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Recommendation ITU-T Y.4500.6

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GLOBAL INFORMATION INFRASTRUCTURE

General	Y.100–Y.199
Services, applications and middleware	Y.200–Y.299
Network aspects	Y.300–Y.399
Interfaces and protocols	Y.400–Y.499
Numbering, addressing and naming	Y.500–Y.599
Operation, administration and maintenance	Y.600–Y.699
Security	Y.700–Y.799
Performances	Y.800–Y.899

INTERNET PROTOCOL ASPECTS

General	Y.1000–Y.1099
Services and applications	Y.1100–Y.1199
Architecture, access, network capabilities and resource management	Y.1200–Y.1299
Transport	Y.1300–Y.1399
Interworking	Y.1400–Y.1499
Quality of service and network performance	Y.1500–Y.1599
Signalling	Y.1600–Y.1699
Operation, administration and maintenance	Y.1700–Y.1799
Charging	Y.1800–Y.1899
IPTV over NGN	Y.1900–Y.1999

NEXT GENERATION NETWORKS

Frameworks and functional architecture models	Y.2000–Y.2099
Quality of Service and performance	Y.2100–Y.2199
Service aspects: Service capabilities and service architecture	Y.2200–Y.2249
Service aspects: Interoperability of services and networks in NGN	Y.2250–Y.2299
Enhancements to NGN	Y.2300–Y.2399
Network management	Y.2400–Y.2499
Network control architectures and protocols	Y.2500–Y.2599
Packet-based Networks	Y.2600–Y.2699
Security	Y.2700–Y.2799
Generalized mobility	Y.2800–Y.2899
Carrier grade open environment	Y.2900–Y.2999

FUTURE NETWORKS

CLOUD COMPUTING

INTERNET OF THINGS AND SMART CITIES AND COMMUNITIES

General	Y.4000–Y.4049
Definitions and terminologies	Y.4050–Y.4099
Requirements and use cases	Y.4100–Y.4249
Infrastructure, connectivity and networks	Y.4250–Y.4399
Frameworks, architectures and protocols	Y.4400–Y.4549
Services, applications, computation and data processing	Y.4550–Y.4699
Management, control and performance	Y.4700–Y.4799
Identification and security	Y.4800–Y.4899
Evaluation and assessment	Y.4900–Y.4999

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T Y.4500.6

oneM2M management enablement (BBF)

Summary

Recommendation ITU-T Y.4500.6 specifies the usage of the BBF TR-069 protocol and the corresponding message flows including normal as well as error cases to fulfil oneM2M management requirements.

- Protocol mapping between the oneM2M service layer and BBF TR-069 protocol. The Mca reference point, ms interface and la interface are possibly involved in this protocol mapping.
- Mapping between oneM2M management-related resources and the BBF TR-069 protocol remote procedure calls (RPCs) and BBF TR-181i2 data model.
- Specification of new BBF TR-181 data model elements to fulfil oneM2M specific management requirements that cannot be currently translated.

History

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Table of Contents

		Page
1	Scope.....	1
2	References.....	1
3	Definitions	1
	3.1 Terms defined elsewhere	1
	3.2 Terms defined in this Recommendation.....	2
4	Abbreviations and acronyms	2
5	Conventions	2
6	Mapping of basic data types	3
7	Mapping of identifiers	4
	7.0 Introduction	4
	7.1 Mapping of device identifiers to the node resource	4
	7.2 Identifier of an object instance	4
8	Mapping of resources	5
	8.0 Introduction	5
	8.1 General mapping assumptions.....	5
	8.2 Resource [deviceInfo]	5
	8.3 Resource [memory]	6
	8.4 Resource [battery]	6
	8.5 Resource [areaNwkInfo]	7
	8.6 Resource [areaNwkDeviceInfo]	7
	8.7 Resource [eventLog]	8
	8.8 Resource [deviceCapability]	8
	8.9 Resource [firmware].....	9
	8.10 Resource [software].....	10
	8.11 Resource [reboot]	12
	8.12 Resource [cmdhPolicy]	12
	8.13 Resource type <mgmtCmd>	17
	8.14 Resource type <execInstance>	18
9	Mapping of procedures for management	18
	9.0 Introduction	18
	9.1 Resource type <mgmtObj> primitive mappings	18
	9.2 <mgmtCmd> and <execInstance> resource primitive mappings.....	28
10	Server interactions	36
	10.0 Introduction	36
	10.1 Communication session establishment.....	36
	10.2 Processing of requests and responses	37
	10.3 Discovery and synchronization of resources	38

	Page
10.4 Access management	38
11 New management technology specific resources	39
Annex A – oneM2M specification update and maintenance control procedure.....	40
Bibliography.....	41

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Recommendation ITU-T Y.4500.6

oneM2M management enablement (BBF)

1 Scope

This Recommendation describes the protocol mappings between management resources for oneM2M and the BBF TR-181i2 data model.

This Recommendation contains oneM2M Release 2 specification – oneM2M Management Enablement (BBF) V2.0.1 and is equivalent to standards of oneM2M partners including ARIB, ATIS [b-ATIS.oneM2M.TS0006V201], CCSA [b-CCSA M2M-TS-0006-V2.0.1], ETSI [b-ETSI TS 118 106], TTA, TSDSI [b-TSDSI STD T1.oneM2M TS-0006-2.0.1 V1.0.0], TTA [b-TTAT.MM-TS.0006 v2.0.1] and TTC [b-TTC TS-M2M-0006v2.0.1].

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T Y.4500.1]	Recommendation ITU-T Y.4500.1 (2018), <i>oneM2M – Functional architecture</i> .
[ITU-T Y.4500.4]	Recommendation ITU-T Y.4500.4 (2018), <i>Service layer core protocol specification</i> .
[ITU-T Y.4500.11]	Recommendation ITU-T Y.4500.11 (2018), <i>Common terminology</i> .
[BBF TR-069]	TR-069, Issue 1, Amendment 6 (2018), <i>CPE WAN management protocol</i> .
[BBF TR-106]	TR-106, Issue 1, Amendment 7 (2013), <i>Data model template for TR-069-enabled devices</i> .
[BBF TR-131]	TR-131, Issue 1, Amendment 1 (2015), <i>ACS northbound interface requirements</i> .
[BBF TR-181]	TR-181, Issue 2, Amendment 11 (2016), <i>Device data model for TR-069</i> .

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

For the purposes of this Recommendation, the terms and definitions given in oneM2M TS-0011 [ITU-T Y.4500.11] and the following apply.

3.1.1 application entity [ITU-T Y.4500.11]: represents an instantiation of application logic for end-to-end M2M solutions.

3.1.2 common services entity (CSE) [ITU-T Y. 4500.11]: Represents an instantiation of a set of common service functions of the M2M environments. Such service functions are exposed to other entities through reference points.

3.1.3 CPE proxier [BBF TR-069]: A CPE that is capable of proxying the communication between an ACS and a proxied device.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

For the purposes of this Recommendation, the abbreviations given in oneM2M TS-0011 [ITU-T Y.4500.11] and the following apply:

ACS	Auto-Configuration Server
ADN	Application-Dedicated Node
AE	Application Entity
ASN	Application Service Node
CMDH	Communication Management and Delivery Handling
CPE	Customer Premises Equipment
CWMP	Common premises equipment Wide area network Management Protocol
DM	Device Management
DU	Deployment Unit
IN-CSE	Infrastructure Node-Common Services Entity
LAN	Local Area Network
MN	Middle Node
MoCA	Multimedia over Coax Alliance
OUI	Organizationally Unique Identifier
PC	Product Class
RPC	Remote Procedure Call
SN	Serial Number
UPA	Universal Powerline Association
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
USB	Universal Serial Bus
UUID	Universal Unique Identifier
XML	Extensible Markup Language
Wi-Fi	Wireless Fidelity

5 Conventions

The keywords "shall", "shall not", "should", "should not", "may", "need not" in this Recommendation are to be interpreted as follows.

Shall/shall not:

Requirements

- 1) effect on this Recommendation: This Recommendation needs to describe the required feature (i.e., specify a technical solution for the requirement);
- 2) effect on products: every implementation (M2M Solution that complies with this Recommendation) must support it;
- 3) effect on deployments: every deployment (M2M service based on this Recommendation) must use the standardized feature where applicable – otherwise interoperability problems with other services could arise, for example.

Should/should not

Recommendation

- 1) effect on this Recommendation: This Recommendation needs to describe a solution that allows the presence and the absence of the feature;
- 2) effect on products: an implementation may or may not support it; however, support is recommended;
- 3) effect on deployments: a deployment may or may not use it; however, usage is recommended.

May/need not:

Permission/Option

- 1) effect on this Recommendation: This Recommendation needs to describe a solution that allows the presence and the absence of the required feature;
- 2) effect on products: an implementation may or may not support it;
- 3) effect on deployments: A deployment may or may not use it.

6 Mapping of basic data types

[BBF TR-106] specifies the object structure supported by [BBF TR-069]-enabled devices and specifies the structural requirements for the data hierarchy. This clause includes the mapping attribute data types to [BBF TR-181] parameters that follow the conventions of section 3 of [BBF TR-106] and data types described in Table 4 of [BBF TR-106]. See Table 6-1.

Table 6-1 – Data type mapping

oneM2M data types	Mapping to data types in [BBF TR-106]	Conversion notes
xs:boolean	boolean	
xs:string	string	Mapping is constrained to the size of the string
xs:unsignedInt	unsignedInt	
xs:unsignedLong	unsignedLong	
xs:integer	long	Mapping is constrained to the size of the long data type
Xs:positiveInteger	unsignedLong	Mapping is constrained to a lower limit of 1 and the size of the unsignedLong data type
Xs:nonNegativeInteger	unsignedLong	Mapping is constrained the size of the unsignedLong data type
Comma-separated Lists	Comma-separated Lists	Data structure is represented by comma-separated list as described in section 3.2.3 of [BBF TR-106]

In some instances, the conversion of the contents between data types will cause an error to occur (e.g., xs:integer is too long). When an error occurs in the conversion of a data type, the response status code is STATUS_BAD_REQUEST.

7 Mapping of identifiers

7.0 Introduction

[BBF TR-069] specifies three types of device, known as customer premises equipment (CPE), that are capable of being managed from the perspective of the BBF TR-069 agent as follows.

- CPE that hosts the BBF TR-069 agent: section A.3.3.1 of [BBF TR-069] defines the required fields for a CPE to be identified. These fields include the organizationally unique identifier (OUI) and serial number (SN) of the CPE assigned by the CPE manufacturer. The manufacturer may assign a product class (PC) to the CPE. The format of the identifier is as follows: OUI-[PC]-SN.
- Virtual device: This type of device is addressed as a CPE. The virtual device has its own OUI-[PC]-SN as represented by the CPE proxier. The CPE proxier emulates a common premises equipment wide area network management protocol (CWMP) agent for each virtual device.
- Embedded device: This type of device is addressed as one or more objects within the data model of the CPE that hosts the BBF TR-069 agent.

7.1 Mapping of device identifiers to the node resource

Node resources are identified for each instance of an application-dedicated node (ADN), application service node (ASN) and middle node (MN), and are identified using the M2M node identifier (M2M-Node-ID) specified in oneM2M TS-0001 [ITU-T Y.4500.1].

CPE device identifiers shall map to the nodeID attribute of the <node> resource. CPE device identifiers are obtained from the contents of the following attributes:

- Device.DeviceInfo.ManufacturerOUI;
- Device.DeviceInfo.ProductClass;
- Device.DeviceInfo.SerialNumber.

Virtual device identifiers shall map to the nodeID attribute of the <node> resource. The virtual device identifiers are obtained from the CPE proxier using the contents of the attributes:

- Device.ManagementServer.VirtualDevice.{i}.ManufacturerOUI;
- Device.ManagementServer.VirtualDevice.{i}.ProductClass;
- Device.ManagementServer.VirtualDevice.{i}.SerialNumber.

Embedded device identifiers shall map to the nodeID attribute of the <node> resource. Embedded device identifiers are obtained using the containing CPE device or virtual device identifiers along with the contents of the attributes of the:

- Device.ManagementServer.EmbeddedDevice.{i}.ControllerID;
- Device.ManagementServer.EmbeddedDevice.{i}.ProxiedDeviceID.

7.2 Identifier of an object instance

The BBF TR-069 specification permits objects to have multiple object instances where each object instance is contained within the objectPath attribute of the resource within the context of the resource's objectId as defined in clause 1 of [BBF TR-069].

In order to allow the application entity (AE) or CSE originating the request that manipulates a resource to easily align the M2M service layer with the resource's external technology identifier, the value of the object instance "{i}" should be a part of the identifier of the resource in the M2M service layer where possible. For example, if the [areaNetwork] resource has an object instance identifier of "Device.X_oneM2M_org_CSE.1.M2MareaNetworkDevice.[foo]", then the M2M service layer resource should be identified using the object instance of the underlying technology (e.g., "/foo" for the resource areaNetwork).

8 Mapping of resources

8.0 Introduction

This clause contains all information on how to map management resources from oneM2M TS-0004 [ITU-T Y.4500.4] to managed objects and parameters as defined in the [BBF TR-181] data model or the remote procedure calls (RPCs) in [BBF TR-069].

8.1 General mapping assumptions

8.1.0 Introduction

[BBF TR-069] specifies a protocol for communication between CPE and an auto-configuration server (ACS). Any BBF TR-069-enabled device has to follow the data model as described in [BBF TR-106] and [BBF TR-181] as well as RPCs described in [BBF TR-069].

As [BBF TR-181] is the model on which the resources are mapped, all resources shall have the objects of the BBF TR-181 namespace (e.g., "urn:broadband-forum-org:tr-181-2-7-0").

8.1.1 Mapping of device identifiers

The device identifiers for CPEs are mapped to the resource types [deviceInfo].

CPE and virtual devices map their Device Identifiers (OUI-[PC-]SN) to the manufacturer, deviceType and deviceLabel attributes of the resource [deviceInfo].

For embedded devices, the ControllerID and ProxiedDeviceID parameters of the Device.ManagementServer.EmbeddedDevice.{i} object instance are mapped to the deviceLabel attribute of the Resource [deviceInfo] as a comma-separated list: "Device.ManagementServer.EmbeddedDevice.{i}.ControllerID, Device.ManagementServer.EmbeddedDevice.{i}.ProxiedDeviceID".

8.1.2 Mapping of embedded devices

The BBF TR-181 [BBF TR-181] specification does not provide a mechanism where embedded devices provide information related to the Device.DeviceInfo objects and sub-objects. Instead, [BBF TR-181] provides this information in a manner that is reliant on the underlying technology (e.g., ZigBee®, UpnP) of the embedded device.

As such the mapping of the [memory] and [battery] resources are implementation specific for each underlying technology and is outside the scope of this Recommendation.

8.2 Resource [deviceInfo]

The resource [deviceInfo] is a read-only resource that shall map to the Device.DeviceInfo object of [BBF TR-181] for CPE and virtual devices. See Tables 8.2-1 and 8.2-2.

The information shall be retrieved using the GetParameterValues RPC of [BBF TR-069].

NOTE – The SerialNumber, ModelNumber, ProductClass attributes for a virtual device are the same values as the Device.ManagementServer.VirtualDevice.{i} object in the CPE proxier.

Table 8.2-1 – Resource [deviceInfo] for CPE and virtual devices

Attribute name of [deviceInfo]	BBF TR-181 parameter
deviceLabel	Device.DeviceInfo.SerialNumber
manufacturer	Device.DeviceInfo.Manufacturer
model	Device.DeviceInfo.ModelNumber
deviceType	Device.DeviceInfo.ProductClass
fwVersion	Device.DeviceInfo.SoftwareVersion if the device supports only one software version. If the device supports multiple software versions this shall map to Device.DeviceInfo.AdditionalSoftwareVersion
swVersion	Device.DeviceInfo.SoftwareVersion
hwVersion	Device.DeviceInfo.HardwareVersion

Table 8.2-2 – Resource [deviceInfo] for embedded devices

Attribute name of [deviceInfo]	BBF TR-181 parameter
deviceLabel	Comma-separated list: "Device.ManagementServer.EmbeddedDevice.{i}.ControllerID, Device.ManagementServer.EmbeddedDevice.{i}.ProxiedDeviceID
manufacturer	No mapping available
model	No mapping available
deviceType	No mapping available
fwVersion	No mapping available
swVersion	No mapping available
hwVersion	No mapping available

8.3 Resource [memory]

The resource [memory] is a read-only resource that shall map to the Device.DeviceInfo.MemoryStatus object of [BBF TR-181] for CPE and virtual devices. See Table 8.3-1.

The information shall be retrieved using the GetParameterValues RPC of [BBF TR-069].

Attempts to modify the attributes of the memory Resource causes an error code "operation unsupported" to be returned.

Table 8.3-1 – Resource [memory]

Attribute name of [memory]	BBF TR-181 parameter
memAvailable	Device.DeviceInfo.MemoryStatus.Free
memTotal	Device.DeviceInfo.MemoryStatus.Total

8.4 Resource [battery]

The resource [battery] is a read-only resource that shall map to an instance of the Device.DeviceInfo.X_oneM2M_org_BatteryStatus.Battery.{i} object for CPE and virtual devices. See Table 8.4-1.

The information shall be retrieved using the GetParameterValues RPC of [BBF TR-069].

Table 8.4-1 – Resource [battery]

Attribute name of [battery]	BBF TR-181 parameter
batteryLevel	Device.DeviceInfo.X_oneM2M_org_BatteryStatus.Battery.{i}.Level
batteryStatus	Device.DeviceInfo.X_oneM2M_org_BatteryStatus.Battery.{i}.Status

8.5 Resource [areaNwkInfo]

The resource [areaNwkInfo] is a multi-instance resource where each instance of the resource shall map to an instance of the Device.X_oneM2M_org_CSE.{i}.M2MareaNetwork.{i} object. See Table 8.5-1.

As the resource [areaNwkInfo] is a multi-instance resource, the M2MareaNetwork object is a multi-object instance that can be created and deleted.

The M2MareaNetwork instance shall be created using the Add Object RPC of [BBF TR-069].

The M2MareaNetwork instance shall be deleted using the Delete Object RPC of [BBF TR-069].

The information of an M2MareaNetwork shall be retrieved using the GetParameterValues RPC of [BBF TR-069].

The information of an M2MareaNetwork shall be modified using the SetParameterValues RPC of [BBF TR-069].

Table 8.5-1 – Resource [areaNwkInfo]

Attribute name of [areaNwkInfo]	X_oneM2M_org parameter
areaNwkType	Device.X_oneM2M_org_CSE.{i}.M2MareaNetwork.{i}.Type
listOfDevices	Device.X_oneM2M_org_CSE.{i}.M2MareaNetwork.{i}.ListOfDevices

8.6 Resource [areaNwkDeviceInfo]

The resource [areaNwkDeviceInfo] is a multi-instance resource where each instance of the resource shall map to an instance of the Device.X_oneM2M_org_CSE.{i}.AreaNetworkDevice.{i} object. See Table 8.6-1.

As the resource [areaNwkDeviceInfo] is a multi-instance resource, the AreaNetworkDevice object is a multi-object instance that can be created and deleted.

Instances of the resource [areaNwkDeviceInfo] are referenced in the listOfDevices attribute of the associated resource [areaNwkInfo].

The M2MareaNetworkDevice instance shall be created using the Add Object RPC of [BBF TR-069].

The M2MareaNetworkDevice instance shall be deleted using the Delete Object RPC of [BBF TR-069].

The information of an M2MareaNetworkDevice shall be retrieved using the GetParameterValues RPC of [BBF TR-069].

The information of an M2MareaNetworkDevice shall be modified using the SetParameterValues RPC of [BBF TR-069].

Table 8.6-1 – Resource [areaNwkDeviceInfo]

Attribute name of [areaNwkDeviceInfo]	X_oneM2M_org parameter
devId	Device.X_oneM2M_org_CSE.{i}.M2MareaNetworkDevice.{i}.Host
devType	Device.X_oneM2M_org_CSE.{i}.M2MareaNetworkDevice.{i}.Type
areaNwkId	Reference to Device.X_oneM2M_org_CSE.{i}.M2MareaNetworkDevice.{i}.M2MareaNetwork
sleepInterval	Device.X_oneM2M_org_CSE.{i}.M2MareaNetworkDevice.{i}.SleepInterval
sleepDuration	Device.X_oneM2M_org_CSE.{i}.M2MareaNetworkDevice.{i}.SleepDuration
status	Device.X_oneM2M_org_CSE.{i}.M2MareaNetworkDevice.{i}.Status
listOfNeighbors	Device.X_oneM2M_org_CSE.{i}.M2MareaNetworkDevice.{i}.Neighbors

8.7 Resource [eventLog]

The resource [eventLog] is a multi-instance resource where each instance of the resource shall map to an instance of the Device.DeviceInfo.X_oneM2M_org_Diagnostics.EventLog.{i} object. See Table 8.7-1.

The EventLog instance shall be created using the Add Object RPC of [BBF TR-069].

The EventLog instance shall be deleted using the Delete Object RPC of [BBF TR-069].

The information of an EventLog instance shall be retrieved using the GetParameterValues RPC of [BBF TR-069].

The information of an EventLog instance shall be updated using the SetParameterValues RPC of [BBF TR-069].

Table 8.7-1 – Resource [eventLog]

Attribute name of [eventLog]	BBF TR-181 parameter
logTypeId	Device.DeviceInfo.X_oneM2M_org_Diagnostics.EventLog.{i}.Type
logData	Device.DeviceInfo.X_oneM2M_org_Diagnostics.EventLog.{i}.Data
logStatus	Device.DeviceInfo.X_oneM2M_org_Diagnostics.EventLog.{i}.Status
logStart	Set to "True" , the Device.DeviceInfo.X_oneM2M_org_Diagnostics.EventLog.{i}.Enable parameter is set to "True".
logStop	Set to "True" , the Device.DeviceInfo.X_oneM2M_org_Diagnostics.EventLog.{i}.Enable parameter is set to "False".

8.8 Resource [deviceCapability]

The resource [deviceCapability] represents a capability of device that can be administratively enabled or disabled. The lists of capabilities that are managed are defined in the enumeration of the capabilityName attribute. The BBF TR-181 data model defines a subset of capabilities listed in the deviceCapability enumeration. The supported device capabilities within [BBF TR-181] include:

- local area network (LAN) interfaces: universal serial bus (USB), wireless fidelity (Wi-Fi), HomePlug, multimedia over coax alliance (MoCA), Universal Powerline Association (UPA);
- hardware capabilities: SmartCardReader.

See Table 8.8-1.

The information shall be retrieved using the GetParameterValues RPC of [BBF TR-069].

The capabilities shall be enabled and disabled using the SetParameterValues RPC of [BBF TR-069].

Table 8.8-1 – Resource [capabilityInstance]

Attribute name of [capabilityInstance]	BBF TR-181 parameter
capabilityName	This attribute is fixed based on the value of the capabilityName attribute
attached	Returns "True"
capabilityActionStatus	Status is defined as: • Success if the SetParameterValues RPC indicates that the operation was successful • Failure if the response to the SetParameterValues RPCs indicates that the operation failed • In process if the SetParameterValues RPC is initiated but the response to the SetParameterValues RPC has not been received
currentState	USB: Device.USB.Interface.{i}.Enable Wi-Fi: Device.Wi-Fi.Radio.{i}.Enable HomePlug: Device.HomePlug.Interface.{i}.Enable MoCA: Device.MoCA.Interface.{i}.Enable UPA: Device.UPA.Interface.{i}.Enable SmartCardReader: Device.SmartCardReaders.SmartCardReader.{i}.Enable
enable	USB: Device.USB.Interface.{i}.Enable Wi-Fi: Device.Wi-Fi.Radio.{i}.Enable HomePlug: Device.HomePlug.Interface.{i}.Enable MoCA: Device.MoCA.Interface.{i}.Enable UPA: Device.UPA.Interface.{i}.Enable SmartCardReader: Device.SmartCardReaders.SmartCardReader.{i}.Enable
disable	Same parameter is used to disable a capability as the enable attribute

8.9 Resource [firmware]

The resource [firmware] represents a firmware instance and is not considered a BBF TR-069-managed entity within the device until the firmware resource's update attribute has been assigned a value of "True". When this occurs, the BBF TR-069 Download RPC shall be invoked. See Table 8.9-1.

NOTE – In many instances, the server from which the firmware is downloaded requires authentication in the form of username and password credentials. The CSE that executes firmware download shall maintain the mapping of the username and password of the download server needed to download the firmware outside the lifecycle of the specific firmware.