



MEF Standard
MEF 130

Device Physical and Environmental Service
Attributes

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Table of Contents

1	List of Contributing Members	1
2	Abstract	1
3	Terminology and Abbreviations	2
4	Compliance Levels	2
5	Introduction	3
6	Key Concepts and Definitions	4
6.1	Device	4
6.2	Device Service Attributes	4
7	Device Service Attributes	5
7.1	Device Identifier Service Attribute.....	5
7.2	Width Service Attribute	5
7.3	Depth Service Attribute	6
7.4	Height Service Attribute	6
7.5	Weight Service Attribute	6
7.6	Labeling Service Attribute.....	6
7.7	Fan Service Attribute.....	6
7.8	Noise Level Service Attribute	7
7.9	Environmental Class Service Attribute	7
7.10	Maximum Operating Altitude Service Attribute	7
7.11	Interfaces and Cables Service Attribute	7
7.12	Operating Temperature Service Attribute	9
7.13	Humidity Service Attribute	10
7.14	Power Service Attribute.....	10
7.15	AC Power Cord Service Attribute	10
7.16	Mounting Service Attribute	11
7.17	Clearances Service Attribute	11
8	References	13
	Appendix A Acknowledgements (Informative)	14



List of Tables

Table 1 – Terminology and Abbreviation..... 2
Table 2 – Device Service Attributes 5

1 List of Contributing Members

The following members of the MEF participated in the development of this document and have requested to be included in this list.

- AT&T
- Bell Canada
- Cisco
- Lumen Technologies
- Nokia
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2 Abstract

A Device is a physical component used in provisioning a product or service (e.g., Access E-Line, MEF 51.1 [9]) that requires the involved parties to agree on specific Service Attribute values. This document defines physical and environmental Service Attributes for such Devices in a manner that is independent from the MEF-defined products and services for MEF connectivity Services.

3 Terminology and Abbreviations

This section defines the terms used in this document. In many cases, the normative definitions to terms are found in other documents. In these cases, the third column is used to provide the reference that is controlling, in other MEF or external documents.

Term	Definition	Reference
Customer	Party responsible for meeting the physical and environmental requirements of the space in which the Device is to be deployed.	This document.
Device	A physical component used in provisioning a product or service.	This document.
OTN	Optical Transport Network	ITU-T G.709 [8]
Provider	Party that owns the Device.	This document.
SDH	Synchronous Digital Hierarchy	ITU-T G.707 [7]
SONET	Synchronous Optical Network	Telcordia GR-253-CORE [14]

Table 1 – Terminology and Abbreviation

4 Compliance Levels

The key words "**MUST**", "**MUST NOT**", "**REQUIRED**", "**SHALL**", "**SHALL NOT**", "**SHOULD**", "**SHOULD NOT**", "**RECOMMENDED**", "**NOT RECOMMENDED**", "**MAY**", and "**OPTIONAL**" in this document are to be interpreted as described in BCP 14 (RFC 2119 [5], RFC 8174 [6]) when, and only when, they appear in all capitals, as shown here. All key words must be in bold text.

Items that are **REQUIRED** (contain the words **MUST** or **MUST NOT**) are labeled as [**Rx**] for required. Items that are **RECOMMENDED** (contain the words **SHOULD** or **SHOULD NOT**) are labeled as [**Dx**] for desirable. Items that are **OPTIONAL** (contain the words **MAY** or **OPTIONAL**) are labeled as [**Ox**] for optional.

5 Introduction

The primary motivation for this document is to provide sufficient technical specificity to allow a Service Provider, Operator or Subscriber to successfully plan and integrate a Device into its quoting, ordering, inventory, and deployment processes. For example, the Device can be Service Provider-owned and managed equipment that is in space owned or leased by the Subscriber or a third party, or Operator-owned and managed equipment that is in space owned or leased by a Service Provider/Super Operator (SP/SO) using the services of that Operator.

When a Device owned by one partner needs to be placed in space specified by the other partner, establishing the values for the Service Attributes greatly improves the chances that the Device will be successfully deployed.

The involved party combinations in the selection of Device Service Attribute values are:

1. Subscriber and Service Provider
2. Service Provider and Operator
3. Super Operator and Operator

The three relationships above require an agreement between the two parties on the Device Service Attribute values. In this document, “Customer” is used to refer to as the party responsible for specifying the physical and environmental requirements of the space in which the Device is to be deployed, and “Provider” is used to refer to the party that owns the Device.

6 Key Concepts and Definitions

This section introduces concepts and definitions that are used throughout this document.

6.1 Device

A Device is a physical component used in provisioning a product or service (e.g., Access E-Line MEF 51.1 [9]) that requires the involved parties to agree on specific Device Service Attribute values.

6.2 Device Service Attributes

A Device is described using Service Attributes. A Service Attribute is specific information that is agreed by the parties involved with the Device that describes some aspect of its physical capabilities and/or environmental requirements. The Device Service Attribute values provide sufficient detail for the Device to be specified in a quote or order, be successfully deployed, be identifiable after deployment, and be stored in an inventory database. Like all Service Attributes, values in this document need to be agreed to by the parties involved. How the agreement is reached is beyond the scope of this document. Some examples:

- The Service Provider proposes a particular Device and associated Service Attribute values, and the Subscriber agrees.
- The Subscriber requests from the Service Provider a particular set of Device Service Attribute values and the Service Provider agrees.

Note that the Service Attributes describe physical and environmental characteristics of a Device. They do not constrain how the product or service is implemented in the Service Provider or Operator network.

7 Device Service Attributes

The Device Service Attributes are summarized in Table 2 and described in detail in the following sub-sections.

Attribute Name	Sub-section of this document
Device Identifier	Defined in Section 7.1.
Width	Defined in Section 7.2.
Depth	Defined in Section 7.3.
Height	Defined in Section 7.4.
Weight	Defined in Section 7.5.
Labeling	Defined in Section 7.6.
Fan	Defined in Section 7.7.
Noise Level	Defined in Section 7.8.
Environmental Class	Defined in Section 7.9.
Maximum Operating Altitude	Defined in Section 7.10.
Interfaces and Cables	Defined in Section 7.11.
Operating Temperature	Defined in Section 7.12.
Humidity	Defined in Section 7.13.
Power	Defined in Section 7.14.
AC Power Cord	Defined in Section 7.15.
Mounting	Defined in Section 7.16.
Clearances	Defined in Section 7.17.

Table 2 – Device Service Attributes

7.1 Device Identifier Service Attribute

The value of the Device Identifier Service Attribute is a String that is used to identify a Device for management purposes.

- [R1] The value of Device Identifier Service Attribute **MUST** be a string consisting of UTF-8 characters in the range of 32-126 (0x20 to 0x7e), inclusive.
- [R2] The value of the Device Identifier Service Attribute **MUST** be less than or equal to 53 characters in length.
- [R3] The value of the Device Identifier Service Attribute **MUST** be unique among all Devices deployed by the Provider.

7.2 Width Service Attribute

The value of the Width Service Attribute specifies the width of the Device. Width refers to the front horizontal extent of the Device when the Device is oriented per an orientation recommended by the manufacturer of the Device. This may be important, for example, because the Device needs

mounting in a cabinet or rack that has width restrictions. The value is 2-tuple of the form $\langle width, unit \rangle$ where *width* is a real number > 0 and *unit* is *Inches* or *Millimeters*.

7.3 Depth Service Attribute

The value of the Depth Service Attribute specifies the depth of the Device. Depth refers to the side horizontal extent of the Device when the Device is oriented per an orientation recommended by the manufacturer of the Device. This may be important, for example, because the Device needs mounting in a cabinet or rack that has depth restrictions. The value is 2-tuple of the form $\langle depth, unit \rangle$ where *depth* is a real number > 0 and *unit* is *Inches* or *Millimeters*.

7.4 Height Service Attribute

The value of the Height Service Attribute specifies the height of the Device. Height refers to the side vertical extent of the device when the device is oriented per an orientation recommended by the manufacturer of the Device. This may be important, for example, because the Device needs mounting in a cabinet or rack that has height restrictions. Height can be expressed in inches, millimeters, or 1.75-inch Rack Units (RU). The value is 2-tuple of the form $\langle height, unit \rangle$ where *height* is a real number > 0 and *unit* is *Inches* or *Millimeters* or *RU*.

7.5 Weight Service Attribute

The value of the Weight Service Attribute specifies the weight of the Device. This may be important, for example, because the Device needs mounting in a cabinet or rack that has weight restrictions. The value is a 2-tuple of the form $\langle weight, unit \rangle$ where *weight* is a real number > 0 and *unit* is *Pounds* or *Kilograms*.

7.6 Labeling Service Attribute

The Labeling Service Attribute specifies a human and/or machine-readable label placed on the external surface of the Device by the Provider. The value of the Labeling Service Attribute is either:

- *None*, or a combination of *Strings*, *QR Codes*, and *Bar Codes*.

In addition to the content, the format, size, and positioning of the label may need to be agreed. These details are outside the scope of this document.

7.7 Fan Service Attribute

The Fan Service Attribute denotes if one or more fans are contained within the Device. The value of the Fan Service Attribute is a Boolean:

- *TRUE*-Device contains one or more fans.
- *FALSE*-Device does not contain fan(s).

If a fan or fans are present, then regular on-site maintenance visits may need to be scheduled and site access coordinated to check/change the fan filter(s). The air flow rate may be a concern to the Customer. These aspects are beyond the scope of this document.

7.8 Noise Level Service Attribute

The Noise Level Service Attribute denotes the maximum noise level that can be acceptably emitted from the Device measured in decibels (dBs). The value is a real number ≥ 0 given in dBs.

7.9 Environmental Class Service Attribute

The value of the Environmental Class Service Attribute is a classification used for safety, spatial and environmental design guidelines. The value is *None* or one or more of the values below:

- *NEBS [15] Level 1,*
- *NEBS [15] Level 2,*
- *NEBS [15] Level 3*
- *ASHRAE [1] Environmental Class A1,*
- *ASHRAE [1] Environmental Class A2,*
- *ASHRAE [1] Environmental Class A3,*
- *ASHRAE [1] Environmental Class A4,*
- *ASHRAE [1] Environmental Class B,*
- *ASHRAE [1] Environmental Class C,*
- *IEEE 1613 [4]*
- *ETSI ES 202 336-12 [2]*
- *Other*

7.10 Maximum Operating Altitude Service Attribute

The Maximum Operating Altitude Service Attribute specifies the maximum altitude above sea level at which the Device has been designed to operate. The value is *Unspecified* or a 2-tuple of the form $\langle \textit{altitude}, \textit{unit} \rangle$ where *altitude* is an integer > 0 and *unit* is *Feet* or *Meters*.

7.11 Interfaces and Cables Service Attribute

The Interfaces and Cables Service Attribute specifies the interfaces on the Device and the data cables that come with the Device. The value of the Interfaces Service Attribute is a list of 7-tuples, one for each Interface, of the form $\langle \textit{I/F Identifier}, \textit{Data-Cable}, \textit{Physical-Layer}, \textit{Connector}, \textit{Field-Pluggable}, \textit{Gender}, \textit{Synchronous-Ethernet} \rangle$.

- The value of *I/F Identifier* is a String that is human-readable on the outside of the Device adjacent to the interface that it identifies.

[R4] The value of *I/F Identifier* **MUST** be a string consisting of UTF-8 characters in the range of 32-126 (0x20 to 0x7e), inclusive.

- [R5] The value of the Device Identifier Service Attribute **MUST** be less than or equal to 53 characters in length.
- [R6] The value of *I/F Identifier* **MUST** be unique among the set of interfaces on a specific Device.
- The value of *Data-Cable* is either *None* or a non-empty list of 4-tuples of the form $\langle \text{CableType}, \text{CableLength}, \text{ConnectorA}, \text{ConnectorZ} \rangle$.
 - The value of *CableType* is one of the following:
 - *Cat5 Ethernet*
 - *Cat5e Ethernet*
 - *Cat6 Ethernet*
 - *Cat6e Ethernet*
 - *Single Mode Fiber*
 - *Multi-mode Fiber 50-micron core*
 - *Multi-mode Fiber 62.5-micron core*
 - *CableLength* is a 2-tuple of the form $\langle \text{length}, \text{unit} \rangle$ where *length* is a real number > 0 and *unit* is *Feet* or *Meters*.
 - The value of *ConnectorA* indicates the type of connector per MEF 61.1.1 [10] Section A-1.3.1. It is the cable end that connects to the Device.
 - The value of *ConnectorZ* indicates the type of connector per MEF 61.1.1 [10] Section A-1.3.1. It is the cable end that connects to Customer equipment.
 - The value of *Physical-Layer* is a 3-tuple of the form: $\langle p, c, o \rangle$ where
 - *p* is the Client Protocol,
 - *c* is the Coding Function, and
 - *o* is the Optical Interface Functionwhere *p* is one of *Ethernet*, *Fiber Channel*, *SDH*, *SONET* or *OTN*.

If $p=\textit{Ethernet}$, then the value of *c* is one of the Ethernet PHY types as specified in MEF 61.1.1[10] Table A1-4 and the value of *o* is *N/A*.

If $p=\textit{Fibre Channel}$ then the value of $\langle c, o \rangle$ is one of the values as specified in MEF 63 [11] Section 8.1.2 Physical Layer Service Attribute Table 5.

If $p=\textit{SDH}$ then the value of $\langle c, o \rangle$ is one of the values as specified in MEF 63 [11] Section 8.1.2 Physical Layer Service Attribute Table 6.

If $p=\textit{SONET}$ then the value of $\langle c, o \rangle$ is one of the values specified in MEF 63 [11] Section 8.1.2 Physical Layer Service Attribute Table 7.

If $p = \textit{OTN}$ then the value of $\langle c, o \rangle$ is one of the values specified in MEF 64 [12] Section 8.1.2 ENNI List of Physical Layer Common Attributes including Tables 3 through 6.

- The value of *Connector* is either *None* or indicates the type of connector per MEF 61.1.1 [10] Section A-1.3.1. If the value of the *Connector* parameter is *None*, then the Device is agreed to be deployed with no pluggable present for the interface.
 - [R7] If the value of *Data-Cable* is not *None* and the value of *Connector* is not *None*, then the value of *Connector* and the value of *ConnectorA* must form a matched pair of *Socket/Plug* for at least one of the cables in the list of *Data-Cables*.
- The value of *Field-Pluggable* is one of *Pluggable*, *Fixed*, or *Unspecified* indicating whether the interface is fixed or supports a field pluggable interface.
 - [R8] If the value of *Field-Pluggable* is *Pluggable*, and the value of *Connector* is not *None*, a pluggable interface is agreed to be present that matches the agreed values of the *Physical-Layer*, *Connector*, and *Synchronous-Ethernet* parameters.
 - [R9] If the value of *Field-Pluggable* is not *Pluggable*, then the value of *Connector* **MUST NOT** be *None*.
- The value of *Gender* is either *Socket*, *Plug*, or *N/A*. If the value of *Gender* is *Socket* and the Interface is customer facing, then the Customer is expected to provide the *Data-Cable* (copper or fiber) with a plug with a connector type specified by *Connector*. When *Gender* equals *Plug*, that means the Provider is providing the *Data-Cable*. When *Gender* equals *Socket*, that means the *Data-Cable* is provided by the Customer. When *Gender* equals *N/A* then no *Data-Cable* specified.
 - [R10] When the value of *Connector* is *None*, the value of *Gender* **MUST** be *N/A*.
- The value of *Synchronous-Ethernet* indicates if the interface supports Synchronous Ethernet. The options are: *Supported* or *Unsupported*.
 - [R11] When *p* is not equal to *Ethernet* the value of *Synchronous-Ethernet* **MUST** be *Unsupported*.

7.12 Operating Temperature Service Attribute

The Operating Temperature Service Attribute specifies the minimum and maximum operating temperatures within which the Device was designed to operate. The value of the Operating Temperature Service Attribute is a 3-tuple represented as $\langle tmin, tmax, unit \rangle$ where: *tmin* is the Operating Temperature minimum expressed as an integer, *tmax* is the Operating Temperature maximum expressed as an integer and *unit* is either *Celsius* or *Fahrenheit*.

7.13 Humidity Service Attribute

The value of the Humidity Service Attribute is an integer between 0 and 100, expressed as a percentage of relative humidity. The value is the maximum relative humidity in which the Device has been designed to operate.

7.14 Power Service Attribute

The Power Service Attribute specifies the power requirements for the Device. The value is either *None* or the 7-tuple of the form $\langle \text{Voltage}, \text{Redundancy}, \text{Backup_time}, \text{Input_Power}, \text{Current} \rangle$ where:

- *Voltage* specifies the voltage level of the power input needed and whose value is one of:
 - *-24V DC*,
 - *-48V DC*,
 - *120V/60Hz AC*,
 - *240V/50Hz AC*,
 - *AC auto-ranging*.
- *Redundancy* specifies the power input redundancy and whose value is one of
 - *None*,
 - *1+1*,
 - *1:N*.
- *Backup_time* specifies the length of time in minutes that the Device can successfully operate using a secondary power source (e.g., battery or generator) when the primary power source has failed. It is a real number ≥ 0 .
- *Input_Power* specifies the maximum power consumption and whose value is a real number > 0 in Watts.
- *Current* specifies the maximum current that the Device draws represented as a 2-tuple as $\langle \text{current_draw}, \text{rated_voltage} \rangle$ where *current_draw* is in Amperes and *rated_voltage* is in Volts, both as real numbers.

[R12] If the value of the Power Service Attribute is *None*, then the value of Fan Service Attribute **MUST** be *FALSE*.

7.15 AC Power Cord Service Attribute

The AC Power Cord Service Attribute specifies the characteristics of power cords that come with the Device. The value of this Service Attribute is either *None* or a list of 3-tuples of the form: $\langle \text{Cable Length Range}, \text{Connector Type}, \text{Cable Color} \rangle$ where:

- *Cable Length Range* is a 3-tuple of the form $\langle \text{Cable_min}, \text{Cable_max}, \text{unit} \rangle$ where the lengths are expressed as a real number > 0 and *unit* is in feet or meters. *Cable_min* is minimum cable length, *Cable_max* is maximum cable length.
- *Connector Type* refers to the power plug used to connect the power cable from the Device to the Power outlet.

- The value is expressed as a single item from the enumeration *A-O* (Plug Type designation) as specified in IEC World Plugs [3].
- *Cable Color* is the color of the cable jacket. The Customer may require a specific color be used. The value is expressed as a String, for example “Blue”.

[R13] The value of *Cable Color* **MUST** be a string consisting of UTF-8 characters in the range of 32-126 (0x20 to 0x7e), inclusive.

[R14] The value of the *Cable Color* parameter **MUST** be less than or equal to 53 characters in length.

[R15] The value of the AC Power Cord Service Attribute **MUST** be *None* if the value of the Power Service Attribute Parameter Voltage parameter is *-24 DC* or *-48V DC*.

[R16] If the value of the Power Service Attribute is *None*, then the value of the AC Power Cord Service Attribute **MUST** be *None*.

7.16 Mounting Service Attribute

The Mounting Service Attribute specifies the types of mounting compatible with the Device. The value of this Service Attribute is a list containing one or more of these mounting options:

- *Indoor Rack Mount 19 inches, single device,*
- *Indoor Rack Mount 19 inches, multiple devices,*
- *Indoor Rack Mount 23 inches, single device,*
- *Indoor Rack Mount 23 inches, multiple devices,*
- *Indoor Wall Mount,*
- *Indoor Shelf Mount,*
- *Outdoor Wall Mount,*
- *Outdoor Pole Mount,*
- *Outdoor Cabinet Mount,*
- *Other.*

Some devices may be mounted in a rack side by side which is addressed with *multiple devices* options above.

7.17 Clearances Service Attribute

The Clearance Service Attribute specifies the minimum amount of empty space needed around the device for cabling, airflow, installation, servicing, etc. It is a 7-tuple of the form *<Above, Below, Left, Right, Front, Behind, Unit>* where:



- *Above* refers to the vertical empty space above the Device when the Device is oriented per an orientation recommended by the manufacturer. Its value is a real number ≥ 0 where the units are specified in *Unit*.
- *Below* refers to the vertical empty space below the Device when the Device is oriented per an orientation recommended by the manufacturer. Its value is a real number ≥ 0 where the units are specified in *Unit*.
- *Left* refers to the horizontal empty space to the left of the Device when the Device is oriented per an orientation recommended by the manufacturer. Its value is a real number ≥ 0 where the units are specified in *Unit*.
- *Right* refers to the horizontal empty space to the right of the Device when the Device is oriented per an orientation recommended by the manufacturer. Its value is a real number ≥ 0 where the units are specified in *Unit*.
- *Front* refers to the horizontal empty space in front of the Device when the Device is oriented per an orientation recommended by the manufacturer. Its value is a real number ≥ 0 where the units are specified in *Unit*.
- *Behind* refers to the horizontal empty space behind the Device when the Device is oriented per an orientation recommended by the manufacturer. Its value is a real number ≥ 0 where the units are specified in *Unit*.
- *Unit* is specified as *Inches* or *Millimeters*.

8 References

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- [16] Telcordia SR-3580, *NEBS™ Criteria Levels*, January 2018.



Appendix A Acknowledgements (Informative)

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