How the FreeBSD Project Works

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FreeBSD Project

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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!
Introduction to FreeBSD

• Open source BSD UNIX-derived OS
• ISP server network server platform
  – Yahoo!, Verio, NY Internet, ISC, ...
• Appliance/product/embedded OS foundation
  – VXWorks, Mac OS X, ...
• One of most successful open source projects
• Focus on storage, networking, security
Introduction to FreeBSD (cont)

- Active development community
  - Central source repository and revision control
  - Extensive online community
  - Over 340 active CVS committers
  - Thousands of contributors

- Liberal Berkeley open source license
  - Designed to maximize commercial reuse
  - No requirement that derived works be open source
  - Extensive use in commercial, research systems
What do you get with FreeBSD?

- Complete, integrated UNIX system
  - Multi-processing, multi-threaded kernel
    - Intel/AMD 32/64-bit, Itanium, sparc64, ARM, PPC
  - 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
- Over 16,600 third party software packages
The FreeBSD Project

• One of the most successful open source projects in the world
  – Can't throw a stone without hitting FreeBSD
    • Root name servers
    • Major web hosts, search engines
    • Routing infrastructure
    • Foundation for major commercial operating systems
  – And much more...

• But the FreeBSD Project is more than software
What the Project Is Depends on Who You Ask

- FreeBSD Core Team Member
- FreeBSD src Developer
- FreeBSD portmgr Member
- FreeBSD Documentation Team Member
- FreeBSD Users
FreeBSD Project

• Global community of developers and users
  – FreeBSD.org web site, mailing lists
  – Developer community
    • Core team
    • Committers
    • Ports maintainers
    • Contributors
  – User community
    • User groups, advocacy, training, ...
  – FreeBSD Foundation
FreeBSD Foundation

- Non-profit organization based in Boulder, CO
  - Sponsored development
  - Intellectual property, contracts, licensing, legal
  - Developer travel grants
  - Event 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
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 Developer Age Distribution (March 2007)
FreeBSD Processes

- Committer life cycle and commit bits
- Core Team
- Mailing Lists
- Web pages, documentation
- Groups/projects
- Derived projects

- Events
- Development cycle
- 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
Distribution of Commit Bits
(March 2007)

348 Total Committers

- src 125
- src-doc 13
- src-ports 47
- ports 85
- doc-ports 22
- doc 23
- src-doc-ports 31

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FreeBSD Core Team

• 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 1,500 ports maintainers
  - Over 16,600 ports

- Averages
  - 85 ports/committer
  - 9 ports/maintainer
  - 8 maintainers/committer
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

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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
• Shows scalability of community model
Mailing Lists

- Over 60 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

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FreeBSD Project Web Pages
(Just a few)
Events

• Conferences
  – USENIX ATC
  – BSDCan
  – BSDCon
  – EuroBSDCon
  – AsiaBSDCon
  – NYCBSDCon
  – MeetBSD
  – BSDConTR

• Developer Summits
  – Two day events, at conferences
  – March 2007: AsiaBSDCon, Tokyo, JP
  – May: BSDCan 2007, Ottawa, CA
  – September 2007, EuroBSDCon, Copenhagen, DK
FreeBSD Developer Summit
BSDCan May 2006
A Few Highlights
Developer Summits, 2006

• Network stack virtualization
• Xen, Sun4v
• SCTP
• 32-processor systems
• Multi-threaded, multi-processor network stack performance
• Interrupt filters

• FreeBSD/embedded
• FreeBSD 802.11
• Ports
• TrustedBSD Audit
• ZFS, GJournal
• Revision control
• gcc4

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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 2007Q4

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

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

- Sun4v

- Security
  - New privilege arch

- 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/projcvs – FreeBSD project cvs
    - /home/dcvs – 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 it happen
  - Join this community!