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

Submission Title: [Evaluation methodology by theoretical throughput analysis for MAC-SAP]

Date Submitted: [January 18, 2007]

Source: [Hiroyuki Nakase[2] , Fumihide Kojima[1], Zhou Lan[1], Chang-Woo Pyo[1], Hiroshi Harada[1], Masahiro Umehira[1], Shuzo Kato[1], Yukimasa Nagai[3], Takahisa Yamauchi[3], Yasuyuki Oishi[4]]

Company [NICT[1], Tohoku University[2], Mitsubishi electric[3] , FUJITSU[4]]

Address[1][3-4 Hikari-no-oka, Yokosuka-shi, Kanagawa 239-0847, Japan][2][2-1-1 Katahira, Aoba-ku, Sendai-shi, Miyagi 980-8577, Japan][3][5-1-1 Oofuna, Kamakura, Kanagawa 247-8501, Japan][4][5-5 Hikari-no-Oka, Yokosuka-shi, Kanagawa 239-0847, Japan]

Voice:[+81-46-847-5295[1], +81-22-217-55316 [2], +81-467-41-2885[3], +81-46-839-5373[4]]

FAX: [+81-46-847-5440[1], +81-22-217-55336[2], +81-467-41-2486[3], +81-46-839-5560[4]]

E-Mail:[f-kojima@nict.go.jp[1], lan@nict.go.jp[1], cwpyo@nict.go.jp[1], harada@nict.go.jp[1], umehira@mx.ibaraki.ac.jp, shu.kato@nict.go.jp[1], nakase@riec.tohoku.ac.jp[2], Nagai.Yukimasa@ds.MitsubishiElectric.co.jp[3], Yamauchi.Takahisa@cw.MitsubishiElectric.co.jp[3], yasu@labs.fujitsu.com[4]]

Re: [Discussion on TG3c MAC evaluation]

Abstract: [Evaluation methodology by theoretical throughput analysis for MAC-SAP of TG3c was proposed.]

Purpose: [To be considered in 15.3c MAC evaluation]

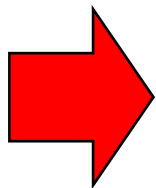# Evaluation methodology by theoretical throughput analysis for MAC-SAP

Hiroyuki Nakase (Tohoku University),
Fumihide Kojima, Zhou Lan, Chang-Woo Pyo,
Hiroshi Harada, Masahiro Umehira, Shuzo Kato (NiCT),
Yukimasa Nagai, Takahisa Yamauchi (Mitsubishi electric),
Yasuyuki Oishi (FUJITSU)

Summary

- ■ This presentation is to decide the **descriptions for MAC performance evaluation scenario** in the selection criteria.

- ■ MAC-SAP throughput are evaluated by the **theoretical analysis**.

- ■ The MAC-SAP throughput are analyzed based on **link-by-link connection from UM1 through UM5**.

Background

- ■ Doc 572r0 was proposed MAC simulation scenarios based on computer simulation.

- ■ Straw pole showed that analytical evaluation was preferred by the TG3c participants.

- ■ The group needs a clear analytical system evaluation scenario for selection criteria document.

Analytical evaluation methodology for MAC-SAP throughput

Basic Concept

1. Theoretical throughput analysis is employed to evaluate MAC performances. (Simulation is not necessary)

2. The analysis for UM1 and 5 is mandatory for proposal. (UM2, 3, and 4 are option as same as PHY evaluation)

3. Upon the analysis, parameters related to the PHY characteristics are assumed to be a black box represented by BER/PER.

Items to be reported –
All parameters required for third-party validation

- # Details of protocol
  - Frame structure, Inter frame spacing, Retransmission method, Aggregation method (if defined), etc.
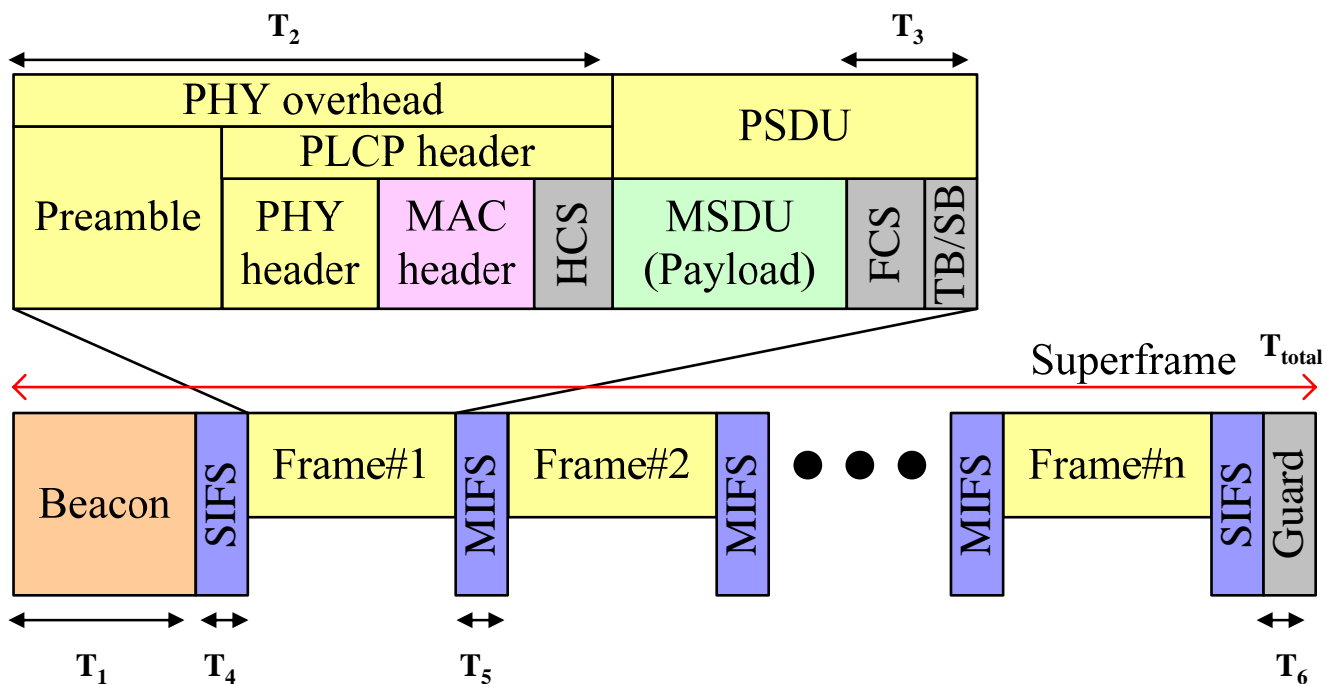
- # Considered parameters for throughput analysis:
  - Examples:
    - Super frame size, Beacon duration, CAP duration, guard-time duration, etc.

Evaluation example of No-ACK for UM1

■ Theoretical link-by-link throughput analysis using TDMA protocol.

Throughput @ NoError = PHYrate x (Ttotal − (T1 + T2+ T3+ T4+ T5+ T6)) / Ttotal

Throughput @ NoARQ = PHYrate x PER x (Ttotal − (T1 + T2+ T3+ T4+ T5+ T6)) / Ttotal

Summary

- Proposed system evaluation scenarios and items to be reported for UM1 and 5.
  - The evaluation scenario is based on theoretical analysis.

- This method is applicable to UM2-4 as well.
  - The evaluation can be carried out using link-by-link throughput analysis.