Specification for TRAN Layer Services

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Abstract: This specification clarifies the transaction codes that shall be used by Serial Bus TRAN layer implementations. Uniform behavior of TRAN layers is intended to promote the interoperability of Serial Bus products manufactured by diverse vendors.

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1. Overview

IEEE Draft Standard P1394, High Performance Serial Bus, has been ratified as a standard by the IEEE balloting group and is expected to be published in the early part of 1996. Recent discussions, commencing with a presentation at the Architecture working group meeting of the 1394 Trade Association in Bothell, Washington in July, 1995, have demonstrated that there is ambiguity in clause 7, "Transaction layer specification", with respect to the uniform use of transaction codes and response codes.

Action is underway to commence IEEE work on extensions and clarifications to IEEE Draft Standard P1394; this work is expected to include revisions to the transaction layer specification. However, the proposed work is anticipated to take between twelve and eighteen months, commencing in January 1996. In the interim, industry consensus is needed to maintain interoperability between Serial Bus devices manufactured by different vendors.

This specification addresses the clarifications needed in clause 7 of the Serial Bus standard. Members of the 1394 Trade Association shall implement the TRAN layer in their products in accordance with this specification.

Although the 1394 Trade Association is not an accredited standards body, its membership consists of leading developers of Serial Bus products. This membership, for the most part, is also very active in the IEEE standards development process and intends to propose this specification for inclusion in the IEEE extensions to Serial Bus.

2. References

IEEE Draft Standard P1394, High Performance Serial Bus, Draft 8.0v2, July 7, 1995

3. Current ambiguities

Clause 6 of Draft Standard P1394, “Link layer specification”, in the descriptions of the different types of primary Serial Bus packets, requires that the transaction codes (*tcode*) used in response to data requests correspond to the original *tcode* of the request. That is, a read response for data quadlet shall be sent only in response to a read request for data quadlet, a read response for data block shall be sent only in response to a read request for data block and a lock response shall be sent only in response to a lock request. This is a pleasing symmetry but a close examination of clause 7, “Transaction layer specification”, reveals that insufficient information is communicated to the TRAN layer in order for it to meet this requirement.

The portion of clause 7 that describes which *tcode* the TRAN layer shall select for a READ or WRITE request mandates, at present, that a quadlet *tcode* shall be used if the data length of the transaction is four, independent of whether or not the destination offset is quadlet aligned. This is does not conform to the expectations of most Serial Bus implementors, namely, that quadlet transactions should be used only if the address is quadlet aligned.

4. TRAN layer services

Uniform behavior of TRAN layer implementations shall be achieved by conformance to the specifications given below. Briefly, the specifications:

limit the use of quadlet READ and WRITE transactions to the case where the data length is four and the destination offset is quadlet aligned,

optionally permit the use of block READ and WRITE transactions in the case where the data length is four and the destination offset is quadlet aligned,

add a new parameter to a TRAN layer data service so that quadlet responses may be properly generated for quadlet requests and block responses for block requests, and

emphasize that support for quadlet transactions is mandatory in all Serial Bus implementations but that support for block transactions is optional.

4.1 Transaction data request (TRAN_DATA.request)

In clause 7.1.2.1, a new parameter shall be added to the list of parameters communicated to the transaction layer *via* this service:

- Packet format. In the case of READ or WRITE transactions with a data length of four and a quadlet aligned destination address, this parameter shall govern the type of *tcode*, quadlet or block, generated by the transaction layer. This parameter shall have a value of BLOCK TCODE or QUADLET TCODE.

4.2 Transaction data response (TRAN_DATA.response)

In clause 7.1.2.4, a new parameter shall be added to the list of parameters communicated to the transaction layer *via* this service:

- Packet format. In the case of READ or WRITE transactions, this parameter shall indicate the type of *tcode*, quadlet or block, received by the transaction layer. This parameter shall have a value of BLOCK TCODE or QUADLET TCODE.

4.3 Sending a transaction request

Clause 7.3.3.1.2, under the heading “State TX1: Send Transaction Request”, currently has language that describes how the transaction code parameter (communicated to the LINK layer *via* LK_DATA.request) is to be selected. That language, starting with the last sentence of the first paragraph shall be replaced with:

The transaction code parameter value shall be set to:

- write request for data quadlet, if the transaction type value in the transaction data request is WRITE, the data length is four, the destination address is quadlet aligned and the packet format value is QUADLET TCODE.

- write request for data block, if the transaction type value in the transaction data request is WRITE, the data length is four, the destination address is quadlet aligned and the packet format value is BLOCK TCODE.

- write request for data block, if the transaction type value in the transaction data request is WRITE and the data length is not four or the destination address is not quadlet aligned.

- read request for data quadlet, if the transaction type value in the transaction data request is READ, the data length is four, the destination address is quadlet aligned and the packet format value is QUADLET TCODE.

- read request for data block, if the transaction type value in the transaction data request is READ, the data length is four, the destination address is quadlet aligned and the packet format value is BLOCK TCODE.

- read request for data block, if the transaction type value in the transaction data request is READ and the data length is not four or the destination address is not quadlet aligned.
- lock request, if the transaction type value in the transaction data request is LOCK.

4.4 Sending a transaction response

Clause 7.3.3.1.3, under the heading “State TX2: Send Transaction Response”, currently has language that describes how the transaction code parameter (communicated to the LINK layer *via* LK_DATA.response) is to be selected. That language, starting with the last sentence of the first paragraph shall be replaced with:

The transaction code parameter value shall be set to:

- write response for data quadlet, if the transaction type value in the transaction data request is WRITE, the data length is four and the packet format value is QUADLET TCODE.

- write response for data block, if the transaction type value in the transaction data request is WRITE and the data length is not four or the packet format value is BLOCK TCODE.

- read response for data quadlet, if the transaction type value in the transaction data request is READ, the data length is four and the packet format value is QUADLET TCODE.

- read response for data block, if the transaction type value in the transaction data request is READ and the data length is not four or the packet format value is BLOCK TCODE.

- lock response, if the transaction type value in the transaction data request is LOCK.

4.5 CSR Architecture transactions mapped to Serial Bus

In clause 7.4, below Table 7-10, “CSR Architecture / Serial Bus transaction mapping”, a paragraph describes alignment and minimal transaction requirements for Serial Bus nodes. That paragraph shall be replaced with the following language:

At a minimum, all Serial Bus nodes shall implement support for transaction data requests with a transaction type of READ or WRITE, a data length of four and a destination address that is quadlet aligned. These correspond to the read4 and write4 requests of the CSR Architecture.

All other transaction support, *i.e.*, transaction data requests with a data length other than four, a destination address that is not quadlet aligned or lock requests, is optional.

NOTE: Transaction support for block reads and writes for some arbitrary data length *n* does not necessarily imply transaction support for any other length block read or write.