Cyber Photonic Platform Consortium

Guideline

# Specification Guidelines for the Rack and Blade of Disaggregated Optical Transport/Node Systems

v.2.0  2019/02/25

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**Abstract:** This document presents guidelines for rack systems that are suitable for disaggregated optical network systems, addressing common housing aspects such as mechanical dimensions, front panel design, electrical power supply options, and the degree of freedom in the control interface. Through these guidelines, vendors who are interested in supplying disaggregated optical components and large and small network operators who are interested in introducing pay-as-you-grow disaggregated optical network systems will obtain an overview of the necessary considerations for physical implementations.

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# UPDATE HISTORY

| Version | Date | Contents |
|---|---|---|
| 1.00 | 2016/03/22 | Preliminary draft as a VICTORIES document |
| 1.01 | 2016/03/23 | Editorial: File size was reduced by image processing etc. |
| 1.20 | 2016/08/05 | Definition of standard chassis was changed from 5RU to 6RU and handling of the DC power supply was changed. |
| 1.30 | 2017/02/20 | Photos of standard rack and standard chassis were added. |
| 1.51 | 2017/04/10 | Tentative release. Modified introduction and inserted a preface for the tentative release. |
| 1.52 | 2018/07/09 | Release. Modified blade specification and removed the preface for the tentative release. |
| 2.0 | 2019/02/25 | Transferred to CPPC and released as a CPPC document. |

# 1. Background and Purpose

Network softwarization is expected to play a critical role in the sustainable growth of information infrastructures. Hardware abstraction[1] and intermediate controllers[2] have been developed to offer flexible management of multi-layer resources including the physical and, particularly, optical layers. The Cyber Photonic Platform (CPP)[3] is intended to disaggregate and automatize the physical layer and enhance total network automation. To build an efficient communication infrastructure realized through a pay-as-you-grow, multiple-vendor, and multi-generation platform, the disaggregated platform of optical layer functions will be inseparable from such flexible resource management. The disaggregated platform enhances the flexibility of the physical layer by means of modular hardware structures, which are essential for the softwarization of optical layer functions. Optical layer functions include, but are not limited to, optical switches such as optical cross-connect (OXC), wavelength cross-connect (WXC), and multicast switch (MCS); muxponders/transponders; ODU switches; optical amplifiers; and monitors.

The physical implementations of such a disaggregated platform require a common housing in terms of the mechanical dimensions, electrical power supply, control interfaces, and so on. This document presents universal guidelines for a rack system for disaggregated optical network systems. The physical rack system consists of blades, chassis, and racks. The blade incorporates optical devices and peripheral devices such as control circuits, the chassis houses the blades, and the rack mounts the chassis/blades (see Fig. 2(a)). Such a rack system enables the integration of multiple optical devices and accommodates all necessary functions with flexibility.

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[1] M. D. Leenheer et al., "Open and programmable metro networks," in Proc. OFC2016, Th1A.7, 2016.

[2] A technical report has been accepted by IEC TC86 SC86C WG5: IEC TR 62343-6-10:2017, Dynamic modules - Part 6-10: Design guide - Intermediate controller for multiple dynamic module systems.

[3] CPPC Technical White Paper, "Cyber Photonic Platform: Automatizing the Physical Layer for Total Network Automation."

The disaggregated platform that forms the basis of the optical network architecture of CPP is depicted in Fig. 1; a detailed explanation can be found in the CPPC White Paper referenced in footnote 3. Between the disaggregated platform at the physical layer and the upper-layer control/management plane, which typically includes a software-defined network controller or network management system, there are two hardware abstraction layers (HALs). One is the CPP-Manager for network-wide HAL and the other is the intermediate controller for intra-node HAL. Hereafter, the intermediate controller is referred to by its development codename in CPP: BlueBox. The BlueBox encapsulates the detailed physical topology and interfaces of the blades within the node, and communicates with a centralized network resource management module via a specific protocol for the southbound interface as a representative of the node components.

Accordingly, these guidelines do not prescribe the details of the physical or logical interfaces, but instead allow component vendors' as much freedom of choice as possible while stipulating the minimum requirements for realizing a convenient, pay-as-you-grow, multi-vendor, and multi-generation platform. In other words, all that is required is to define a common mechanical dimension, a design guideline for the front panel and housing, a few options for the electrical power supply, and some degree of freedom for the control interface.

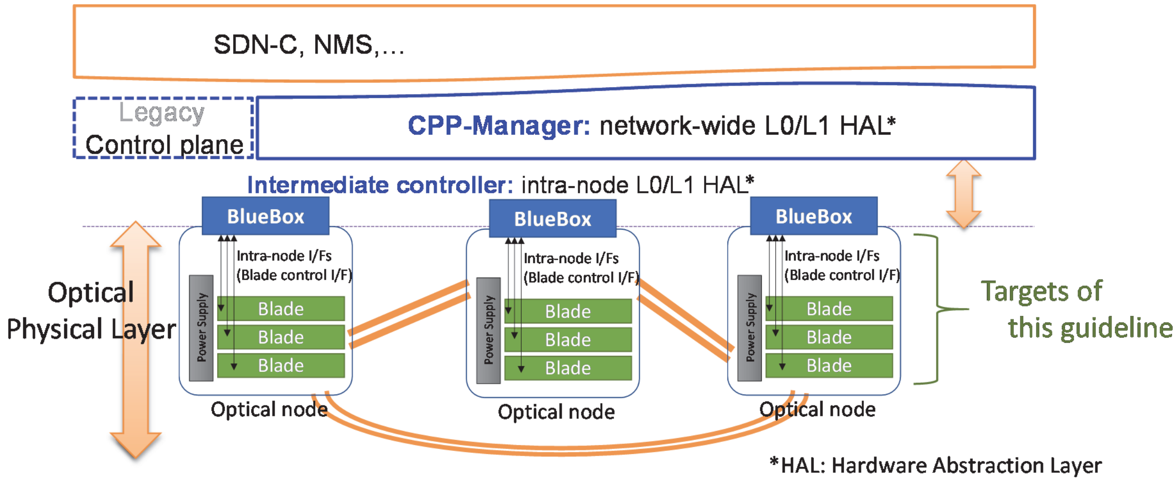



**Fig. 1:** Architectural definition of the disaggregated blades.

# 2. Introduction to the Standard Rack

## 2.1 Components and Names

As shown in Fig. 2(a), the standard rack consists of side panels and a chassis, and the blade is mounted on the chassis.

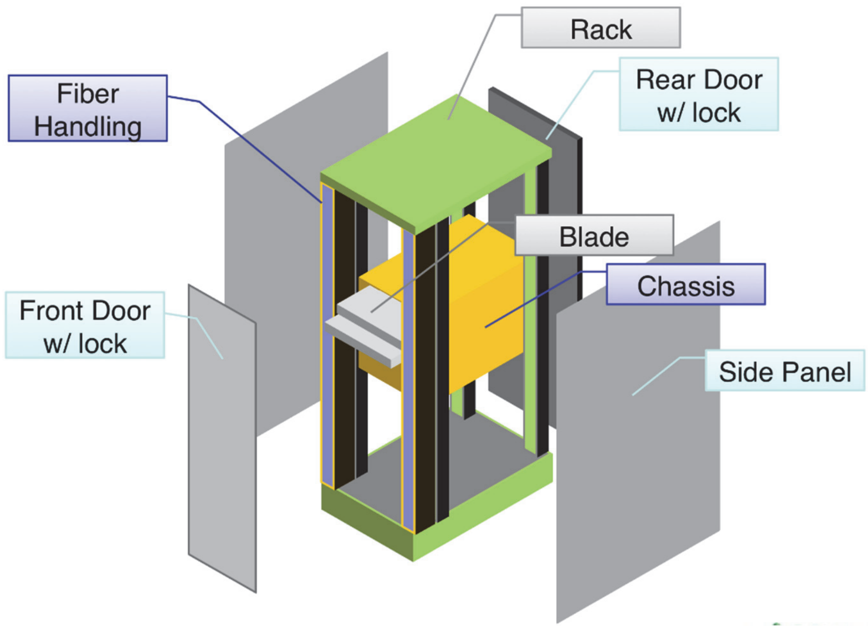



**Fig. 2(a):** Configuration and names of the standard rack

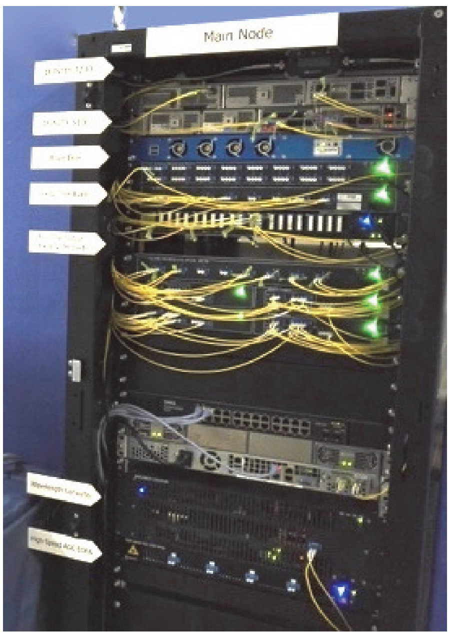



**Fig. 2(b):** Exterior view of the standard rack with some of blades (hereinafter referred to as the "standard blade")

## 2.2 STANDARD CHASSIS

The structure of the chassis mounted on the standard rack is shown in Fig. 3(a). The chassis is configured such that six blades of height 1RU can be mounted. The chassis plays a role in the coordination between the mounted blades and the sharing of control among multiple blades.

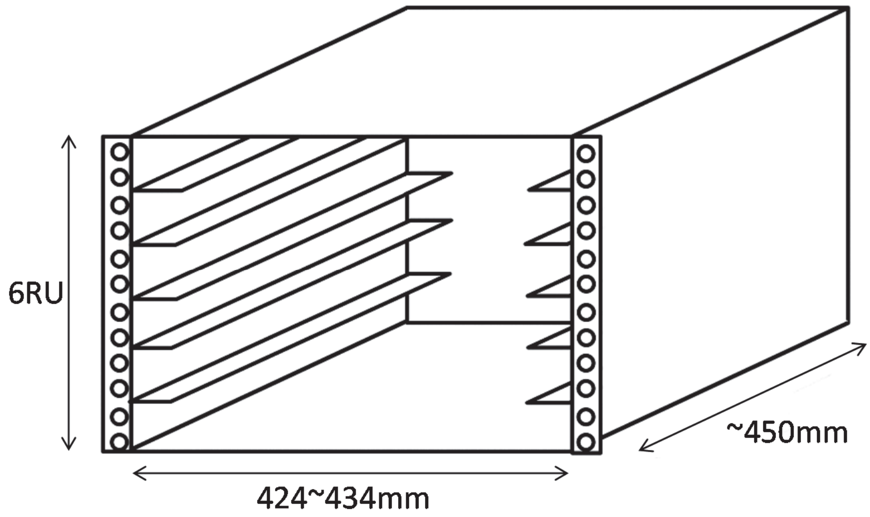



**Fig. 3(a):** Configuration of the standard chassis. The chassis is compatible with a 19-inch rack. Examples of the specific dimensions are illustrated.


**Fig. 3(b):** Exterior view of the standard chassis

## 2.3. STANDARD BLADE

As shown in Fig. 4(a), the blade is composed of a "casing unit" and a "front panel." The front panel is provided with "LED lamps" that display the blade's status, a "control interface," and "input/output optical ports." The illustrative photographs of the front and rear of actual blades in the chassis are shown in Figs. 4(b) and 4(c), respectively.

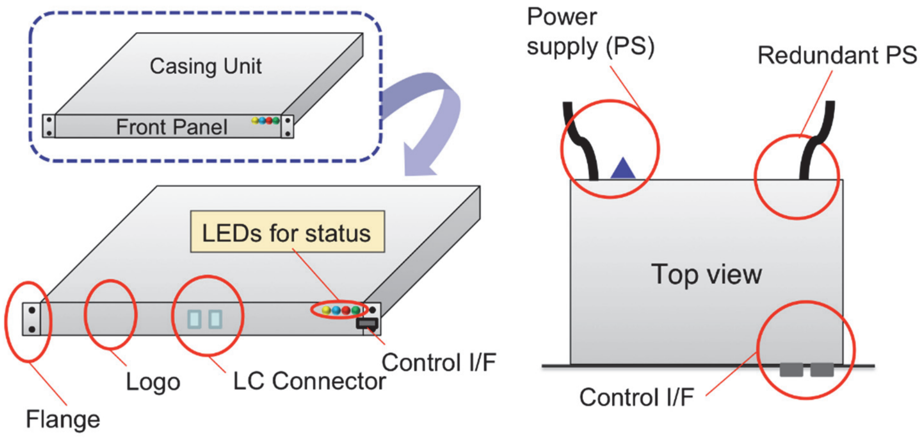



**Fig. 4(a):** Blade configuration diagram


**Fig. 4(b):** Exterior view of a blade (front side)


**Fig. 4(c):** Exterior view of a blade (rear side)

# 3. Blade Specifications

## 3.1 Casing Unit

The specifications of the casing, the main component of the blade, should address the following considerations.

A) The casing should be mountable on a 19-inch standard rack. Examples of the typical dimensions are as follows.
   - Width: 424–434 mm
   - Depth[4]: less than 450 mm
   - Height: 42.5–43.5 mm
     (If the blade has n RUs, the height should be within $(n\text{-}1)\times 44.5+[42.5 \text{ to } 43.5]$ mm for $1 < n \leq 6$. )

B) When a cooling function is required, a front air intake and rear air exhaust should be used.

C) The AC inlet should be mounted on the rear of the casing such that an AC 100–240 V (50/60 Hz) power connection is supported. Multiple AC inlets can be provided when installing a redundant power supply.

D) A power switch should be installed at the rear side. When installing a redundant power supply, multiple power switches can be provided.

E) When using a DC power supply, the following should be ensured.
   - Rear side of the casing should be equipped with a -48 V screw terminal input. Although there is no particular restriction on the location of the screw terminal, it is preferable to place it at the left end or the right end.
   - For a redundant power supply, the screw terminal input should be installed at the right end and the left end of the rear side of the casing.
   - The screw terminal input should be connected floating from the earth.
   - The total input power of the blade that requires the DC supply installed in one chassis should be 5 kW or less.

F) In case of a redundant power supply of -48 V DC, the screw terminal input should be installed at the right end and the left end of the rear side of the casing.

G) For a detailed design drawing, see section 4.

[4] The depth is limited to 450 mm for traditional racks with a depth of 600 mm (considering optical fibers and cabling).

## 3.2 Front Panel

The specifications of the casing, the main component of the blade, should address the following considerations. Such front panel designs ensure ease-of-maintenance, which plays a more important role in the disaggregated platform than in conventional all-in-one systems.

A) The panel should be compatible with the 19-inch standard rack and have a thickness of 3 mm or less.

B) The blade name should be displayed in the region from the left end of the panel to a distance of 100 mm and from the upper end to a distance of 8.0 mm.

C) The logo/name of the company should be freely displayed in the region from the left end of the panel to a distance of 20–100 mm, and from the lower end to a distance of 8.0 mm.

D) At the left and right ends of the panel, screw holes should be available for attaching to the standard rack. The mounting positions of the screw holes should conform to EIA-310-D, and the pitch should be either universal (repeat of 15.875 mm - 15.875 mm - 12.7 mm) or wide (repeat of 31.75 mm - 12.7 mm).

E) As a control interface, one or more USB ports, EIA-232-D (RS-232C) ports, or RJ45 (Ethernet) ports should be installed (regardless of the shape/type of USB and the like). The mounting area should be kept at least 22 mm from the upper end of the panel and within 82.6 mm of the right end of the panel.

F) The input/output optical port should be compatible with standard single-mode fiber, the connector shape should be LC, and the end processing should be UPC or SPC.

G) To display the state of the device, LEDs indicating the status should be mounted according to the following specifications.
   - For the position of LEDs and the position on the panel where the display names of the status represented by the LEDs are displayed, refer to Table 1 and Fig. 5.
   - All devices should be equipped with at least two LEDs, namely PWR and ALM. Other LEDs can be mounted as needed.
   - The status and color of the LEDs, from right to left, are as shown in Table 1. For the other LEDs, the display name and color can be chosen arbitrarily.

H) The LED lamps should be attached to the reverse side of the panel by making 3-mm-diameter holes, as shown in Fig. 5.

I) The paint color for the front panel should be Munsell N2 with 50% semi-gloss. In addition, the letters should be engraved or screen-printed in fixed-width Gothic font of character height 3.0 mm and character color Munsell N9. However, the character height for the blade name in the upper left of the panel should be 5.0 mm. The letters should be in English.

**Table 1:** Example of LED status indicators

| Display Name | Color | Meaning when light is on | Meaning when it is off |
|---|---|---|---|
| PWR | Green | Power ON | Power OFF |
| ALM | Red | Detection of abnormal situation | Normal operation |
| OLN | Blue | Online state | Offline state |
| MSG | Yellow | With notification status | No notification status |

For example, the MSG indicator can be used to indicate to the site workers which blade should be replaced.

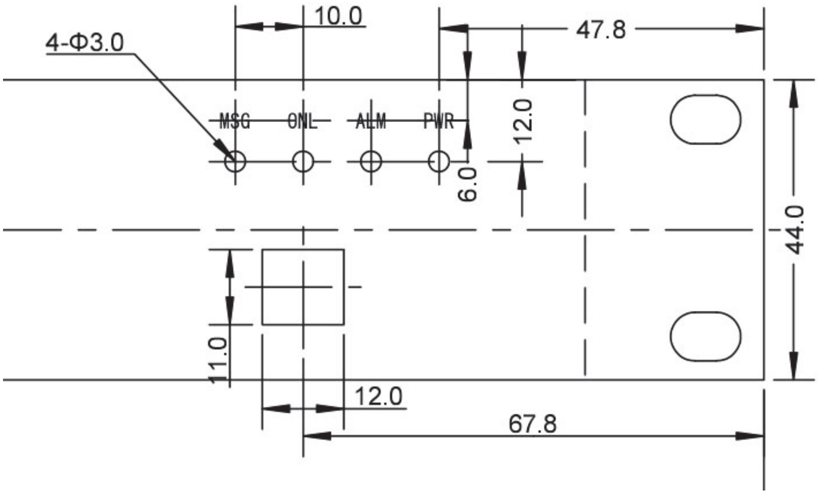



**Fig. 5:** LED mounting position

## 3.3. Interface with BlueBox

As the control software implemented on BlueBox is assumed to operate in a stateless fashion, each blade should carry a control interface that supports the following features.

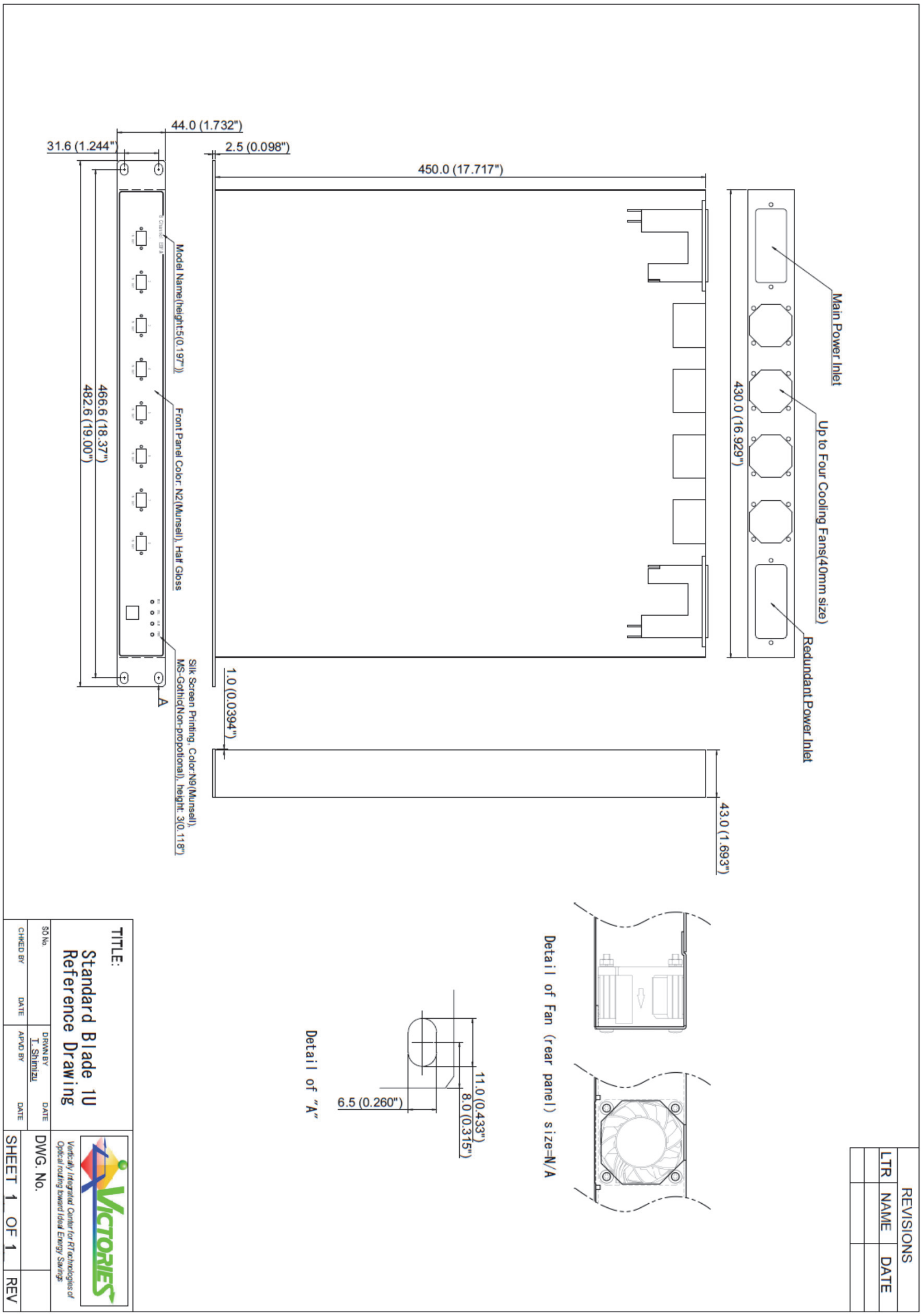
A) The blade should answer queries from BlueBox about the current status of the blade's functions (e.g., connection status among optical switch ports).

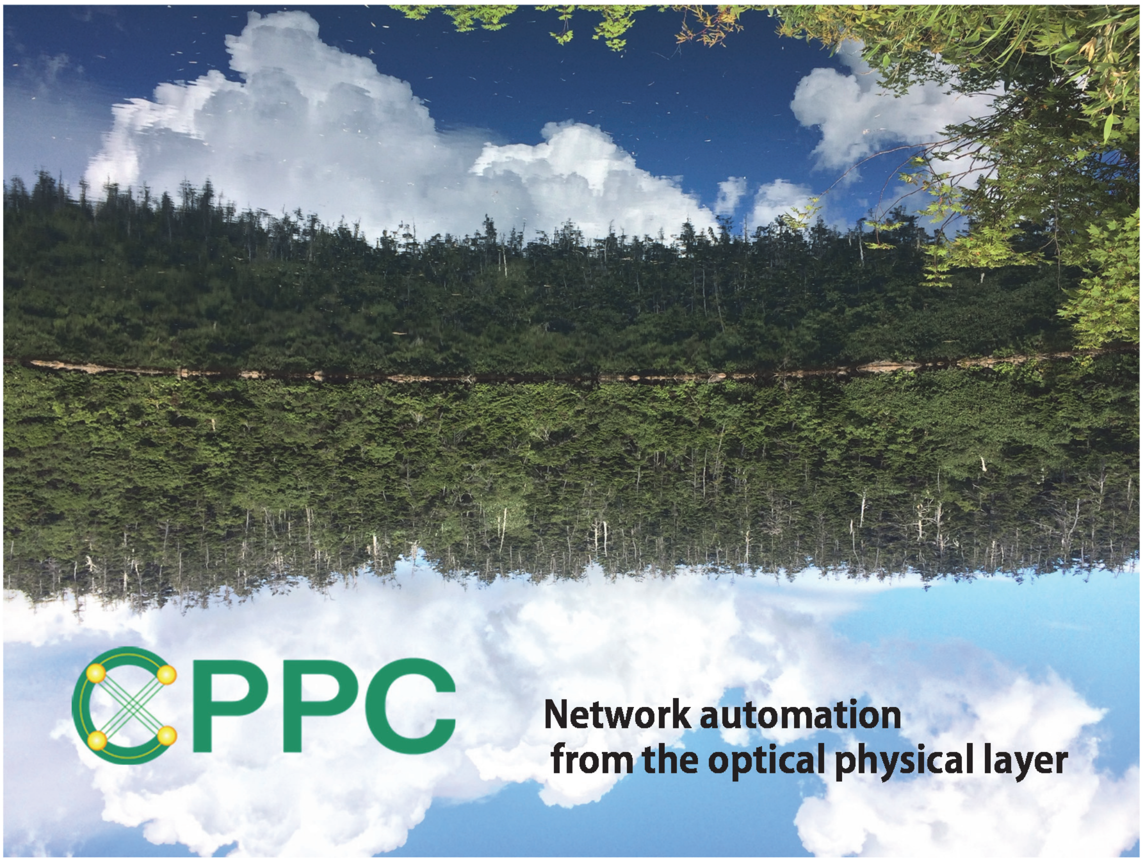
B) The blade should provide information to identify itself to BlueBox. Specifically, the blade should provide at least one of the following features.

- A unique serial number.
- A settable static IP address (if the blade is controlled through IP networks).
- A readable unique serial number in the USB device descriptor (if the blade is controlled via USB interface).
- If the blade is controlled via a serial connection interface, a USB to serial conversion cable with the feature denoted in the previous item should be employed.

# 4. BLADE DESIGN DRAWING






## ABOUT CPPC

The Cyber Photonic Platform Consortium (CPPC) was established on April 1, 2018, as one of the AIST consortia. The purpose of CPPC is to drive the automation of an optical network layer leading to new market creation, and to pursue the sustainable development of the future information communication industry.

For more information about CPPC, please go to https://unit.aist.go.jp/esprit/cppc/.

These guidelines were authorized by the steering committee of CPPC.