

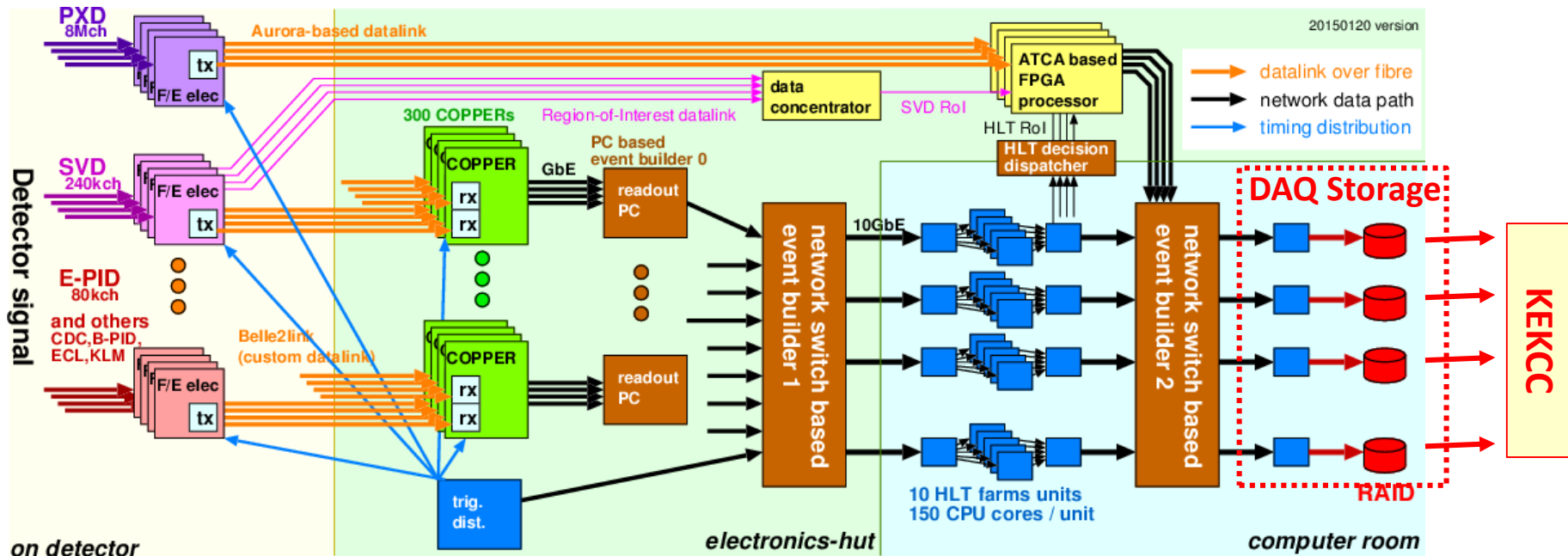
Storage

Tomoyuki Konno

TRG/DAQ workshop

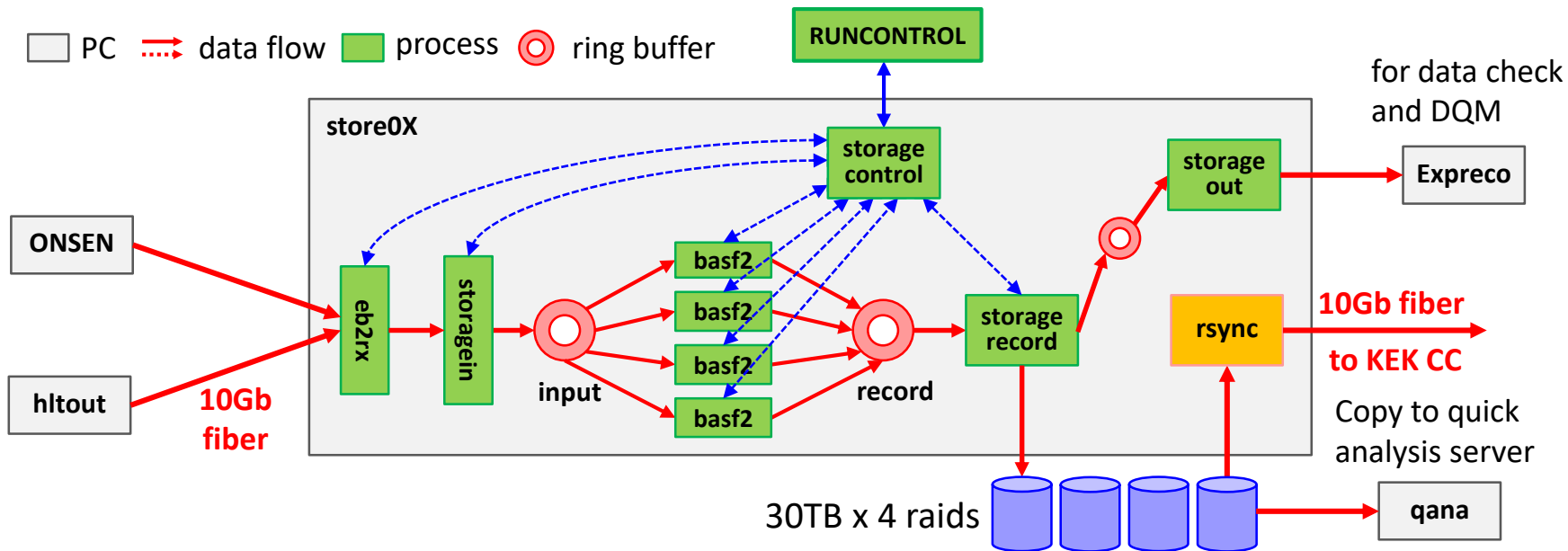
2017/08/24, NTU, Taipei

Introduction



- The storage system is to record all data read by the detector frontend electronics
 - 2nd level of event builder finally merges all detector data before recording
- Events are distributed to 10 HLS-storage units
 - Flow rate: $3\text{GB/s} / 10 \text{ units} = 300\text{MB/s/unit} @ 30\text{kHz}$
 - Data transfer to KEK-CC is also parallelized up 10 lines of 10Gbps links

Status



Functions of storage system are now in operation

- Recorder of all data after event builder 2 as ROOT object : 2GB/file
 - Calculate check sum (adler-32) during writing files
- Data transmission to KEK CC is now operational
 - T.Hara-san and Yamagata-san established transfer chain to KEKCC
- Event samples to express reco and event display shown at control room
- Files are also copied to quick analysis server for further studies

File naming rule

- Current file path based on agreements with offline group:
`<exp_no>/<run_no>/<run_type>.<exp_no>.<run_no>.<unit>.f<file_index>.sroot`
=> ex) 0001/03921/cosmic.0001.03921.HLT1.f00000.sroot
 - run_type : label to identify kinds of run
 - exp_no, run_no : experiment and run numbers (4 and 5 digits)
 - unit : name of HLT unit (HLT1, HLT2, ...)
 - file_index : sequential number of files in a run (6 digits)
- Kinds of run type is defined as below:
 - cosmic : Cosmic ray data taking
 - beam : Beam run (Phase II and Phase III)
 - test : Test operation with multiple detectors
 - debug : performance test without transfer
 - <detector> : Standalone detector test
 - cdc / ecl / top / klm/ arich / svd / pxd / trg / daq

File database

- Summary table for recorded file information in DAQ DB
- Recorder process creates database entry when new file is created
 - file path, host(hlt01-hlt10), label, exp#,run#,file# are recorded
 - file size, #events, check sum, time_close are updated when file is closed
 - time_sent : when file is transferred to KEKCC
 - time_delete : when file is deleted from the online disk
- Properties of the table is dumped into text file for hand-shaking with KEKCC
 - Transferred via the same path of data file transfer

| path | label | expno | runno | fileno | size | nevents | chksum | time_close |
|--|--------|-------|-------|--------|------------|---------|----------|------------------------|
| /rawdata/disk01/storage/0001/02917/test.0001.02917.sroot | test | 1 | 2917 | 0 | 115258302 | 3684 | 4f10d614 | 2017-06-25 13:25:01+09 |
| /rawdata/disk01/storage/0001/02916/test.0001.02916.sroot | test | 1 | 2916 | 0 | 190087896 | 6085 | 5da1975f | 2017-06-25 13:19:24+09 |
| /rawdata/disk01/storage/0001/02915/test.0001.02915.sroot | test | 1 | 2915 | 0 | 338438377 | 10831 | f9bbbe99 | 2017-06-25 13:15:52+09 |
| /rawdata/disk01/storage/0001/02914/test.0001.02914.sroot | test | 1 | 2914 | 0 | 32814101 | 1054 | 613fe44d | 2017-06-25 13:13:05+09 |
| /rawdata/disk01/storage/0001/02913/test.0001.02913.sroot | test | 1 | 2913 | 0 | 136460391 | 4369 | dd8cfa92 | 2017-06-25 13:11:00+09 |
| /rawdata/disk01/storage/0001/02912/test.0001.02912.sroot | test | 1 | 2912 | 0 | 1136736613 | 36370 | d05a4f22 | 2017-06-25 13:10:58+09 |
| /rawdata/disk01/storage/0001/02908/cosmic.0001.02908.sroot-5 | cosmic | 1 | 2908 | 5 | 815530900 | 9025 | ffe55db7 | 2017-06-25 12:39:01+09 |
| /rawdata/disk01/storage/0001/02908/cosmic.0001.02908.sroot-4 | cosmic | 1 | 2908 | 4 | 2097215324 | 23198 | aebc924 | 2017-06-25 12:37:50+09 |
| /rawdata/disk01/storage/0001/02908/cosmic.0001.02908.sroot-3 | cosmic | 1 | 2908 | 3 | 2097210605 | 23274 | a5449445 | 2017-06-25 12:34:46+09 |
| /rawdata/disk01/storage/0001/02908/cosmic.0001.02908.sroot-2 | cosmic | 1 | 2908 | 2 | 2097184872 | 23276 | fec9de23 | 2017-06-25 12:31:42+09 |
| /rawdata/disk01/storage/0001/02908/cosmic.0001.02908.sroot-1 | cosmic | 1 | 2908 | 1 | 2097215896 | 23232 | cca52ae1 | 2017-06-25 12:28:37+09 |
| /rawdata/disk01/storage/0001/02908/cosmic.0001.02908.sroot | cosmic | 1 | 2908 | 0 | 2097176013 | 23215 | 4d67724c | 2017-06-25 12:25:34+09 |

Browsing file database

File record

localhost:8080/logdaq/datafiles.html

Belle II DAQ File record

Show entries

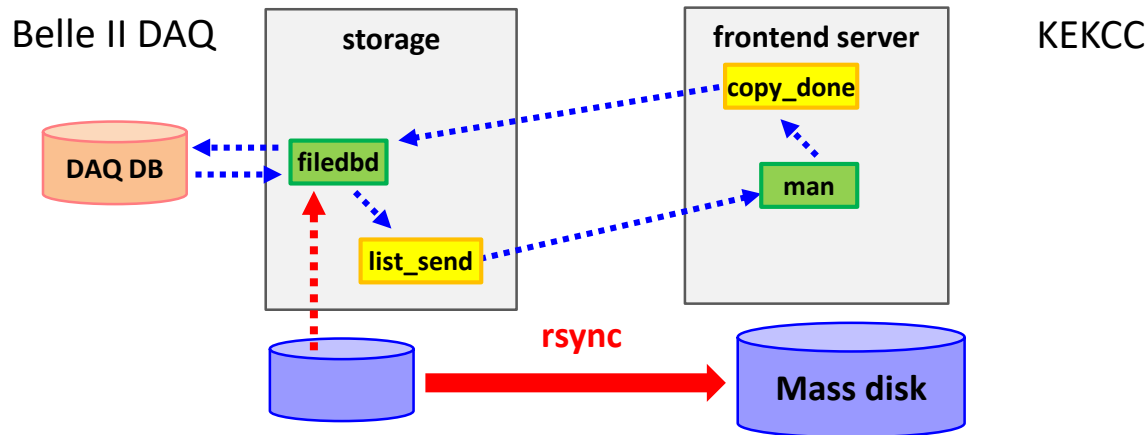
| Time closed | Run type | Exp# | Run# | File# | File path @ Quick analysis server |
|------------------------|----------|------|------|-------|---|
| 2017-08-22 07:38:14+09 | cosmic | 1 | 3931 | 9 | /rawdata/disk03/storage/0001/03931/cosmic.0001.03931.HLT1.f00009.root |
| 2017-08-22 07:38:01+09 | cosmic | 1 | 3931 | 8 | /rawdata/disk03/storage/0001/03931/cosmic.0001.03931.HLT1.f00008.root |
| 2017-08-22 07:34:17+09 | cosmic | 1 | 3931 | 7 | /rawdata/disk03/storage/0001/03931/cosmic.0001.03931.HLT1.f00007.root |
| 2017-08-22 07:30:35+09 | cosmic | 1 | 3931 | 6 | /rawdata/disk03/storage/0001/03931/cosmic.0001.03931.HLT1.f00006.root |
| 2017-08-22 07:26:52+09 | cosmic | 1 | 3931 | 5 | /rawdata/disk03/storage/0001/03931/cosmic.0001.03931.HLT1.f00005.root |
| 2017-08-22 07:23:10+09 | cosmic | 1 | 3931 | 4 | /rawdata/disk03/storage/0001/03931/cosmic.0001.03931.HLT1.f00004.root |
| 2017-08-22 07:19:28+09 | cosmic | 1 | 3931 | 3 | /rawdata/disk03/storage/0001/03931/cosmic.0001.03931.HLT1.f00003.root |
| 2017-08-22 07:15:45+09 | cosmic | 1 | 3931 | 2 | /rawdata/disk03/storage/0001/03931/cosmic.0001.03931.HLT1.f00002.root |
| 2017-08-22 07:12:03+09 | cosmic | 1 | 3931 | 1 | /rawdata/disk03/storage/0001/03931/cosmic.0001.03931.HLT1.f00001.root |
| 2017-08-22 07:08:22+09 | cosmic | 1 | 3931 | 0 | /rawdata/disk03/storage/0001/03931/cosmic.0001.03931.HLT1.f00000.root |
| 2017-08-22 07:02:53+09 | cosmic | 1 | 3930 | 0 | /rawdata/disk03/storage/0001/03930/cosmic.0001.03930.HLT1.f00000.root |

Showing 1 to 10 of 200 entries

Previous **1** 2

- Information for recent data files are summarized in a web page:
<http://b2db.daqnet.kek.jp/logdaq/datafile.html>

Data hand-shaking with KEKCC

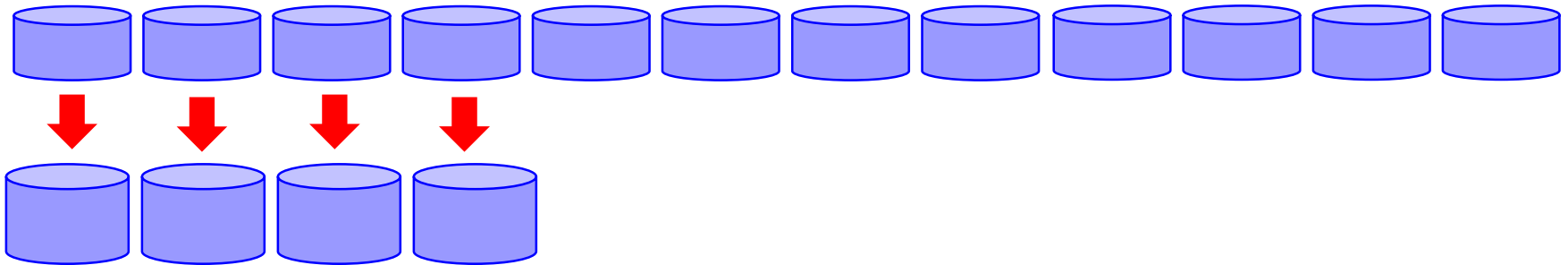


Information about file statuses is shared between DAQ and KEKCC

- File based hand shaking via rsync (same line as file transfer)
- list_send (DAQ to KEKCC) : list of data files ready to be transferred
 - listed files that all files are closed in a run (time_close is filled)
 - Refreshed when copy_done file is updated
 - Monitored and transferred at interval from KEKCC
- copy_done (KEKCC to DAQ) : list of data files ready to be removed
 - time_transferred in file database will be filled
 - copy_done file is created when files in a list_send are fully processed

File transfer to quick analysis server

Disk partitions in a HLT unit (9TB/partition)



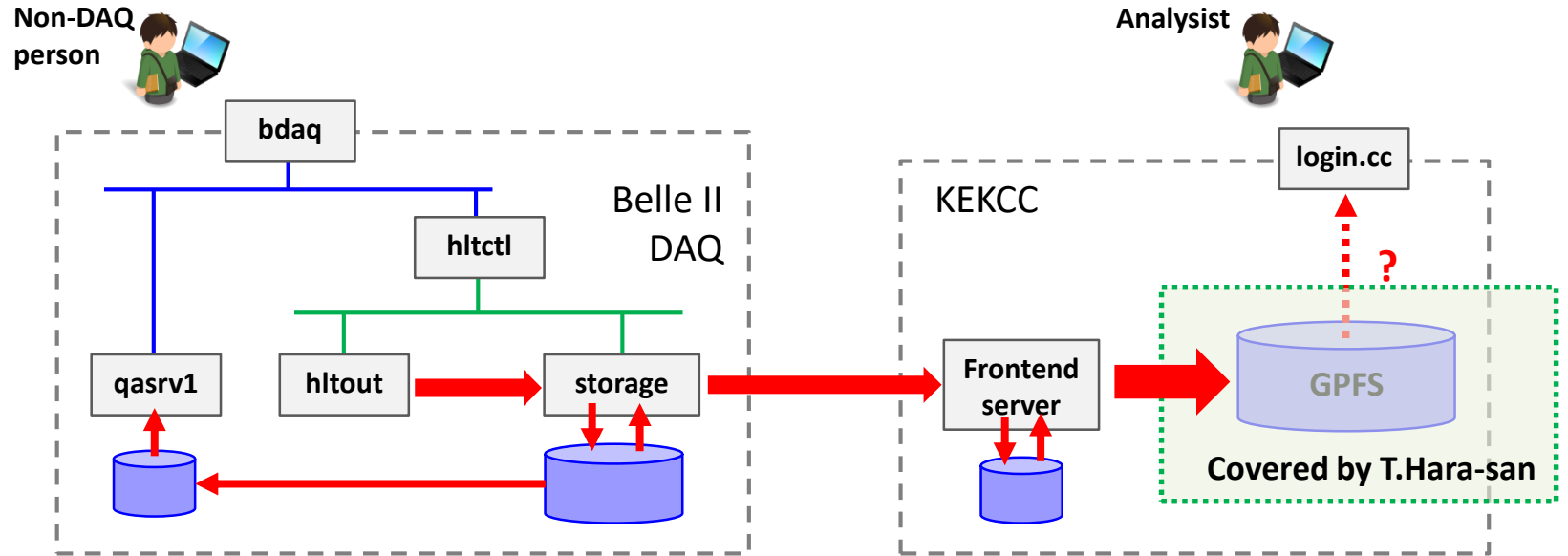
Disk partitions in quick analysis server (12TB/partition)

- Currently, all data files are copied to quick analysis server
 - Simply synchronizes each disk partition by rsync
 - Data size is not so large : limited number of channels, short DAQ time...
- It is getting difficult to share all data files due to increase of data rate
 - => I would like to select data files to save disk space
 - cosmic / beam : first several files are transferred and removed in 1-2 days
 - test / <detector> : all files are transferred and removed in 1-2 days
 - => All data files should be in KEKCC. Further analysis is available at KEKCC

Summary

- Storage system is working in global cosmic ray operation
- File naming rule is redefined based on agreement with offline group
 - `<exp>/<run>/<runtype>.<exp>.<run>.f<fileindex>.sroot`
 - "cosmic" means Belle II global run in GCRT
 - File database is prepared to record file information
- Data transfer paths after recording are now established
 - To quick analysis server
 - Transferred by rsync to PCs available for non DAQ experts
 - # of transferred files will be reduced and the data files will be removed in 1-2 days after transfer
 - To KEKCC
 - Automatic file transfer scheme is established
 - Cosmic data files are also being transferred

Data handling after recording



- Data files in the storage disks are copied to KEKCC and quick analysis server
 - Quick analysis server for expert studies : rsync in interval
 - KEKCC : transfer and processing with ROOT conversion
 - Transfer scheme is managed by T.Hara-san
 - Based on rsync controlled from KEKCC side

Reuse of HLT test bench

(photos from Itoh-san)



Machines are now moved to the server room next to HLT units

Quick analysis PC cluster

- Dedicated network between DAQ disk and analysis server
- Login PC (hlttb01) connects to daqnet for users

(from Itoh-san)

