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June 10, 2002

To: T10 Technical Committee
From: Bill Galloway
Subj: SAS Credit Not Ready

A new primitive is needed to allow the recipient of frames to say that it does not have anymore credit and will not have any credit anytime soon.

Actions:

Rename RRDY(1) in primitive tables to CREDIT_BLOCKED.

Update state diagrams with new parameters.

Add following paragraph:

7.1.4.x CREDIT_BLOCKED
CREDIT_BLOCKED indicates that no more credit is going to be sent during this connection.

Update the following paragraphs:

7.13.6.2.1 SSP_R1:Receive state description
The receive state receives frames and primitives.

As a result of receiving an RRDY the receive state shall send a ~~credit~~ RRDY received parameter to the tx_credit_monitor state.

As a result of receiving an CREDIT_BLOCKED the receive state shall send a CREDIT_BLOCKED received parameter to the tx_credit_monitor state.
…

7.13.6.10 SSP_TF3:Credit_wait state

7.13.6.10.1 SSP_TF3:Credit_wait state overview
The credit_wait state monitors the credit not available parameter, ~~and~~ the credit available parameter, and the credit blocked parameter from the tx_credit_monitor state.

If the last parameter received from the tx_credit_monitor state was a credit not available parameter then there is no transmit frame credit available and the credit_wait state shall wait for a credit available parameter indication, a credit blocked parameter indication or a credit timeout, ~~up to a credit time-out, until a credit available parameter is indicated from the tx_credit_monitor state~~ before exiting the credit_wait state.

The credit_wait state shall initialize a credit time-out timer to one millisecond and start the timer on the transition into the credit_wait state.

7.13.6.10.2 Transition SSP_TF3:SSP_TF4 (Credit_wait:Indicate_frame_tx)
The SSP_TF3:SSP_TF3 transition shall occur after a credit available parameter from the tx_credit_monitor state indicates there is transmit frame credit ~~is~~ available to transmit a frame and after indicating to the tx_credit_monitor state using the credit used parameter that a transmit credit was used.

7.13.6.10.3 Transition SSP_TF3:SSP_TF5 (Credit_wait:Indicate_DONE_tx)
The SSP_TF3:SSP_TF5 transition shall occur if the credit time-out timer is exceeded before transmit frame credit is available and after the credit_wait state sends a confirmation to the port layer using the credit time-out parameter that a credit time-out occurred.

The SSP_TF3:SSP_TF5 transition shall occur if the credit blocked parameter and credit not available parameter are both indicated from the tx_credit_monitor state and after the credit_wait state sends a confirmation to the port layer using the credit blocked parameter that credit is blocked.

When a time-out has occurred the SSP_TF3:SSP_TF5 transition shall contain an indication that a credit time-out occurred.

7.13.6.5 SSP_RCM1:Rcv_credit_monitor state
The rcv_credit_monitor state monitors the receivers resources and keeps track of the number of RRDYs transmitted verses the number of ACKs and NAKs transmitted.

Anytime resources are released or become available the rcv_credit_monitor state shall send a receiver resources available parameter to the tx_~~RRDY~~CREDIT_idle state.

When the SSP state machines are entered into as the result of receiving an enable SSP parameter from the connected state there is no frame receiver resource credit for the current connection. The rcv_credit_monitor state shall only send a receiver resources available parameter to the tx_~~RRDY~~CREDIT_idle state after frame receive resources become available. The specifications for when or how resources become available is outside the scope of this standard.

The rcv_credit_monitor state shall only indicate through the receiver resource available parameter the amount of resources available to handle received frames (e.g., if the rcv_credit_monitor state has resources for 5 frames the maximum number of receiver resources available requests outstanding is 5).

The rcv_credit_monitor state shall use the RRDY transmitted parameter from the tx_~~RRDY~~CREDIT_idle state to keep track of the number of RRDYs transmitted. The rcv_credit_monitor state shall use the ACK/NAK transmit parameter from the accepted_frame state to keep a track of the number of frames received.

Anytime the number of RRDYs exceeds the number of ACKs and NAKs the rcv_credit_monitor state shall indicate to the frame_rcv state using the credit extended parameter that credit has been given to the transmitter.

Anytime the number of RRDYs is ~~less than or~~ equal to the number of ACKs and NAKs the rcv_credit_monitor state shall indicate to the frame_rcv state using the credit exhausted parameter that on credit has been given to the transmitter.

The rcv_credit_monitor state may send a receiver resources blocked parameter to the tx_CREDIT_idle state to indicate that no more credit is going to be sent during this connection. After sending a receiver resources blocked parameter to the tx_CREDIT_idle state, the rcv_credit_monitor state shall not send a receiver resources available parameter to the tx_CREDIT_idle state for the duration of the current connection. The resources blocked

parameter should be sent to the tx_CREDIT_idle state when no further credit is going to become available within a Credit Timeout (i.e. less than one millisecond).

7.13.6.14 SSP_TCM1:Tx_credit_monitor state

The tx_credit_monitor state shall keep track of the number of transmit frame credits received verses the number of transmit frame credits used. The tx_credit_monitor state adds transmit frame credit for each ~~credit~~ RRDY received parameter indication from the receive state and subtracts transmit frame credit for each credit used parameter indication from the credit_wait state. The tx_credit_monitor state shall remember the credit blocked parameter indication from the receive state.

The tx_credit_monitor indicates to the credit_wait state using the credit not available parameter any time there is no transmit frame credit available.

The tx_credit_monitor indicates to the credit_wait state using the credit available parameter any time there is transmit frame credit available.

The tx_credit_monitor indicates to the credit_wait state using the credit blocked parameter any time the credit is blocked.

When the connected state is entered into the initial value of the transmit frame credit and credit blocked shall be zero in the tx_credit_monitor state ~~shall be set to zero~~.

7.13.6.16 SSP_TR1:Tx_~~RRDY~~CREDIT_idle state

7.13.6.16.1 Tx_~~RRDY~~CREDIT_idle state description

The tx_~~RRDY~~CREDIT_idle state waits for ~~a receiver resource available parameter~~ an indication from the rcv_credit_monitor state.

When the tx_~~RRDY~~CREDIT_idle state is transitioned into from the indicate_~~RRDY~~CREDIT_tx state with an indication that a RRDY was transmitted it shall indicate to the rcv_credit_monitor state using the RRDY transmitted parameter that an RRDY has been transmitted.

7.13.6.16.2 Transition SSP_TR1:SSP_TR2 (Tx_~~RRDY~~CREDIT_idle:Indicate_~~RRDY~~CREDIT _tx)

~~The SSP_TR1:SSP_TR2 transition shall after an indication from the rcv_credit_monitor state using the receiver resource available parameter that credit is available.~~

The SSP_TR1:SSP_TR2 transition shall occur on an indication from the rcv_credit_monitor state using the receiver resource available parameter that an RRDY is to be transmitted or the receiver resource blocked parameter that a CREDIT_BLOCKED is to be transmitted.

In the case of a receiver resource available a transmit RRDY indication is passed to the indicate_CREDIT_tx state.

In the case of a receiver resource blocked a transmit CREDIT_BLOCKED indication is passed to the indicate_CREDIT_tx state.

7.13.6.17 SSP_TR2:Indicate_~~RRDY~~CREDIT _tx state

7.13.6.17.1 Indicate_~~RRDY~~CREDIT _tx state description

~~The indicate_RRDY_tx state requests a single RRDY be transmitted by sending a transmit RRDY parameter to the transmit state each time it is transitioned into from the tx_RRDY_idle state.~~

The indicate_CREDIT_tx state indicates to the transmit state using the transmit RRDY parameter or the transmit CREDIT_BLOCKED parameter that a single RRDY or CREDIT_BLOCKED be transmitted each time it is transitioned into from the tx_CREDIT_idle state.

A transmit RRDY parameter is indicated to the transmit state if the transition from the tx_CREDIT_idle indicated an RRDY is to be transmitted.

A transmit CREDIT_BLOCKED parameter is indicated to the transmit state if the transition from the tx_CREDIT_idle indicated a CREDIT_BLOCKED is to be transmitted.

7.13.6.17.2 Transition SSP_TR2:SSP_TR1 (Indicate_~~RRDY~~CREDIT _tx:Tx_~~RRDY~~CREDIT _idle)

The SSP_TR2:SSP_TR1 transition shall occur after an indication from the transmit state using the RRDY transmitted parameter or the CREDIT_BLOCKED transmitted parameter that an RRDY or CREDIT_BLOCKED was transmitted.