

Design and Implementation of UPnP enabled DVD Player

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ABSTRACT

This paper titled “DESIGN AND IMPLEMENTATION OF UPnP ENABLED DVD PLAYER” describes about the UPnP technology and how to design and implement this type of DVD Player in home networking. Such DVD Player can be controlled from different Control Points (PC, Mobile etc.) available in the same home networking.

This paper consists of mainly four sections titled introduction, requirements specification, design and implementation.

This template will be helpful to design and implement other devices like refrigerator, microwave oven, stereo to make home networking more flexible and interactive.

General Terms

Home networking

Keywords

UPnP, Home networking, Control Points

1. INTRODUCTION

UPnP [5] is a future technology very suitable for Home Networking [1; 2; 4; 6]. It will bring many devices working on different media converge on a common network for communication. Scope of this paper is to design and implement UPnP enabled DVD Player to improve Home Networking. This device template is compliant with the UPnP Device Architecture version 1.0[5]. It defines a device type referred to herein as DVDPlayer: 1. It is a Digital Versatile Disc (DVD) player that can hold one or more DVDs internally, play a DVD, control volume, tone, and spatial balance, and output the signal through external, analog connectors.

It enables the following functions:

- Adding / removing discs.
- Manually playing, pausing, stopping play.
- Automatically playing a disc when inserted.
- Playing tracks and discs in order or randomly.

It does not enable:

- Retrieving files from a DVD.
- Saving data on a DVD.
- Recording audio on DVD.

2. REQUIREMENTS SPECIFICATION

Device Type

The following device type identifies a device that is compliant with this template [15]:

urn :schemas-upnp-org:device: DVDPlayer:1

The shorthand DVDPlayer: 1 is used herein to refer to this device type.

Software Requirements

Operating System Windows XP or Linux

GUI JAVA

Communication XML

Protocols stack [5] required:

UPnP vendor					
UPnP Forum					
UPnP Device Architecture					
HTTPM U	GENA	SSDP	HTTPU SSDP	SOAP HTTP	HTTP GENA
UDP				TCP	
IP					

Architecture:

In this mainly three UPnP components are involved Control Point, Source of the media content and the Sink for the content. These three components work together to accomplish the task. The interaction among these three is shown in the following figure No. 1[5].

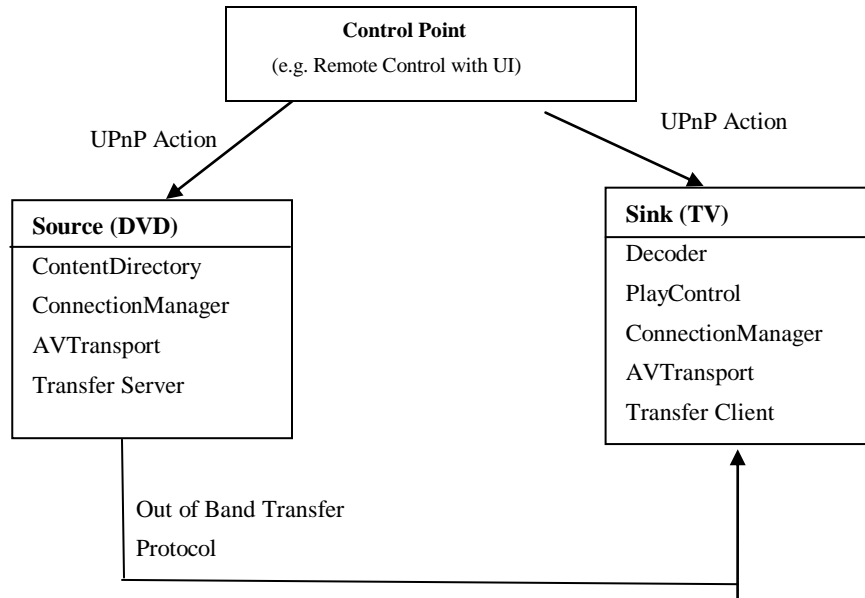


Figure 1: 3 Box Architecture

Source: It contains or has access to a variety of entertainment content.

Sink: It obtains content from a source via some network.

Control Point: It provides user interface for the user. One can control operation (e.g. play, stop, pause) in order to accomplish the desired task.

Device Functional Requirements:

DVDPlayer: 1 product must implements minimum version numbers of all required embedded devices and services specified in the following table no. 1[5].

Table 1: Device Functional Requirements

Device Type	Root	Req. or Opt.	Service Type	Req. or Opt. ¹	Service ID ²
DVDPlayer:1	yes	R	SwitchPower:1	R	<u>SwitchPower</u>
			ChangeDisc:1	R	<u>ChangeDisc</u>
			PlayDVD:1	R	<u>PlayDVD</u>
			Audio:1	R	<u>Audio</u>
			ContentDirectory:1.0	R	<u>ContentDirectory</u>
			ConnectionManager:1.0	R	<u>ConnectionManager</u>
			AVTransport:1.0	O	<u>AVTransport</u>

¹ R = Required, O = Optional.

² Prefixed by urn:upnp-org:serviceid

3. DESIGN

Services to be designed [5; 16; 17]: As given in table no. 1

To understand we can take example of one of these services

About PlayDVD: 1: It provides programmatic control to the play mechanism of a DVD player.

It enables the following functions:

- Play, pause, and stop of play mechanism.
- Play programs that specify which next track to play and whether to repeat.
- Querying for information stored on the disc about the disc and its tracks.

Theory of operation:

To automatically play a DVD when it is inserted, a control point subscribes to eventing from ChangeDisc and receives an event when a DVD has been inserted in the disc tray. The control point closes the disc tray door (if open) and sends the play action to PlayDVD.

```
// Subscribe to eventing from ChangeDisc
// Receive event when DVD is inserted
// Is the disc tray door open?
// Check value of evented DoorIsOpen variable
// Then close door
// Invoke CloseDoor
// Start play
// Invoke Play on PlayDVD service
```

State variables:

State variables required for this service as shown in the following table no. 2[5].

Table 2: State variables

Variable Name	Req. or Opt. ¹	Data Type	Allowed Value	Default Value
PlayMode	R	string	PLAY, PAUSE, STOP	STOP
PlayProgram	R	string	ONCE_IN_ORDER, REPEAT_IN_ORDER, ONCE_RANDOM, REPEAT_RANDOM	ONCE_IN_ORDER
DiscTOC	R	string	(none)	(none)
DiscNumberOfTracks	R	ui1	>= 0, <= 255, +=1	(none)
TrackNumber	R	ui1	>= 0, <= 255, +=1	(See below.)

TrackDuration	R	time	(none)	(none)
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¹ R = Required, O = Optional.

Eventing and Moderation [5]:

Table 3: Event moderation

Variable Name	Evented	Moderated Event
PlayMode	yes	No
PlayProgram	yes	No
DiscTOC	yes	No
DiscNumberOfTracks	yes	No
TrackNumber	yes	No
TrackDuration	yes	No

Actions[5]:

Table 4: Actions

Name	Req. or Opt. ¹
Play	R
Pause	R
Stop	R
GetPlayMode	R
SetPlayProgram	R
GetPlayProgram	R
GetDiscInfo	R
SelectTrack	R
NextTrack	R
PrevTrack	R
GetTrackInfo	R

¹ R = Required, O = Optional.

Stop

It stops playing the DVD in the disc tray. It resets the play program; when play is restarted, it will pick up at the beginning of the play program. (It is not an error if there is no DVD in the disc tray or if the door is open. It is not an error if the DVD is already stopped.)

Arguments

(None)

Effect on State

Sets the PlayMode state variable to STOP. It does not change any other state variables. That is,

ASSIGN (PlayMode, STOP)

4. IMPLEMENTATION

Code for Service Description (PlayDVD:1)

[5; 9; 10]:

//This XML code provides programmatic control to the play mechanism of a DVD player//

```
<? xml version="1.0"?>
<scpd xmlns="urn:schemas-upnp-org:service-1-0">
  <specVersion> <!-- UPNP version 1.0 -->
    <major>1</major>
    <minor>0</minor>
  </specVersion>
  <actionList>
    <action> <!-- play the DVD -->
      <name>Play</name>
    </action>
    <action> <!-- suspect play -->
      <name>Pause</name>
    </action>
    <action> <!-- stop playing and reset -->
      <name>Stop</name>
    </action>
  </actionList>
```

5. CONCLUSION

In this paper, a simulated Universal Plug and Play (UPnP) DVD Player is designed and implemented. This DVD Player includes different services like DVD playing, Audio setting, Disc changing and showing the content directory. We explore these services through their different functions (play, pause, stop, search etc.). The primary goal of this work was to design and implement an UPnP based DVD Player to improve home networking with some extended functionality like listing of the films and songs based on director name, artist name etc. The design presented in this paper is useful and can provide guidelines for the design and implementation of other such devices to improve home networking. Additional areas of study could include searching of the films and songs based on the individual queries and study could include the security that is necessary component of a reliable home networking system. This work will be left for future research.

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