ATLAS TDAQ RoI Builder and the Level 2 Supervisor system


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The Level 1 Trigger system (LVL1) identifies a number of RoIs for the HLT - spatially limited areas ('roads') in the detector.

The information from Level 1 includes the selected trigger type and the details of where in $\eta$ and $\phi$ the trigger objects are located.

Using this information as guidance, HLT processors request a subset of the event data from the ROSs to perform the event selection.

In this way only a few per cent of the event data need to be transferred initially to the HLT system — thus considerably reducing the network bandwidth required.

The Region of Interest Builder (RoIB) takes raw event fragments from various Level 1 Trigger sources and assembles all the fragments of a given event into an RoI record.

The Level 2 Supervisor (L2SV) receives the RoI records and distributes them to HLT processors that require it for further event selection and disposition.
RoIB/L2SV system overview

- **VMEbus system**

- The input stage consists of Input Cards that receive and buffer the RoI fragments

- The Builder Cards in the assemble the RoI fragments into RoI records

- The Single Board Computer (SBC) for the purposes of configuration, control and monitoring

- ATLAS standard S-LINKs for inputs and outputs

- 4 Input Cards, 4 Builder Cards and 16 L2SVs
RoIB Input Card

- All transfer from the Input Cards to the Builder cards is via J3 high density 250 pin connector and a custom backplane.
- Several modes of operation:
  - Diagnostic Run Mode
  - Sniffer Mode
  - No Sniffer Data Mode

- Data from the FIFO are parsed, formatted into two 20 bit words, and transferred to the Builder Cards.
- The flow control signals are transferred via User Defined pins on J2.
The Level 1 information required for the HLT system is the concatenation of all RoI fragments for an event (RoI record).

The subsystem on the Builder Card that builds the RoI record is the Assembly Unit.

The Input Cards pass RoI fragments to a set of Builder Cards using round robin algorithm.

The hardware is set to deal automatically with the number of cards, number of channels, number of L2SVs, etc.

Flow Control between the input buffer in the Builder Card and the Input Card.
RoIB custom backplane

- Signals are carried via a custom backplane at 3.3 volt logic levels.
- Special attention is paid in the custom backplane to avoiding crosstalk:
  - reduced the clock frequency (20 MHz)
  - limiting the number of Builder Cards to 4

- In order to check possible transmission errors, a checksum is generated in the Input Cards on each fragment, transferred to the Builder Card, and compared with a checksum being generated.
RoIB standalone tests

- A VME is used as a Controller in the RoIB crate
- It allows two levels of testing of the RoIB
- Basic single card initial checkout
  - **Input Card**
    - single S-Link to sniffer RAM test
    - write/read RAM test,
  - **Builder Card**
    - spy FIFO
    - single S-Link output
- Multi-card integrated checkout
  - use external PCs for data sources/sinks
  - 3 levels of complexity
    - spy FIFO (requires no external sources/sinks)
    - check readout (requires external sink)
    - check readout with external data source and external sink, sample monitoring data
L2SV processor farm

- The Level 2 Supervisor farm - up to 16 commercial rack mounted PCs
- Connected to the RoIB via ATLAS standard SLINKs and to the High Level Trigger – via Ethernet
- Each PC is equipped with FILAR card - quad S-LINK LDCs to PCI Interface.
- Each processor in the farm is responsible for distributing RoI records to the HLT processors farm and effectively managing the processing resources of the HLT farm via a load balancing algorithm.
- It receives the final decision on an event based on the result of the HLT processor.
- The decision results are communicated to the Data Flow Manager (DFM) so that accepted events can be further analyzed and rejected events can be flushed from the Readout System.
RoIB integration tests and commissioning

- Initial test of the small RoIB system (one input and one builder board) was in H8 test beam, it was integrated with Level 1 Trigger outputs from muon calorimeter trigger.
- The RoIB installed recently in USA15 underground counting room contain 4 Input Cards and 3 Builder cards,
- 2 L2SV processors are used in the SDX1 counting room.
- The size of the L2SV farm will be supplemented according to need determined by the increasing event rate during commissioning.