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INTERNATIONAL STANDARD

Information technology – UPnP Device Architecture – Part 8-4: Internet Gateway Device Control Protocol – Wide Area Network Connection Device



ISO/IEC 29341-8-4:2008(E)

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3, rue de Varembé
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Email: inmail@iec.ch
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Part 8-4: Internet Gateway Device Control Protocol – Wide Area Network Connection Device

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The list of all currently available parts of the ISO/IEC 29341 series, under the general title *Universal plug and play (UPnP) architecture*, can be found on the IEC web site.

This International Standard has been approved by vote of the member bodies, and the voting results may be obtained from the address given on the second title page.

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ORIGINAL UPNP DOCUMENTS
(informative)

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. 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
UPnP Basic:1 Device	ISO/IEC 29341-2
UPnP AV Architecture:1	ISO/IEC 29341-3-1
UPnP MediaRenderer:1 Device	ISO/IEC 29341-3-2
UPnP MediaServer:1 Device	ISO/IEC 29341-3-3
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: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
UPnP AVTransport:2 Service	ISO/IEC 29341-4-10
UPnP ConnectionManager:2 Service	ISO/IEC 29341-4-11
UPnP ContentDirectory:2 Service	ISO/IEC 29341-4-12
UPnP RenderingControl:2 Service	ISO/IEC 29341-4-13
UPnP ScheduledRecording:1	ISO/IEC 29341-4-14
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 HVAC_ZoneThermostat:1 Device	ISO/IEC 29341-6-2
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 BinaryLight:1 Device	ISO/IEC 29341-7-1
UPnP DimmableLight:1 Device	ISO/IEC 29341-7-2
UPnP Dimming:1 Service	ISO/IEC 29341-7-10
UPnP SwitchPower:1 Service	ISO/IEC 29341-7-11
UPnP InternetGatewayDevice:1 Device	ISO/IEC 29341-8-1
UPnP LANDevice:1 Device	ISO/IEC 29341-8-2
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 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 WANPPPConnection:1 Service	ISO/IEC 29341-8-20
UPnP WLANConfiguration:1 Service	ISO/IEC 29341-8-21
UPnP Printer:1 Device	ISO/IEC 29341-9-1
UPnP Scanner:1.0 Device	ISO/IEC 29341-9-2
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 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 QOS v2 Schema Files	ISO/IEC 29341-11-2

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UPnP Document Title	ISO/IEC 29341 Part
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 RemoteUIClientDevice:1 Device	ISO/IEC 29341-12-1
UPnP RemoteUIServerDevice:1 Device	ISO/IEC 29341-12-2
UPnP RemoteUIClient:1 Service	ISO/IEC 29341-12-10
UPnP RemoteUIServer:1 Service	ISO/IEC 29341-12-11
UPnP DeviceSecurity:1 Service	ISO/IEC 29341-13-10
UPnP SecurityConsole:1 Service	ISO/IEC 29341-13-11

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1. Overview and Scope

This device template is compliant with the UPnP Device Architecture, Version 1.0.

WANConnectionDevice is a REQUIRED virtual device defined under
urn:schemas-upnp-org:device:*WANDevice*

An instance of ***WANDevice*** is specified under the root device
urn:schemas-upnp-org:device:*InternetGatewayDevice*

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 *Theory of Operation* section describes the services contained in ***WANConnectionDevice*** in more detail.

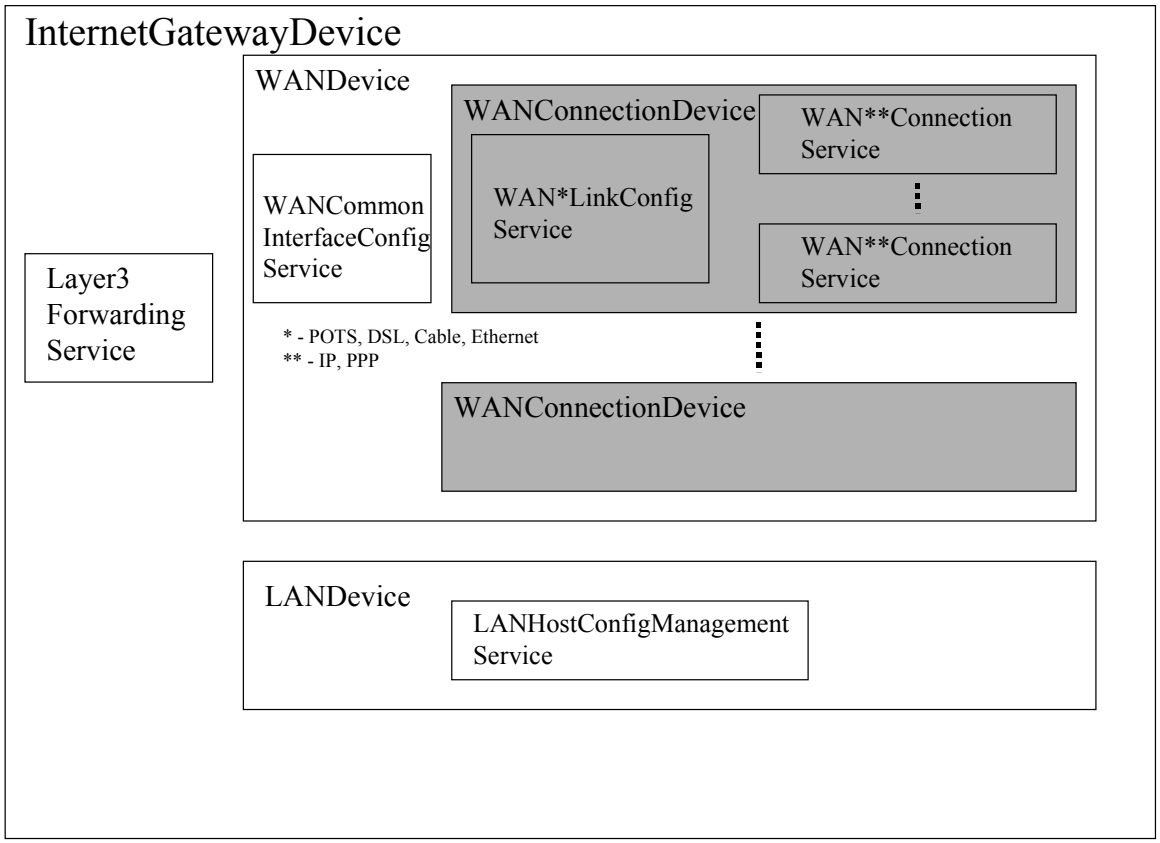

Figure 1: *WANConnectionDevice* Devices and Services Hierarchy

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2. Device Definitions

2.1. Device Type

The following device type identifies a device that is compliant with this template:

urn:**schemas-upnp-org:device**:*WANConnectionDevice:1*

2.2. Device Model

Products that expose devices of the type **urn:schemas-upnp-org:device:***WANConnectionDevice:1* must implement minimum version numbers of all required embedded devices and services specified in the table below.

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Table 1: Device Requirements

DeviceType	Root	Req. or Opt.[1]	ServiceType	Req. or Opt.[1]	Service ID[2]
			WANPOTSLinkConfig:1	*O for POTS modems*	*WANPOTSLinkC1*
			WANDSLLinkConfig:1	*O for DSL modems*	*WANDSLLinkC1*
			WANCableLinkConfig:1	*O for Cable modems*	*WANCableLinkC1*
			WANEthernetLinkConfig:1	*O for Ethernet attached modems*	*WANEthLinkC1*
			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:1	*R for modems that support IP based connections*	*Multiple instances possible within a WANConnectionDevice. ServiceIDs for multiple instances will be WANIPConn1, WANIPConn2, WANIPConn3 and so on.*
			Non-standard services embedded by an UPnP vendor go here.	*X*	*TBD*
Non-standard devices embedded by a UPnP vendor go here.	*TBD*	*X*	*TBD*	*TBD*	*TBD*

[1] R = Required, O = Optional, X = Non-standard.
[2] Prefixed by urn:**upnp-org**:**serviceId**: .

Note: the word modem in the table above refers to the WAN interface (or ***WANDevice***).

2.2.1. Description of Device Requirements

Each ***WANConnectionDevice*** models a link on a physical WAN interface. A ***WANDevice*** may 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.

2.2.2. 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 in a ***WANConnectionDevice***.

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2.3. 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{PPP/IP}Connection*** service instances. Properties specific to a link are modeled in a ***WAN{POTS/DSL/Cable/Ethernet}LinkConfig*** service.

In accordance with UPnP Device Architecture version 1.0, the maximum number of ***WANConnectionDevice*** instances is static and specified in the ***InternetGatewayDevice*** description document. Similarly, the number of ***WAN{PPP/IP}Connection*** service instances contained in each ***WANConnectionDevice*** is also pre-specified..

The definition of the ***WAN*LinkConfig***[1] and ***WAN*Connection***[2] services is based on the following broad objectives:

- To allow for the distinction 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[3] specified by DSLForum)
- `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 2 illustrates the process of configuration and connection management, using a DSL modem as an example. Note that the configuring agent and subsequent user(s) of connections need not be the same network entities. The 4 conceptual steps are described below.

- **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 derived from step above.

[1] Refer to companion DCP drafts for specific ***WAN*LinkConfig*** descriptions and description of variables such as `LinkType`.

[2] Refer to companion DCP drafts for specific ***WAN*Connection*** service descriptions and variables such as `PossibleConnectionTypes` and `ConnectionType`.

[3] Refer to the DSL Forum website (www.dslforum.org) for more details.

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- **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.

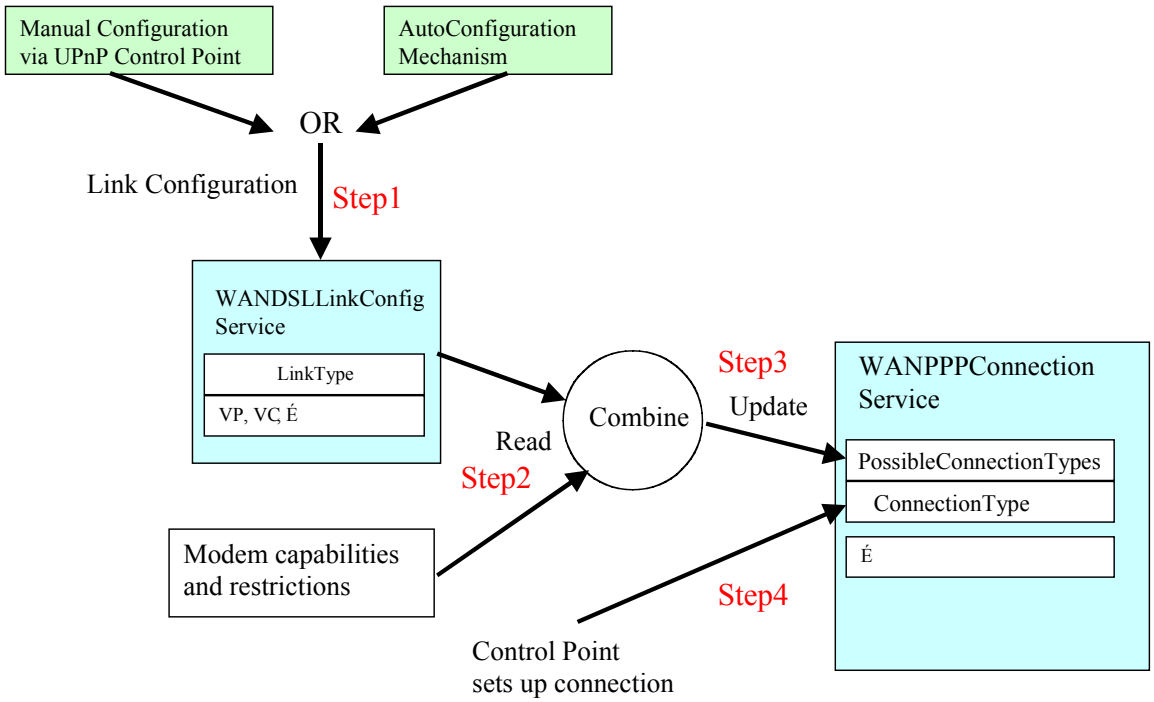

Figure 2: Configuration and Connection Management

The following table lists valid combinations of `LinkType` and `PossibleConnectionTypes` as well as connection service type for different types of WAN interfaces.

Modem Type	LinkType	Available Modem Capabilities	Possible Connection Types	Connection Service Type
DSL	Unconfigured	Not Applicable	Unconfigured	Not Applicable
	EoA[4]	Bridge	IP_Bridged	**WANIPConnection**
		Router	IP_Routed	WANIPConnection
	IPoA	Router	IP_Routed	WANIPConnection
	CIP	Router + CIP	IP_Routed	WANIPConnection
	PPPoA	Router	IP_Routed	**WANPPPConnection**
		PPTP Relay	PPTP_Relay	WANPPPConnection
		PPPoE Relay	PPPoE_Relay	WANPPPConnection

[4] Refer to the ***WAN*LinkConfig*** service descriptions for a more detailed description of each of the `LinkType` and `PossibleConnectionTypes` values, including acronym expansions.

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		L2TP Relay	L2TP_Relay	WANPPPConnection
		DHCP Spoofer	DHCP_Spoofed	WANPPPConnection
	PPPoE	Router	IP_Routed	WANPPPConnection
		PPTP Relay	PPTP_Relay	WANPPPConnection
		L2TP Relay	L2TP_Relay	WANPPPConnection
		Bridge	PPPoE_Bridged	WANPPPConnection
		DHCP Spoofer	DHCP_Spoofed	WANPPPConnection
Cable	Ethernet	Router	IP_Routed	**WANIPConnection**
		Bridge	IP_Bridged	WANIPConnection
POTS	DialupPPP	Router	IP_Routed	**WANPPPConnection**
Ethernet-Attached (External)	Ethernet	Router	IP_Routed	**WANIPConnection**
		Bridge	IP_Bridged	WANIPConnection
		Router*	IP_Routed	**WANPPPConnection**

***NOTE TO 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) may 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.

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3. 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: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:
                                    WANDSLLinkConfig[5]: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:
                                    WANPPPConnection[6]:1</serviceType>
                        <serviceId>urn:upnp-
                  org:serviceId:WANPPPConn1</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>
```

[5] NOTE to 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.

[6] NOTE to implementers: This template is representative of one connection type; PPP in this case. Depending on the type of connection, substitute or add service names.

--`,,```,,,,````-`-`,,`,,`,`,,`---

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

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3. Test

No semantic tests are defined for this device.

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

3, rue de Varembé
PO Box 131
CH-1211 Geneva 20
Switzerland

Tel: + 41 22 919 02 11
Fax: + 41 22 919 03 00
info@iec.ch
www.iec.ch

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