



# Open. Together.

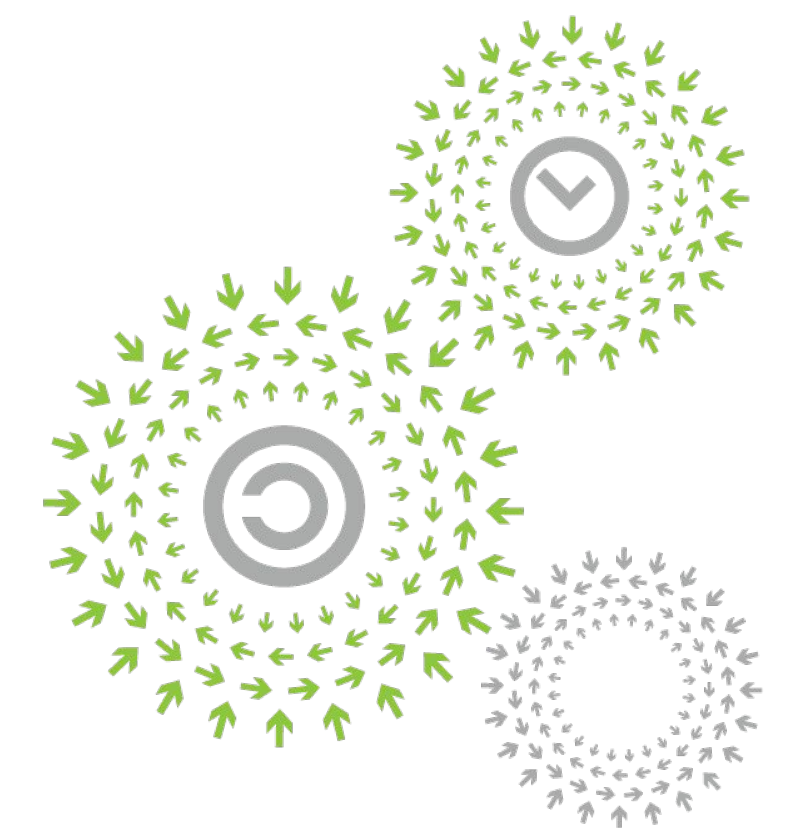


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Networking:Software

# Architecture and Design of Open Network Linux

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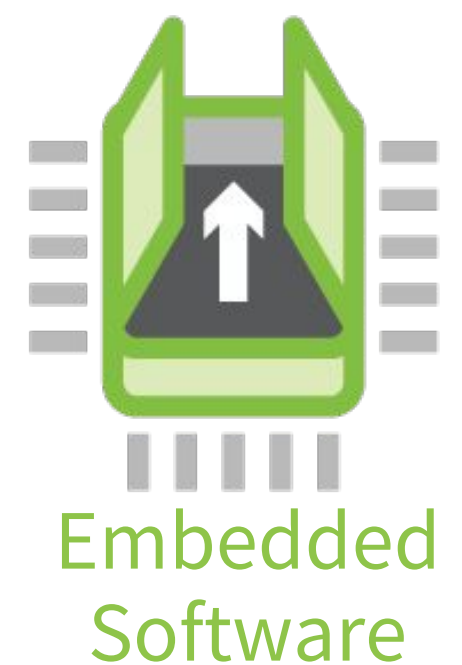
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# What is Open Network Linux?



NETWORKING

Open Network Linux (ONL) is an open-source, foundational platform software layer for next-generation, modular NOS architecture on open networking hardware. Networking solutions based on ONL are delivering speed, freedom and economics and have now been adopted by hundreds of data center organizations, across hyperscalers, service providers, mainstream enterprises, and SaaS/cloud providers.



# Thanks for the marketing. Really, what is it?

- ONL is a Linux distribution and development platform designed for and tested on OCP/Open Networking Hardware
- It provides the starting point for developing and deploying a Network Operating System.
- Open Network Linux is an OCP Networking Subproject and is the reference Network Operating System for the Open Compute Project
- 120 Platforms and Growing

# ONL Basic Design Goals

- Multiple Architecture Support
  - X86\_64, PowerPC, ARM32, ARM64
- Stateful and Stateless Management Models
- Polymorphic Platform Support
- Brandable and Customization
- Designed from the beginning as an extensive base layer for building other NOS

# The Anatomy of an ONL NOS

- Linux Kernel
- The Loader Initrd
- A Debian-based userland
- The ONL Platform APIs

# ONL Kernels

- ONL Kernels start with an LTS kernel release.
  - Currently 3.16, 4.9, or 4.14
- Kernel patches are applied only when necessary to satisfy the requirements of ON custom hardware or SOCs
  - Any source or configuration changes to ONL kernels may affect multiple platforms and are both discouraged and scrutinized
- The LTS base is advanced with released patch levels

# ONL Platform Kernel Modules

- Kernel drivers for a specific platform must be developed as loadable modules only
  - Platform kernel modules are segregated and loaded only for the the platform or platforms for which they are intended



# The Loader

- The ONL Loader is a traditional initrd environment designed to support NOS selection based on preferred deployment criteria
  - Locally installed filesystems
  - Locally installed Switch Images (more later)
  - Downloaded Switch Images
- The Loader decides what and how the system should be started.

# The Root Filesystem

- The base of the ONL root filesystem is a selectable Debian distribution.
  - Built using a combination of multistrap and custom tools
- The debian prebuilt package repositories are combined with custom ONL system packages and your own software to produce your base Network Operating System

# Deployment Models

- ONL Systems can be constructed and deployed via two different operational models
  - Stateful/Traditional
  - Stateless

# Traditional Installation

- The root filesystem is installed on local persistent media
- The system is managed like a “normal” distribution.
  - Configuration changes are permanent.
  - Packages can be installed or removed at will.

# Deployment via Switch Images

- The ONL system can be built into a self-contained Switch Image (SWI)
  - SWIs are entire root filesystems contained in a squashfs format.
  - An overlayfs is used in conjunction with the squashfs to provide a read/write root filesystem that is present only in memory.

# The Advantage of the Switch Image

- All switches start in the same state.
- Upgrading or Rollback is as simple as selecting a different SWI
- SWIs can be delivered dynamically via the network
- Modification errors are non-destructive and won't brick your switch.
- Easily supports centralized fleet management.

# The ONL Platform APIs

- Switches have some very specific hardware that requires special knowledge to operate.
  - CPLDs with custom registers and features
  - A variety of I2C bus trees for accessing fans, thermals, PSUs, and SFPs
- All of these concepts are present on each platform but each one is different.

# Polymorphic Platform Support

- The ONL Platform APIs provide a common application framework for discovering, interrogating, and operating all FRUs and SFPs on any platform.
- Applications written to the ONL Platform APIs are dynamically portable across all supported platforms.



# The ONL Build Environment

- The ONL build environment is delivered as a preconfigured Docker container with all toolchains, cross compilers, and necessary dev packages for building each architecture and debian distribution.

# ONL Resources

- ONL on Github
  - <https://github.com/opencomputeproject/OpenNetworkLinux>
- ONL Documentation
  - <http://opencomputeproject.github.io/OpenNetworkLinux/>
- ONL Homepage
  - <http://opennetlinux.org/>
- The ONL Platform HCL
  - <http://opennetlinux.org/hcl>
- The ONL OCP Wiki
  - <https://www.opencompute.org/wiki/Networking/ONL>
- Additional Collateral
  - <https://www.bigswitch.com/solutions/technology/open-network-linux>



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