Preliminary Report: XMonad

Practical Course – Contributing to an Open-Source Project

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1st of December 2020

1 Introduction and definitions

XMonad is a *"dynamically tiling X11 window manager that is written and configured in Haskell"*. It is designed to be *"lightweight, minimal, extremely customizable and crash-free"*. This window manager is entirely usable with just the keyboard, with optional mouse support [1]. It is considered as one of the well known "real-world" software written in Haskell[1].

1.1 Definitions

- **X11 Window System**: The most used GUIs manager on UNIX-Like Operating Systems [2].

- **Window Manager**: The ArchWiki [3] defines a window manager as a *"system software that controls the placement and appearance of windows within a windowing system in a graphical user interface."*

  - **Tiling Window managers**: Window managers who place windows in non-overlapping tiles are called tiling window managers, in contrast to *stacking* or *floating* window managers. [3]

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[1] https://github.com/xmonad/xmonad/issues/93#issuecomment-298145660

2 XMonad: Short History and Motivation

Spencer Janssen, one of the original authors of XMonad, used dwm[2] as his window manager. Dwm is a tiling window manager, written and configured in C. That inspired him to create a similar project in Haskell, which he, Don Stewart, and Jason Creighton worked on. Brandon S. Allbery helped them make XMonad compliant with the "Inter-Client Communication Conventions Manual" rules defined by X11.[4]

XMonad was announced on the 22nd of April 2007 by Spencer Janssen over at the Haskell-café mailing-list [5]. In its first version, XMonad comprised of less than 500 lines of code. The original project was available on Hackage and darcs. By February 2008, the team had 34 developers that contributed to XMonad. 45% of the code lines were comments, which was a sign of a well-documented project. [1]

By 2011, the three original authors left the project [6][3]. Since February 2017, the XMonad Core team is composed of 7 developers. The latest release of the core package, release 0.15, was published on the 30th of September 2018 [7]. The last release of library community-contributed modules, xmonad-contrib, is a year younger than the core package [8], with the next release 0.17 being planned and discussed on GitHub as of the time of writing [9] [4].

Currently, the core package has more than 90 contributors to its codebase, which consists of more than 3000 lines of code (36% of which are comments).[10] These numbers are much higher for the xmonad-contrib library: around 25 000 lines of code (45% of which are comments) from 280 contributors.[11]

3 Who uses XMonad

XMonad is mainly used by GNU/Linux users since it is built for the X window system. It is also possible to integrate it with macOS. [12]

XMonad could be described as a "niche inside a niche": On one hand, tiling window managers are not widely used. No GNU/Linux mainstream distribution includes a tiling window manager as a default. On the other hand, Haskell is not a popular programming language [13]. XMonad is at the intersection of these two worlds, and the users are required to write some

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[2]dwm - dynamic window manager, `https://dwm.suckless.org/`

[3]Commit history on `https://github.com/xmonad/xmonad/graphs/contributors`

[4]See `https://github.com/xmonad/xmonad-contrib/issues/393`

Haskell code if they want to customize anything.

However, many XMonad users do not have prior experience with Haskell. One of the contributing factors is the comprehensive documentation of the different modules, as well as the availability of various example configurations, either hosted at the Haskell wiki or privately shared independently by users. The XMonad team tries to abstract

As Will Farrington [14] puts it:

> "I may not know much (really, any) Haskell itself, but employing it as a "configuration language" is certainly far easier than anyone might give it credit... the modules are perhaps the best bit of documentation I've seen in any code, ever. Additionally, you get a free IRC room full of other XMonad users who are always more than willing to point you in the right direction . . . "

XMonad was discribed by Brent Yorgey, one of the maintainers of XMonad, as the "Haskell gateway drug"[15]. The Haskell syntax seems so unusual and intriguing to some users; that they decide to learn more about this functional language. That was the reason that Derek Taylor, a content creator on the YouTube channel "DistroTube"; started learning Haskell [16].

4   Project structure

XMonad is currently hosted on github. The project itself is split into different repositories, mainly:

- xmonad/xmonad: this is is the core of XMonad. The data structures for configuring and interacting with the X11 server are defined here, as well as some defaults to be used out of the box. The code is roughly split into a "pure" part that handles operations on the state of the window manager (called the StackSet) and into an IO part that interacts with the system. The state of the core is quite stable, and the changes are kept to a minimum. It is also a requirement that every pure function added to the core must come with QuickCheck properties to act as a specification. Some parts of the (pure) code have been re-implemented and formalized in Coq [17]. This is why XMonad is claimed to be crash-free [1]: the combination of smart data-structures, formal and semi-formal verification, and Haskell's strong type system give high static guarantees.

- xmonad/xmonad-contrib: this repository contains the third party extensions to XMonad. Contributions here are highly encouraged, since

most of the features are implemented here. It is possible to only use the core of XMonad, but with a limited set of features: the core, for example, does not have support for status bars, and only includes three basic layouts. Since customizing XMonad is done by writing Haskell code, many users will find it natural to share their ideas and contributions with the community. This can explain why the xmonad-contrib repository is more active than the core.

Adding to the two main repositories, there are some other ones like xmonad/xmonad-web for the xmonad.org website, or xmonad/xmonad-extras for third party modules that require extra dependencies.

4.1 Interactions and relationships with other projects

4.1.1 Haskell-X11

X11 is a Haskell binding to the X11 graphics library. Although heavily used by the XMonad, this library existed long before XMonad. It was created in 1999 by Alastair Reid [18]. The library was moved to GitHub in April 2007 [19]. After that, the original authors of XMonad heavily contributed to the project. They also hold the copyright for the library between 2007 and 2009. The library is heavily used by XMonad since it is necessary to interact with the X Window System. In GitHub, it is hosted under the XMonad organization. [18]

4.1.2 XMobar

In favor of the "do one thing and do it well" philosophy, XMonad comes with no status bar. Xmobar is a status bar that was specifically designed by Andrea Rossato to be used with XMonad. XMonad provides some dedicated functions to make interacting with xmobar easier. The status bar could although be used with any window manager, not just XMonad. [20]

5 Organization

5.1 Governance structure

The structure of governance in XMonad is relatively flat. There is a team of maintainers, who mainly take care of merging and reviewing pull-requests and organize releases.

5.2 Communication

The official communication channels to talk with the community are the #xmonad IRC channel on `chat.freenode.org` and the XMonad mailing list[5].[1] However, the mailing list is not as active as it used to be when it launched. Github issues are also used for discussion, as the mentioned planning of the 0.17 xmonad-contrib's release. Relevant discussions from the IRC channel also get quoted on GitHub, so they are publicly accessible. The main repository also includes a list of maintainers, as well as their contact information. [6]

5.3 Contributions

Bug reports and pull-requests get managed on Github. There are templates for pull requests and issues, with a checklist for what to help provide better information for other contributors. The repositories also have over 30 labels to help better categorize submissions. However, these are often not used, making searching through issues and pull requests tedious. [6]

The main repository hosts a `CONTRIBUTING` file that explains the difference between the different parts of the project and states the policies and guidelines regarding pull-requests. Adding to that, the documentation contains a page [21] where a high-level view of the source code is presented, as well as the coding style and the licensing policy. The XMonad wiki also includes a development tutorial [22], walking users through writing a simple module, as well as a guided tour of the source code, where the most important parts of the code are explained [23].

5.4 Releases

Currently, no one is responsible for doing new releases. A transition is being currently discussed on Github since the maintainers who were publishing new releases are not available anymore. [6]

6 Legal and licensing information

XMonad is licensed under the BSD3 license [6]. The author of a module holds its copyright, and they should submit it either under the same license or a more permissive one [21] .

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[5]See `https://mail.haskell.org/mailman/listinfo/xmonad`

7   Funding

XMonad is not receiving funding or accepting donations. All work on the code is currently being completely volunteered.

8   Summary and criticisms

XMonad is a reliable window manager with many features. It also provides a high potential for customizability since it is configured in Haskell. The source code is heavily documented, with its important parts heavily tested and even formally verified.

The original authors of the window manager are not active anymore. However, it is still maintained and improved by the community. XMonad has a flat governance structure, with a team of maintainers to manage the contributions. The project's workflow is strongly integrated with Github: adding to hosting the source code, it is used as a bug-tracker, discussions', and contributions' platform.

However, some parts of XMonad are not well-maintained. The official website contains pages that have not been updated in more than a decade[6]. The communication channels can be considered as old-fashioned, even though the IRC channel is still active. That can discourage new users from getting in touch with the community. The releases are also not published regularly, which limits the access of some users to the full set of features: if they want to use all the features, they are required to use the git versions of the different repositories, which is less convenient than just downloading the binaries.

With more than 280 contributors, and 13 years being used, XMonad is still attracting new users, with more ideas to improve the project. It draws some of them into learning Haskell, and provides an example on how it can be meaningfully applied in real-world scenarios.

References

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