Multicast Considerations over IEEE 802 Wireless Media

Charlie Perkins

Dorothy Stanley

Warren Kumari

JC. Zuniga

IETF 95 Buenos Aires

April 5, 2016

Wireless multicast problems

- Highest power to reach them all
- Lowest data rate (the "basic rate")
- Transmit characteristics must satisfy the "neediest" customer
  - ➤ ➔ These factors all increase *media occupancy,* and thus *interference*
- No acknowledgement
  - ➤ ➔ Unreliable compared to unicast
- Interference range is *irregular* and *time-varying*
- Wireless multicast often affects wired LANs

Outline of current Internet Draft

- Identified Issues at Layer 2
- Some Possible Effects on Representative IETF protocols
  - IPv4 uses
  - IPv6 uses
  - Disabling Multicast on WiFi
  - Spurious Neighbor Discovery
- Layer 2 optimizations
  - Proxy ARP in 802.11-2012
  - Buffering to improve Power-Save
  - IPv6 support in 802.11-2012
  - Directed Multicast Service (DMS)
  - GroupCast with Retries (GCR)
- Higher Layer Optimizations and Mitigations
  - Mitigating Problems from Spurious Neighbor Discovery
- Multicast Considerations for Other Wireless Media

Proxy ARP in 802.11-2012

- AP acts as the central "manager" for all the 802.11 STAs in its BSS
  - Proxy ARP is easy to implement at the AP
- Reduced broadcast traffic (transmitted at low data rate) on the wireless medium
- AP replies to ARP requests, so STA can sleep more – improving power savings
- Keeps broadcast ARP frames off the wireless medium

Buffering to improve Power-Save

- For unicast, AP can buffer frames for delivery to the STA at the time when the STA is scheduled for reception.
  - In other words, the STA does not have be awake exactly when the frame arrives.
- This strategy does not work for multicast

IPv6 support in 802.11-2012

- IPv6 uses Neighbor Discovery Protocol (NDP)
- AP can perform a proxy function for NDP in a way analogous to Proxy ARP, with similar benefits

Directed Multicast Service (DMS)

- DMS enables a client to request that the AP convert multicast to unicast

- DMS Requires 802.11n A-MSDUs

- Individually addressed frames are acknowledged and are buffered for power save clients.

- Requesting STA may specify traffic characteristics for DMS traffic

- DMS was defined in IEEE Std 802.11v-2011

- DMS is not currently implemented in products.

GroupCast with Retries (GCR)

- GCR uses either unsolicited retries or a block acknowledgement mechanism
- Still does not guarantee success.
- Retransmissions are group addressed
- GCR may cause too much latency; the AP must:
  - unicast a Block Ack Request (BAR) to a subset of members.
  - wait for the corresponding Block Ack (BA).
  - retransmit any missed frames.
  - resume other operations which may have been delaye GroupCast with Retries (GCR)
- GCR is not currently implemented in products.

Spurious Neighbor Discovery

- Snoopers looking for victims – adds substantially to background interference
  - 2000 broadcasts/sec
- ARP sponges – provide fake resolution
- Negative ARP cache – store request failure
- Firewall unused addresses
- Disabling ARP request – AP already has at L2
- NAT ☹

Mailing list mcast-wifi

- https://www.ietf.org/mailman/listinfo/mcast-wifi

Related WG topics

- [intarea]
  - draft-perkins-intarea-multicast-ieee802-00.txt
- [mboned]
  - draft-mcbride-mboned-wifi-mcast-problem-statement-00.txt
- [6man]
  - draft-vyncke-6man-mcast-not-efficient-01
- [pim]
  - "submit solutions for IGMP and MLD to adapt to wireless link conditions" (April 2016)