LHCb Nightly Build System

The System

The LHCb Nightly Build System is a collection of tools and scripts that allow automation of build and test tasks for LHCb software.

A technical description of the system can be found in LHCbNightliesImplementation and hints on how to fix some problems in LHCbNightliesTroubleshooting.

Status of nightlies

The current status of the LHCb nightly builds is available at https://lhcb-nightlies.web.cern.ch/. See also the status of the LCG nightlies.

RSS feeds reporting about error/warning details for slots, projects or specific platforms can be defined on the summary webpage:

- use "Custom RSS feed" button in the top of the summary webpage

Configuration

The Nightly Build System configuration is defined in terms of slots, projects and platforms.

A slot is a consistent set of inter-related software projects that should be built and tested together. The configuration of a slot includes, in addition to the list of configured projects, the list of platforms the slot should be built for and some extra metadata for the fine tuning of the build.

Software projects are defined in the slot configuration with enough detail to be able to check-out the code from the software repositories. The special version HEAD means master plus all merge requests targeting master that are labelled with the name of the slot (see LBCORE-1156), or with all-slots. Any other version maps directly to Git (as in git checkout version). Special configurations can be defined on an ad hoc basis (for example projects in 2016-patches check out 2016-patches plus all merge requests targeting 2016-patches branch that are labelled with all-slots label).

For the platforms we use the strings that identify the SupportedPlatforms.

Regular builds

Every night we start the build of several slots, whose configurations are stored on Gitlab (LHCbNightlyConf).

Monitoring

%TODO%

Kibana monitoring of the LHCb build machines can be found here.

Running from the nightlies
The following instructions are for DaVinci, but they apply to any other project; instructions for Gauss are here. The first thing is to decide which slot. Usually one slot builds DaVinci on the latest LHCb, or the LHCb release candidate, and the other uses the head of Gaudi. Which one to pick is up to what you want to do. See https://lhcb-nightlies.web.cern.ch/ for the definitions. Then decide on the day. Make sure that the version you picked actually compiles. Now you have a slot, say lhcb-head and a day, say last night.

First do

```
lb-dev --nightly lhcb-head [ day ] DaVinci HEAD
```

where day is optional. The default is Today, or pick up a day like Mon, Tue... This builds you a directory ./DaVinciDev_HEAD/. In there check out what you need

```
cd DaVinciDev_HEAD
git lb-use DaVinci
git lb-checkout DaVinci /master Phys/DaVinci
```

and any other needed packages (see Git4LHCb on how to work with LHCb software under Git). Then do

```
./run gaudirun.py <options>
```

This will execute gaudirun.py in the environment of your local project. You can also use

```
./run bash --norc
```

or

```
./run tcsh -f
```

to start a new subshell in the modified environment.

See also GaudiCMakeConfiguration#Building_with_CMake.

You can also run from ganga %TODO% instructions to be updated, previous instructions for SetupProject no longer valid

### Nightly tests reference files

The testing infrastructure is described in GaudiTestingInfrastructure wiki. The nightlies execute in all slots all the tests that have been defined for packages being build in that slot. The tests that fall because of a mismatch between the output and the reference file produce a special file with extension .new. (Note that .new files are also produced for passing tests when there are counter differences below threshold, typically 0.0001).

If you want to copy the nightly reference files to commit them as replacements without needing to re-run the tests yourself, you can use lbn-get-new-refs, a script that adds the .new files to some local checkout. For example, to update the Brunel references in master with those from today's lhcb-head nightly we can do as follows.

1. Obtain a local checkout of the branch you'd like to update
   - Using lb-dev

```
lb-dev --nightly lhcb-head Brunel/HEAD
cd BrunelDev_HEAD
git lb-use Brunel
git lb-checkout Brunel/master Rec/Brunel
git lb-checkout Brunel/master BrunelSys
```

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* or by cloning the entire project

```bash
  git clone ssh://git@gitlab.cern.ch:7999/lhcb/Brunel.git
  cd Brunel
  git checkout master
```

2. Download the `.new` files from the nightlies (repeat for all necessary platforms, at the time of writing these are: `x86_64-centos7-gcc9-opt`, `x86_64+avx2+fma-centos7-gcc9-opt`, and for Brunel `x86_64-centos7-gcc9-dbg` has to be included as well)

```
  lb-set-platform x86_64-centos7-gcc9-opt
  lbn-get-new-refs lhcb-head Today Brunel
```

You can replace `Today` with the actual build ID. When using `ci-test slots` (lhcb-master-mr) this is a must.

3. Replace the existing `*.ref` files with the uploaded `*.ref.new`, To do the replacement of multiple files in one go (recursively, ignoring symlink refs), you can use

```
  find -name '*.new' -exec bash -c 'new={}; ref=${new%.new}; test -f "$ref" -a ! -L "$ref" && mv -i "$new" "$ref" ' \;
```

This recipe also works if you first download platform-specific refs for more than one platform.

4. Finally commit and push to a new branch to make a merge request. It is useful to mention the build id (slot and number) in the commit message.

Since LHCh!2260 (and following fixes), new references produced by `validateWithRef` are made as minimal as possible. This is done by only storing the preprocessed stdout plus all summary tables (counters, TTree and histograms). In this way irrelevant lines would not be part of the ref files, thereby reducing diffs and conflicts. Occasionally, this allows for rebasing reference updates on other reference updates with automatic conflict resolution:

```
  git rebase -Xtheirs origin/master
```

Here `-Xtheirs` means that non conflicting changes are merged and all conflicts are resolved in favour of the branch being rebased. When using this recipe, inspect visually the diff to make sure the conflict resolution is sensible.

**Allen tests reference files**

The Allen standalone suite of tests can be run as part of the Allen gitlab CI. Each pipeline run consists of several stages, including an (optional) Check stage, followed by Build, Run, Test and Publish. The job `test_physics_efficiency` of stage Test checks the physics efficiency of jobs against reference files. If the results obtained in a MR are expected to have an impact on the physics efficiency, this job will fail, pointing to the need of updating the reference files.

In order to update reference files for a MR you should follow these steps:

1. Issue an Allen CI pipeline on the desired branch and get a failing `test_physics_efficiency` job.
2. Fetch the failing job's artifacts by navigating to the failing job's webpage and clicking on "Download" on the Job artifacts section on the right. Note that artifacts will be removed after one week.
3. Unzip the artifacts to a destination of your choice `artifacts_location`.
4. Obtain a local checkout of the Allen branch you want to update, and cd into the test/reference folder within:
   - `git clone ssh://git@gitlab.cern.ch:7999/lhcb/Allen.git`
   - `cd Allen`
   - `git checkout <branch_name>`
   - `cd test/reference`
5. Apply the patches in the artifacts one by one:
   - `for i in artifacts_location/validation_output/*; patch < $i; done`
6. Finally submit the changes to either the MR where the difference appeared or to a separate MR.

### Platform specific references

To have different references depending on the platform you need to suffix the filename with the platform, e.g. `hlt1_reco_baseline.ref.x86_64+avx2+fma-centos7-gcc8-opt`. You can have a single reference match multiple platforms by omitting some of the tokens split by `-`. For instance, `hlt1_reco_baseline.ref.x86_64` would match all but the `avx2` platform and `hlt1_reco_baseline.ref.x86_64+avx2+fma` would match only the `avx2` platform. The general logic is that the platform where you run is split into tokens with `-` as a separator and the same is done with the last part of the ref filename. The filename where the most tokens are a subset of the platform's tokens is the reference used for the validation, see here.

### Nightly tests input data

When nightly tests require event data as input, they should used files stored in the CERN-SWTEST storage element, and described in the Test Files database. See the TestFileDB TWiki for details.

### Reproducing nightly tests locally

To re-run the nightly tests locally for a certain project (e.g. Moore), you should do the following steps (in bash). First, copy the full project from the nightlies:

```bash
cp -r $LHCBNIGHTLIES/lhcb-head/Today/MOORE/MOORE_HEAD .
cd MOORE_HEAD
```

Then, setup the environment and configure your local copy:

```bash
. $LHCBNIGHTLIES/lhcb-head/Today/setupSearchPath.sh
export USE_CMAKE=1
make configure
```

You can now run a single test with

```bash
make test ARGS="-R cosmics -V"
```
If you want to run the test manually (without make), obtain the command from `make test ARGS="-R cosmics -V -N"` by removing "--report" "ctest".

For more options for selecting which tests to run, see the CMake FAQ

### Documentation

- A New Nightly Build System for LHCb (*Marco Clemencic and Ben Couturier*)
  LHCb-INT-2013-006, Poster-013-328
- Nightly build and test system supports LHC experiments (*Stefan Roiser, Ana Gaspar, Yves Perrin, Victor Diez and Karol Kruzelecki*) CERN Computer Newsletter April-June 2009