Online Testbench for LHCb High Level Trigger Validation

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Introduction

- LHCb aim: Use first 2008 low-energy beams for Online and Offline system commissioning
  - Full Experiment System Test (FEST)
- Problem: LHC breakdown :-(
  - Currently no data
  - Fast start-up expected, not so much time for commissioning
- Solution: Do not wait for the LHC
  - Minimum bias simulated event injection
  - FEST results: See poster 278 from Marco Cattaneo
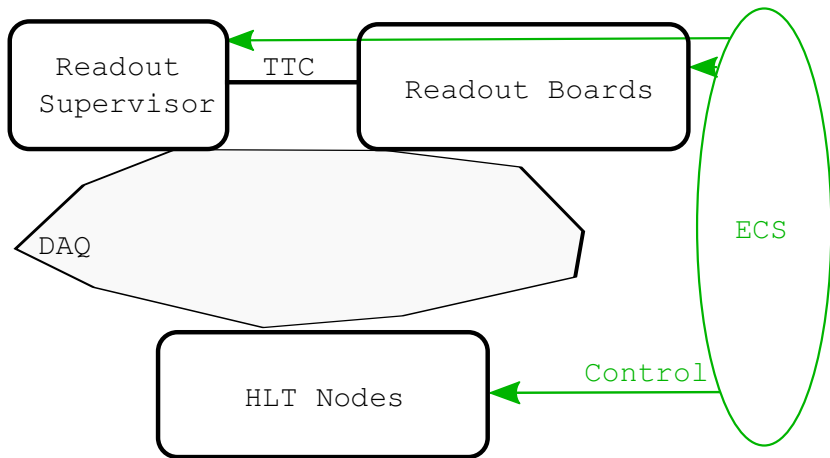
Outline

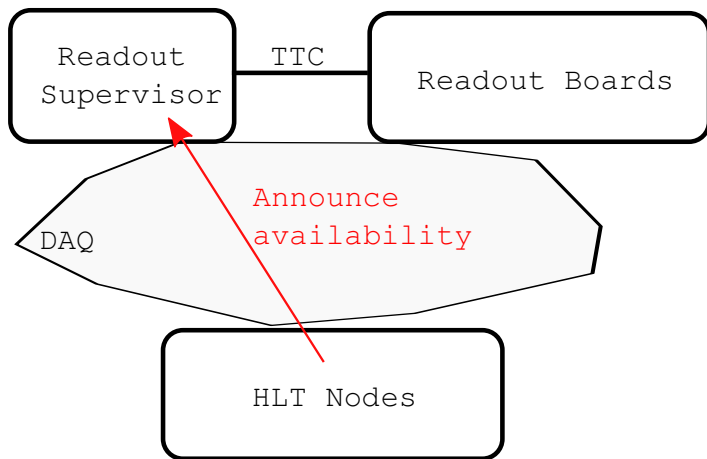# Outline

Outline

Outline
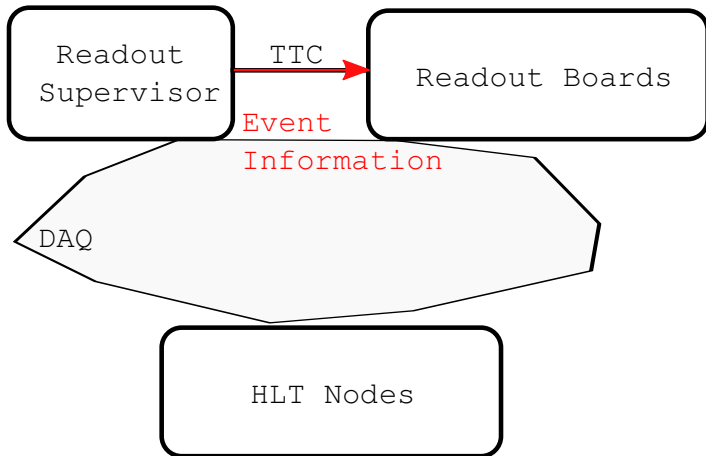
Purpose of FEST

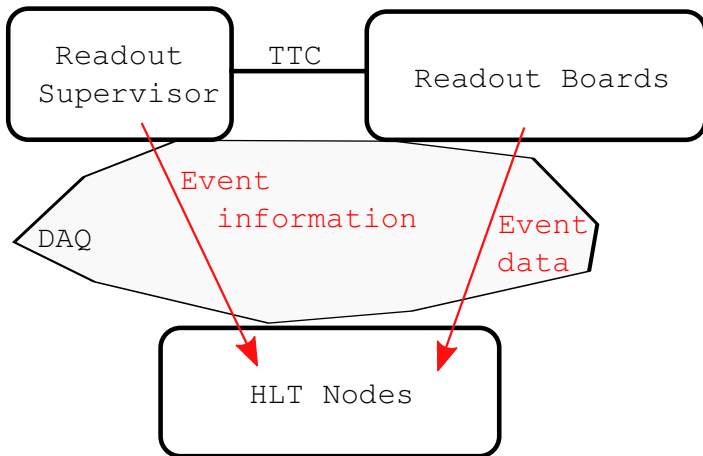# LHCb DAQ Main Entities

LHCb Run Operation

LHCb Run Operation

- Distribute clock, trigger decisions and HLT destination node

LHCb Run Operation

- Typically 35 kB per event

Generate FEST data-flow

- Read simulated events from data storage
- Convert data in DAQ format, as real readout boards data format
- Inject data at a minimum rate of 2 kHz $=$ 70 MB/s
- Farms accept these events: The normal processing starts

Integration

- In the Online System
  - Respect the LHCb DAQ protocol
  - Use Readout Supervisor as director
  - Answer HLT availabilities
- In the Experiment Control System (More information in talk 313 from Clara Gaspar)
  - Monitored
  - Easy to operate
  - Other run activities in parallel
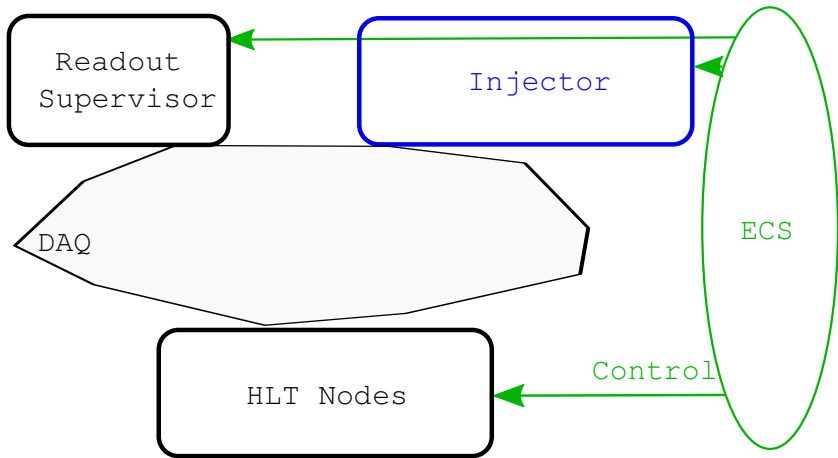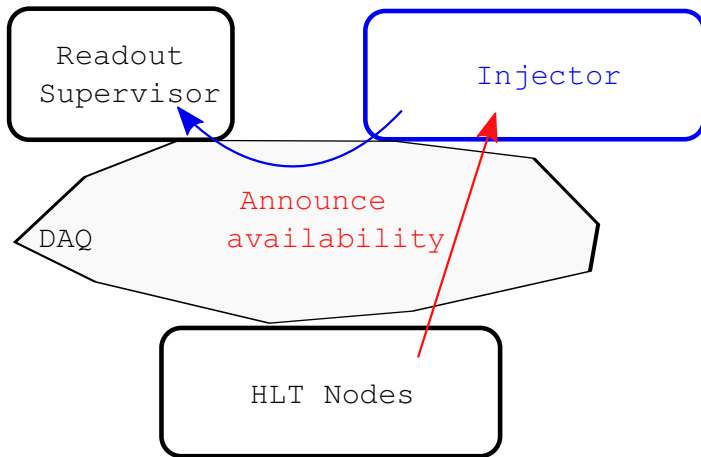   - Independent partition ID

Outline

FEST Main Entities
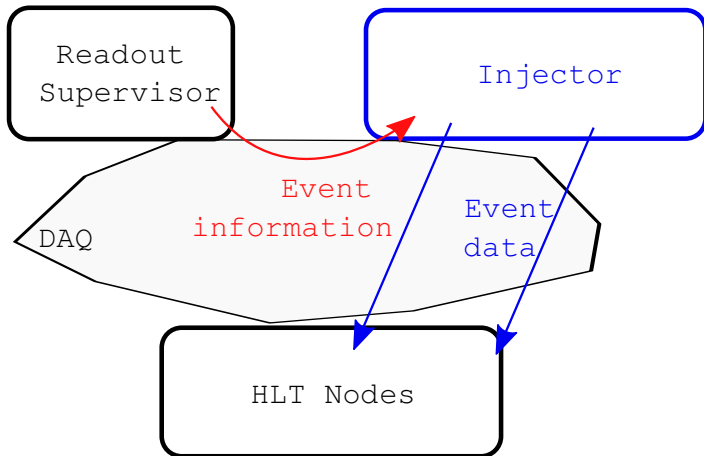

- No TTC interface for event information

FEST Run Operation

- Be the farm node for the supervisor
- Be the supervisor for the farm nodes

FEST Run Operation

- DAQ protocol unchanged

Tasks

- Emulating Readout Supervisor data-flow
  - Pretend to be a Readout Supervisor
    - Managing HLT availabilities
    - Sending event information
  - Pretend to be a HLT farm node
    - Forwarding HLT availabilities
    - Managing event information
- Emulating Readout boards
  - Mix different event types according to the Trigger Type
  - "Translate" file formatted events to DAQ format data
    - 300 Readout board packets
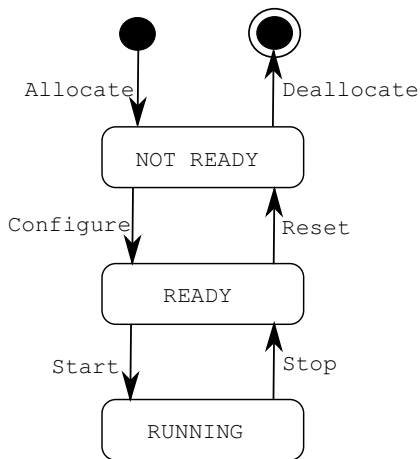 - Send them all from Readout boards IP addresses

Multithreaded Gaudi Services

- Use of the standard LHCb framework Gaudi
  - One instance of event reader service for each event type
  - Injector tasks encapsulated in a unique service
- 1 Injector task = 1 Thread
- Communication tools
  - Standard Online Buffer Managers
  - Semaphores
  - Mutexes

Injector Finite State Machine

- Transition on ECS commands
  - Standard in Gaudi Framework
  - Manage propagation through threads

Injector Control Panel

- Unique partition ID
- Configure subpartitions enabling Readout boards emulation

Partition Control Panel

- Run information
- Sub-system configuration

Outline

Performance Results

Fiber Channel Reading Performances
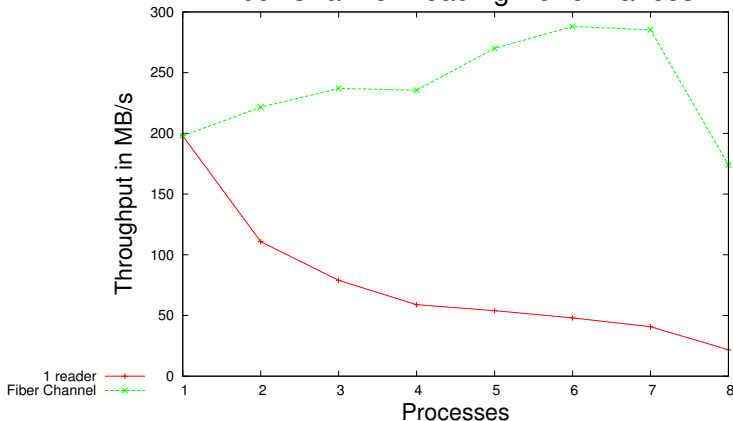
- Input rate
  - Maximum input rate can be reached
  - Reader throughput aggregation = Throughput of Fiber Channel
- Output rate follows the Readout Supervisor rate

Results/Requirements

- Stable 2 kHz HLT input rate
    - Injection rate configured with ECS and regulated by HLT availabilities
- Perfect emulation of the readout board outputs
- Same way of operating as normal run
    - Except some configuration options
- Tool easy to configure and run via ECS
    - Same way as any other detector or sub-detector

Summary

- Already an invaluable debugging tool
  - Lifetime is expected to be as long as the LHCb experiment's
- Full System Tests held regularly
  - 1 FEST week each month
  - Reminder: FEST results developed in Poster 278 from Marco Cattaneo