FreeBSD 10 - Powerful Virtualization Solutions

FreeBSD pioneered operating system-level virtualization with the Jail facility in 2000. This early innovation in virtualization forged a path for similar technologies such as Solaris Zones (2005) and Linux Containers/Docker (2014).

FreeBSD 10 includes several virtualization technologies, providing users with greater flexibility for provisioning a virtualized solution that matches their workflow. These solutions include:

- The BSD Hypervisor, bhyve(8). This Type-2 hypervisor supports a number of guests, including FreeBSD, OpenBSD, NetBSD and many Linux® distributions. Combining bhyve and ZFS volumes enables powerful capabilities in provisioning, snapshotting and rolling back virtual machines.
- Support for VirtIO, the paravirtualization interface developed for the Linux Kernel-based Virtual Machine (KVM). FreeBSD's virtio(4) driver provides a BSD-licensed, clean-room implementation and provides disk I/O, network I/O, memory ballooning, and PCI. It has been tested with the Qemu, KVM, VirtualBox, and bhyve hypervisors.
- Paravirtualized drivers that support Microsoft Hyper-V.
- VMware VMXNET3 Virtual Interface Controller device, vmx(4), provides support for the VMXNET3 virtual NIC available in virtual machines by VMware. This driver supports the VMXNET3 driver protocol and is optimized for the virtual machine, providing features such as multiqueue support, IPv6 checksum offloading, MSI/MSI-X support and hardware VLAN tagging in VMware's VLAN Guest Tagging mode.
- Xen PVHVM virtualization.
- In addition to these virtualization technologies, there is official cloud support for Amazon EC2, Microsoft Azure, and Vagrant/ Hashicorp Atlas, Google Compute Engine, and unofficial support for Openstack.

"The FreeBSD 10 branch of releases build upon the stability of FreeBSD 9, adding a number of high profile enhancements and features to help support the needs of our growing number of users such as Netflix, WhatsApp, Juniper, Yahoo Inc, NetApp, and many more. The releases would not be possible without the hard work of hundreds of people"

— Glen Barber, Release Engineer
The FreeBSD Project

FreeBSD 10 - ARM-Ready

FreeBSD continues to improve its support for the ARM family of processors, including support for ARMv6 and ARMv7, SMP, and thread-local storage (TLS). Supported processors include:

- CHROMEBOOK (Samsung Exynos 5250)
- COLIBRI (Freescale Vybrid)
- COSMIC (Freescale Vybrid)
- Genesi Efika MX SmartBook and SmartTop (Freescale i.MX515)*
- IMX53-QSB (Freescale i.MX53)
- QUARTZ (Freescale Vybrid)
- RADXA (Rockchip rk30xx)
- WANDBOARD (Freescale i.MX6)
- BEAGLEBONE
- PANDABOARD
- ZEDBOARD
- Raspberry PI
- MV78x60
- OMAP4
- Exynos 5420 Octa
- Toradex Apalis i.MX6

Superpages support on ARM has been added which provides improved performance and scalability by allowing TLB translations to dynamically cover large physical memory regions. This provides a superpages management mechanism roughly equivalent to FreeBSD's i386 and amd64 architectures. All ARMv6 and ARMv7-based platforms can take advantage of this feature.*

The FreeBSD Foundation is collaborating with Cavium Inc. to develop the FreeBSD ARMv8 reference design and implementation based on the ThunderX™ workload optimized processor family.

FreeBSD 10 - Modern Hardware Support

New console driver, vt(4), provides multiple virtual terminals with an extensive feature set. It includes support for UTF-8, double-wide characters, Asian character sets, graphics-mode consoles, and integration with Kernel Mode Setting (KMS) video drivers for switching between the X Window System and virtual terminals.*

FreeBSD 10 adds Unified Extensible Firmware Interface (UEFI) boot loader support. The root file system may be UFS or ZFS, and the loader supports multiple ZFS boot environments *

The Open Fabrics Enterprise Distribution (OFED) and OFED Infiniband core version provides parity with Linux, including Mellanox drivers for 56Gb Infiniband.

The nvme(4) driver provides NVM Express support. NVM Express is an optimized register interface, command set and feature set of PCI Express (PCIe)-based Solid-State Drives (SSDs).

10.x

A complete list of the features in the current release is available on the web at
http://www.freebsd.org/releases

FreeBSD FOUNDATION

FreeBSD 10 – Continuing to Innovate

Capsicum has been enabled in the kernel by default, allowing sandboxing of several programs, such as tcpdump, that work within the capability mode. Capsicum is a lightweight framework for providing privilege separation that dramatically reduces the avenues available to security exploits and limits the capabilities of attackers.

The **built-in netmap(4) framework** provides high-performance, direct-to-hardware packet I/O. It offers low latency and high packet per second rates to userland applications while bypassing any kernel-side packet processing. With netmap(4), it is trivial to fully saturate a 10 Gbps network interface with minimal packet sizes, making FreeBSD an ideal platform for building extremely fast traffic generators, monitors, software switches, and network middleboxes, for interconnecting virtual machines or processes, and for performance testing of high speed networking applications without the need for expensive hardware.

A **native in-kernel iSCSI stack**, which includes both the target and initiator, provides the high performance and reliability required by enterprise deployments. The iSCSI initiator supports redirection handling when an iSCSI device is configured with multiple IP addresses across different network interfaces without the need for additional client-side configuration. The iSCSI ctld(8) daemon supports restricted access based on hostnames and IP addresses.

The use of **unmapped I/O** greatly reduces latency and increases I/O scalability on many-CPU machines. It improves performance by avoiding mapping buffers in the buffer cache, significantly reducing overhead on multi-processor systems. Performance tests indicate a reduction of up to 25-30% of system time on I/O intensive workloads.*

Support for the **UDP-Lite protocol (RFC 3828)** has been added to the IPv4 and IPv6 networking stacks.

The **new filesystem automount facility**, **autofs(5)**, similar to that found in other UNIX®-like operating systems, such as OS X™ and Solaris™, and provides LDAP integration. It uses a Sun™-compatible configuration file and is administered with the automount(8) userland utility, and the automountd(8) and autounmountd(8) daemons.

The **maximum addressable memory on 64-bit systems has been increased** to 4TB.

About the FreeBSD Project

FreeBSD provides a modern operating system that is *up-to-date* and *scalable*, offers *high-performance*, *security*, and *advanced networking*. Use it for personal workstations, Internet servers, embedded devices, routers, and firewalls. The FreeBSD packages collection includes popular software like: *Apache web server, GNOME, KDE, X.org, Python, Firefox and nearly 26,000 software applications*. FreeBSD is online at www.FreeBSD.org.

About the FreeBSD Foundation

A 501(c)(3) non-profit organization dedicated to supporting and promoting the FreeBSD Project and community, the Foundation gratefully accepts donations from individuals and businesses. Donations are used to fund and manage *projects* and *developer summits*, sponsor *FreeBSD events*, and provide *travel grants* to FreeBSD developers. The Foundation also represents the FreeBSD Project in executing contracts, license agreements, and other legal arrangements that require a recognized legal entity.

The FreeBSD Foundation is entirely supported by donations. More information is online at www.FreeBSDFoundation.org.

* Starred items in this brochure indicate features of FreeBSD whose development has been funded in part by The Foundation.

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