

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

Submission Title: [The embedded CAP for GTS transmission for IEEE 802.15.4e]

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Re: [IEEE P802.15.4e Call For proposal]

Abstract: [This document proposes an enhancement to IEEE 802.15.4-2006 MAC Layer with modified superframe structure named embedded CAP]

Purpose: [This document is a response to call for preliminary proposals.]

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The embedded CAP for GTS transmission for IEEE 802.15.4e

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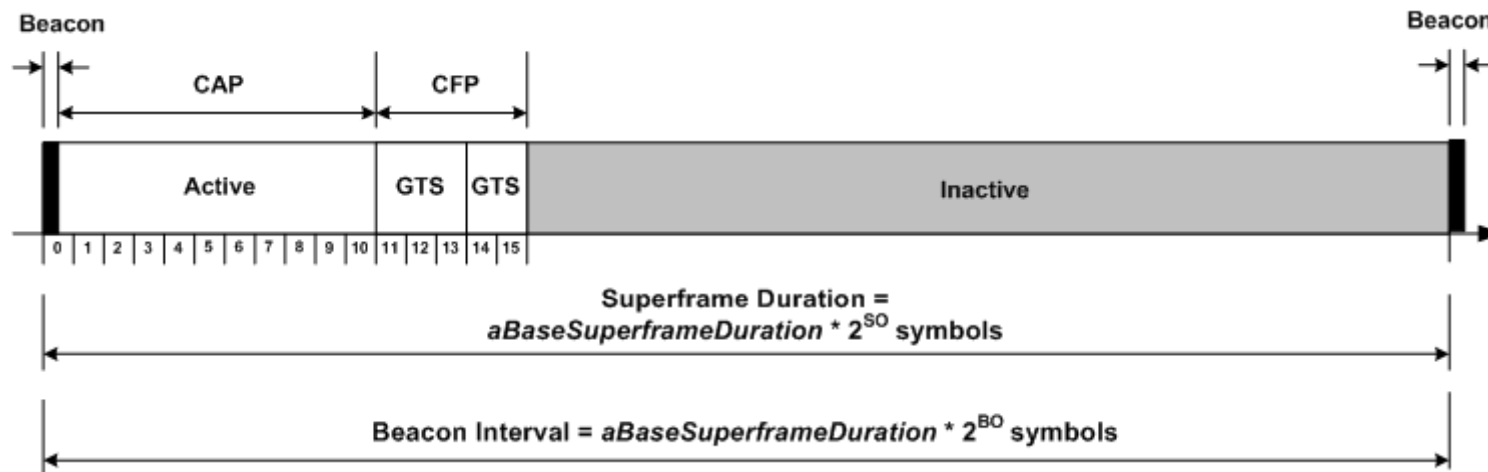
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Objective and proposed solution

- 802.15.4e Requirements
 - TDMA/determinism is required
 - New superframe structure is needed
- GTS/CFP solution
 - Using CFP is a good solution because it maintains TDMA/determinism and time guarantee
 - But we still need CAP

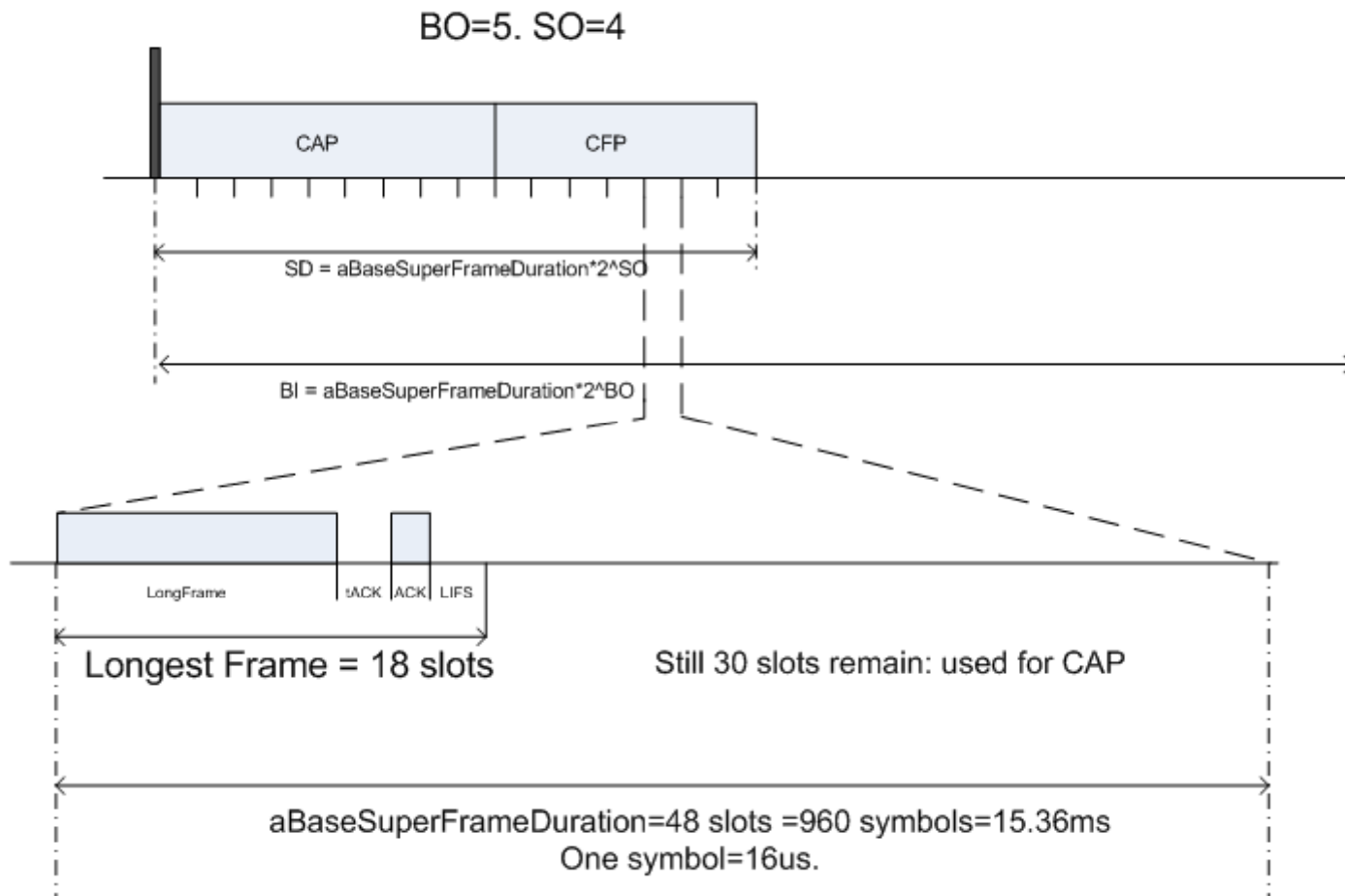
Proposed Ideas

- Traditional case: one CFP slot just for one node transmission



- Proposed idea: Embedded CAP
 - To allow remaining time in GTS for other nodes to transmit packets via CSMA/CA

An Example for timeline Analysis



An Example for timeline Analysis

- Timeline analysis:
 - One aBaseSuperFrameDuration= 960 symbols = 48 slots = 15.36ms.
 - One successfully transmission for longest PHY layer packet is 18 slots, so still a lot of time has been idle in CFP = 30 slots = 600 symbols There is enough time for one data packet transmission
- Basic idea:
 - To allow remaining time (600 symbols in the example) in GTS for other nodes to transmit packets via CSMA/CA

Basic Idea for Embedded CAP

- Embedded CAP for GTS
 - If the node is in its own GTS, it just transmits. In other GTSs, it waits for ACK and then uses CSMA/CA (CCA 3 times in this case) to compete the channel for transmission
 - In its own CFP. It can transmit one packet or multi packets. If the multiple case(frame burst), the next packet should be immediately be transmitted after the previous ACK.
 - If one node do not have any packet to transmit in its own CFP period, it will send a short probe frame and the ACK will be sent back to release the channel for other nodes.
 - Once a node has data to transmit. It should start the transmission at the beginning of its CFP slot.

Slide 7

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changing ACK scheme?
taerim, 7/6/2008

Protocol and Analysis

- CFP guarantee and CAP as supplement
 - Guarantee the CFP performance
 - In CFP, the assigned node has the priority to transmit
 - Besides its own CFP, all other time the node can access channel using modified CSMA/CA, utilize the channel more efficient
 - Potential throughput increase

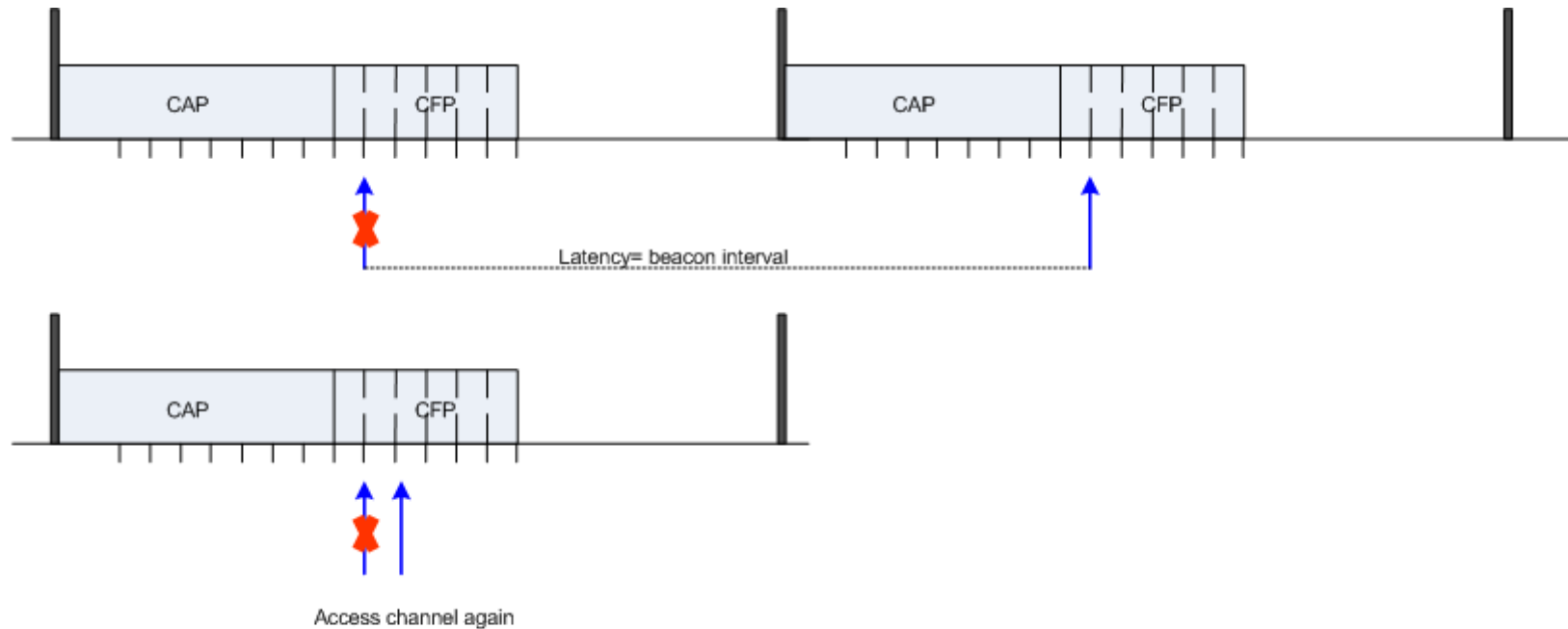
Backward Compatibility with 802.15.4

- 802.15.4 vs 802.15.4e
 - If the slot is assigned to 802.15.4 device, 15.4e device can not compete for 15.4 assigned CFP slot.
 - 15.4 devices do not need to add anything under these scheme. They could start transmission anytime in its assigned CFP slots
 - 15.4e can only use embedded CAP in those slots assigned to other 15.4e devices, and they must start transmission in the begin point of CFP slots.

Potential Qos Support

- There are several methods to guarantee Qos
 - Two-level Qos support.
 - Higher Qos (in its CFP slot, no other node could use)
 - Lower Qos (in its CFP slot, other node could use embedded CAP to transmit packets.)

An example to use embedded CAP in GTS to reduce delay



- If in its own CFP, the packet is failed.
 - 802.15.4: wait for next CFP slot
 - Proposed solution: can access other's CFP channel using CSMA/CA

Salient features for proposed scheme

- Major reduction delay for GTS frame re-transmission
- Throughput increase by using the slot time more efficiently
- Potential support for diff Qos

Thanks!
Q & A