



OpenCAPI 3.0 Ready Definition

Version 1.1

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Approved

Approved for Distribution to OpenCAPI Members Only

Approved

OpenCAPI 3.0 Ready Definition

OpenCAPI Compliance Work Group
OpenCAPI Consortium

Version 1.1 (07 April 2020)

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Abstract

This document defines the requirements that need to be met to be asserted as an OpenCAPI 3.0 Ready device or OpenCAPI 3.0 Ready host. It is the work product of the OpenCAPI Consortium Compliance Work Group

This document is handled in compliance with the requirements outlined in the OpenCAPI Consortium Work Group (WG) process document. Comments, questions, etc. can be submitted to membership@opencapi.org.

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Preface

This document defines the requirements that must be met to be asserted as an OpenCAPI 3.0 Ready device or OpenCAPI 3.0 Ready host. It is the work product of the OpenCAPI Consortium OpenCAPI Compliance Work Group.

Conventions

The OpenCAPI Consortium documentation uses several typesetting conventions.

Notices

This section describes Engineering and Developer notices.

Engineering notes

Engineering notes provide additional implementation details and recommendations not found elsewhere. The notes might include architectural compliance requirements. That is, the text might include Architecture compliance terminology. These notes should be read by all implementation and verification teams to ensure architectural compliance.

Developer notes

Developer notes are used to document the reasoning and discussions that led to the current version of the architecture. These notes might also include recommended changes for future versions of the architecture, or warnings of approaches that have failed in the past. These notes should be read by verification teams and contributors to the architecture.

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Document change history

Each release of this document supersedes all previously released versions. The change history log lists all significant changes made to the document since its initial release.

Revision date	Summary of changes
07 April 2020	Version 1.1. Removed Table 2-1, 3-1, 3-2, moved them to an OpenCAPI 3.0 Interop Systems Definition reference document.
30 March 2020	Updated Table 2-1 to include IBM IC922 server Updated Table 3-1 to include the Monza package
22 October /2019	Version 1.0. Initial release.

Glossary

The following terms are used in this document.

AFU	Attached functional unit. Architecturally, AFU refers to an end-point unit or resource. Communication from the processor to the AFU goes through a protocol stack, transaction layer (TL), data link layer (DL), and physical medium layer (PHY). Command and data packets at the AFU interface are specified by the AFU command/data interface, which is the interface between the AFU protocol stack and the AFU.
DL	OpenCAPI data link layer found on the host processor.
DLx	OpenCAPI data link layer found on the external OpenCAPI device.
DUT	Device under test.
OMI	OpenCAPI memory interface.
OpenCAPI Ready™	The term defined in this document that asserts a minimum set of characteristics has been met to show a product should be interoperable with other OpenCAPI products.
PHY	Physical medium layer. The PHY layer interfaces to the DL and the network.
TL	OpenCAPI transaction layer found on the host processor.
TLx	OpenCAPI transaction layer found on the external OpenCAPI device.
TMLA	Trademark license agreement.

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References

The following documents can be helpful when reading this specification.

[OpenCAPI 3.0 Transaction Layer Specification v1.7, 19 February 2019](#)

25 Gbps Physical Signaling Specification

25 Gbps Interface Mechanical Specification

The following information is located on the [OpenCAPI Consortium website](#):

- OpenCAPI Ready trademark
- OpenCAPI Ready mark (Logo)
- OpenCAPI Ready list
- OpenCAPI Ready request form
- TMLA links/references/options

1. Introduction

The OpenCAPI Ready™ program is used by the OpenCAPI Consortium to enable OpenCAPI 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 OpenCAPI Ready products. This document defines the meaning of OpenCAPI Ready™ and its different categories.

OpenCAPI ecosystem participants who have items or products they are interested in marking shall follow the appropriate criteria described below.

Solution components that submit a request as described in *Section 1.3 Requesting a product to be included on the OpenCAPI Ready list on page 10* will automatically be listed on the OpenCAPI Consortium OpenCAPI Ready List.

Organizations wishing to mark a solution component must receive a license to display the OpenCAPI Ready mark. See *Section 1.4. Requesting license to display the OpenCAPI Ready mark on page 11*.

1.1 OpenCAPI Ready™ mark

The OpenCAPI Consortium has established OpenCAPI Ready™ as a special badge or mark used by an OpenCAPI 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 have been defined to increase the likelihood components bearing the mark are compatible.

The mark is available for OpenCAPI Consortium members interested in providing components/products to the OpenCAPI ecosystem. The mark makes a strong statement about support of the OpenCAPI technology as an alternative to other server solutions. See <https://opencapi.org/compliance> for the OpenCAPI Ready mark logo.

1.2 Demonstrating OpenCAPI Ready

An entity desiring to demonstrate that a product or solution satisfies the respective criteria may do so in the following way:

- Self-assessment.

1.3 Requesting a product to be included on the OpenCAPI Ready list

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

Each entity requesting a product be included in the OpenCAPI Ready list must provide the following information regarding the specific product or component to the OpenCAPI Consortium via the online OpenCAPI Ready Request.

Upon receipt of a request containing the required information, the OpenCAPI Consortium will confirm receipt of the request via email. After completeness and applicability of the request is reviewed by the OpenCAPI Consortium, the Consortium will respond via email regarding the status of the OpenCAPI Ready request.

Requested information for internal processing:

- Requester/contact name.
- Contact email address.
- Contact phone number (optional).
- Requested information for publishing on OpenCAPI.org
- Company
- Product/component designator (unique name or label).
- Short product/component description.
- Product/component information URL.
- Keywords (comma separated) to help an interested party search for this product. (optional). Keywords that repeat information are not necessary. Instead, broader categories and alternate industry terms are very helpful.
- Version of OpenCAPI 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.
- List of supported OpenCAPI specifications (TL, DL).
- Product/component category (OpenCAPI 3.0 Device Interface Class Device, OpenCAPI 3.0 Device Interface Class Host System).
- Ready criteria assessment: Describe how the product fulfills the criteria defined for the selected product category/categories in this document.
- Image/graphic for inclusion with the description (optional, consortium member grants OpenCAPI Consortium rights to use and publish the provided image).
- Information on product availability (i.e., geographies)
- Updates to this information can be provided to OpenCAPI Consortium.

1.4 Requesting license to display the OpenCAPI Ready mark

The OpenCAPI Consortium requires an agreed to trademark license agreement (TMLA) to display the mark. Once the TMLA is agreed to and logged, the OpenCAPI Ready mark can be displayed in accordance with the guidelines.

Reference versions of the OpenCAPI Ready™ TMLA and usage guidelines can be reviewed at:
<https://opencapi.org/compliance>.

During completion of the online OpenCAPI Ready request, the submitter has three options regarding the TMLA.

TMLA options:

- Submit the request without a TMLA. The approved product shall not display the OpenCAPI Ready mark.
- Review the TMLA and accept via "click-through".
- Download the TMLA for signature. Upload the signed TMLA.

Note: Products approved for OpenCAPI Ready listing will be listed on the OpenCAPI Ready list regardless of TMLA option selected.

1.5 Publication of OpenCAPI Ready products

The OpenCAPI Consortium will publish a list of components that have been shown to be OpenCAPI Ready. The OpenCAPI Ready list is located on the [OpenCAPI Consortium website](#). This list will be updated regularly. All approved products will be automatically included in the OpenCAPI Ready list.

1.6 Scope

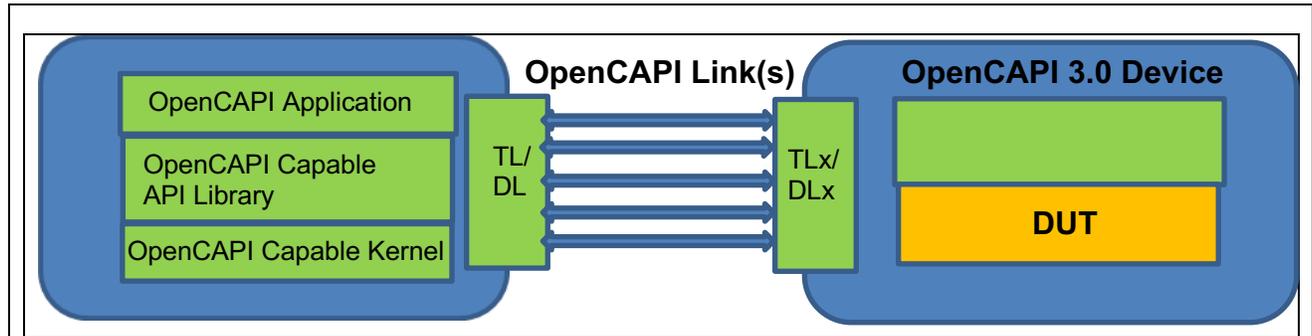
Use of the OpenCAPI Ready mark by OpenCAPI ecosystem product developers or inclusion on the OpenCAPI Ready list indicates that a product has been shown/demonstrated to meet a minimum set of characteristics.

Note: The OpenCAPI Ready mark does not ensure that products bearing the OpenCAPI Ready mark are interoperable, compatible, or suitable for the indicated purpose. In addition, it is the responsibility of the vendor to confirm compliance with any other necessary specifications and regulations such as but not limited to *IEEE® 802.3™*, *RoHS (Restrictions of Hazardous Substances)*, UL, CCC. etc.

2. OpenCAPI Ready 3.0 device definition

The OpenCAPI Ready mark and OpenCAPI Ready list apply to OpenCAPI 3.0 device interface class devices. Figure 2-1 provides an abstracted view of a notional OpenCAPI solution and its key components.

Figure 2-1. OpenCAPI 3.0 platform solution overview for device compliance



This section outlines all the requirements an OpenCAPI 3.0 device must meet to be considered OpenCAPI Ready. When submitting a product for approval, the manufacturer of the OpenCAPI device shall assert that it has satisfactorily met these requirements. An OpenCAPI 3.0 device shall meet all the requirements in the following list:

- (1) An OpenCAPI Ready 3.0 device shall meet all the requirements of the 25 Gbps PHY signaling specification. This includes the OIF specification requirements referenced in this document. The current version of the specification that shall be met is found [here](#).
- (2) An OpenCAPI Ready 3.0 device shall meet all the requirements of the PHY mechanical specification. The current version of the specification that shall be met is found [here](#).
- (3) An OpenCAPI Ready 3.0 device shall support at least one OpenCAPI 3.0 capable host. The host may be selected from the OpenCAPI 3.0 Interop Systems Definition document.
- (4) An OpenCAPI Ready 3.0 device shall support at least one OpenCAPI 3.0 kernel supported by the host.

An OpenCAPI-capable host kernel that may be used is the Linux Kernel, version 4.18 or greater:

<https://www.kernel.org/>

The following Linux distros may also be used:

Ubuntu 18.10 – comes with libocxl 1.1

Ubuntu 18.04 LTS – must update to at least libocxl 1.1 using the link in (5) below.

RHEL 7.6-ALT – must install libocxl using the link in (5) below.

RHEL 8.0 – comes with accepted libocxl version.

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- (5) An OpenCAPI Ready 3.0 device shall support at least one OpenCAPI 3.0 capable API library.

An OpenCAPI capable host API library that may be used for this assertion is the libocxl driver, at least version 1.1 or greater, located here: <https://github.com/OpenCAPI/libocxl>.

- (6) Support at least one OpenCAPI 3.0 TLx/DLx implementation, one AFU, and one application. The procedure described in *Section 2.1* may be used to assert meeting this requirement.

2.1 Functional test for OpenCAPI 3.0 devices

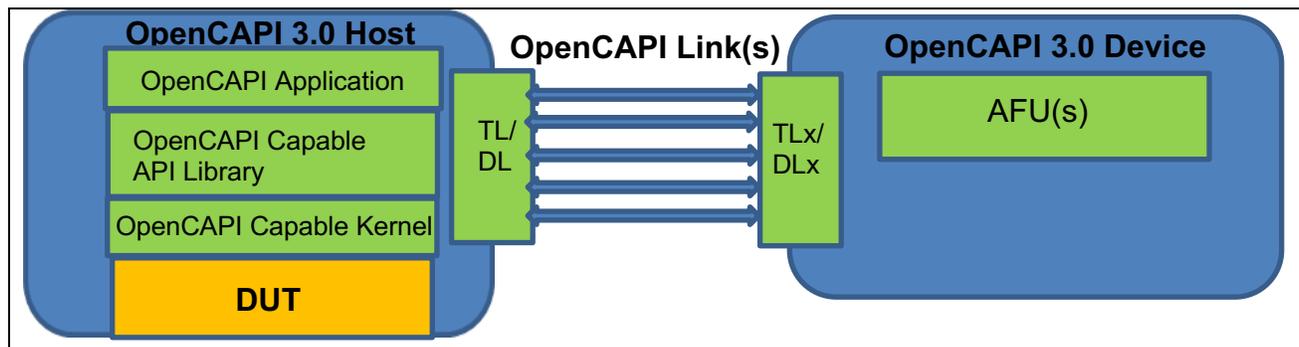
This test will verify that requirements (3) – (6) in *Section 2* are met for OpenCAPI 3.0 devices:

- (1) Acquire an OpenCAPI-capable host system. Refer to the OpenCAPI 3.0 Interop Systems Definition reference document for a list of acceptable systems.
- (2) Follow instructions to install an OpenCAPI-capable host kernel and OpenCAPI capable API library. Recommended kernels and API libraries are listed in Section 2 of this document.
- (3) Acquire an OpenCAPI application executable. An OpenCAPI application acceptable for this requirement may be obtained from [here](#).
- (4) Install an OpenCAPI device with an OpenCAPI AFU design where required on one of the device's OpenCAPI links. The source code for building an AFU acceptable for this requirement may be obtained from [here](#).
- (5) Run the application executable on an OpenCAPI host. It shall attach to the device design. Run the application normally and print pass/fail criteria upon completion.
- (6) Repeat steps (4) and (5) for all other OpenCAPI links on the device. Once the application reports a pass scenario for all links, the validation of this test is completed.

3. OpenCAPI Ready 3.0 host system definition

The OpenCAPI Ready mark and OpenCAPI Ready list apply to OpenCAPI 3.0 host systems. *Figure 3-1* provides an abstracted view of a notional OpenCAPI solution and its key components.

Figure 3-1: OpenCAPI 3.0 platform solution overview for host compliance



This section outlines all the requirements an OpenCAPI 3.0 host system must meet to be considered OpenCAPI Ready. The manufacturer of the OpenCAPI host shall assert when it has satisfactorily met these requirements. An OpenCAPI 3.0 host shall meet all the requirements in the following list:

- (1) An OpenCAPI Ready 3.0 host shall meet all the requirements of the 25 Gbps PHY signaling specification. This includes the OIF specification requirements referenced in this document. The current version of the specification that shall be met is found [here](#).
- (2) An OpenCAPI Ready 3.0 host shall meet all the requirements of the PHY mechanical specification. The current version of the specification that shall be met is found [here](#).
- (3) An OpenCAPI Ready 3.0 host system shall use an OpenCAPI 3.0 host processor to interface with any OpenCAPI link to an OpenCAPI device. One of the processors listed in the OpenCAPI 3.0 Interop Systems Definition document may be used.
- (4) An OpenCAPI Ready 3.0 host shall support at least one OpenCAPI 3.0 capable device. An OpenCAPI capable device may be selected from the OpenCAPI 3.0 Interop Systems Definition document.
- (5) An OpenCAPI Ready 3.0 host shall support at least one OpenCAPI 3.0 capable host kernel.

An OpenCAPI capable host kernel that may be used is the Linux Kernel, version 4.18 or greater: <https://www.kernel.org/>

The following Linux distros may also be used:

Ubuntu 18.10 – comes with libocxl 1.1
 Ubuntu 18.04 LTS – must update to at least libocxl 1.1 using the link in (6) below.
 RHEL 7.6-ALT – must install libocxl using the link in (6) below.
 RHEL 8.0 – comes with accepted libocxl version.

- (6) An OpenCAPI Ready 3.0 host shall support at least one OpenCAPI capable API library.

An OpenCAPI capable host API library that may be used for this assertion is the libocxl driver, located here: <https://github.com/OpenCAPI/libocxl>

- (7) Support at least one OpenCAPI 3.0 TL/DL implementation, one AFU, and one application. The procedure described in *Section 3.1* may be used to assert meeting this requirement.

3.1 Functional test for OpenCAPI 3.0 hosts

This test will verify that requirements (4) – (7) in *Section 3* are met for OpenCAPI 3.0 hosts:

- (1) Acquire an OpenCAPI capable device with an OpenCAPI AFU design and corresponding application executable. Contact the company corresponding to the selected device in the OpenCAPI 3.0 Interop Systems Definition reference document for information on how to obtain a device with the recommended design and corresponding application.
- (2) Follow instructions to install an OpenCAPI capable host kernel and OpenCAPI capable API library. Recommended kernels and API libraries are listed in *Section 3* of this document.
- (3) Install an OpenCAPI host with the OpenCAPI device design obtained in step (1) on one of the host's OpenCAPI links.
- (4) Run the application executable obtained in step (1) on an OpenCAPI host. It shall attach to the device design. Run the application normally and print pass/fail criteria upon completion.
- (5) Repeat steps (3) and (4) for all other OpenCAPI links on the host. Once the application reports a pass scenario for all links, the validation of this test is completed.