Group assignment

The scenario

Imagine you have to process 400 terabits of raw data per second at a future HEP experiment. Assume the data arrives in a data center, with the information from all sub-detectors already combined for every event. There is no strict latency requirement, i.e. you can use deep buffers inside the servers to store the data until a decision is taken.

The physics you are interested in requires the most complete knowledge of the event possible, ideally track reconstruction, particle identification, calorimeter reconstruction, particle building, maybe jet reconstruction. And possibly other objects you would like the trigger to reconstruct to make your analysis more sensitive.

The task

Design a trigger system which reduces the rate by at least a factor 1000!

Each group will choose and discuss one of the three following topics:

Topic 1

Can you achieve the data reduction in a single step? What are the advantages / disadvantages of multiple selection steps?

Which computing architecture(s) would you choose for your data center? Would you offload parts of the workload to accelerators? If yes, which ones?

Topic 2

What would be the dataflow of your DAQ system? How would you model the data processing and relations between the different parts of your system?

How would you ensure the pipelining between accelerators and the servers? Are there any bottlenecks to consider? How would you address them?

Topic 3

How does the detector layout influence the data flow (eg. would you rather have a homogeneous detector where all particles pass through the same detectors or one with different sub-detectors in different regions of phase space)? Do you have recommendations for the detector design that would allow for a more performant DAQ system, depending on the architectures you choose for your system?