T/R Data Transfer

20 July 2000

1. Introduction

Transfer of Trigger/Road (T/R) data from the FRC daughterboard to the daughterboards of other cards in the system is a multi-step process. It is shown as a block diagram in Fig. 1.

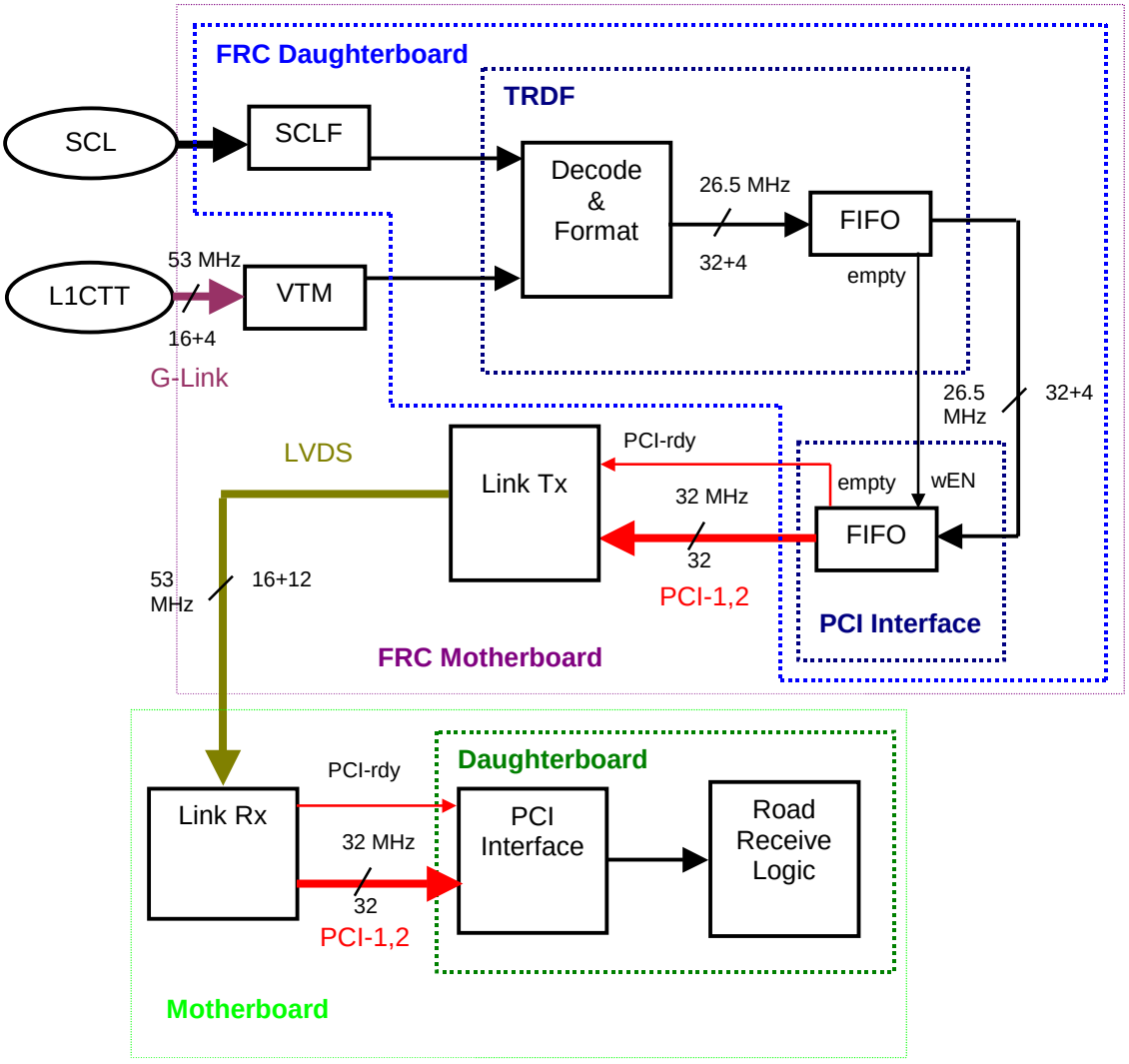

Figure 1: Block diagram for T/R data transfer from the FRC to other cards.

2. Transfer Times

All elements in the T/R data transfer chain begin transfers as soon as they see data. The arrival time of the first T/R data word at the *Road Receiver Logic* of the STCs/TFCs is therefore set by the latency of all elements in the chain. Latencies are given in Table 1, assuming that the SCL information arrives at the TRDF well ahead of the L1CTT data (a reasonable assumption since the latency in the L1CTT is large). Note that in the table below, the L1CTT latency is measured with respect to L1 Accept being sent from the Trigger Framework. All other latencies are with respect to the arrival of the first data word at the element.

Element	**Latency [μs]**
L1CTT	2.90
VTM	?
TRDF	>0.08
FRC PCI	0.25
Link Tx	?
Link Rx	?
STC/TFC PCI	0.25
Total time after L1 Accept	**>3.5**

Table 1: Latencies by element in the transfer of T/R data.

The total transfer time for a T/R data block can be found from the latency plus the time to transfer the data over the slowest link in the system. Both the G-link input to the VTM and the LVDS links send 16 data bits at 53 MHz and are therefore slower than the PCI-bus, which transfers 32-bit words at 32 MHz. The total times (measured from L1 Accept) when T/R data arrives at the daughterboards (DBs) of the other cards in the system are given in Table 2. The L1CTT data sizes and other parameters of the T/R data used in this calculation are also given in Table 2. Averages are taken for Z→bb events, as summarized in *Data Output from L2STT to Level-3*[1]. Error conditions are explained in the next section.

	Header Words		**No. of Roads**	**Trailer Words**			**Total Size**	**Time from L1 Accept [μs]**	
	T/R	**CTT**	**CTT**	**CTT**	**pad**	**T/R**		**1st**	**All**
Norm–min	1	4	0	1	3	1	10	3.5	3.9
ave			2	1	1	1	10	3.5	3.9
max			46	1	1	1	54	3.5	5.5
no BoE	1	0	0			1	2	*var*	*var*
no EoE	1	4?	?	?	?	1	?	3.5	5.5

Table 2: T/R data sizes in 32-bit words and transfer times from L1 accept, including latency and assuming uninterrupted transfer at 26.5 MHz.

3. Error Conditions

Errors detected in the data seen by the FRC come in two categories:

a) **Fatal:** these errors are non-recoverable and cause SCL_INIT to be requested immediately

b) **Non-Fatal:** these errors are signaled by bits in the T/R Trailer word. They indicate that the data from the FRC for this event is corrupt and should not be used. However, data for subsequent events may be ok. The general strategy is to keep track of these errors and request SCL_INIT if a pre-determined number of them occur in a row. This number is downloadable at initialization.

3.1 Individual Error Conditions

A list of error conditions seen by the FRC is given in Table 3.

Fatal errors and cause SCL_INIT to be requested immediately either by asserting L1_ERROR or L2_ERROR (see the SCL_INIT Document[2]).

Non-fatal errors are flagged by bits in the T/R trailer word (see the T/R data format document[3]). A count of how many times each error has occurred in a row is also kept and SCL_INIT is requested (by *L1/L2_ERROR*) if this count exceeds a preset value, loaded at initialization.

Error	**Severity**	**Condition**	**Action when Fatal**
INP_BX_ERR	fatal	BX(SCL) ≠ BX(L1CTT)	*L1_ERROR*
INP_TURN_ERR	fatal	TURN(SCL) ≠ TURN(L1CTT)	*L1_ERROR*
L3_BXIN_ERR	fatal	BX(DB L3 Data) ≠ BX(BM message)	*L1_ERROR*
L3_BXOUT_ERR	fatal	BX(BC Output) ≠ Evt No.(BM message)	*L2_ERROR*
NO_BOE	non-fat	2 EoE's in L1CTT data from VTM seen with no BoE in between	*L1_ERROR*
NO_EOE	non-fat	no EoE seen in L1CTT data from VTM within a number of clock cycles equal to the max allowed number of L1CTT words (downloadable number, 52 by default)	*L1_ERROR*
CTT_ERR	non-fat	Error Flags set in L1CTT data Trailer (will not be dealt with by FRC)	—

Table 3: Error conditions in the FRC

References

[1] U. Heintz, *Data Output from L2STT to Level-3* (4-Feb-00)
http://physics.bu.edu/~heintz/STT/L3_readout.pdf

[2] *SCL INIT in the STT* (in preparation)
[3] *T/R Data Format* (13-July-00) http://www.nevis.columbia.edu/~evans/stt/sb_0700/TR_Data.pdf