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
  - Mac OS X, VXWorks, NetApp, Secure Computing, Nokia, nCircle, Isilon, Symmetricon, NetScaler, Juniper, Thomson, Panasas, IronPort, Palisade, Avid, The Weather Channel, Sandvine, Blue Coat, ...
- 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 ...
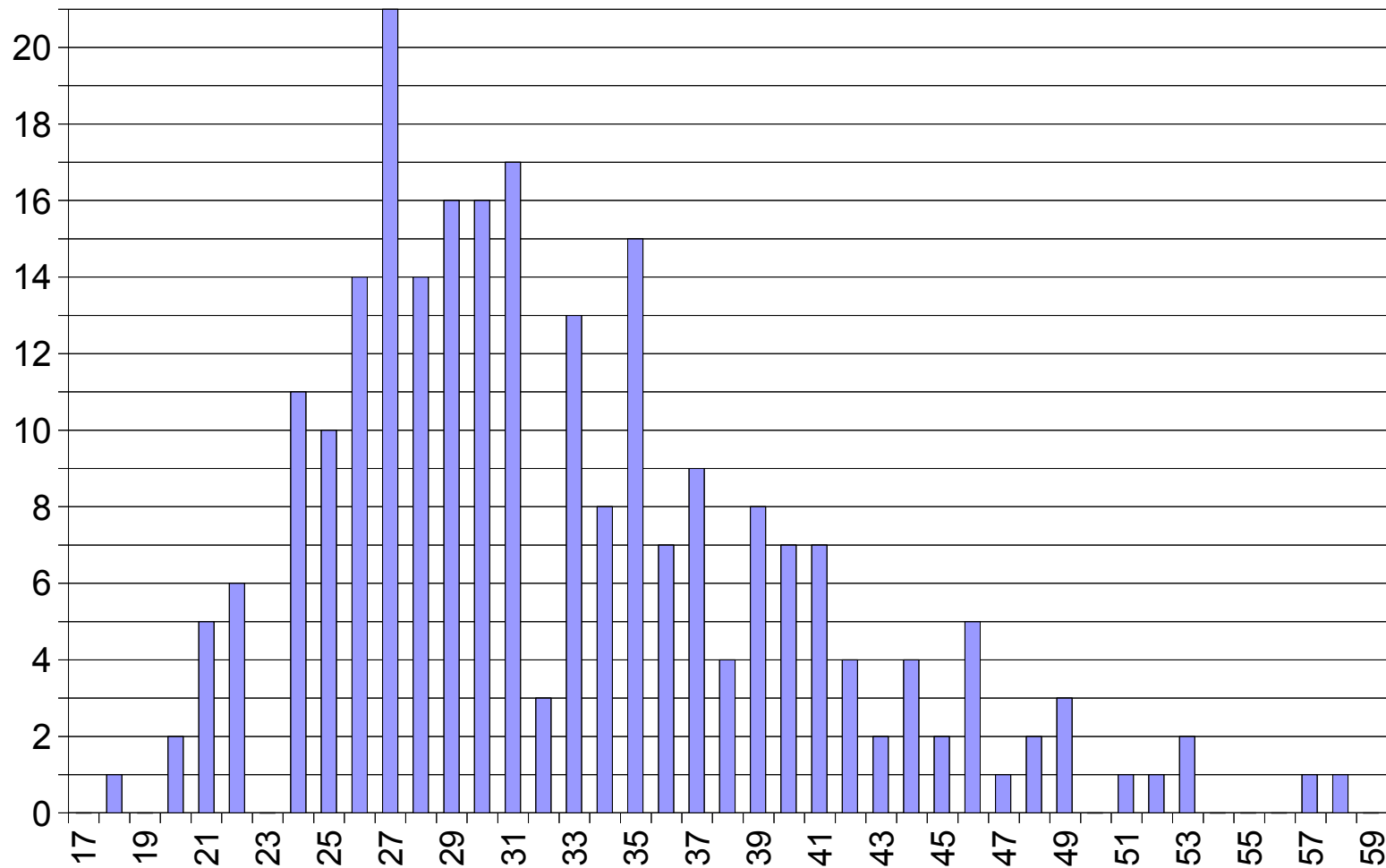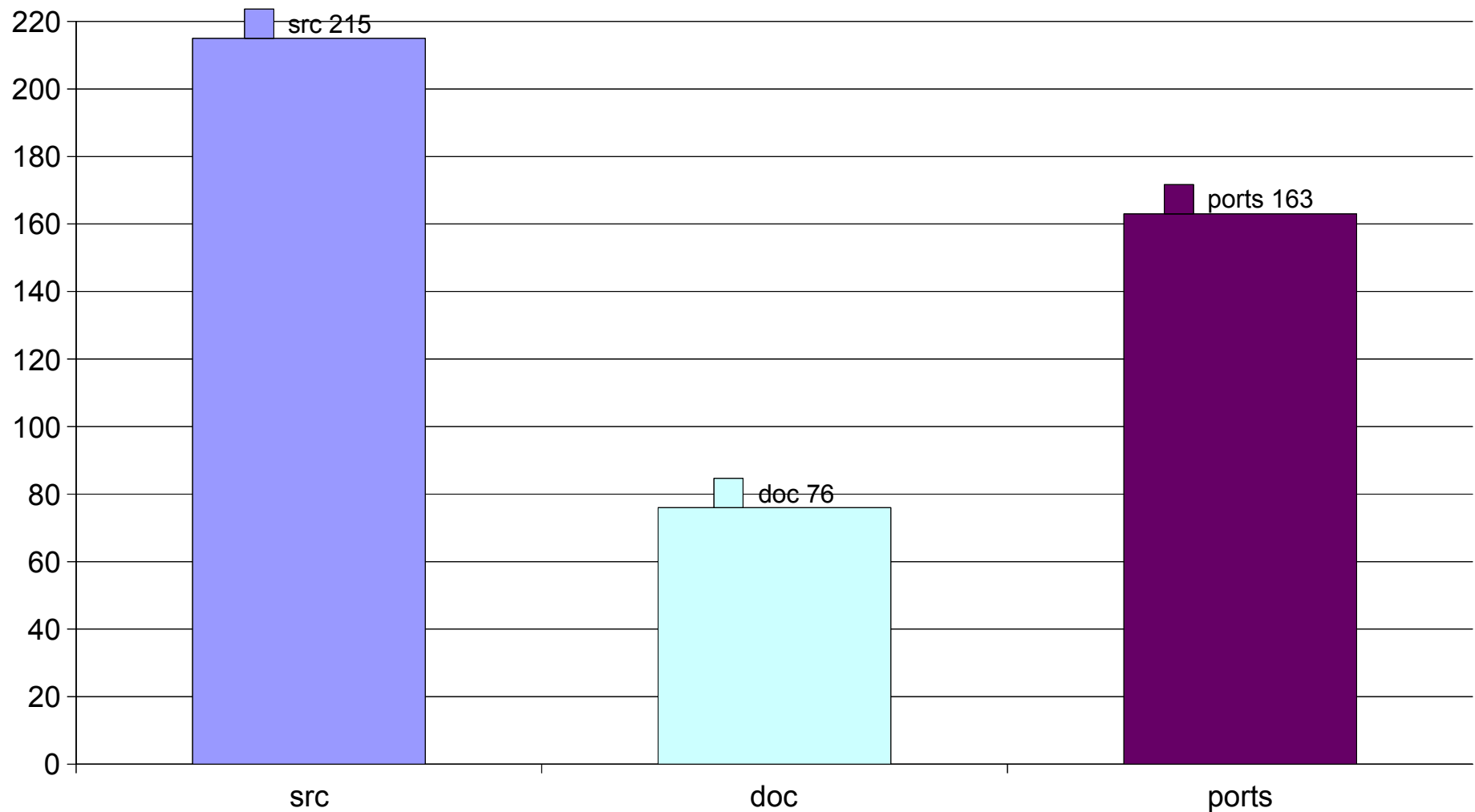
Locations of FreeBSD Committers (March 2007)
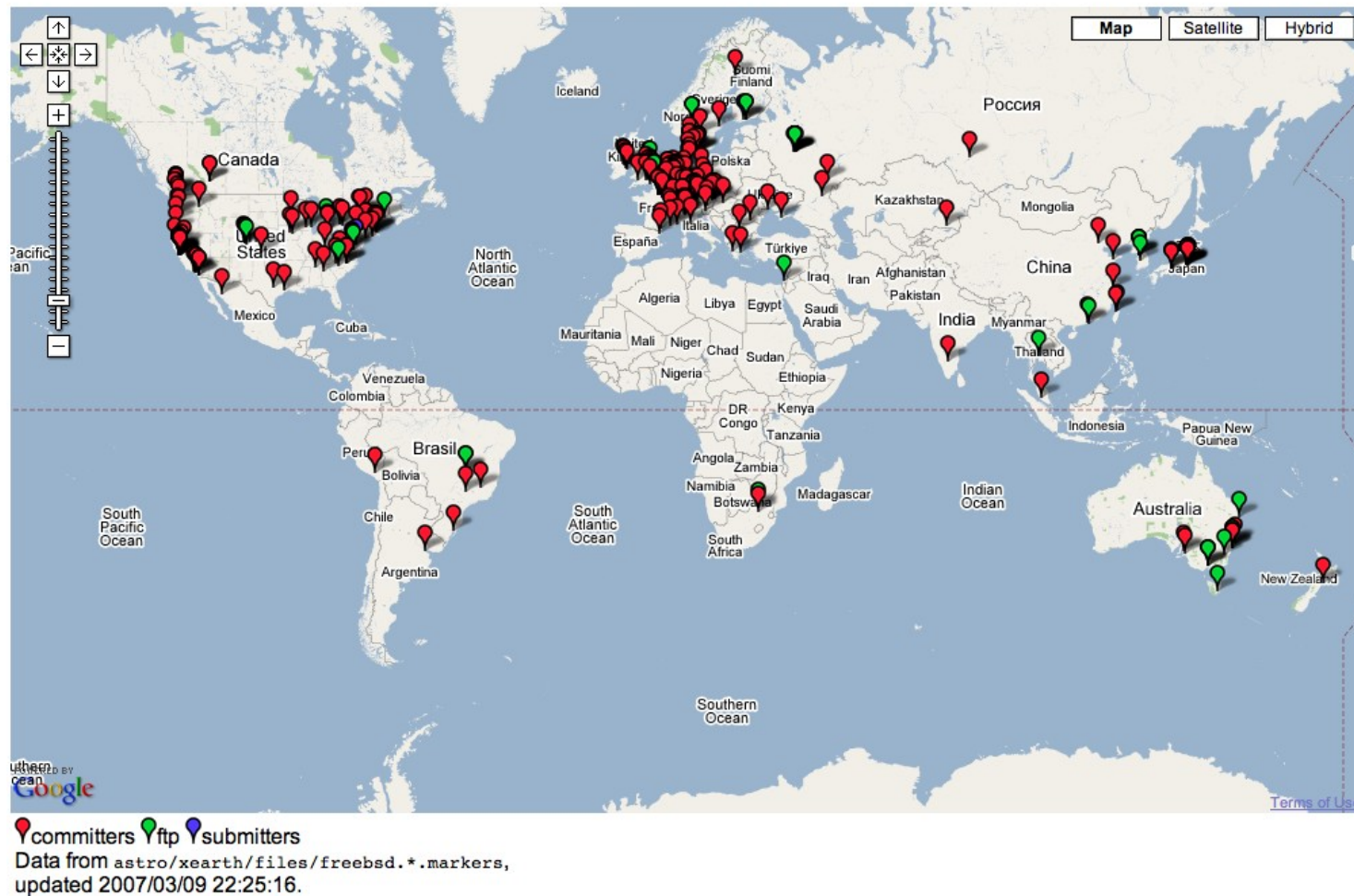
FreeBSD Developer Age Distribution (March 2007)

Number of Commit Bits by Type (March 2007)

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)

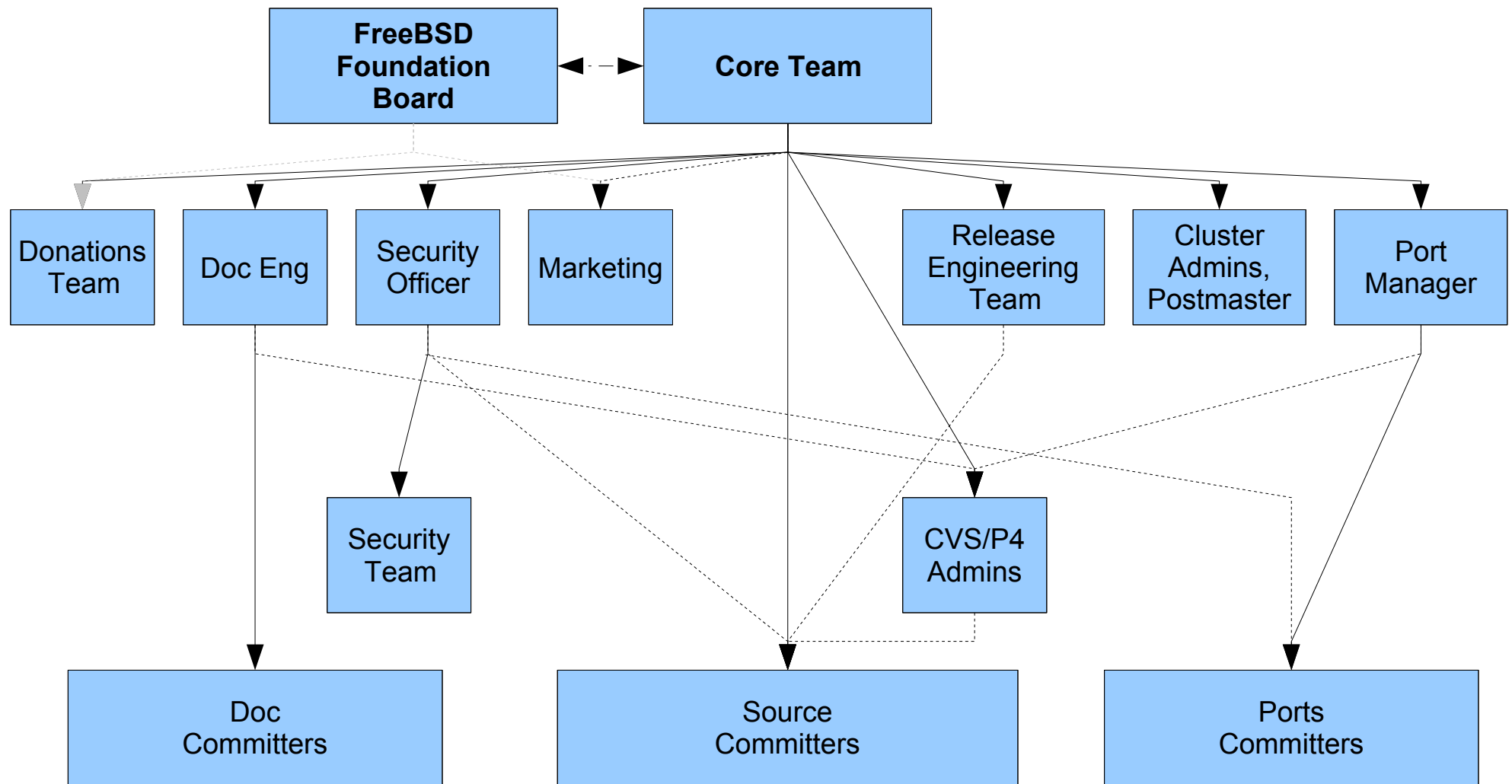 – Rules, conflict resolution, enforcement

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)
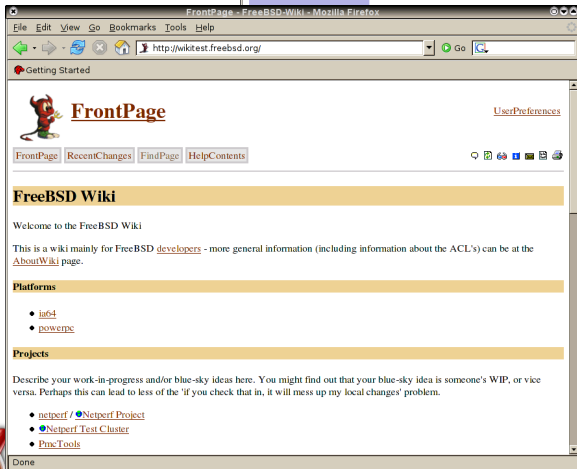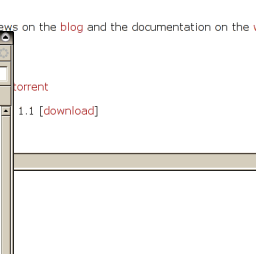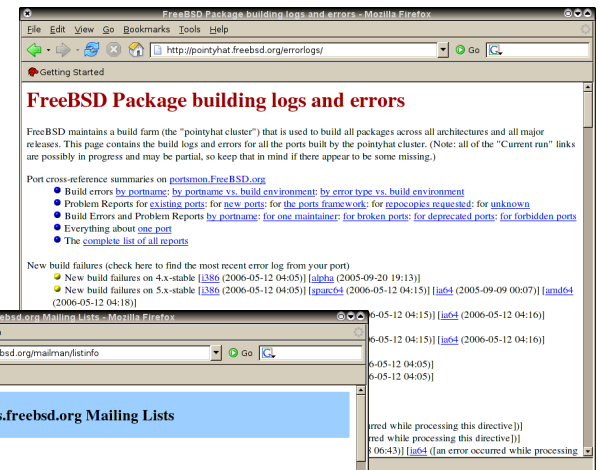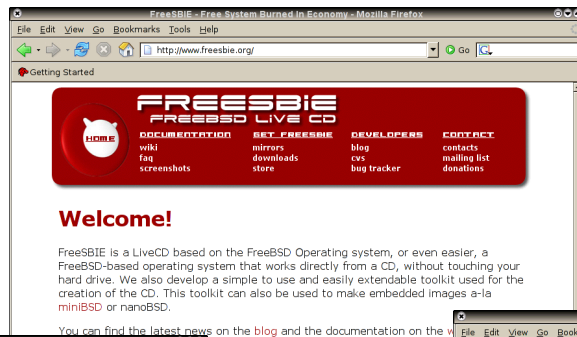
How the FreeBSD Project Works

Events

- Conferences

    - USENIX ATC

    - BSDCan

    - BSDCon

    - EuroBSDCon

    - AsiaBSDCon

    - NYCBSDCon

    - 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
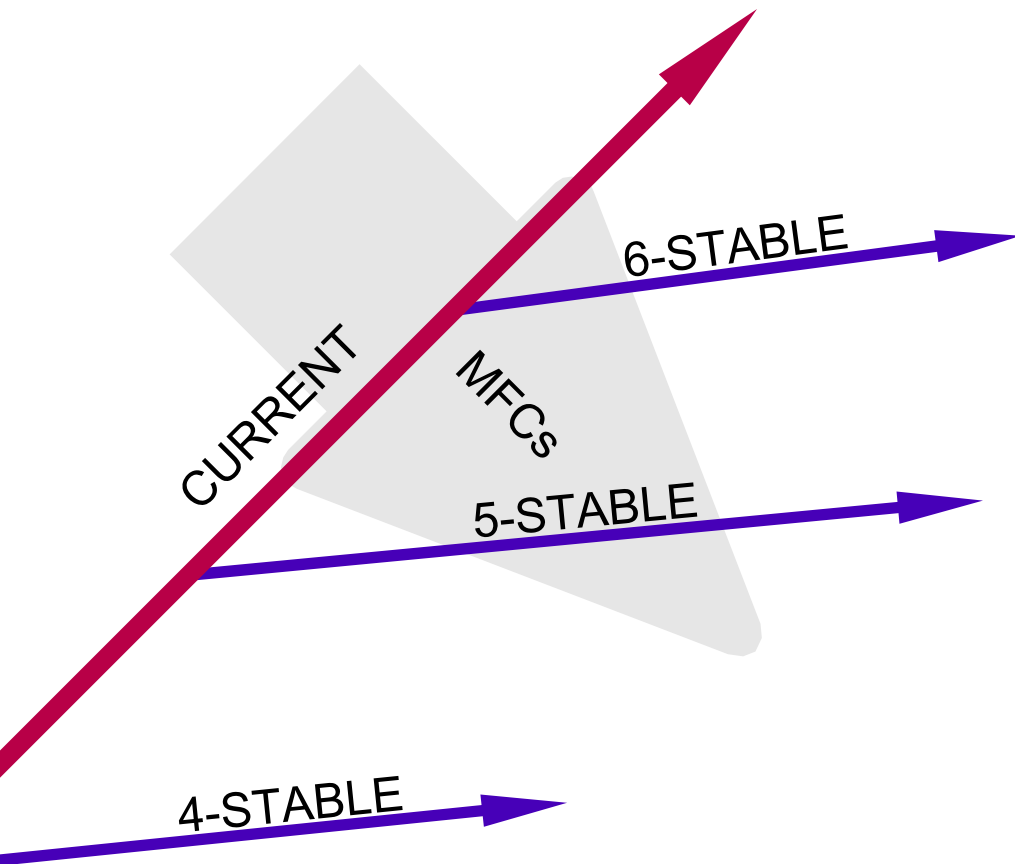
- Simultaneous parallel development

- 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

  - Project releases at http://www.FreeBSD.org/

  - CDs/DVDs from several vendors

  - Derived systems (PC-BSD, DesktopBSD, et al).

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/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, ...

Perforce Development Branches

Sun4v

ZFS

CURRENT

TrustedBSD

ACLs

Audit

MAC

SEBSD
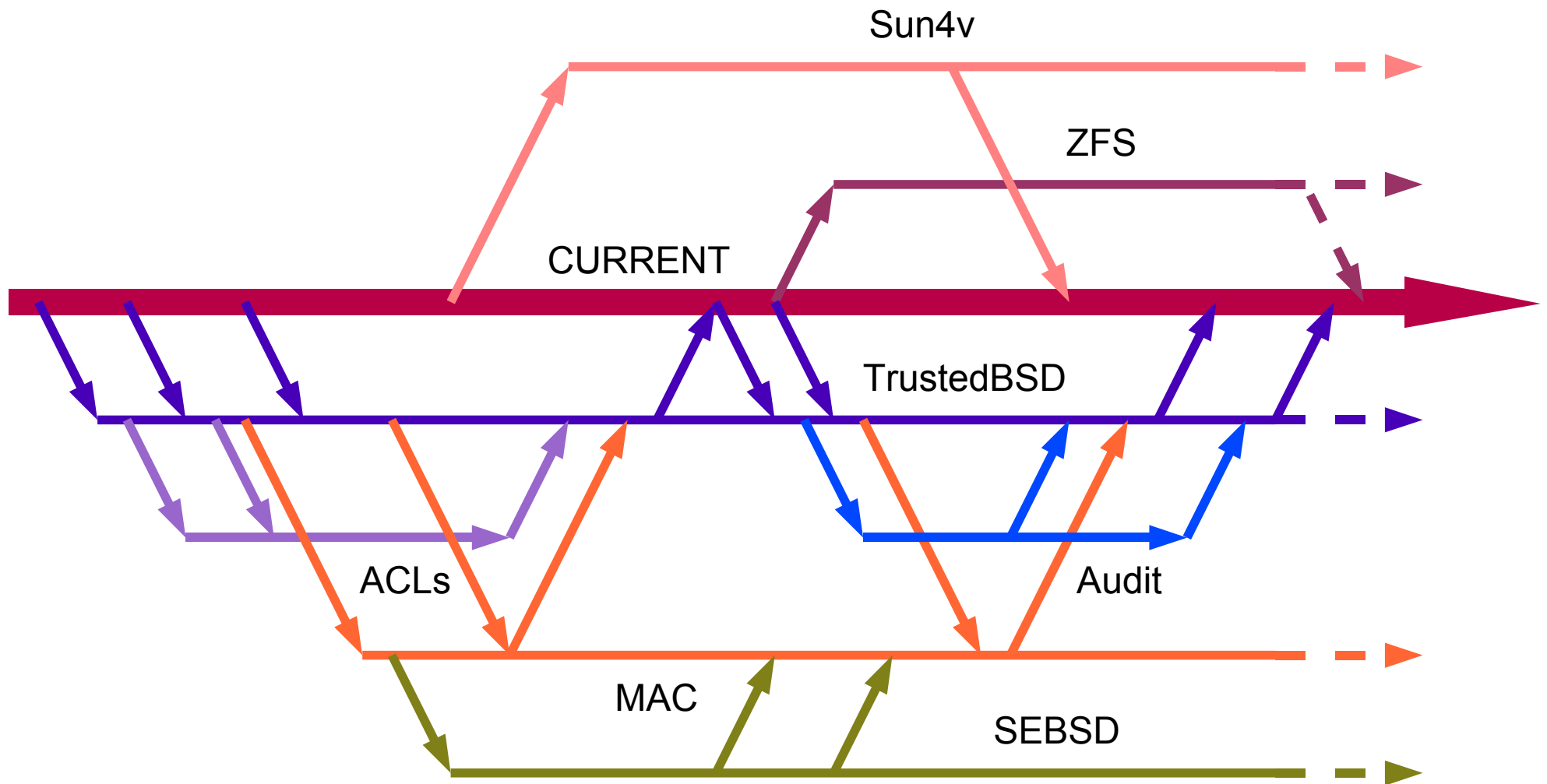
Revision Control: the Future

- 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/