

BrightnESS Wrap-up

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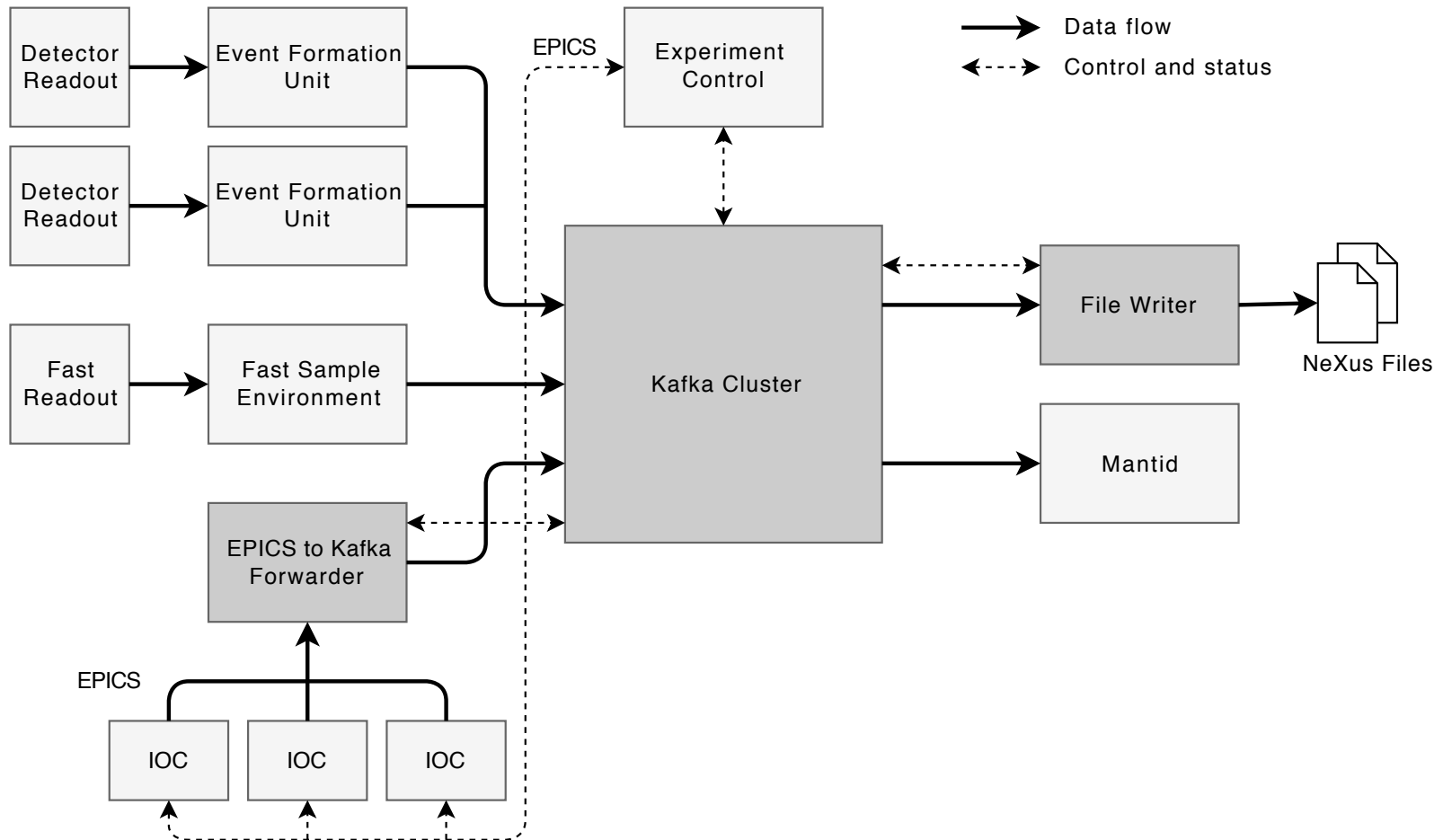
31 August, 2018

- The tasks in BrightnESS WP5
- Aggregation and streaming software architecture
- Event formation and fast sample environment
- EPICS forwarding
- NeXus file writing
- Development status
- Performance tests

The tasks in BrightnESS WP5

- WP5: Real-Time Management of ESS Data
 - Task 5.1: Creating a standard neutron event data stream for different detector types
 - Task 5.2: Creating a standard method for streaming meta-data for fast applied fields
 - Task 5.3: Software to aggregate and make available the neutron event data and sample meta-data

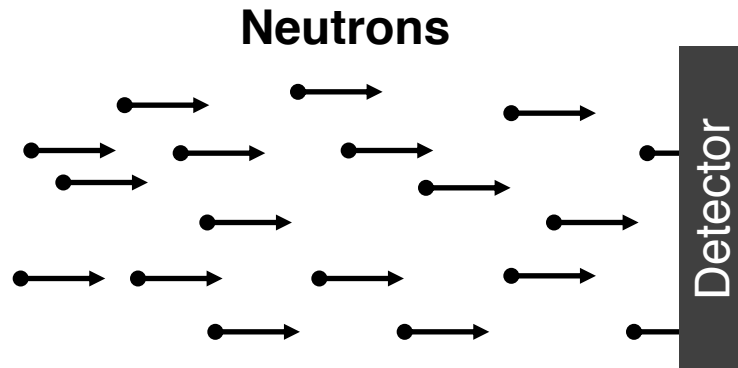
Aggregation and streaming software architecture



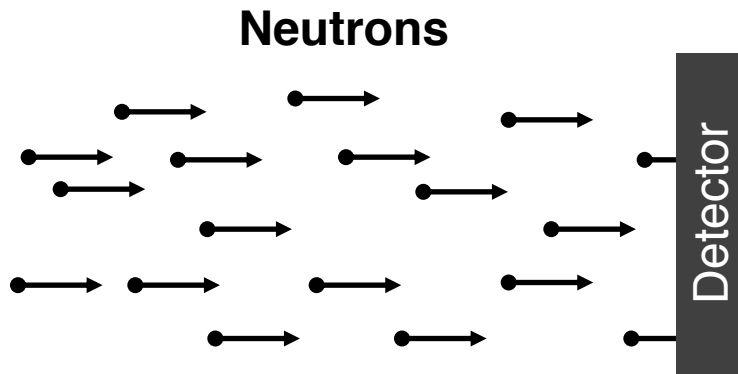
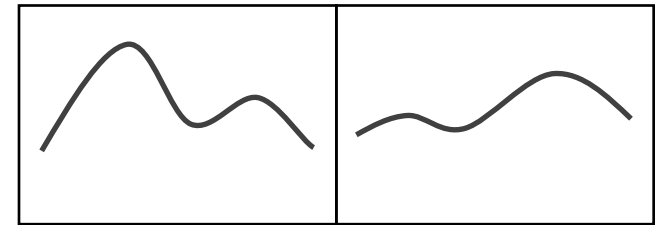
Aggregation and streaming software architecture

- Apache Kafka-based, using Google FlatBuffers for serialisation
- C++ in-house development: Event Formation Unit, EPICS to Kafka Forwarder, NeXus File Writer, in collaboration with ISIS, PSI and Elettra
- Command and status messages sent through Kafka using JSON
- Using Graphite/Grafana for metrics, Graylog for logging

Event mode data acquisition



Histograms

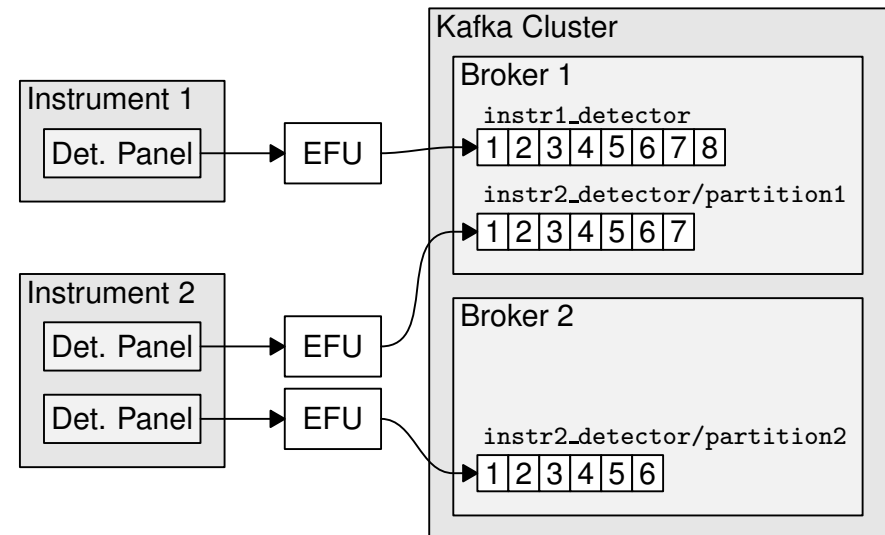


Events

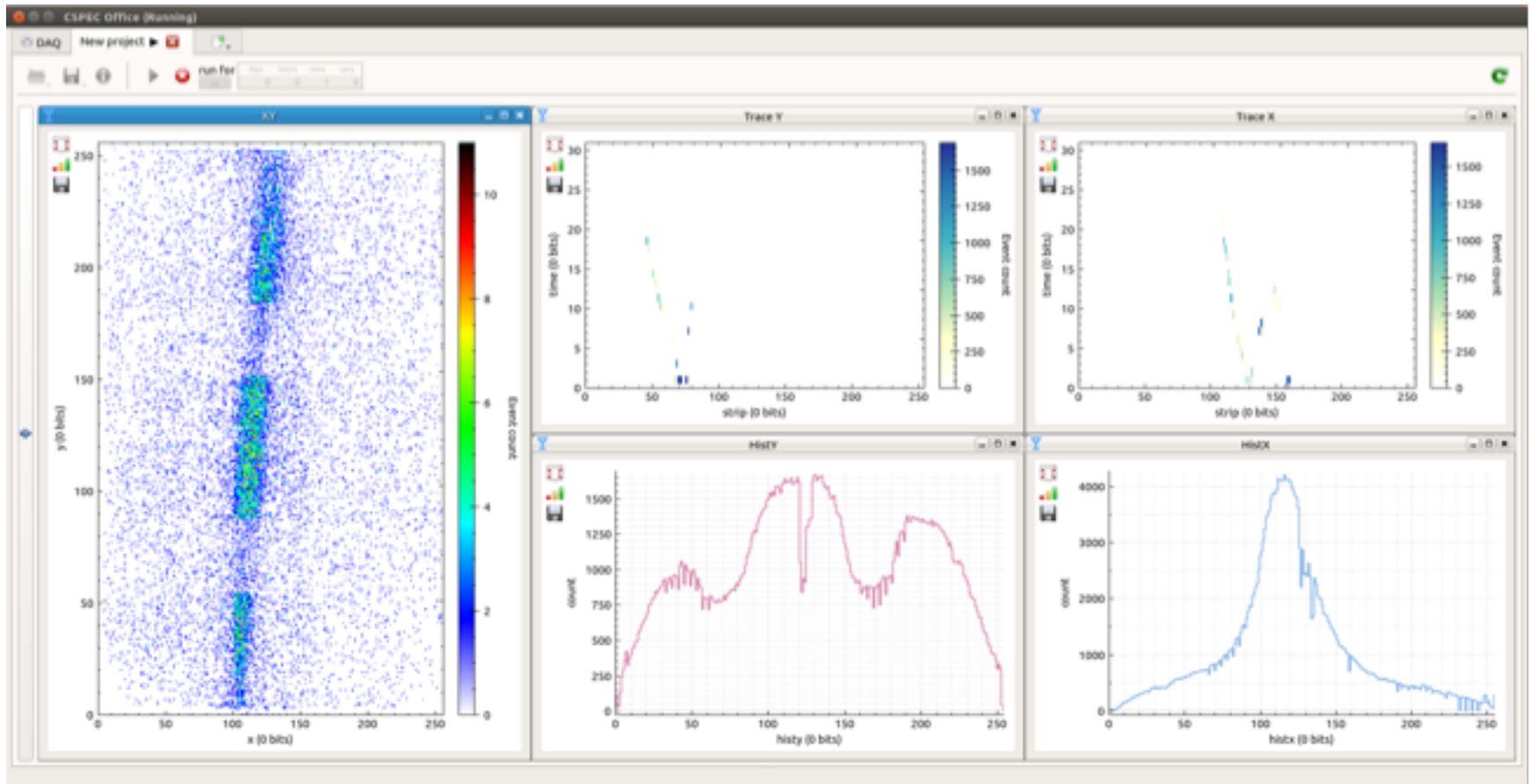
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Event formation and fast sample environment

- Event Formation Unit receives raw data and sends events to Kafka
- One topic per detector, with partitioning for scalability
- Fast sample environment solution based on the same software

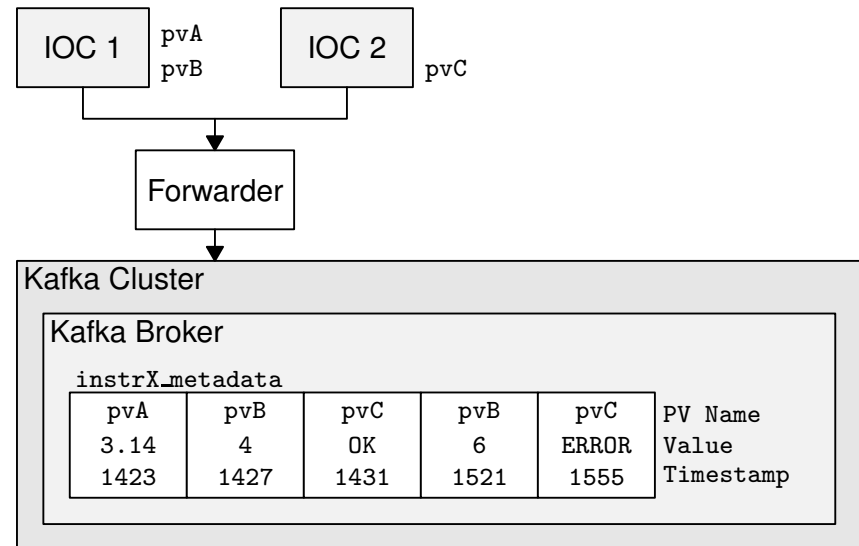


Event formation and fast sample environment



EPICS forwarding

- Forwarding application subscribes to EPICS process variables (PVs) and writes data to Kafka
- Data for multiple PVs in an instrument are multiplexed over the same topic



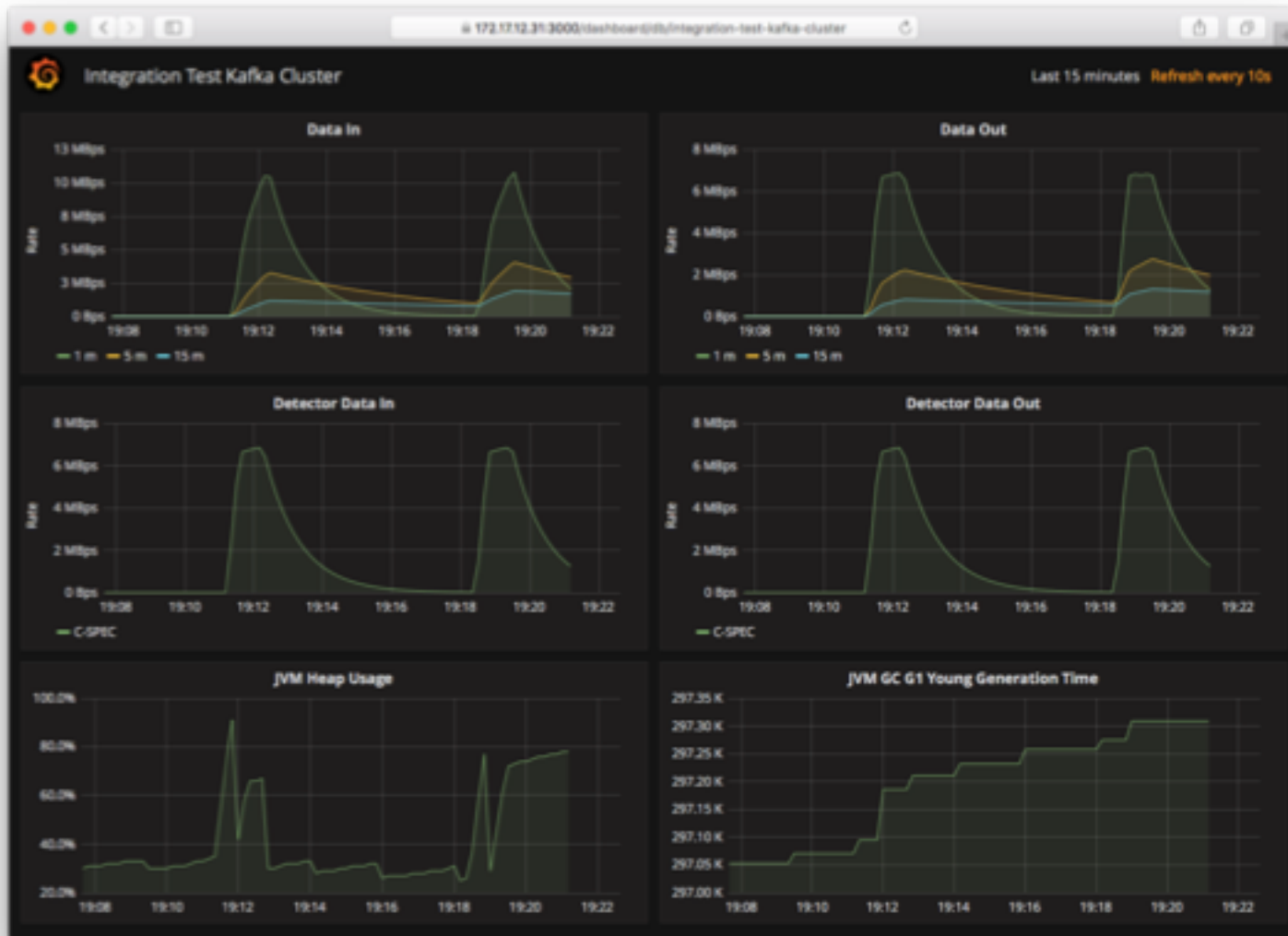
NeXus file writing

- NeXus is an HDF5-based data format for neutron, X-rays and muon science
- The NeXus file writer subscribes to a configurable list of Kafka topics and writes experiment data to files
- NeXus file structure and topic names are described in a JSON configuration file or command message

Development status

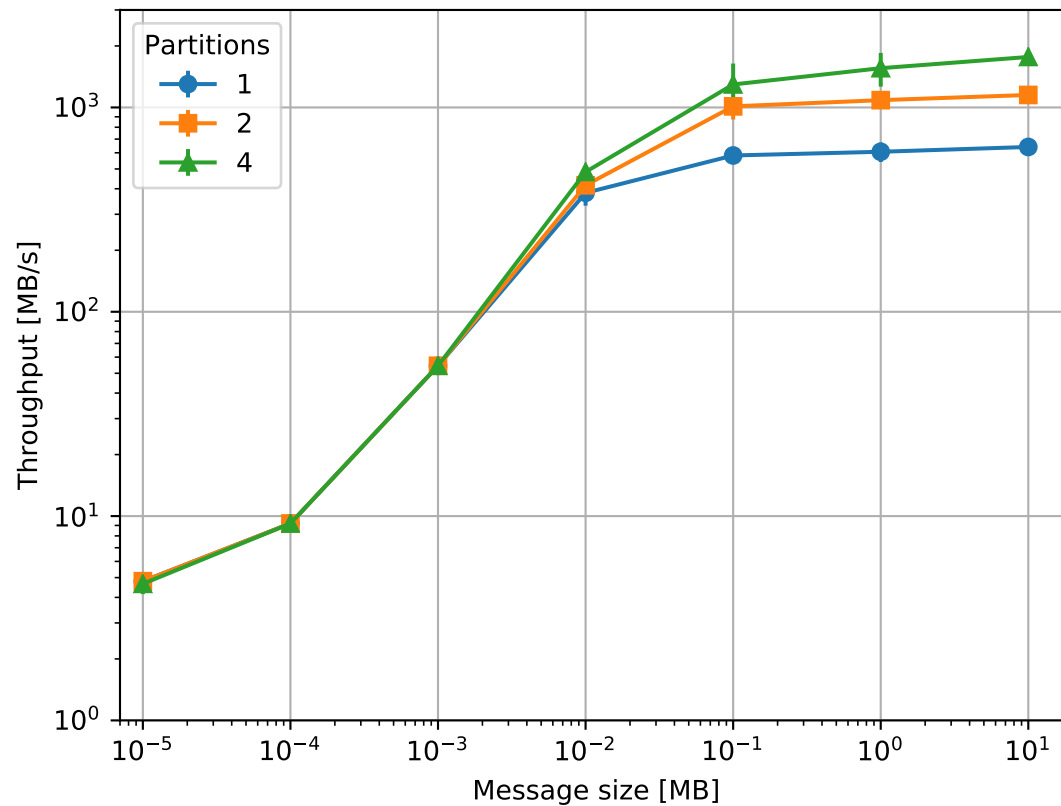
- Continuous integration on DMSC computing infrastructure
- Performance and scaling tests run at PSI
- System used at the BER-II reactor at HZB for acquiring data from an ESS test chopper
- Demonstrations of the Event Formation Unit at the ESS Utgård laboratory
- EPICS forwarder and Kafka deployed at three ISIS instruments

Development status



Performance tests

Scalability measurements: throughput as a function of the number of Kafka brokers with an event producer and a file writer, using one partition per broker.



Performance tests

Kafka throughput as a function of message size and number of partitions.
Two servers run the brokers, while a third runs the event producer.

