143.2.6 MCRS Time synchronization

For MCRS to provide the intended skew and jitter remediation capabilities, a sufficient delay margin has to be built into the MCRS buffering at the ONU and the OLT. Such delay margin is established at the ONU registration time by proper setting of MCRS ENV_RX read and write pointers at the OLT and the ONU.

Upon power-up or reset, an unregistered ONU synchronizes to the received clock and aligns to 257-bit block and FEC codeword boundaries on each of its active (enabled) receive channels (see ONU Synchronizer Process, 142.3.5.4.2). After that, the received data is passed to FEC decoder, which introduces a near-constant (± <TBD> EQT) delay. Corrected data from the FEC decoder is passed to xMII and is received into ONU MCRS ENV_RX buffer. The following are the ONU rules for setting the ENV_RX write and read pointers:

1. Write pointer

    a. ONU MCRS always sets the write pointer for the ENV_RX buffer to equal the EPAM value in any envelope header it receives, regardless of the LLID value in that envelope header.

    b. If multiple receive channels are active, the write pointers are set independently for each channel based on EPAM values in envelope headers received on each channel.

2. Read Pointer

    a. The read pointer increments synchronously with the *LocalTime* counter, which is locked to the xMII receive clock of an active (enabled) receive channel with the lowest index.

    b. In an unregistered ONU, upon every update of a write pointer associated with the receive channel with the lowest index, the read pointer is also updated according to the following equation:

    $$ReadPointer = WritePointer\ XOR\ 0x20$$

In the OLT, PCS receiver synchronizes on Start-of-Burst Delimiter (see OLT Synchronizer Process, 142.3.5.4.2) independently on each active (enabled) receive channel. After that, the received data is passed to FEC decoder, which introduces a near-constant (± <TBD> EQT) delay. Corrected data from the FEC decoder is passed to xMII and is received into OLT MCRS ENV_RX buffer. The following are the OLT rules for setting the ENV_RX write and read pointers:

1. Write pointer

    a. When receiving an envelope from a registered ONU, the OLT MCRS sets the write pointer for the ENV_RX buffer to equal the EPAM value in the envelope header.

b. When receiving an envelope from an unregistered ONU, the OLT MCRS sets the write pointer according to the following equation:

$$WritePointer = ReadPointer \text{ } XOR \text{ } 0x20.$$

NOTE: The OLT MCRS determines that an envelope is from an unregistered ONU by either checking the LLID value in the envelope header (DSC_PLID) or by checking that an envelope header is received during the discovery window (see 144.x.x.x). Otherwise, the envelope is assumed to be received from a registered ONU.

2. Read Pointer

a. The read pointer increments synchronously with the *LocalTime* counter, which is locked to the xMII transmit clock.

b. If the OLT implements multiple transmit channels, all these channels share the same xMII transmit clock. Correspondingly, the read pointers for all channels increment synchronously and maintain equal values.

The above set of rules ensures that a delay of 32 EQT is built into the ONU MCRS receive path and a similar delay of 32 EQT is built into the OLT MCRS receive path. Therefore, the total round-trip delay measured by the MPCP (see 144.3.1.1) during an ONU discovery and registration includes a built-in margin of 64 EQT that is used to eliminate skew between different channels or the timing jitter within a channel. During the normal operation of a registered ONU, the delay any EQ experience in the ENV_RX buffer is inversely correlated with the accumulated skew and jitter that this EQ encountered after leaving the ENV_TX buffer in the transmitting MCRS, such that the sum of the two delays remain constant.