Interlaken Dual Calendar Extension Protocol Definition

February 2014

Revision 1.0

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Revision History

Revision 1.0   20 February 2014
• Initial public release of the Document

1   Introduction

Interlaken connects components via multiple high-speed serialized links. The Interlaken Protocol Specification defines a single calendar to communicate XON/XOFF status from flow control sender to receiver.

For some Interlaken applications there may be a need to add/remove channels or change channel priority during operation. One example of this would be Online Insertion or Removal (OIR) of interfaces. Another example would be the dynamic re-provisioning of channel bandwidth. In such cases this requires Interlaken channels to be updated dynamically without affecting traffic of the interface, including the channel being added, removed, or re-provisioned. There are multiple approaches supporting such functionality, each with differing hardware and software complexity trade-offs.

This "Dual Calendar" Interlaken specification extension standardizes a hardware based implementation to support dynamic reconfiguration of flow control calendars without affecting active traffic. This feature resembles the "Hit-less Bandwidth Re-provisioning" capability previously defined in OIF-SPI4-02.01 - System Packet Interface Level 4 (SPI-4) Phase 2: OC-192 System Interface for Physical and Link Layer Devices.

This Dual Calendar feature is an optional extension and does not alter the operation of the Interlaken protocol as currently specified in the Interlaken Protocol Specification, v1.2 or the Interlaken Retransmit Extension v1.2. Both sides of an Interlaken link must be dual calendar capable for the link to operate in dual calendar mode.

2   Dual Calendar Operation

In dual calendar operation two calendars are maintained, one that is currently in use (active), and the other that can be updated and/or changed (shadow).

For the purpose of explanation, the two calendars are referred as "CAL0" and "CAL1". A "calendar selection (CAL_SEL) bit" is defined in the flow control sequence, as the first calendar slot of an entire calendar. This CAL_SEL bit indicates which calendar is used by the following flow control sequence. The flow control transmitter sets the value of the CAL_SEL bit to 0, if CAL0 is active or to 1, if CAL1 is active. Based on the CAL_SEL bit, the flow control receiver determines which calendar is active. Introduction of CAL_SEL bit for dual calendar operation increases the flow control calendar length by one.

To add/remove channels or to change channel bandwidth, the shadow calendar is updated identically in both the transmitter as well as the receiver. A user may then choose to switch from the active calendar to the reconfigured shadow calendar. The implementation of the switching process is user specific. The flow control transmitter should start using the new calendar only after it completes the transmission of the current active calendar.

The receiver automatically switches to the new calendar when it sees the updated CAL_SEL bit at the beginning of a flow control calendar.

After switching, the shadow calendar becomes the active calendar and the previously active calendar becomes the shadow calendar. During this switching process the following three cases can occur:

1. A channel is added-The flow control status of this newly added channel is sent by the transmitter and updated at the receiver.
2. A channel is removed- The transmitter does not send any flow control status for removed channels. The receiver updates status of these removed channels as "XOFF".
3. A channel is re-provisioned- For channels present in both calendars, the transmitter sends the latest flow control status and the receiver updates the received status accordingly. The switching process should not affect the flow control status of re-provisioned channels. For example, if a channel was XON before and after switching, the receiver should not unnecessarily XOFF the channel during switching, or vice-versa.

2.1   Dual Calendar In-Band

In In-band flow control with dual calendar mode, when the reset calendar bit in the Burst/Idle control word is set, the first calendar slot (bit 55 of the control word) represents the CAL_SEL bit.
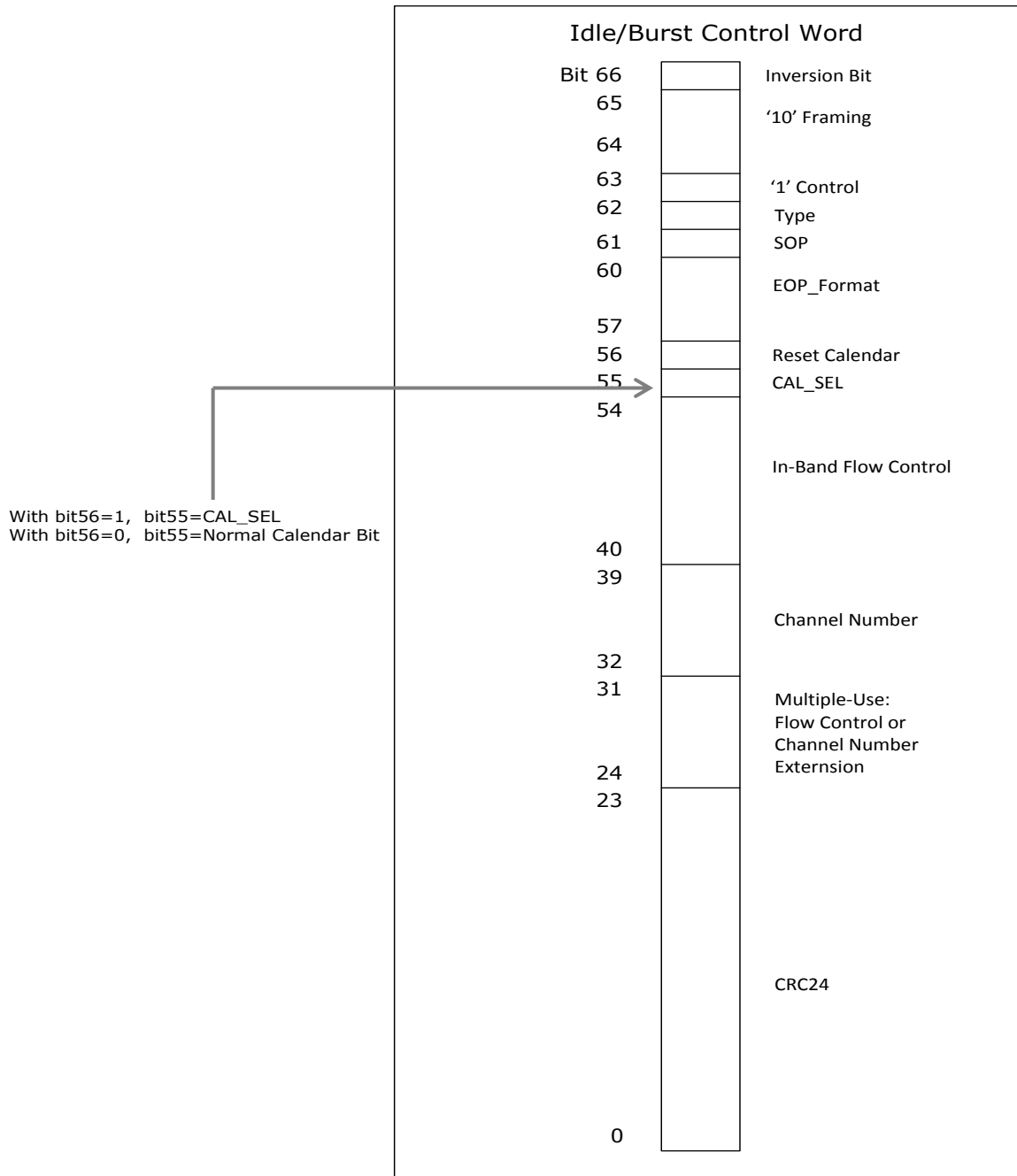

Figure 1: In-Band Dual Calendar CAL_SEL

2.2   Dual Calendar Out-of-Band

In dual calendar mode, the out-of- band flow control uses the first calendar slot as CAL_SEL bit.
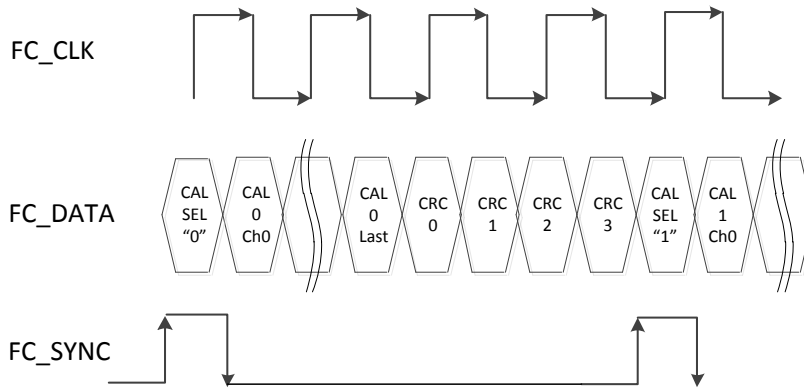

Figure 2: Out-of-Band Dual Calendar CAL_SEL Bit

Status messaging and retransmission message are also supported with the dual calendar mode. CAL_SEL bit is not present in the status message.

2.3   CAL_SEL bit protection

For in-band flow control, CAL_SEL bit is protected by CRC24. For out-of-band flow control, CAL_SEL bit is protected by CRC4. There is no need for an additional error protection method.

In case of a CRC24 or CRC4 error, the receiver shall act as defined in Interlaken Protocol Section 5.4.11.6: If an error is detected, the receiver should behave conservatively and assume that all channels are in the XOFF state until the next calendar reset and subsequent error-free status messages.