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.

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_RRDYCREDIT_idle state

7.13.6.16.1 Tx_RRDYCREDIT_idle state description
The tx_RRDYCREDIT_idle state waits for a receiver resource available parameter an indication from the rcv_credit_monitor state.

When the tx_RRDYCREDIT_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_RRDYCREDIT_idle:Indicate_RRDYCREDIT_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_RRDYCREDIT_tx state

7.13.6.17.1 Indicate_RRDYCREDIT_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.