Extended MPCP Slot Data Transmission
Experimental System for Active Optical Access Network

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Abstract—Extended MPCP (IEEE802.3av) data transmission experimental system for optical slot-based Access Network is designed. The slot-based two-way communication was successfully established by extended MPCP. The method does not need to analyze frame-header at switch system.

I. INTRODUCTION

Passive Optical Network (PON) is prevalent for Fiber-To-The-x (FTTx) [1]. However, the optical splitter essentially suffers high optical attenuation. Therefore, the authors proposed Active Optical access Network (ActiON) using our new PLZT high-speed optical switch developed with EpiPhotonics Corp [2]–[4]. It consists of Optical Line Terminal (OLT), Optical Network Unit (ONU) and PLZT optical switch system. ActiON achieves a long transmission distance (128 subscribers and 40 km service) compared to PON because point-to-point communication is realized by switching. ActiON is compatible with 10GE-PON (IEEE 802.3av), consequently, utilizes Multi Point Control Protocol (MPCP) [5]. MPCP is used for 1) “Discovery process” initially establishing connections between OLT and ONUs, 2) “Gate and Report process” operating upstream transmissions from ONUs to OLT. However, ActiON needs the configuration for controlling an optical switch. Only conventional MPCP cannot control an optical switch system.

This paper focuses on the optical slot transmission method using our extended MPCP for controlling an optical switch system. We successfully verified this transmission method by experiment using our newly developed OLT, ONU and Slot Switch having slot transmission configuration.

II. EXTENDED MPCP SLOT TRANSMISSION METHOD

The O/E/O conversion and the data analysis processing frame by frame at an optical switch system can be a bottleneck. And, it causes a high-cost architecture in more than 10Gbps high-bandwidth environment. Therefore, ActiON adopts fixed-length time slot switching method without data analysis processing, as shown in Figure 1. PLZT switch system mainly consists of optical switches, switch driver and Slot Allocation Module having RAM and FPGA. Dynamic Bandwidth Allocation (DBA) allocates each ONU slots according to the demand from/to ONUs. To update slot switching schedule, OLT sends PLZT switch system the Slot Allocation message every several cycles on the outband control line. The Slot Allocation message is stored in RAMs at Slot Allocation Module. FPGA reads and writes to the RAMs, and sends the appropriate switching pattern signal to the switch driver. The switch driver sends switch signals to the optical...
III. EXPERIMENT

Figure 4 shows the experimental setup of ActiON. We newly developed the prototype of OLT, ONU and Slot Switch. Slot Switch emulates PLZT optical switch system which is now developing. This experimental system was designed with three ONUs.

The data transmission consists of two phases: “Synchro phase” and “Slot data transmission phase.” Figure 5 (a) shows the message-flow of demonstrated synchro phase including Discovery process. First, OLT sends RESET message (Extended MPCP: Type=0x880A) to Slot Switch. After receiving RESET message, Slot Switch starts to operate a time-slot schedule. OLT is synchronized with Slot Switch by using Timestamp field of ACK message. Also, Slot Switch periodically sends SYNC message (Extended MPCP: Type=0x880B) to adjust synchronization with OLT. Second, OLT sends a Slot Allocation messages (Extended MPCP: Type=0x880C and 0x880D) for initializing Slot Allocation schedule. Slot Switch emulates PLZT optical switch system which is now developing. This experimental system was designed with three ONUs.

On the other hand, ONU sends a buffered data by Gate message within Grant Length. Also, Time Slot #0 is Communication Channel (CC) used for our previously proposed Discovery Process [2].

REFERENCES