Multicast & Traffic Shaping Issues

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1. DataCollection Message Flows
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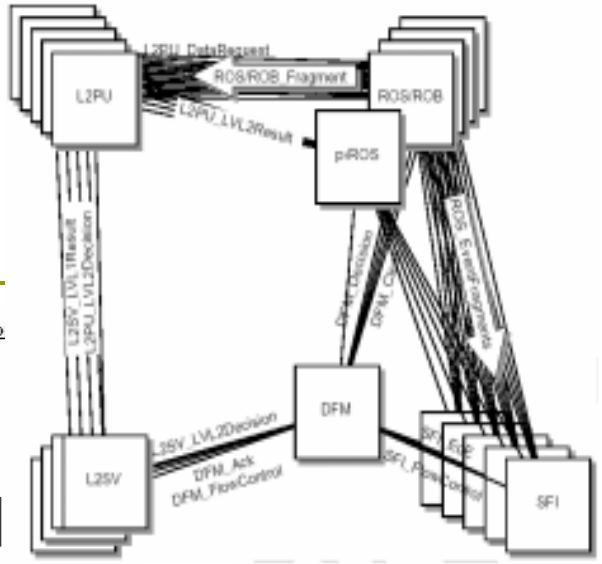
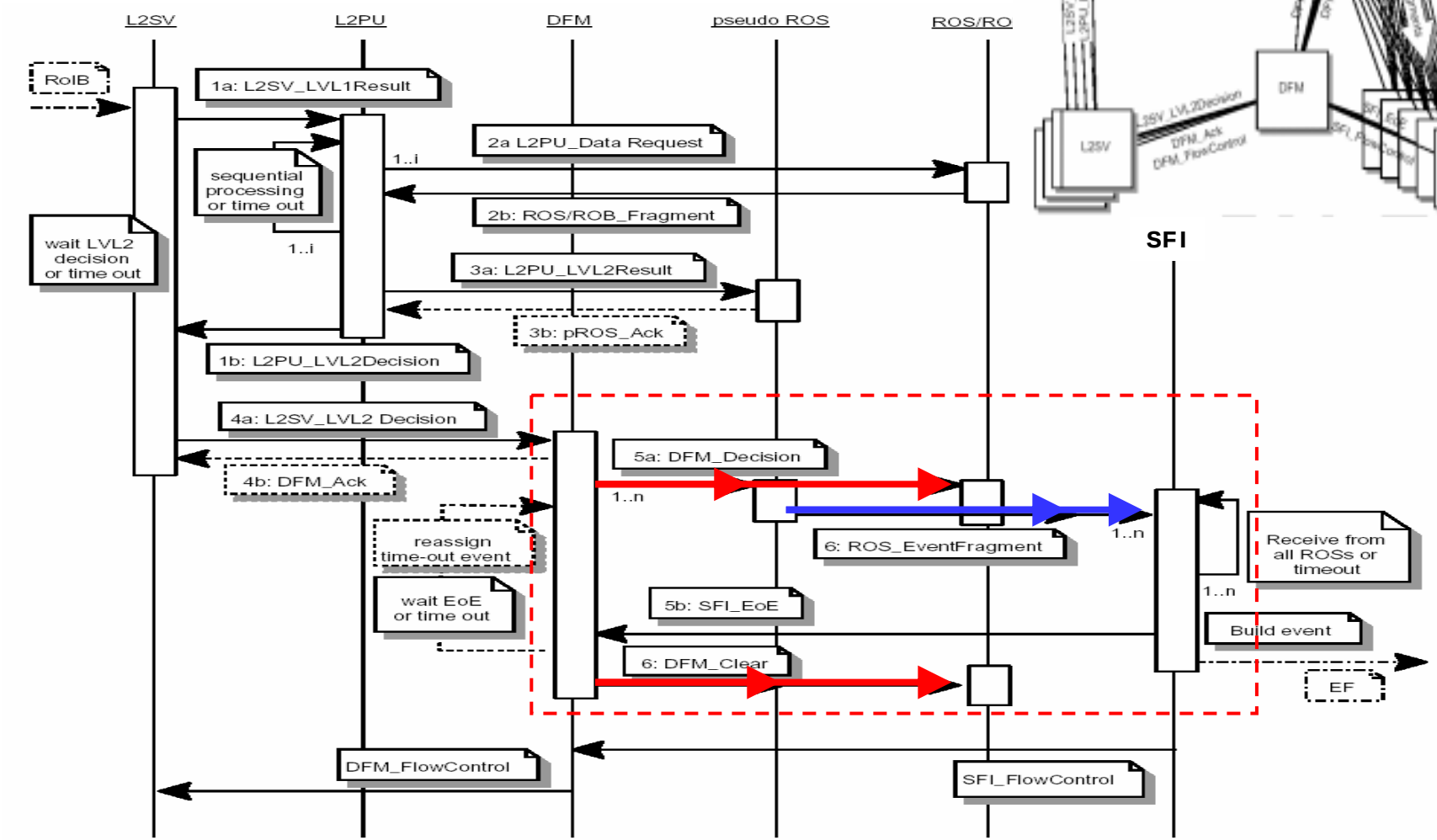
4. Summary

Two scenarios of message flows

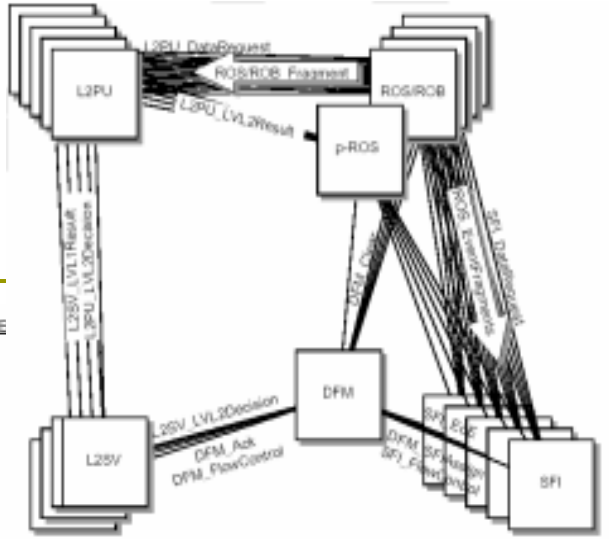
- ‘classic’ scenario
  - DFM sends DFM_Decision to all ROSs. And they sends ROS event fragments to one SFI.
  - PUSH message flow
- ‘request-reply’ scenario
  - DFM sends DFM_SFIAssign to one SFI. And the SFI sends SFI_DataRequest to all ROSs to get ROS event fragments.
  - PULL message flow

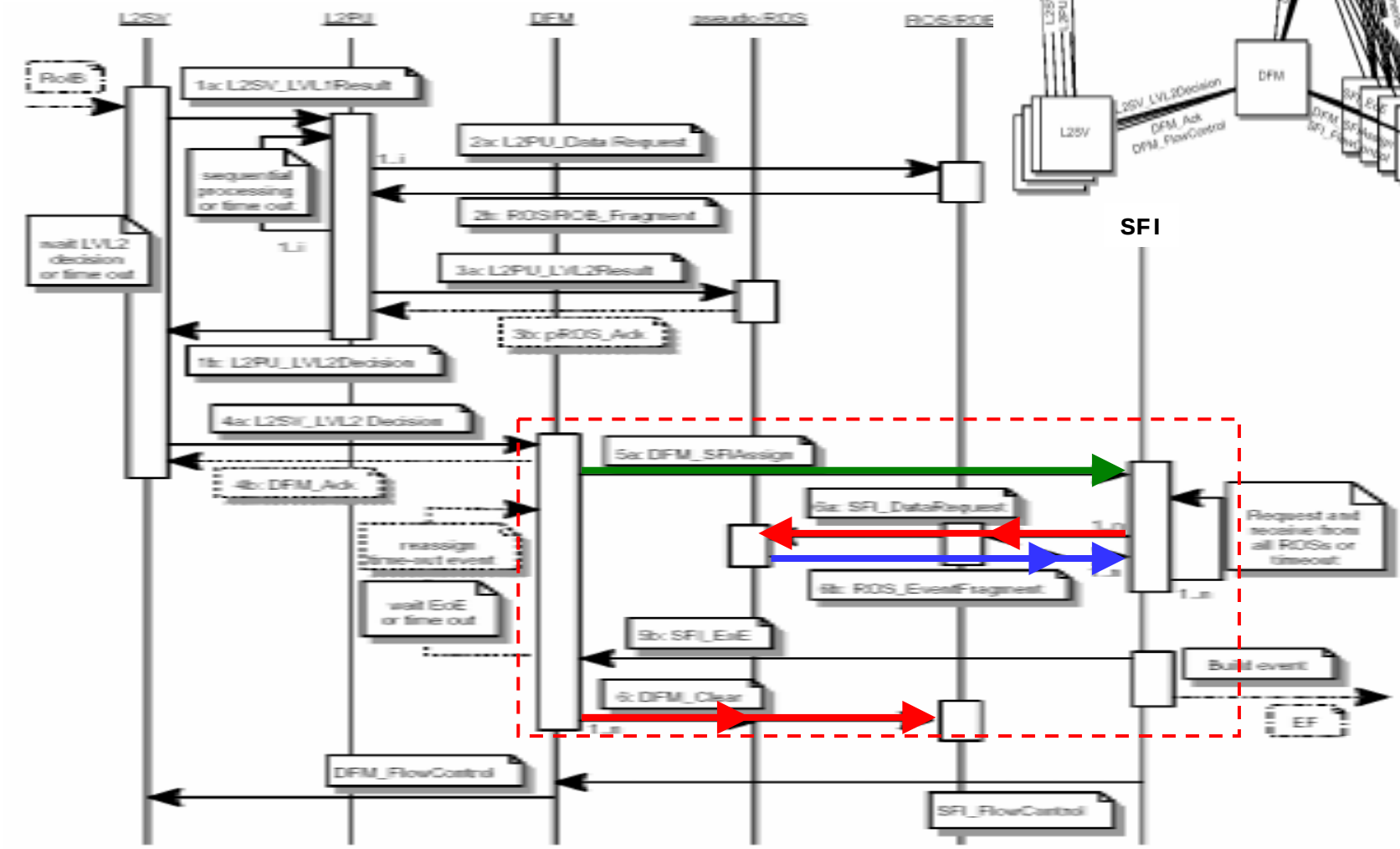
‘Classic’ Scenario





‘Request-Reply’ Scenario





Multicast

- Multicast is very important method when we try to send the same data to many hosts.

- In DataCollection dataflow, the multicast is applied to
  - for ‘classic’ scenario
    - DFM_Decision
    - DFM_Clear
  - for ‘request-reply’ scenario
    - SFI_DataRequest
    - DFM_Clear

- The problem is
  - the multicast messages are non-reliable,
  - i.e., the multicast has a possibility of packet losses
    - because these messages are sent with datagram.

Reliable multicast messages (1)

- Unicast messages
  - The sender sends the message to each receiver individually.
  - This scheme
    - improves the probability of delivery,
    - increases the overhead, and
    - guarantees delivery, in case of TCP, but even more overhead.

- Replicated messages
  - Every message is sent twice or more in subsequent multicasts.
  - This scheme
    - causes extra bandwidth on the network, and
    - just adds reliability, but doesn't guarantee delivery.

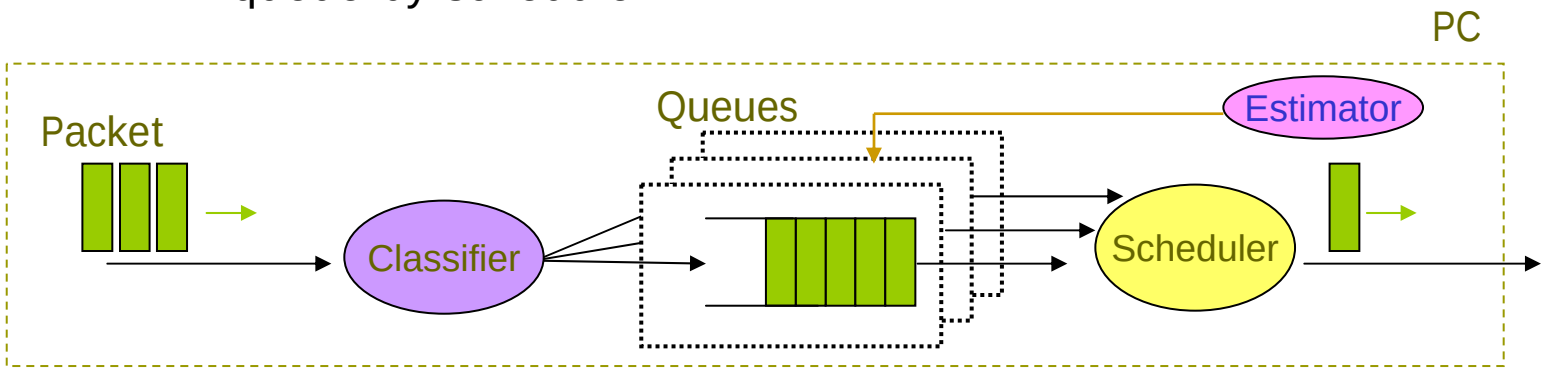
Reliable multicast messages (2)

- Negative Acknowledgements
  - Every multicast message is sent with a unique sequence counter. The receiver sends back the acknowledgement which tells an undelivered message exists.
  - In this scheme, the problems are
    - the recovery protocol which is not simple, and
    - negative acknowledgement explosion.

- QoS controlled messages in the sending hosts.
  - The messages controlled by QoS are sent in defined time intervals.
  - This situation results to avoid the packet loss, because one of the reasons of packet loss is that the messages are sent in very short time intervals.
  - This scheme may improve reliability.

What is QoS?

- QoS Control Technology
  - the technology to control data traffic on a per node basis.
    - Bandwidth Allocation, Error Rate, Transfer Latency, ...
    - Classification
      - The output packets are classified and put into the classified queues according to rules, for example, the destination addresses, the port numbers, and so on.
    - Queue Management and Scheduling
      - A timing to send the data are controlled at the point of output queue by scheduler.



Using Multicast in DataCollection

- Multicast potentially not 100 % reliable
- And making multicast reliable adds overhead

- Impact on lost multicast messages for DataCollection
  - DFM_Decision message lost (PUSH)
    - SFI realizes via missing fragment, SFI can re-ask.
  - SFI_DataRequest message lost (PULL)
    - SFI realizes via missing fragment, SFI can re-ask.
  - DFM_Clear message lost
    - ROB buffer potentially overflows
    - DFM could add to DFM_Clear message the oldest LVL1_ID still in the system
    - ROB would clear accordingly

- 100 % reliable multicast probably not required

Traffic Shaping

- The event builder dataflow is funnel shaped.
  - All senders send each fragment to one receiver at the same time.
- This situation causes congestion and potential packet loss.

- In order to avoid these problems, traffic shaping is relevant for both ‘classic’ and ‘request-reply’, scenarios.

- Traffic shaping
  - Traffic randomization at the level of the ROSs (PUSH)
    - The ROSs decide the event fragment to send at specific algorithm.
  - Traffic shaping at the SFI (PULL)
    - The SFI controls traffic shaping by sending the SFI_DataRequest to individual groups of ROSs.
  - Bandwidth allocation with QoS in the ROS hosts
    - QoS in the ROS can restrict the allocated bandwidth to each SFI
    - This avoids congestion in the network.

Summary of Traffic Shaping

- Traffic shaping depends on the traffic scenario, PUSH or PULL.
- In case of PUSH, traffic shaping may lead to additional requirements to the ROS;
  - special algorithms to control the sending of fragments to the SFI
  - or, apply the QoS in the ROS hosts
    - QoS works on an IP stack only, TCP or UDP
- In case of PULL, SFI can control the traffic.
  - may increase message rate to be handled by SFI.

Summary

- Multicast
  - An infrequent loss of multicast messages will not cause problems for TDAQ, if ROBs can clear old events as defined by DFM.
- Traffic Shaping
  - Traffic shaping is handled either at the SFI or in the ROSs.
  - QoS can be beneficial if applied in the ROSs.