

# Introduction to the BSD Family of Operating Systems

Summertime 2009

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# This presentation will cover...

- History/comparison of BSD Projects
- BSD release engineering process
- Overview of BSD license
- How BSD differs from Linux
- Features unique to BSD
- Additional Resources

# History/Comparison

- BSD (Berkeley Software Distribution)
- Unix was introduced to Berkeley in 1974
- Ken Thompson and Bill Joy arrived in 1975
- 1977 was first “distribution”, it added features and enhancements to Unix
- DARPA funding for faster filesystem, security enhancements and TCP/IP (CSRG)

# History/Comparison

- Net/1 (1989) didn't require AT&T license
- 4.4BSD-Lite (1994) removed all AT&T files
- In 1995, Berkeley dissolved the CSRG
- NetBSD and FreeBSD (1993)
- OpenBSD (1995)
- DragonFly BSD (2003)
- PC-BSD (2006)

# History/Comparison

## NetBSD

Focus: clean design and portability (57 supported ports)

Current Release: 5.0 (April 2009)

“Of course it runs NetBSD”

<http://www.netbsd.org>

# History/Comparison

## FreeBSD

Focus: production server stability and application support (over 20,100)

Current Release: 6.2 (May 2009)

“The power to serve”

<http://www.freebsd.org>

# History/Comparison

## OpenBSD

Focus: security and dependable release cycle

Current Release: 4.5 (May 2009)

“Only two remote holes in the default install, in a heck of a long time!”

<http://www.openbsd.org>

# History/Comparison

## DragonFly BSD

Focus: filesystem architecture

Current Release: 2.2.1 (April 2009)

<http://www.dragonflybsd.org>

# History/Comparison

## PC-BSD

Focus: anyone can install and use BSD  
(desktop market)

Current Release: 7.1 (April 2009)

<http://www.pcbsd.org>

# History/Comparison

- While each BSD project has a separate focus, the communities share ideas/code
- BSD is neither “fragmented” nor “dead”
- FreeBSD 396 commit bits
- NetBSD 281 commit bits
- OpenBSD 122 commit bits
- plus thousands of contributors for software, docs, translations, bug fixes
- Linux has 1 committer, 547 maintainers

# Release Engineering

Principles used by the BSD projects reflect their academic roots:

- well defined process for earning a “commit bit” includes a period of working under a mentor
- code repository from Day 1 and can trace original code back to CSRG days
- no “leader”, instead well defined release engineering, security, and doc teams

# Release Engineering

- development occurs on CURRENT which is frozen in preparation for a RELEASE
- nightly builds (operating system and apps) help ensure that upgrades and installs don't result in library incompatibilities (safe for production)
- documentation considered as important as code

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- the copyright notice is retained
- the disclaimer is included that the software is provided as-is

<http://www.opensource.org/licenses/bsd-license.php>

# BSD License

- “commercial-friendly” license
- considered to be a “permissive” rather than “copyleft” license
- permissiveness reflects BSD's academic roots: code should be of high quality and available for any purpose

Result?

BSD code is everywhere!

Many companies contribute to/support BSD

# BSD License

BSD code is everywhere! Some examples:

- Darwin (Mac OSX and iPhone)
- Juniper JUNOS, VxWorks RTOS, QNX RTOS, Isilon, NetApp, Nokia Checkpoint firewalls
- Panasas distributed filesystem
- nCircle IP360, RTMX, vantronix appliances, Ironport AsyncOS, FreeNAS
- Yahoo!, Verio, NYI, ISC, Datapipe, Pair Networks run on FreeBSD

# BSD License

Companies support BSD:

- Hudson River Trading, NetApp, Google, Juniper Networks, Swisscom, Ironport, TrendMicro donated over \$10,000 to FreeBSD Foundation
- Yahoo! hosts FreeBSD build farm/repo, allBSD, Sentex, ISC provide misc. hosting
- many developers with commit bits are paid by their employer to work on BSD
- many companies contribute code back

# Differences from Linux

- complete operating system, not kernel + distro
- integration of features not limited by copyleft
- high “bus factor”
- consistent separation between system and third party (/usr/local)

# Differences from Linux

End-user:

- probably wouldn't notice that BSD is not a Linux distro, especially if installation is running their usual desktop manager
- might miss bash (easily installed)
- might notice that software is easier to install and upgrade, using different tools
- might be surprised to learn that apps are “open source”, not “Linux”

# Differences from Linux

Power user/sysadmin:

- device names (e.g. eth0 vs. rl0 or ath0)
- no runlevels (one config file rc.conf)
- pf firewall with config file
- flat config file for kernel
- one config file philosophy (e.g. firewall, QoS, spam filtering, NAT, redundancy)
- BSD vs. GNU style command switches
- man pages with working examples

# Differences from Linux

Power user/sysadmin:

- UFS
- library incompatibilities and upgrade disasters are rare
- consistent layout
- <http://cvsweb.allbsd.org>
- securelevels
- features are built-in and tested
- rarely install drivers

# Features Unique to BSD

- FreeBSD jails
- FreeBSD GEOM storage framework
- NetBSD build.sh for crosscompiling
- pkgsrc for cross-platform pkg mgmt
- VuXML or audit-packages
- NetBSD veriexec file integrity subsystem
- binary emulation (linux, solaris, sco, etc.)
- FreeBSD netgraph networking framework

# Features Unique to BSD

- ZFS and dtrace support (FreeBSD)
- CARP for failover redundancy
- FreeBSD superpages for speed
- BSM audit framework (Solaris compatible)
- freebsdupdate (working snapshots)
- ALTQ for QoS
- HAMMER for high availability

# Did you Know?

- BSD TCP/IP is reference implementation
- BIND, Sendmail
- vi, termcap, csh, ping, symlinks, job control
- first mass net-based development effort
- virtual memory subsystem used by Linux is from NetBSD (uvm)
- OpenSSH, OpenBGPD, OpenNTPD, OpenCVS

# Did you Know?

- bpf and zero-copy bpf
- systrace developed by OpenBSD
- NetBSD set Internet2 speed record
- bcrypt, honeyd, MD5 password hash routine
- strlcpy & strlcat to reduce buffer overflow

# Additional Resources

<http://oreilly.com/catalog/opensources/book/kirkmck.html>

[http://en.wikipedia.org/wiki/OpenBSD\\_security\\_features](http://en.wikipedia.org/wiki/OpenBSD_security_features)

<http://www.trustedbsd.org/>

<http://www.bsdcertification.org>

# Books:

BSD Hacks

Best of FreeBSD Basics

Definitive Guide to PC-BSD (early 2010)

Absolute BSD

Absolute FreeBSD

Absolute OpenBSD

# Questions:

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