Preliminary RA power observations on wifi

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Measurements

- Questions
  - What is the power impact of RA packets on wifi networks?
  - Is there a difference between unicast and multicast RA?
  - How does this interact with unicast RA and unicast RS refresh?
- Device characteristics
  - Recent Nexus devices have RA rate-limiting in wifi firmware
    - Bit-for-bit identical RAs rate-limited to 1 / minute
    - Should (TM) make it possible to measure the cost of wifi without measuring the cost of waking up the main processor
      - Thus, results should apply to similar wifi chipsets
  - Device used likely sets DTIM to 3 when screen off
    - Thus, 2 out of 3 multicast packets dropped

Measurement setup

- Matched pair of:
  - Nexus 6 devices with battery eliminator
  - Monsoon power monitor, set to 4.3V - https://www.msoon.com/LabEquipment/PowerMonitor/
  - Average power measurements for several-second intervals in quiescent state
- D-Link DIR-835 running OpenWRT Barrier Breaker
  - WPA2 personal, lab-only AP. <5 clients, noisy RF environment
- RAs sent by Python code using scapy
  - Send RAs every X seconds in parallel to both devices:
  - Device A: unicast MAC (AP doesn't send these to device B)
  - Device B: solicited-node multicast MAC address (dropped by wifi multicast filter in device A)
  - Identical 70-byte RA sent to ff02::1 with no options

Observations

- Results:
  - Wifi off: **~5.4mA**. Wifi connected: **~6.0mA**
  - RAs every second: multicast: **~6.0mA**, unicast **~180mA**
  - RAs every 5 seconds: multicast: **~6.0mA**, unicast: **~65mA**
- Possible explanations:
  - Fundamental nature of 802.11?
    - Unicast can arrive at arbitrary times
    - Unicast requires host to **transmit** in order to poll for traffic and ack traffic
    - Multicast:
      - On lightly-loaded network, sent right after DTIM, while receiver is already awake
      - Sent at lower rate (6Mbps?), but packet is very small (70 bytes at 6Mbps = ~1ms)
  - Interaction with RA deduplication? More work needed

Questions?