Conditions Database use cases and workflows

Giacomo Govi
Andrea Formica, Paul Laycock

HSF Condition Database activity meeting
6th April 2022

Outline

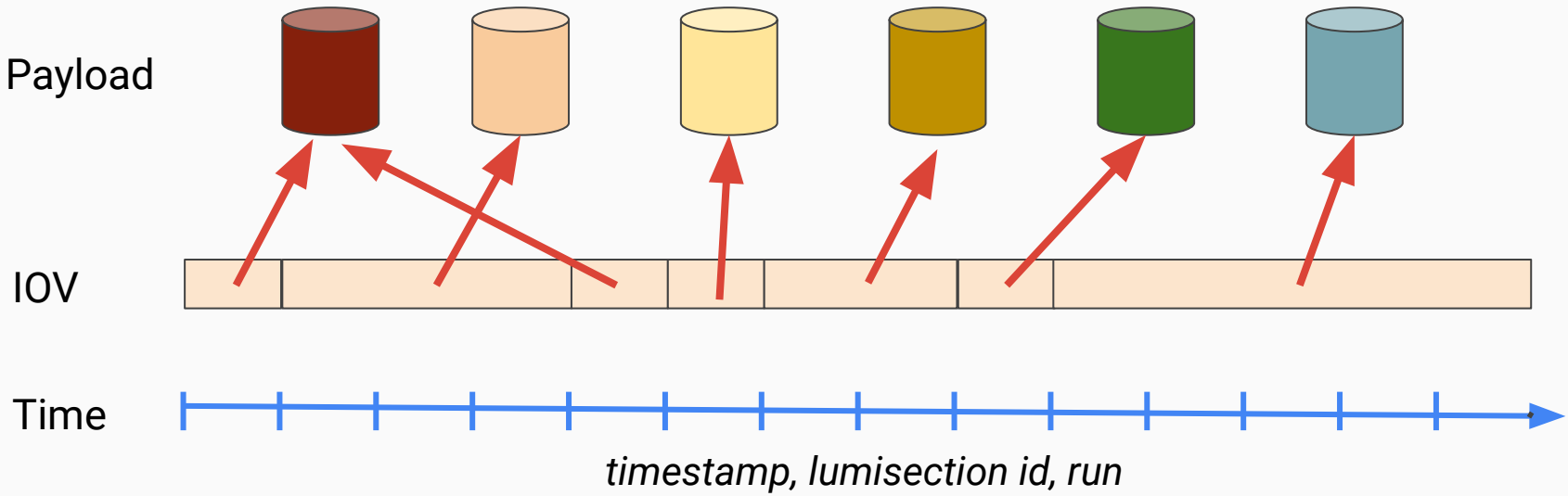
- Condition Data
  - Target data
  - Categories breakdown
- Data model
  - General concepts
- Workflows
  - Online: trigger reconstruction
  - Offline: express, prompt, iterative reconstruction
  - Analysis: production/private
  - General considerations

Condition Data

- The ‘extreme’ definition
  - *Everything that is not event data and is needed to produce physics data processing result*
- Definition by use cases (preferable)
  - *Data required in processing event data*
    - Detector Calibrations
    - Configurations
    - Construction data (Geometry)
    - Subsystem status
    - Beam params/Luminosity
  - Varying with time, possibly required in versions
- Boundaries
  - Experience suggests to set a limit to the ambitions to support all non-event data that *could* become conditions
    - Metadata, Slow Control Data

Data model concept

- “Payload”
  - The Bulk data required in a specific processing context.
  - Persistified/Stored as a whole
  - Assigned with a unique identifier
- “Interval Of Validity”
  - The target time range
  - Supporting various ‘time’ granularities
    - *Run, Lumisection, Timestamp*
  - Covering the full time span of physics event data collected



Online Workflows

- **HLT/DQM**
  - Online reconstruction
    - event selection
    - monitoring
  - Critical for data taking
    - Problems may lead to data loss (forever)
  - Data set generally reduced and less granular
  - Configuration data injected at run start
  - Validation of consumed data essential
  - Frozen conditions
    - or:
  - Update of specific conditions during the data taking run
    - Potentially challenging
    - Can be essential for an efficient filtering

Offline Workflows I

- **“Express” Reconstruction**
  - Reconstruction starting with a short delay from the DAQ
    - Range: 30mins-1hours?
  - Critical for next steps of recos
    - Producing conditions for prompt reco
  - Same as HLT: frozen or update?
    - Depends on how the workflow is steered
- **“Prompt” Reco**
  - The earliest offline reconstruction
    - Usually 48 hours latency wrt DAQ
  - Critical for the overall data production
    - Typically automated
  - Generally requiring the full set of Conditions
    - With the full time granularity available
  - Pre-validation of consumed frozen data very important
  - Conditions up to date will be provided in time to be consumed
    - Require proper synchronization between workflows

Offline Workflows II

- **Re-Reco**
  - Offline reprocessing
  - Executed with an optimized schedule
  - Only required if problem have been spotted in prompt reco?
  - Using the general computing resource of the experiment
    - Scheduled allocation required

- **Centralised/Distributed analysis**
  - Generally for wide, multi-purpose campaigns
  - Centralised effort in coordination
    - To provide coherent condition set
    - Satisfying the general scope
  - Frequently scoped to produce reduced data sets
    - Required as input data for the analysis

- **Private analysis**
  - Should not require access to central storage
  - Require conditions can be distributed in selected, minimalistic exports

Requirements/all workflows I

- **Latency**
  - Updates need to describe the state of the concerned system within the timescale of the expected change
  - Minimizing the updating time is essential for the updates to HLT/Express/Prompt workflows
- **Consistency**
  - Data Updates and Data Fetching by consuming workflows are asynchronous.
  - All of the sub-processes involved in workflows must be forced to consume the same conditions, irrespective of the access time.
- **Reproducibility**
  - A re-run of must reproduce the same selection/results
  - Every updated Tag must be left in the database with the same IOV sequence consumed by the workflows

Access patterns

- Update once
  - Need to meet the previous requirements
    - Provide IOVs “in the future” wrt the target workflow
    - Do not break history
  - Hand-shake Conditions Producer/Consuming Workflow
    - For the IOV definition:
      - HLT, Express, Prompt
    - The target workflow needs to be stopped when required conditions are not updated in time
      - Prompt
- Read many times
  - Consuming conditions at production workflows
    - Same data requested simultaneous by several clients
    - Multiple nodes, processes, threads
  - Consuming by individual analysis jobs
    - Scattered, heterogeneous requests

Requirements I

- Data model
  - payload
    - ?
  - IOV
    - map the information to identify the time target within the consuming process
  - metadata
    - identify set of homogeneous sets of pairs payload+IOV
    - enable versioning
    - identify coherent conditions super sets
    - track changes
    - select frozen snapshots of condition sets

Requirements II

- Condition data service
  - enable the coupling between payload and iov
  - enable the filtering by metadata
  - support the required volumes, depending on:
    - scope
    - time granularity
    - payload sizes
  - support transactions
    - data consistency
  - support data fetching with high rate simultaneous requests