FreeBSD Foundation Update

The FreeBSD Foundation is a 501(c)(3) non-profit organization dedicated to supporting and building the FreeBSD Project and community worldwide. It represents the FreeBSD Project in executing contracts, license agreements, copyrights, trademarks, and other legal arrangements which require a recognized legal entity.

It also funds and manages development projects, sponsors FreeBSD events and Developer Summits, and provides travel grants to FreeBSD developers who would otherwise be unable to attend Developer Summits.

This article summarizes the conferences and projects that the Foundation funded in 2011. It concludes with how you can assist the Foundation in its efforts.

Conferences ,Travel Sponsorship, and Conference Booths

In 2011, the Foundation provided sponsorship for the following BSD conferences:

- AsiaBSDCon, held in Tokyo, Japan from March 17-20
- BSDCan and Developer Summit, held in Ottawa, Canada from May 11-14
- KyivBSD, held in Kiev, Ukraine on September 24
- EuroBSDCon and Developer Summit, held in Maarssen, Netherlands from October 6-9
- FreeBSD Vendor Summit, held in Santa Clara, CA from November 3-4

In addition to sponsoring these conferences, the Foundation paid for developers to attend the following conferences:

- FOSDEM: 1 developer
- BSDCan: 6 developers
- EuroBSDCon: 6 developers
- GSoC Mentor Summit: 1 developer

Each sponsored developer provides a trip report that indicates the value that was gained from their travel

sponsorship. Trip reports are available online at the Foundation's blog: *http://freebsdfoundation.blogspot.com/.*

Directors from the FreeBSD Foundation also volunteer at FreeBSD booths at conferences that provide exhibition areas. Visiting a FreeBSD booth provides an excellent opportunity to discuss and suggest funded development work as well as to make a donation to the Foundation. At least one Director was present at the following conference booths:

- FOSDEM, held in Brussels, Belgium on February 5-6
- SCALE, held in Los Angeles CA on February 26
- AsiaBSDCon, held in Tokyo, Japan from March 17-20
- Indiana LinuxFest, held in Indianapolis, IN on March 26
- FlourishConf, held in Chicago, IL on April 2
- BSDCan, held in Ottawa, Canada on May 13-14
- SouthEast LinuxFest, held in Spartanburg, SC on June 11
- Ohio LinuxFest, held in Columbus, OH on September 10
- EuroBSDCon, held in Maarssen, Netherlands on October 8-9
- LISA, to be held in Boston, MA on December 7-8 (upcoming)

For 2012, the following conferences have confirmed a FreeBSD booth with Foundation representation:

- SCALE, to be held in Los Angeles, CA on January 21
- NorthEast LinuxFest, to be held in Worcester, MA on March 17
- Indiana LinuxFest, to be held in Indianapolis, IN on April 14
- BSDCan, to be held in Ottawa, ON on May 11-12

It is expected that FreeBSD booths will be arranged at the other conferences that were attended in 2011, once the conference dates and locations have been confirmed.

Funded Development Projects

In 2011, the Foundation budgeted $125,000 to fund development work. $85,000 worth of work has been completed and two additional projects are being considered for the remainder of the 2011 budget. The following development projects have met their completion milestones:

IPv6 support in FreeBSD and PC-BSD

Bjoern Zeeb, recipient of the Itojun Service Award for his work on open source implementations of IPv6, was awarded a grant to improve the maturity of IPv6 support in FreeBSD and PC-BSD. This project was jointly sponsored with iXsystems, the corporate sponsor of the PC-BSD project.

FreeBSD's original KAME-based reference implementation of IPv6 first appeared in FreeBSD 4.0 and is found in a broad range of FreeBSD-derived commercial products. Before this project, IPv6 was an optionally configured feature present in the default FreeBSD kernel; however, that configuration also implied configuration of IPv4. With much „IPv6-ready" application software relying on dual-stack behavior, broken IPv6 applications go unnoticed. This project added support for an IPv6 kernel without IPv4 which makes FreeBSD and PC-BSD the ideal test and development platform for both open source and proprietary IPv6-aware application software.

This project was completed in time for both the FreeBSD and PC-BSD projects to participate in World IPv6 Day, held on June 8. IPv6-only versions of FreeBSD (*http://www.freebsd.org/ipv6/*) and PC-BSD (*http://pcbsd.org/IPv6*) are available.

Resource Containers Project

Edward Napierala was awarded a grant to implement resource containers and a simple per-jail resource limits mechanism.
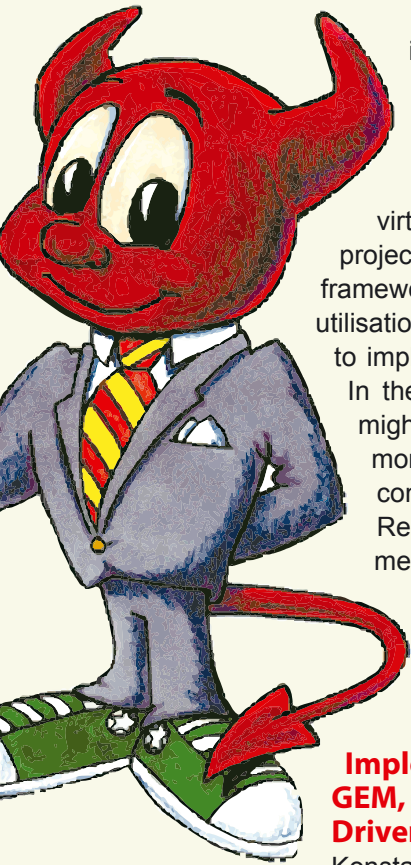
Unlike Solaris zones, the implementation of FreeBSD Jails did not provide per-jail resource limits. As a result, users were often forced to replace jails with other virtualization mechanisms. This project created a single, unified framework for controlling resource utilisation, and used that framework to implement per-jail resource limits. In the future, the same framework might be used to implement more sophisticated resource controls, such as Hierarchical Resource Limits, or to implement mechanisms similar to AIX WLM. It could also be used to provide precise resource usage accounting for administrative or billing purposes.

Implementing support of GEM, KMS, and DRI for Intel Drivers

Konstantin Belousov was awarded a grant to implement support of GEM, KMS, and DRI for Intel video drivers. This project was also co-sponsored by iXsystems.

The project implemented GEM, ported KMS, and wrote new DRI drivers for Intel Graphics, including the latest Sandy Bridge generation of integrated graphic units. Once the work is fully tested, it will be committed and should allow the latest Intel open-source drivers with integrated, 3D-accelerated graphical capabilities to run on FreeBSD, expanding the range of hardware where FreeBSD is suitable for the desktop. PC-BSD testing snapshots that use the committed code are expected to be available before the end of the first quarter of 2012.

Feed-Forward Clock Synchronization Algorithms Project

Julien Ridoux and Darryl Veitch at the University of Melbourne were awarded a grant to implement support of feed-forward clock synchronization algorithms.

For many years, NTP has been the reference solution to synchronize computer clocks inexpensively. However, the ntpd daemon has begun to show limitations which are mainly due to the feed-back nature of its interaction with the kernel.

In contrast, a feed-forward approach is inherently robust and allows near-optimal performance to be reached. This project extended the FreeBSD kernel timing system to support feed-forward synchronisation daemons. This new synchronisation system allows both feed-back and feed-forward approaches to run on one system and give users the possibility to select the one more suited to their needs.

This feed-forward approach provides various new features such as faster timestamping, a new difference clock to measure time intervals with GPS-like accuracy and extremely high robustness, the ability to replay the clock offline based on stored raw timestamps, and accurate timing for virtual machines and live VM migration.

Implementing xlocale APIs

David Chisnall received a grant to implement xlocale APIs to enable the porting of libc++.

FreeBSD has always had its own C standard library implementation but uses the GPL-licensed GNU libstdc++ as the C++ standard library. libc++ is an alternative library that was developed as part of the LLVM project and which is available under the UIUC and MIT licenses. This library depends on a low-level C++ ABI library. An implementation of this ABI was written for PathScale and the FreeBSD and NetBSD Foundations jointly paid the costs for it to be open sourced.

The other dependency is the C standard library. libc++ was written by Apple and uses a set of non-portable extensions for localisation known as xlocale. This project implemented the missing xlocale APIs into FreeBSD's standard C library. Now that the project is complete, it is possible to build libc++ on FreeBSD.

DIFFUSE

The Swinburne University of Technology's Centre for Advanced Internet Architectures was awarded a grant to implement DIFFUSE for FreeBSD.

DIFFUSE (*Distributed Firewall and Flow-shaper Using Statistical Evidence*) is an extension to the FreeBSD IPFW firewall subsystem which allows IPFW to classify traffic based on statistical properties of realtime flows and to instantiate network actions across a distributed set of action nodes for particular flows. DIFFUSE uses machine learning techniques to enable robust and efficient classification of IP traffic flows based on their unique statistical properties in addition to traditional inspection of packet header or payload contents. DIFFUSE also allows traffic classification to occur in one place (e.g. in the core of a network) and trigger traffic

shaping and differentiation elsewhere (e.g. at the edges of a network).

This project integrated the DIFFUSE prototype into FreeBSD which will increase FreeBSD's utility to designers and implementers of FreeBSD-based networking infrastructure. DIFFUSE has applications in ISP, residential broadband, and large corporate network scenarios.

Five New TCP Algorithms Project

Grenville Armitage was awarded a grant to implement five new TCP congestion control algorithms.

Previous to this development work, FreeBSD's TCP stack did not have an easy-to-use mechanism for introducing new congestion control algorithms. This project delivered the following enhancements to FreeBSD's TCP stack:

*   Modular congestion control framework.
*   Khelp (Kernel Helper) and Hhook (Helper Hook) frameworks.
*   Basic Khelp/Hhook integration with the TCP stack.
*   ERTT (Enhanced Round Trip Time) Khelp module for delay-based TCP algorithms.
*   Modularised implementations of NewReno, CUBIC and HTCP loss-based TCP algorithms.
*   Modularised implementations of Vegas, „HD" and „CHD" delay-based TCP algorithms.
*   Technical report comparing the computational overhead associated with TCP before and after integrating the new frameworks and modularised NewReno algorithm (*http://caia.swin.edu.au/reports/ 110228A/CAIA-TR-110228A.pdf*).

Each congestion control algorithm is implemented as a loadable kernel module. Algorithms can be selected to suit the application/network characteristics and requirements of the host's installation. The modular framework makes it much easier for developers to implement new algorithms, allowing FreeBSD's TCP to be at the forefront of advancements in this area, while still maintaining the stability of its network stack.

Other Projects

In addition to the development projects, the Foundation also negotiated a non-exclusive copyright license to the libcxxrt C++ runtime software from PathScale. This software is an implementation of the C++ ABI originally developed for Itanium and now used for the x86 family by BSD operating systems. libcxxrt will be available under the 2-clause BSD license. This implementation is a full replacement for the GNU libsupc++ library for platforms that use the Itanium

C++ ABI, including i386 and x86-64, and will replace portions of the C++ stack previously only available under the GPL. It provides implementations of the dynamic features of C++, including dynamic casting, exception handling, and thread-safe static initializers, and will continue the gradual replacement of GNU toolchain and runtime components, furthering the aim of a purely BSD-licensed system.

The Foundation Needs Your Help!

The FreeBSD Foundation is entirely supported by donations. The Foundation is thankful for the support it receives from the many individuals and companies who value FreeBSD. As of December 1, the Foundation has raised $201,000 towards its 2011 goal of $400,000.

You can help us to reach our fund raising goal of $400,000 by the end of December by making a donation.

See *http://www.freebsd foundation.org/donate/* for details about the donation process.

By helping the Foundation meet its fund raising goal, you are enabling the Foundation to increase its project development funding, purchase needed equipment for the FreeBSD project's infrastructure, and support more FreeBSD related conferences.
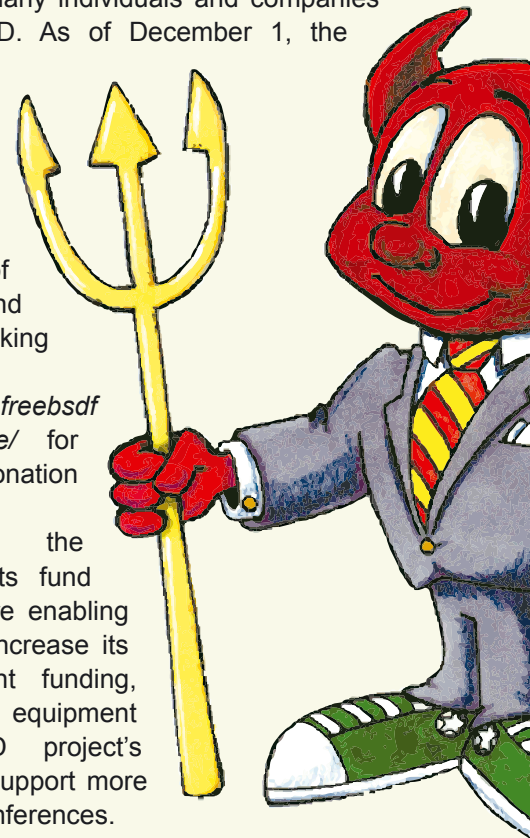
DRU LAVIGNE

Dru Lavigne is author of BSD Hacks, The Best of FreeBSD Basics, and The Definitive Guide to PC-BSD. As Director of Community Development for the PC-BSD Project, she leads the documentation team, assists new users, helps to find and fix bugs, and reaches out to the community to discover their needs. She is the former Managing Editor of the Open Source Business Resource, a free monthly publication covering open source and the commercialization of open source assets. She is founder and current Chair of the BSD Certification Group Inc., a non-profit organization with a mission to create the standard for certifying BSD system administrators, and serves on the Board of the FreeBSD Foundation.