ROB_{IN} Performance Measurements

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ROB Complex Hardware Organisation

Mode of Operation

ROB Complex Software Organisation

Performance Measurements

Discussion
• ROB Controller is based on either PowerPC VME/CompactPCI SBC, or on PC

• Same network connection serves for L2 / DAQ dataflow, run control and monitoring

• Host memory and ROBINs event memories are directly accessible to NIC
Saclay ROB\textsubscript{IN}

- 3 PMC-s of Version #1 available
- Version #2 with 100 MHz I960JT CPU and 8 MByte Event Memory under development
Operation of ROB Complex for Data Requests

- Buffers can be allocated in ROB Controller: ROBIN DMAs event data - preprocessing
- Buffers can be mapped on ROBINs event memory: NIC DMAs event data
- Capability of sending chained buffers
### ROB Complex Software Organisation

**ROB Controller**

- **ROB Complex Application**
  - **ROB**\textsubscript{IN} API and Application
  - **Low Level Communication**
  - **ROB**\textsubscript{IN} Hardware Abstraction
  - **Host Platform Abstraction**

**ROBIN-s**

- **ROB**\textsubscript{IN} application
- **Low Level Communication**
- **Hardware Abstraction**

- **Host Platform and ROB**\textsubscript{IN} hardware are hidden
- **ROB**\textsubscript{IN} hardware abstraction performs basic operation: Load Code, Start, Reset, Halt...
- **Low Level Communication** performs message passing and allows for debugging
- **Simplified ROB**\textsubscript{IN} Application: no data input
- **C code for:**
  - Saclay ROB\textsubscript{IN}, LynxOS / PowerPC VME/CompactPCI SBCs, Linux / PC
  - Transtech Sharc PMC, WinNT / PC
Low Level Communications

- Command Descriptor
- Command Table
  - Cmd Type
  - Cmd Size
  - Command
- Free Command Queue
  - Get Free Command
  - Fill Command
  - Post Command
  - Check Status
- Status Queue
- Bi-directional communications
- Synchronous and asynchronous commands
- Minimal use of PCI bus for implementation on PLX9080
**ROB\textsubscript{IN} Low Level Communication Performance**

- **Data Request command size**: 4 32-bit words
- **Event Clear Request command size**: 50 32-bit words (50 events to clear)

![Command Servicing Rate](image1)

![Command Servicing Time](image2)

- **Dummy asynchronous commands immediately acknowledged by ROB\textsubscript{IN}**

Latency = 1 / Rate
Event Management in ROB\textsubscript{IN}

- Hashing mechanism for incoming events has been added
  
  **Hash Table**
  
  **Event Descriptor**
  
  - Event Id
  - Next Desc Ptr
  - Status Page Id
  - # of_pages
  - Page Id
  - Used Size
  - ... 
  - Page Id
  - Used Size

  **Free Event Descriptor Queue**

- For data request:
  - Find entry in the hash table: event id \% hash\_table\_size
  - Find event descriptor in the corresponding chain
  - Return event pages

- For event clear request:
  - Find event descriptor in the hash table and remove it
  - Free event resources
  - Return event descriptor to the free queue
**Performance at Low Level Communication**
- Rate ~68 kHz; Latency ~18 µs

**For 2 kByte events**
- Rate ~51 kHz; Latency ~23 µs

**Event Memory Page Size**: 1 kByte
**ROB\textsubscript{IN} Event Clear Request Performance**

- Event Memory Page Size: 1 kByte
- For each cleared event a new event is generated

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**Performance at Low Level Communication for event grouping factor of 50**

- Rate \(\sim 55\) kHz; Latency \(\sim 25\ \mu s\)

**For 2 kByte events**

- Together Event Clear and Generation take \(\sim 12\ \mu s\) per event
- Sustained event rate equals \(\sim 83\) kHz
Mixing Data and Clear Event Requests

- Event Size: 2 kByte
- Selection Request: 3 kHz
- Event grouping factor of 50 for Clear Requests
- Event Filter Request: 2 kHz
- No Flow Control on Clear Requests
- Pipeline only one Clear Request at a time
- Flow Control: Deterministic Data Request Servicing
  -> Clear Request adds at most 700 µs
Discussion

- **ROB\textsubscript{IN} Application**
  - Event management using hash table has been added
  - More realistic behaviour for Data Request and Event Clear commands

- **ROB\textsubscript{IN} performance has been measured with stand-alone program**
  - ROB Complex Platform: 400 MHz Pentium \parallel PC running Linux
  - Saclay ROB\textsubscript{IN}: Version #1 with 33 MHz I960 processor and 512 kByte system memory
  - Data Request service rate: up to 40 kHz and above; Event Clear rate: up to 83 kHz
  - For Event Clear requests the necessity of Flow Control has been identified
  - The Flow Control assures deterministic Data Request servicing times

- **ROB\textsubscript{IN} Application is still under development**
  - Waiting for the Version 2 of the Saclay ROB\textsubscript{IN}
  - More realistic event handling from input port will be added

- **ROB Complex has been integrated in the ATM testbed**
  - New series of measurements foreseen at CERN this month