Solutions for P802.1Qbz / P802.11ak:
Station subset issue
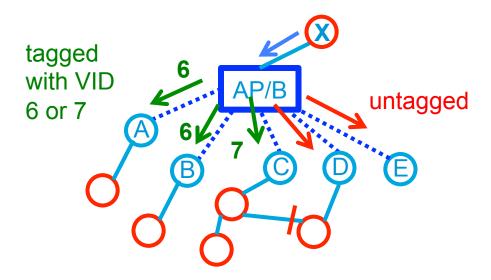
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Version 2

Introduction

- This presentation is available at:
  http://www.ieee802.org/1/files/public/docs2012/bz-nfinn-soln-station-subset-0113-v01.pdf

- It attempts to answer one of the questions raised by:
  http://www.ieee802.org/1/files/public/docs2012/bz-nfinn-pt-to-pt-problem-list-1112-v02.pdf

Station subset problem

- AP sends the "same" multicast from X to stations behind station/ bridges A through E.

- But, tagging differences and VLAN translations result in three different resultant frames, and at least three transmissions: VID 6 (A and B), VID 7 (C), and untagged (D and E).

- How do we send each one to the right subset of stations?

Alternative 1:
Four address format

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- 802.11 defines four addresses for every frame:
  - ➤ **Receiver** Address: Which station(s) (AP or non-AP) should receive frame.
  - ➤ **Destination** Address: Destination address in original MAC service request.
  - ➤ **Source** Address: Source address in original MAC service request.
  - ➤ **Transmitter** Address: Which station (AP or non-AP) that transmitted frame.

- Typically, AP and non-AP stations use only three addresses per frame, by using formats that combine two addresses into a single 6-byte field:
  - ➤ UP TO AP: Receiver (the AP), Destination, Source = Transmitter (non-AP).
  - ➤ FROM AP: Receiver = Destination (non-AP), Source, Transmitter (the AP).
  - ➤ Which, of course, is the root of the "reflection" problem.

Just use all four addresses!

- **If you simply use all four addresses for exactly the purpose described in 802.11, this problem can be solved.**

- The key is the definition of the Receiver address:

  - ➢ **Receiver** Address: Which station(s) should receive frame,

- And to notice that the Receiver Address can be a **multicast address**.

- Each non-AP (or AP) station attached to the transmitting AP "subscribes to" (accepts frames containing) some multicast Receiver Addresses (the right ones) and discards frames with other multicast Receiver Addresses (the wrong ones).

Alternative 2: 802.11n-2009 A-MSDU

IEEE Std 802.11n-2009 A-MSDU

- The A-MSDU described in 802.11n is a three-address frame (on the outside) that carries any number of encapsulated frames.

- The encapsulated data frames' Destination and Source addresses are internal to the frame, and not used in the outer three address fields.

- The outer Source/Transmitter address can be used by a transmitting non-AP station bridge to discard reflections, using the Source address of the reflected frame, in exactly the same way it discards them, now.

- The outer Destination and Receiver addresses are always the AP/ Bridge on frames sent towards the AP, and the Destination/ Receiver address on frames sent by the AP is a multicast address denoting some subset of the non-AP stations.

Both alternatives

For either alternative, 2 issues to settle:

- The AP and its attached stations have to agree on what to use for the multicast Receiver (four-address alternative) or Receiver/ Destination (A-MSDU alternative) addresses.

- We have to make sure that existing non-AP stations will not do the wrong thing when they receive frames containing multicast Receiver addresses that are not the broadcast address.

Receiver multicast addresses

- There is a protocol described in IEEE Std 802.1BR for distributing a mapping between multicast MAC addresses and a list of delivery ports (e.g. for non-AP stations S1, S2, …):

MAC address	S1	S2	S3	S4	S5	S6	S7	…
01-80-C2-XX-00-01	Y	Y	N	N	Y	N	Y	…
01-80-C2-XX-00-05	Y	Y	Y	N	Y	Y	Y	…
01-80-C2-XX-00-12	N	N	N	Y	Y	N	N	…
…	…	…	…	…	…	…	…	…

- Distributing the vectors has problems with delays that are similar to the delay problems when distributing MAC address mappings in the proposal by Zhuang and Wang (document 12-1449).

- These problems can be minimized by suitable rules regarding what kinds of changes can be made to the vector list.

Old non-AP stations

- One easy solution, very similar to what is often done, today:

- Non-AP stations that expect frames without a VLAN tag, and that do not understand multicast Receiver addresses, use different SSIDs, one per VLAN.

- Non-AP stations that understand VLAN tags, but do not understand the new multicast Receiver addresses, can all go on one SSID, different from the above (but could use the above SSIDs.

- New non-AP stations that understand multicast Receiver addresses, whether bridges or not, must go on one SSID, different from all of the above.

- Some day, when all stations understand multicast Receiver addresses, only the last SSID is needed.

No Free Lunch

- It was mentioned in the architecture solutions deck (see references) that bridging makes no demands on an AP for behaviors not already exhibited by many APs.

- The use of multicast Receiver addresses **does** introduce a new behavior.

- Before, the AP used destination MAC address and VLAN ID to select the security association on which to transmit a frame.

- Now, the AP must do the above, but must **also** use that information, plus the ingress port (security association ID), in order to select the Receiver MAC address.

Details: vector distribution rules

Multicast vector distribution rules

- The AP generates and maintains a list of addresses and distribution vectors as shown in the table, above.

- Each non-AP station maintains only a vector with one bit per multicast Receiver address (they are all in a relatively small range), stating whether that station accepts frames with that address, or not. Bits for unknown addresses are 0. It does not bother to remember the vectors.

- When a vector is created, changed, or deleted, the AP sends messages to update the stations as necessary, and retransmits as necessary, until all notified stations have acknowledged the update.

- A vector can be used by the AP before the acknowledgements are received (or even before the notifications are sent), due to these rules:
  - A station can be added, but never removed, from an existing address's vector.
  - A vector can be deleted, and after all ACKs are received, the address can be redefined with any value.

- With these rules, when the vectors change, extra frames will likely be discarded, but none will be relayed when they should not be.