Status of HLT Integration

LS1 evolution - PSC and athenaHLT

Ricardo Abreu
Werner Wiedenmann
Frank Winklmeier

CERN

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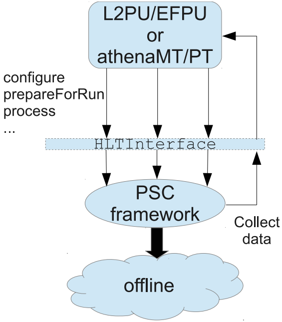
- LS1 evolution of PSC and athenaHLT caused by evolution of TDAQ
  - foundation is the merge of L2 and EF
- The *origin* of the changes is on the *HLT Interface*
  - the main **point of integration** with the HLT

HLT Interface

- Package that provides the API that the PUs and the HLT use to communicate
- Composed of mainly two parts:
  - FSM API → **used** by *PU*; **implemented** by *HLT*
  - DC API → **used** by *HLT*; **implemented** by *PU*
- Changes on the interface affect *both sides*



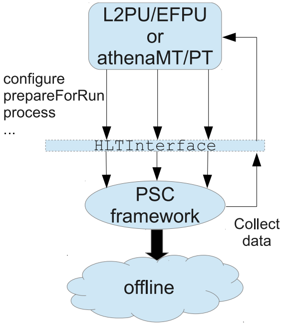
Evolution of the PSC and athenaHLT can be seen as deriving from changes in the HLT Interface

PSC framework

- The part that concretizes the HLT Interface on the HLT side
  - it wraps the rest of the HLT so that it can be executed online

athenaHLT (old athenaMT/PT)

- An alternative concretization of the online dataflow (PU+...)
  - allows the offline execution of the HLT without having to run a partition
  - useful for dev, auto testing, and reprocessing



LS1 changes on HLT Interface

Changes to the HLT Interface

1. One **single interface** (following L2 style for `process`) → *Merge*
2. Transitions receive **parameters in `boost::property_trees`** → *Ptrees*
3. New transitions for multi-process handling → *Forking*
4. **New data collection** scheme, with ROB reserving and monitoring → *DC*

Impact Item 1 – Merge

Summary

1. One **single interface** (following L2 style for `process`) → *Merge*

In general, it involves:

- preservation/adaptation of logic from one of the levels
- accumulation of logic from both levels
- renaming of things (from L2/EF to HLT)
  - ☞ the notions of L2/EF were fundamental and infused many code fragments
  - ☞ type names, includes, error ids, messages, comments, control flow constructs (like if-else)
  - ☞ Done, except where "external" software is involved
    - not evolved yet (e.g. eformat)
    - not integrated yet (e.g. trigger flags)
- used opportunity to improve and reorganize the code

Work simultaneous with ptrees

- Items 3 and 4 clearly separated → can be done separately from the rest;
- Work for items 1 and 2 (ptrees) is naturally coupled → both change same element of HLT Interface

Impact Item 2 – Ptrees

Summary

2. Transitions receive **parameters in `boost::property_trees`** → *Ptrees*

- Allows arbitrary communication from DF to HLT
  - 👍 no need to change HLT Interface when information exchange changes
- The HLT Interface abstains from specifying the communication contents
- Of course, both sides still need to agree
  - 👎 Detection of problems passed to run-time when the compiler could have been done it → accepted downside

In practice...

- Approach replaces 2 ways of receiving information in the HLT: direct parameters and global info (e.g. OKS, RunParams)
- The only transitions where *any* information is being inserted in the ptrees are `configure` and `prepareForRun`
  - ☞ In the future, also `prepareWorker` and possibly `finishWorker` and `hltUserCommand`
  - ☞ Biggest chunk of the work on `configure`
- Work on this point consisted mainly on:
  - ☞ establishing contents/structure of the ptrees and aligning with other developers
  - ☞ fill them in according to the user's intentions
  - ☞ read and use them, replacing previous approaches

Impact Item 3 – Forking

Summary

3. New transitions for multi-process handling → *Forking*

- In order to profit from the CoW feature, the HLTPU forks into several processes
  - during PU's `prepareForRun`
  - after HLT's `prepareForRun`
- the new transitions are: `prepareWorker` and `finishWorker`

```
HLTPU::prepareForRun()
{
  ...
  // the HLT does its prepareForRun here
  HLTInterface.prepareForRun(...)

  // the HLT finished preparing. Now we fork
  fork_result = fork();

  if(fork_result == IN_CHILD_PROCESS)
  {
    // here we know we are in one of the forked units
    // we need to setup individual stuff
    HLTInterface.prepareWorker(...)
  }
  else // IN_MOTHER_PROCESS
    setupWhateverIsNeededForMother();
}
```

Impact Item 3 – Forking (continued)

But why are new transitions needed?

- Some of the parameters that are set in the configuration are meant to be unique to each process (e.g. PID)
- after the forking, each process has copies of these parameters → a new transition is needed to individualize them (`prepareWorker`)

Potential pitfall

- By the time the `prepareWorker` transition is reached, copies of the original info may already have been created by the software down the stack.
- To detect these copies:
  1. make info unavailable before `prepareWorker`
  2. see where problems appear (i.e. places where the info is expected)
  3. solve by moving code to `prepareWorker` or by overwriting existing copies
- In practice, not many cases expected

- When coming back from running, forked processes need a chance to cleanup
  - ☞ `finishWorker` called during HLTPu's `stopRun` but after HLT's `stopRun`

Impact Item 4 – Data Collection

Summary

4. **New data collection** scheme, with ROB reserving and monitoring → *DC*

- In the old days...
  - L2 received a L1R and requested necessary ROBs
    - requests packed and cached by the ROBDataProviderSvc
  - EF received already the full event
- In the new scheme...
  - The HLT follows the L2 approach for the DC, but
    - caching and packing managed entirely by the *Data Collection Manager* (DCM)
    - ROBDataProviderSvc only forwards requests to reserve and collect data to the DCM
  - DC component of the HLT Interface changed to:
    - include a reserve method
    - piggyback cost-monitoring relevant data on the collect method (e.g. was the ROB cached)
  - ROBDataProviderSvc interface to HLT algorithms stays the same

athenaHLT has to implement the Data Collection

- reproducing the behavior of the DCM
- some aspects remain to be defined (e.g. from what threshold of cached ROBs will the DCM get the full event)

Global progress

Changes to the HLT Interface

1. One **single interface** (following L2 style for `process`) → *Merge* ■ ■ ■ ■
   - ☞ only sparse changes left, to integrate external code
2. Transitions receive **parameters in `boost::property_trees`** → *Ptrees* ■ ■ ■ □
   - ☞ RunParams still read from IS
     - some discussion still ongoing regarding future set of run params
   - ☞ HLTImplementationDB config from athenaHLT also pending (`--use-database`)
     - some reflection still needed (see twiki for details)
3. New transitions for multi-process handling → *Forking* ■ □ □ □
   - ☞ To do...
4. **New data collection** scheme, with ROB reserving and monitoring → *DC* ■ ■ □ □
   - ☞ Werner's work needs to be integrated
     - His simulation of DCM's job has to be passed to athenaHLT

5. Much necessary code restructuring/rewrite ■ ■ ■ ■

Focusing on athenaHLT

Examples of things that have been done...

Python bindings for the new HLT Interface

- including ptree bindings that try to incorporate python spirit
  - `myptree['path.to.my.stuff'] = 'foobar'`
  - same approach followed for iterators, key/value concepts, membership tests, etc.

New configuration strategy

- further encapsulate option specification and separate it from parsing
- implement a `configuration` class, following the RAII principle, which encapsulates the configuration
  - responsible for parsing and digesting the cli args
  - works with different option specifications (i.e. *file_based*, *emon* when supported)
  - provides a standard way to access configuration for the rest of the program
  - generates ptrees on the fly
  -
    ```
    c = configuration(file_opt_spec, cli_args)
    print "joboptions:", c['joboptions']
    print "precommands:", c['precommand']
    print "config ptree:", c.get_config_ptree()
    ```

athenaHLT – more examples of changes

Integrate processor with new configuration scheme

- Processor now receives configuration object in the constructor
  - (plus online infrastructure for future runs with online monitoring)
- old way of accessing attributes maintained but redirected
  - `processor.libraries` internally translated to `processor.config['libraries']`
  - `processor.run_number` internally translated to `processor.config['run-number']`
  - old code accessing the attributes could be maintained

Automatic testing and development scaffolding

- many unit tests
- some integration (application-level) tests (more to be added in time)
- In both cases
  - brought old tests up to speed / replaced outdated ones
  - added new ones
  - improved testing framework
  - made test failure detectable with exit code
- Include notions of unsupported and untested options
  - Using an option with a value that wasn't explicitly marked as supported results in an error
  - Using an option with a value that was marked as untested results in a warning

athenaHLT - examples of current features

- Many features that were supported in athenaMT/PT are already supported in athenaHLT
  - Most still marked as untested

Examples

- input event modifiers
- saving output events with different compression levels
- interactive more with python prompt
- static and dynamic run-number overwriting
- timeout watchdog
- Changing the PSC's setup python file
- Pre and post commands
- etc.

Practicalities

- athenaHLT is already available in the SVN (along with the PSC)
  - Tags `TrigKernel-20-00-00`, `TrigServices-20-00-00`, `TrigPSC-20-00-00`, and `HLTTestApps-20-00-00`
- However, it requires the new HLT Interface
  - which requires `C++11`
- Have currently been working with a custom HLT Interface
- Should go into a nightly soon - dev/devval or MIG8?
  - compile against tdaq-05-00-01 / C++11 offline nightly?
- Move of hltinterface package to latest tdaq-common (01-23-00)
  - Will be used in dev/devval in the next few days, leading towards release 18
  - PSC packages will have no more dependency on tdaq and can be moved to AtlasTrigger later on