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OSF on Intel Xeon processor-
based Servers from Blueprint to
Production Quality

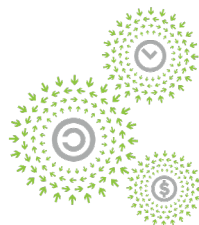


NOVEMBER 9-10, 2021

OSF on Intel Xeon processor-based Servers from Blueprint to Production Quality

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Jonathan Zhang, Software Engineer, Meta

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Includes the effect of Intel Thermal Velocity Boost, a feature that opportunistically and automatically increases clock frequency above single-core and multi-core Intel Turbo Boost Technology frequencies based on how much the processor is operating below its maximum temperature and whether turbo power budget is available. The frequency gain and duration is dependent on the workload, capabilities of the processor and the processor cooling solution.

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Agenda

- The path till today
- How did we get here
- Benefits demonstrated
- Next steps



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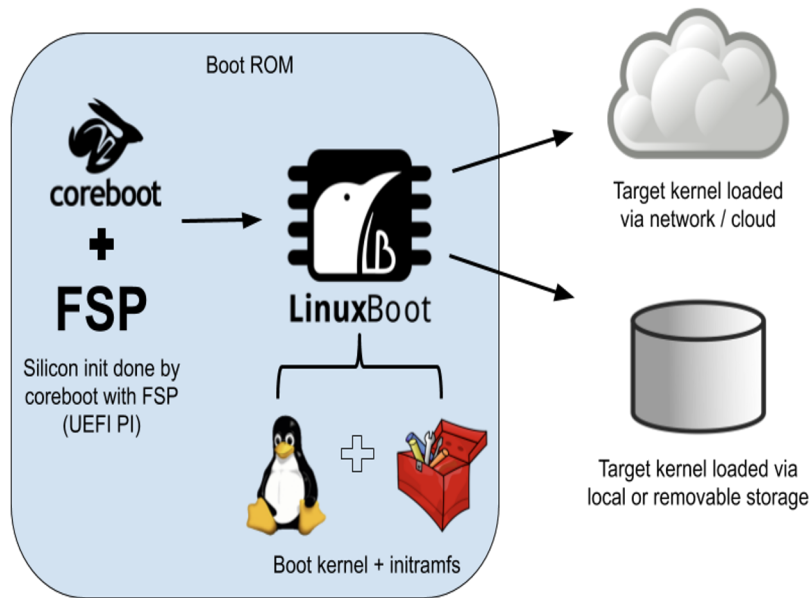


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The OSF and Xeon-SP



(Tux the penguin: lewing@isc.tamu.edu)

(LinuxBoot logo: <https://www.linuxboot.org/page/artwork/>)

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The Path

OCP Server	Xeon Server Processor	FSP Status	Work Duration	Test Pass Rate
TiogaPass	SkyLake - SP	Prototype	Jan. 2019 - Feb. 2020	38%
DeltaLake	CooperLake - SP	Statement Of Work	Mar. 2020 - July 2021	95%
Next Generation single socket server	SapphireRapids - SP (SPR-SP)	Included in Intel Reference Platform BIOS	Jan. 2021 on-going	Trending better than DeltaLake

- **Single** coreboot code base: <https://review.coreboot.org/>
- **Single** LinuxBoot kernel code base: <https://www.kernel.org/>
- **Single** LinuxBoot initramfs code base: <https://github.com/u-root/u-root/>

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The Lookback



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	2018	2021
FSP	No FSP for Xeon-SP	FSP for SPR-SP is POR
coreboot	No support for Xeon-SP and server features	Support for Xeon-SP and server features is mature
LinuxBoot	No support for bootloader	bootloader technology is mature
Ecosystem	Not exist	Industry coalition formed to collaborate on OSF for Xeon-SP; Partial stack deployed by multiple hyperscalers, some deployments are at scale

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2019

- Open System Firmware from scratch
- OCP regional summit 2019
- Jonathan Zhang / David Hendricks




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**OCP**
REGIONAL
SUMMIT

Open. Together.

Agenda

- **What is FB doing? Why?**
- The build system design
- How do we enable our partners and the community?



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2020

- Xeon-SP FSP and coreboot status update
- OCP global virtual summit 2020
- Anjaneya Reddy Chagam, Intel
- Jonathan Zhang, Meta

Agenda

- Facebook Open System Firmware
- Intel® Firmware Support Package (FSP) Overview
- coreboot Xeon SP (SKX & CPX) FSP status
- Summary and Next Steps
- Demo

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2020

- OCP SErver Feature Development with coreboot/Linuxboot
- OCP global virtual summit 2020
- Jonathan Zhang, Meta
- Johnny Lin, Wiwynn

Agenda

- Overview
- Server Features and Designs
- Call to Action

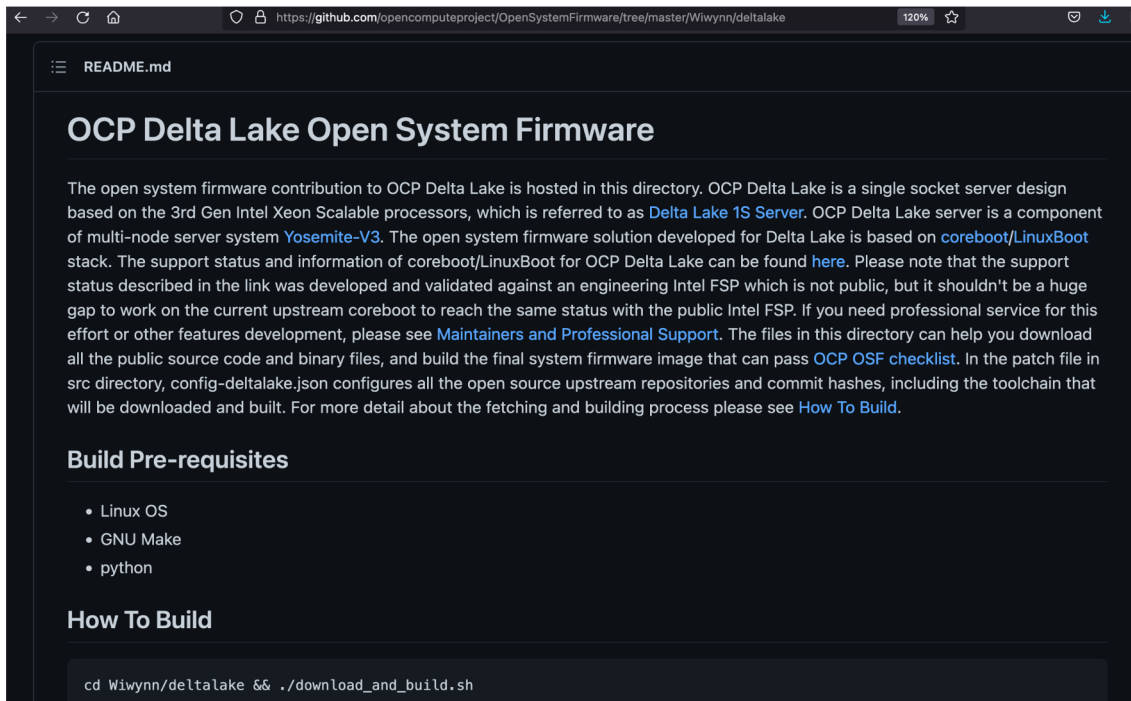
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2021



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ACCEPTED™

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2021

DeltaLake As OCP Accepted:

Open Hardware + Open Firmware =

Happier OCP Community



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Intel Firmware Support Package (FSP)

- FSP spec publicly available
- Distributed as binary after platform launch
 - CooperLake/IceLake Xeon Processor FSP binaries available now on Intel github
- Well defined interfaces for boot loader integration (e.g., coreboot)
 - OCP Tioga Pass (Skylake-SP), DeltaLake (CooperLake-SP) coreboot firmware available now
- Binary customization
- Unmet needs that require focus
 - RAS support using Standalone MM



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Upstream First

- Use one code base for all platform
- Insist quality code update
- Uphold the design philosophy and architecture
- Fill in gaps:
 - coreboot -- Xeon-SP split IIO, RAS, CBnT, BMC interaction, configuration management etc.
 - u-root -- bootloader and tools (system boot)
 - Test harness:
<https://github.com/facebookincubator/contest>
 - Build system:
<https://github.com/facebookincubator/osf-builder/>

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Ecosystem

- Solve industry problems
 - OSF for MonoLake serving circular economy
 - OSF for DeltaLake enabling OCP adoption
- Form industry coalition
 - No reinventing the wheel
 - Collaborating on design, debug and code review on technologies of common interest



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Test, Test, Test

- Power/Performance
- Register level check: Intel self test tool
- Industry standard tests: FTWS
- Solution level tests: tests from OS, from OpenBMC
- Stress tests



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New technology Development

- End to end solution involves more than host firmware
 - Hardware (Silicon, platform)
 - Host firmware
 - kernel/OS
 - Device Firmware
 - Infrastructure
- Distributed knowledge
 - Hype-scaler: solution level requirement
 - Silicon Vendor: processor internal
 - Device Vendor
 - Server Vendor

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OSF enables shorter
TTM for new technology



Case study: CXL Memory Device

- **Challenge**

For CXL memory device with externally attached DIMM, how to populate smbios tables?

- **Reality**

- The CXL spec does not provide a way for CXL device to communicate this to host
- This is not part of silicon initialization

- **Conclusion**

- OSF to provide reference implementation

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Server Platform Development

- Coreboot makes it easier to debug issues in other components
 - Hardware design
 - Other firmware components
- Linuxboot enables easier debugging of kernel related issues.

OSF architecture helps with quality server platform development

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New Server Development

- **Engineering philosophy**

- Single code base
 - for different platform (such as multiple generations of Xeon-SP processors)
 - among partners
- Partner/Community collaboration
 - Bug fixes
 - New features
 - Code review

- **Benefits**

- Lowered development cost
- Better quality

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Sustaining

- Linux engineer as firmware engineer
- One set of device driver for both target OS and firmware → improved quality and security
- One set of infrastructure tools for both target OS and firmware → simplified infrastructure tools
- Open code base instead of closed code base

OSF reduces problem surfaces
and enables faster problem
solving

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Next Steps

- Technology
 - Follower → **Leader**
- Ecosystem
 - Production Ready → **Industry Adoption**

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Call to Action

- **Join us in this transformation**

- OCP OSF project:

<https://www.opencompute.org/projects/open-system-firmware>

- Open source communities:

- coreboot: <https://www.coreboot.org/>
- Linuxboot: <https://www.linuxboot.org/>
- contest: <https://github.com/facebookincubator/contest>
- osf-builder: <https://github.com/linuxboot/osf-builder/>

- **Benefit from OSF powered solution**

- OCP for OCP DeltaLake Server:

<https://github.com/opencomputeproject/OpenSystemFirmware/tree/master/Wiwynn>

- OCP MonoLake Server:

<https://review.coreboot.org/c/coreboot/+/-/57561>



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Open Discussion



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GLOBAL
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