



BreezeACCESS® VL

Concatenation in Version 3.1

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Written By: Yossi Artzi		No. of pages: 7
Title: Product Experts		Rev: A
Approved By:		Name:
Product Experts Director		Ulik Broida
R&D Product Manager		Ronen Shabo
Product Line Manager		Lior Mishan

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Contents

Scope	1
Introduction.....	1
The Concatenation Process.....	1
Maximum Frame Length.....	3
Backward Compatibility	3
Performance & Throughput	4

Scope

The purpose of this document is to describe the functionality of the concatenation feature in firmware version 3.1.

Introduction

The concatenation feature was first introduced in version 3.0 where concatenation of up to two Ethernet packets into a single concatenated “wireless” packet was possible. In version 3.1 the system is able to concatenate up to eight packets while utilizing a larger wireless packet.

Frames transmitted over the wireless medium are bridged to or from the Ethernet, and therefore are restricted to the maximum Ethernet size of 1522 bytes. When employing concatenation, the transmitter can bundle up to eight Ethernet packets into a single wireless LAN packet. This larger packet enhances the efficiency of the wireless channel, enhancing system capacity and link throughput.

The Concatenation Process

When enabling the concatenation feature in a unit (be it SU or AU), it bundles up to eight Ethernet packets into one wireless packet. By doing so, the air protocol of the system is utilized more efficiently as the overhead required for the transmission of each packet is significantly reduced.

The actual concatenation is performed by the system as follows:

- Each Ethernet packet destined for transmission to the wireless is marked as having the potential to be concatenated.
- When a unit attempts to transmit the packet, it checks if the wireless medium is “clear” for transmission. If the wireless medium is clear, the unit immediately transmits the packet.
- If the wireless medium is currently occupied, the unit checks if the buffer of the potentially available packets for concatenation holds additional packets with the same wireless destination. (The same mechanism is implemented in SUs and AU. Hence, the AU manages one concatenation buffer and not a buffer for each SU).
 - **If the TX buffer is empty or there is no other packet with the same wireless destination and the medium is occupied**, the packet goes into this buffer and is kept there for maximum 10 msec. After 10 msec, the packet is sent to the wireless medium.
 - **If the concatenation buffer holds another packet directed to the same wireless address**, the packet is concatenated with the packet in the buffer.

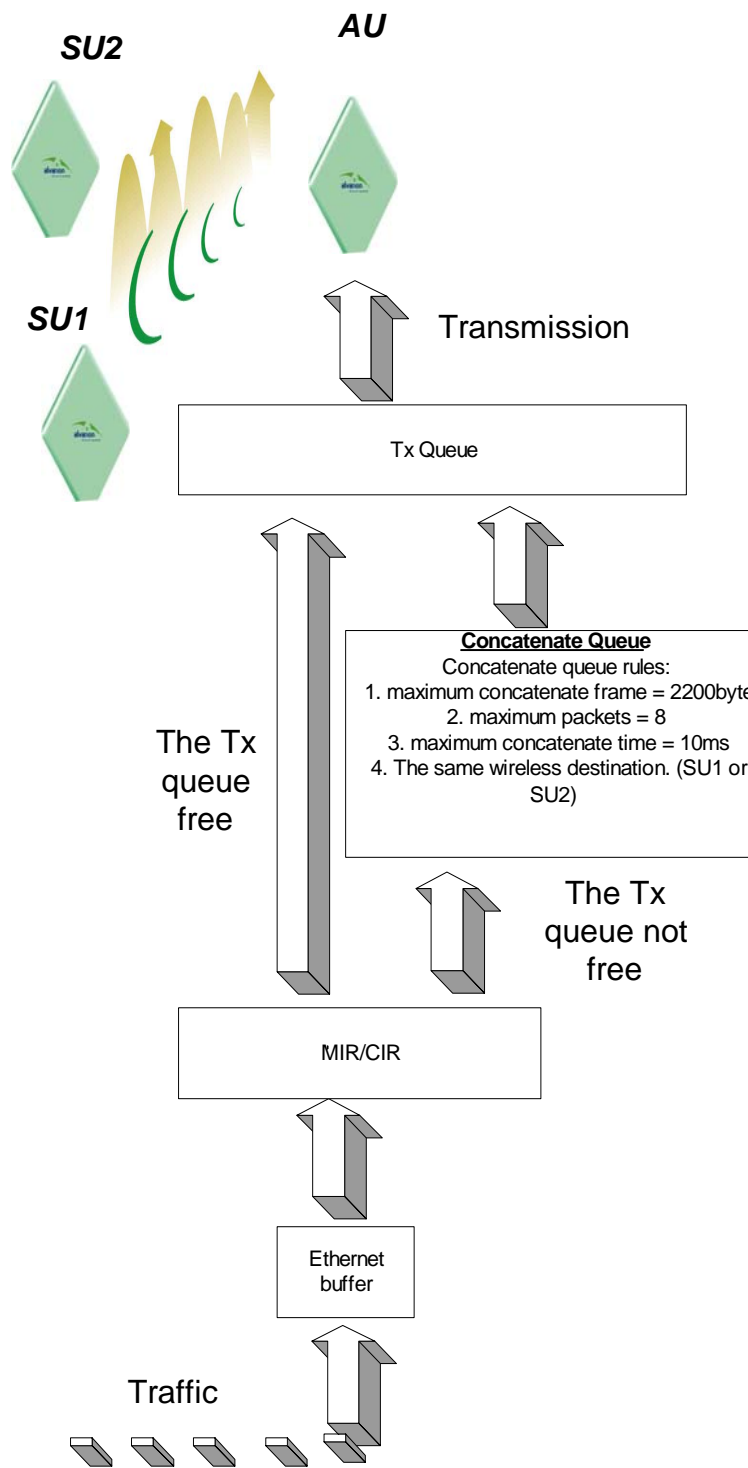


Figure 1: Concatenation Transmission Flow Control

Maximum Frame Length

The maximum frame length is defined according to the hardware revision of the unit. The maximum frame length is 2200 bytes for units with hardware revision 'A' and 'B', and 3400/4032 bytes (depending on firmware version) for units of hardware revision 'C' and above. In order for the link to utilize wireless concatenated frames larger than 2200 bytes, both the AU and the SU must be with hardware revision 'C' or above.

Backward Compatibility

As the VL utilizes a link capability feature (the AU is "aware" of the SU's revision and firmware version) the concatenation feature is backward compatible. Upon link establishment, the SU and AU exchange firmware version and hardware revision information. Relying on this information exchange the concatenation feature will operate according to the inferior firmware and hardware limitation of one of the units. The following table summarizes the concatenation feature's operation when using different hardware and firmware versions.

Table 1: Hardware and Firmware Revisions

HW Revision	Software Release	Packet Size [Bytes]	Maximum Number of Concatenated Packets
A/B/C	Under 3.0	No concatenation	No concatenation
A/B	3.0	2200	2
A/B	3.1	2200	8
C	3.0	3400	2
C	3.1	4032	8

NOTE



The concatenation mechanism will adapt the lowest HW version in a mixed topology network.

SW version 3.1 is able to concatenate up to 8 frames.

SW version 3.0 is able to concatenate maximum 2 frames. For example, if the AU/SU is of hardware revision C and the SU/AU is of hardware revision B and running firmware version 3.1 the maximal wireless packet size will be 2200.

Performance & Throughput

Table 2 shows performance (throughput) with concatenation mode enabled (up to 8 packets) in different hardware and firmware versions.

Table 2: UDP Performance and Throughput

Packet Size [Bytes]	VL (SU-54) HW Revision B Release 3.0 [Mbps]	VL (SU-54)HW Revision C Release 3.1 [Mbps]
384	9.95328	12.383232
512	13.164544	16.375808
768	20.262912	22.14912
1024	31.014912	36.30464

NOTE

The throughput tests were conducted in a lab using a UDP packet generator. The test setup was 1 AU and 5 SUs (distance of less than 2 km between AU and SU) and with the following system configuration:



- 20Mhz Band
- Burst mode – Enable
- Concatenation – Enable
- WEP – Disable
- AES – Enable