svn update by Glen Barber

The FreeBSD 10-RELEASE cycle is in high gear, and with 9.2-RELEASE officially available, 10 is the primary focus of the Release Engineering team.

In addition to bug fixes and stability enhancements, FreeBSD 10-RELEASE will contain a number of exciting new features.

VIRTIO SUPPORT

WITH VIRTUAL MACHINES, the hypervisor would traditionally emulate real, physical devices to provide to the virtual machine. Emulating the raw device was often inefficient, and would often result in an input/output performance penalty within the virtualized environment.

VirtIO is a specification for paravirtualized input/output devices in a virtual machine. The VirtIO module proivides a shared memory transport between the virtual machine and the hypervisor. This shared memory transport is called the "virtqueue."

The VirtIO PCI driver creates an emulated PCI device that is then made available to the virtual machine. The emulated PCI devices use the virtqueue to directly access memory allocated to the device, resulting in a performance gain within the virtualized environment.

VirtIO was originally developed for the Linux KVM, but has since been adapted to other virtual machine hypervisors, such as BHyVe, VirtualBox, and Qemu.

VirtIO support was **added** in revision (Link: r227652).

BHyVe

BHyVe IS THE BSD Hypervisor, developed by Peter Grehan and Neel Natu. The design goal of BHyVe is to offer a lightweight paravirtualization environment on FreeBSD.

BHyVe requires Intel CPUs with VT-x and Extended Page Table (EPT) support. These features are on all Nehalem CPUs and newer, but not available on Atom CPUs.

BHyVe appeared in FreeBSD 10-CURRENT in revision (Link: r245652).

RDRAND

RDRAND is the Intel CPU instruction set used to access the hardware random number generator.

Software random number generators use seeded entropy obtained from various sources. For example, Ethernet interfaces and software interrupts handlers can be used as sources for entropy to seed random number generation.

Hardware random number generators gather their entropy through physical means, such as thermal "noise" within the device. By using such unpredictable physical entropy sources, the hardware random number generator can gather a higher level of randomness, which, in turn, means a greater possibility of truly random numbers. Having the device directly on the CPU reduces the need for an additional hardware device to be added to the system.

The Intel random number generator is available on the "Bull Mountain" CPU, and present on Ivy Bridge and newer.

The rdrand driver was **added** to FreeBSD 10-CURRENT in revision (Link: r240135).

MULTI-PROCESSOR SUPPORT IN PF

SINCE ORIGINALLY being imported from OpenBSD, one of the performance limitations of PF (Packet Filter) was that it could only run bound to a single CPU. This meant that on multi-processor systems, PF could not take advantage of the additional CPUs, which means that PF would not necessarily show any performance gain when run on 2- or 24- core machines.

Work done on FreeBSD 10-CURRENT introduces multi-processor support to PF, which introduces fine-grain locking support. This allows PF to take advantage of multiple CPUs on the system, which significantly improves performance.

Multi-processor support for PF was introduced in revision (Link: r240233).

The pf firewall, originally from OpenBSD, got **upgraded** to support fine-grain locking and better utilization on multi-cpu machines, which allows it to perform significantly faster.

UNMAPPED IO IN DISK DRIVERS

The FreeBSD kernel maps I/O buffers in the kernel page table. On multi-core systems, the mapping must be flushed on all TLBs (translation lookaside buffers) due to this global mapping. When the number of cores on the system increases, there is a performance bottleneck, since during buffer creation and destruction, the

initiating thread must wait for all other cores on the system to execute.

FreeBSD 10 introduces unmapped I/O buffers, which eliminate the need to perform translation lookaside buffer shootdown for buffer creation and destruction, eliminating up to 30% of system time on I/O-intensive workloads.

Unmapped I/O support was initially **introduced in revision** (Link:r248508) for the ahci(4) and md(4) drivers. Support for additional drivers followed in subsequent revisions.

RASPBERRY PI AND BEAGLEBONE SUPPORT

FreeBSD 10 runs on the Raspberry Pi, BeagleBone, and several other embedded platforms. Although the FreeBSD Project does not yet provide official images for these platforms, several sets of tools exist to create images that can be written to compact flash cards.

One of these tools is "Crochet", which can be used to build images for Raspberry Pi, BeagleBone, and a number of other platforms. Crochet can be found here (Link: https://github.com/kientzle/crochet-freebsd).

Raspberry Pi support was **introduced in revision** (Link: r239922).

CLANG AS THE DEFAULT COMPILER

GCC is no longer part of the default base system on most architectures. The FreeBSD Project has switched from GCC to CLANG as the default compiler. This provides FreeBSD with a more modern, actively-developed default compiler.

Although GCC is not built by default, it is still available in the FreeBSD 10 base system.

The **change** to disable GCC by default was concluded with revision (Link: r255348).

As a hobbyist, Glen Barber became heavily involved with the FreeBSD project around 2007. Since then, he has been involved with various functions, and his latest roles have allowed him to focus on systems administration and release engineering in the Project. Glen lives in Pennsylvania, USA.