Data reflection: What 802.1 needs from 802.11

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Version 1

A short statement of the "reflection problem"

- There is a problem with frames transmitted by non-AP stations being reflected back to that station by the Access Point.

- There are many possible ways to solve the problem.

- This deck concentrates on the problem statement, not the solution, although two obvious but non-workable solutions are discussed.

- **IEEE 802.1 requests that IEEE 802.11 provide a means in 802.11ak to solve this problem.**

Reflected frames: normal non-AP use

- A non-AP station uses its own MAC address as both the Ethernet source address and the transmitter address. The AP uses the Ethernet destination as the receiver address. Hence, three addresses are sufficient for both directions.

- A broadcast UP frame (non-AP station to AP):

Receiver (AP)	Ether Dest. (broadcast)	Ether Src. / Xmitter	rest of frame

- A broadcast DOWN frame (AP to non-AP station):

| Receiver/Ether Dest. (broadcast)	Ether Src.	Xmitter (AP)	rest of frame

- If the station sees its own MAC address in the Ether Source, it discards the frame, else it passes it up to its MAC client.

Reflected frames: the problem for bridges

- **CASE 1:** Suppose a non-AP station/bridge **B** is forwarding data for attached wired device **X**.

- Suppose **X** sends a frame (a broadcast, for example) up through bridge **B**.
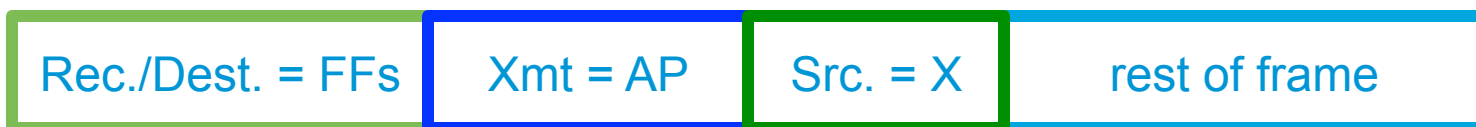
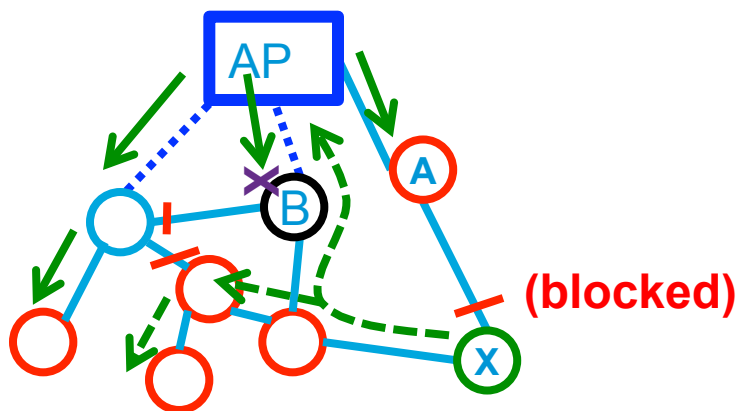| Rec. = AP	Dest. = FFs.	Src. / Xmit = X	rest of frame

CASE 1

(blocked)
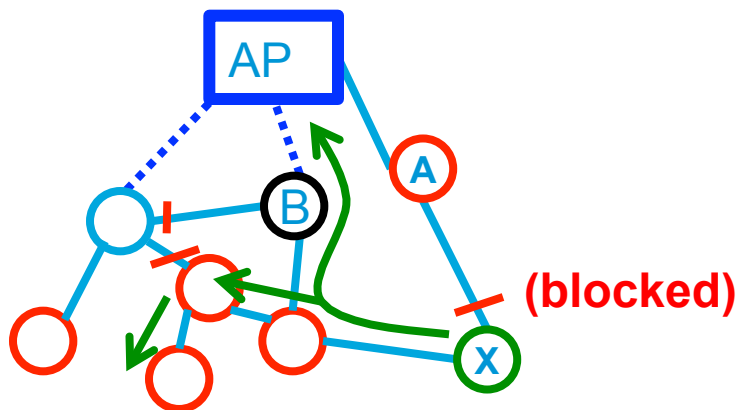
Reflected frames: the problem for bridges

- The Access Point reflects the frame back down to all of the AP's stations, including **X**.

- Bridge **B** needs to **discard** the frame. (Its portion of the network has already seen it.)

| Rec./Dest. = FFs | Xmt = AP | Src. = X | rest of frame |

CASE 1
discard
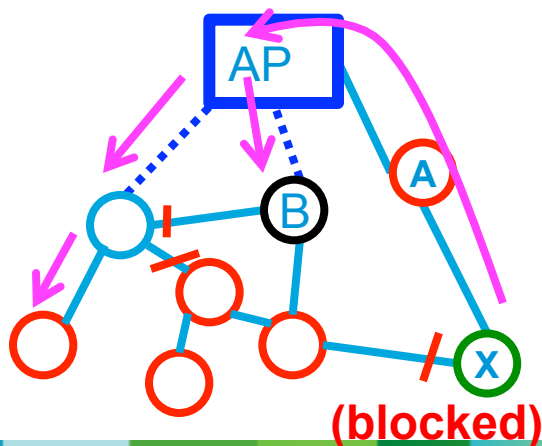
Reflected frames: the problem for bridges

- **CASE 2:** Suppose instead, that the spanning tree has changed, so that *X* has effectively moved, and transmits that same broadcast frame.

- The Access Point transmits the broadcast to all of its stations, including bridge *B*.

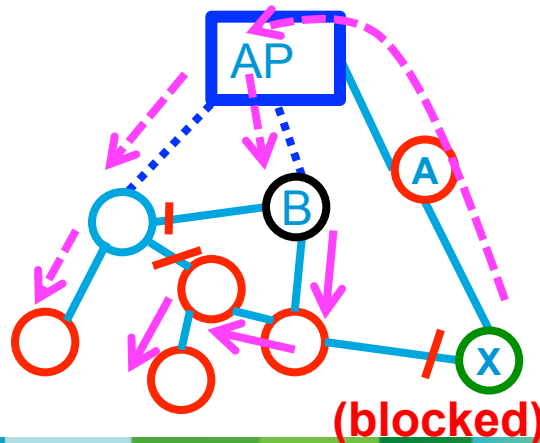| Rec./Dest. = FFs	Xmt = AP	Src. = X	rest of frame

CASE 2

AP

A

B

X

(blocked)

Reflected frames: the problem for bridges

- Bridge **B must relay** the frame down to the part of the network that hasn't seen it, yet.

Reflected frames: the problem for bridges

- The problem is that Case 1 and Case 2 result in **exactly the same frame** sent from the AP to bridge **B**.

- Bridge **B doesn't know** whether to **discard** the frame (the correct action in Case 1) or to **forward it and learn X**'s new location (the correct action in Case 2); it cannot distinguish the two cases.

Rec./Dest. = FFs	Xmt = AP	Src. = X	rest of frame

CASE 1?
discard?

(blocked)

CASE 2?
relay?

(blocked)
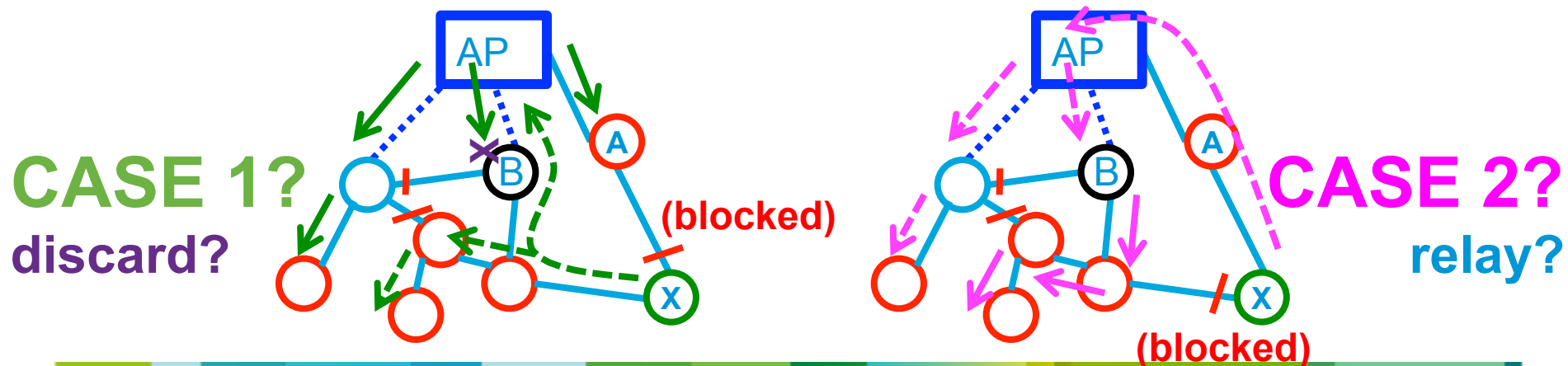
Two non-solutions

- **Question:** Why can't the bridge just discard frames based on the MAC addresses that it knows are "behind" it.

- **Answer:** If there were no wired connections below the bridge/stations, or closing the loop between the bridge/station and the AP, that would be possible. (It is, in fact, done today in a non-standard but common behavior.) But, in the general case, it is **only through learning** source addresses that the bridge "knows" anything about what is or is not behind it. The problem, here, is that there is nothing in the frame to tell the bridge whether to **apply** its already-learned knowledge or to **learn** new knowledge to apply, later.

Two non-solutions

- **Question:** Why can't the bridge just remember what frames were sent to the AP and discard them if and when they come back?

- **Answer:** Frames have different priorities. If the frame were reflected simultaneously with transmission (as in the original Fat Yellow Coax), the device could discard it easily. But, there can be an arbitrary time delay between the UP frame and the reflection. The bridge would have to store all UP frames in a content-addressable memory and look for matches. Not only is this very expensive, but frames can be lost, and duplicate frames can be legitimately sent, which further confuses this plan.

Additional constraints on any solution

- **Flooded unicasts:** It is not only frames with multicast or the broadcast addresses that may be reflected back down by the AP, or sent to all bridges by the AP. The AP must distribute frames sent to unicast addresses that are unknown to it to all station/bridges, but the station/bridge that sent it up to the AP (if any – maybe it came through the wire to the AP) must know to discard it.

- **Old stations:** We must know what existing non-AP stations will do with any new frame formats used. If one AP transmission can suffice for frame to be accepted or discarded by both the appropriate non-bridge stations and the appropriate bridge stations, that would be ideal. If two transmissions (in different formats) are required of the AP, we must be certain that existing stations and new station/bridges will each pass only one of the frames to their respective MAC clients.

Thank you.