Advanced Systems

C++ Project Management

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Abstract

TODO

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Even though this may seem like a trivial matter at first, there are a few rules one needs to follow to not run into any cross-platform compatibility issues. In fact, not complying to these rules willingly may sometimes cause security issues as any shell metacharacter[1] in a filename will be executed (unescaped) by another shell script [1] [2]. See also `https://en.wikipedia.org/wiki/Filename` for a comprehensive list of filename limitations put in place by various operating systems. In general, prefer UTF-8 encoded lowercase filenames across a file systems. Using white space characters in directory and filenames is also better to be avoided because many Unix/Linux shell scripts presume that there are no white space characters in filenames. For instance, in June of 2021, Microsoft's Ubuntu repositories broke due to white spaces filenames [3]. Moreover, the POSIX standard may reserve a subset of all possible filenames that consists of identifiers that begin with an underscore and continue with either another underscore or a capital letter in the global namespace. The class of names that contains all names matching this restriction can be expressed by the following regular expression [4]: `_[_A-Z][0-9_a-zA-Z]*`. For similar reasons, you should never use a hyphen as the first character in a filename because by convention, programs accepts their options as their first argument, usually preceded by a dash [5]. On top of that, Windows also reserves a list of filenames for internal use only:

- `CON`
- `AUX`
- `NUL`
- `COM1`, `COM2`, `COM3`, `COM4`, `COM5`, `COM6`, `COM7`, `COM8`, `COM9`
- `LPT1`, `LPT2`, `LPT3`, `LPT4`, `LPT5`, `LPT6`, `LPT7`, `LPT8`, `LPT9`

This limitation also applies to lowercase deviations of these filenames followed by an extension [6]. Finally, using short and concise filenames is also strongly encouraged to comply with Windows' default maximum path length of 260 characters (as opposed to Linux' maximum path length of 4096 characters on most prominent distributions). While it is possible to opt into long paths to lift this limitation on Windows starting with Windows 10 (Version 1607 and later [7]), it is not reasonable to assume that end-users have enabled this feature on their machine.

[1] Characters that must be escaped in a shell script before they can be used as an ordinary character are termed shell metacharacters.

3 GitHub Workflow

Over the years a successful development model has emerged, at the center of which stands the idea to use two persistent branches for the entire life span of a project. The `main` branch at `origin` (formerly denoted by `master`) reflects a production-ready state of the source code that is also used to deploy the latest version of an executable or library. Its next to kin is known by more by one name and represents successive versions of release candidates that are currently in development. Changes made to this branch should give continual assurance that code and environment operate as designed and are always in a good and deployable state [8]. Some good names for this secondary branch are

- `dev`
- `development`
- `integration`
- `future`

The GitHub workflow envisages that new, short-lived feature/topic branches use this secondary branch as both a basis and a target for pull requests. To ensure that features and patches find their way quickly into the `main` branch, a strategy has been devised through trial and failure by many open-source software communities. Note that while all branches converge towards a common future, there are a few exceptions to this rule. GitHub pages, for example, uses a special branch (`gh-pages`) for hosting static websites, though this is a less common occurrence in C++ projects.

Automatic test runs encourage a culture of early feedback and vivid communication in code reviews between developers when it matters the most. This is especially crucial in multidisciplinary projects where it is important to bring collaborators from various fields early on together in order to progress and mature in an environment that makes allowances for mistakes. Reducing friction in this stage has a positive effect on the productivity of the team, but also decreases the time and cost for future deployments. This is another side effect of moving testing and InfoSec activities to earlier lines of work.

Continuous integration providers such as GitHub Actions and AppVeyor allow open-source project maintainers to build, test and deploy applications on virtual machines at zero-cost. They can be added as required passes to pull requests to verify that new submissions meet a pre-defined set of conditions before they go through a code review. Since these jobs can target multiple operating systems and architectures, testing cross-platform support has become much easier than in the past. CI scripts can also be used to perform a wide range of additional tests such as static code analysis, test coverage or code quality appraisal.

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