FreeBSD in the Enterprise

An Introduction for Linux Users

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FreeBSD in a nutshell

- Freely available Unix-like operating system
- Runs on x86, Alpha, Sparc64, IA-64, AMD64 architectures
- Over 11,000 software packages available
- Many commercial users
- Thousands of developers around the world contributing to it
- Used as an operating systems research platform
- So far, so Linux...
• BSD developed at University of California, Berkeley, as alterations to AT&T Unix
• Initial implementation of key Unix concepts, such as sockets, virtual memory, and TCP/IP
• 386BSD developed to implement BSD Unix on x86 architecture in early 1990s
• FreeBSD developed from 386BSD project (as did NetBSD)
• Now has 350+ active developers, and 1,000's of contributors
Places you’ll find FreeBSD

- Powering websites
  - Yahoo!
  - Sony Japan
  - Netcraft
  - NTT/Verio
- “Grunt work”
  - Disney
  - Manex VFX
  - NASA
- ISPs
  - UUNet, Pair, Demon, EasyNet, ...
- Embedded Systems
  - IBM
  - Intel
  - Nokia
  - Checkpoint
  - Juniper Networks
  - Coyote
- Other operating systems
  - Mac OS X
  - Embedded
Enterprise Use

• FreeBSD is used by some of the largest banks in the world to process over 1.5 trillion US Dollars (43,500,000,000,000 Rubles) of business to business transactions per year.

• Perl, Apache, X11, and other Open Source software also used in this application.

• FreeBSD Jails used for system security.
Factors that Help

• Stability
• Source availability for helping understand and fix problems that occur (having the source to the system helps you understand why your application does not do what you expect)
• Excellent performance
• Easy hardware upgrade paths
• The application is spread over many servers. Need more power in one part? Add more FreeBSD boxes.
• PC hardware sometimes is less than perfect, but at PC hardware prices, hot spares are practical.
• BSD has existed since the last 1970's and was the testbed and reference implementation for TCP/IP.
• The Internet Software Consortium (ISC) uses FreeBSD exclusively for f-root domain servers (in 21 cities now, usually with 3 servers per city).
• Modern FreeBSD is extremely refined and mature.
• FreeBSD consistently placed at the top of the "uptime" lists produced by Netcraft to measure the stability of the world's busiest websites.
Differences from Linux
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THIS SOFTWARE IS PROVIDED BY THE AUTHOR AND CONTRIBUTORS "AS IS", AND ANY EXPRESS OR IMPLIED LIMITED
• Don't claim that you wrote the code
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• Apart from that, do anything you want with the code
• The GPL mandates that source code be disclosed.
• The BSD License allows source code changes to be kept secret.
• GPL is often categorised as "Copyleft", as distinct from "Copyright".
• BSD License is "Copycentre". We actively encourage third parties to use the source code.
• Donating changes back is purely at the discretion of the party making the changes.
• The entire source code for FreeBSD is stored in a CVS repository
• The logs, and individual changes for each file can be traced back to 1994.
• The source tree can be checked out at any state, or corresponding to any release
• CDs are available taking the history back a further 20 years
Changes to the FreeBSD tree are available in a number of ways (CVS, CVSup, CTM (e-mail), Web)

It is possible to maintain a local mirror of the complete CVS tree

You can 'tag' a local copy of the tree as buildable, and then selectively include changes from FreeBSD
• FreeBSD Source Code
  – Available on CD (freebsdmall.com, others)
  – Can be downloaded from ftp.freebsd.org

• Changes to the source code
  – Can be updated using CVS
  – Can be updated using CVSup (faster CVS)
  – Changes can be automatically e-mailed in, and integrated with your local source tree

• Can be browsed, with history, on the web, at
  http://www.freebsd.org/cgi/cvsweb.cgi
• Two layers of FreeBSD organization
• The committers, and everyone else
• Committers have write access to the source tree
• Everyone else submits patches or bug reports using FreeBSD's problem reporting system, and waits for a committer to commit the change
• Individuals who submit many patches (that work) are invited to become committers
• 9 committers form the elected "core team", for dispute resolution
Development Organization

Thousands of contributors

9 core team

Source code

300+ committers
FreeBSD is a complete OS

- FreeBSD consists of all the components needed for a complete operating system
  - kernel
  - compiler
  - include files
  - libraries
  - user-land utilities

- Kernel and userland are kept synchronized, and can be built, from source, as a unit
FreeBSD releases maintained using CVS branches

Head of the tree (- current) is now FreeBSD 6.0

When 4.0 came out, a branch was created for “4- STABLE” and minor releases up to 4.11 happened every 4 months.

These minor releases (4.1, 4.2, etc) consist of bug fixes backported from - CURRENT, and new features in - CURRENT that have been extensively tested

5.0 process was a little different, and was not declared 5- STABLE until 5.3, due to the number of advanced new features and reimplementation of SMP introduced in FreeBSD 5.
FreeBSD Release Model

March 2000, FreeBSD 4.0
FreeBSD Release Model

FreeBSD- Current (became 5.0)

FreeBSD- Stable

March 2000, FreeBSD 4.0
FreeBSD Release Model

- FreeBSD- Current (became 5.0)
- FreeBSD- Stable
  - 4.3, April 2001
  - 4.2, November 2000
  - 4.1.1, September 2000 (crypto)

- March 2000, FreeBSD 4.0
  - 4.1, July 2000
• FreeBSD has over 11,000 applications available as binary packages
• Linux has similar number of applications available in a number of different binary formats (RPM, Deb, and others, depending on the distribution).
• Packages are built from the “ports tree” of which more later
• FreeBSD and Linux roughly equal in this respect...
FreeBSD runs 95%+ of Linux binary applications unchanged

- Oracle
- VMWare
- Netscape
- RealPlayer
- Flash
- NetBackup
- Quake III
- …
• The source code is a great reference
• Run standard development tools
  – gcc
  – gdb
  – ddd
  – (x)emacs
  – make
FreeBSD on the Desktop

- A great server OS is a great desktop OS
- FreeBSD runs all the desktop apps you’re familiar with
  - GNOME
  - KDE
  - StarOffice / OpenOffice
  - Mozilla / Firefox
  - WordPerfect
  - VMWare
  - GIMP
  - XMMS
  - CD recording
  - MP3 ripping
  - Gnutella
  - Afterstep / Enlightenment / Sawfish / BlackBox / IceWM ...
FreeBSD Technologies

• The Build System / Release System
• The Ports System
• NDISulator (Windows Driver Compatibility)
• Linux Compatibility
• Netgraph
• ... and more
The Build System
Building World

- The entire operating system, including all libraries and utilities can be built with a single command: “make world”
- The source code for the system is placed in /usr/src during installation.
- Much easier to secure a system if a bug is found in a key library like OpenSSL.
- More information in build(7) and Handbook.
• You can even build a complete release of FreeBSD, including FTP install directories, floppy images, and ISO images for CDROMs with one command.

• “make release” is used by many large companies to produce special versions of FreeBSD with special patches or additional software installed by default.

• It is also the well documented way in which the release engineering team makes all official releases of FreeBSD.
• “make release” makes it much easier to deploy thousands of systems pre-configured for a specific environment.

• The release engineering team for FreeBSD publishes schedules, identifies QA issues that must be resolved before release, and publishes documents to help other people build FreeBSD based products.

• See release(7) and www.freebsd.org/releng
Linux Compatibility
• Code like
  ```c
  fd = open("/etc/passwd", O_RDONLY);
  ```
• Becomes
  ```c
  syscall(5, ...)
  ```
• Kernel knows it’s a FreeBSD binary, uses `freebsd_syscalls[]` array
  ```c
  freebsd_syscalls[5] = freebsd_open(...);
  ```
• File is opened
Running a Linux binary

- **Code like**
  ```c
  fd = open("/etc/passwd", O_RDONLY);
  ```
- **Becomes**
  ```c
  syscall(5, ...)
  ```
- **Kernel knows it’s a Linux binary, uses**
  ```c
  linux_syscalls[] array
  linux_syscalls[5] = linux_open(...);
  ```
- **File is opened**
- **All Linux file operations redirected to /compat/linux first**
• No slowdown; this is *not* emulation
• Efficiency of TCP/IP and VM system means some Linux apps run *faster*
• SCO (ibcs2) compatibility handled in the same way
NDISulator

Windows Network Device Driver Compatibility
• Compatibility layer for NDIS Windows Driver Kernel API.
• Allows driver .inf and .sys files to be turned into FreeBSD loadable kernel modules.
• Can load and unload windows network device drivers in FreeBSD!
• Some wireless hardware vendors refuse to release specifications, so this is the only method to use such cards with an open source operating system.
• More information in ndis(9).
• http://www.freebsd.org
• http://www.freebsd.org/docs.html
• FreeBSD Handbook (Russian translation available)
• Local User Groups, Mailing lists
Questions?