The Other Unix-Like Operating System
And Why We Should Work Together!

Deb Goodkin – Executive Director
The FreeBSD Foundation
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@dgoodkin
deb@freebsdfoundation.org
Who Am I?

- Joined FreeBSD Foundation in August, 2005

- Technical background – 20 years in storage development as firmware engineer, logic designer, applications engineer, technical marketing and technical sales

- Grew up in San Diego and graduated from UCSD

- Enhancing my FreeBSD skills so I can teach others how to use and contribute to FreeBSD
Goals

- Share FreeBSD’s long history

- What is FreeBSD and Why People Use It

- FreeBSD Feature Highlights

- Why you should use and/or contribute to FreeBSD

- Why We Should Work Together
What is the Other Unix-like OS?

It’s FreeBSD!

BSD = Berkeley Software Distribution
The FreeBSD World

FreeBSD is an open source Unix-like operating system descended from the Unix 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 501(c)3 non-profit organization registered in Colorado, USA in 2000 dedicated to supporting the FreeBSD Project, its development and its community.
What is FreeBSD?

It’s not a Linux Distribution!

One of the oldest (1993), largest, and most successful open source projects in the world

Complete operating system including kernel, userland, documentation, and tools

Over 30,000 3rd Party Open Source Packages
What is FreeBSD?

Created and distributed by a community of highly technical and committed contributors (Over 400 active developers and thousands of contributors)

Works on Intel / AMD x86 32 and 64-bit, 32 and 64 bit ARM, RISC-V, PowerPC, MIPS, AWS, Azure, GCP, …

10s of millions of deployed systems
Why is it called Unix-like?

The term Unix is a trademark of The Open Group - must comply with the Single Unix Specification

A Unix-like (sometimes referred to as UN*X or *nix) operating system is one that behaves in a manner similar to a Unix system, while not necessarily conforming to or being certified to any version of the Single UNIX Specification. Wikipedia
Abridged BSD Family Tree

AT&T Unix

BSD

FreeBSD

NetBSD
The Evolution of FreeBSD

A Brief Look Back at the History of FreeBSD

In 1969 Ken Thompson, Dennis Ritchie and others started working on a program that utilized the full
Evolution of Unix and Unix-like systems

By Eraserhead1, Infinity0, Sav_vas - Levenez Unix History Diagram, Information on the history of IBM’s AIX on ibm.com, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=1801948
Who Uses FreeBSD

NetApp

Juniper Networks

VMware

ARM

VERISIGN

Huawei

Intel

SONY

NGINX

Trivago

Groupon

FlightAware

deb@freebsdfoundation.org
@dgoodkin
Most Likely You Use FreeBSD!

- iPhone or Apple computer
- Streaming Netflix
- Messaging someone over Facebook’s WhatsApp application
- Sony PlayStation 4
- FlightAware
- Groupon
Why Use FreeBSD?

- Friendly and Approachable Community
- Excellent Documentation
- Good Tooling and Modern Compilers
- Consistent Development and Release Processes
- Wide Variety of Architectures Supported
- 2-clause BSD license - Does not restrict what you can do with your own code!
- Secure
How the Project Works

Independent of the FreeBSD Foundation

Developer Elected Core Team

Mentorship for Commit Bit

Functional Teams (core, release engineering, security, ports, documentation, …)

Collaborative Development Environment
FreeBSD Project Org Chart

FreeBSD Foundation

FreeBSD Project

Core Team

Security Team

Document Team

Cluster Admin

Release Engineering

Ports Management

Other Teams include:
- Ports secteam
- Security Officer
- Bugmeisters
- Ports Security Team
- Continuous Integration Testing Admins
- Postmaster Team
- Webmaster Team
- Phabricator Code Review Administration

Core Team - 9
Committers - ~400
Contributors - Thousands

deb@freebsdfoundation.org
@dgoodkin
FreeBSD core team

9-member elected management body
• Elections held every two years
• Active committers vote for core members
• Non-voting core team secretary is selected by the core team

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

We have no “benevolent” dictators for life!
Who are the FreeBSD committers

Locations
- 34 countries
- 6 continents

Ages
- Oldest (documented) committer born in 1948
- Youngest (documented) committer born in 1997
- Average age 42
- Data from circa June 2019

Committer Age Distribution
FreeBSD Releases

POLA: Principle Of Least Astonishment
Don't break things that work
Upgrades are generally painless
Even across major releases

Two types of releases:

Major Release
(Dot Release) –
12.0 - Around
every two years
(supported for 5 years)

Point Release –
11.3 Around every 9 months – ABI/API compatibility

Two types of branches:

Current – Head – All changes to base system committed here. Dot releases built from here.

Stable – After testing, most changes in current moved here. Point releases built from stable.
Weekly snapshots available for current and stable branches

Supported Releases
» Production: 12.0, 11.3, 11.2
» Upcoming: 12.1
» Support Lifecycle
Contributing to FreeBSD

Many ways to get involved with the project, including contributing code, writing documentation, maintaining ports, and advocacy. BSD conferences around the world!

Working on FreeBSD is the best place to learn systems programming and study operating systems.

Easy to get started contributing.

The size of the project allows for a greater chance for anyone to make a notable impact.
Contributing to FreeBSD

Some of the most notable BSD and FreeBSD Founders are still involved in the Project – And, they are approachable!

Largest and oldest democratically run open source project - committers can commit their changes directly to the source tree without having to go through hierarchy of lieutenant model.

Approachable and friendly community with a strong mentoring culture.

Functional teams that allow developers to support FreeBSD while following their interests.
Why Companies Use FreeBSD?

- History of innovation
- High performance
- Great tools
- ABI stability within major releases
- Mature release model
- Excellent documentation
- Business Friendly License
- ZFS
- Open community
Applications

Netflix – High performance content delivery

Sony Playstation 4 - Embedded

NetApp ONTAP – FreeBSD based enterprise storage

Groupon and WhatsApp - Datacenter applications

Apple - Uses large portions of FreeBSD in their Mac OS and iOS

Citrix NetScaler – load balancer

Microsoft – Supports FreeBSD in the cloud environment

Bally Wulff – Gaming Machines
Where FreeBSD Stands Out

Embedded Systems
Video CDN/Streaming
Security
Research
Cloud and Virtualization
Storage
Networking
High Performance
Data Centers
Servers
ISPs
Kernel features

Multi-processing multi-threaded kernel

Support for many popular hardware architectures:
Intel/AMD x86/64, 32- and 64-bit ARM, RISC-V, PowerPC, MIPS

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
Userland features

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
Other Features

• **Robust file systems** including UFS and ZFS (Active work happening on ZFS)

• **DTrace** - an advanced event-based performance analysis and troubleshooting tool. DTrace can help you identify and quantify the root cause of virtually any performance issue, in both user-level and kernel code. It can be executed using custom and powerful one-liners and scripts.

• **Jails** – Lightweight virtualization added to FreeBSD in the early 2000s.

• **bhyve** – Full-blown hypervisor. This hypervisor supports a number of guests, including FreeBSD, OpenBSD, Microsoft Windows, and many Linux distributions.

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

• **Capsicum** – Capsicum is a lightweight OS capability and sandbox framework developed at the University of Cambridge Computer Laboratory. Capsicum extends the POSIX API, providing several new OS primitives **to support object-capability security** on UNIX-like operating systems.

deb@freebsd.org
@dgoodkin
The FreeBSD Foundation

Founded in March 2000

501(c)3 (non-profit public charity)

Based in Boulder, Colorado

100% Funded by donations

Separate from the FreeBSD Project

Support critical needs of Project
May work on multiple operating systems during your employment

Learn from each other. We both have successes and failures.

Different coding methodologies and philosophies – Understanding the reasons for both.

FreeBSD’s smaller code base makes it a great reference platform.

“Using and learning FreeBSD made me a better Linux admin and systems engineer.”
Why Get Involved in FreeBSD

• Be part of an inclusive and welcoming community
• Learning opportunities from experts
• Opportunities to work in areas you’re interested in
• Resume building - highlight skills in public forum
• Have fun working with like minded individuals
• Learn from reading real operating system code!
• Learn about other technologies including File Systems, Networking, Storage, Security, Virtualization, …
• Learn Best Practices
Get your hands dirty!

FreeBSD images available from all major cloud providers
◦ Amazon AWS
◦ Microsoft Azure
◦ Digital Ocean
◦ Gandi
◦ Vagrant
◦ Etc…

Or install in VMware / VirtualBox / …

https://www.FreeBSD.org/where.html
Resources

Mailing Lists
http://lists.freebsd.org

FreeBSD Handbook

History
https://www.mckusick.com/history/

Forums:
http://forums.freebsd.org/

https://www.freebsdfoundation.org/journal/