1 Overview

Disclaimer: The information in this document is based on SAS-2 r13. In any discrepancy between this document and the current version of the SAS standard the current SAS standard shall be complied with. This document does not contain any normative SAS information. It should only be used as a reference.

This document contains flow charts which represent the reading and writing of data as represented in the SAS-2 initiator transport layer state machines and target transport layer state machines. Only the part of the state that covers the reading or writing is represented in these flowcharts. In some cases, not every error condition handled by the state is represented in the flowchart and some states (e.g., ST_TTS1 and ST_TTS2) carry out functions for both reads and writes that are flowcharted separately.

The following states are in full or partially covered in this document:

- **initiator read:**
  - A) ST_ITS6:Receive_Data_In state (see figure 1);

- **initiator write:**
  - A) ST_ITS1:Initiator_Start state (see figure 2);
  - B) ST_ITS2:Initiator_Send_Frame state (see figure 3 and figure 4); and
  - C) ST_ITS5:Prepare_Data_Out state (see figure 5);

- **target read:**
  - A) ST_TTS1:Target_Start state (see figure 6);
  - B) ST_TTS2:Target_Send_Frame state (see figure 7 and figure 8); and
  - C) ST_TTS3:Prepare_Data_In state (see figure 6);

- **target write:**
  - A) ST_TTS1:Target_Start state (see figure 9);
  - B) ST_TTS2:Target_Send_Frame state (see figure 10);
  - C) ST_TTS4:Prepare_Xfer_Rdy state (see figure 9); and
  - D) ST_TTS5:Receive_Data_Out state (see figure 11).
2 ST_ITS transport layer read data flowcharts

DATA OFFSET field = Contains the first offset location into read data buffer for the current DATA information unit
Data-In Buffer Offset = Offset into read data buffer for the last received data frame.
Data-In Buffer Size = The number of bytes to be read as requested by the application client.

Figure 1 — Representation of transport layer (i.e., ST_ITS6) read data operation
3 ST_ITS transport layer write data flowcharts

Data-Out Buffer Offset = Offset into the application client write buffer.
Data-In Buffer Offset = Offset into the application client read buffer.

Figure 2 — Representation of transport layer (i.e., ST_ITS1) write data operation
Data-Out Buffer Size = Size of the application client write buffer.
Data-Out Buffer Offset = Offset into the application client write buffer.
Requested Offset = The value in the current Xfer_Rdy's Requested Offset.
Write Data Length = The value of the current Xfer_Rdy's Write Data Length.

**Figure 3 — Representation of transport layer (i.e., ST_ITS2) write data operation (part 1 of 2)**
Note: This part of the flow handles Transmission Status confirmations that indicate an error occurred on the frame transmission or that the nexus failed.

Transmission Status (NAK Received)
Transmission Status (ACK/NAK Timeout)
Transmission Status (Connection Lost Without ACK/NAK)

Retry Enabled

Maximum number of retries reached

Correct Transmission Complete to ST_IFR (see messages sent to the ST_IFR state machine description SAS-2)

Transmission Complete (Data-Out Failed, NAK Received) to ST_IFR or
Transmission Complete (Data-Out Failed, ACK/NAK Timeout) to ST_IFR

ST_ITS1

Wait for any Transmission Status confirmation to be received

Data-Out Buffer Offset = Request Offset

Set Retry

Figure 4 — Representation of transport layer (i.e., ST_ITS2) write data operation (part 2 of 2)
Data-Out Buffer Offset = Offset into the application client write buffer.
Requested Offset = The value in the current Xfer_Rdy’s Requested Offset.
Write Data Length = The value of the current Xfer_Rdy’s Write Data Length.

**ST_ITS5**

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ST_ITS2

DATA OFFSET field = Data-Out Buffer Offset

Write Data Length - (Data-Out Buffer Offset - Requested Offset) GE maximum size of DATA IU

Amount of data placed into the DATA field = Write Data Length - (Data-Out Buffer Offset - Requested Offset)

Amount of data placed into the DATA field = maximum size of DATA IU

Retry

CHANGING DATA POINTER = 0

CHANGING DATA POINTER = 1

Data-Out Buffer Offset = DATA OFFSET field + number of bytes in the DATA field

ST_ITS2
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Note: Any Transmission Status, or Return to Start is passed to ST_ITS2

**Figure 5 — Representation of transport layer (i.e., ST_ITS5) write data operation**
4 ST_TTS transport layer read data flowcharts

Read Data Offset = Offset into application client read data buffer
Read Data Frames Transmitted = The number of Transmission Status (Frame Transferred) confirmations received
Read Data Frames ACKed = The number of Transmission Status (ACK Received) confirmation received.
Balance Point Read Data Offset = Offset into the application client read data buffer for last data frame that the number of frames transmitted = number ACKs received
Data-In Request Byte Count = The number of bytes requested to be transferred. Set by the device server.
Read Data Buffer End = Offset into the application client read buffer of last location into which data may be placed

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**ST_TTS1**

- Read Data Offset = application client buffer offset
- Balance Point Read Data Offset = application client buffer offset
- Read Data Frames ACKed = 0
- Read Data Frames Transmitted = 0
- Read Data Buffer End = application client buffer offset + request byte count

**ST_TTS2**

- RETRANSMIT BIT = 0
- CHANGING DATA POINTER = 0
- Data offset = Read Data Offset
- Read Buffer End - Read Data Offset GE maximum size of DATA IU
- Amount of Data to transfer = Data-In Request Byte Count - Read Data Offset

or

- CHANGING DATA POINTER = 1
- Read Data Frames ACKed = 0
- Read Data Frames Transmitted = 0
- Data-in Request Byte Count GE maximum size of DATA IU
- Amount of Data to transfer = maximum size of DATA IU

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**ST_TTS3**

- RETRANSMIT BIT = 0
- CHANGING DATA POINTER = 0
- Data offset = Balance Point Read Data Offset
- Read Data Offset = Balance Point Read Data Offset
- Read Buffer End - Balance Point Read Data Offset GE maximum size of DATA IU
- Amount of Data to transfer = Data-In Request Byte Count - Balance Point Read Data Offset

or

- CHANGING DATA POINTER = 1
- Data-in Request Byte Count GE maximum size of DATA IU
- Amount of Data to transfer = maximum size of DATA IU

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Set the DATA field to the information in the Device Server Buffer argument that corresponds to the read data to be transferred

Note: Any Transmission Status is passed to ST_TTS2

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_Figure 6 — Representation of transport layer (i.e., ST_TTS1 and ST_TTS3) read data operation_
Read Data Offset = Offset into application client read data buffer and the device server read data buffer
Read Data Frames Transmitted = The number of Transmission Status (Frame Transferred) confirmations received
Read Data Frames ACKed = The number of Transmission Status (ACK Received) confirmation received.
Balance Point Read Data Offset = Offset into the application client read data buffer for last data frame that the number of frames transmitted = number ACKs received
Read Data Buffer End = Offset into the application client read buffer of last location into which data may be placed

**Figure 7 — Representation of transport layer (i.e., ST_TTS2) read data operation (part 1 or 2)**
Figure 8 — Representation of transport layer (i.e., ST_TTS2) read data operation (part 2 or 2)
5 ST_TTS transport layer write data flowcharts

Requested Write Data Length = Amount of write data requested by the device server from the application client buffer
Requested Write Data Offset = Device server requested offset in the application client buffer for write data
Data-Out Request Byte Count = The number of bytes requested to be transferred. Set by the device server.
Application Client Buffer Offset = The offset into the application clients buffer that contains the write data

ST_TTS1

Requested Write Data Offset = Application Client Buffer Offset

First Burst?

Yes

Requested Write Data Length = First Burst Size

No

Requested Write Data Length = Data-Out Request Byte Count

ST_TTS2

ST_TTS5

Requested Offset = Requested Write Data Offset
Retransmit Bit = 0

Requested Write Data Length GT receive resources

Yes

Write Data Length = length of receive resources
Requested Write Data Length = length of receive resources

ST_TTS5

No

Requested Write Data Length = Requested Write Data Length

ST_TTS2

ST_TTS4

Requested Offset = Requested Write Data Offset
Retransmit Bit = 0

Requested Write Data Length GT receive resources

Yes

Write Data Length = length of receive resources
Requested Write Data Length = length of receive resources

ST_TTS5

No

Requested Write Data Length = Requested Write Data Length

ST_TTS2

Figure 9 — Representation of transport layer (i.e., ST_TTS1 and ST_TTS4) write data operation
Figure 10 — Representation of transport layer (i.e., ST_TTS2) write data operation
Data Offset = Offset into application client write data buffer and the device server write data buffer (Data Offset field from received write Data IU).
Requested Write Data Length = Amount of write data requested in the Xfer_rdy to be sent from the application client buffer.
Requested Write Data Offset = Xfer_rdy information unit offset into the application client buffer for write data.
Data-Out Request Byte Count = The number of bytes requested to be transferred by the device server.
Write Data Offset = The current offset into the application client buffer that contains the write data.
Bytes received = The number of bytes in the last write Data Information unit that was received.
Application Client Buffer Offset = The initial offset into the application client buffer that contains the write data.

**Figure 11 — Representation of transport layer (i.e., ST_TTS5) write data operation**