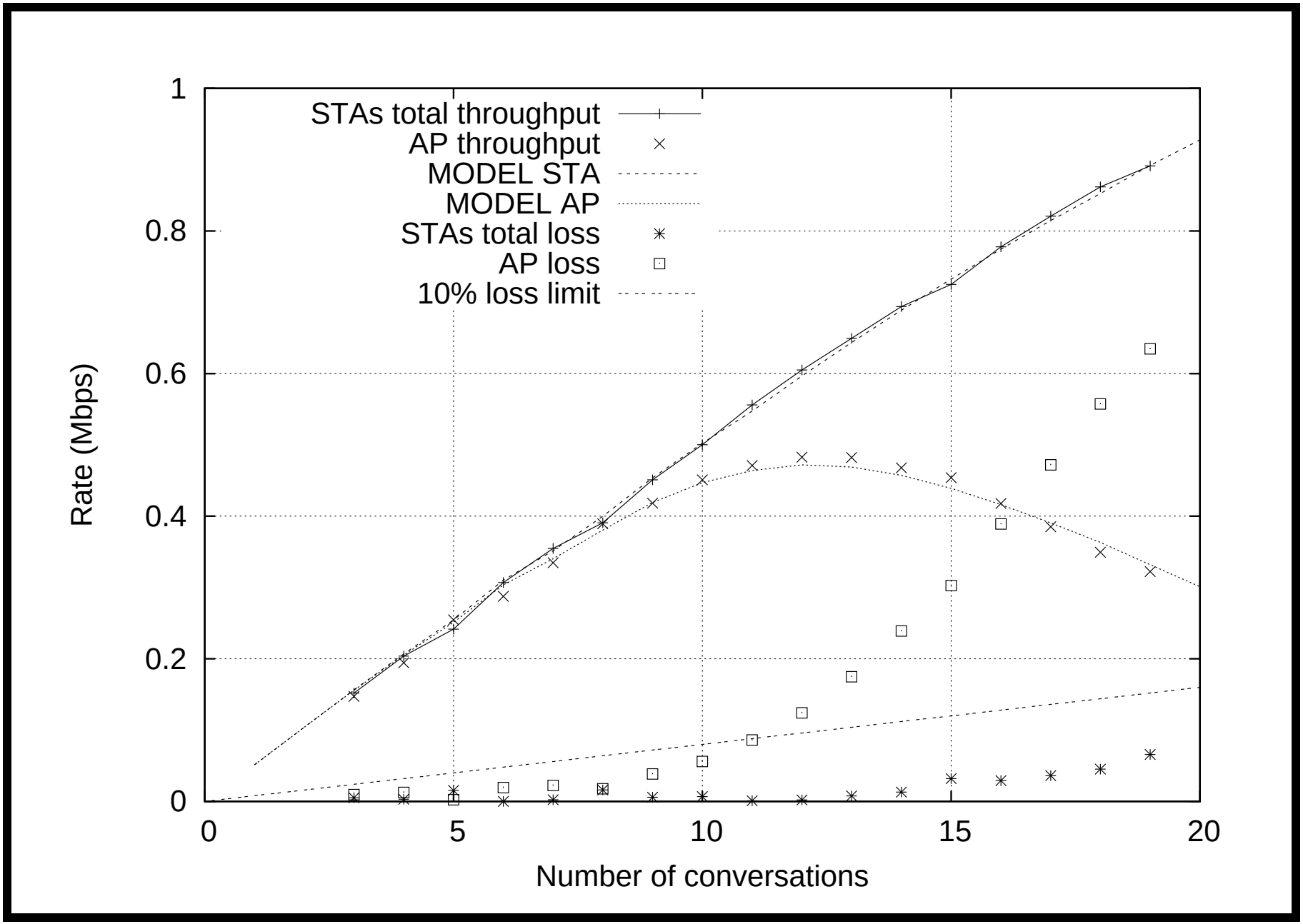
- 802.1b network, 11Mpbs data, 1Mbps basic.
- Want to send 80 bytes data.
- Overhead of headers (UDP, IP, MAC, PHY), interframe spacing (DIFS, SIFS) and MAC ACK.
- Takes $651\mu s$ for rate $80B/651\mu s = 0.98Mbps$.
- @64Kbps a call, that's 15.4 calls.

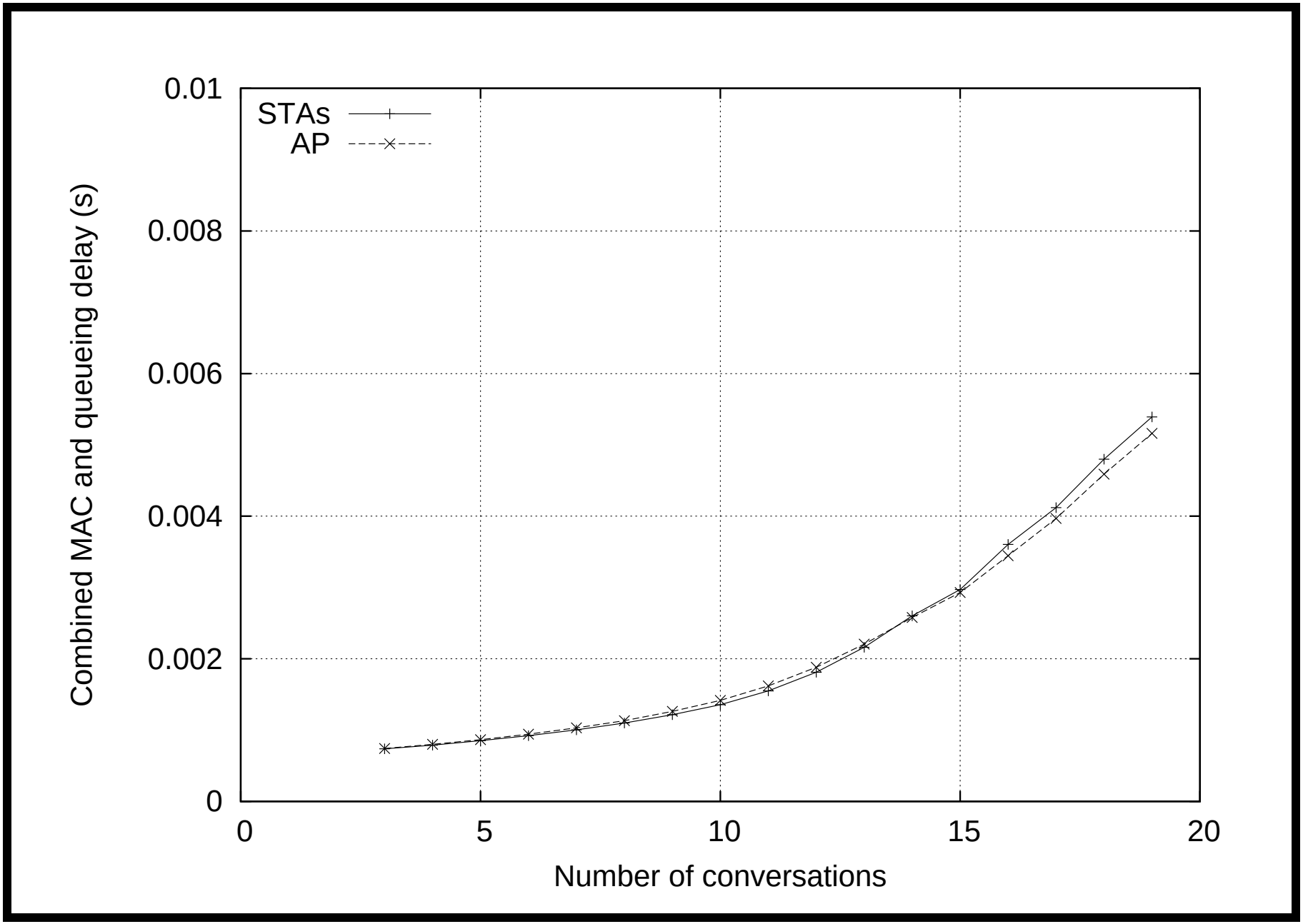
(Calculation from Capacity of an IEEE 802.11b Wireless LAN Supporting VoIP, Hole and Tobagi, ICC 2004).

In practice?

- Network with Access Point (AP).
- One end of call in wireless network.
- One end of call in wired network.
- Silence supression.

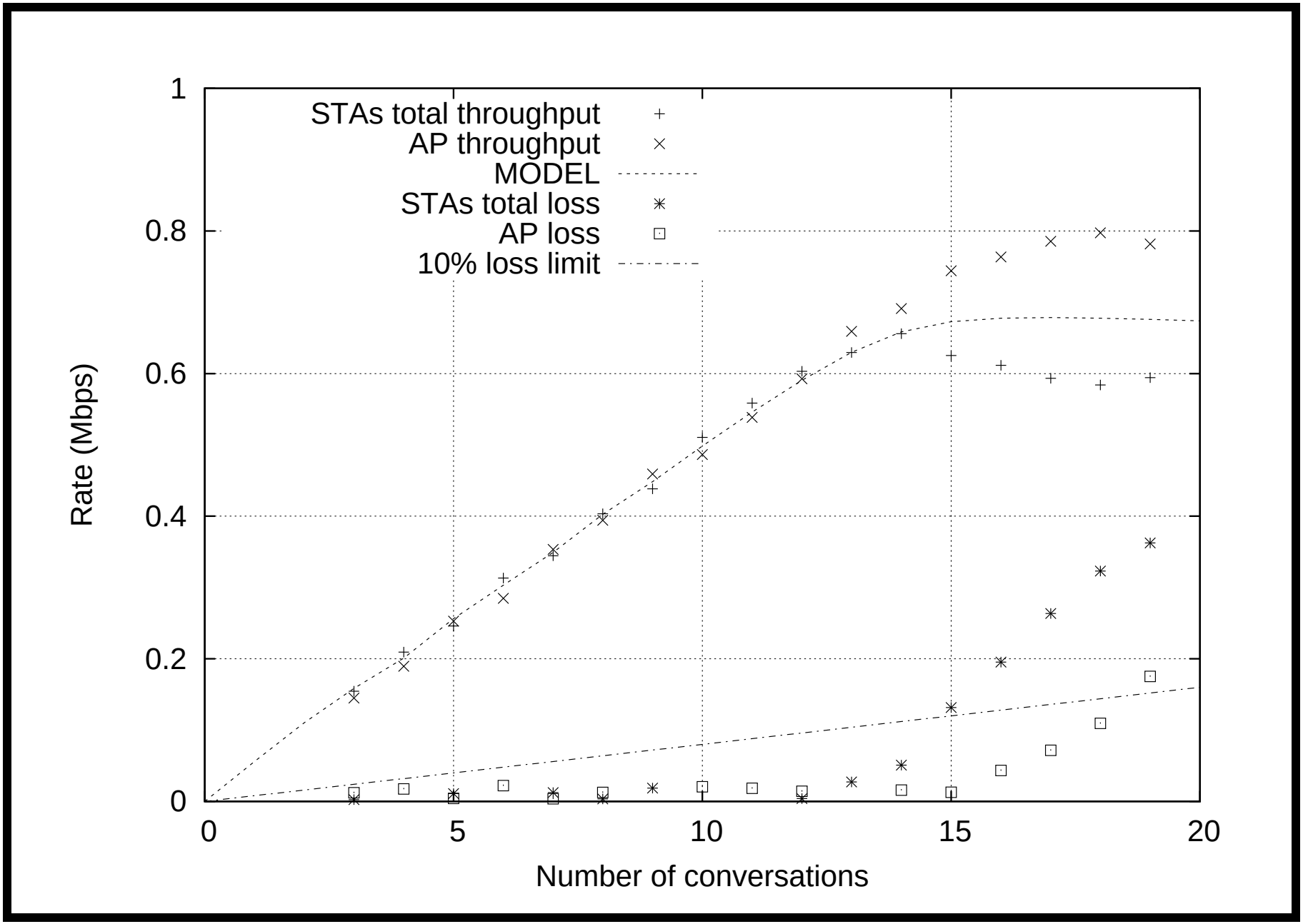
Want to model/simulate CSMA/CA system in terms of simple throughput/delay.


STAs total throughput
AP throughput
MODEL STA
MODEL AP
STAs total loss
AP loss
10% loss limit
Rate (Mbps)
Number of conversations
0
0.2
0.4
0.6
0.8
1
0
5
10
15
20


STAs
AP
Combined MAC and queueing delay (s)
0.01
0.008
0.006
0.004
0.002
0
0
5
10
15
20
Number of conversations

Observations

- ≈ 4 calls short of limit.
- AP is falling behind.
- In saturation, MAC is per-station fair.
- AP carries half traffic, MAC assigns $1/(n+1)$.
- Use 802.11e TXOP to fix.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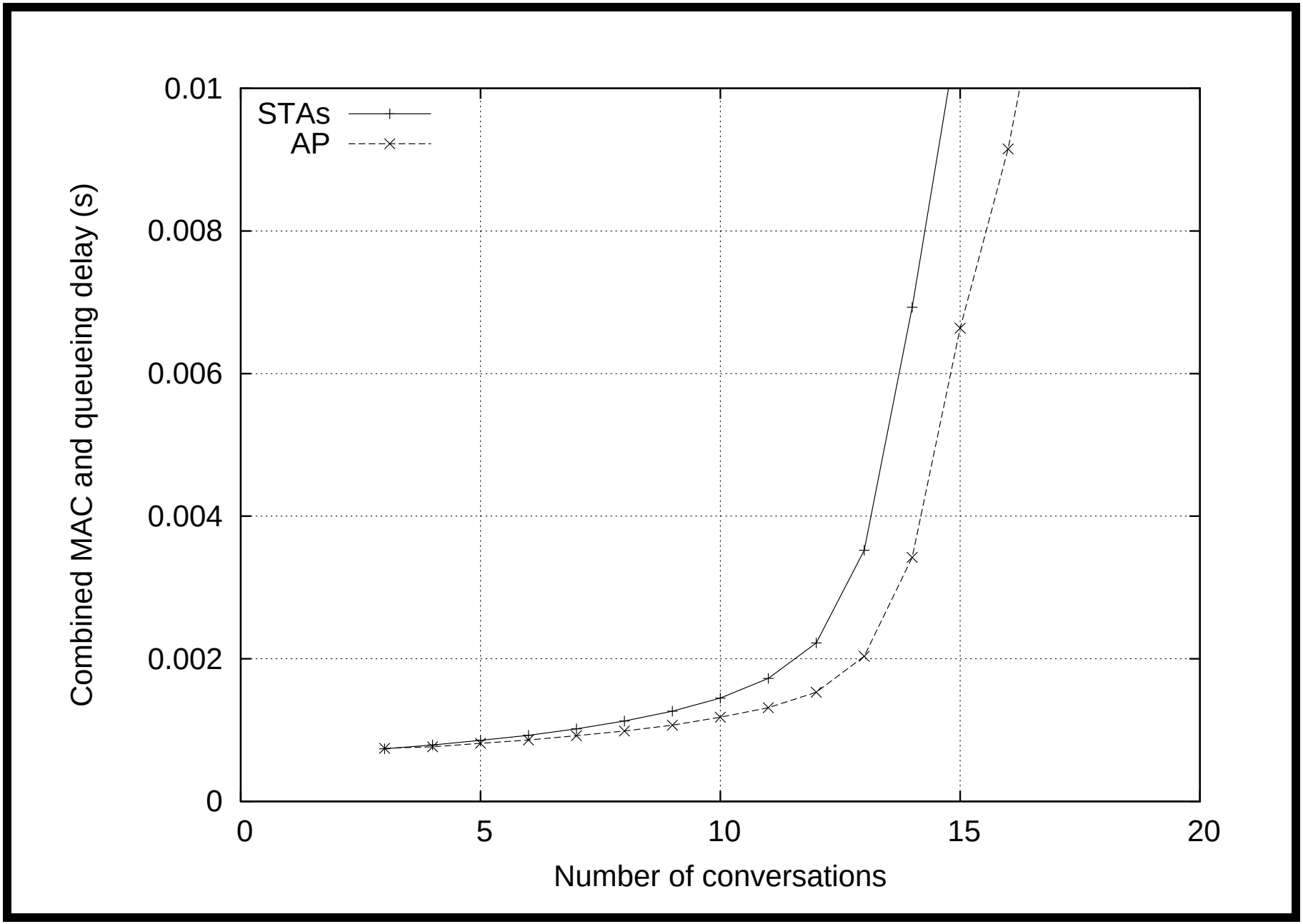
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Observations

- Simple parameter adjustment.
- Could determine active calls from queue.
- Large TXOP lets AP get ahead when overloaded.
- Large TXOP might give large jitter, factor with CWmin.

Further work

- Combining voice and data with 802.11e.
- Analytic model including CWmin, AIFS and nonhomogenious traffic.
- Experimental validation using small 802.11e testbed.