How the FreeBSD Project Works

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Introduction

- What is FreeBSD?
- What is the FreeBSD Project?
- How does the FreeBSD Project work?
- And does it all depend on who you ask?
  - Caveat: kernel developer!
FreeBSD

- Open source BSD UNIX OS (1978, 1992)
- ISP server network server platform
  - Yahoo!, Verio, NY Internet, ISC, Demon, ...
- Appliance/product/embedded OS foundation
- Can't use the Internet without using FreeBSD
What do you get with FreeBSD?

- Complete, integrated UNIX system
  - Multi-processing, multi-threaded kernel
    - Intel/AMD 32/64-bit, ia64, sparc64, ARM, PPC, (MIPS)
  - UNIX, POSIX, BSD programming interfaces
  - Multi-protocol network stack
    - IPv4, IPv6, IPX/SPX, AppleTalk, IPSEC, ATM, Bluetooth, 802.11, SCTP, ...
  - Standard and embedded build/integration targets
  - Extensive documentation
- 17,300 third party software ports
The FreeBSD Project

• Online development community
  – Central source repository and revision control
  – Extensive online community
  – 340 CVS committers, thousands of contributors
  – Extensive user community

• Liberal Berkeley open source license
  – Designed to maximize commercial reuse
  – No requirement that derived works be open source
  – Extensive use in commercial, research systems
FreeBSD Foundation

• Non-profit organization based in Boulder, CO
  – Intentionally independent from FreeBSD Project
  – Sponsored development
  – Intellectual property, contracts, licensing, legal
  – Developer travel grants, vent sponsorship
  – Hardware purchase
  – Collaborative R&D agreements

• Support the FreeBSD Project – consider a donation today!
What the Project Produces

- FreeBSD kernel, user space
- Security officer, release engineering
- Ports collection, binary packages
- FreeBSD releases
- Manuals, handbook, web pages, marketing
- Technical support, debugging, etc.
- A variety of user/community events
Things We Consume

- Beer, soda, chocolate, and other vices
- Donated and sponsored hardware
  - Especially in racks, with hands
- Bandwidth in vast and untold quantities
- Travel grants, salaries, contracts, grants
- Thanks, user testimonials, good press
- Yet more bandwidth
FreeBSD People and Processes

- FreeBSD committers
- Core Team
- Ports committers and maintainers
- Groups/projects
- Derived projects
- Mailing lists
- Web sites

- Events
- Development cycle and branches
- Release Cycle
- CVS and Perforce
- Clusters
- Conflict resolution
FreeBSD Committers

- Committer is someone with CVS commit rights
- 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
  - Mentor proposes to core@ (portmgr@, doceng@)
  - Guide through first few months of committing
Who are the Committers? (2006-2007)

• Locations
  – 34 countries
  – 6 continents

• Ages
  – Oldest (documented) committer born 1948
  – Youngest (documented) committer born 1989
  – Mean age 32.5, median age 31, stddev 7.3

• Professional programmers, hobbyists, consultants, university professors, students ...
Locations of FreeBSD Committers (March 2007)

FreeBSD locations

[Map of FreeBSD committer locations around the world, showing various locations marked with pins.

Data from astro/xearth/files/freebsd.*.markers, updated 2007/03/09 22:25:16.]
FreeBSD Developer Age Distribution (March 2007)
Number of Commit Bits by Type (March 2007)

src 215
doc 76
ports 163
FreeBSD Core Team

• Historically “key” developers but now ...
• ... 9-member elected management body
  – Votes and candidates from the full set of active FreeBSD committers
  – Core secretary
• Responsibilities
  – Administrative (commit bits, hats, team charters)
  – Strategic (project direction, coordination, cajoling)
  – Rules, conflict resolution, enforcement
Ports Committers, Maintainers

• Slightly stale data, of course (~2006)
  – 158 ports committers
  – Over 1,400 ports maintainers
  – Over 16,600 ports

• Averages
  – 85 ports/committer
  – 9 ports/maintainer
  – 8 maintainers/committer
FreeBSD Project Org Chart (Sort of)
Groups and Projects

- Developers
  - Source Developers
  - Core Team
  - Core Team Secretary
  - Release Engineering Team
  - Release Engineering Build Teams
  - Security Officer
  - Security Team
  - Ports Team
  - Port Managers
  - Doceng Team
  - Documentation Team
  - Vendor Relations Team

- Administrative
  - Foundation Board of Directors
  - Foundation Operations Manager
  - FreeBSD.org admins@
  - FreeBSD.org webmaster
  - Sentex cluster admins
  - ISC cluster admins
  - Mirrors Team
  - Donations Team
  - Marketing Team
  - Perforce Admins
  - CVS Admins
  - Postmaster
Wait, I'm Not Done Yet!

- Administrative (cont)
  - CVSUP Mirrors Team
- Other Contributors
  - Perforce Contributors
  - Questions Subscribers
- Software Adaptation Projects
  - FreeBSD GNOME Project
  - FreeBSD KDE Project
  - Mono on FreeBSD
  - OpenOffice.org on FreeBSD
  - Java on FreeBSD
- Special Projects
  - Stress Testing
  - FreeBSD Tinderbox
  - FreeBSD Standards
  - SoC Mentors
  - Monthly Status Reports
  - Coverity Team
- External Projects
  - KAME Project
  - TrustedBSD Project
  - PC-BSD
  - DesktopBSD
Derived Projects and Organizations

- Interesting and important growth in ecosystem
- Projects that consume FreeBSD but produce something new and different
  - FreeSBIE, pfSense, PC-BSD, Darwin, DesktopBSD, DragonflyBSD, FreeNAS, ...
  - Features to flow up- and down-stream
  - Avoid stepping on toes of derived projects, while fostering their growth
- Importance of a scalable community model
Mailing Lists

- Over 100 active central mailing lists
- Mostly public
  - Some exceptions (core, re, so, portmgr, ...)
- Organized loosely by topic
  - -announce, -current, -arch, cvs-all, -security, ...
  - -chat, -hackers, -questions...
- Place where vast majority of FreeBSD discussion and planning takes place
  - Both developer and user
FreeBSD Project Web Pages
(Just a few)
Events

- **Conferences**
  - USENIX ATC
  - BSDCan
  - BSDCon
  - EuroBSDCon
  - AsiaBSDCon
  - NYCBSCon
  - MeetBSD
  - BSDConTR

- **Developer Summits**
  - Two day events
  - March 2007: AsiaBSDCon, Tokyo
  - May: BSDCan 2007, Ottawa
  - September 2007, EuroBSDCon, Copenhagen
FreeBSD Developer Summits
BSDCan 2006-2007
Recent Development Projects

- DTrace
- Network virtualization
- Xen
- Sun4v
- SCTP
- 32-core scalability
- Multi-threaded, multi-processor network stack

- 802.11n + Virtual AP
- ARM, MIPS, PPC
- Security auditing
- MAC Framework
- ZFS, GJournal
- gcc 4.2
- Coverity
- 10gbps optimization
FreeBSD Development Cycle

• Branched development model
  – 7-CURRENT – Cutting edge development
  – 6-STABLE – Active development with releases
  – 5-STABLE – Legacy branch with releases
  – 4-STABLE – Legacy branch

• Goal
  – 18-24 month major “dot zero” releases (6.0, 7.0, ...)
  – 4-6 month minor “dot” releases (5.5, 6.1, 6.2, ...)

• Balance is tricky but important
Development Branches

- Simultaneous parallel development
- Divergence based on feature maturity
- “MFC” merges changes from CURRENT to STABLE branches
FreeBSD Releases

• Three active development branches in CVS
  – 5.x – Major development branch, in maintenance
  – 6.x – Refinement and optimization of 5.x branch
  – 7.x – Active feature development

• Most recent releases FreeBSD 5.5, 6.2
  – CDs/DVDs from several vendors
FreeBSD Release Cycle

- Most of the time open development
- Release cycle on STABLE branches
  - Code slush
  - Code freeze
  - Beta series, branching
  - Release candidate series
  - Release
  - Errata/Security advisories
- Big “dot zero” releases less frequently
FreeBSD 7-CURRENT
7.0 due 2007Q3/Q4

- MP Scalability
  - 16+ core scalability
  - ULE2 scheduler
  - New threading library
  - Scalable jemalloc

- File systems
  - Sun's ZFS file system
  - GJournal for UFS

- Sun4v

- Networking
  - Direct dispatch
  - Zero-copy BPF
  - 10gbps optimizations
  - SCTP

- Superpages

- And much more ...
CVS

• Primary revision control system
  – Most project activity is in CVS
  – 10+ year revision history
  – One commit every 11.8 minutes for last three years
  – Technical limitations becoming more apparent
  – Actually four repositories
    • /home/ncvs – FreeBSD src cvs
    • /home/pcvs – FreeBSD ports cvs
    • /home/projcvvs – FreeBSD project cvs
    • /home/dcvvs – FreeBSD documentation cvs
Perforce

- Secondary revision control system
  - Supports heavily branched development
  - FreeBSD developers
  - Guest accounts and project accounts
- Active project include
  - SMPng, TrustedBSD Audit, TrustedBSD MAC
  - TrustedBSD SEBSD, Alan Cox Superpages, uart
  - ARM, Summer of Code, dtrace, Xen, Sun4v
  - GEOM, GJournal, ZFS, CAM locking, netperf, ...
Revision Control: the Future

- Heavy use of Perforce a symptom of CVS weaknesses
  - Need lightweight branching, history-aware merging
  - Need access control
- Every few years, consider options
  - Cost of migration very high – interrupt development, retrain developers, high risk
- Currently evaluating several of revision control systems to see if any meet requirements
FreeBSD.org Cluster

• Hosted at Yahoo!
  – Mail servers (hub, mx1, mx2)
  – Distribution (ftp-master, www)
  – Shell access (freefall, builder)
  – Revision control (repoman, spit, ncvsup)
  – Ports cluster (pointyhat, gohans, blades)
  – Test systems (sledge, pluto, panther, beast)
  – Name server (ns0)
  – NetApp filer (dumpster)
Other Clusters

- Korean Ports Cluster
- allbsd.org
  - Multiprocessor Sun hardware for testing
- Sentex Cluster
  - Security officer
  - Network, SMP performance, storage work
- ISC Cluster
  - ftp.freebsd.org, Coverity, test systems, ports
Conflict Resolution

• Developers generally characterized by:
  – Independence
  – Cooperation
  – Common sense

• Facilitated by intentional avoidance of overlap

• Strong technical disagreements, personality conflicts, etc, do occur

• When they get out of hand, generally mediated by a member of core
What Is a Bikeshed, Anyway?

- A very special kind of conflict
- Not specific to FreeBSD, but one of our favorites
- Strong opinions easier to have on unimportant details
Conclusion

• FreeBSD Project one of the largest, oldest, and most successful open source projects
  – Hundreds of committers, thousands of contributors
  – Millions of lines of code
  – Tens of millions of deployed systems
• Highly successful community model makes this happen
  – Join this community!
• http://www.FreeBSD.org/