Saving Power Consumption using PSM for WiFi Devices

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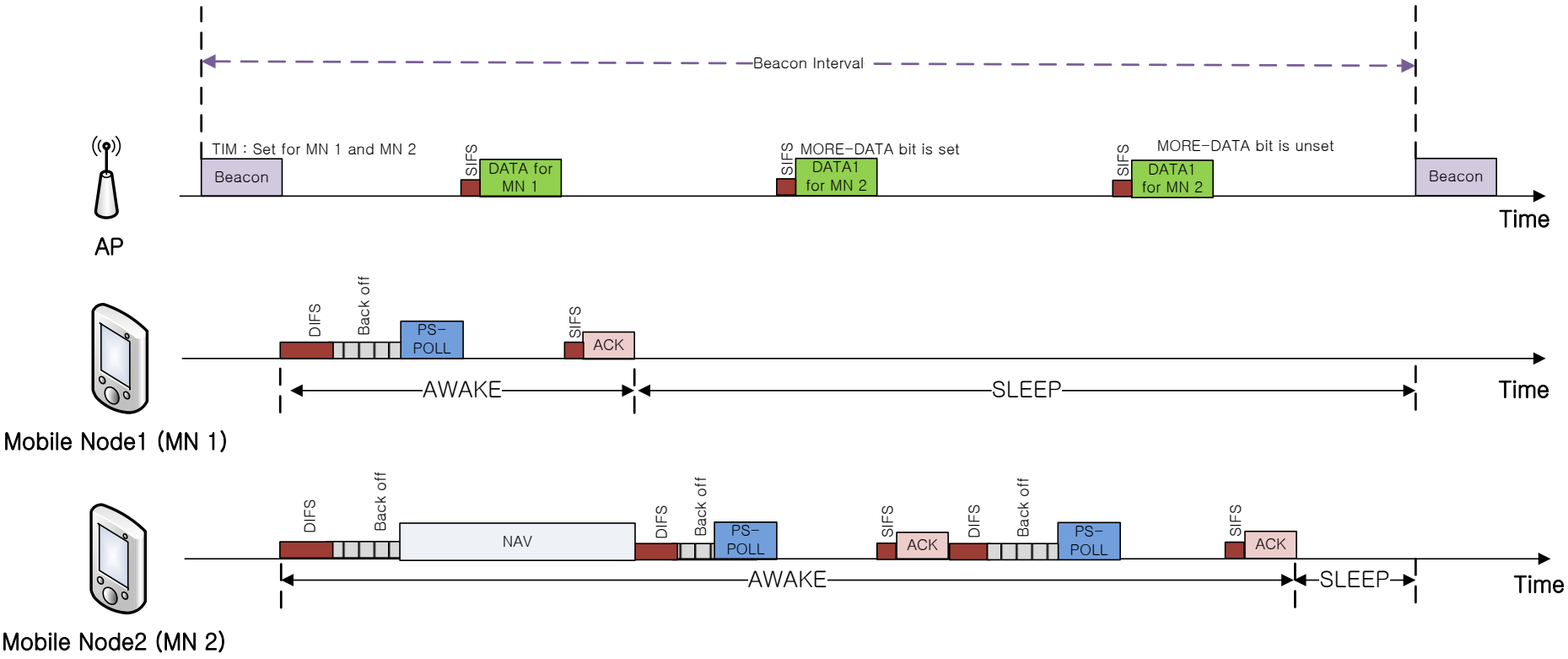
Overview

- IEEE 802.11 standard defines **Power Saving Mode (PSM)** to reduce power consumption.
- There are two power states Awake(receive data but high power consumption) and Sleep(cannot receive data but low power consumption).
- Type of Power Mode : CAM (constantly awake mode), static PSM, adaptive PSM.
- We will approve adaptive PSM to save our devices' power consumption.

Technical Background

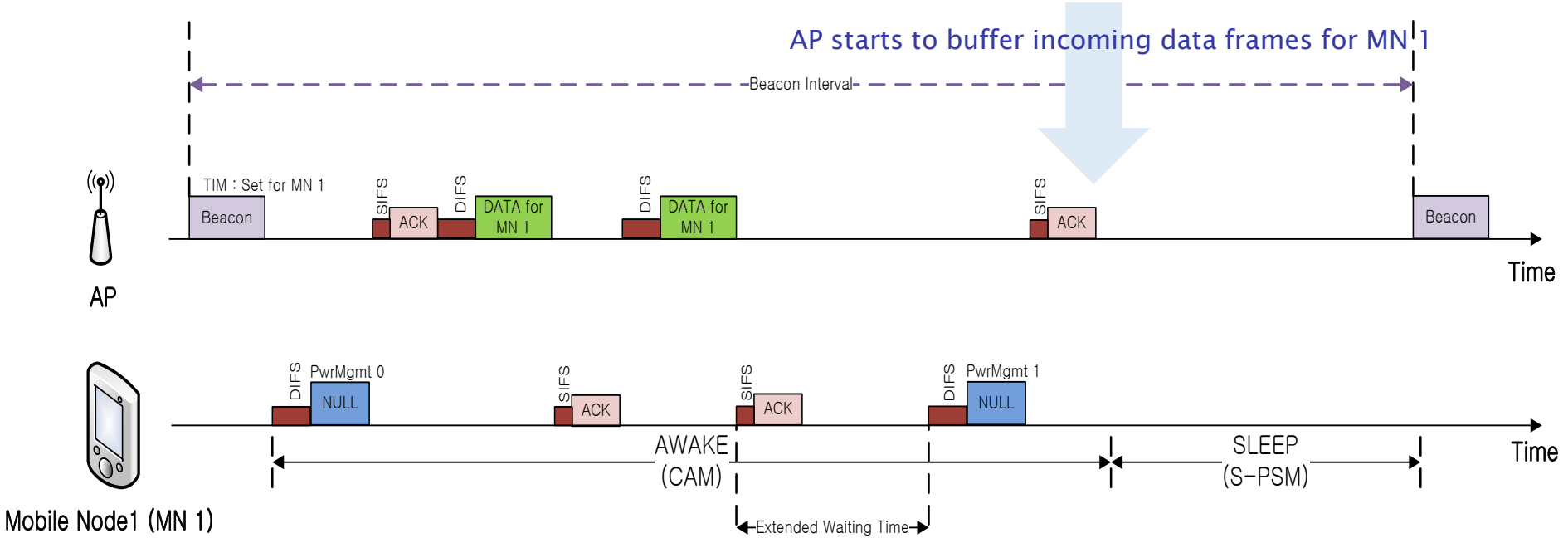
- Static PSM (S-PSM) [1]



AP sends beacon with TIM (set if client has queued data). After that, mobile node wakes up and send PS-POLL to get the data. If there is more data to send in AP queue, AP set MORE-DATA field 1. Then, MN sends the PS-POLL again. Otherwise (if MORE-DATA = 0), MN goes to sleep.

Technical Background

- Adaptive PSM



AP sends beacon with TIM. Then mobile node sends the NULL data frame with PwrMgmt bit unset to get data. AP sends all buffered data frames even if there is no additional request from MN. If there is no received data during extended waiting time (tail time), MN sends NULL data with PwrMgmt bit set (1) and goes to sleep.

Technical Background

- Paper works
  - Bounded slowdown of observed RTT [2]
    - The TCP data packets are delayed until the beginning of a beacon period.
    - Limitation of S-PSM and A-PSM motivation is well defined in this paper.

    → **We should implement both S-PSM and A-PSM on NS-2 to compare each**

  - NAPMAN [3]
    - NAPman aims to deliver energy savings without unfairness.
    - This paper point out the effect of coexistence of devices and traffic patterns

    → **We should experiment in several traffic pattern scenario**

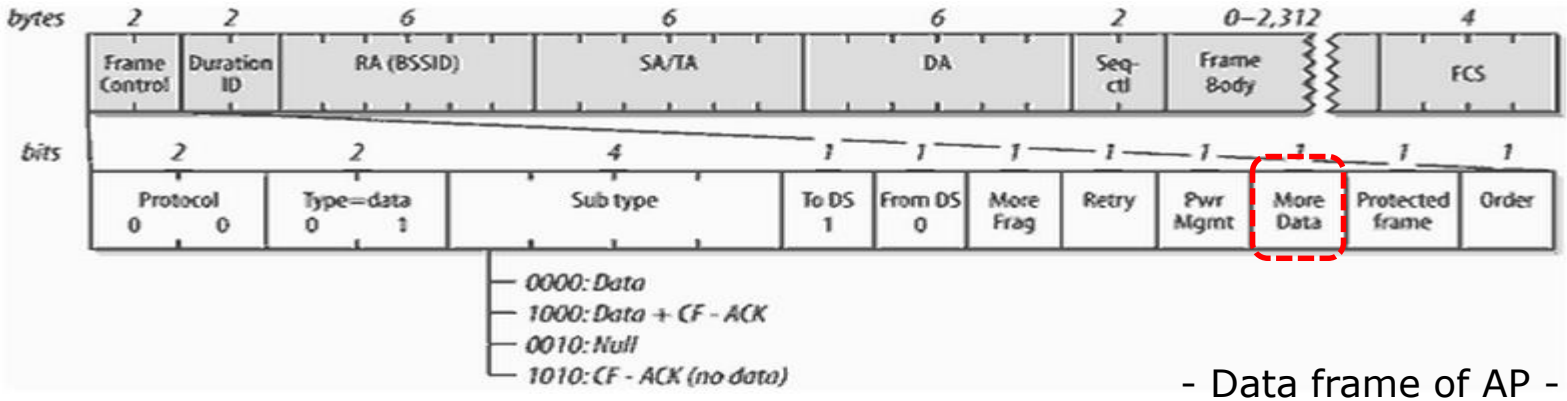
Scope of the Project

- Final Goal
  - Construct a research environment through implementation of PSM operation simulation
  - Propose the approved algorithm of previous adaptive PSM.

- Development environment
  - **NS2 :** Famous network simulator which has many references. But there is no proper PSM module. [4]
  - We implement PSM by revising NS2.
  - Implementation of real device is very difficult because we can’t modify our phone firmware.

System Requirements [1/3]

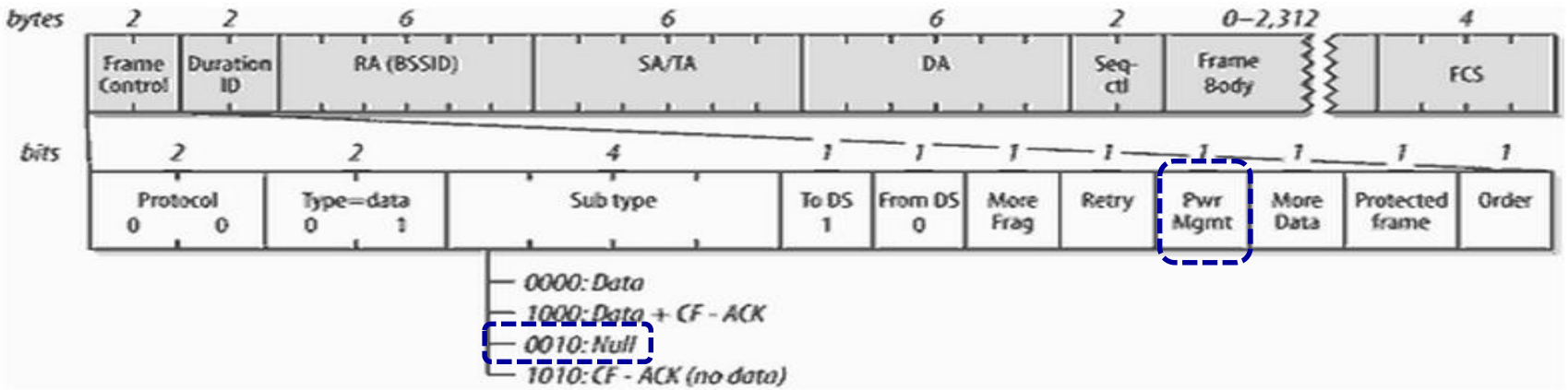
- Functional requirements for Static PSM operation
  - Transmitter side
    - PSM queue
    - Data frame (more data bit)
    - Beacon
      - TIM
  - Receiver side
    - Sleeping schedule
    - PS-POLL



- Data frame of AP -

System Requirements [2/3]

- Functional requirements for Adaptive PSM operation
  - Transmitter side
    - PSM queue
    - Beacon
      - TIM
  - Receiver side
    - Sleeping schedule (tail time)
    - NULL instead of PS-POLL (only setting the PwrMgmt bit)



- NULL data frame is used instead of PS-POLL

System Requirements [3/3]

- Traffic patterns
  - Wireshark [5]
    - Packet analyzer by capturing network packets. We can draw the traffic pattern from it.
  - Applications
    - FTP, Youtube, Web surfing, KakaoTalk
- Evaluation
  - Scenario
    - We will decide the scenario after analyzing traffic patterns using wireshark.
  - Measurement
    - Throughput
    - Energy consumption

Summary

- What to do
  - Construct a research environment through implementation of PSM operation simulation using NS2.
  - Propose approved algorithm of previous adaptive PSM.

- Specific requirements
  1) Static-PSM: PSM queue, TIM, PS-POLL, sleep scheduling
  2) Adaptive-PSM: PSM queue, TIM, NULL data, sleep scheduling

Reference

[1] IEEE 802.11 standard, “http://standards.ieee.org/getieee802/download/802.11-2012.pdf”, 2012

[2] R Krashinsky, H Balakrishnan, "Minimizing energy for wireless web access with bounded slowdown", Wireless Networks, 2005.

[3] E Rozner, V Navda, R Ramjee, "NAPman: network-assisted power management for wifi devices," MobiSys, 2010.

[4] NS2, “https://www.nsnam.org/”

[5] Wireshark, “https://www.wireshark.org/”

THANK YOU !