An introduction to the FreeBSD Project

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Who am I?

FreeBSD src and ports committer
- Mostly active in the network stack (IPv6, if_bridge, network device drivers)
- Former member of the security team and retired core team secretary
- Maintainer of several ports and some unpopular contributed code (tzdb)

Director of the FreeBSD Foundation
- Bouncing from conference to conference around the world
- Tirelessly advocating FreeBSD to potential contributors

Consultant
- Device drivers and real-time operating systems
- Electronics, particularly wireless
- Professional paranoid

What is FreeBSD?

FreeBSD is an open source Unix-like **operating system** descended from patches developed at the University of California, Berkeley in the 1970s.

The FreeBSD Project is an active open source **community** since 1993 with hundreds of committers and thousands of contributors around the world.

The FreeBSD Foundation is a **non-profit organisation** registered in Colorado, USA in 2001 dedicated to supporting the FreeBSD Project, its development and its community.

Who uses FreeBSD?

Who uses FreeBSD?

Gandi

NetApp

Dell/EMC/Isilon

Panasas

Apple

Limelight Networks

Swisscom

Sentex

RTEMS

WhatsApp

Juniper Networks

Verisign

Perseus Telecom

Sony

XipLink

McAfee

NYI

Yahoo

Where FreeBSD excels

Video caching servers
- Netflix

Playstation 3 and 4
- Sony

Global instant messaging
- WhatsApp/Facebook

Enterprise file servers
- NetApp
- Dell/EMC/Isilon

Routers and switches
- Juniper Networks

Key internet infrastructure
- Many DNS root servers
- DNS servers for several ccTLDs

Where FreeBSD excels

Community

- Friendly and professional
- Many active contributors and committers for 10+ and even 20+ years (and longer)

Mentoring

- Built into the Project's culture and processes

Documentation

- FreeBSD Handbook, FAQ, Developers' Handbook, Porters' Handbook, Documentation Project Primer, man pages

Licence

- 2-clause BSD licence
- Does not restrict what you can do with your own code!

Why do people develop with FreeBSD?

Excellent features

High performance

Excellent tools

Mature development process

Proven track record

Friendly licence

The FreeBSD operating system

WHAT'S IN THE BOX AND HOW DOES IT WORK?

FreeBSD is a complete system

- Not just a kernel!

- Development tools and source code

- Complete documentation

- More than 25,000 third-party open source software packages

The FreeBSD kernel

- Multi-processing multi-threaded kernel

- Support for many popular hardware architectures
  - Intel/AMD x86/64, ARM, PowerPC, MIPS, sparc64

- UNIX, POSIX, BSD programming interfaces

- Multi-protocol network stack
  - IPv4, IPv6, IPX/SPX, AppleTalk, IPSEC, ATM, Bluetooth, IEEE 802.11, SCTP,…
  - Reference implementation for many protocols

- Unified, coherent build-system across components

- Extensive documentation

System call translation

- Affectionately known as "Linux personality disorder" or "Linuxolator".

- Natively runs a substantial subset of Linux ELF binaries on FreeBSD.

- Often runs Linux binaries faster than Linux*.

Use cases: not invented here applications for Linux, databases, CAD tools,…

Known to work: Oracle, Eagle CAD, Mentor Graphics, many others!

* Usual disclaimers apply. Batteries not included. May contain traces of nuts.

The FreeBSD userland

- Complete, integrated Unix system
  - Expected tools are in the base installation – no extra packages needed
  - Build-time knobs to trim the system down for appliances

- Kernel and userland maintained together
  - Userland is always in sync with the kernel
  - New kernel features are immediately available in userland

- Strong focus on consistency

- POLA: Principle of Least Astonishment

- Extensive documentation – again

Pervasive security features

- A jail(8) is a network-connected chroot(8)
  - With many nice extra features
  - VIMAGE provides a complete network stack to every jail

- Reduce the power of "root"

- Improved compartmentalisation of services with Capsicum

- Flexible configuration options

- Mandatory access controls and audit frameworks

FreeBSD

The FreeBSD network stack

TCP/IP was originally developed on BSD and FreeBSD remains the reference implementation for several network protocols.

- Full support for IPv4 and IPv6

- Active development on TCP with pluggable congestion control
  - New Reno, CUBIC and RACK in supported releases
  - BBR in -CURRENT (soon) for aggressively antisocial networking

- Reference implementation of SCTP

FreeBSD filesystems

UFS

- Traditional Unix filesystem
- High performance
- Snapshots
- Journaled Soft Updates

ZFS

- Zetabyte file system (originally from Sun)
- Filesystem and volume manager
- RAID (many options)
- Fully up to date and supported in FreeBSD!

freeBSD®

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Virtualisation

- Very lightweight virtualisation with jail(8) and VIMAGE

- Full Xen DomU support

- bhyve hypervisor
  - Native hypervisor
  - Runs FreeBSD and other BSDs, Linux and Windows images
  - Ported to macOS as xhyve

- Ready to use installation images for popular virtualisation platforms
  - VMWare, VirtualBox, KVM/qemu, HyperV
  - Amazon EC2 marketplace and Azure available, Google Cloud Compute work in progress

Ports and packages

25,000 packages for use on FreeBSD

Databases

Programming languages

Human languages

Editors

Network tools

Graphics

Audio

Benchmarks

Documentation

FreeBSD is extensively documented
- FreeBSD Handbook, Developers' Handbook, Porter's Handbook
- Online Unix manual pages
- Several articles on www.freebsd.org

Developers write their own documentation

Professional tech writers copy-edit and write higher-level documentation

Working with FreeBSD

GETTING STARTED WITH DEVELOPING ON FREEBSD

Develop in any language

C

C++

Erlang

Go

Rust

Java (openjdk8)

Python

Perl

PHP

Keeping up to date

SUBVERSION

- Official repository

- All branch names properly reflected

- Releases cut from this repository

- https://svn.freebsd.org

GIT AND GITHUB

- Mirror of Subversion

- Easier branch model

- Rebasing hazards

- Pull requests coming soon

The source tree

Complete operating system in the base Subversion repository
- Coherent and structured build system
- Build all of FreeBSD with a single command
- Every component lives in its own subdirectory
- Kernel is just another subdirectory (sys/)

Documentation is part of the source tree
- Userspace manpages live with the respective components
- Kernel documentation lives in share/man
- Several historical papers in share/misc

Branched development model

The FreeBSD development process

MFC

HEAD

11-STABLE

11.0

10-STABLE

10.0   10.1   10.2   10.3

9-STABLE

9.0   9.1   9.2   9.3
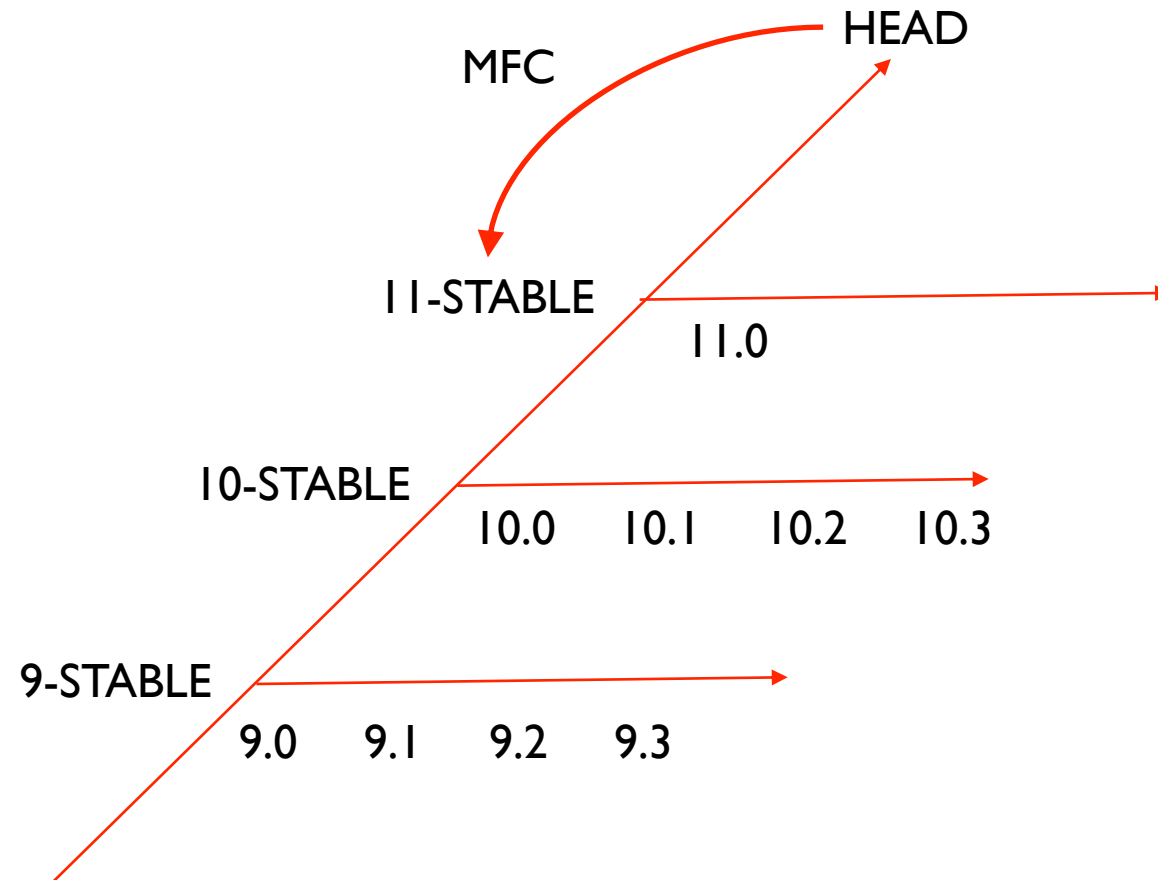
The ports tree

The ports tree is a collection of over 25,000 third-party open source packages.

- Flexible, source-based package management framework

- Maintainers port third-party software to FreeBSD

- Ports committers keep ports up to date

- Separate repository from src, not tagged to releases

- Quarterly "snapshots" are branched and tagged

Building your own packages

The poudriere system is used to build package sets locally

Package sets can be hosted by anyone

Sets can be of mixed origin
- Officially distributed from freebsd.org
- Built internally as part of your product

Depends on the ports system

Ports has its own repository
- Subversion
- GitHub

FreeBSD

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Contributing code

Project accepts code changes under the BSD license

Anyone can create an account on the code review system
- reviews.freebsd.org

Committers review contributions
- Commit if accepted
- Comment if changes are required

Eventually you may also become a committer
- We recruit!

The BSD licence

```
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The FreeBSD community

WHO ARE THESE PEOPLE?

FreeBSD committers

A committer has write access to one or more FreeBSD repositories.

Three main repositories:
- src: the base system and the kernel
- ports: third-party packages
- doc: documentation (handbook, etc)

Committers are selected based on key characteristics:
- Technical expertise
- History of contribution to the FreeBSD Project
- Ability to work well in the community
- Having made these properties obvious!

Key concept: mentor

The FreeBSD community **notices** contributors who are easy to work with, willing to learn and who establish a *track record* of submitting good patches.

Contributors are *recommended* for a commit bit. New committers have a **mentor** who is responsible for reviewing each of their commits.

After a variable period of time, pre-approval is no longer required and the committer can commit directly. Committers are still expected to seek peer review for non-trivial patches or new code.

Once released from mentorship, committers can mentor new committers themselves.

FreeBSD core team

Historically "key" developers but now…

…9-member elected management body
- Votes and candidates from the full set of active committers
- Co-opted non-voting core team secretary

Responsibilities
- Administrative (commit bits, hats, team charters)
- Strategic (project direction, coordination, cajoling)
- Rules, conflict resolution, enforcement

We have no "benevolent" dictators for life!

Conflict resolution

Developers generally characterised by:

- Independence
- Cooperation
- Common sense

Facilitated by intentional avoidance of overlap.

Strong technical disagreements, personality conflicts,…

Mediation by core.

Hats, groups and teams

Developers

- src, ports, doc committers
- Core team
- Core team secretary
- Release engineering team
- Release engineering builders
- Security officer
- Security team
- Security team secretary
- Ports manager team
- Ports manager secretary
- Documentation team
- Vendor relations team

Administrative

- Foundation board of directors
- Foundation staff
- FreeBSD.org clusteradm
- FreeBSD.org webmaster
- FreeBSD.org mirrors team
- Donations team

- Postmaster

Wait! I'm not done yet!

Administrative (cont.)
- Sentex cluster admins
- NYI cluster admins

Other contributors

Software adaptation teams
- GNOME team
- KDE team
- Mono on FreeBSD
- Python team
- Java team

Special projects
- Stress testing
- FreeBSD tinderbox
- GSoC mentors
- Continuous integration testers

External teams
- TrustedBSD project
- TrueOS developers
- FreeNAS
- pfSense

Who are the FreeBSD committers

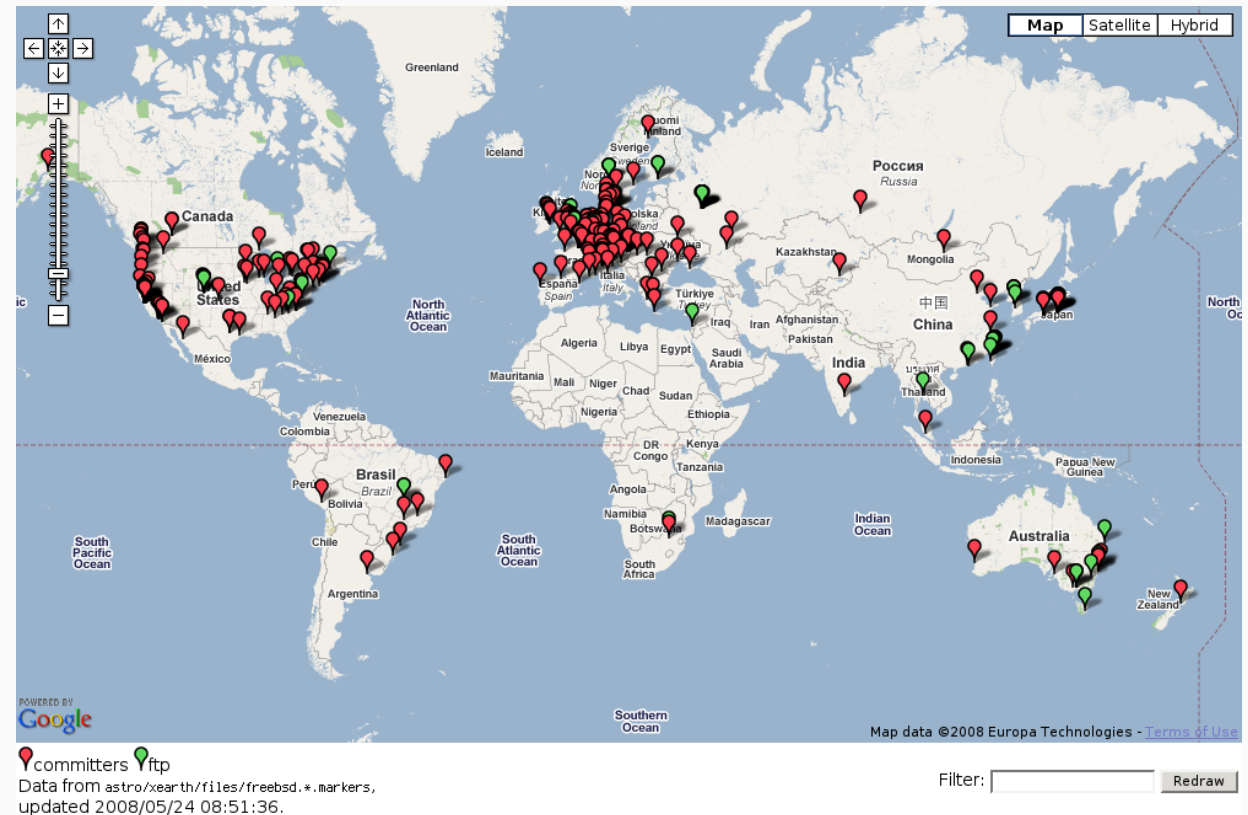Locations
- 34 countries
- 6 continents

Ages
- Oldest (documented) committer born in 1948
- Youngest (documented) committer born in 1991
- Mean age 39.5, median age 38, stddev 7.7
- Data from circa July 2015

Professional programmers, hobbyists, consultants, university professors, students
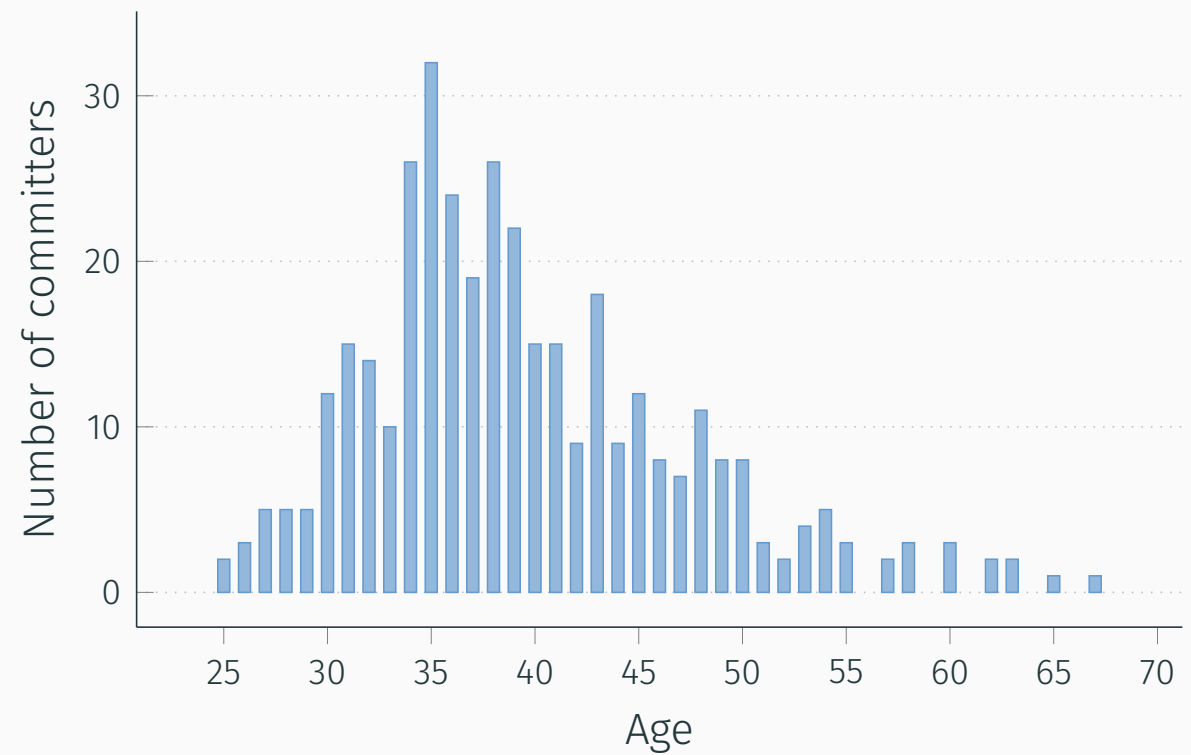
Community demographics
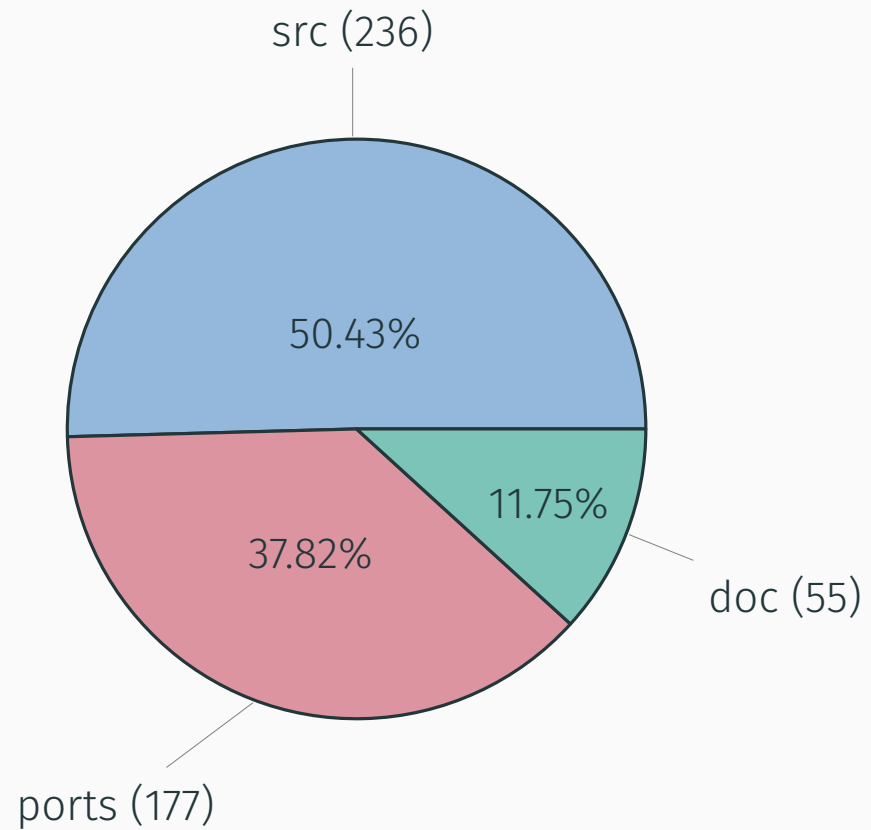

LOCATIONS OF FREEBSD COMMITTERS

Community demographics

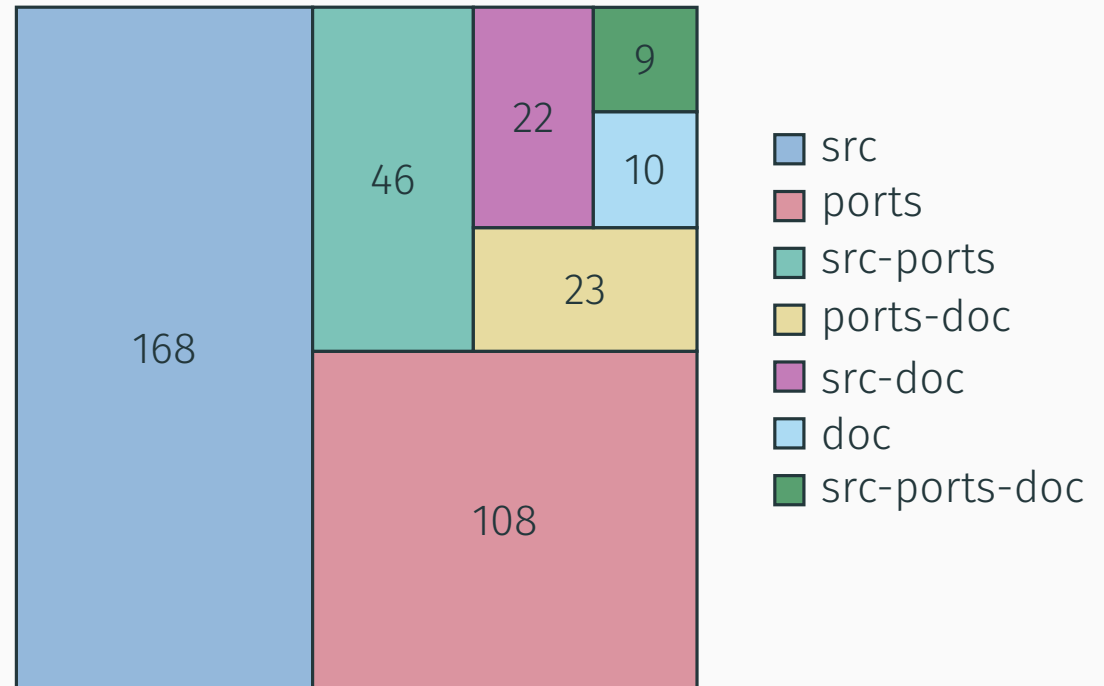## FREEBSD COMMITTER AGE DISTRIBUTION

Community demographics

NUMBER OF COMMIT BITS BY TYPE

src (236)

50.43%

11.75%

37.82%

doc (55)

ports (177)

Community demographics

DISTRIBUTION OF COMMIT BITS

- src — 168
- ports — 108
- src-ports — 46
- ports-doc — 23
- src-doc — 22
- doc — 10
- src-ports-doc — 9

Why get involved?

Advantages of joining the FreeBSD community

- Opportunity to work with a mature open source community with well-documented processes and a built-in culture of mentoring.
- Ability to learn from senior technologists who have written filesystems, network stacks, security frameworks and much more!
- Interact with people from around the globe who share your passion.

A large and diverse body of work

- Source code and documentation for all aspects of an operating system spanning several decades of development.
- Opportunity to participate in a large source repository with several hundred active contributors.

The FreeBSD community

No glass ceiling

- No one cares about (or necessarily even knows) your age, gender, race, sexual preferences, lifestyle choices or anything else about you. You are known entirely by your body of work and how you participate in the community.
- You can find a niche and over time become an expert in that niche.
- Collaborate with and build professional relationships with other experts across the globe.

No toxic community

- FreeBSD has no angry "benevolent" dictators for life.
- Our community has a long history of avoiding poisonous people.

How to become a FreeBSD committer

Anyone can download the FreeBSD source code and submit patches.

Find an area that interests you, submit patches and engage with reviewers.

Engage with the community around your area of interest (IRC, mailing lists).

Report bugs. Review patches.

Get involved. **Be visible!**

Come to our conferences!

The FreeBSD Foundation offers several travel grants (fellowships) to community members who need assistance with travel expenses for attending conferences related to FreeBSD development and advocacy.

https://www.freebsdfoundation.org/what-we-do/grants/

FreeBSD