Implementation of IEEE 802.11s Mesh Powersave

Marco Porsch

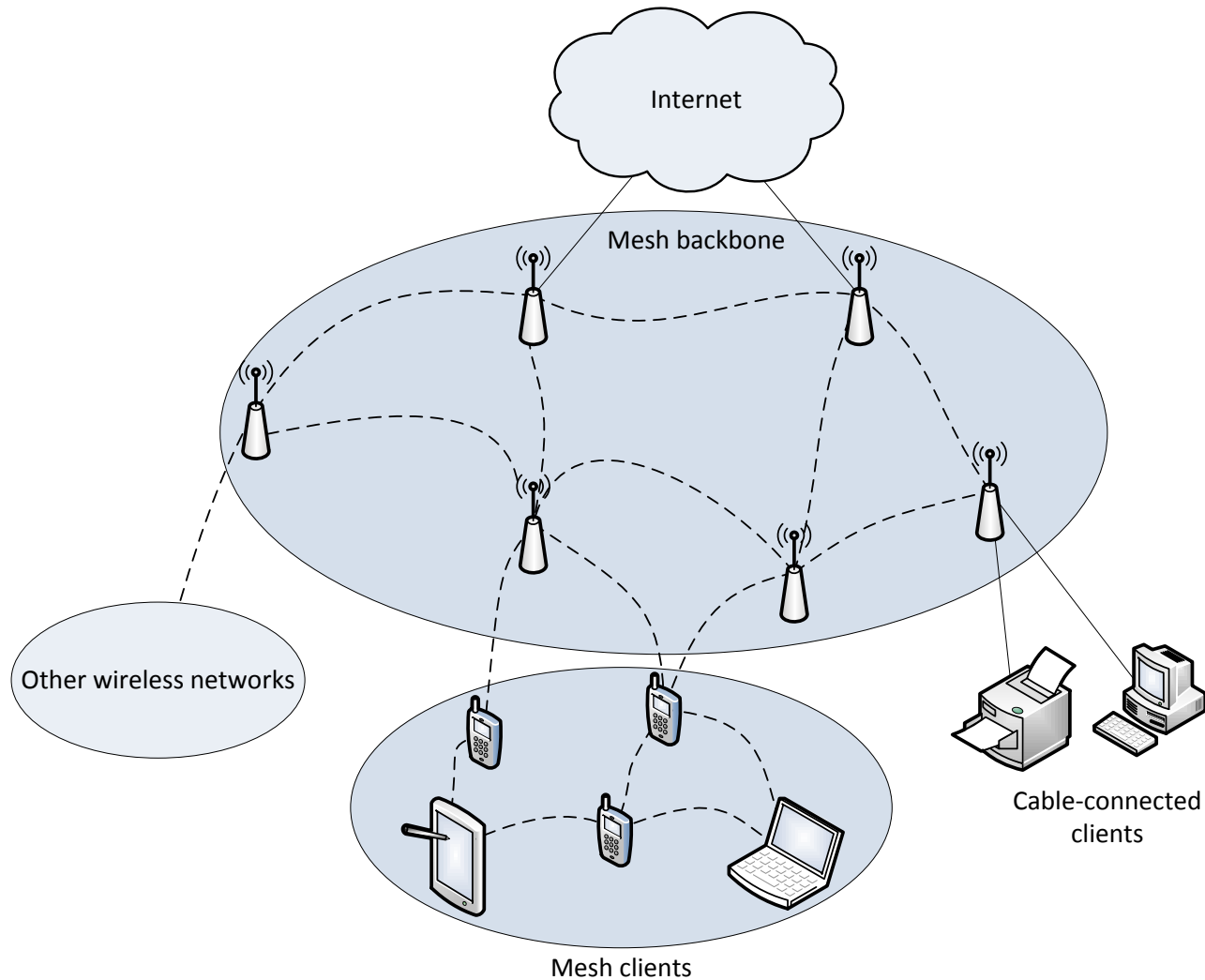cozybit Inc. / Chemnitz University of Technology

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Outline

- What are IEEE802.11s Wireless Mesh Networks?

- IEEE 802.11s Power Save

- Implementation Details

- TODO List

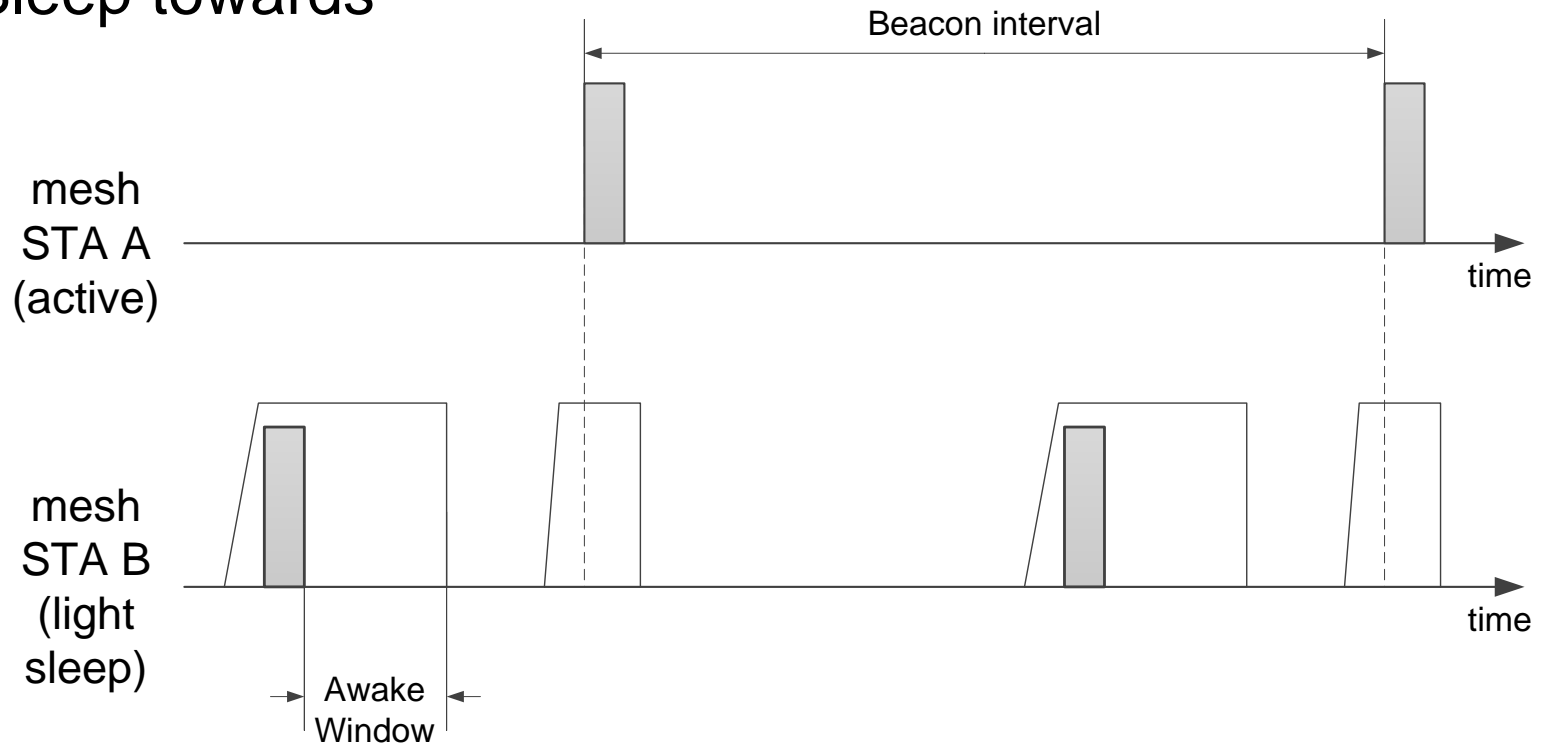# What are IEEE802.11s Wireless Mesh Networks?

Internet

Mesh backbone

Other wireless networks

Cable-connected clients

Mesh clients

IEEE 802.11s Power Save

- Power modes configured per peer link
  - 3 possible modes: Active, Light Sleep or Deep Sleep
  - indicated in QoS Data/Null frames towards peer

- Energy-saving by disabling radio completely
  - only if all links in Light/Deep Sleep state

- Buffering of frames addressed to sleeping STAs

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IEEE 802.11s Power Save

- Mesh STAs stay awake after own beacon transmission

- Mesh STAs wake up for beacons of peers they are in Light Sleep towards
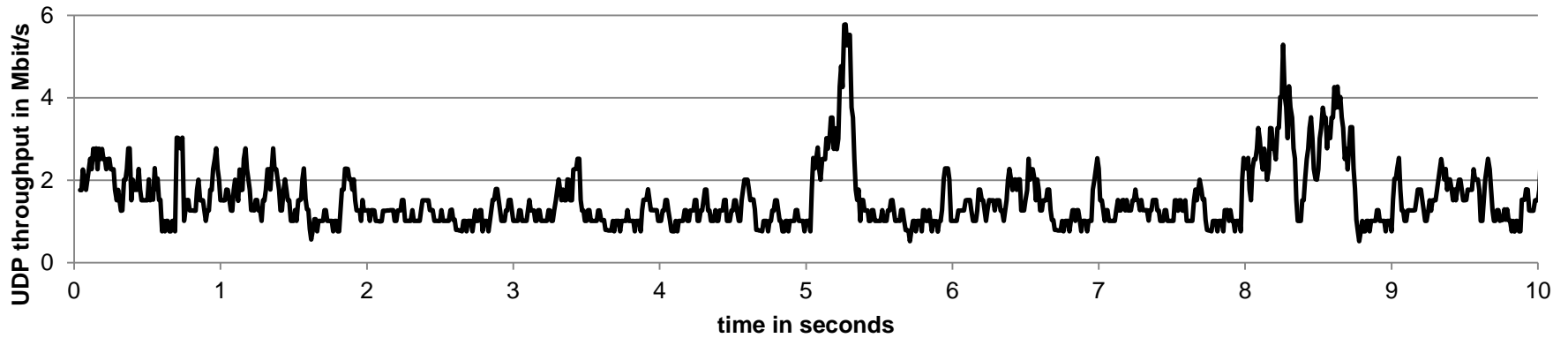
IEEE 802.11s Power Save

- Frame exchange in Peer Service Periods
    - initiated and ended with trigger frames
    - one or bidirectional communication
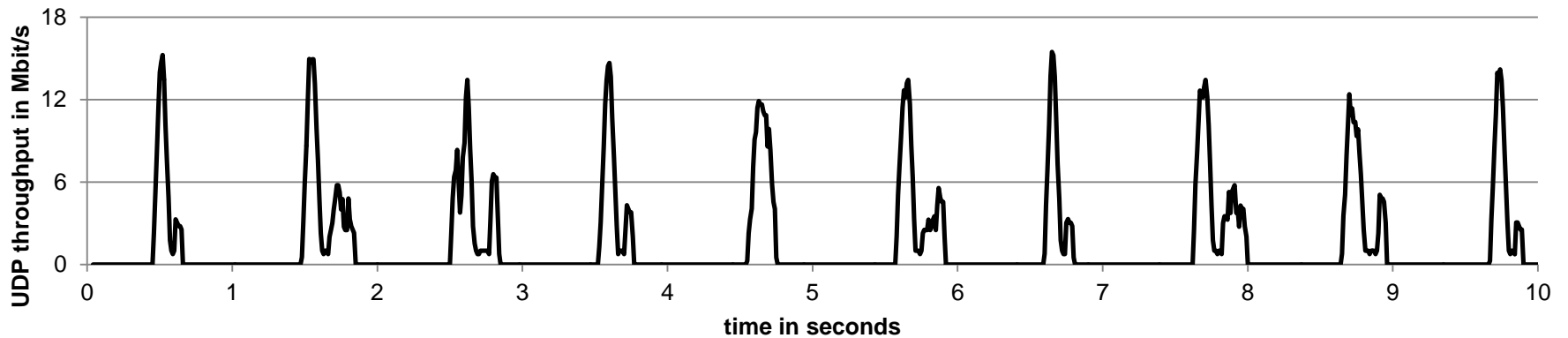   - peers stay awake during Peer Service Period
    - dynamic duration

→ Traffic shaping + sleep coordination scheme

IEEE 802.11s Power Save

a) link in active mode

b) link in light sleep mode
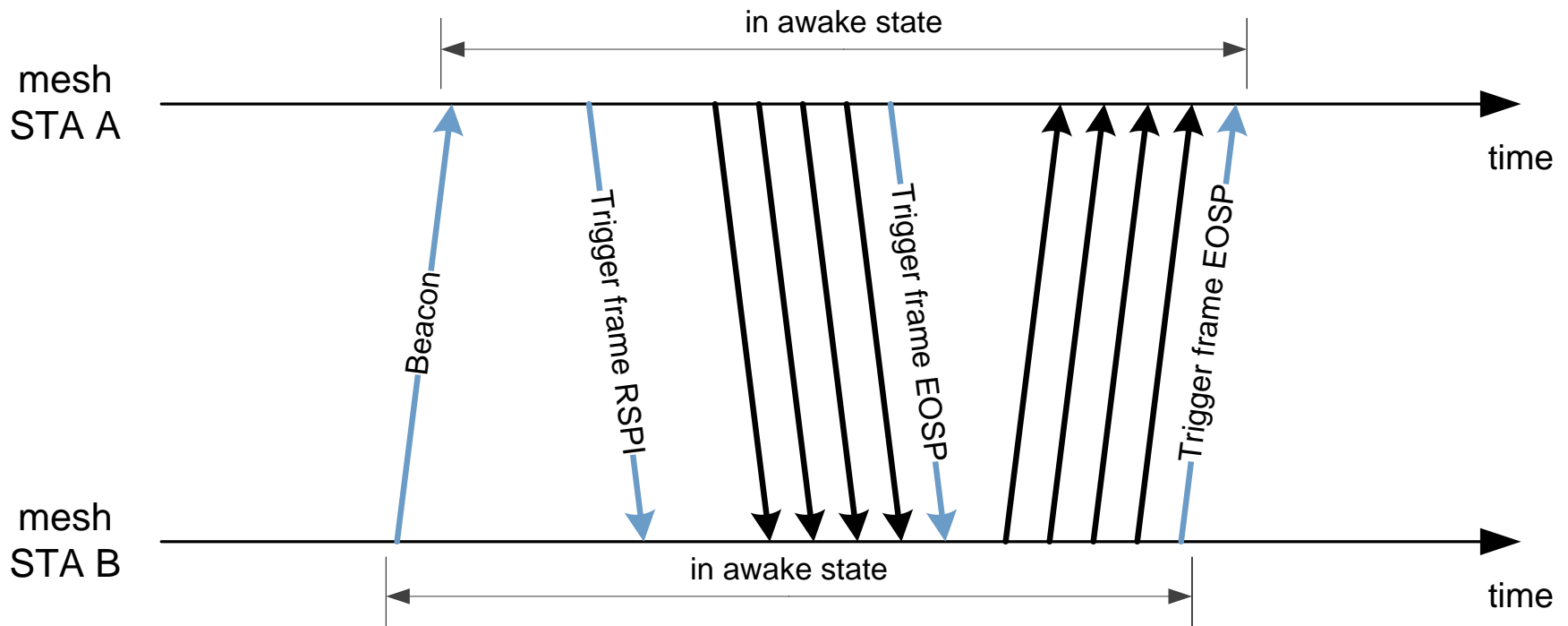
Implementation Details

- mac80211:
  - PS mode setting & local PS state logic
  - PS mode indication & neighbor PS mode tracking
  - frame buffering for PS STAs

```
struct sta_info {
    …
    enum nl80211_mesh_power_mode local_ps_mode;
    enum nl80211_mesh_power_mode peer_ps_mode;
    enum nl80211_mesh_power_mode nonpeer_ps_mode;
    …
}
```
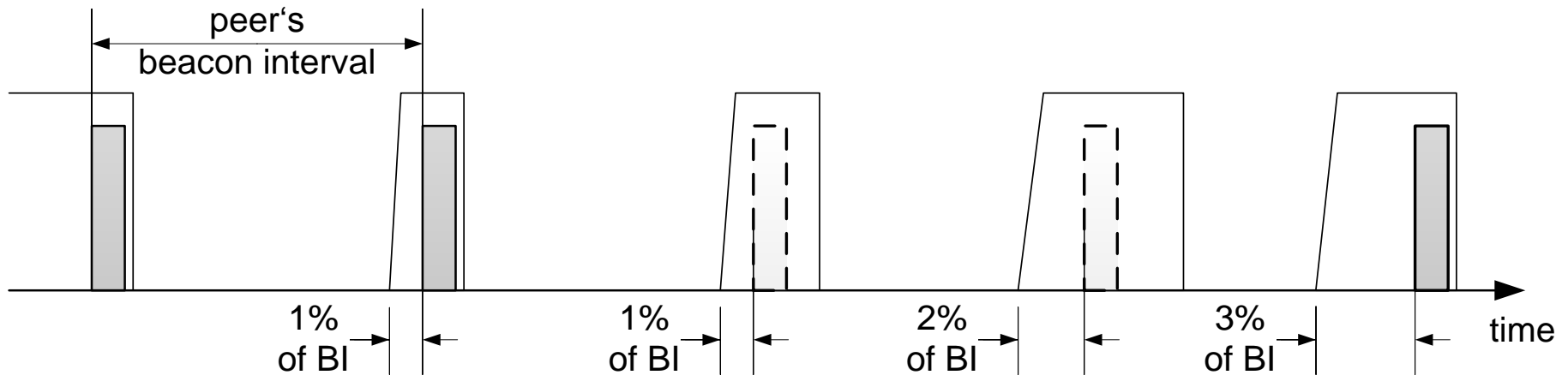
Implementation Details

- mac80211:
  - additional beacon IEs: TIM & awake window
  - Peer Service Periods

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clean code
no wires

Implementation Details

- Driver (ath9k, carl9170, ath9k_htc):
  - keep track of peer's beacons
  - determine next wakeup & config HW/timer accordingly
  - awake windows

TODO List

- Link-dynamic PS

- full Deep Sleep mode

- Move all mesh PS routines to mac80211 & add simple driver interface

```
void (*radio_sleep) (struct ieee80211_hw *hw, u64 until);
void (*radio_wakeup)(struct ieee80211_hw *hw);
```

- Cleanup & send to linux-wireless

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Questions?

- The code is available online at

  https://github.com/cozybit/open80211s/tree/ft-powersave

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