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**Information technology — UPnP  
Device Architecture —**

**Part 24-2:  
Internet gateway device control  
protocol — Level 2 — Wide area  
network connection device**

*Technologies de l'information — Architecture de dispositif UPnP —  
Partie 24-2: Protocole de contrôle de dispositif de passerelle  
Internet — Niveau 2 — Dispositif de connexion de réseau étendu*





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## 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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ISO/IEC 29341-24-2 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](#).

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5 956 487 / US; 6 170 007 / US; 6 139 177 / US; 6 529 936 / US; 6 470 339 / US; 6 571 388 / US; 6 205 466 / US

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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       |

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|   |                          |
|---|--------------------------|
| 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 WANPPPPConnection: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 |



|   |                          |
|---|--------------------------|
| UPnP LowPowerDevice:1 Service                           | ISO/IEC 29341-16-11:2011 |
| UPnP QoS Architecture:3                                 | ISO/IEC 29341-17-1:2011  |
| UPnP QoSDevice:3 Service                                | ISO/IEC 29341-17-10:2011 |
| UPnP QoSManager:3 Service                               | ISO/IEC 29341-17-11:2011 |
| UPnP QoSPolicyHolder:3 Service                          | ISO/IEC 29341-17-12:2011 |
| UPnP QoSDevice:3 Addendum                               | ISO/IEC 29341-17-13:2011 |
| UPnP RemoteAccessArchitecture:1                         | ISO/IEC 29341-18-1:2011  |
| UPnP InboundConnectionConfig:1 Service                  | ISO/IEC 29341-18-10:2011 |
| UPnP RADAConfig:1 Service                               | ISO/IEC 29341-18-11:2011 |
| UPnP RADASync:1 Service                                 | ISO/IEC 29341-18-12:2011 |
| UPnP RATAConfig:1 Service                               | ISO/IEC 29341-18-13:2011 |
| UPnP RAClient:1 Device                                  | ISO/IEC 29341-18-2:2011  |
| UPnP RAServer:1 Device                                  | ISO/IEC 29341-18-3:2011  |
| UPnP RADiscoveryAgent:1 Device                          | ISO/IEC 29341-18-4:2011  |
| UPnP SolarProtectionBlind:1 Device                      | ISO/IEC 29341-19-1:2011  |
| UPnP TwoWayMotionMotor:1 Service                        | ISO/IEC 29341-19-10:2011 |
| UPnP AV Architecture:2                                  | ISO/IEC 29341-20-1       |
| UPnP AVTransport:3 Service                              | ISO/IEC 29341-20-10      |
| UPnP ConnectionManager:3 Service                        | ISO/IEC 29341-20-11      |
| UPnP ContentDirectory:4 Device                          | ISO/IEC 29341-20-12      |
| UPnP RenderingControl:3 Service                         | ISO/IEC 29341-20-13      |
| UPnP ScheduledRecording:2 Service                       | ISO/IEC 29341-20-14      |
| UPnP MediaRenderer:3 Service                            | ISO/IEC 29341-20-2       |
| UPnP MediaServer:4 Device                               | ISO/IEC 29341-20-3       |
| UPnP AV Datastructure Template:1                        | ISO/IEC 29341-20-4       |
| UPnP InternetGatewayDevice:2 Device                     | ISO/IEC 29341-24-1       |
| UPnP WANIPConnection:2 Service                          | ISO/IEC 29341-24-10      |
| UPnP WANIPv6FirewallControl:1 Service                   | ISO/IEC 29341-24-11      |
| UPnP WANConnectionDevice:2 Service                      | ISO/IEC 29341-24-2       |
| UPnP WANDevice:2 Device                                 | ISO/IEC 29341-24-3       |
| UPnP Telephony Architecture:2                           | ISO/IEC 29341-26-1       |
| UPnP CallManagement:2 Service                           | ISO/IEC 29341-26-10      |
| UPnP MediaManagement:2 Service                          | ISO/IEC 29341-26-11      |
| UPnP Messaging:2 Service                                | ISO/IEC 29341-26-12      |
| UPnP PhoneManagement:2 Service                          | ISO/IEC 29341-26-13      |
| UPnP AddressBook:1 Service                              | ISO/IEC 29341-26-14      |
| UPnP Calendar:1 Service                                 | ISO/IEC 29341-26-15      |
| UPnP Presense:1 Service                                 | ISO/IEC 29341-26-16      |
| UPnP TelephonyClient:2 Device                           | ISO/IEC 29341-26-2       |
| UPnP TelephonyServer:2 Device                           | ISO/IEC 29341-26-3       |
| UPnP Friendly Info Update:1 Service                     | ISO/IEC 29341-27-1       |
| UPnP MultiScreen MultiScreen Architecture:1             | ISO/IEC 29341-28-1       |
| UPnP MultiScreen Application Management:1 Service       | ISO/IEC 29341-28-10      |
| UPnP MultiScreen Screen:1 Device                        | ISO/IEC 29341-28-2       |
| UPnP MultiScreen Application Management:2 Service       | ISO/IEC 29341-29-10      |
| UPnP MultiScreen Screen:2 Device                        | ISO/IEC 29341-29-2       |
| UPnP IoT Management and Control Architecture Overview:1 | ISO/IEC 29341-30-1       |

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|   |                     |
|---|---------------------|
| UPnP DataStore:1 Service                                    | ISO/IEC 29341-30-10 |
| UPnP IoT Management and Control Data Model:1 Service        | ISO/IEC 29341-30-11 |
| UPnP IoT Management and Control Transport Generic:1 Service | ISO/IEC 29341-30-12 |
| UPnP IoT Management and Control:1 Device                    | ISO/IEC 29341-30-2  |
| UPnP Energy Management:1 Service                            | ISO/IEC 29341-31-1  |

## 1 Scope

This document specifies the characteristics of the UPnP networked device named WANConnectionDevice:2, version 2. This device definition is compliant with *UPnP Device Architecture 1.0* [14] and *UPnP Device Architecture 1.1* [15].

## 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.

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Available at <http://upnp.org/specs/gw/UPnP-gw-InternetGatewayDevice-v2-Device.pdf>.
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Available at: <http://upnp.org/specs/gw/UPnP-gw-WANDevice-v2-Device.pdf>.
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Available at: <http://upnp.org/specs/gw/UPnP-gw-WANPPPConection-v1-Service.pdf>.
- [14] *UPnP Device Architecture 1.0*, UPnP Forum.  
Available at: <http://upnp.org/specs/arch/UPnP-arch-DeviceArchitecture-v1.0.pdf>.
- [15] *UPnP Device Architecture 1.1*, UPnP Forum.  
Available at: <http://upnp.org/specs/arch/UPnP-arch-DeviceArchitecture-v1.1.pdf>.
- [16] *Data elements and interchange formats – Information interchange -- Representation of dates and times*, International Standards Organization, December 21, 2000.  
Available at: [ISO 8601:2000](#).

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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 [14], [15], [1] and the following apply.

#### 3.1 Abbreviated terms

##### 3.1.1

##### IGD

Internet Gateway Device

##### 3.1.2

##### VC

Virtual Circuit

##### 3.1.3

##### WAN\*LinkConfig

any or all of the services WANPOTSLinkConfig [12], WANDSLLinkConfig [10], WANCableLinkConfig [8], WANEthernetLinkConfig [11]

[SOURCE: [1]]

##### 3.1.4

##### WAN\*\*Connection

either or both of the services WANPPPConnection [13], WANIPConnection [3]

[SOURCE: [1]]

### 4 Device model

#### 4.1 Device type

A service that complies with this specification shall identify itself with the URN:

urn:schemas-upnp-org:device:WANConnectionDevice:2

All uses of the name WANConnectionDevice in this document specifically refer to version WANConnectionDevice: DeviceVersion of this device type.

#### 4.2 Device architecture

##### 4.2.1 Device requirements

Each WANConnectionDevice models a link on a physical WAN interface. A WANDevice, [2], shall contain one or more instances of WANConnectionDevice corresponding to one or more active links on a modem. WANCommonInterfaceConfig is a service in WANDevice that models attributes and actions that are common across all links and all connection instances on a link.

WANConnectionDevice is a container for a link and connection services specific to a link on a WAN interface. Most types of WAN interfaces can be modeled by a single instance of WANConnectionDevice. However, in the case of DSL, each VC can have unique link attributes and can be provisioned for connection services that are different from other VCs. In this case, each VC will be modeled by an instance of WANConnectionDevice. Also, in the case of a POTS modem based InternetGatewayDevice (IGD), each separate ISP instance can be modeled as an instance of WANConnectionDevice.

The describes the services contained in WANConnectionDevice in more detail.

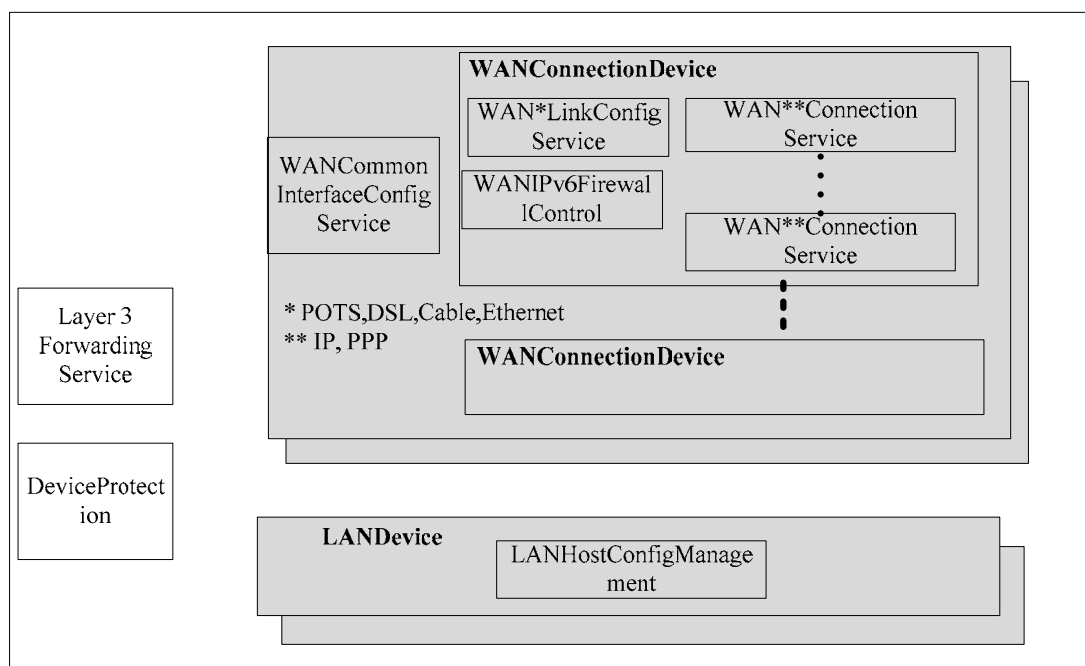


Figure 1 — **WANConnectionDevice** devices and services hierarchy

Instances of shall implement minimum version numbers of all required embedded devices and services specified in Table 1.

Table 1 — Device Requirements

| DeviceType | Root | R/A | ServiceType                              | R/A <sup>a</sup>   | Service ID<br>(prefixed by<br><a href="#">urn:upnp-org:serviceId:</a> )   |
|------------|------|-----|--|--|---|
|            |      |     | <a href="#">WANPOTSLinkConfig:1</a>      | <a href="#">A for POTS modems</a>                                | <a href="#">WANPOTSLinkC1</a>   |
|            |      |     | <a href="#">WANDSLLinkConfig:1</a>       | <a href="#">A for DSL modems</a>                                 | <a href="#">WANDSLLinkC1</a>  |
|            |      |     | <a href="#">WANCableLinkConfig:1</a>     | <a href="#">A for Cable modems</a>                               | <a href="#">WANCableLinkC1</a>  |
|            |      |     | <a href="#">WANEthernetLinkConfig:1</a>  | <a href="#">A for Ethernet attached modems</a>                   | <a href="#">WANEthLinkC1</a>  |
|            |      |     | <a href="#">WANPPPPConnection:1</a>      | <a href="#">R for modems that support PPP based connections</a>  | <a href="#">Multiple instances possible within a WANConnectionDevice. ServiceIDs for multiple instances will be WANPPPPConn1, WANPPPPConn2, WANPPPPConn3 and so on.</a>   |
|            |      |     | <a href="#">WANIPConnection:2</a>        | <a href="#">R for modems that support IPv4 based connections</a> | <a href="#">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.</a> |
|            |      |     | <a href="#">WANIPv6FirewallControl:1</a> | <a href="#">A for IPv6 enabled IGDs</a>                          | <a href="#">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.</a>                          |

| DeviceType   | Root       | R/A      | ServiceType  | R/A <sup>a</sup> | Service ID<br>(prefixed by<br>urn:upnp-org:serviceId:)           |
|--|------------|----------|--|------------------|--|
|  |            |          |  |                  | <u>WANIPv6Firewall2</u> ,<br><u>WANIPv6Firewall3 and so on</u> . |
|  |            |          | <i>Non-standard services<br/>embedded by an UPnP<br/>vendor go here.</i> | <i>X</i>         | <i>TBD</i>   |
| <i>Non-standard<br/>devices<br/>embedded by<br/>an UPnP<br/>vendor go<br/>here.</i>            | <i>TBD</i> | <i>X</i> | <i>TBD</i>   | <i>TBD</i>       | <i>TBD</i>   |
| <sup>a</sup> The term modem in this column refers to the WAN interface (or <u>WANDevice</u> ). |            |          |  |                  |  |

#### 4.2.2 Relationships between services

The DefaultConnectionService state variable in the Layer3Forwarding service refers to the UDN of a WANConnectionDevice instance – this is an external dependency. There may also be dependencies between a specific instance of WAN\*LinkConfig and WAN\*\*Connection service or WANIPv6FirewallControl service in a WANConnectionDevice.

## 5 XML Device Description

```

<?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: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>
      <!--
        Description of embedded devices added by UPnP vendor (if any) go here
      -->
    </deviceList>
    <presentationURL>URL for presentation</presentationURL>
  </device>
</root>

```

<sup>1</sup> NOTICE for implementers: This template is representative of one link type; DSL in this case. Depending on the type of modem, substitute or add device specific service names.

<sup>2</sup> NOTICE for implementers: This template is representative of one connection type; IP in this case. Depending on the type of connection, substitute or add service names.



## **6 Test**

No semantic tests are defined for this device.

## Annex A (informative)

### Theory of Operation

Connections to the Internet are initiated either from the WAN interface of an IGD or are relayed or bridged through the WAN interface. DSL can be provisioned to support multiple Virtual Circuits (VCs) simultaneously. Each VC can in turn be provisioned to support one or more PPP connections or an IP connection. To handle these scenarios, each [WANDevice](#) includes one or more instances of [WANConnectionDevice](#). A [WANConnectionDevice](#) encapsulates a logical or physical link on a WAN interface over which connections are modeled. Furthermore, connections on a WAN interface can be of type PPP or IP. These are modeled by corresponding [WAN\\*\\*Connection](#) service instances for IPv4 connections or [WANIPv6FirewallControl](#) service instances for IPv6 connections. Properties specific to a link are modeled in a [WAN\\*LinkConfig](#) service.

The definition of the [WAN\\*LinkConfig](#)<sup>3</sup>, [WAN\\*\\*Connection](#)<sup>4</sup> and [WANIPv6FirewallControl](#) services are based on the following broad objectives:

- To enable distinguishing between Internet access scenarios that are typically independent of the modem types used and configuration scenarios that are specific to modem types. This enables easier modeling of various connectivity scenarios independent of the underlying modem type or its configuration.
- To support most of the commonly deployed connection types (either originating at the WAN interface of the gateway or relayed/bridged through the gateway).
- To support manual (may need Out-Of-Band security and access control mechanisms) or automatic configuration of parameters on a modem.
- To ensure extensibility for new connection types in future.

Configuration and connectivity scenarios are independent of each other. However, there is an implied relationship in that control points will first need to complete configuration actions (unless this process is completed automatically) before initiating any connectivity related actions. It is also important to note that auto and manual configuration of a modem are mutually exclusive operations in most cases. Furthermore, in most deployment scenarios, auto configuration is given higher priority over manual configuration.

The process of configuration and subsequent management of WAN connections is via 3 variables:

- [LinkType](#): This variable, if defined in a [WAN\\*LinkConfig](#) service, indicates the protocol configured on a specific link. This variable can be set manually, or through an automatic mechanism (for example, AutoConfig<sup>5</sup> specified by Broadband Forum).
- [PossibleConnectionTypes](#): specifies only those connection types that are permissible in a particular implementation for a specific modem link configuration (as indicated by the value of [LinkType](#)). This variable is defined in [WAN\\*Connection](#) service.
- [ConnectionType](#): indicates a specific connection type selected from those permissible on a link, as indicated by [PossibleConnectionTypes](#). This variable is defined in [WAN\\*Connection](#) service.

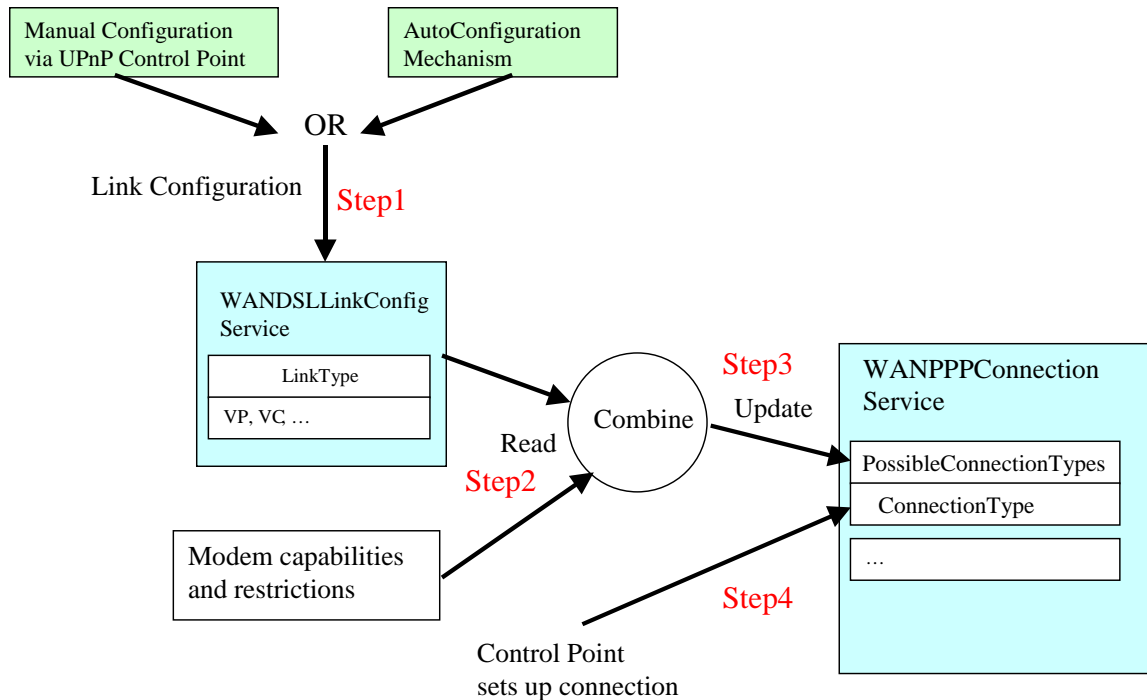
Figure A.1 illustrates the process of configuration and connection management, using a DSL modem as an example. Notice that the configuring agent and subsequent user(s) of connections need not be the same network entities. The 4 conceptual steps are:

<sup>3</sup> Refer to the individual [WAN\\*LinkConfig](#) specifications for descriptions of those services and variables such as [LinkType](#).

<sup>4</sup> Refer to the individual [WAN\\*Connection](#) specifications for descriptions of those services and variables such as [PossibleConnectionTypes](#) and [ConnectionType](#).

<sup>5</sup> Refer to the Broadband Forum website (<http://www.broadband-forum.org>) for more details.

- **Step 1:** A configuring entity sets up the LinkType to an appropriate value.
- **Step 2:** The value of LinkType is combined with the capabilities of the modem to come up with a list of possible connection types appropriate for the particular configuration.
- **Step 3:** The variable PossibleConnectionTypes is updated with the list created in Step 2.
- **Step 4:** A control point may subsequently initiate a connection by setting ConnectionType to a value from the allowable list specified in PossibleConnectionTypes. In this step, a control point evaluates its own capabilities vis-à-vis the capabilities exposed in PossibleConnectionTypes and selects one that is appropriate for its use. In some deployment scenarios, the value of ConnectionType may be strictly read-only from a control point perspective.



**Figure A.1 — Configuration and Connection Management**

Table A.1 lists valid combinations of LinkType and PossibleConnectionTypes as well as connection service type for different types of WAN interfaces.

**Table A.1 — Valid Combinations of LinkType and PossibleConnectionTypes**

| Modem Type | <u>LinkType</u> <sup>a</sup> | Available Modem Capabilities | <u>PossibleConnectionTypes</u> <sup>a</sup> | Connection Service Type  |
|------------|------------------------------|------------------------------|---|--------------------------|
| DSL        | <u>Unconfigured</u>          | Not Applicable               | <u>Unconfigured</u>                         | Not Applicable           |
|            | <u>EoA</u>                   | Bridge                       | <u>IP_Bridged</u>                           | <u>WANIPConnection</u>   |
|            |                              | Router                       | <u>IP_Routed</u>                            | <u>WANIPConnection</u>   |
|            | <u>IPoA</u>                  | Router                       | <u>IP_Routed</u>                            | <u>WANIPConnection</u>   |
|            | <u>CIP</u>                   | Router + CIP                 | <u>IP_Routed</u>                            | <u>WANIPConnection</u>   |
|            | <u>PPPoA</u>                 | Router                       | <u>IP_Routed</u>                            | <u>WANPPPPConnection</u> |
|            |                              | PPTP Relay                   | <u>PPTP_Relay</u>                           | <u>WANPPPPConnection</u> |
|            |                              | PPPoE Relay                  | <u>PPPoE_Relay</u>                          | <u>WANPPPPConnection</u> |
|            |                              | L2TP Relay                   | <u>L2TP_Relay</u>                           | <u>WANPPPPConnection</u> |
|            |                              | DHCP Spoofer                 | <u>DHCP_Spoofed</u>                         | <u>WANPPPPConnection</u> |
|            | <u>PPPoE</u>                 | Router                       | <u>IP_Routed</u>                            | <u>WANPPPPConnection</u> |

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| Modem Type                   | <u><a href="#">LinkType</a></u> <sup>a</sup> | Available Modem Capabilities | <u><a href="#">PossibleConnectionTypes</a></u> <sup>a</sup> | Connection Service Type                 |
|------------------------------|--|------------------------------|---|---|
|                              |  | PPTP Relay                   | <u><a href="#">PPTP_Relay</a></u>                           | <u><a href="#">WANPPPConnection</a></u> |
|                              |  | L2TP Relay                   | <u><a href="#">L2TP_Relay</a></u>                           | <u><a href="#">WANPPPConnection</a></u> |
|                              |  | Bridge                       | <u><a href="#">PPPoE_Bridged</a></u>                        | <u><a href="#">WANPPPConnection</a></u> |
|                              |  | DHCP Spoofers                | <u><a href="#">DHCP_Spoofed</a></u>                         | <u><a href="#">WANPPPConnection</a></u> |
| Cable                        | <u><a href="#">Ethernet</a></u>              | Router                       | <u><a href="#">IP_Routed</a></u>                            | <u><a href="#">WANIPConnection</a></u>  |
|                              |  | Bridge                       | <u><a href="#">IP_Bridged</a></u>                           | <u><a href="#">WANIPConnection</a></u>  |
| POTS                         | <u><a href="#">PPP_Dialup</a></u>            | Router                       | <u><a href="#">IP_Routed</a></u>                            | <u><a href="#">WANPPPConnection</a></u> |
| Ethernet-Attached (External) | <u><a href="#">Ethernet</a></u>              | Router                       | <u><a href="#">IP_Routed</a></u>                            | <u><a href="#">WANIPConnection</a></u>  |
|                              |  | Bridge                       | <u><a href="#">IP_Bridged</a></u>                           | <u><a href="#">WANIPConnection</a></u>  |
|                              |  | Router <sup>b</sup>          | <u><a href="#">IP_Routed</a></u>                            | <u><a href="#">WANPPPConnection</a></u> |

<sup>a</sup> Refer to the [WAN\\*LinkConfig](#) service specifications for a more detailed description of each of the [LinkType](#) and [PossibleConnectionTypes](#) values, including abbreviation expansions.

<sup>b</sup> NOTICE for implementers: PPP-based connected types, originating from the WAN interface of an IGD, are possible for an Ethernet-attached external modem, most likely over an Ethernet or IP link. For example, a PPPoE connection can originate on the WAN interface of the IGD, terminating at the ISP head-end, with the externally attached modem acting as a pass-through Ethernet bridge. However, modeling this (or other similar) connection type(s) might require additional variables and/or actions in the [WANPPPConnection](#) service not currently defined by the IGD working committee. If needed, these features should be implemented as vendor extensions.



