IEEE P802.11
Wireless Access Method and Physical Layer Specifications

Title: Suggest to use a different compression for the bitmap in the TIM frame.

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Abstract:
This document proposes to use an uncompressed bitmap but delete trailing zero's in the TIM frame to reduce complexity for both an AP and a Station.

Introduction:

The current traffic Indication Map as described in section 4.3.2.1 includes a compressed bitmap to identify which station that is in Power Save mode has frames buffered in the AP.
The current specification requires an AP to compress the bitmap following the rules supplied, which effectively eliminates the bytes in the bitmap that are zero, while it adds some overhead of the BlockID bytes to describe which bytes are deleted in the TIM.

Subsequently, each station has to decompress the bitmap in order to find the bit of interrest. The time needed for this decompression is variable for each station, and depends on the value of the assigned SID.
Stations with a low SID will find their bit sooner then stations who have been assigned a high SID.
Moreover according to the standard (section 8.2.1.7 bullit b) the stations should further identify whether more then one station has its traffic indication bit set in order to determine whether the subsequent PS-Poll frame should be send with or without a prior backoff.

To reduce the complexity in both the AP and the station, it is proposed to simplify the compression significantly.
The advantage of the proposed scheme is that there is no difference in effort needed by different stations depending on their SID. In addition it is very simple to determine

whether more stations have traffic buffered, so that it is easy to determine whether a backoff is needed prior to the PS-Poll.
The only compression still performed on the transmitted bitmap is that all trailing bitmap bytes with a value 0 are not transmitted.

An additional advantage of the uncompressed scheme is that the bitmap can be bigger, so that more stations could be associated with the same BSS. The maximum number of SIDs assigned is now increased from 1791 to 2015.

It should be noted that it is very desirable that APs do assign an as low as possible SID that is available between 1 and 2015. This will compact the bitmap that represents the associated stations, and will minimize the amount of Bytes that must be stored, and must be transmitted in the TIM.
Statements of this effect should be added in the standerd, but are not part of this proposal.

Background:

The following is an example of the differences between the current and proposed approach for an already large network (80 stations/BSS).

- **Assume 80 stations associated and,**
  - **a: Station 10, 20, 30, 40, 50, 60 and 70 have traffic buffered.**
  - **b: Station 20 and 70 has traffic buffered.**
  - **c: Station 20 has traffic buffered.**

- **Compressed Bitmap**
  - **a: BID=EE, 04, 20, 40, 01, 04, 01 BID=01, 01: Total 9 Bytes**
  - **b: BID=04, 20, BID=01, 01: Total 4 Bytes**
  - **c: BID=04, 04: Total 2 Bytes**

- **Uncompressed Bitmap:**
  - **a:** 00, **04, 20, 40,** 00, **01, 04, 10, 01: Total 9 Bytes**
  - **b:** 00, 00, **20,** 00, 00, 00, 00, 00, **01: Total 9 Bytes**
  - **c:** 00, 00, **20: Total 3 Bytes**

Assuming that the minimum number of bytes in a Beacon is 29 (assuming an 8 octet ESSID), then the conclusion is that the advantage of compression is very marginal.

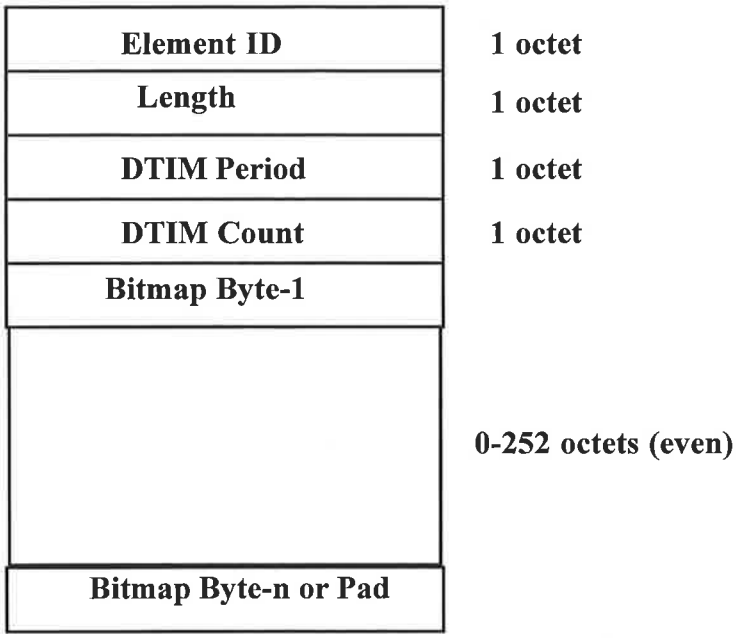
For small to medium networks the advantage of the current compression scheme is very marginal compared to the total number of bytes that will be in the Beacon.
For large BSSs the difference will grow assuming that a low percentage of stations have traffic buffered. however the difference can be negative when in each block there is at least one station with traffic buffered.

Conclusion:

A different compression method that does only delete trailing zero bytes has the advantage of reduced complexity for both AP and Stations, at the expense of little additional bytes in the Beacon, while more stations can potentially be assigned in the same BSS.

The proposed text for section 4.4.2.1 is as follows (replace cmplete section):

4.4.2.1 Traffic Indication Map (TIM)



The TIM element information field shall contain the DTIM Period and DTIM Count parameters, and a bitmap of between 0 and 252 Bytes, with a pad byte as needed to make the total Element an even number of octets.

The DTIM count field shall indicate how many Beacons (including the current frame) will appear before the next DTIM. A DTIM Count of 0 shall indicate that the current TIM is a DTIM. The DTIM Count field shall be a single octet.

The DTIM Period field shall indicate the number of Beacon intervals between succesive DTIMs. If all TIMs are DTIMs, the DTIM Period field shall have value 1. The DTIM Period field shall be a single octet.

The Bitmap field shall contain between 0 and 252 octets representing a bitmap. Each bit within the bitmap shall indicate whether a unicast frame is currently buffered for a station with a particular Station ID. There is a one to one mapping between the bits in the bitmap and the Station ID (SID) of associated stations. The bitmap is maintained within the access point. The actual transmitted bitmap in the TIM element is compressed such that all trailing bytes of the bitmap with value 0 are not transmitted.

Bit 0 of the first byte of the Bitmap (SID=0) shall indicate that multicast traffic is buffered for transmission after the next Beacon with a DTIM Count value of 0.