

# Techniques for Short Downlink Frames

## Authors:

| Name                | Affiliation | Phone | email                                                                            |
|---------------------|-------------|-------|----------------------------------------------------------------------------------|
| Brian Hart          | Cisco       |       | <a href="mailto:brianh@cisco.com">brianh@cisco.com</a>                           |
| Sean Coffey         | Realtek     |       | <a href="mailto:coffey@realtek.com">coffey@realtek.com</a>                       |
| Leif Wilhelmsson    | Ericsson AB |       | <a href="mailto:leif.wilhelmsson@ericsson.com">leif.wilhelmsson@ericsson.com</a> |
| Kåre Agardh         | Sony Mobile |       | <a href="mailto:kare.agardh@sonymobile.com">kare.agardh@sonymobile.com</a>       |
| Sigurd Schelstraete | Quantenna   |       | <a href="mailto:sschelstraete@quantenna.com">sschelstraete@quantenna.com</a>     |

## Overview

### Situation:

- Whether or not a user is running obvious network applications (browsing, video streaming, etc), their 802.11 client continually receives (and transmits) short packets, at a low duty cycle [1-7]
  - Uplink: NBNS, LDAP, LLMNr, BJNP, ARP, DNS
  - Downlink unicast: NBNS, LDAP, ARP, DNS
  - Downlink multicast/broadcast: LLMNr, BJNP, ICMPv6, IGMPv2
  - 60-120 octets is typical of these frames

### Problem tackled in this presentation:

- It is difficult to aggregate such downlink traffic; recent channel sounding is not available for such traffic
- Networks with many users per channel experience poor throughput due to preamble overheads

### Solution:

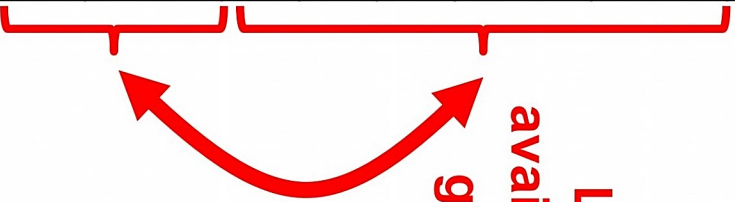
- Study different MU/aggregation schemes, and if a new technique is found that outperforms existing 802.11 techniques, then add a short frame requirement to the 802.11ax SFD

## Transmission duration comparison

- What is the best way to send 4 downlink frame to 4 clients, in an 80 MHz BSS, where each frame carries 90 octets?

| Technique ID | Technique                                        | Medium time (see notes)           |
|--------------|--------------------------------------------------|-----------------------------------|
| 0            | Aggregation with other traffic to the same RA    | Disallowed due to traffic pattern |
| 1            | Explicit sounding + DL-MU-MIMO Data + polled BAs | $\geq 846$ us                     |
| 2            | 4 * Data+Ack                                     | 456 us                            |
| 3a           | PSMP (SIFS)                                      | 462 us                            |
| 3b           | PSMP (RIFS)                                      | 350 us                            |
| 4            | DL-OFDMA Data + UL-MU-MIMO Ack                   | 142 us                            |
| 5            | DL-OFDMA Data + UL-OFDMA Ack                     | 114 us                            |

**Large available gains!**



## **Socializing the following (no strawpoll yet)**

**Add to the SFD:**

**“The 802.11ax amendment shall require a solution that provides significantly increased efficiency for short MSDUs (<250 octets) intermittently transmitted to different non-AP STAs”**

## Short Frame/Packet References

- [1] Bill Carney et al, 11-13-0728-01-0hew-network-optimization-for-expected-traffic-patterns.pptx
- [2] Jim Lansford, 11-14-0546-01-00ax-packet-traffic-measurements-around-boulder-colorado.ppt
- [3] Phillip Barber et al, 11-13-1438-00-0hew-traffic-observation-and-study-on-virtual-desktop-infrastructure.pptx
- [4] Bill Carney et al, 11-13-1305-00-0hew-traffic-simulation-simplifications.pptx
- [5] Ericsson measurement, 2012/Q4, smartphone-dominated mature LTE/HSPA/2G network
- [6] A. Doufexi, S. Armour, P. Karlsson, M. Butler, A. Nix, D. Bull, J. McGeehan, "A Comparison of the HIPERLAN/2 and IEEE 802.11a Wireless LAN Standards," IEEE Communications Magazine, May 2002, Vol. 40, No. 5
- [7] ChaoChun Wang et al, 11-13-1407-00-0hew-simulation-based-study-of-qoe.pptx