

FreeBSD on ARM64

Michael Dexter

editor@callfortesting.org

bsd.network/@dexter

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Made with LibreOffice on FreeBSD 14.1

Introduction: Michael Dexter

Locally: Portland Linux/Unix Group co-organizer since 2009

Globally: Familiar presenter at AsiaBSDCon, BSDCan, EuroBSDcon, Storage Developer Summit...

\$day_job: Enterprise storage support using Free Software

Other: Oregon Latvian Society Board Member and A/V guy

Previous: Neighborhood SWNI Association President & Chair

Phones and Drawers of Raspberry Pi's, Right?

ARM64

That Thing From the 1990's?

FreeBSD

Fast Forward to Today... ARM64

Server-Side

The leading AMD64/x86_x64 architecture alternative
Licensed, but not Free and Open

Mobile/Embedded-Side

The majority of handheld devices
Countless embedded systems
Countless small boards

Fast Forward to Today... ARM64

Server-Side and Mobile/Embedded-Side

Together...

A cat video super tubeline!

Fast Forward to Today... ARM64

Server-Side and Mobile/Embedded-Side

Unfortunately, these extremes represent
quite the bathtub curve...

Fast Forward to Today... ARM64

Filling the Bathtub...

There a trail of tears of fruit boards and desktop attempts

Raspberry Pi! Orange Pi! Banana Pi! Rock This! Rock That!

I reserve the right to not like device tree & u-boot acrobatics

Several are surviving but *whoops...*

Fast Forward to Today... ARM64

Filling the Bathtub...

The Raspberry Pi business model
was not ready for lockdown!

They went from being available in a
PSU vending machine to *all the money!*

Fast Forward to Today... ARM64

Filling the Bathtub...

Just give me a Mini-ITX board with an Intel NIC & a PCIe slot!

SolidRun HONEYCOMB LX2 at \$919 PCIe!

Radxa Rock 5 ITX at \$160

OverDrive 1000 \$600

Firefly ITX-3588J \$500

Conclusive WHLE-LS1

Fast Forward to Today... ARM64

Filling the Bathtub...

Interesting but increasingly unobtainium!

The Lenovo ThinkPad X13s “Snapdragon”

Windows Dev Kit 2023

This *REALLY* should not be this difficult.
If there aren't three or more available on eBay...

Fast Forward to Today... ARM64

Filling the Bathtub...

In all practicality...

Proprietary!

Apple dominates the middle ground

Thank you Asahi Linux and UTM!

OpenBSD/NetBSD: “Use the Asahi installer...”

Fast Forward to Today... ARM64

As for me?

A donated OverDrive 1000

A donated ThunderX

Some Fruit Boards

Looking at the Orange Pi 5 Plus, Nano Pi, and Rock 5 ITX

Donations Welcome!

Fast Forward to Today... ARM64

THE CROSSROADS

UEFI and GICv3

Fast Forward to Today... FreeBSD

Where to start?

Together with OpenBSD...

The universal donor operating systems

Are there any OpenSSH users in the building?

Fast Forward to Today... FreeBSD

Those cat videos all travel through BSD TCP/IP Stacks

Those systems are all managed with OpenSSH

Nearly every mobile device contains BSD code

**Netflix pushes up to 40% of US evening
Internet traffic using FreeBSD**

Fast Forward to Today... FreeBSD

NOPE **BSD is not Dying**

Most BSD projects are backed by
public-benefit non-profit organizations

and...

www.takeitoffpdx.com can remove that CentOS tattoo!

FreeBSD is...

A feature-rich, permissively-licensed,
general-purpose operating system...

That runs on ARM64!

FreeBSD Features

- Unified Sources: Base, Ports, Docs
 - Install media/VMs with three commands
- Fast, Definitive TCP/IP Stack
- Unified IPv4/IPv6 Stack
- VNET and Netgraph Virtual Networking Stacks
- PF and IPFW Packet Filters/Firewalls

FreeBSD Features

- Unified, Flexible Storage Stack and Utilities
- Definitive Overwriting File System (UFS)
- Definitive Copy on Write File System (OpenZFS)
- The Only OS to Ship with OpenZFS
- DTrace Tracing
- Growing libxo coverage for output like JSON
- CTRL-T

FreeBSD Features

- Definitive Containers (Jails)
- bhyve (“beehive”) Hypervisor
- Xen Hypervisor

Note my dozen more talks on these...
Catch me afterwards

FreeBSD: OpenZFS

“The last word in file systems”

Flexible, Fast, Scalable...

No Snark: Do you care about your data?

FreeBSD: Permissively Licensed Copyrighted

Only time will tell what license will ultimately
deliver the most software freedom
but in the mean time...

I will never understand
freedom through restrictions

FreeBSD: Permissively Licensed Copyrighted

It is self-defeating not to give back

The Permissive License Proprietization Curse

callfortesting.org/curse/

FreeBSD: Permissively Licensed Copyrighted

FreeBSD is also the basis of

TrueNAS CORE, pfSense, and OPNsense

The #1 “Linux” appliances that aren’t GNU/Linux
(Though TrueNAS is experimenting with GNU/Linux)

You can build TrueNAS CORE and OPNsense!

Exemplary GPL-compliance...

despite zero obligation to do so

FreeBSD on ARM64

That all said...

FreeBSD/ARM arrived in 2005 in 6.0

FreeBSD/ARM64 arrived in 2016 in 11.0

Tier-1 Architecture since 2021 and 13.0

FreeBSD on ARM64

Good Fruit Board Support...

Clear Focus on Cavium/Ampere

Most UEFI Systems “Just work”

FreeBSD on ARM64

Thinking back to the bathtub curve...

GENERIC 32/64-bit Images

Pine64, Pinebook, Rock64, RockPro64,
Raspberry Pi, dozens of u-boot packages

FreeBSD on ARM64

About that GICv3...

The Generic Interrupt Controller

Hardware-Assisted Virtualization

FreeBSD on ARM64

Stuff just got real

FreeBSD on ARM64: Value Proposition

Why Big Iron ARM64?

+/- 20% Power Savings

Up to 192 Cores per Socket

FreeBSD on ARM64: Value Proposition

Zero obligation to emulate a 1980 PC

GNU/Linux/illumos distros and the BSDs
do not carry that baggage

FreeBSD on ARM64: Value Proposition

No Core Scarcity and No Hyper-threading

Pin Everything

Pin a hardware core to each storage and networking device...

FreeBSD on ARM64: Value Proposition

Pin hardware cores to Virtual Machines

Predictable Performance

Quality of Service Guarantees

Wait, we can afford that?

FreeBSD on ARM64: Value Proposition

bhyve on ARM64

Just became usable in 15.0-CURRENT

Limited to 16 vCPUs per VM

No PCI Pass-Through (PPT) yet...

FreeBSD on ARM64: Value Proposition

bhyve on ARM64

The Asahi Linux folks say the M2 and onward CPUs support nested virtualization

Proprietary macOS 15 supports it on an M3

FreeBSD on ARM64: Value Proposition

bhyve on ARM64

asdf

NOTES

Note how they collide/intersect

Squeeze in OccamBSD/Imagine to showcase?
Virtualize Pfsense OPNsense



Thank You! ❤️

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