

An Advanced CSMA/CA System for Wide Area Broadband Wireless Access

Kaoru Sano and Hiroshi Kobayashi
Tokyo Denki University, Japan

Osamu Moriya
Toshiba Corporation, Japan

I. INTRODUCTION

- The purpose of this research is:
 - To propose a new broadband wireless access system for solving the digital divide in developing countries.
 - Conventional systems have:
 - Reservation-based access control such as DOCSIS that takes time for the connection to be established and does not provide a flexible response to a large amount of burst traffic.
 - Synchronous CSMA/v-MCA* (NP system) where throughput performance degrades rapidly due to the intervention of larger RTTs.
 - In the proposed advanced CSMA/CA (TP system),
 - Maximum throughput of approximately 0.9 was observed regardless of network length and physical speed, while maintaining the low latency that is characteristic of contention-based access control.
- * carrier sense multiple access with variable multiple collision avoidance

II. SYNCHRONOUS CSMA/v-MCA ON PTMP NETWORKS

- Each device executes CS or CD as its own responsibility in almost all of the contention-based, medium access, control schemes.
- On PTMP (point to multipoint) networks, BS can substitute CS and CD in the upstream channels for CPE and precisely control transmission timing of upstream frames.
- Using these features, the NP system achieves higher throughput with low latency over any network length. However, the throughput degrades rapidly in networks that are long and with higher physical speed.

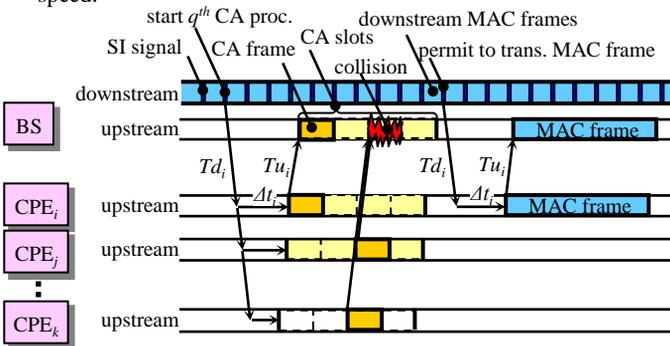


Fig. 1. Synchronous CSMA/v-MCA (NP system).

III. ADVANCED CSMA/CA SYSTEM

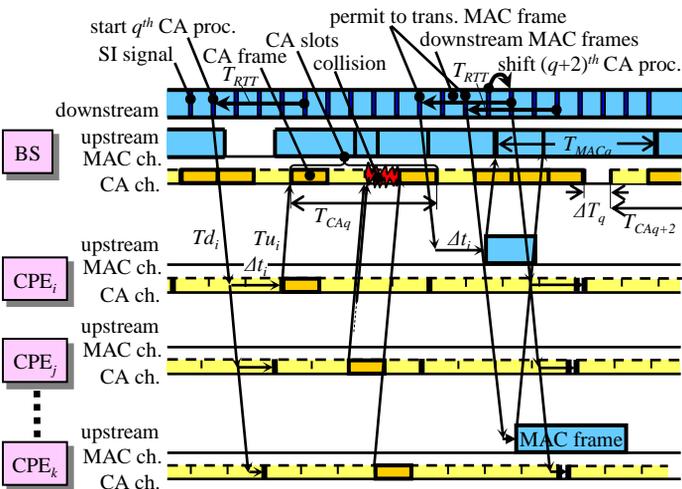


Fig. 2. Implementation of the advanced CSMA/CA (TP system).

- In order to incorporate total precedence transmission of all CA and MAC frames that minimizes the time wasted for upstream channels:
 - An out-of-band signaling system is introduced.
 - The CA procedure and the MAC frame transmission run independently.
 - The upstream BW is properly distributed to CA and MAC channels.
 - Flow control is added to the CA procedure.

IV. PERFORMANCE EVALUAION

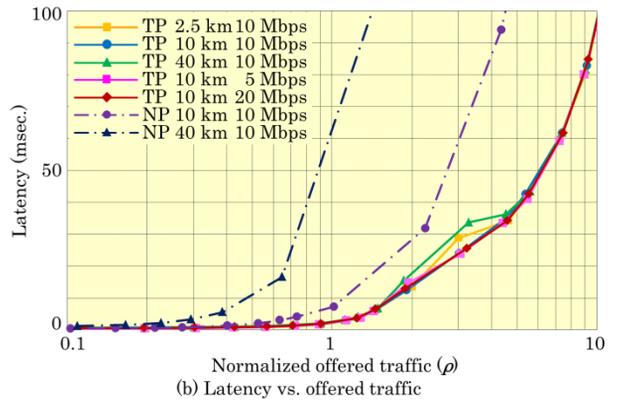
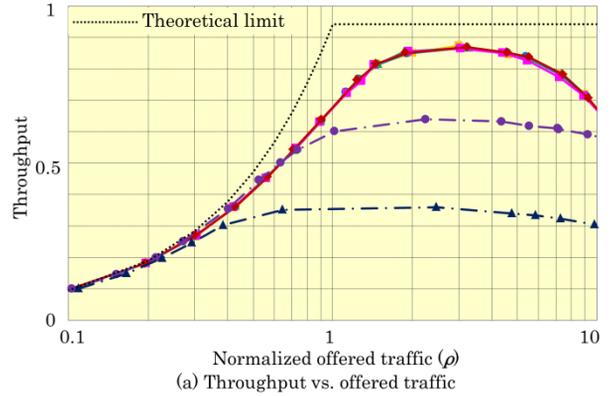


Fig. 3. Performance comparison between NP and TP systems.

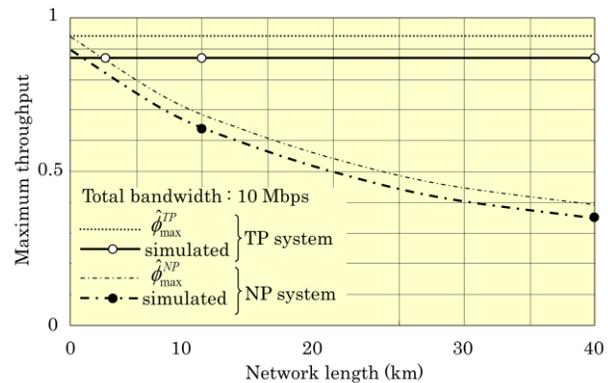


Fig. 4. Performance comparison between theoretical and simulated maximum throughput.

V. CONCLUSIONS

- An advanced CSMA/CA system was developed to minimize the wasted time for upstream channels.
- Maximum throughput of approximately 0.9 was obtained regardless of network length and physical speed, which achieves the low latency of the contention system.
- A remarkably large performance improvement in wireless LAN may also be achieved by implementing the proposed scheme.