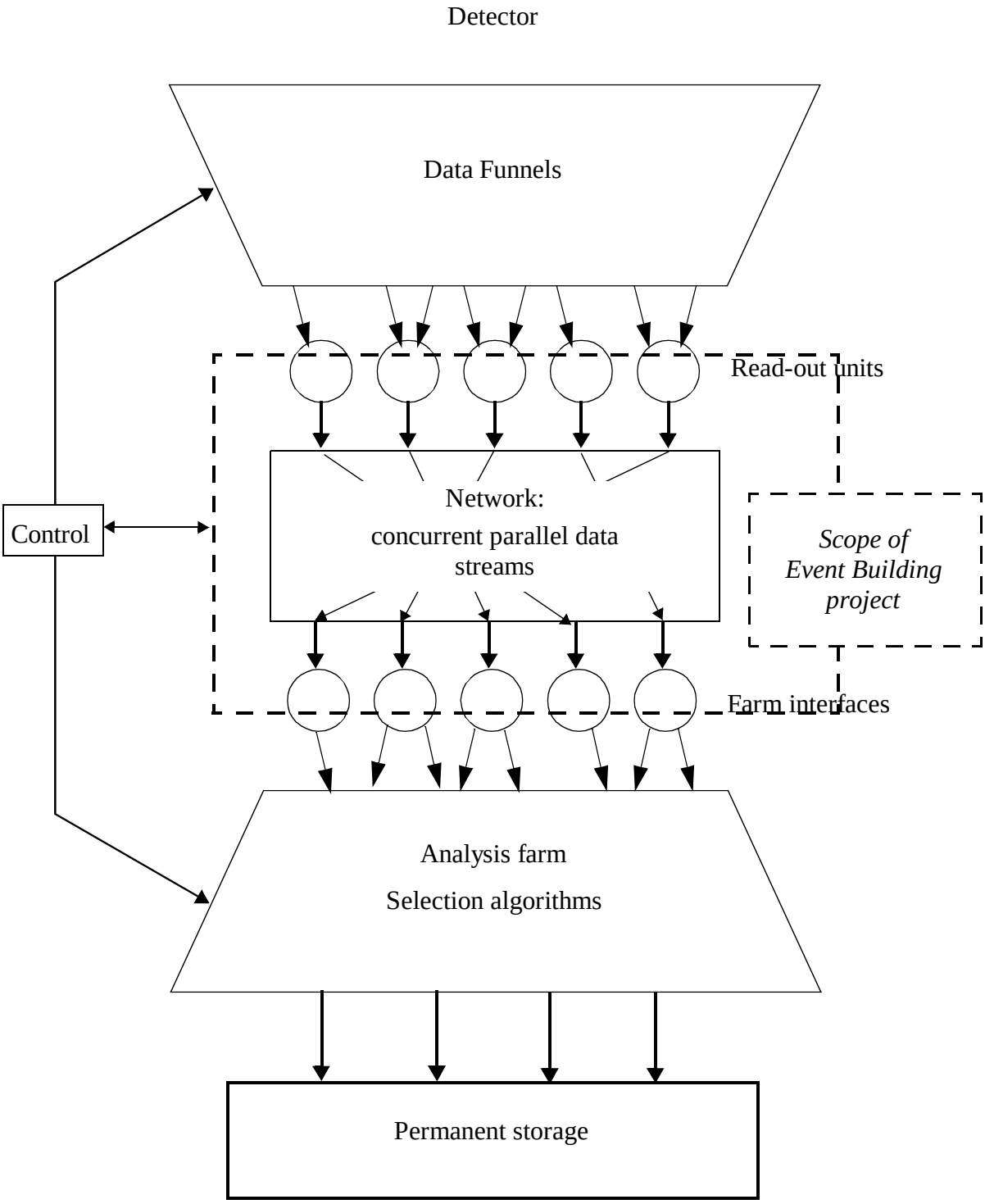
LHCb Event Building Project

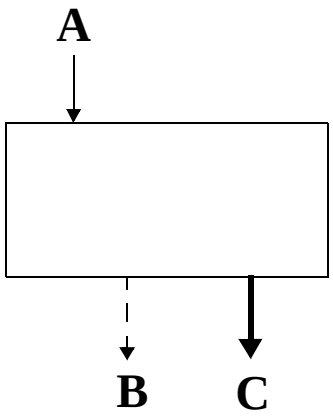
- "Event Building" in DAQ
- Limitations of network capabilities
- Impact on RU implementation
- Summary of the project

Event Building in DAQ



Limitations in switching networks

A) Non-Blocking Switches



If B is idle -> A can send to B

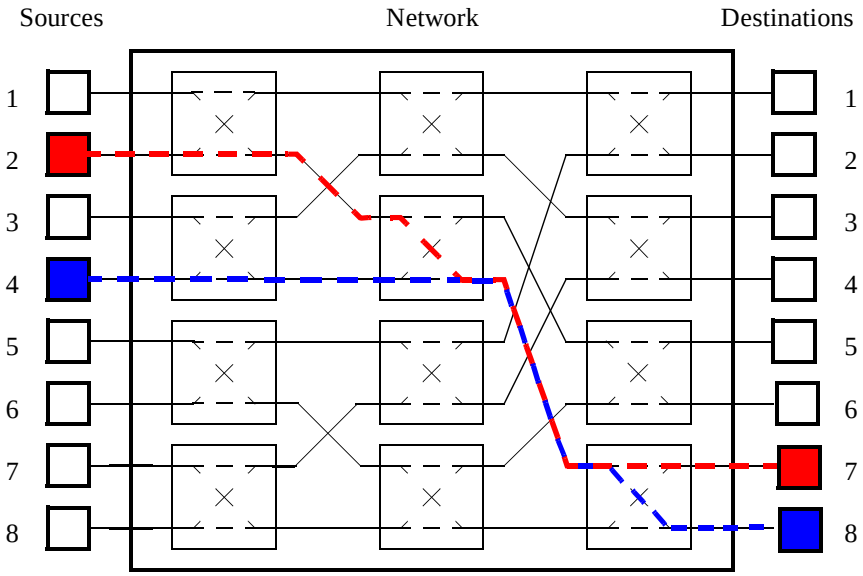
BUT:

If C is busy then A cannot send to C

--> 1st limitation

Usually commercial switches are non-blocking

B) Switching networks made of non-blocking switches can be blocking (--> 2nd limitation)



Sources 2 and 4 have to share the same internal link between stages 2 and 3 although they send data to different destinations (7 and 8)

Methods to overcome/control contention

Contention: When 2 simultaneous data transfers require the same path.
In absence of contention control, data is lost

A) Flow Control

The network provides information to signal contention:

- ***Back Pressure:***

  A cannot send data to B if B is busy --> A waits and retries

- ***Collision detection:***

  A sends to B and is notified if (not) successful.
  A re-sends until successful

Consequence: ***lower bandwidth utilization***

- Theory: maximum for patcket switching network, random traffic:

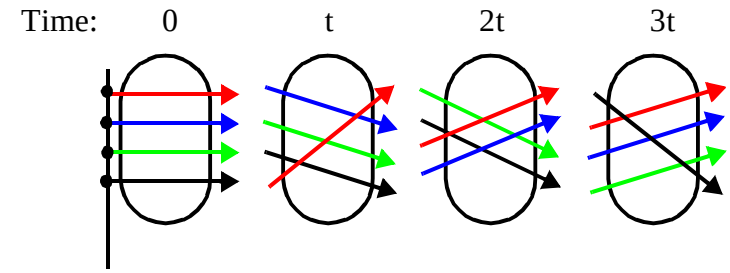
$$2 - \sqrt{2} \cong 60\%$$

- 30 % to 65 % in Myrinet simulation, depending on configuration (similar to a packet switching network due to constant sub-event size)

B) Traffic shaping

The traffic is controlled before submission to the network

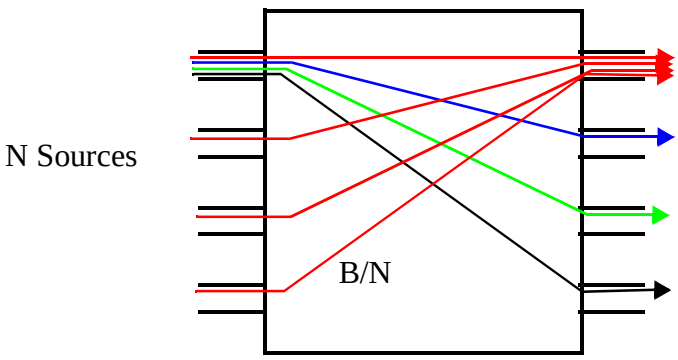
- ***Barrel Shifter:***



- ***Rate Division***

Divide the total input link bandwidth equally between the destinations:
B/N per “virtual connection” (N = number of sources)

Works only if the data is chopped in small packets and consecutive packets are sent to different destinations

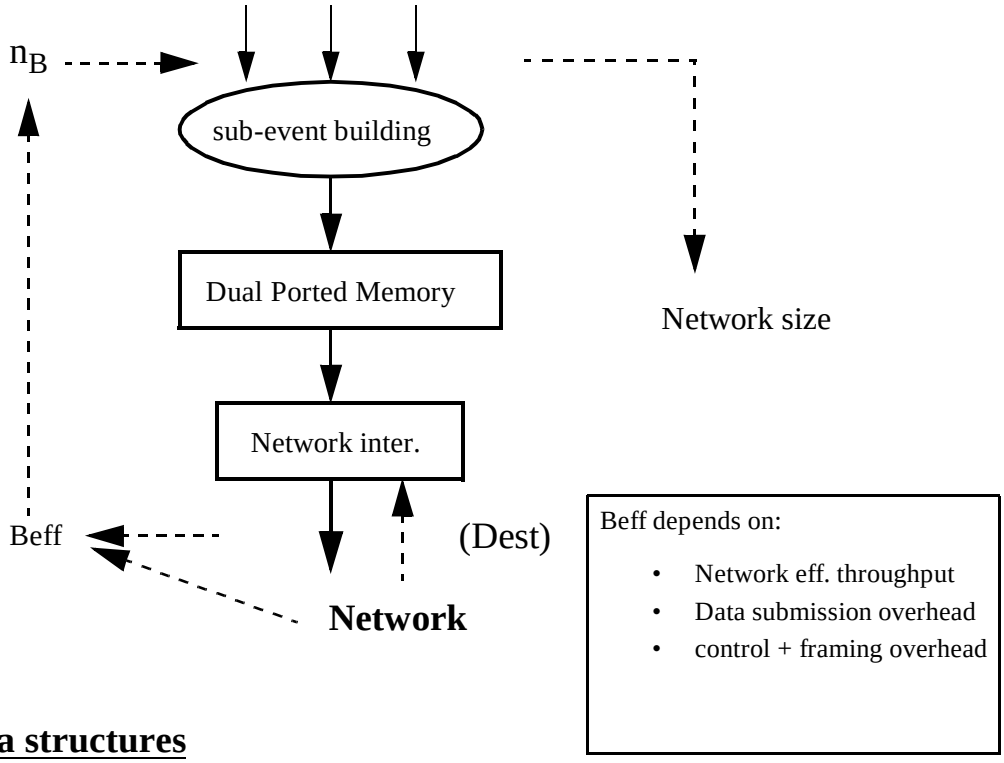


High throughput can be reached:

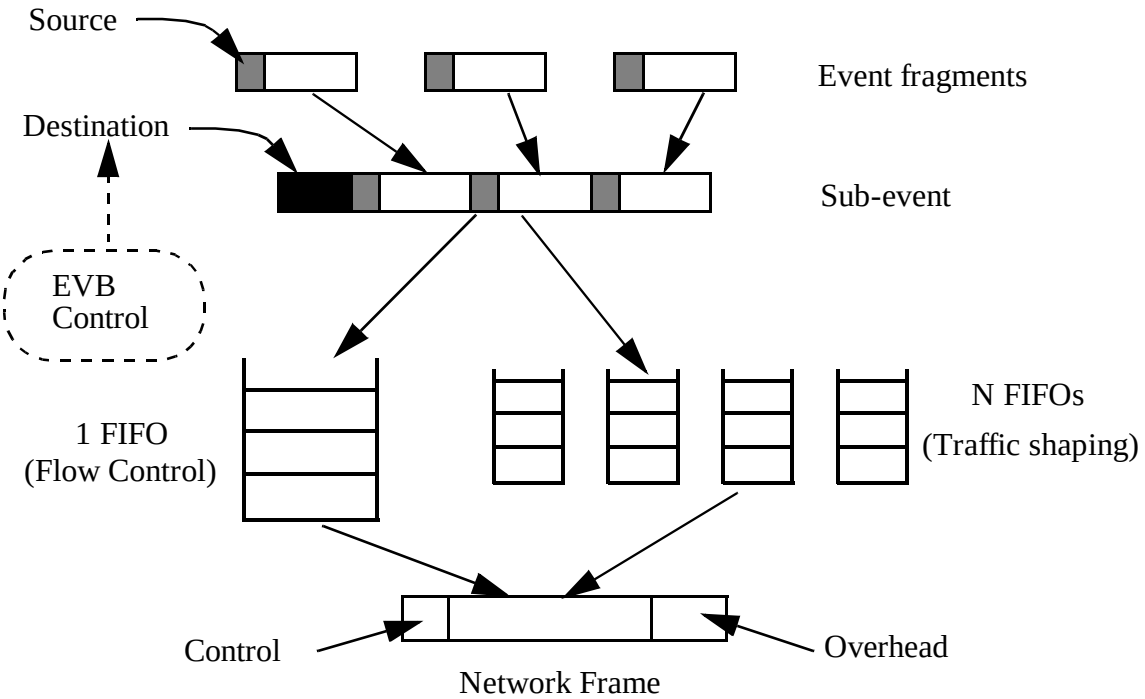
- 100% in Myrinet simulation equivalent to a barrel shifter
- Close to 100% on ATM demonstrator (rate division)

Relationships with the Read-Out Unit

A) Data Flow



B) Data structures



Summary of the project

Goal

Make recommendations for the implementation of the event builder (Level 2/3, possibly Level 1):

- Network technology
- Traffic control, event building control
- Implementation of RUs and SFCs

Scope

- the network
- the sources and destinations (RUs and SFCs)
- the event building control

Boundary conditions (requirements)

- FE links specification
- Number of processors
- Interface with the DAQ control

Activities

Investigate suitable technologies and evaluate their applicability by means of software modelling, setting-up of prototypes and small scale systems

Resources

- 3 - 4 persons
- . . .