

OpenPOWER Ready™

Definition and Criteria

Workgroup Notes

Revision 1.0 (March 29, 2016)



www.openpowerfoundation.org

OpenPOWER Ready™: Definition and Criteria

Revision 1.0 (March 29, 2016)

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Abstract

OpenPOWER Ready™ is a mark used by the OpenPOWER Foundation to enable OpenPOWER ecosystem product developers to indicate that a product has been shown / demonstrated to meet a minimum set of characteristics and should be interoperable with other OpenPOWER Ready products. This document defines the meaning of OpenPOWER Ready™ and its different forms: OpenPOWER Ready™ IO Adapter, OpenPOWER Ready™ System, OpenPOWER Ready™ CAPI Accelerator, OpenPOWER Ready™ Operating System, OpenPOWER Ready™ Application, OpenPOWER Ready™ System Support Components.

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Preface

1. Conventions

The OpenPOWER Foundation documentation uses several typesetting conventions.

Notices

Notices take these forms:



Note

A handy tip or reminder.



Important

Something you must be aware of before proceeding.



Warning

Critical information about the risk of data loss or security issues.

Command prompts

\$ prompt Any user, including the root user, can run commands that are prefixed with the \$ prompt.

prompt The root user must run commands that are prefixed with the # prompt. You can also prefix these commands with the **sudo** command, if available, to run them.

2. Document change history

This version of the guide replaces and obsoletes all earlier versions.

The following table describes the most recent changes:

| Revision Date | Summary of Changes |
|------------------|---|
| March 25, 2016 | <ul style="list-style-type: none"> Rev 1.0 - Approval version Cleaned URLs |
| March 23, 2016 | <ul style="list-style-type: none"> Rev 0.12 Removed 2016 from title. Added link to TMLA text Added links to request document templates modified section 1.6 Scope |
| March 4, 2016 | <ul style="list-style-type: none"> 2016 Rev 0.10 Updated intro to encourage broad participation. 2016 Rev 0.9 Updated system OS criteria |
| March 3, 2016 | <ul style="list-style-type: none"> Change title to 2016 and change rev to 0.8 Added trademark symbols Removed "OpenPOWER Intention" Added additional miscellaneous category |
| February 2, 2016 | <ul style="list-style-type: none"> Many changes from review of 0.0.6 |

| Revision Date | Summary of Changes |
|----------------------|---|
| January 27, 2016 | <ul style="list-style-type: none">• Many changes from review of 0.0.5 by WGs and BOD |
| January 20, 2016 | <ul style="list-style-type: none">• Added OpenPOWER Ready Graphics |
| January 15, 2016 | <ul style="list-style-type: none">• Added SW chapter• Updated CAPI chapter per Accelerator WG Feedback• Added more details on intent and process in intro.• Added references into IO chapter. |
| December 8, 2015 | <ul style="list-style-type: none">• Added more details on intent and process in intro.• Added chapter on OpenPOWER Ready CAPI.• Fixed improper abbreviations of OpenPOWER Foundation, OpenPOWER Ready, and OpenPOWER Intent |
| October 3, 2015 | <ul style="list-style-type: none">• Initial draft based on input from OPIO and DEVPLAT Workgroup |

1. Introduction

OpenPOWER Ready™ is a mark used by the OpenPOWER Foundation to enable OpenPOWER ecosystem product developers to indicate that a product has been shown / demonstrated to meet a minimum set of characteristics and should be interoperable with other OpenPOWER Ready products. This document defines the meaning of OpenPOWER Ready™ and its different forms: OpenPOWER Ready™ IO Adapter, OpenPOWER Ready™ System, OpenPOWER Ready™ CAPI Accelerator, OpenPOWER Ready™ Operating System, OpenPOWER Ready™ Application, OpenPOWER Ready™ System Support Components.

OpenPOWER ecosystem participants who have items or products they are interested in marking should follow the appropriate criteria described below. Other elements of the entire OpenPOWER platform solution which do not fit into the current criteria are all invited to self-confirm and deploy the OpenPOWER Ready badge.

Solution components receiving license to display the OpenPOWER Ready mark will be listed on the [OpenPOWER Foundation website](#) unless exclusion is requested by the developer.

1.1. OpenPOWER Ready™ Mark

The OpenPOWER Foundation has established OpenPOWER Ready™ as a special badge or mark used by an OpenPOWER ecosystem component producer/developer to attest that a specific component has been shown to satisfy the criteria defined in a specific version of this document. The criteria has been defined to increase the likelihood components bearing the mark are compatible.

The mark is available for any entity interested in providing components/products to the OpenPOWER ecosystem. Combined with an OpenPOWER Foundation membership, companies and other entities can make a strong statement about their support of the OpenPOWER technology as an alternative to other server solutions. Entities providing products that are OpenPOWER Ready are encouraged to join the OpenPOWER Foundation.

Figure 1.1. OpenPOWER Ready Mark with Black Background



Figure 1.2. OpenPOWER Ready Mark with White Background



1.2. Demonstrating OpenPOWER Ready

An entity desiring to demonstrate a product or solution satisfies the respective criteria may do so in one of the following ways:

- Self assessment.
- Third Party assessment.
- Attend OpenPOWER PlugFest.

The OpenPOWER Foundation may sponsor OpenPOWER Plugfests to provide a convenient forum for companies to meet and demonstrate compatability and interoperability.

1.3. Requesting License to Display the OpenPOWER Ready Mark

Evidence that the criteria are met must be provided by the requesting entity.

This information will be provided in a pdf file named in the following way:

OPR_company_product_yr-mon-day.pdf

The pdf file shall be submitted via email to *ready@openpowerfoundation.org*.

The *Subject:* of the email shall be *OpenPOWER Ready Request: product designator* where *product designator* is the "Product / Component Designator" above.

Request File Format

Each entity requesting a license authorizing a product or component to carry the OpenPOWER Ready mark must provide to the OpenPOWER Foundation the following information regarding the specific product or component:

- Owner (Company, entity)
- Contact Name
- Contact email address
- Submission Date

- Product / Component Designator (unique name or label)
- Short product / component description
- Tag string (comma separated) describing keywords, attributes, and tags for enhancing search results.
- Product / component information URL
- Image / graphic for inclusion with the description - Optional. In addition to including this image in the request pdf file a separate jpeg or png file included in the request email will make the creation of the request record in the list database simpler.

- Version of this OpenPOWER Ready Document used for the criteria. Note: It is recommended that the latest version be used. However, a vendor may select a previous level of the criteria.
- Product / component category (System, IO, CAPI, Operating System, Application, System Support Component)
- Ready Checklist: report describing how the product satisfies the criteria.

OpenPOWER Ready Request Templates

A request template in Microsoft® Word format is available:

- http://openpowerfoundation.org/?resource_lib=openpower-ready-request-template

1.4. Granting License to display the OpenPOWER Ready Mark

Upon receipt of a request containing the required information the OpenPOWER Foundation will confirm completeness of the request and respond via email with a trademark license agreement (TMLA) to display the mark. Once the TMLA is signed and logged the OpenPOWER Ready Mark may be displayed in accordance with the guidelines

Reference versions of the OpenPOWER Ready™ TMLA and usage guidelines maybe reviewed at:

- TMLA: http://openpowerfoundation.org/?resource_lib=openpower-ready-tmla
- Usage Guidelines: http://openpowerfoundation.org/?resource_lib=openpower-ready-tmla-usage-guidelines

1.5. Publication of OpenPOWER Ready Products

The OpenPOWER Foundation will publish a list of components that have been shown to be OpenPOWER Ready. The OpenPOWER Ready List is located on the [OpenPOWER Foundation website](#). This list will be updated regularly. All products granted license to display the OpenPOWER Ready Mark will be automatically included in the OpenPOWER Ready List.



Note

If the requesting party wishes the product not be included in the OpenPOWER Ready List this should be indicated in the requesting email.

1.6. Scope

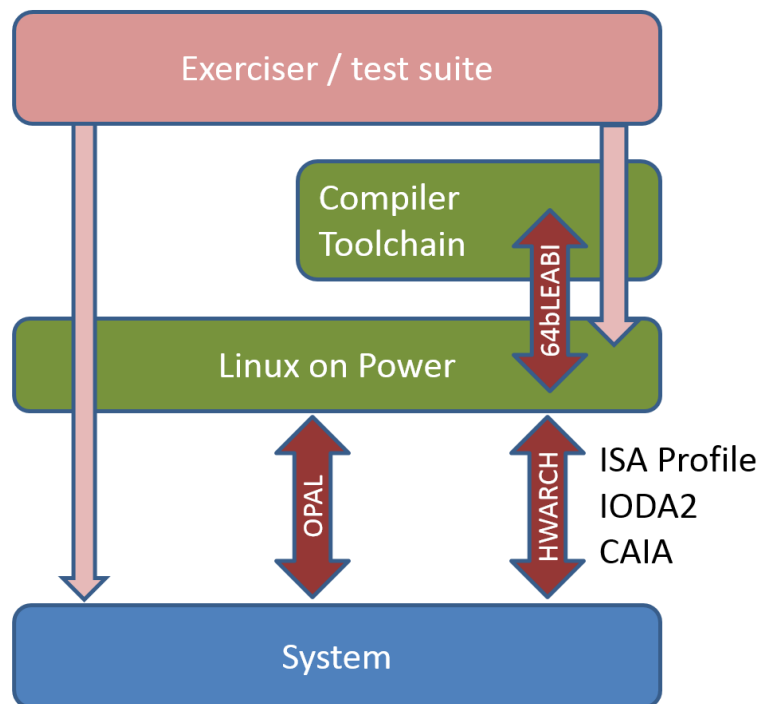
Use of the OpenPOWER Ready mark by OpenPOWER ecosystem product developers indicates that a product has been shown / demonstrated to meet a minimum set of characteristics and should be interoperable with other OpenPOWER Ready products.

The OpenPOWER Ready Mark does not ensure that products bearing the OpenPOWER Ready mark are interoperable, compatible, or suitable for the indicated purpose. In addition, it is the responsibility of the vendor to self-confirm compliance with necessary specifications and regulations such as but not limited to IEEE® 802.3™, PCIe® 3.0, RoHS (Restrictions of Hazardous Substances), etc.

2. OpenPOWER Ready System

This chapter covers the concept of OpenPOWER Ready from a system perspective. The following graphic [Figure 2.1, “OpenPOWER System”](#) [4] provides an abstracted view of a notional OpenPOWER system and the key interfaces that need to be considered.

Figure 2.1. OpenPOWER System



The following describes the key attributes required for a system based on an OpenPOWER ISA Profile rev 1.0.0 chipset to be OpenPOWER Ready.

1. OpenPOWER ISA Profile processor Chipset.



Note

For OpenPOWER ISA Profile V1.0.0 this means POWER8™, POWER8 with NVIDIA® NVLink™, or CP1 and at least one Centaur memory buffer with memory

2. Firmware to initialize the hardware is a modest derivative of the OpenPOWER Abstraction Layer (OPAL) FirmWare base, with no firmware API/ABI changes that have not been accepted upstream.

Developers are encouraged to contribute changes to the OPAL Firmware community as it makes sense for their business so that the community can help develop and maintain their platform.

Platform vendors should remember to ensure a new and unique platform name in the device tree.

3. At least one boot device. Storage or PXE Network boot.

4. Must be able to install and run a current LTS (Long Term Support) version of Ubuntu® Server. At time of writing, Ubuntu® Server 14.04 LTS and/or Ubuntu® Server 16.04 LTS. Ubuntu in this context is an open source little endian OS based on the Linux® kernel, referred to as 'ubuntu server ppc64el' on official Ubuntu mirrors and archives.

It is strongly suggested that in addition to the most current LTS version of Ubuntu® Server, SLES™, RedHat® Enterprise Linux (RHEL), Debian®, CentOS™, Fedora™, and/or open-SUSE™ be shown to operate.

5. System must successfully run an exerciser application. The exerciser application should be open source, compilable with open tools, and provide some output which can indicate functionality. Ideally, it would run against the "core I/O", run SMP, and provide output in a way that indicates some performance of the complete systems (procs and memory).

SYSBENCH is an example of such an exerciser.

HTX is an example of such an exerciser.

6. PCIe® bus should support PCIe gen 1.0, 2.0 and 3.0 adapters.
7. A boot management chip to manage the Power On Reset (POR) and initial Initial Program Load (IPL) is needed.

- Baseboard Management Controller (BMC) is a possible option

For Example: ASPEED® AST2400

8. A system level XML file as input to the OpenPOWER Build process for host firmware.

Due to the level of details required in the XML, it is recommended to use the Open Power Serverwiz. This tool is available on github at <https://github.com/open-power/serverwiz>

9. PNOR, VPD, Thermal and Power devices. See <https://github.com/open-power/docs> for more information regarding OPAL FirmWare expectations.

3. OpenPOWER Ready Software

The OpenPOWER Ready mark also applies to software applications and operating systems.

3.1. OpenPOWER Ready Criteria for Operating Systems

OpenPOWER Ready operating system distributions must meet the following criteria.

1. Demonstrated execution on at least one OpenPOWER Ready system. Ideally the operating system would be tested on multiple systems.

3.2. OpenPOWER Ready Criteria for Application

OpenPOWER Ready applications must meet the following criteria.

1. The application must be compiled and built using an OpenPOWER Ready operating system Distro toolchain.
2. The application must demonstrate execution on an OpenPOWER Ready operating system Distro per [Section 3.1, "OpenPOWER Ready Criteria for Operating Systems" \[6\]](#).

4. OpenPOWER Ready I/O Adapter

An IO Adapter that is OpenPOWER Ready has met the criteria defined in this section.

4.1. PCIe® Requirements

OpenPOWER Ready I/O devices intended for plugging into PCIe Gen3 slots should be PCI-SIG® PCIe 3.0 Specification compliant. It is important to note that PCIe 3.0 standard supports PCIe 1.0 and 2.0 devices as well. PCIe devices that are PCIe 1.0 or 2.0 compliant, satisfy this OpenPOWER Ready criteria.

The device is required to be tested in one of the OpenPOWER Ready systems and the results from the test should be made available. Functional tests described below cover PCIe in addition to device functions.

4.2. Software Requirements

In addition to a Linux on POWER LE (LoP-LE) mode device driver for the device, additional software is frequently required (see the table below for examples). Required software for the claimed functions of the OpenPOWER Ready I/O adapter must be available to the consumer of the device under OSI approved license or commercial license.

OpenPOWER Ready requires test of the offered software in an OpenPOWER configuration. The software test is part of the functional test requirements described below.

Table 4.1. Required Software Testing

| Software | Requirement | Recommendation |
|--------------------------------|--|---|
| Device Driver | <ol style="list-style-type: none"> 1. A LoP-LE Driver is required. Open Source License is desired. 2. Successful Functional Test on at least one of the LoP-LE Distributions (Ubuntu, RHEL, SuSE, PowerKVM™, etc.) | Driver should follow Linux on POWER Device Driver Porting Guide |
| Boot | OPAL Firmware and petitboot as of op-build v1.7 (or later). Additional device drivers may be added to enable boot support off these devices. | Online Documentation available for Driver and Utilities support in OPAL/Petitboot OPAL/Petitboot GIT hub . |
| Serviceability and Management. | LE-LoP based utilities for device Diagnostics, FW update, and Configuration. | These utilities should target open source tools e.g. ethtool. Vendor toolset ported to LE-LoP is acceptable. |
| Storage Management | LE-LoP RAID Configuration Utilities and Storage Enclosure Management. | Package RAID configuration utilities as a petitboot blugin in addition to being made available for LoP linux distros |
| SAN Storage Software. | LE-LoP MPIO and HBA/SAN Management Software is required for FC/FCoE/iSCSI HBAs | Should target open source tools e.g. Linux MPIO. Vendor toolset ported to LE-LoP is acceptable. |
| Advanced Networking | LE-LoP RDMA/OFED, DPDK, OpenOnload, iSCSI, OVS, Overlay Networking etc. is required for devices claiming support of the advanced stacks. | Stacks are open source but require porting, tuning and productization for the devices. Devices claiming support of an "advanced stack" should have the stack's respective open source ported, tuned and productized for the devices. |

4.3. OpenPOWER Ready Functional Test Requirements

I/O Device functional test completion is required with the following test coverage. The IO Adapter owner is responsible for all functional testing.

1. OpenPOWER PCIe compatibility.
 - a. IO Adapters should comply with PCI-SIG requirements.
 - b. IO adapters must successfully operate in an OpenPOWER Ready System

2. Device specific function tests.

- a. Device specific tests vary based on device type.

Example test plans for Ethernet Adapters and Direct Attached Storage are provided in the following workgroup notes from the OpenPOWER Foundation IO Workgroup: *EN Functional Tests Spec* and *DAS Functional Test Spec*.

- b. Device specific testing is required in an OpenPOWER Ready system.

3. Stress tests

- a. These tests verify device under heavy load.
 - b. These tests are required to be completed in an OpenPOWER Ready System.

4. Performance Tests

- a. Performance results from device specific benchmarks should be provided.
 - b. These tests are required to be completed in an OpenPOWER Ready System.

5. Error reporting and recovery

- a. Error reporting and recovery varies with device types
 - b. These tests are required to be completed in and OpenPOWER Ready System.

4.4. SAN/Storage Interoperability

OpenPOWER Ready does not have specific criteria for SAN (FC, FCoE or iSCSI) Interoperability tests but most SAN Storage Products and SAN Switches require interoperability tests. These tests are beyond the scope of OpenPOWER Ready requirements but are highly desired because these are required for many solutions.

4.5. Direct Attached Storage Interoperability

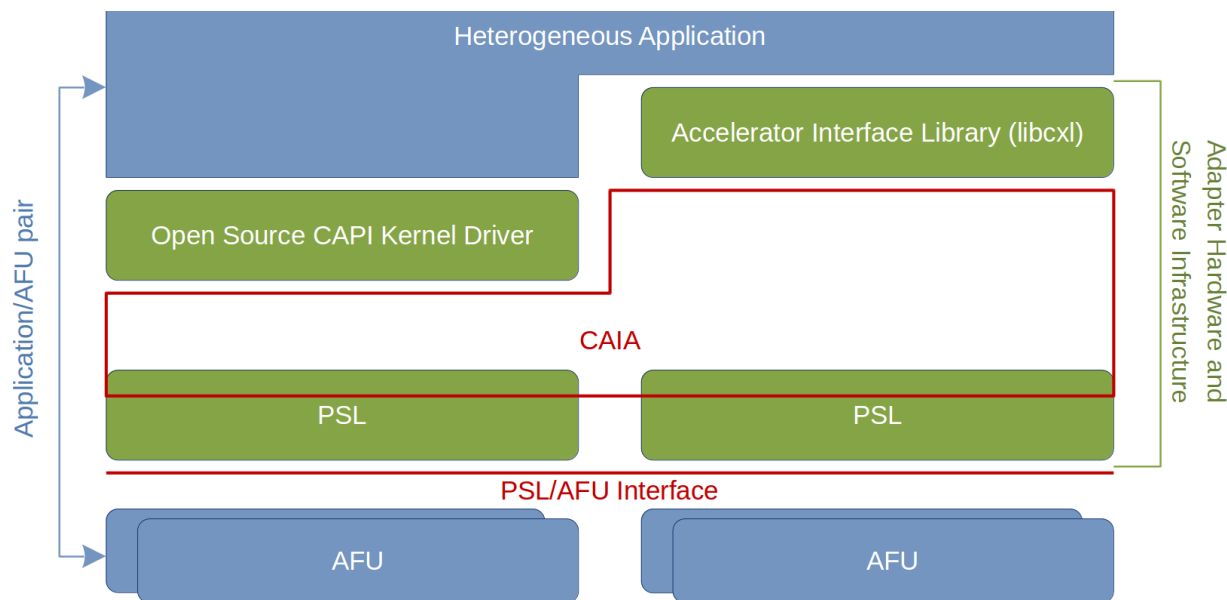
OpenPOWER Ready does not have specific criteria for system / storage expansion interoperability tests. Most configurations require test e.g. SAS HBAs connecting to SAS Expander / Storage enclo-

tures. These tests are not part of OpenPOWER Ready criteria but are highly desired because these are required for many solutions.

5. OpenPOWER Ready CAPI

The OpenPOWER Ready mark also applies to CAPI PCIe adapters and solutions built using them. The following graphic [Figure 5.1, “OpenPOWER CAPI Solution”](#) [10] provides an abstracted view of a notional OpenPOWER CAPI solution and its key components.

Figure 5.1. OpenPOWER CAPI Solution



CAPI solutions include an adapter and its associated driver and management software, and one or more Accelerator Functional Units (AFUs) and libraries or applications that access them. An adapter may support multiple separately sold or user developed AFUs, or it may be packaged with a fixed set of AFUs as a dedicated solution. To be OpenPOWER Ready, a CAPI capable product must meet the following criteria:

1. The product must be supported on at least one OpenPOWER Ready system.
2. Hardware and software components must meet the criteria for adapters and applications listed below. If a solution includes both adapter hardware and application/AFU components, each must meet the relevant criteria.

5.1. OpenPOWER Ready Criteria for CAPI Adapters

CAPI capable PCIe adapters must meet the criteria for OpenPOWER Ready I/O Adapters, as specified in [Chapter 4, “OpenPOWER Ready I/O Adapter”](#) [7] above. In addition, CAPI adapters must support the following CAPI specific criteria:

1. The adapter must support an IBM licensed Power Service Layer (PSL).
2. The adapter should support a kernel and application API library which satisfies the Coherent Accelerator Interface Architecture (CAIA).



Note

The open source CAPI library `libcxl` <https://github.com/ibm-capi/libcxl> may be used and assumed compliant with CAIA.

5.2. OpenPOWER Ready Criteria for CAPI Applications

The application code running on an OpenPOWER Ready operating system on an OpenPOWER Ready system is uniquely tied to Accelerated Functional Units (AFUs) that implement the accelerated services it requires. OpenPOWER Ready applications and/or AFUs must meet the following criteria:

1. Use of an OpenPOWER Ready CAPI adapter per [Section 5.1, “OpenPOWER Ready Criteria for CAPI Adapters” \[10\]](#).
2. Accelerated Functional Units (AFUs) must communicate with the IBM licensed Power Service Layer (PSL) using the PSL/AFU Interface.

The PSL Simulation Engine (PSLSE) or equivalent method may be used to verify that the AFU correctly implements the PSL/AFU Interface. The PSLSE is available via GITHUB at <https://github.com/ibm-capi/pslse>.

3. Applications and/or interface libraries running on the OpenPOWER host should use an API library which satisfies the CAIA to control and communicate with supporting AFUs.



Note

The open source CAPI library `libcxl` may be used and assumed compliant with CAIA.

6. OpenPOWER Ready System Support Components

System support components are components or products that are integral to the system design but are not integral in the architecture computationally. OpenPOWER Ready for such components or products implies that the developer is asserting these components or products may be considered for inclusion in system designs intended for the OpenPOWER community. The OpenPOWER Ready Marking does not indicate such components may be incorporated without proper design, validation, and qualification per accepted design practice.

The System Support Components category is broad and within it are potentially several sub-categories. Future versions of this document may refine the definition, sub-categories, and appropriate criteria.

To be OpenPOWER Ready, a System Support Component should meet one of the following criteria:

1. The component or product should be incorporated in at least one OpenPOWER Ready system.
2. The component / product developer asserts the component / product has been tested and may be considered for use.

Appendix A. OpenPOWER Foundation overview

The OpenPOWER Foundation was founded in 2013 as an open technical membership organization that will enable data centers to rethink their approach to technology. Member companies are enabled to customize POWER CPU processors and system platforms for optimization and innovation for their business needs. These innovations include custom systems for large or warehouse scale data centers, workload acceleration through GPU, FPGA or advanced I/O, platform optimization for SW appliances, or advanced hardware technology exploitation. OpenPOWER members are actively pursuing all of these innovations and more and welcome all parties to join in moving the state of the art of OpenPOWER systems design forward.

To learn more about the OpenPOWER Foundation, visit the organization website at openpowerfoundation.org.

A.1. Foundation documentation

Key foundation documents include:

- [Bylaws of OpenPOWER Foundation](#)
- [OpenPOWER Foundation Intellectual Property Rights \(IPR\) Policy](#)
- [OpenPOWER Foundation Membership Agreement](#)
- [OpenPOWER Anti-Trust Guidelines](#)

More information about the foundation governance can be found at openpowerfoundation.org/about-us/governance.

A.2. Technical resources

Development resources fall into the following general categories:

- [Foundation work groups](#)
- [Remote development environments \(VMs\)](#)
- [Development systems](#)
- [Technical specifications](#)
- [Software](#)
- [Developer tools](#)

The complete list of technical resources are maintained on the foundation [Technical Resources](#) web page.

A.3. Contact the foundation

To learn more about the OpenPOWER Foundation, please use the following contact points:

- General information -- <info@openpowerfoundation.org>
- Membership -- <membership@openpowerfoundation.org>
- Technical Work Groups and projects -- <tsc-chair@openpowerfoundation.org>
- Events and other activities -- <admin@openpowerfoundation.org>
- Press/Analysts -- <press@openpowerfoundation.org>

More contact information can be found at openpowerfoundation.org/get-involved/contact-us.