University of Würzburg
Informatik III (Distributed Systems)
Rastin Pries

Performance of VoWLAN with and without Header Compression

Rastin Pries

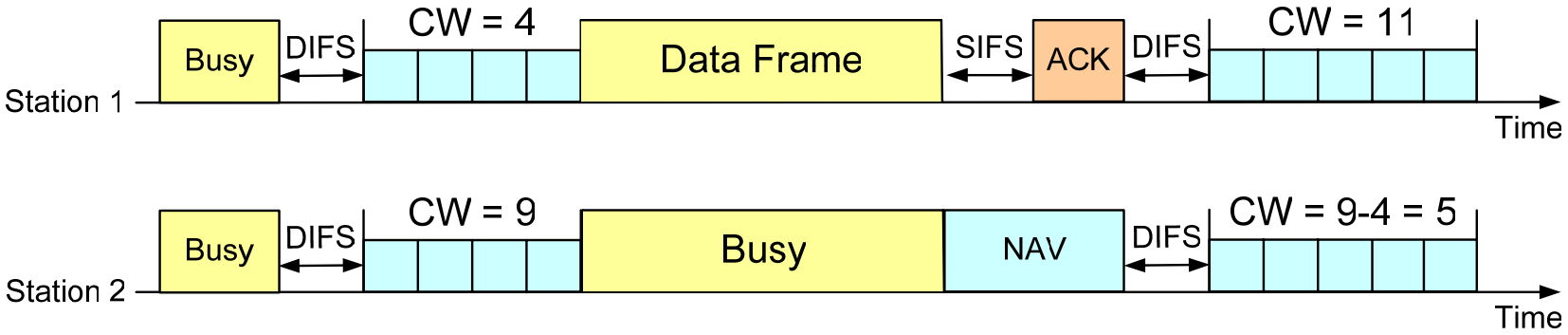
www-info3.informatik.uni-wuerzburg.de

Outline

- The basics of the WLAN technology
- Results of WLAN simulation studies with/without QoS extension
- The basics of the header compression
- Results of simulation studies with header compression
- Conclusion

Access Mechanism for the Wireless Medium

- Distributed Coordination Function (DCF) (→ CSMA-CA)
  - Stations have to equally compete for access to the medium
  - Acknowledgment scheme is used for error indication



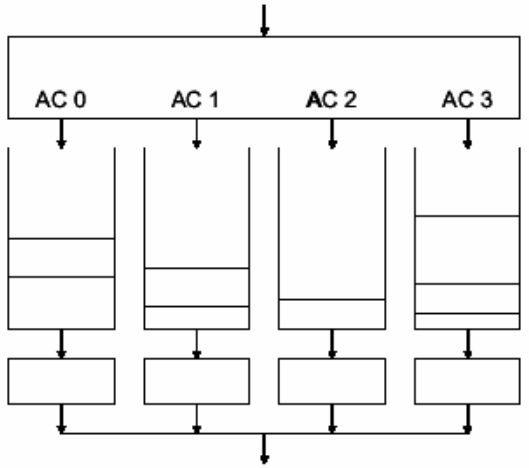
	IEEE 802.11b	IEEE 802.11g
DIFS	50 µs	50 µs
CWmin	31	15
CWmax	1023	1023
Slot Time	20 µs	9 µs

WLAN QoS MAC Protocol (IEEE 802.11e)

- HCF – Hybrid Coordination Function
  - EDCA – Enhanced Distributed Channel Access
  - HCCA – HCF Controlled Channel Access

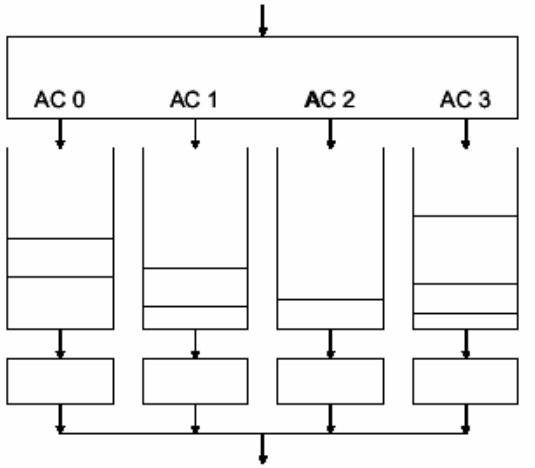
- Service Differentiation with ToS Bit in IP Header

User Priority	802.1D Designation	AC	Designation (Informative)
0	Background (BK)	0	Best Effort
1	-	0	Best Effort
2	Best Effort (BE)	0	Best Effort
3	Excellent Effort (EE)	1	Video Probe
4	Controlled Load (CL)	2	Video
5	Video (VI)	2	Video
6	Voice (VO)	3	Voice
7	Network Control (NC)	3	Voice



Enhanced Distributed Channel Access

- EDCA
  - DIFS → AIFS[AC X]
  - CWmin[AC X], CWmax[AC X]
  - TXOPLimit [AC X]



IEEE 802.11b

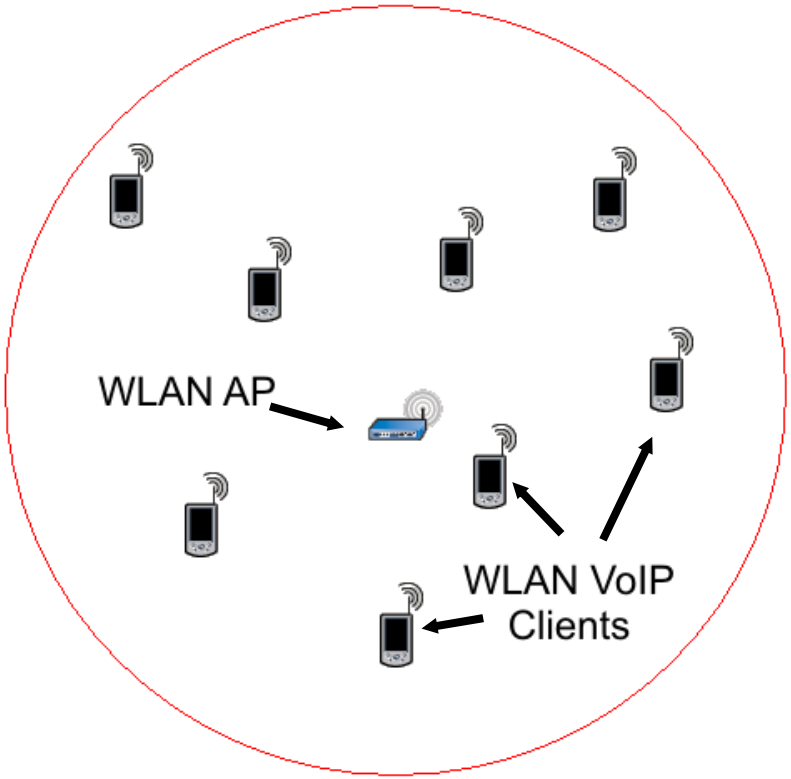
AC	CWmin	CWmax	AIFS [s]
0	31	1023	150 µs
1	31	1023	70 µs
2	15	31	50 µs
3	7	15	50 µs

IEEE 802.11g

AC	CWmin	CWmax	AIFS [s]
0	15	1023	72 µs
1	15	1023	37 µs
2	7	15	28 µs
3	3	7	28 µs

Simulation Setup

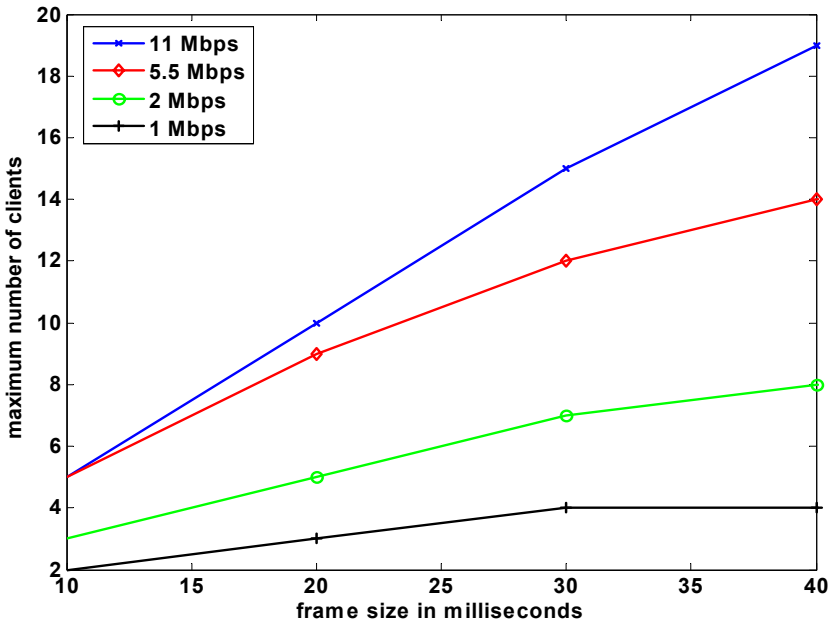
- Simulation scenario
  - Cell size 50m, no data rate fallback
  - Clients communicate with AP only
  - AP acts as VoIP partner
- QoS constraints
  - Delay smaller 100 ms
  - Packet loss smaller 3 %



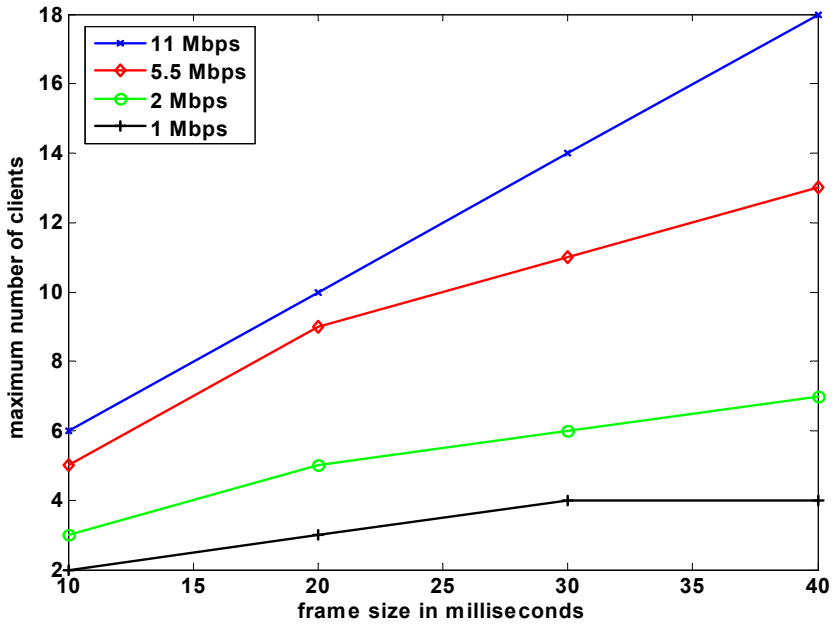
Traffic Model

Voice Codec	G.711
Frame size	10 – 40 ms
Coding rate	64 kbps
Lookahead size	0 ms
Compression/ decompression delay	0 ms

IEEE 802.11b Simulation Results



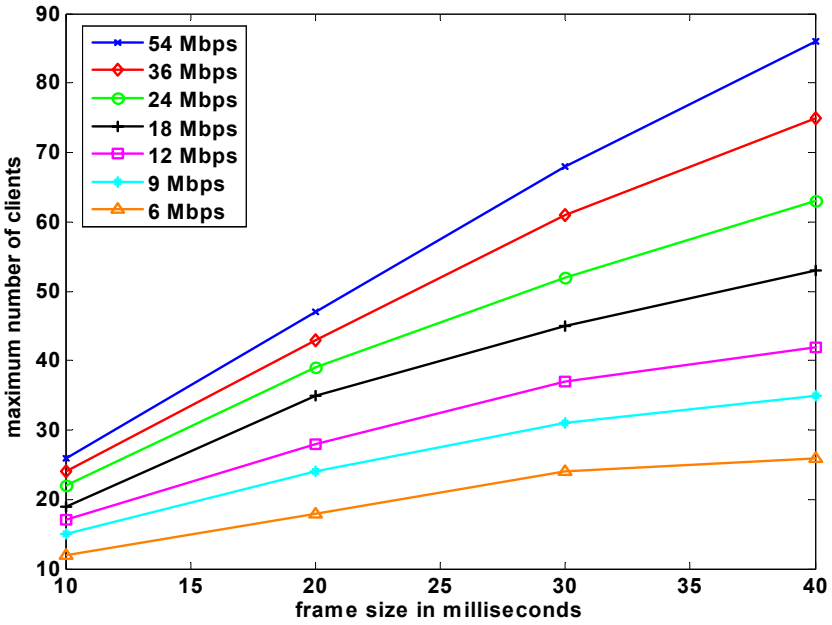
IEEE 802.11b ohne QoS



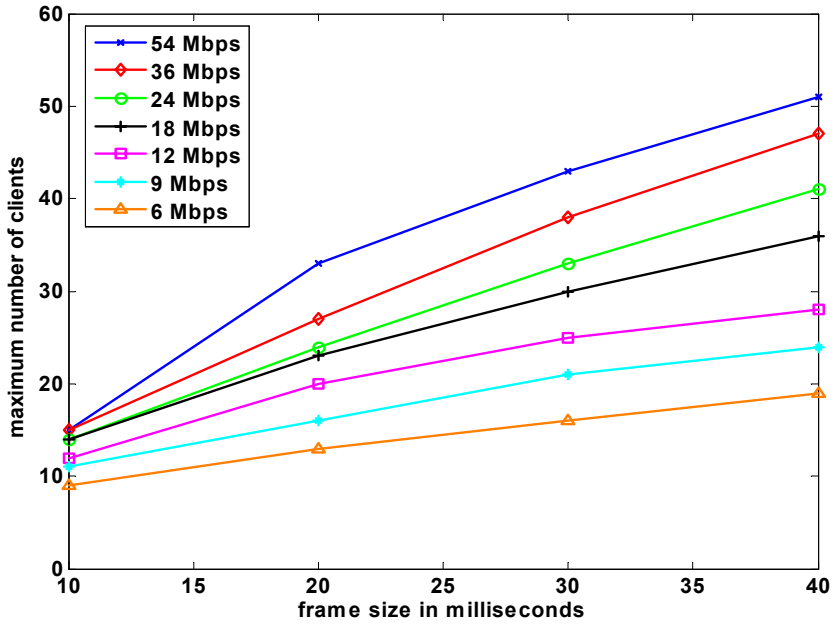
IEEE 802.11b/e mit QoS

- Small number of VoIP clients can be supported
- Bandwith is by far not utilized, for example 2.432 Mbps for 19 Clients
- IEEE 802.11e QoS standard does not increase the performance

IEEE 802.11g Simulation Results



IEEE 802.11g ohne QoS



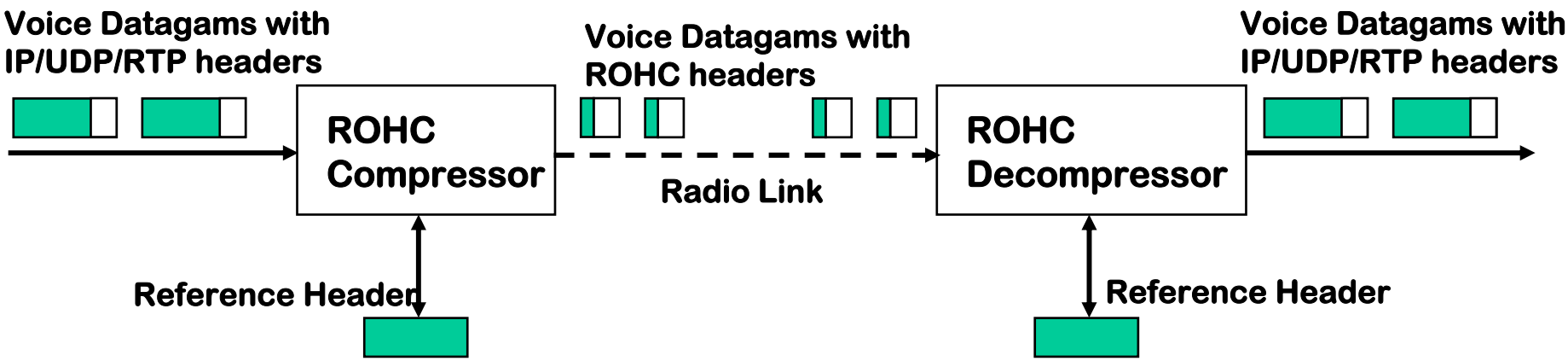
IEEE 802.11g/e mit QoS

- Performance increase compared to IEEE 802.11b simulations
- Bandwith still not utilized
- IEEE 802.11e QoS standard decreases the maximum number of supported clients

Ideas of Header Compression

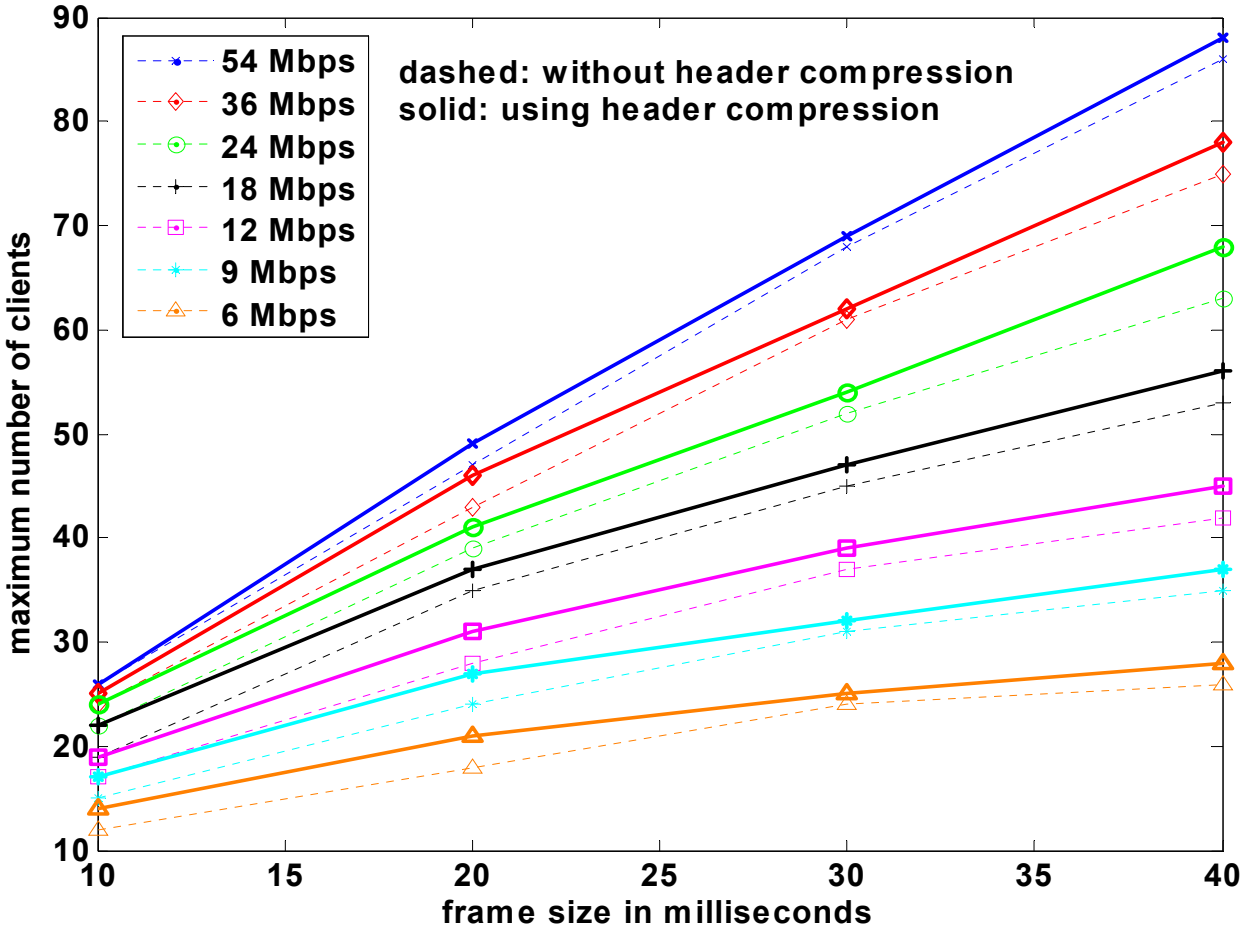
- Typical voice datagrams have a size of 80 Bytes, while the headers (RTP/UDP/IP) are 40 to 60 Bytes
- Reduce header field redundancies
  - Source and destination address remain constant during a call
  - Sequence number changes predictably
- Copies of the full headers are stored and the compression and decompression points
- Robust Header Compression (ROHC) was introduced for links with high loss rates (RFC 3095)

Robust Header Compression

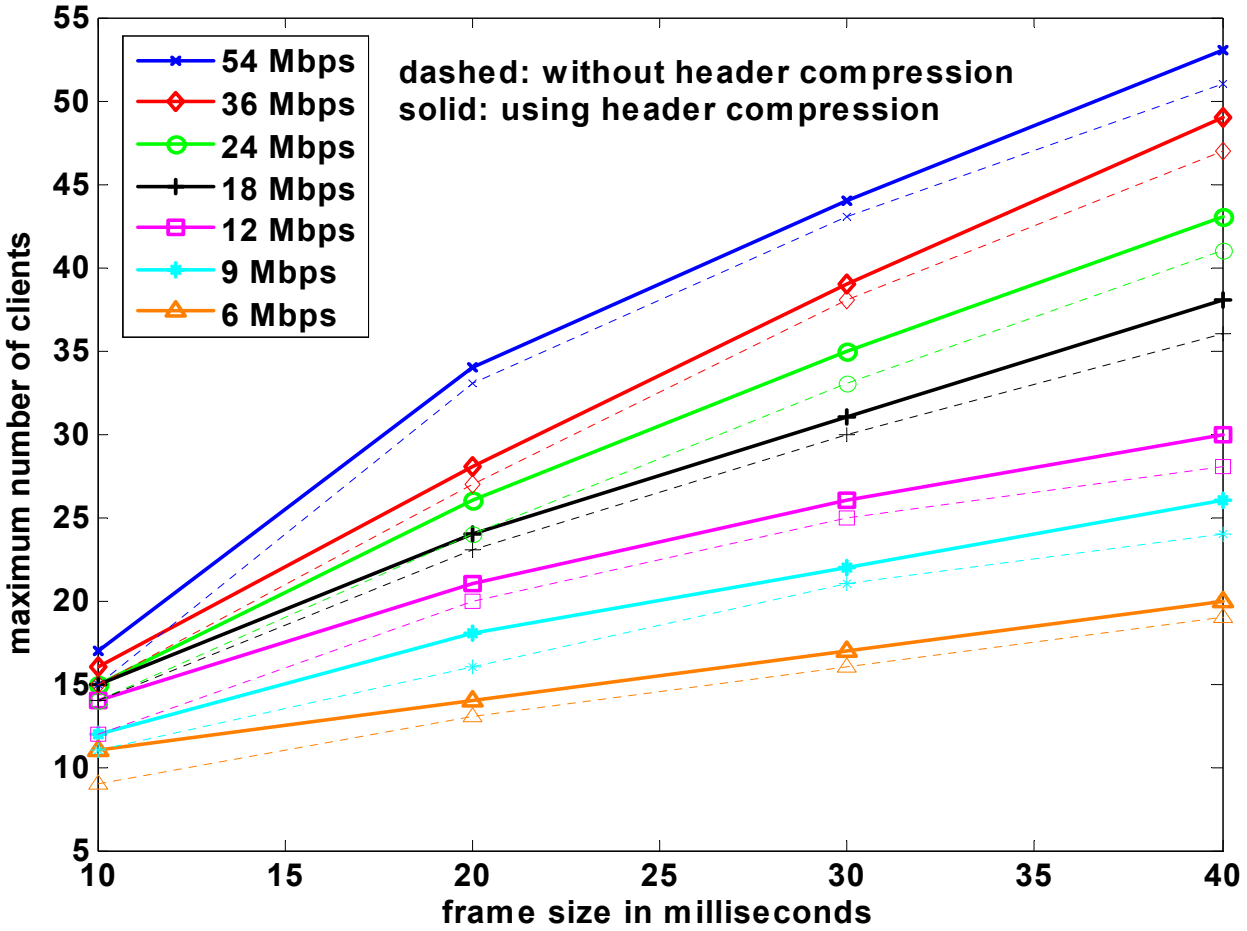


- First packets are sent uncompressed (Initialization and Refresh (IR)) in order for the decompressor to establish the context
- Afterwards the compressor moves to the First Order (FO) or directly to the Second Order State (SO)
- RTP/UDP/IPv4 headers can be reduced to an average size of 4 Bytes

IEEE 802.11g with Header Compression



IEEE 802.11g/e with Header Compression



Conclusion and Outlook

- The maximum number of supported voice clients is rather small
- IEEE 802.11e does not increase the performance when only VoIP clients are in the system → for the IEEE 802.11g standard, the maximum number of supported voice clients decreases
- Header compression only shows a small performance increase
  - Does not cope the extra overhead
- Simulate the performance with VoIP multiplexing
- CDMA based WLAN