Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: [A suggestion for harmonized PAC frame structure]
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Re: []

Abstract: [This document contains a suggestion for PAC frame structure aiming to harmonize both contention-based access and contention-free access]

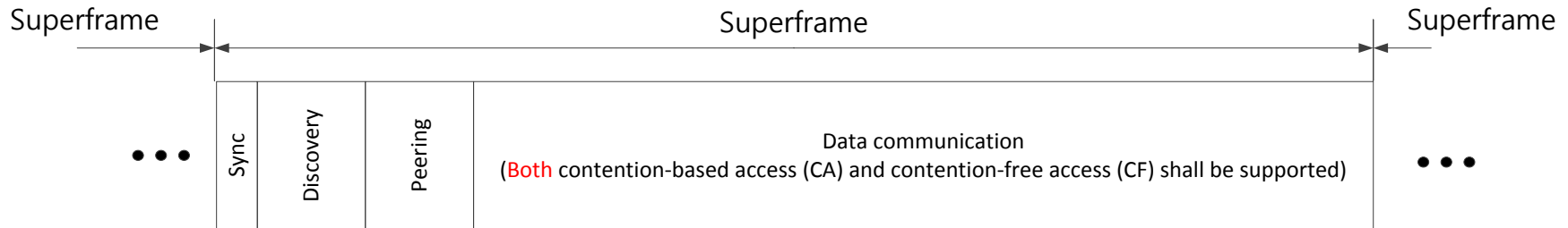**Purpose:** [To provide discussion materials for 802.15.8 TG members]

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Background

- As of this writing, it seems that all TG members have consensus on <u>finalizing draft PFD by the next meeting in Jan. 2014</u> .
  – As all of TG members know, the latest draft PFD (DCN 328r8) is a merely mechanically merged version with all the submitted proposals.

- However, we have not discussed the pros and cons of each proposals.
  – We are not ready to harmonize different ideas in the next meeting.
  – As was usually the case with previous face-to-face meetings, the next meeting will be less likely to be sufficient time for full and frank technological discussion.

- To solicit a heated debate, hopefully, we would like to suggest a PAC frame structure with consideration for the harmonization of both contention-based access and contention-free access.

Suggested frame structure

Superframe | Superframe | Superframe

| Sync | Discovery | Peering | Data communication (Both contention-based access (CA) and contention-free access (CF) shall be supported) |

• Radio resource is comprised of successive superframes with fixed time duration.
  – A superframe includes synchronization interval, discovery interval, peering interval, and data communication interval.
  – Each interval has a fixed time duration.

• In data communication interval, both contention-based access (CA) and contention-free access (CF) shall be supported by PAC in a harmonized way.
  – PAC members need a lot of discussion on the harmonization of both CA and CF.

Rationale behind the suggested structure

- Even though there are a lot of achievable features of PAC, discovery is the key feature which can distinguish PAC from other existing D2D systems.
    - We imagine PDs to be discovered anytime if they are in proximity.
    - To be discovered, a PD shall maintain discovery transmission or reception in low duty cycling mode.

- Even though PAC members consider many usage scenarios, battery-powered hand-held devices must be in the most application scenarios.

- The outstanding advantage of synchronous operation is its potential ability to achieve high power saving effect.
    - By explicitly specifying discovery time interval, PDs in power save mode can awake in time for discovery without dissipating unnecessary power.

Rationale behind the suggested structure (Cont')

- A PD is also supposed to be ready for peering in low duty cycling mode.
    - It is because a PD does not know when another PD send peering request to it.

- Adoption of fixed interval for peering is also needed to conserve power.

- Above considerations motivates PAC to adopt superframe structure based on synchronous operation with fixed discovery interval and fixed peering interval, respectively.

Remarks

- Authors of this document assume that PAC would adopt not multiple but a single MAC layer specification.
  - Should PAC have multiple MAC specifications, proposers of each MAC specification will have a possibility of suffering from lack of comments/contributions from other PAC members, which will result in an imperfect MAC specification.

- Readers are requested to regard the frame structure presented in this documents as one way of harmonize all the proposals presented in July meeting in Geneva, Switzerland.
  - Please, do not hesitate to suggest another way of harmonization.
  - Any comments on the suggested structure will be greatly appreciated.

Relevant issues (1/2)

- Regarding synchronization interval, PAC has 2 definitions of "distributed synchronization" (refer to 328r8).
  - PAC need to debate on the pros and cons of each definitions.

5.1. Synchronization

In synchronized mode, PAC operates in fully distributed synchronization.

[Def. 1] Synchronization among PDs can be achieved by transmitting/receiving synchronization reference signal. When there is already synchronization among PDs, each PD may send synchronization reference signal independently to maintain the synchronization. When there is no synchronization already established, a PD can initiate it by transmitting synchronization reference signal.

[Def. 2] Synchronization among PDs can be achieved by transmitting/receiving synchronization reference signal. The synchronization reference signal may be transmitted by a single PD elected by a group of PDs. When there is no synchronization already established, a PD can initiate it by transmitting synchronization reference signal.

Relevant issues (2/2)

- Regarding discovery interval, proposals can be divided into 3 categories (refer to 520r5).
  - The suggested discovery interval corresponds to the "Dedicated time resource for discovery".

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Discussion on Thread II
(Tuesday AM2)

- Where does the discovery occur?
- Definition
  - Dedicated resource for discovery : discovery uses dedicated time-frequency resource
  - Shared resource for discovery: discovery and data use the same time-frequency resource
- Categorization
  - Dedicated resource for discovery and communication
    - Dedicated frequency resource for discovery
      - e.g. Frequency channel (band)
      - WC Jeong(ETRI) : to be identified later
    - Dedicated time resource for discovery
      - e.g. TDMA, OFDM
      - Samsung (OFDM), Qing(TDMA/OFDM), SS Joo(ETRI, TDMA/OFDM)
      - SC Chang (ETRI)
    - Dedicated time-frequency for discovery
      - e.g. OFDMA, TDMA in one or multiple dedicated channels
      - NICT (dedicated channel), LG (multiple channel, to be discussed more)
  - Shared resource for discovery and communication
    - No proposals identified

Submission   Slide 14   PAC Technical Editors