

BSD for Linux Users

Aaron Poffenberger

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Outline

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Introduction - Background

- Software developer
 - 17+ years professionally
 - 30+ otherwise
 - Security software
 - Design and implement secure APIs
- IT Background
 - Boeing Aerospace Operations
 - ISP (dial-up land)
 - Consulting
- Software Development
 - PentaSafe Technologies
 - NetIQ
 - TheAnimenetwork.com
 - BRS Labs
- CISSP 2005+
- BSD user
- Amateur radio enthusiast

Introduction - OS Bona Fides

- BSD Experience

- FreeBSD 4.x
- OpenBSD 3.3+
- PC-BSD 10.x
- FreeNas
- PFSense

- Macintosh

- System 6 & 7
- Mac OS 8 & 9
- OS X 10.1+

- Windows Experience

- Windows 3.0, WFW
- Windows NT 3.51+ (Intel, Alpha and PPC)

- Linux Experience

- Slackware 3.0
- Yellow Dog Linux 1.x?
- LinuxPPC/MKLinux
- SuSE Linux 4.x - 5.x
- Gentoo
- Smoothwall
- RHEL 4.x - 6.x
- CentOS 4.x - 6.x
- Ubuntu 4.10+
- Fedora 13+
- Kali 1.x+

What is BSD? Then

- Berkeley Software Distribution
 - Not "Berkeley System Distribution"
- Direct descendant from AT&T Unix
 - Brought to Berkeley (*alma mater*) when Ken Thompson took sabbatical in 1975
- Developed by Computer Systems Research Group (CSRG)
UC Berkeley
- Active from 1977 to 1995
- Began as tape of various programs and utilities
- Ended as nearly complete operating system
 - 6 files still "encumbered"

What is BSD? Then cont

- 4.4BSD-Lite final version
- Numerous technologies, programs and other free-software ideas originated or propagated in BSD
 - ed, vi & csh
 - Pascal compiler
 - Berkeley Sockets
 - Berkeley Fast File System
 - BSD license (4-, 3- and 2-clause versions)
 - First Unix to have virtual memory
- The Lawsuit
 - USL sued BSDi and U-Cal Berkeley over licenses
 - Eventual settled when UCB showed USL had violated UCB copyright
 - (Yeah, that's a very short version of the lawsuit history.)
- <https://www.mckusick.com/history/index.html>

What is BSD? Now

- Family of Unix-like operating systems
 - Different focus by project
- Not quite like a Linux distribution
 - Kernels and userland began life at 4.4BSD-Lite, diverged
 - Share code between projects, collaborate
- BSD licensed
- Developed as a complete OS
 - Kernel plus userland
- Emphasis on documentation
- Very POSIX compliant
- Application software from "ports"
 - Similar to packages
 - Historically built-on-demand
 - Now most BSDs offer binaries as well

Notable BSD Systems

- SunOS
- FreeBSD
- NetBSD
- OpenBSD
- MacOS
- DragonFlyBSD
- PC-BSD
- More <http://www.damnsmallbsd.org/pub/BSD-UNIX>

SunOS (not Solaris or OpenSolaris)

- Based on 4.1BSD
- Ran on 68000 series of processors
- v2.0 based on 4.2BSD
 - First release of NFS
- v5.0 and later (Solaris) saw switch to System V Release 4 as base
- The rest is history

FreeBSD

- Started from BSD Net-2 (1993)
 - Tired of waiting for next release of 386BSD
- Focus: server environment, commodity-hardware portability
- Package management:
 - Build-on-demand: Ports
 - Binary: pkgng, pkg (deprecated)

FreeBSD - Interesting and Notable

- Massively scalable (80+ cores, terrabytes of memory)
- High performance
- Long-term support and ABI compatibility
- Jails
 - Lightweight, virtualized OS environment
- Byhve - BSD Hypervisor
- Capsicum enabled by default
- DTrace
- Network Virtualization
- Excellent Linux emulation mode
 - Run Linux binaries unmodified — true ABI compat, not a VM
- <https://www.freebsd.org/features.html>

FreeBSD - Related Projects

- Distributions

- PC-BSD
- PFSense
- OpenSense
- HardenedBSD

- Forks

- DragonFlyBSD (2003)
- MidnightBSD

- Borrows from FreeBSD

- OS X (Darwin) userland
- XNU Kernel combining Mach 2.5 and bits from 4.3BSD

- Started from BSD Net-2 (1993)
 - Tired of waiting for next release of 386BSD
 - Preceded FreeBSD by months
- "Of course it runs NetBSD"
- Focus: clean, portable code, run everywhere
- Package management:
 - Binary: pkgsrc
 - Build-on-demand: Ports
- Interesting and Notable
 - Portable build framework (facilitate cross-compiling)
 - Strange and wonderful: Kernel-scripting in Lua
 - Rump Kernels (@justincormack)
 - Kyua Automated Testing Framework
 - pkgsrc
- Forks
 - OpenBSD

- Fork of NetBSD (October 18, 1995)
- Focus: security
- Package management:
 - Build-on-demand: Ports
 - Binary: pkg
- Interesting and Notable
 - Code audits
 - strcpy and strlcat
 - First wide-spread use of ProPolice
 - W ^ X on generic i386
 - Crypto everywhere
 - Twice-yearly releases
 - Always includes a song and artwork
 - DVDs always comes with cool stickers
 - Quick to prune old code

OpenBSD - Related Projects

- LibreSSL - Fork of OpenSSL
- OpenBGPD - Border Gateway Protocol
- OpenIKED - Internet Key Exchange (IKEv2)
- OpenNTPD - Network Time Protocol (client and server)
- OpenSMTPD - SMTP server
- OpenSSH - Pretty much de facto ssh client and server
- PF - Packet Filter
- Carp - Common Address Redundancy Protocol.
 - Replacement for VRRP and HSRP
- doas - Lighter sudo-like utility
- Many have portable versions

OpenBSD cont

- Forks
 - MirBSD
 - BitRig

MacOS X

- Successor to Mac OS 9 and NeXTSTEP
- Largest UNIX distribution in the world
- Package management:
 - Build-on-demand: Homebrew, MacPorts, Fink
 - Binary: Homebrew, archives (.dmg)

MacOS X - Interesting and Notable

- UI
- BSD on the Desktop (and in the handheld)
- Userland and POSIX APIs mostly from FreeBSD
 - Firewall comes from OpenBSD PF
- Base for iOS
- App store
- Grand Central Dispatch
- Object-C
- clang-llvm development
- XCode
- Applescript

DragonFlyBSD

- Fork from FreeBSD (2003)
- Package management:
 - Build-on-demand: Ports
 - Binary: pkg
- Interesting and Notable
 - VKERNEL - run kernel from userland
 - HammerFS (snapshot-ing FS, multi-node)
 - Transparent disk encryption (dm_{targetcrypt}) compatible with Linux' dm-crypt

- Distribution of FreeBSD
- Focus: desktop and usability
- Package management:
 - Binary: PBI, pkgng
 - Build-on-demand: Ports
- Interesting and Notable
 - Looks just like any desktop OS, ready to use
 - Graphical installer
 - User-friendly tools for cool technologies:
 - Warden for Jail management
 - Life Preserver for backups using ZFS snapshots
 - Including bare-metal restore
 - Lumina Desktop
 - Java and Flash ← not that either is recommended

Other - Notable BSDs

- FreeNAS - FreeBSD-based NAS appliance
 - ZFS, Jails and so much more
- PFSense - FreeBSD-based firewall, VPN gateway appliance
- OpenSense - FreeBSD-based firewall, VPN gateway appliance

Unique Features and Technologies

- Install on ZFS (FreeBSD)
 - Snapshot entire OS
- clang/llvm
- Jails (FreeBSD)
 - Mature technology
 - Lighter than VM
 - Separate IP(s) for Jail
 - Delegate ZFS to Jail users
- PF + CARP
 - Build high-availability firewall and routing appliances

Key Differences - System

- Almost universally installed in cli
 - PC-BSD has graphical installer
- Init
 - No systemd
 - BSD rc system (/etc/rc.d/<daemon> start|stop|reload|status)
 - No procfs (emulation on some BSDs via package)
 - sysctl works via system calls
- Kernel
 - Rarely need to build custom kernel
 - Most have kernel modules (OpenBSD does not)
 - Other than security patches, usually upgraded with system

Key Differences - System cont

- Base OS

- The group of programs and utilities that make-up the BSD
- Ports and packages are usually developed in step with BSD (ABI compatibility issues)
 - FreeBSD ports from any major release work with any minor of that release

- Upgrading varies by BSD

- OpenBSD upgrades base then packages
 - Two branches: current and stable
 - Nearly daily snapshots based on current
- FreeBSD has freebsd-update for patches, security updates and full upgrades
 - Can also track development branches

Key Differences - Userland

- Shell
 - Default shell tends to be ksh and csh (bash available)
 - Mostly POSIX or original Unix/BSD implementations
 - Very few gnu user utils (can be found in packages)
- Users
 - Wheel group for sudoers
- Miscellaneous
 - vi is vi, not vim (packages)
 - tmux rather than screen (packages)
- Install packages:
 - OpenBSD, NetBSD, DragonFlyBSD: `pkg-add <pkg-name>`
 - FreeBSD, DragonFlyBSD: `pkg install <pkg-name>`

Key Differences - License

- BSDs are licensed under one of BSD licenses
 - Great for companies that want to keep some secret sauce
 - Doesn't mean they do...many give back
 - Netflix
 - Verisign
 - Juniper
 - Apple
- Goal is to get high-quality software into as many hands as possible
- Freedom to use code how the end-user wants
- This is a war just waiting to happen so let's move on

Software Availability

- Flash - almost non-existent (PC-BSD)
- Enterprise, web and other software
 - Apache, nginx
 - MySQL, Maria, Postgres, Memcached, Redis
 - Puppet, Salt, Chef
 - Nagios, Wireshark
 - couchDB, hadoop
 - Docker containers (FreeBSD docker-freebsd)
- Productivity:
 - FireFox, Chromium
 - KDE, Gnome, XFCE
 - LibreOffice, T_EX, L_AT_EX
- Dev: practically everything
- 25,128 ports in FreeBSD tree

Hardware Support

- Excellent hardware support in the server room
 - Multiple CPUs (with or without Hyperthreading)
 - Support for AES-NI, VT-x, VT-d
- Very good support at the desktop
 - Varies by BSD
 - PC-BSD/FreeBSD very good
 - OpenBSD very good
 - NetBSD 7 looking very good (@justincormack)
- Graphic Card Support
 - Excellent: Intel
 - DragonFlyBSD very good with latest Intel integrated graphics
 - Very good: Nvidia, AMD
 - Excellent Nvidia-maintained drivers for FreeBSD (PC-BSD)
 - No CUDA dev but perhaps under Linux emulation

Hardware Support

- Other
 - USB 3
 - AHCI (including hotplug)
 - RAID cards (including HBA cards <- very useful with FreeNAS)
 - NICs (10 Gig E)

BSD in Production

- AWS
- Digital Ocean
- Juniper Networks JUNOS
- Netflix
- ScaleEngine
- Tarsnap
- Verisign
- Whatsapp
- More
 - https://en.wikipedia.org/wiki/List_of_products_based_on_FreeBSD
 - <https://www.freebsdoundation.org/testimonials>

BSD in Production

- theanimenetwork.com
 - Ran on OpenBSD until moved to AWS
 - relayd
 - Apache 1.3.1 (OpenBSD-maintained version)
 - MySQL

Why Use BSD?

- Avoid mono-culture -> Verisign model
- Prefer system-as-a-whole development model
- ZFS + Jails for process isolation
 - Much lighter than virtualization
- Performance
 - Netflix doing incredible work on packet pumping
- Old hardware that has to continue running
 - There's probably a version of BSD that runs what you have
 - <https://www.netbsd.org/ports/> (Multiple tiers)
 - <http://www.openbsd.org/plat.html>
 - <https://www.freebsd.org/platforms/>
- You hate systemd ;-)

When You Shouldn't Use BSD

- Same answer as for Linux: When it's not in the customer's or employer's best interest
- Our job as sysadmin, developers and open-source advocates is to meet the customer's need
- There are nearly always open source solutions to the customer's problem
- Customer has to be able to use and maintain the solution after we're gone

Questions

- Questions - You have them, I may have answers

Contact Details

- Aaron Poffenberger
- `akp@hypernote.com`
- `http://akpoff.com`
- `@akpoff`
- This presentation, note on `http://akpoff.com`
- KG5DQJ

Resources

- BSDs

- <http://www.dragonflybsd.org>
- <http://www.netbsd.org>
- <http://www.openbsd.org>
- <http://www.pcbsd.org>
- <https://hardenedbsd.org>
- <https://www.freebsd.org>

- Appliances

- <http://www.freenas.org>
- <https://opnsense.org>
- <https://www.pfsense.org>

- Certification

- <http://www.bsdcertification.org>

Resources cont

- Technologies

- <https://github.com/jmmv/kyua>
- <http://lumina-desktop.org>
- <http://open-zfs.org>
- <http://pkgsrc.org>
- <https://wiki.freebsd.org/pkgng>

- BSD User Groups (BUGs)

- <http://www.berklx.org/bim/>
- <http://www.capbug.org>
- <http://cobug.org>
- <http://www.metabug.org>
- <http://www.nycbug.org>

- Conferences

- <https://www.bsdcn.org/>
- <https://www.eurobsdcon.org>
- <http://www.asiabsdcon.org>

- Presentations, Whitepapers, etc.

- <http://www.openbsd.org/papers/>
- <https://www.freebsd.org/marketing/>
- <http://www.trustedbsd.org/docs.html>
- <https://www.ixsystems.com/case-studies/>
- <https://www.ixsystems.com/literature/>
- <https://www.ixsystems.com/white-papers/>

- Training

- <http://www.freenas.org/freenas-zfs-training/>
- <https://www.ixsystems.com>
- <https://www.mckusick.com/courses/>
- <https://www.pfsense.org/university/>

Resources cont

- Mags, Podcasts and other media

- <http://bsdmag.org>
- <http://bsdtalk.blogspot.com>
- <http://www.bsdnow.tv>
 - Find Kris Moore at iXsystems booth
- <https://www.scaleengine.com/>
- <https://www.freebsd.foundation.org/journal>
- <http://undeadly.org>

Resource cont

- Vendors

- <https://www.ixsystems.com>
- <https://www.freebsdmall.com>

- Hosting

- <http://www.digitalocean.com>
- <http://aws.amazon.com>

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