

# Using FreeBSD to Promote Open Source Development Methods

Brooks Davis

Computer Systems Research Department

The Aerospace Corporation

[brooks@aero.org](mailto:brooks@aero.org)

# What is this talk about anyway?

- AeroSource
  - Set of tools to aid software development
  - Open Source software and methods evangelism
  - Demonstrating good software practice
  - Vehicle for cultural change
- FreeBSD's role
  - Hosting platform
  - Shining example of what Open Source Methods can achieve

# What is The Aerospace Corporation?

- From [www.aero.org](http://www.aero.org):
  - Since 1960 The Aerospace Corporation has operated a federally funded research and development center in support of national-security, civil and commercial space programs. We're applying the leading technologies and the brightest minds in the industry to meet the challenges of space.

# What is The Aerospace Corporation?

- Approximately 2400 engineers in nearly every discipline working most aspects of national security space
- Over 20 locations

# Today's Software Culture(s)

- Two main camps
- Classic Software Engineers
  - Big, important software
    - Flight control, navigation, other mission software
  - Big expensive process
    - Lots of verification and validation
    - Complex, often painful change control process

# Today's Software Culture(s)

- Engineering support software
  - Written to solve today's problem
    - ...but often lives for years or decades
  - Often extremely minimal process
    - Advanced revision control is file server and white board to manage locks

# Problems With Today's Engineering Software Culture

- Code everywhere, mostly inaccessible to others
  - Duplicate code of highly varying quality
- Archaic code
  - Deprecated or dead language features
  - Obsolete practices

# Problems With Today's Engineering Software Culture

- Often no revision control
  - Can't figure out which change broke things
  - Features get “lost” between revisions
  - Releases aren't repeatable
  - Locks on files or manual conflict resolution waste developer time



# Open Source Software (OSS) and Methods to the Rescue

- An alternative to traditional, heavyweight software development methods
  - Can still write software to achieve a goal, not just write software
- OSS methods can produce high quality software
  - See Apache, FreeBSD, PostgreSQL, etc
- OSS methods are necessarily low friction
  - OSS developers usually have day jobs, lives, etc

# Open Source Software (OSS) and Methods to the Rescue

- Making code accessible reduces duplication
  - May improve quality
- OSS tools reduce cost objections

# Enterprise Source Software (ESS)

- Open Source, but restricted to the enterprise
  - Read the code within the enterprise
  - Build and run the code within the enterprise
  - Make changes to the code
  - Redistribute modified versions within the enterprise

# Enterprise Source Software (ESS)

- Not merely using open source software within the enterprise
- ESS can become OSS
- OSS with modifications can be ESS

# The FreeBSD Project as an Example

- Shows what can be achieved through open source methods
- Provides examples of working practices
  - Communications
  - Repository management

# The FreeBSD Project as an Example

## How the FreeBSD Project Works

10 March 2007

Robert Watson

FreeBSD Project

Computer Laboratory  
University of Cambridge



UNIVERSITY OF  
CAMBRIDGE

# The FreeBSD Project as an Example

## The FreeBSD Project

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

10 March 2007



## What do you get with FreeBSD?

- Complete, integrated UNIX system
  - Multi-processing, multi-architecture
    - Intel/AMD 32/64-bit, Itanium
  - UNIX, POSIX, BSD protocols
  - Multi-protocol network stack
    - IPv4, IPv6, IPX/SPX, NFS, 802.11, SCTP, ...
  - Standard and embedded
  - Extensive documentation
- Over 16,600 third party...

10 March 2007



## Locations of FreeBSD Committers (March 2007)



10 March 2007



# The FreeBSD Project as an Example

## How the FreeBSD Project Works: Self-Description as Advocacy



Robert N. M. Watson  
Computer Laboratory  
University of Cambridge

## Introduction

### How the FreeBSD Project Works

21 March 2007  
Robert Watson  
FreeBSD Project  
Computer Laboratory  
University of Cambridge

### 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!

17 May 2007



4

## Who are the Committers?

### Who are the Committers? (2006-2007)

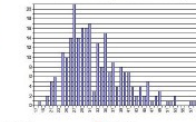
- Locations
  - 34 countries
  - 6 continents
- Ages
  - Oldest (documented) committer born 1948
  - Youngest (documented) committer born 1989
  - Mean age 32.5, median age 31, stddev 7.3
- Professional programmers, hobbyists, consultants, university professors, students ...

21 March 2007

### Locations of FreeBSD Committers (March 2007)



### FreeBSD Developer Age Distribution (March 2007)



- Try to make committers seem human
- Emp

17 May 2007

## FreeBSD and Revision Control

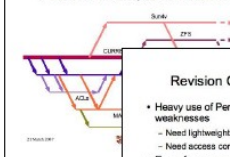
### CVS

- Primary revision control system
  - Most project activity is in CVS
  - 10+ year revision history
  - One commit every
  - Technical limitations
  - Actually four repos:
    - homebrew - FreeBSD
    - homebrew - FreeBSD
    - homebrew - FreeBSD
    - homebrew - FreeBSD

### Perforce

- Secondary revision control system
  - Supports heavily branched development
  - FreeBSD developers
  - Guest accounts and project accounts
- Active project include
  - SMPing, TrustedBSD Audit, TrustedBSD MAC
  - TrustedBSD SEBSD, Alan Cox Superpages, uart
  - ARM, Summer of Code, trace, Xen, Sun4v
  - GEOM, Gjournal, ZFS, CAM locking, netperf, ...

### Perforce Development Branches



### 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 Project lives and breaths CVS/P4
- Importance of heavily branched development

17 May 2007



17



# AeroSource.aero.org

The screenshot shows a web browser window titled "Aerosource - Trac - Konqueror". The browser's address bar is empty, and the page content includes the AeroSource logo, navigation menus, a main heading "Aerosource: Enterprise Source Software at Aerospace", a "Getting Started" section with links to Subversion, Trac, and a Sandbox, and a "Featured Projects" list on the right side.

**AEROSOURCE**  
ENTERPRISE SOURCE SOFTWARE

[Login](#) [Settings](#) [Help/Guide](#) [About Trac](#) [Contact Us](#)

[Project List](#) [Project Library](#) [Create Project](#) [Timeline](#) [Roadmap](#) [Browse Source](#) [View Tickets](#) [New Ticket](#) [Search](#)

[Start Page](#) [Index by Title](#) [Index by Date](#) [Last Change](#)

## Aerosource: Enterprise Source Software at Aerospace

Aerosource is a project management environment for Aerospace that allows the [free sharing of ideas and source code](#) within the Aerospace Corporation. Aerosource is built using the [Trac](#) project management software and utilizes the [Subversion](#) version control system for managing source code.

### Getting Started

[Create a new project](#)

- [Everything you need to know about Subversion](#)
- [Everything there is to know about Trac](#)
- [AerosourceLinks](#) contains links to tutorials and other helpful documentation.
- [ProjectList](#) contains all current Aerosource projects.
- [VideoTutorials](#)
- Try it out in our [Sandbox](#)

### Admin Links

#### Featured Projects (36 of 36 listed)

- [aero\\_idl](#)
- [aeromatlib](#)
- [Aerosource](#)
- [Avant](#)
- [Cell](#)
- [cimus](#)
- [cluster-portal](#)
- [csdai](#)
- [cuda-benchmarks](#)
- [dance](#)
- [deed-sandbox](#)
- [DeviceDatabase](#)
- [dtn](#)
- [enterprise-person](#)
- [eric-astro-tools](#)
- [fellowship](#)
- [FireWatch](#)
- [Knowledge Management Apps](#)
- [LabVIEW](#)
- [m2html](#)
- [mergesort](#)
- [pad-redteam](#)
- [phoenix-command](#)
- [Quantum\\_Computing](#)
- [RACE](#)
- [reanalysis](#)
- [reconfig-demod](#)

# AeroSource Goals

- Promote Enterprise Source Software
  - Encourage code reuse
- Provide developers with good development tools
- Modernize development processes
  - 1990s vs 1970s

# AeroSource.aero.org

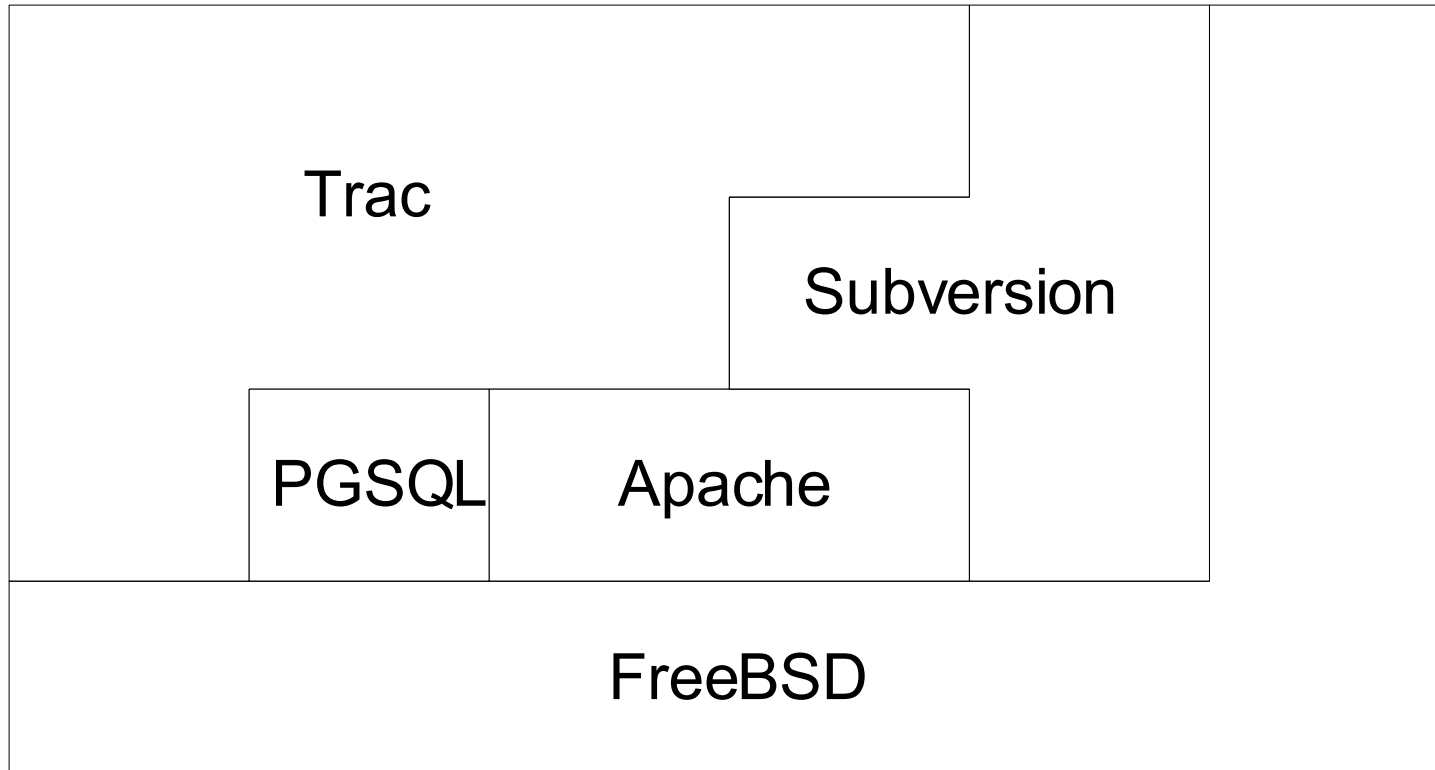
## Implementation Requirements

- Required features
  - Version control including web access
  - Bug, issue, task tracking
  - Website and documentation management
  - All well integrated
  - Internal access only
- Basically SourceForge.net for internal use
- Also needed to be easy to use, operate, maintain, and modify

# AeroSource.aero.org Implementation Options

- SourceForge
- Gforge
- Trac
- Retrospectiva
- CVS/SVN + Bugzilla + Wiki
- ...

# AeroSource.aero.org Implementation



# AeroSource experiences

- Existing CVS/SVN users eager to move
  - Less work for them
- New projects generally interested in many organizations
  - People are realizing that version control is good
- Some instances used for system management tasks
- Strong resistance to Enterprise Source Software ideas in some camps

# Some Objections to ESS

- It's my code
  - Actually, the company owns it
- It's embarrassingly bad code
  - and others can help you improve it
- Rewriting basic algorithms is a right of passage
  - ...or a pointless waste of time?

# Some More Objections to ESS

- Only I can maintain this code
  - Possibly true, but your co-workers aren't stupid
- Only I can use this code correctly
  - Hard to believe if it's documented
- People might submit changes and I'd have to review them
  - Isn't this a good situation to be in?



# AeroSource Projects

- AeroSource
- AeroPorts
- Avant
- fellowship
- FireWatch
- SOAP
- many others

# AeroSource Maintenance

- Eating our own dog food
  - Configuration, custom modules, scripts stored in an AeroSource project
  - Frontpage is the project wiki
  - Use the ticket system where possible
- Basic FreeBSD
  - Standard ports
  - plus local special use ports
- Separate backups with off site storage

# AeroPorts

- AeroPorts
  - Aerospace specific ports
    - Bootstrapping meta-port
    - Ports of internal software
    - Incubator for OSS ports
  - Adds `ports/aero/<category>/<port>` directories
  - Based on a posting to `-ports` by Scot Hetzel
    - Generally works well
    - Minor problems with `portupgrade`

# APT (AeroSpace Ports Tool)

- Integrates ports and AeroPorts
- Wrapper around `portsnap` and `svn`
  - `portsnap` updates ports and constructs `INDEX*` with “`-l descfile`” option
- `portsnap` like interface
  - `init-basic`, `init-aeronet` `fetch` and `extract`
    - Add some `/etc/make.conf` entries
  - `fetch` wraps “`portsnap fetch`”
  - `update` similar to “`portsnap update`”

# Conclusions

- AeroSource is attracting new customers regularly
- OSS methods are attracting developers
  - Efficient and effective methods
  - Free tools
- ESS is gaining traction
  - Work to do in some areas

# The End

# Future Work

- Improve automation
- Increase tutorial content and startup information
- Open source more of our tools
- Consider Trac follow on if deficiencies aren't corrected
- Introduce distributed version control

# Acknowledgments

- Thanks to Michael Gorlick for pushing the initial idea of AeroSource
- Thanks to Mark Thomas for performing the majority of initial Trac setup and customization and being the front line advocate of AeroSource and ESS
- Slides from *How The FreeBSD Project Works* are used with the permission of Robert Watson
- All trademarks, service marks, and trade names are the property of their respective owners



# Promoting AeroSource and ESS

- Internal and External presentations
  - Talks on OSS
  - Tutorial on OSS methods and ESS at GSAW2007
- Trac and Subversion demonstrations
- Management pressure