

ADVANCED SYSTEMS



C++ Project Management

Shinonome Mazawa

June 28, 2021

Abstract

TODO

Contents

1	Introduction	2
2	Directory and File Names	2
3	GitHub Workflow	3
4	DevOps Principles	3
5	Communication	4

1 Introduction

TODO

2 Directory and File Names

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 metacharacter¹ 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 all 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 accept 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.

¹Characters 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.

4 DevOps Principles

In DevOps², the term value stream is defined as the process required to convert a business hypothesis into a technology-enabled service that delivers value to

²The term DevOps was first coined by Patrick Debois in 2009 during the first DevOpsDays in Ghent, Belgium.

the customer. One key point to take away from the three ways is to turn our attention to reducing the overall lead time throughout the development cycle. After all, the proportion of process time to lead time serves as an important measure of efficiency. To enable fast flow and high quality, small batches of work going through the design/development and tests/operations value stream should be favored over big and potentially disruptive changes because value generation only starts once code passes the UAT (User Acceptance Test) in a production environment. A core tenet of virtually all modern process improvements is to continually shorten and amplify our feedback loops. As complex tasks suffer greatly from multitasking, incurring all costs of re-establishing context as well as cognitive rules and goals, it is recommended to implement a limit by codifying and enforcing an upper bound for WIP for each work center [8].

1. Ready
2. Investigate
3. In Progress
4. Done
5. UAT
6. Delivered

Reducing the batch size of each ticket that goes through this cycle results in faster lead times and error detection, but also less WIP and rework.

5 Communication

Communication within the team is one of the determining factors of a project's success. While many people have a solid idea of what good communication constitutes, there are a few points that are worth highlighting here.

Establish at least two lines of communication with all members of the team, the reason being that your primary communication channel is always running at risk of going abruptly offline due to server outage or technical malfunctions. This is especially crucial in emergency situations. Unlike many other lines of work, the work of an engineer³ is foremost of mental nature. Many studies suggest that being constantly exposed to notifications from colleagues and clients harms the productivity of the team [9]. Excessive communication makes it easier to get carried away by extraneous affairs. It is therefore recommended to allocate predictable time-offs to each member to designate periods of time in which they are allowed to remain unresponsive to messages and calls. In the same vein, open office spaces should be avoided because they are equally damaging to the productivity when it comes to work that requires long hours of uninterrupted concentration [10] [11].

In contrast to this train of thought, it is necessary to identify people in your team that have trouble communicating problems early on. The best-case scenario prescribes that information on progress and failure should be communicated in time. According to a survey conducted in 2016 [10], communication challenges

³Going forward, engineer refers to anyone working in our value stream, not just developers.

in geographically distributed Agile development teams appear to be caused largely by time-zone differences and the team configuration. Social exchange theory suggests that predefined goals can help the team understand the value of knowing communication by virtue of knowing that every person involved has a self-interest in staying engaged and obtaining meaningful results. This also implies that management needs to cut down the total amount of meetings that take place between work if there exists a more efficient alternative. While written communication provides the best way of keeping a record, the absence of direct communication can lead to low-cohesion relationships, as a result of which people are more prone to dismiss the opinions and experience of their colleagues. As a project manager, it is your responsibility to address these sort of issues as soon as they rise to the surface.

References

- [1] D. A. Wheeler. “Control characters (such as newline), leading dashes, and other problems.” (2020), [Online]. Available: <https://dwheeler.com/essays/fixing-unix-linux-filenames.html> (visited on 06/17/2021).
- [2] V. Marti. “Vulnerability announced: Update your git clients.” (2014), [Online]. Available: <https://github.blog/2014-12-18-vulnerability-announced-update-your-git-clients/> (visited on 06/17/2021).
- [3] S. Jarina. “Ubuntu repositories broken.” (2021), [Online]. Available: <https://github.com/dotnet/core/issues/6381> (visited on 06/17/2021).
- [4] Oracle. “Standard headers and reserved names.” (2010), [Online]. Available: <https://docs.oracle.com/cd/E19205-01/819-5265/bjaky/index.html> (visited on 06/17/2021).
- [5] S. Garfinkel, D. Weise, and S. Strassmann, *The UNIX Hater Handbook*. IDG Books Worldwide, Inc., 1994, ISBN: 1568842031.
- [6] Microsoft. “Naming files, paths and namespaces.” (2020), [Online]. Available: <https://docs.microsoft.com/en-us/windows/win32/fileio/naming-a-file> (visited on 06/17/2021).
- [7] —, “Maximum path length limitation.” (2020), [Online]. Available: <https://docs.microsoft.com/en-us/windows/win32/fileio/maximum-file-path-limitation> (visited on 06/17/2021).
- [8] G. Kim, P. Debois, J. Willis, J. Humble, and J. Allspaw, *The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations*. IT Revolution Press, 2016, ISBN: 978-1942788003.
- [9] L. A. Parlow and J. L. Porter. “Making time off predictable and required.” (2009), [Online]. Available: <https://hbr.org/2009/10/making-time-off-predictable-and-required> (visited on 06/16/2021).
- [10] S. Yermolaieva, “Communication challenges in agile teams from the communication theory prospective,” Innopolis University, 2020.
- [11] C. Newport, *Deep Work: Rules for Focused Success in a Distracted World*. Grand Central Publishing, 2016, ISBN: 978-1455586691.