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## 29341-24-1

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# Information technology — UPnP Device Architecture —

## Part 24-1:
## Internet gateway device control protocol — Level 2 — Internet gateway device

*Technologies de l'information — Architecture de dispositif UPnP —*

*Partie 24-1: Protocole de contrôle de dispositif de passerelle Internet — Niveau 2 — Dispositif de passerelle Internet*

# CONTENTS

# Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see http://www.iso.org/directives).

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For an explanation on the voluntary nature of Standard, the meaning of the ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword – Supplementary information

ISO/IEC 29341-24-1 was prepared by UPnP Forum and adopted, under the PAS procedure, by joint technical committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

The list of all currently available parts of ISO/IEC 29341 series, under the general title *Information technology — UPnP Device Architecture*, can be found on the ISO web site.

# Introduction

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**Original UPnP Document**

Reference may be made in this document to original UPnP documents. These references are retained in order to maintain consistency between the specifications as published by ISO/IEC and by UPnP Implementers Corporation and later by UPnP Forum. The following table indicates the original UPnP document titles and the corresponding part of ISO/IEC 29341:

| UPnP Document Title | ISO/IEC 29341 Part |
|---|---|
| UPnP Device Architecture 1.0 | ISO/IEC 29341-1:2008 |
| UPnP Device Architecture Version 1.0 | ISO/IEC 29341-1:2011 |
| UPnP Device Architecture 1.1 | ISO/IEC 29341-1-1:2011 |
| UPnP Device Architecture 2.0 | ISO/IEC 29341-1-2 |
| UPnP Basic:1 Device | ISO/IEC 29341-2 |
| UPnP AV Architecture:1 | ISO/IEC 29341-3-1:2008 |
| UPnP AV Architecture:1 | ISO/IEC 29341-3-1:2011 |
| UPnP AVTransport:1 Service | ISO/IEC 29341-3-10 |
| UPnP ConnectionManager:1 Service | ISO/IEC 29341-3-11 |
| UPnP ContentDirectory:1 Service | ISO/IEC 29341-3-12 |
| UPnP RenderingControl:1 Service | ISO/IEC 29341-3-13 |
| UPnP MediaRenderer:1 Device | ISO/IEC 29341-3-2 |
| UPnP MediaRenderer:2 Device | ISO/IEC 29341-3-2:2011 |
| UPnP MediaServer:1 Device | ISO/IEC 29341-3-3 |
| UPnP AVTransport:2 Service | ISO/IEC 29341-4-10:2008 |
| UPnP AVTransport:2 Service | ISO/IEC 29341-4-10:2011 |
| UPnP ConnectionManager:2 Service | ISO/IEC 29341-4-11:2008 |
| UPnP ConnectionManager:2 Service | ISO/IEC 29341-4-11:2011 |
| UPnP ContentDirectory:2 Service | ISO/IEC 29341-4-12 |
| UPnP RenderingControl:2 Service | ISO/IEC 29341-4-13:2008 |
| UPnP RenderingControl:2 Service | ISO/IEC 29341-4-13:2011 |
| UPnP ScheduledRecording:1 | ISO/IEC 29341-4-14 |
| UPnP ScheduledRecording:2 | ISO/IEC 29341-4-14:2011 |
| UPnP MediaRenderer:2 Device | ISO/IEC 29341-4-2 |
| UPnP MediaServer:2 Device | ISO/IEC 29341-4-3 |
| UPnP AV Datastructure Template:1 | ISO/IEC 29341-4-4:2008 |
| UPnP AV Datastructure Template:1 | ISO/IEC 29341-4-4:2011 |
| UPnP DigitalSecurityCamera:1 Device | ISO/IEC 29341-5-1 |
| UPnP DigitalSecurityCameraMotionImage:1 Service | ISO/IEC 29341-5-10 |
| UPnP DigitalSecurityCameraSettings:1 Service | ISO/IEC 29341-5-11 |
| UPnP DigitalSecurityCameraStillImage:1 Service | ISO/IEC 29341-5-12 |
| UPnP HVAC_System:1 Device | ISO/IEC 29341-6-1 |
| UPnP ControlValve:1 Service | ISO/IEC 29341-6-10 |
| UPnP HVAC_FanOperatingMode:1 Service | ISO/IEC 29341-6-11 |
| UPnP FanSpeed:1 Service | ISO/IEC 29341-6-12 |
| UPnP HouseStatus:1 Service | ISO/IEC 29341-6-13 |
| UPnP HVAC_SetpointSchedule:1 Service | ISO/IEC 29341-6-14 |
| UPnP TemperatureSensor:1 Service | ISO/IEC 29341-6-15 |
| UPnP TemperatureSetpoint:1 Service | ISO/IEC 29341-6-16 |
| UPnP HVAC_UserOperatingMode:1 Service | ISO/IEC 29341-6-17 |
| UPnP HVAC_ZoneThermostat:1 Device | ISO/IEC 29341-6-2 |

| | |
|---|---|
| UPnP BinaryLight:1 Device | ISO/IEC 29341-7-1 |
| UPnP Dimming:1 Service | ISO/IEC 29341-7-10 |
| UPnP SwitchPower:1 Service | ISO/IEC 29341-7-11 |
| UPnP DimmableLight:1 Device | ISO/IEC 29341-7-2 |
| UPnP InternetGatewayDevice:1 Device | ISO/IEC 29341-8-1 |
| UPnP LANHostConfigManagement:1 Service | ISO/IEC 29341-8-10 |
| UPnP Layer3Forwarding:1 Service | ISO/IEC 29341-8-11 |
| UPnP LinkAuthentication:1 Service | ISO/IEC 29341-8-12 |
| UPnP RadiusClient:1 Service | ISO/IEC 29341-8-13 |
| UPnP WANCableLinkConfig:1 Service | ISO/IEC 29341-8-14 |
| UPnP WANCommonInterfaceConfig:1 Service | ISO/IEC 29341-8-15 |
| UPnP WANDSLLinkConfig:1 Service | ISO/IEC 29341-8-16 |
| UPnP WANEthernetLinkConfig:1 Service | ISO/IEC 29341-8-17 |
| UPnP WANIPConnection:1 Service | ISO/IEC 29341-8-18 |
| UPnP WANPOTSLinkConfig:1 Service | ISO/IEC 29341-8-19 |
| UPnP LANDevice:1 Device | ISO/IEC 29341-8-2 |
| UPnP WANPPPConnection:1 Service | ISO/IEC 29341-8-20 |
| UPnP WLANConfiguration:1 Service | ISO/IEC 29341-8-21 |
| UPnP WANDevice:1 Device | ISO/IEC 29341-8-3 |
| UPnP WANConnectionDevice:1 Device | ISO/IEC 29341-8-4 |
| UPnP WLANAccessPointDevice:1 Device | ISO/IEC 29341-8-5 |
| UPnP Printer:1 Device | ISO/IEC 29341-9-1 |
| UPnP ExternalActivity:1 Service | ISO/IEC 29341-9-10 |
| UPnP Feeder:1.0 Service | ISO/IEC 29341-9-11 |
| UPnP PrintBasic:1 Service | ISO/IEC 29341-9-12 |
| UPnP Scan:1 Service | ISO/IEC 29341-9-13 |
| UPnP Scanner:1.0 Device | ISO/IEC 29341-9-2 |
| UPnP QoS Architecture:1.0 | ISO/IEC 29341-10-1 |
| UPnP QosDevice:1 Service | ISO/IEC 29341-10-10 |
| UPnP QosManager:1 Service | ISO/IEC 29341-10-11 |
| UPnP QosPolicyHolder:1 Service | ISO/IEC 29341-10-12 |
| UPnP QoS Architecture:2 | ISO/IEC 29341-11-1 |
| UPnP QosDevice:2 Service | ISO/IEC 29341-11-10 |
| UPnP QosManager:2 Service | ISO/IEC 29341-11-11 |
| UPnP QosPolicyHolder:2 Service | ISO/IEC 29341-11-12 |
| UPnP QOS v2 Schema Files | ISO/IEC 29341-11-2 |
| UPnP RemoteUIClientDevice:1 Device | ISO/IEC 29341-12-1 |
| UPnP RemoteUIClient:1 Service | ISO/IEC 29341-12-10 |
| UPnP RemoteUIServer:1 Service | ISO/IEC 29341-12-11 |
| UPnP RemoteUIServerDevice:1 Device | ISO/IEC 29341-12-2 |
| UPnP DeviceSecurity:1 Service | ISO/IEC 29341-13-10 |
| UPnP SecurityConsole:1 Service | ISO/IEC 29341-13-11 |
| UPnP ContentDirectory:3 Service | ISO/IEC 29341-14-12:2011 |
| UPnP MediaServer:3 Device | ISO/IEC 29341-14-3:2011 |
| UPnP ContentSync:1 | ISO/IEC 29341-15-10:2011 |
| UPnP Low Power Architecture:1 | ISO/IEC 29341-16-1:2011 |
| UPnP LowPowerProxy:1 Service | ISO/IEC 29341-16-10:2011 |

ix

Introduction

Version 2 of the Internet Gateway Device Device Control Protocol (IGD DCP:2) was created to address limitations in version 1, with the following specific enhancements:

- Update *WANIPConnection* service based on developer feedback and maintenance need
  - NAT terminology update
  - New actions better suited for application development
  - Limited port mapping lease time
  - Enhanced security for the actions and parameters
- Security and access control support
  - Allow basic IGD:1 compliant functionality without requiring new protocols to be supported
  - Protect and require authentication on functionality potentially creating security threats. These features will not be available for legacy control points and backward compatibility is limited in these cases where other role than *Public* is recommended.
- Add support for IPv6 Firewall control (*WANIPv6FirewallControl*). This service allows creating and maintaining pinholes for inbound traffic from the Internet

Due to lack of developer interest, *WANPPPConnection* service was NOT updated to reflect the changes made to *WANIPConnection*.

## 1 Scope

This document specifies the characteristics of a device that manages connectivity to the Internet as an "edge" device between a residential Local Area Network and a Wide Area Network. The gateway can be physically implemented as a standalone device, or logically as a set of UPnP devices and services on a PC. This specified device is intended to be controlled from inside the home network. Control from outside the home network typically requires access control mechanisms that are outside the scope of this document. This specified device is also not intended for use with small business networks.

This document defines version 2 of the device named *InternetGatewayDevice*. It is a UPnP root device, and is identified by the UPnP device type *InternetGatewayDevice:2*. It is compliant with the UPnP Device Architecture, Versions 1.0 and 1.1 ([15] and [16], respectively). *InternetGatewayDevice:2* encapsulates several sub-devices and services that collectively comprise the Internet Gateway Device Control Protocol (DCP).

Figure 1 is a conceptual illustration of a generic Internet Gateway device consisting of one or more physical WAN and LAN interfaces.
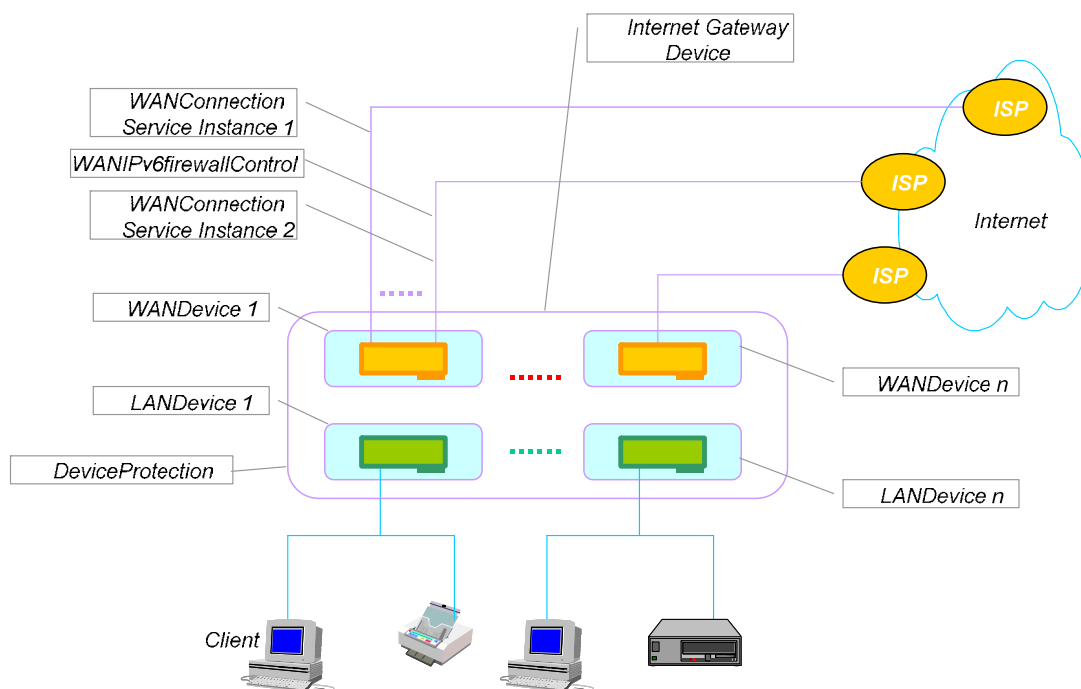
**Figure 1 — *InternetGatewayDevice* with LAN and WAN Interfaces**

## 2   Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

[1] *DeviceProtection:1*, version 1.0, UPnP Forum, February 24, 2011.
Available at: http://upnp.org/specs/gw/UPnP-gw-DeviceProtection-v1-Service.pdf.

[2] *WANDevice:2*, version 1.0, UPnP Forum, September 10, 2010.
Available at: http://upnp.org/specs/gw/UPnP-gw-WANDevice-v2-Device.pdf.

[3] *WANConnectionDevice:2,* version 1.00, UPnP Forum September 10, 2010.
Available at: http://upnp.org/specs/gw/UPnP-gw-WANConnectionDevice-v2-Device.pdf.

[4] *WANIPConnection:2,* version 1.00, UPnP Forum, September 10, 2010.
Available at: http://upnp.org/specs/gw/UPnP-gw-WANIPConnection-v2-Service.pdf.

[5] *WANIPv6FirewallControl:1,* version 1.0, UPnP Forum, December 10, 2010, Available at: http://upnp.org/specs/gw/UPnP-gw-WANIPv6FirewallControl-v1-Service.pdf.

[6] *LANDevice:1,* version 1.0, UPnP Forum, November 19, 2001.
Available at: http://upnp.org/specs/gw/UPnP-gw-LANDevice-v1-Device.pdf.

[7] *LANHostConfigManagement:1,* version 1.0, UPnP Forum, November 19, 2001.
Available at: http://upnp.org/specs/gw/UPnP-gw-LANHostConfigManagement-v1-Service.pdf.

[8] *Layer3Forwarding:1,* version 1.0, UPnP Forum, November 19, 2001.
Available at: http://upnp.org/specs/gw/UPnP-gw-Layer3Forwarding-v1-Service.pdf.

[9] *WANCableLinkConfig:1,* version 1.0, UPnP Forum, November 19, 2001.
Available at: http://upnp.org/specs/gw/UPnP-gw-WANCableLinkConfig-v1-Service.pdf.

[10] *WANCommonInterfaceConfig:1,* version 1.0, UPnP Forum, November 19, 2001.
Available at: http://upnp.org/specs/gw/UPnP-gw-WANCommonInterfaceConfig-v1-Service.pdf.

[11] *WANDSLLinkConfig:1,* version 1.0, UPnP Forum, November 19, 2001.
Available at: http://upnp.org/specs/gw/UPnP-gw-WANDSLLinkConfig-v1-Service.pdf

[12] *WANEthernetLinkConfig:1,* version 1.0, UPnP Forum, November 19, 2001.
Available at: http://upnp.org/specs/gw/UPnP-gw-WANEthernetLinkConfig-v1-Service.pdf.

[13] *WANPOTSLinkConfig:1,* version 1.0, UPnP Forum, November 19, 2001.
Available at: http://upnp.org/specs/gw/UPnP-gw-WANPOTSLinkConfig-v1-Service.pdf.

[14] *WANPPPConnection:1,* version 1.0, UPnP Forum, November 19, 2001.
Available at: http://upnp.org/specs/gw/UPnP-gw-WANPPPConnection-v1-Service.pdf.

[15] *UPnP Device Architecture*, version 1.0, UPnP Forum, June 8, 2000.
Available at: http://upnp.org/specs/arch/UPnPDA10_20000613.pdf.
Latest version available at: http://upnp.org/specs/arch/UPnP-arch-DeviceArchitecture-v1.0.pdf.

[16] *UPnP Device Architecture*, version 1.1, UPnP Forum, UPnP Forum, October 15, 2008.
Available at: http://upnp.org/specs/arch/UPnP-arch-DeviceArchitecture-v1.1.pdf.

[17] ISO 8601:2000, *Data elements and interchange formats – Information interchange -- Representation of dates and times*, International Standards Organization, December 21, 2000.
Available at:
http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=26780.

[18] IETF RFC 3986, *Uniform Resource Identifier (URI): Generic Syntax*, T. Berners-Lee, R. Fielding, L.Masinter, January 2005.
Available at: http://tools.ietf.org/html/rfc3986.

[19] IETF RFC 3339, *Date and Time on the Internet: Timestamps*, G. Klyne, Clearswift Corporation, C. Newman, Sun Microsystems, July 2002.
Available at: http://tools.ietf.org/html/rfc3339.

[20] *Extensible Markup Language (XML) 1.0 (Third Edition)*, François Yergeau, Tim Bray, Jean Paoli, C. M. Sperberg-McQueen, Eve Maler, eds., W3C Recommendation, February 4, 2004.
Available at: http://www.w3.org/TR/2004/REC-xml-20040204.

[21] *XML Schema Part 2: Data Types, Second Edition*, Paul V. Biron, Ashok Malhotra, W3C Recommendation, 28 October 2004.
Available at: http://www.w3.org/TR/2004/REC-xmlschema-2-20041028.

## 3   Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the terms and definitions given in [15], [16], [1] and the following apply.

### 3.1  Security terms

**3.1.1**
**access level**
a set of rights that allows a control point to control or query another device or service—used interchangeably in this document with the term role, as defined in [1]

### 3.2  Abbreviated terms

**3.2.1**
**DCP**
Device Control Protocol

**3.2.2**
**IGD**
Internet Gateway Device

**3.2.3**
*WAN*LinkConfig*
any or all of *WANPOTSLinkConfig*, *WANDSLLinkConfig*, *WANCableLinkConfig*, *WANEthernetLinkConfig*

**3.2.4**
*WAN**Connection*
any or both of *WANPPPConnection*, *WANIPConnection*

# 4   Device Model

## 4.1   Device Type

The following URN identifies a device that is compliant with this specification:

urn:**schemas-upnp-org:device**:*InternetGatewayDevice:2*

## 4.2   Requirements for an Internet Gateway Device

The following list of requirements has been identified on the capabilities of an Internet Gateway in coming up with the devices and services hierarchy for the gateway DCP.

- The *InternetGatewayDevice* shall support 1 WAN interface, but may support more than one physical WAN interface to connect to the Internet.

- The *InternetGatewayDevice* shall support 1 LAN interface, but may support more than one physical LAN interface to connect to the residential network.

- The *InternetGatewayDevice* should support *DeviceProtection* defined in [1].

- The *InternetGatewayDevice* shall support IGD Specific security as defined in 4.4, but may implement stricter security policy.

An implementation may host the WAN interface and LAN interface (mentioned above) on the same physical network interface card (NIC).

- Each WAN interface shall support one Internet connection, but may simultaneously support more than one Internet connection. Each of these connections will be modeled as instances of a service in the DCP.

- The *InternetGatewayDevice* shall be IP addressable from the residential LAN at all times to be UPnP compliant. More specifically, in the case of gateways with broadband modems on the WAN side, the *InternetGatewayDevice* shall be addressable.

  - When the device is not configured for WAN access or does not have any WAN connectivity.

  - Before, during and after modem and link configuration with a head-end device in the Internet service provider's central office.

- Connectivity on the WAN side shall enable nodes on the residential LAN to access resources on the Internet. A gateway may support modems and/or connections on a modem to a service provider, not resulting in Internet connectivity – for example, POTS dial-up access to a modem bank of a home security monitoring service provider. Such connections are outside the scope and requirements of the gateway DCP.

In this document, an Internet connection implies IP connectivity to an Internet Service Provider. Figure 2 illustrates the hierarchy of devices and services in an *InternetGatewayDevice*. A physical modem on the WAN side and a connection interface/port on the LAN side of the *InternetGatewayDevice* are modeled by a *WANDevice* and a *LANDevice* instance respectively. Depending on the hardware capabilities of an Internet Gateway, more than 1 instance of *WANDevice* and/or *LANDevice* are possible in an actual implementation of the gateway DCP description document. Virtual connection interfaces – such as Virtual Circuits (VC) on a DSL modem, are modeled by one or more instances of *WANConnectionDevice*. Sub-devices and services mentioned in this document are defined in companion documents that together specify the DCP for an Internet Gateway. It is

recommended that _DeviceProtection_ service will be connected to _InternetGatewayDevice_ in the device and service hierarchy.
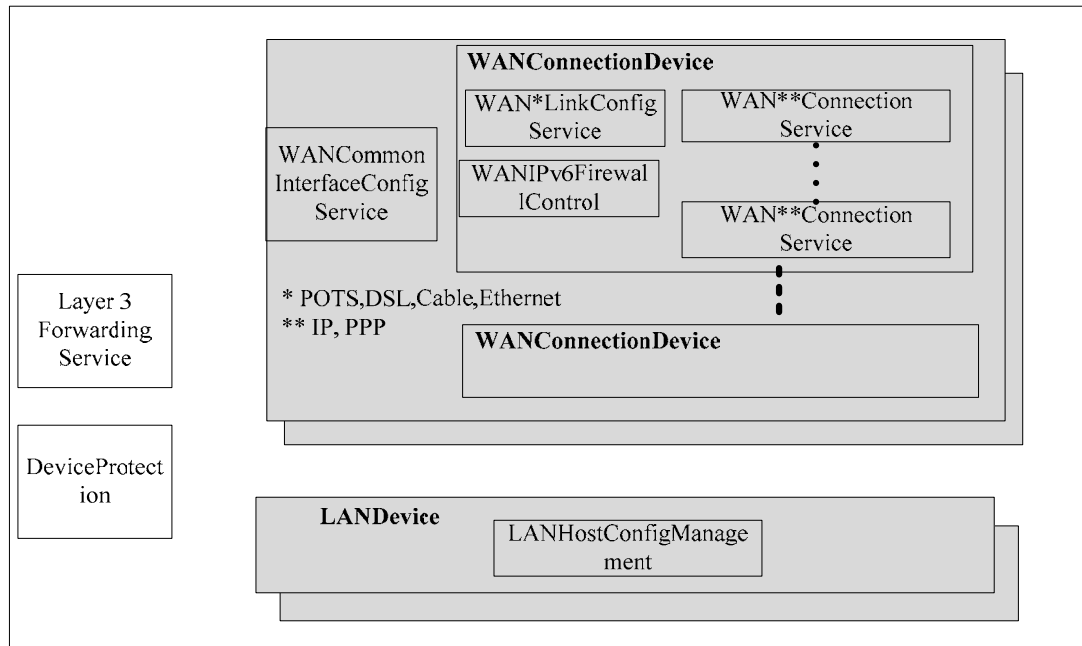


**Figure 2 — _InternetGatewayDevice_ Devices and Services Hierarchy**

### 4.3    Device Architecture

Products that expose devices of the type **urn:schemas-upnp-org:device:**_InternetGatewayDevice:2_ shall implement minimum version numbers of all required embedded devices and services specified in Table 1.

**Table 1 — Device Requirements**

| DeviceType | Root | R/A [a] | ServiceType | R/A [a] | Service ID [b] |
|---|---|---|---|---|---|
| | | | _Layer3Forwarding:1_ | _A_ | _L3Forwarding1_ |
| | | | _DeviceProtection:1_ | _A_ | _DeviceProtection1_ |
| | | | _Other standard UPnP devices and Services go here_ | _X_ | _TBD_ |
| | | | _Non-standard services embedded by an UPnP vendor go here._ | _X_ | _TBD_ |
| _WANDevice:2_ | | _R_ | _WANCommonInterfaceConfig:1_ | _R_ | _WANCommonIFC1_ |
| | | | _Non-standard services embedded by an UPnP vendor go here._ | _X_ | _TBD_ |
| _WANConnectionDevice:2 (an instance of WANDevice may include one or more WANConnectionDevice instances)_ | | _R_ | _WANPOTSLinkConfig:1_ | _A for POTS modems_ | _WANPOTSLinkC1_ |
| | | | _WANDSLLinkConfig:1_ | _A for DSL modems_ | _WANDSLLinkC1_ |
| | | | _WANCableLinkConfig:1_ | _A for Cable modems_ | _WANCableLinkC1_ |
| | | | _WANEthernetLinkConfig:1_ | _A for Ethernet_ | _WANEthLinkC1_ |

| DeviceType | Root | R/A [a] | ServiceType | R/A [a] | Service ID [b] |
|---|---|---|---|---|---|
| | | | | *attached modems* | |
| | | | *WANPPPConnection:1* | *R for modems that support PPP based connections* | *Multiple instances possible within a WANConnectionDevice. ServiceIDs for multiple instances will be WANPPPConn1, WANPPPConn2, WANPPPConn3 and so on.* |
| | | | *WANIPConnection:2* | *R for modems that support IPv4 based connections* | *Only 1 instance per WANConnectionDevice is envisioned at this time, although the design could support multiple instances in future. ServiceIDs for multiple instances will be WANIPConn1, WANIPConn2, WANIPConn3 and so on.* |
| | | | *WANIPv6FirewallControl:1* | *A for IPv6 enabled IGDs* | *Only 1 instance per WANIPv6FirewallControl is envisioned at this time, although the design could support multiple instances in future. ServiceIDs for multiple instances will be WANIPv6Firewall1, WANIPv6Firewall2, WANIPv6Firewall3 and so on.* |
| | | | *Non-standard services embedded by an UPnP vendor go here.* | *X* | *TBD* |
| *LANDevice:1* | | *A* | *LANHostConfigManagement:1* | *A* | *LANHostCfg1* |
| *Non-standard devices embedded by an UPnP vendor go here.* | *TBD* | *X* | *TBD* | *TBD* | *TBD* |

[a] R = Required, A = Allowed , X = Non-standard

[b] Prefixed by urn:**upnp-org**:**serviceId**:

### 4.3.1 Device Requirements

As shown in Table 1, the DCP defines 3 Connection services (*WANIPConnection*, *WANPPPConnection* and *WANIPv6FirewallControl*) and 4 *LinkConfig* services to accommodate various types of WAN interfaces and connection types. In addition, it includes *DeviceProtection* service for managing access control. Table 2 briefly describes the purpose of each of the services. An actual implementation of the DCP will instance only those *Connection* and *LinkConfig* services that are appropriate for the gateway device being modeled.

**Table 2 — Service Descriptions**

| Service Name | Service Description |
|---|---|
| *WANPPPConnection* | PPP connections originating at the gateway or relayed or bridged through the gateway [14] |
| *WANIPConnection* | IPv4 connections originating or relayed or bridged through the gateway [4] |
| *WANPOTSLinkConfig* | Configuration parameters associated with a WAN link on a Plain Old Telephone Service (POTS) modem [13] |

| Service Name | Service Description |
|---|---|
| *WANDSLLinkConfig* | Configuration parameters associated with a WAN link on a Digital Subscriber Link (DSL) modem [11] |
| *WANCableLinkConfig* | Configuration parameters associated with a WAN link on a cable modem [9] |
| *WANEthernetLinkConfig* | Configuration parameters associated with an Ethernet- attached external modem (cable or DSL). If proprietary mechanisms are available to discover and configure an external modem, it is recommended that modem-specific *LinkConfig* services be modeled instead of this service. [12] |
| *WANIPv6FirewallControl* | Allows controlling IPv6 firewall to open Pinholes [5] |
| *DeviceProtection* | This service facilitates authentication and access control in the gateway device [1] |

### 4.3.2 Relationships between Services

*Layer3Forwarding* identifies a default service, which is a specific instance of *WAN\*\*Connection* for IPv4 connections (or *WANIPv6FirewallControl* for IPv6 connections) in a *WANConnectionDevice*. *WANCommonInterfaceConfig* defines variables and actions common across all instances of *WAN\*\*Connection*s and *WANIPv6FirewallControl*s in a *WANDevice*. There may also be dependencies between a specific instance of *WAN\*LinkConfig* and *WAN\*\*Connection* or *WANIPv6FirewallControl* service in a *WANConnectionDevice*.

*DeviceProtection* is used to create trusted relationship between *InternetGatewayDevice* and a control point. If an action requires authentication and authorization, then this service is used to create the relationship and to verify that the relationship exists. Subclause 4.4 defines what actions can be used without authentication, and also what level of authorization is recommended for the rest of the actions that require higher level of security.

## 4.4 Security policies

Subclause 4.4 describes the recommended set of default security policies for roles and for assigning roles to services and actions.

### 4.4.1 Access control and user roles

*InternetGatewayDevice:2* that implements the *DeviceProtection* service implements following user roles as defined in [1]:

- *Public* requires neither authentication nor authorization. This user role is intended for applications making e.g. port mappings for themselves and do not require any other sort of configuration.

- *Basic* level requires authentication and authorization as specified in this document. Authentication is based on [1]. *Basic* role is intended for standard operation like creating port mappings for other devices or controlling on-demand connectivity. Usually, *Basic* role is assigned to actions making impact on single device's service. It is expected that when a new device is introduced, it is in IGD case automatically granted *Basic* access level.

- *Admin* access is intended for management of settings and risky actions that are not required in normal usage. It is recommended that administration interface SHOULD REQUIRE additional security measures. This access level is recommended, if the changes made impact to whole network's service or has impact to the several services. For instance, configuring DNS or DHCP settings would be a good example.

- *Vendor-defined* roles can be created, but it is required that all other roles are implemented and supported. It is also required that control points supporting three predefined roles are able to operate with the gateway. Role names shall be maximum 64 characters long and shall not contain spaces. Role names not defined by the Forum shall be prefixed with a Vendor Domain Name followed by a colon (such as "example.com:"). Forum-defined Role names shall be defined in service specifications and/or DCP-specific security considerations documents published by Working Committees.

This document recommends the default access level to be applied for each action of the legacy services (version 1 and version 2). In other words, this document does not require that a vendor shall implement the access level defined in this document for each action of his *InternetGatewayDevice:2* implementation. As a result, vendors are allowed to implement different access control policies than defined in this document. For example, a vendor can decide to set a *Public* access level for opening port mappings with ports lower than or equal to 1023 instead of a *Basic* access level.

When new users/control points are introduced and authorized with IGD, they should be automatically granted *Basic* access role. *Admin* level should be granted as defined in [1].

### 4.4.2 General policies

It is required that *InternetGatewayDevice:2* contains the newest version of each service. Therefore, earlier versions must not be used if newer version exists.

It is recommended that *DeviceProtection* service is implemented and applied. If *DeviceProtection* service is not implemented and applied it is recommended that control points only be allowed to access actions and parameters defined as *Public* role in this document. Refer to access levels in the Actions table for each service in the remaining subclauses of 4.4.

UPnP IGD shall expose UPnP services only over the LAN interface. IGD shall reject UPnP requests from the WAN interfaces.

### 4.4.3 *WANIPConnection:2*

#### Table 3 — Recommended access levels for *WANIPConnection:2* actions

| Name | Access level | Description |
|------|-------------|-------------|
| *SetConnectionType()* | *Admin* | Impacts connectivity for all applications |

| Name | Access level | Description |
|---|---|---|
| *GetConnectionTypeInfo()* | *Public* | Allows retrieving information |
| *RequestConnection()* | *Basic* | Starting a connection is normal operation and should not require strict security, but *Basic* authentication is recommended |
| *RequestTermination()* | *Admin* | Ending connection impacts connectivity for all applications |
| *ForceTermination()* | *Admin* | See previous |
| *SetAutoDisconnectTime()* | *Admin* | IGD configuration – not part of normal usage |
| *SetIdleDisconnectTime()* | *Admin* | IGD configuration – not part of normal usage |
| *SetWarnDisconnectDelay()* | *Admin* | IGD configuration – not part of normal usage |
| *GetStatusInfo()* | *Public* | Allows retrieving information – does not change operation |
| *GetAutoDisconnectTime()* | *Public* | Allows retrieving information – does not change operation |
| *GetWarnDisconnectDelay()* | *Public* | Allows retrieving information – does not change operation |
| *GetNATRSIPStatus()* | *Public* | Allows retrieving information – does not change operation |
| *GetGenericPortMappingEntry()* | *Public* for CP's IP address and ports greater than or equal to 1024 | Allows retrieving information on device's own port mappings when ports *are not* well-known ports |
| | *Basic* for CP's IP address and ports lower than or equal to 1023 | Allows retrieving information on device's own port mappings when ports *are* well-known ports |
| | *Basic* for other IP addresses and ports greater than or equal to 1024 | *Basic* level access is recommended for 3-box scenario *without* well-known ports |
| | *Admin* for other IP addresses and ports lower than or equal to 1023 | *Admin* level access is recommended for 3-box scenario *with* well-known ports |
| *GetSpecificPortMappingEntry()* | *Public* for CP's IP address and ports greater than or equal to 1024 | Allows retrieving information on device's own port mappings when ports *are not* well-known ports |
| | *Basic* for CP's IP address and ports lower than or equal to 1023 | Allows retrieving information on device's own port mappings when ports *are* well-known ports |
| | *Basic* for other IP addresses and ports greater than or equal to 1024 | *Basic* level access is recommended for 3-box scenario *without* well-known ports |
| | *Admin* for other IP addresses and ports lower than or equal to 1023 | *Admin* level access is recommended for 3-box scenario *with* well-known ports |
| *AddPortMapping()* | *Public* for CP's IP address and ports greater than or equal to 1024 | Allows setting port mappings for device itself when ports *are not* well-known ports |
| | *Basic* for CP's IP address and ports lower than or equal to 1023 | Allows setting port mappings for device itself when ports *are* well-known ports |
| | *Basic* for other IP addresses and ports greater than or equal to 1024 | *Basic* level access is recommended for 3-box case *without* well-known ports |
| | *Admin* for other IP addresses and ports lower than or equal to 1023 | *Admin* level access is recommended for 3-box case *with* well-known ports |
| *DeletePortMapping()* | *Public* for CP's IP address and ports greater than or equal to 1024 | Allows removing port mappings for device itself when ports *are not* well-known ports |

| Name | Access level | Description |
|---|---|---|
| | *Basic* for CP's IP address and ports lower than or equal to 1023 | Allows removing port mappings for device itself when ports *are* well-known ports |
| | *Basic* for other IP addresses and ports greater than or equal to 1024 | *Basic* level access is recommended for 3-box case *without* well-known ports |
| | *Admin* for other IP addresses and ports lower than or equal to 1023 | *Admin* level access is recommended for 3-box case *with* well-known ports |
| *DeletePortMappingRange()* | *Public* for CP's IP address and ports greater than or equal to 1024 | Allows removing device's port mappings for device itself when ports *are not* well-known ports |
| | *Basic* for CP's IP address and ports lower than or equal to 1023 | Allows removing device's port mappings for device itself when ports *are* well-known ports |
| | *Basic* for other IP addresses and ports greater than or equal to 1024 | *Basic* level access is recommended for 3-box case *without* well-known ports |
| | *Admin* for other IP addresses and ports lower than or equal to 1023 | *Admin* level access is recommended for 3-box case *with* well-known ports |
| *GetExternalIPAddress()* | *Public* | Allows retrieving WAN interface's IP address |
| *GetListOfPortMappings()* | *Public* for CP's IP address and ports greater than or equal to 1024 | Allows retrieving information on device's own port mappings when ports *are not* well-known ports |
| | *Basic* for CP's IP address and ports lower than or equal to 1023 | Allows retrieving information on device's own port mappings when ports *are* well-known ports |
| | *Basic* for other IP addresses and ports greater than or equal to 1024 | *Basic* level access is recommended for 3-box scenario *without* well-known ports |
| | *Admin* for other IP addresses and ports lower than or equal to 1023 | *Admin* level access is recommended for 3-box case *with* well-known ports |
| *AddAnyPortmapping()* | *Public* for CP's IP address and ports greater than or equal to 1024 | Allows setting port mappings for device itself when ports *are not* well-known ports |
| | *Basic* for CP's IP address and ports lower than or equal to 1023 | Allows setting port mappings for device itself when ports *are* well-known ports |
| | *Basic* for other IP addresses and ports greater than or equal to 1024 | *Basic* level access is recommended for 3-box case *without* well-known ports |
| | *Admin* for other IP addresses and ports lower than or equal to 1023 | *Admin* level access is recommended for 3-box case *with* well-known ports |

### 4.4.4    *WANPPPConnection:1*

**Table 4 — Recommended access levels for *WANPPPConnection:1* actions**

| Name | Access level | Description |
|---|---|---|
| *GetConnectionTypeInfo()* | *Public* | Allows retrieving information |
| *SetConnectionType()* | *Admin* | Impacts connectivity for all applications |
| *GetConnectionTypeInfo()* | *Public* | Allows retrieving information |
| *RequestConnection()* | *Basic* | Starting a connection is normal operation and should not require strict security, but *Basic* authentication is recommended |
| *RequestTermination()* | *Admin* | Ending connection impacts connectivity for all applications |

| Name | Access level | Description |
|---|---|---|
| *ForceTermination()* | *Admin* | Ending connection impacts connectivity for all applications |
| *SetAutoDisconnectTime()* | *Admin* | IGD configuration – not part of normal usage |
| *SetIdleDisconnectTime()* | *Admin* | IGD configuration – not part of normal usage |
| *SetWarnDisconnectDelay()* | *Admin* | IGD configuration – not part of normal usage |
| *GetStatusInfo()* | *Public* | Allows retrieving information – does not change operation |
| *GetAutoDisconnectTime()* | *Public* | Allows retrieving information – does not change operation |
| *GetWarnDisconnectDelay()* | *Public* | Allows retrieving information – does not change operation |
| *GetNATRSIPStatus()* | *Public* | Allows retrieving information – does not change operation |
| *GetGenericPortMappingEntry()* | *Public* for CP's IP address and ports greater than or equal to 1024 | Allows retrieving information on device's own port mappings when ports *are not* well-known ports |
| | *Basic* for CP's IP address and ports lower than or equal to 1023 | Allows retrieving information on device's own port mappings when ports *are* well-known ports |
| | *Basic* for other IP addresses and ports greater than or equal to 1024 | *Basic* level access is recommended for 3-box scenario *without* well-known ports |
| | *Admin* for other IP addresses and ports lower than or equal to 1023 | *Admin* level access is recommended for 3-box scenario *with* well-known ports |
| *GetSpecificPortMappingEntry()* | *Public* for CP's IP address and ports greater than or equal to 1024 | Allows retrieving information on device's own port mappings when ports *are not* well-known ports |
| | *Basic* for CP's IP address and ports lower than or equal to 1023 | Allows retrieving information on device's own port mappings when ports *are* well-known ports |
| | *Basic* for other IP addresses and ports greater than or equal to 1024 | *Basic* level access is recommended for 3-box scenario *without* well-known ports |
| | *Admin* for other IP addresses and ports lower than or equal to 1023 | *Admin* level access is recommended for 3-box scenario *with* well-known ports |
| *AddPortMapping()* | *Public* for CP's IP address and ports greater than or equal to 1024 | Allows setting port mappings for device itself when ports *are not* well-known ports |
| | *Basic* for CP's IP address and ports lower than or equal to 1023 | Allows setting port mappings for device itself when ports *are* well-known ports |
| | *Basic* for other IP addresses and ports greater than or equal to 1024 | *Basic* level access is recommended for 3-box case *without* well-known ports |
| | *Admin* for other IP addresses and ports lower than or equal to 1023 | *Admin* level access is recommended for 3-box case *with* well-known ports |
| *DeletePortMapping()* | *Public* for CP's IP address and ports greater than or equal to 1024 | Allows removing device's port mappings when ports are *not* well-known ports |
| | *Basic* for CP's IP address and ports lower than or equal to 1023 | Allows removing device's port mappings when ports *are* well-known ports |
| | *Basic* for other IP addresses and ports greater than or equal to 1024 | *Basic* level access is recommended for 3-box case *without* well-known ports |

| Name | Access level | Description |
|---|---|---|
| | Admin for other IP addresses and ports lower than or equal to 1023 | Admin level access is recommended for 3-box case *with* well-known ports |
| GetExternalIPAddress() | Public | Allows retrieving WAN interface's IP address |
| RequestConnection() | Basic | Starting a connection is normal operation and should not require strict security, but Basic authentication is recommended |
| ConfigureConnection() | Admin | Allows configuring password and user name for PPP – hence Admin level access is recommended |
| GetLinkLayerMaxBitRates() | Public | Informational action, no security threat |
| GetPPPEncryptionProtocol() | Public | Informational action, limited security threat |
| GetPPPCompressionProtocol() | Public | Informational action |
| GetPPPAuthenticationProtocol() | Public | Informational action, limited security threat |
| GetUserName() | Admin | User names should not be accessed via UPnP, serious security threat |
| GetPassword() | Admin | User names should not be accessed via UPnP, serious security threat |

Vendors, ISP, or users may disable GetPassword() and GetUsername() actions, if so desired. This would be recommendable for added security.

### 4.4.5    WANIPv6FirewallControl:1

**Table 5 — Recommended access levels for WANIPv6FirewallControl:1 actions**

| Name | Access level | Description |
|---|---|---|
| GetFirewallStatus() | Public | This allows knowing if the firewall is active and if pinholes can be made through UPnP |
| AddPinhole() | Basic for a non-wildcarded InternalPort | Basic level access is recommended to create any firewall pinholes as firewall control impacts the security of the local network |
| | Admin for a wildcarded InternalPort | Admin level access is recommended to open a firewall pinhole with a wildcarded InternalPort as the pinhole created by this action could enable port scans for the specified destination address |
| UpdatePinhole() | Basic for a non-wildcarded InternalPort | Basic level access is recommended to update any firewall pinholes as firewall control impacts the security of the local network |
| | Admin for a wildcarded InternalPort | Admin level access is recommended to update a firewall pinhole with a wildcarded InternalPort as the pinhole updated by this action could enable port scans for the specified destination address |
| DeletePinhole() | Basic for a non-wildcarded InternalPort | Basic level access is recommended to delete any firewall pinholes as firewall control impacts the security of the local network |
| | Admin for a wildcarded InternalPort | Admin level access is recommended to delete a firewall pinhole with a wildcarded InternalPort as this level access is recommended to create this type of pinhole |
| CheckPinholeWorking() | Basic for a non-wildcarded InternalPort | Basic level access is recommended to check that a firewall pinhole is working as firewall control impacts the security of the local network |
| | Admin for a wildcarded InternalPort | Admin level access is recommended to check that a firewall pinhole with a wildcarded InternalPort is working as this level access is recommended to create this type of pinhole |
| GetOutboundPinholeTimeout() | Public | Information retrieval to allow CP's to know automatic pinhole expiration time |

### 4.4.6    *LANHostConfigManagement:1*

*LANHostConfigManagement:1* is risky service that should be implemented with minimal features and potentially also be disabled in normal operation, as it is not needed for typical IP configuration. Also it is recommended that maximum level of security would be applied.

**Table 6 — Recommended access levels for *LANHostConfigManagement:1* actions**

| Name | Access level | Description |
|---|---|---|
| *SetDHCPServerConfigurable()* | *Admin* | Allows enabling, disabling DHCP configuration – impacts to basic settings of the network -> *Admin* |
| *GetDHCPServerConfigurable()* | *Public* | Allows knowing if DHCP server can be configured over UPnP -> *Public* |
| *SetDHCPRelay()* | *Admin* | Allows enabling DHCP relay service, Impacts basic settings of the network-> *Admin* |
| *GetDHCPRelay()* | *Public* | Allows knowing if DHCP relay service is active or not. Informational action -> *Public* |
| *SetSubnetMask()* | *Admin* | Sets used subnet mask - > impacts basic setting of a network -> *Admin* |
| *GetSubnetMask()* | *Public* | Informational action -> *Public* |
| *SetIPRouter()* | *Admin* | Allows setting routers information in DHCP – impacts the network -> *Admin* |
| *DeleteIPRouter()* | *Admin* | Allows deleting a router's information in DHCP – impacts the network -> *Admin* |
| *GetIPRoutersList()* | *Public* | Allows getting information of current routers. Informational action, no serious threats as the information is provided by DHCP -> *Public* |
| *SetDomainName()* | *Admin* | Impacts basic network settings -> *Admin* |
| *GetDomainName()* | *Public* | Information provided also by DHCP and this is informational action -> *Public* |
| *SetAddressRange()* | *Admin* | This does impact basic settings of the network -> *Admin* |
| *GetAddressRange()* | *Public* | Informational action->*Public* |
| *SetReservedAddress()* | *Admin* | Allows setting addresses that are not distributed by DHCP. Impacts basic network settings -> *Admin* |
| *DeleteReservedAddress()* | *Admin* | Allows removing addresses the list of reserved addresses that are not distributed by DHCP. Impacts basic network settings -> *Admin* |
| *GetReservedAddresses()* | *Admin* | DHCP specific configuration -> *Admin* |
| *SetDNSServer()* | *Admin* | Impacts basic settings of the network->*Admin* |
| *DeleteDNSServer()* | *Admin* | Impacts basic settings of the network->*Admin* |
| *GetDNSServers()* | *Public* | Information distributed by DHCP -> *Public* |

### 4.4.7    *Layer3Forwarding:1*

**Table 7 — Recommended access levels for *Layer3Forwarding:1* actions**

| Name | Access level | Description |
|---|---|---|
| *SetDefaultConnectionService()* | *Admin* | Impacts basic settings of the network->*Admin* |
| *GetDefaultConnectionService()* | *Public* | Informational action ->*Public* |

### 4.4.8    *WANEthernetLinkConfig:1*

**Table 8 — Recommended access levels for *WANEthernetLinkConfig:1* actions**

| Name | Access level | Description |
|---|---|---|
| *GetEthernetLinkStatus()* | *Public* | Informational action ->*Public* |

### 4.4.9 *WANCableLinkConfig:1*

**Table 9 — Recommended access levels for *WANCableLinkConfig:1* actions**

| Name | Access level | Description |
|---|---|---|
| *GetCableLinkConfigInfo()* | *Public* | Informational action ->*Public* |
| *GetDownstreamFrequency()* | *Public* | Informational action ->*Public* |
| *GetDownstreamModulation()* | *Public* | Informational action ->*Public* |
| *GetUpstreamFrequency()* | *Public* | Informational action ->*Public* |
| *GetUpstreamModulation()* | *Public* | Informational action ->*Public* |
| *GetUpstreamChannelID()* | *Public* | Informational action ->*Public* |
| *GetUpstreamPowerLevel()* | *Public* | Informational action ->*Public* |
| *GetBPIEncryptionEnabled()* | *Public* | Informational action ->*Public* |
| *GetConfigFile()* | *Public* | Informational action ->*Public* |
| *GetTFTPServer()* | *Public* | Informational action ->*Public* |

### 4.4.10 *WANDSLLinkConfig:1*

**Table 10 — Recommended access levels for *WANDSLLinkConfig:1* actions**

| Name | Access level | Description |
|---|---|---|
| *SetDSLLinkType()* | *Admin* | Impact network connectivity -> *Admin* |
| *GetDSLLinkInfo()* | *Public* | Informational action ->*Public* |
| *GetAutoConfig()* | *Public* | Informational action ->*Public* |
| *GetModulationType()* | *Public* | Informational action ->*Public* |
| *SetDestinationAddress()* | *Admin* | Impacts network connectivity -> *Admin* |
| *GetDestinationAddress()* | *Public* | Informational action ->*Public* |
| *SetATMEncapsulation()* | *Admin* | Impacts network connectivity -> *Admin* |
| *GetATMEncapsulation()* | *Public* | Informational action ->*Public* |
| *SetFCSPreserved()* | *Admin* | Impacts network connectivity -> *Admin* |
| *GetFCSPreserved()* | *Public* | Informational action ->*Public* |

### 4.4.11 *WANCommonInterfaceConfig:1*

**Table 11 — Recommended access levels for *WANCommonInterfaceConfig:1* actions**

| Name | Access level | Description |
|---|---|---|
| *SetEnabledForInternet()* | *Admin* | Enables / disables network connectivity to Internet -> *Admin* |
| *GetEnabledForInternet()* | *Public* | Informational action ->*Public* |
| *GetCommonLinkProperties()* | *Public* | Informational action ->*Public* |
| *GetWANAccessProvider()* | *Public* | Informational action ->*Public* |
| *GetMaximumActiveConnections()* | *Public* | Informational action ->*Public* |
| *GetTotalBytesSent()* | *Public* | Informational action ->*Public* |
| *GetTotalBytesReceived()* | *Public* | Informational action ->*Public* |
| *GetTotalPacketsSent()* | *Public* | Informational action ->*Public* |
| *GetTotalPacketsReceived()* | *Public* | Informational action ->*Public* |
| *GetActiveConnection()* | *Public* | Informational action ->*Public* |

### 4.4.12 *WANPOTSLinkConfig:1*

**Table 12 — Recommended access levels for *WANPOTSLinkConfig:1* actions**

| Name | Access level | Description |
|---|---|---|
| *SetISPInfo()* | *Admin* | Impacts network connectivity -> *Admin* |
| *SetCallRetryInfo()* | *Admin* | Impacts network connectivity -> *Admin* |
| *GetISPInfo()* | *Public* | Informational action -> *Public* |
| *GetCallRetryInfo()* | *Public* | Informational action -> *Public* |
| *GetFclass()* | *Public* | Informational action -> *Public* |
| *GetDataModulationSupported()* | *Public* | Informational action -> *Public* |
| *GetDataProtocol()* | *Public* | Informational action -> *Public* |
| *GetDataCompression()* | *Public* | Informational action -> *Public* |
| *GetPlusVTRCommandSupported()* | *Public* | Informational action -> *Public* |

## 5   XML Device Description

```xml
<?xml version="1.0"?>
<root xmlns="urn:schemas-upnp-org:device-1-0">
  <specVersion>
    <major>1</major>
    <minor>0</minor>
  </specVersion>
  <URLBase>base URL for all relative URLs</URLBase>
  <device>
    <deviceType>urn:schemas-upnp-org:device:InternetGatewayDevice:2</deviceType>
    <friendlyName>short user-friendly title</friendlyName>
    <manufacturer>manufacturer name</manufacturer>
    <manufacturerURL>URL to manufacturer site</manufacturerURL>
    <modelDescription>long user-friendly title</modelDescription>
    <modelName>model name</modelName>
    <modelNumber>model number</modelNumber>
    <modelURL>URL to model site</modelURL>
    <serialNumber>manufacturer's serial number</serialNumber>
    <UDN>uuid:UUID</UDN>
    <UPC>Universal Product Code</UPC>
    <iconList>
      <icon>
        <mimetype>image/format</mimetype>
        <width>horizontal pixels</width>
        <height>vertical pixels</height>
        <depth>color depth</depth>
        <url>URL to icon</url>
      </icon>
      <!-- XML to declare other icons, if any, go here -->
    </iconList>
    <serviceList>
      <service>
        <serviceType>urn:schemas-upnp-org:service:Layer3Forwarding:1</serviceType>
        <serviceId>urn:upnp-org:serviceId:L3Forwarding1</serviceId>
        <SCPDURL>URL to service description</SCPDURL>
        <controlURL>URL for control</controlURL>
        <eventSubURL>URL for eventing</eventSubURL>
      </service>
      <service>
        <serviceType>urn:schemas-upnp-org:service:DeviceProtection:1</serviceType>
        <serviceId>urn:upnp-org:serviceId:DeviceProtection1</serviceId>
        <SCPDURL>URL to service description</SCPDURL>
        <controlURL>URL for control</controlURL>
        <eventSubURL>URL for eventing</eventSubURL>
      </service>
      <!-- Declarations for other services added by UPnP vendor (if any) go here -->
    </serviceList>
    <deviceList>
      <device>
        <deviceType>urn:schemas-upnp-org:device:WANDevice:2</deviceType>
        <friendlyName>short user-friendly title</friendlyName>
        <manufacturer>manufacturer name</manufacturer>
        <manufacturerURL>URL to manufacturer site</manufacturerURL>
        <modelDescription>long user-friendly title</modelDescription>
        <modelName>model name</modelName>
        <modelNumber>model number</modelNumber>
        <modelURL>URL to model site</modelURL>
        <serialNumber>manufacturer's serial number</serialNumber>
        <UDN>uuid:UUID</UDN>
        <UPC>Universal Product Code</UPC>
        <iconList>
          <icon>
            <mimetype>image/format</mimetype>
            <width>horizontal pixels</width>
            <height>vertical pixels</height>
            <depth>color depth</depth>
            <url>URL to icon</url>
```

```
            </icon>
            <!-- XML to declare other icons, if any, go here -->
        </iconList>
        <serviceList>
          <service>
            <serviceType>urn:schemas-upnp-
org:service:WANCommonInterfaceConfig:1</serviceType>
            <serviceId>urn:upnp-org:serviceId:WANCommonIFC1</serviceId>
            <SCPDURL>URL to service description</SCPDURL>
            <controlURL>URL for control</controlURL>
            <eventSubURL>URL for eventing</eventSubURL>
          </service>
          <!-- Declarations for other services added by UPnP vendor (if any) go here
-->
        </serviceList>
        <deviceList>
          <device>
            <deviceType>urn:schemas-upnp-
org:device:WANConnectionDevice:2</deviceType>
            <friendlyName>short user-friendly title</friendlyName>
            <manufacturer>manufacturer name</manufacturer>
            <manufacturerURL>URL to manufacturer site</manufacturerURL>
            <modelDescription>long user-friendly title</modelDescription>
            <modelName>model name</modelName>
            <modelNumber>model number</modelNumber>
            <modelURL>URL to model site</modelURL>
            <serialNumber>manufacturer's serial number</serialNumber>
            <UDN>uuid:UUID</UDN>
            <UPC>Universal Product Code</UPC>
            <iconList>
              <icon>
                <mimetype>image/format</mimetype>
                <width>horizontal pixels</width>
                <height>vertical pixels</height>
                <depth>color depth</depth>
                <url>URL to icon</url>
              </icon>
              <!-- XML to declare other icons, if any, go here -->
            </iconList>
            <serviceList>
              <service>
                <serviceType>urn:schemas-upnp-
org:service:WANDSLLinkConfig¹:1</serviceType>
                <serviceId>urn:upnp-org:serviceId:WANDSLLinkC1</serviceId>
                <SCPDURL>URL to service description</SCPDURL>
                <controlURL>URL for control</controlURL>
                <eventSubURL>URL for eventing</eventSubURL>
              </service>
              <service>
                <serviceType>urn:schemas-upnp-
org:service:WANIPConnection²:2</serviceType>
                <serviceId>urn:upnp-org:serviceId:WANIPConn1</serviceId>
                <SCPDURL>URL to service description</SCPDURL>
                <controlURL>URL for control</controlURL>
                <eventSubURL>URL for eventing</eventSubURL>
              </service>
              <!-- Declarations for other services added by UPnP vendor (if any) go
here -->
            </serviceList>
            <deviceList>
```

---

[1] NOTE to implementers: This template is representative of one device type – a DSL modem in this case. Depending on the type of modem, substitute or add device specific service names.

[2] NOTE to implementers: This template is representative of one connection type –IP in this case. Depending on the type of connection, substitute or add device specific service names.

```
                    <!-- Description of embedded devices added by UPnP vendor (if any) go
here -->
            </deviceList>
            <presentationURL>URL for presentation</presentationURL>
          </device>
        </deviceList>
        <presentationURL>URL for presentation</presentationURL>
      </device>
      <device>
        <deviceType>urn:schemas-upnp-org:device:LANDevice:1</deviceType>
        <friendlyName>short user-friendly title</friendlyName>
        <manufacturer>manufacturer name</manufacturer>
        <manufacturerURL>URL to manufacturer site</manufacturerURL>
        <modelDescription>long user-friendly title</modelDescription>
        <modelName>model name</modelName>
        <modelNumber>model number</modelNumber>
        <modelURL>URL to model site</modelURL>
        <serialNumber>manufacturer's serial number</serialNumber>
        <UDN>uuid:UUID</UDN>
        <UPC>Universal Product Code</UPC>
        <iconList>
          <icon>
            <mimetype>image/format</mimetype>
            <width>horizontal pixels</width>
            <height>vertical pixels</height>
            <depth>color depth</depth>
            <url>URL to icon</url>
          </icon>
          <!-- XML to declare other icons, if any, go here -->
        </iconList>
        <serviceList>
          <service>
            <serviceType>urn:schemas-upnp-
org:service:LANHostConfigManagement:1</serviceType>
            <serviceId>urn:upnp-org:serviceId:LANHostCfg1</serviceId>
            <SCPDURL>URL to service description</SCPDURL>
            <controlURL>URL for control</controlURL>
            <eventSubURL>URL for eventing</eventSubURL>
          </service>
          <!-- Declarations for other services added by UPnP vendor (if any) go here
-->
        </serviceList>
        <deviceList>
          <!-- Description of embedded devices added by UPnP vendor (if any) go here
-->
        </deviceList>
        <presentationURL>URL for presentation</presentationURL>
      </device>
      <!-- Description of embedded devices added by UPnP vendor (if any) go here -->
    </deviceList>
    <presentationURL>URL for presentation</presentationURL>
  </device>
</root>
```

## 6 Test

No semantic tests are defined for this device.

## Annex A

## Theory of Operation

Each *WANDevice* in Figure 1 can be viewed as an instantiation of a physical WAN interface. If an *InternetGatewayDevice* provides multiple WAN physical interfaces to UPnP clients, each of these will typically be included in the device description document as distinct *WANDevice* instances. However, an implementation may choose to encapsulate more than one physical WAN interface in a single *WANDevice*. This may be done, for example, in applications that use asymmetric connections like a satellite downlink and POTS uplink. Another example would be where multiple physical WAN interfaces are pooled and presented as one device. Aspects such as load balancing between the pooled resources would be transparent to UPnP clients in this case.

All Internet connections are set up from or through a WAN interface of the *InternetGatewayDevice* to Internet Service Providers (ISPs). *WANDevice* is a container for all UPnP services associated with a physical WAN device. It is assumed that clients are connected to *InternetGatewayDevice* via a LAN (IP-based network). Each link on a WAN interface is modeled by an instance of *WANConnectionDevice* in *WANDevice*. A *WANConnectionDevice* in turn contains one link-specific *WAN\*LinkConfig*[3] service and one or more instances of *WAN\*\*Connection* service for IPv4 connections, or *WANIPv6FirewallControl* service for IPv6 connections.

A *WANDevice* provides a *WANCommonInterfaceConfig* service that encapsulates Layer 1 and Layer 2 properties relevant to Internet access common to the specific WAN access type and across multiple *WAN\*\*Connection* (and *WANIPv6FirewallControl*) service instances.

The gateway device may also support multiple physical LAN interfaces. It may support distinct subnets of client nodes on the residential network. Each *LANDevice* – identified in the device description document with a UDN – typically corresponds to a physical LAN interface (or port) on the *InternetGatewayDevice*. However, an implementation may choose to encapsulate more than one physical LAN interface in a single *LANDevice*. This would be the case if two LAN subnets that are bridged are to be presented as a single logical LAN interface. Devices on a LAN may configure, initiate and/or share Internet connections.

The *InternetGatewayDevice* may also support Layer-3 packet transformation and forwarding functions managed and applicable across all connection instances. These functions are currently modeled in *Layer3Forwarding* service. Layer-3 packet forwarding functions that are specific to a connection will be modeled in each *WAN\*\*Connection* (or *WANIPv6FirewallControl*) service instance.

---

[3] If link configuration services for interfaces types other than these are needed, they can be implemented as vendor-proprietary extensions.