

EDCA Bandwidth Factor

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Abstract

The Medium Time returned for an EDCA Admission Control TSPEC includes the packet length, SIFS and ACK. It does not include the overhead required for medium access. This presentation investigates the medium access overhead with respect to the number of VO and VI streams and recommends an EDCA Bandwidth Factor which can be used so as to better estimate the required bandwidth.

Medium Time

- **Medium Time = Surplus Bandwidth Allowance * pps * medium time per frame exchange where:**
 - $\text{pps} = \text{ceiling}(\text{Mean Data Rate} / 8) / \text{Nominal MSDU Size}$;
 - $\text{medium time per frame exchange} = \text{duration}(\text{Nominal MSDU Size}, \text{Minimum PHY Rate}) + \text{SIFS} + \text{ACK duration}$;
 - $\text{duration}()$ is the PLME-TXTIME primitive defined in the standard that returns the duration of a packet based on its payload size and the PHY data rate employed
- **Note that it represents the time that the packet is on the air, and does not include the time between packets, the Medium Access Time**
- **The Medium Access Time includes SIFS, AIFSN and the Contention Window value.**

Medium Access Time

- **The Medium Access Time includes SIFS, AIFSN and the Contention Window value**
- **As the number of streams increases, each stream is held up in the contention window while another stream is transmitting.**
- **The total time required for EDCA streams is therefore greater than the Medium Time and it varies with the number of streams.**
- **This total required time compared to the Medium Time is termed the EDCA Overhead Factor.**

Investigation into EDCA Overhead Factor

- **A simulation program was written to measure the throughput and delays for multiple streams. The following can be set for each stream:**
 - EDCA parameters
 - Packet Size
 - Data rate, Mbps
 - PHY Rate, Mbps
- **The outputs are:**
 - Packets in, Packets out
 - Actual data rate
 - Maximum and Average Packet Delay

Requirement

- **For a set number of streams, the data rate was varied and the average packet delay noted.**
- **For the values to be acceptable, or a PASS, the criteria used was:**

Average Delay < 2 times the SI of the packet

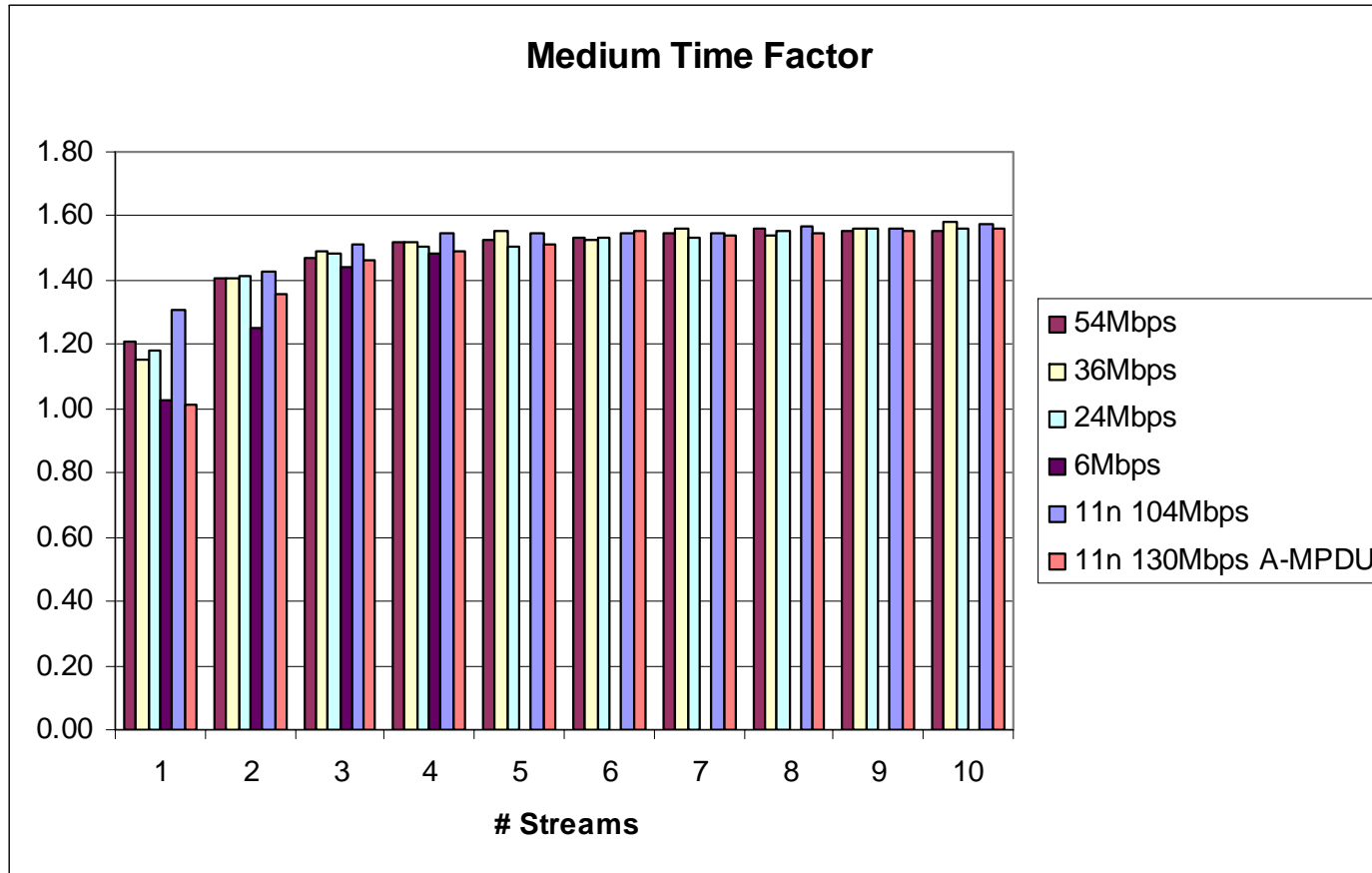
- Where $SI = \text{reciprocal of Packets per Second} = 1/\text{pps}$
- And $\text{pps} = \text{data rate}/\text{packet length}$

Methodology

- **For a set number of streams, the data rate was varied until the average delay for every stream was acceptable**
- **The total Medium time was then noted, in μ secs**
 - Medium Time Factor = $1\text{sec}/\text{Medium Time}$ (overhead)
- **For VI the packet size was set to 1470Bytes**
- **In general the VO packet size was set to 208Bytes and the data rate to 83.2kbps**

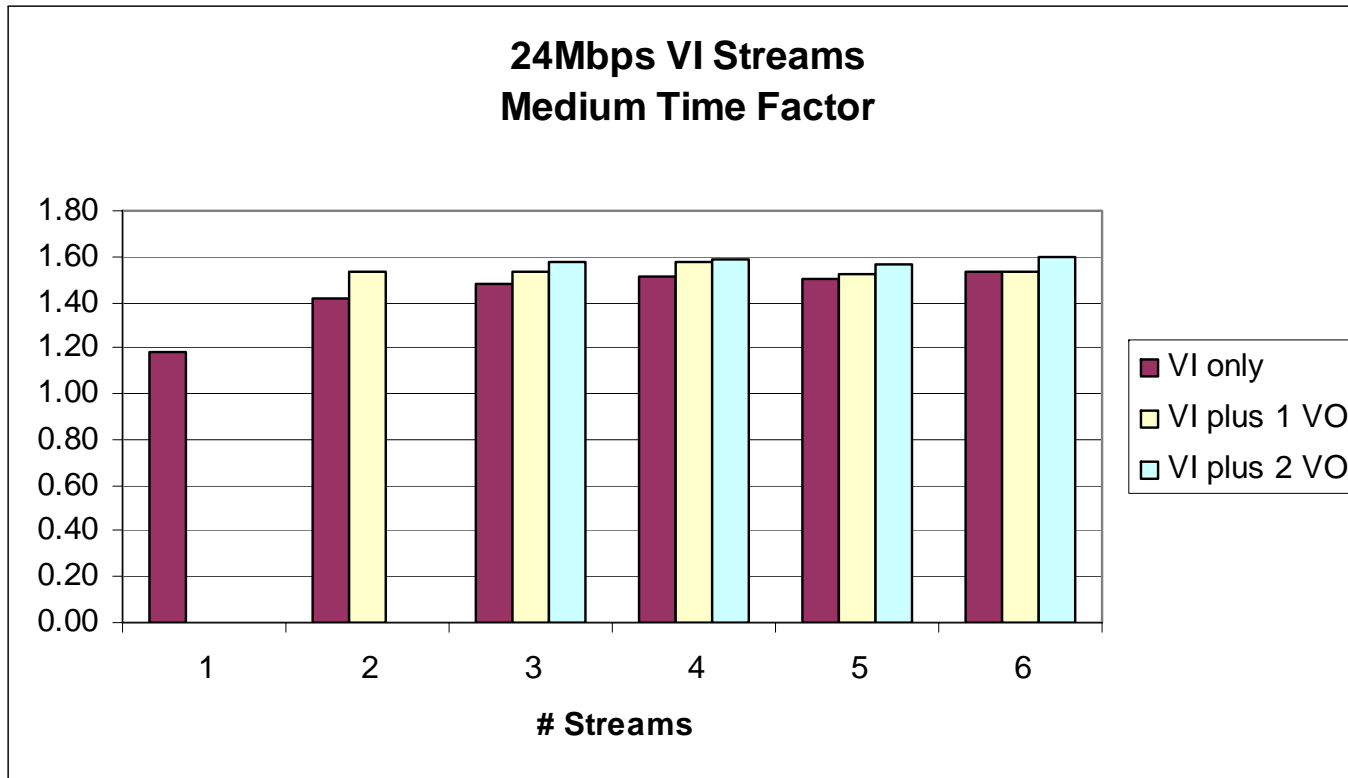
- **Most measurements carried out for 11a/g.**
- **104Mbps 11n was used but not with any MAC enhancements**
 - 11n calculation of Medium Time is complicated by the MAC enhancements

Results for equal streams



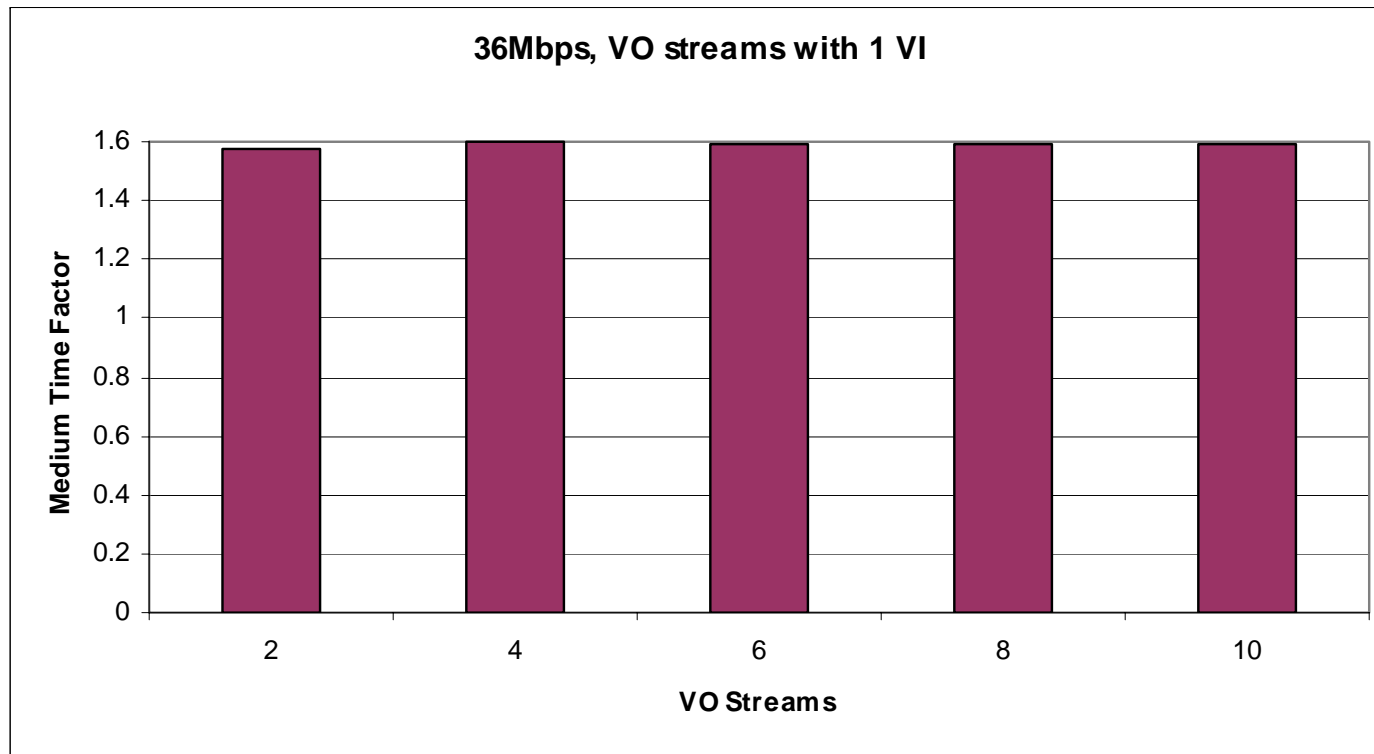
**Note: After 4 Streams, Overhead is effectively constant
VO results appears similar to VI**

Results for VI streams with VO voice



Note: Two VO streams is higher factor

VI Stream with VOs



Note: Two VO streams is higher factor

EDCA BW Factor

Number of Streams	EDCA BW Factor	
	VI or VO only, one VO plus VI	2 or more VO plus VI
1	-	-
2	1.40	-
3	1.50	1.55
4+	1.55	1.60

Based upon results, this is suggested EDCA BW Factor Table