FreeBSD Foundation December Update

The FreeBSD FOUNDATION

Dedicated to supporting the FreeBSD Project and Community

Upcoming Events

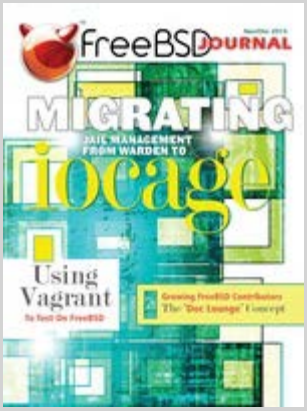
SCALE 14x
January 21-24, 2016
Pasadena, CA

FOSDEM 2016
January 30-31, 2016
Brussels, Belgium

FreeBSD Storage Summit
February 22, 2016
Santa Clara, CA

USENIX FAST '16
February 22-25, 2016
Santa Clara, CA

FreeBSD Journal



The November/December issue of the *FreeBSD Journal* is now available! Don't miss articles on The BSD Router Project, Using Vagrant to Test on FreeBSD, and more.

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Message from the Executive Director

It's hard to believe 2016 is right around the corner. The past year has been very productive for the Foundation. From funding important development projects and spreading the word about FreeBSD to new audiences, to supporting Project infrastructure and publishing the informative Journal, your donations have allowed us to work hard supporting the Project you love. Take a moment to see what we've been up to over the past twelve months and join me as the excitement builds to see what new initiatives the coming year has in store.

Deb

Development Projects Update

As 2015 draws to a close I look back at a year of Foundation-sponsored projects, and am amazed at what we've accomplished. The Foundation hired our first permanent technical staff member in 2013, and we've increased the amount of staff-led project development work every year since. Our permanent staff members take on new development projects, but also provide a long-term effort on maintaining and improving FreeBSD subsystems.

While we provide a lot of support to the FreeBSD Project through our permanent staff, we also realize the importance of funding developers through project grants to work on specific, individual projects. In 2015, we funded four developers with direct project grants, continued our sponsorship of a research master's on multipath TCP on FreeBSD, and provided hardware for developers performing hardware bring-up. The graph below shows Foundation-sponsored commits by year, and a few of our significant projects are listed below. Thank you to all the Foundation donors for your support in 2015, and I look forward to reporting on even more work on security, performance, hardware support, and toolchain support in 2016.

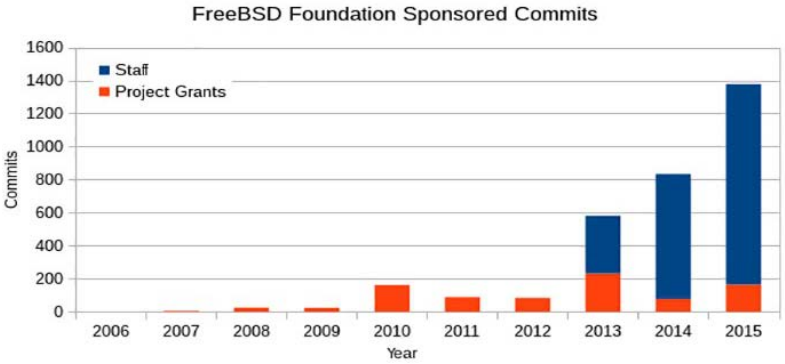
“Awesome! This is the best way to popularize FreeBSD!!” San Jose, California

“I’ve found it really practical, and great reading...it caters to all levels of users.” Brooklyn, NY

Why Choose FreeBSD?

"Juniper offers high-performance network infrastructure powered by JUNOS (TM) software, one network operating system that integrates routing, switching, security and network services. FreeBSD serves as the basis of JUNOS software, providing many of the essential operating system services of the UNIX-based system. Today, JUNOS software runs on a broad portfolio of Juniper products designed for the diverse and demanding needs of converged networks, from small offices to the largest TeraPop sites in the world.

Juniper benefits from the powerful collaboration between leading universities, individuals, and commercial organizations developing FreeBSD to advance the operating system functionality. The FreeBSD release system provides Juniper with a roadmap for features and a stable base for our code, while its practical licensing enables Juniper to develop intellectual property for advancing high-performance networking. Juniper employs many active FreeBSD developers that continually contribute to the FreeBSD project to further its development as a leading operating system."



FreeBSD/arm64 port

In 2015 the Foundation continued working with ARM, Cavium, Semihalf and Andrew Turner to develop the FreeBSD port to the 64-bit ARM architecture (AArch64). The funded project started near the end of 2014, and arm64 is now a viable, usable platform for FreeBSD. The porting effort consisted of basic architectural support and platform-specific support for the Cavium ThunderX, our initial hardware reference platform. Andrew Turner focused on architectural support while Semihalf focused on the ThunderX platform, although both contributed to all aspects of the port.

Foundation staff members Ed Maste, Glen Barber and Konstantin Belousov also contributed to the architecture port in various ways. We are now producing snapshot install media images for FreeBSD/arm64 and an experimental package set has about 17,000 third-party software packages available. Testing, performance tuning, and additional platform support is ongoing, with a target of having arm64 as a Tier-1 platform in the FreeBSD 11.0 release.

Multipath TCP (MPTCP) research master's

Part of the Foundation’s mission is supporting FreeBSD as a research platform. We continued our sponsorship of Nigel Williams’ research master's at Swinburne University of Technology. Nigel is working on the development of an experimental multipath TCP (MPTCP) stack for FreeBSD. Multipath TCP (MPTCP) is an extension to TCP that allows for the use of multiple network interfaces on a standard TCP session. The addition of new addresses and scheduling of data across them occurs transparently from the perspective of the TCP application. Over the year multiple versions of the in-progress patch set were posted for review and testing. The Foundation is now investigating next steps on the path of bringing the work into FreeBSD proper.

New automounter

The new automounter is a cleanroom implementation of functionality available in most other Unix systems, using proper kernel support implemented via an autofs filesystem. The automounter supports a standard map format, and integrates with the Lightweight Directory Access Protocol (LDAP) service. Edward Tomasz Napierała continued working on the automounter this year, committing improvements and adding removable media support.

Root remount

Another of Edward’s projects, the root remount project provides the ability to boot with a temporary root file system (rootfs), configure the kernel to be able to access the real rootfs, and then replace the temporary rootfs with the real one. This is similar to the pivot_root functionality found in Linux.

UEFI and secure boot

FreeBSD’s UEFI boot support needs to interoperate with many different EFI

-- Naren Prabhu, Vice President Foundation Technologies, Juniper

firmware implementations, and it's only after broad testing that we were able to identify some incompatibilities. Through effort from Foundation staff and from volunteers in the FreeBSD community we've fixed UEFI boot on a variety of hardware and virtualization platforms, including Apple Macbook and Mac Pro computers and VirtualBox and VMware. These improvements will be available in FreeBSD 11.0 and 10.3.

We also started working on support for secure boot. To date we've been working on individual tools -- the `uefisign(8)` utility to add Authenticode signatures to EFI files, and the `sysutils/pesign`, `sysutils/sbsigntool` and `sysutils/shim` ports. Next year we'll integrate these components into a broader secure boot implementation.

Virtual machine images

Glen Barber continued work on improving the underlying framework and producing images for various virtual machine hypervisors and cloud hosting providers. With these improvements and work done by other FreeBSD developers, the FreeBSD Release Engineering Team was able to add Amazon Machine Images (AMIs), Google Compute Engine (GCE) images and Vagrant images for amd64, as well as virtual machine images for arm64 to the release build process.

Modern x86 platform support

Foundation staff member Konstantin (Kostik) Belousov added support for new features in modern x86 platforms. This includes support for the enhanced local interrupt controller (APIC) mode called x2APIC, which supports virtualization and reduces access overheads. Kostik added End of Interrupt (EOI) suppression, an optimization that reduces the number of APIC messages that must be broadcast. Interrupt Remapping (IR) support for VT-d is another feature added last year. It allows hypervisors to delegate interrupt programming for devices owned by a guest to the guest operating system. Kostik also added support for DMA Remapping (DMAR) and Process Context Identifier (PCID).

Atomic operations

Another one of Kostik's projects was improved atomic operation support. The goal was to audit and upgrade the usage of lockless facilities, with the intent of fixing bugs before they're observed in the wild. Because most FreeBSD development and testing still happens on x86 computers which have a strongly ordered memory model, it is possible that errors in the use of atomics may go undetected. This project produced an improved `atomic(9)` man page to remove erroneous and ambiguous statements, and preemptively fixed the lockless algorithm used by timekeeping and other kernel and userland issues.

Update and merge VIMAGE support

Jails are the lightweight virtualization (container) mechanism in FreeBSD. The FreeBSD community has been trying to integrate Marko Zec's VIMAGE work as a stable feature since 2008. Unfortunately little progress has been made since then. The Foundation awarded a project grant to Björn Zeeb to address network stack teardown and ordering issues in VIMAGE, and address memory leaks in teardown. This is a portion of the effort required for full VIMAGE support, and will arrive in FreeBSD in time for the 11.0 release.

-- contributed by Ed Maste

Silicon Valley Vendor and Developer Summit Recap

On November 2nd and 3rd this year we held our latest Silicon Valley Vendor and Developer Summit at the NetApp campus in Sunnyvale California. We held two days of talks and discussion covering a range of topics. The Vendor/Dev Summits work to bring together companies building products on or with FreeBSD and the broader developer community. They are held several times a year, often in parallel with other BSD events such as AsiaBSD, BSDCan and EuroBSD. The Silicon Valley summit is the only stand alone Vendor/Dev Summit that we hold and it has been run successfully now for the last several years. The space was donated by NetApp and meals and coffee were sponsored by The FreeBSD Foundation, Juniper Networks and TidalScale Inc.

This year we had over a 100 people and more than 20 companies in attendance. Topics of discussion ranged over new developments in persistent memory, the use of FreeBSD by a company that builds rackscale systems, developments in our compiler and tool suite, as well as others. The complete schedule, and some of the slides, are available on the FreeBSD Wiki.

One of the highlights of our vendor summits is the "Have/Need/Want" session where vendors tell the community what they can give back and upstream, while letting the community know what features they need in the near term and might want in the medium or long term. It's always a lively discussion! The notes from the session are on their own page.

-- contributed by George Neville-Neil

The Faces of FreeBSD Series: Erin Clark

Next up in the Faces of FreeBSD series reboot is Erin Clark. You can find her full interview on the blog.

Please take a minute and read more about Erin and stay tuned for future interviews with FreeBSD enthusiasts who are advocating for FreeBSD, improving FreeBSD, writing for FreeBSD, running conferences, and helping in other various ways.

TeachBSD Course Materials Now Available

Last week, FreeBSD Foundation board members George Neville-Neil and Robert Watson announced the launch of their TeachBSD initiative. TeachBSD offers a set of reusable course materials designed to allow others to teach both university students and software practitioners FreeBSD operating system fundamentals. The Foundation is proud to have partly sponsored their efforts to teach the initial graduate level course on operating

systems with tracing at the University of Cambridge. Other course and tutorial variations are currently being developed and will be offered in 2016. Hear more about the class from George and Robert during their BSDTalk Interview.

Fundraising Update: We're in the Home Stretch!

We only have a few more days left to meet our fundraising goal for 2015! Thank you to everyone who has made a donation this year, to help us continue supporting FreeBSD. As of this writing, we've raised just over $642,000 from 1436 donors, moving us closer towards our goal of raising $1,250,000 from 2000 donors. Did you know the Foundation is 100% funded by your donations? With a spending budget of $1,250,000, we need to raise that amount to continue supporting the projects, advocacy, staff, and FreeBSD Project services and hardware that we currently support.

To give you an idea of how we use your donations, here's where your support went this year:

- Funded and managed the port of FreeBSD to the new AArch64 64-bit ARM architecture, funded university research on Multipath TCP for FreeBSD, the reroot root file system remount project, and other projects.
- Employed three full-time development engineers who focus on code fixes and improvements, new features and functionality.
- Provided full-time release engineering support, resulting with on-time and reliable releases.
- Purchased hardware to upgrade and improve FreeBSD infrastructure. This includes supporting the replication of our data and services such as subversion repo, web presence, mail, wiki, and others. We're upgrading our test infrastructure to handle more modern hardware and providing access to any project member who wishes.
- Sponsored many BSD conferences including: AsiaBSDCon, BSDCan, Ottawa Developer Summit, vBSDCon, Santa Clara Vendor/Developer Summit, Cambridge FreeBSD Developer Summit, and EuroBSDCon.
- Awarded travel grants to 22 FreeBSD contributors to attend 9 conferences/summits around the world to connect face-to-face with other FreeBSD people to work on projects, attend informative presentations to help further their involvement in FreeBSD, promote FreeBSD at non-BSD conferences, and share their work with others.
- Attended and sponsored non-BSD conferences, such as the Grace Hopper Conference, womENcourage, OSCON, SNIA and USENIX LISA to promote FreeBSD, educate people on FreeBSD, and recruit new people to the Project.

- Funded education projects to teach and provide curriculum for FreeBSD classes from middle school to graduate level university classes.
- Funded and supported a professionally produced, high-quality, informative FreeBSD magazine, that has over 11,000 subscribers.
- Advocated for FreeBSD by providing FreeBSD literature for all levels of users, to be handed out at conferences and events around the world.
- Provided legal support for the Project and continued protecting the FreeBSD trademarks and IP.

We believe this support is imperative for improving the operating system, recruiting more people to the project, increasing the number of companies using FreeBSD internally and in their products, offering operating systems classes that include FreeBSD, and performing more research on and with FreeBSD.

We need your help, more than ever, to continue supporting FreeBSD.

Please make a donation today. Thank you for your continued support!

-- *contributed by Deb Goodkin*