PlayCD:1 Sample Service Template

For UPnP™ Version 1.0

Status: Preliminary Design (TPD)
Date: ~~23 August 2000~~ 5 February 2001

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Contents

List of Tables

1. Overview and Scope

This sample service template is compliant with the UPnP Device Architecture version 1.0. It defines a service type referred to herein as PlayCD:1.

PlayCD:1 provides programmatic control to the play mechanism of a CD player. It assumes two mechanisms are defined elsewhere: (a) a disc tray that is either empty or contains the current CD to be played, and (b) a door that gives the user access to add / remove a CD to / from the disc tray. Some actions defined herein for PlayCD:1 return an error if the disc tray is empty or the door is open.

PlayCD:1 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.

PlayCD:1 does not enable:

- Querying for information about the disc that is not stored on the disc itself, e.g., artist or title for a particular track.
- Getting information about one disc while another disc is playing.
- Labeling certain discs or groups of discs for handy reference when adding them into the changer.

Adjusting the volume, treble, base, balance, etc. of playback is done using another service type described elsewhere.

This is only a sample. It does not replace the work of an UPnP Forum working committee. It is only intended to illustrate the use of device and service templates.

1.1. Change Log

[14 Aug 2000] Fleshed out v0.02. Renamed from CDAudio.
[15 Aug 2000] v0.03. Renamed from CDPlay. Added DiscTOC and cut DiscTitle state variables. Added errors for door open. Added play program for once in random order.
[17 Aug 2000] v0.04. Moved Relationships to Other Service Types to device template.
[22 Aug 2000] v0.05. Rearranged order of argument sub elements.
[23 Aug 2000] v0.06. Explained what happens if the door is opened. Added missing allowed value to Table 1. Defined error codes for CDs with too few and too many tracks. Clarified that there is no effect on state by an action if an error occurs. Revised default value for TrackNumber. Removed 711 Invalid Program because redundant with 402 Invalid Args.
[5 Feb 2001] v0.04. Fixed <retval /> elements in XML Service Description.

2. Service Modeling Definitions

2.1. Service Type

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

urn:schemas-upnp-org:service:*PlayCD*:*1*

The shorthand PlayCD:1 is used herein to refer to this service type.

2.2. State Variables

Defines state variables for whether the player is currently playing or not, the program of play that the player will follow, and information about the disc and track being played. Specifics for these state variables are listed in the table and subsections below.

Table 1: State variables

Variable Name	Req. or Opt. [1]	Data Type	Allowed Value	Default Value	Eng. Units
PlayMode	R	string	PLAY, PAUSE, STOP	STOP	n/a
PlayProgram	R	string	ONCE_IN_ORDER, REPEAT_IN_ORDER, ONCE_RANDOM, REPEAT_RANDOM	ONCE_IN_ ORDER	n/a
DiscTOC	R	string	(none)	(none)	n/a
DiscNumberOfTracks	R	ui1	>= 0, <= 255, += 1	(none)	n/a
TrackNumber	R	ui1	>= 0, <= 255, +=1	(See below.)	n/a
TrackDuration	R	time	(none)	(none)	ISO 8601
Non-standard state variables implemented by an UPnP vendor go here.	X	*TBD*	*TBD*	*TBD*	*TBD*

[1] R = Required, O = Optional, X = Non-standard.

2.2.1. PlayMode

Indicates whether the player is currently playing (PLAY), not playing and paused mid-track (PAUSE), or not playing and reset to the beginning of the play program (STOP). Going to PLAY after PAUSE picks up play where it left off; going to PLAY after STOP picks up at the beginning of the play program. Must be STOP if there is no CD in the disc tray or the door is open. The default value (STOP) indicates that a player should not play when it is powered up.

2.2.2. PlayProgram

Indicates the order in which tracks on the CD will be played and whether tracks are played repeatedly or not. Tracks may be played in the order in which they appear on the CD, either stopping after all have been played (ONCE_IN_ORDER) or looping back to the beginning after all have been played (REPEAT_IN_ORDER). Alternatively, tracks may be played once in random order (ONCE_RANDOM) or

continuously in random order (REPEAT_RANDOM). (Not dependent on whether there is a CD in the disc tray or the door is open.) The default value (ONCE_IN_ORDER) indicates that a player should reset the play program to playing each track in order, just once when the player is powered up.

2.2.3. DiscTOC

Indicates the table of contents of the CD in the disc tray, that is, the list of frame offsets for tracks. Approximates a universally-unique identifier for the CD (but varies from one pressing to another). Comma delimited. Must be the empty string if there is no CD in the disc tray.

2.2.4. DiscNumberOfTracks

Indicates the number of tracks on the CD in the disc tray. Must be 0 if there is no CD in the disc tray.

2.2.5. TrackNumber

Indicates the track number for the current track, according to the play program, of the CD in the disc tray. Must be 0 if there is no CD in the disc tray. When a player is powered up or when a new CD is moved into the disc tray, a player should start at the first track if the play program is ordered, or start at a random track if the play program is random.

2.2.6. TrackDuration

Indicates the total duration for the current track, in minutes and seconds, according to play program, of the CD in the disc tray. (Does not indicate time remaining to play of this track.) Must be 0:00 if there is no CD in the disc tray.

2.2.7. Non-Standard State Variables Implemented by an UPnP Vendor

To facilitate certification, non-standard state variables implemented by an UPnP vendor should be included in this service template. The UPnP Device Architecture lists naming requirements for non-standard state variables (cf. section on Description).

2.2.8. Relationships Between State Variables

PlayMode: The value is independent of any other state variable.

PlayProgram: The value is independent of any other state variable.

DiscTOC, DiscNumberOfTracks: The values are dependent on the specific CD in the disc tray. The value of DiscNumberOfTracks is determined by the value of DiscTOC (but not vice-versa).

TrackNumber, TrackDuration: The values are dependent on the specific CD in the disc tray and the specific track selected by the play program. The value of TrackDuration is determined by the value of DiscTOC and TrackNumber.

Relationships between standard state variable(s) defined herein and any non-standard state variable(s) is TBD.

2.3. Eventing and Moderation

As the table below summarizes, PlayCD:1 defines non-moderated eventing for all of its state variables.

Table 2: Event moderation

Variable Name	Evented	Moderated Event	Max Event Rate [1]	Logical Combination	Min Delta per Event [2]
PlayMode	yes	no	n/a	n/a	n/a
PlayProgram	yes	no	n/a	n/a	n/a
DiscTOC	yes	no	n/a	n/a	n/a
DiscNumberOfTracks	yes	no	n/a	n/a	n/a
TrackNumber	yes	no	n/a	n/a	n/a
TrackDuration	yes	no	n/a	n/a	n/a
Non-standard state variables implemented by an UPnP vendor go here.	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*

[1] Determined by N, where Rate = (Event)/(N secs).
[2] (N) * (allowedValueRange Step).

2.3.1. Event Model

Some control points will need to be able to react to changes when the standard state variables change state. None of the state variables contain large values, and none are likely to change particularly rapidly, so none are moderated. Note that control points do not need to subscribe to eventing to correctly control this service.

2.4. Actions

As the table below summarizes, PlayCD:1 defines actions to play a CD, set a play program, and get information about the currently loaded CD and selected track. Immediately following the table is detailed information about these actions, including short descriptions of the actions, the effects of the actions on state variables, and error codes defined by the actions.

Except where noted, if an action is an error, calling the action will have no effect on state.

Table 3: 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
Non-standard actions implemented by an UPnP vendor go here.	X

[1] R = Required, O = Optional, X = Non-standard.

2.4.1. Play

Play starts playing the CD in the disc tray. The CD is played according to the program mode. It is an error if there is no CD in the disc tray or if the door is open. (It is not an error of the CD is already playing.)

2.4.1.1. Arguments

(None.)

2.4.1.2. Effect on State

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

ASSIGN(PlayMode, PLAY)

2.4.1.3. Errors

errorCode	errorDescription	Description
402	Invalid Args	See UPnP Device Architecture section on Control.
501	Action Failed	See UPnP Device Architecture section on Control.
701	No Disc	See Common Error Codes below.
703	Door Open	See Common Error Codes below.
711	No Tracks	See Common Error Codes below.
712	Too Many Tracks	See Common Error Codes below.
800-899	*TBD*	*(Specified by UPnP vendor.)*

2.4.2. Pause

Stops playing the CD in the disc tray. It does not reset the play program; when play is restarted, it will pick up where it left off. It is an error if there is no CD in the disc tray or if the door is open. (It is not an error if the CD is already paused.)

2.4.2.1. Arguments

(None.)

2.4.2.2. Effect on State

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

ASSIGN(PlayMode, PAUSE)

2.4.2.3. Errors

Same as Play.

2.4.3. Stop

Stops playing the CD 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 CD in the disc tray or if the door is open. It is not an error if the CD is already stopped.)

2.4.3.1. Arguments

(None.)

2.4.3.2. Effect on State

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

ASSIGN(PlayMode, STOP)

2.4.3.3. Errors

errorCode	errorDescription	Description
402	Invalid Args	See UPnP Device Architecture section on Control.
501	Action Failed	See UPnP Device Architecture section on Control.
800-899	*TBD*	*(Specified by UPnP vendor.)*

2.4.4. GetPlayMode

Queries whether the CD in the disc tray is playing or not.

2.4.4.1. Arguments

Returns the value of the PlayMode state variable.

Argument(s)	Direction	relatedStateVariable
Mode	OUT [R]	PlayMode

[R] Return value.

2.4.4.2. Effect on State

(None.)

2.4.4.3. Errors

errorCode	errorDescription	Description
402	Invalid Args	See UPnP Device Architecture section on Control.
501	Action Failed	See UPnP Device Architecture section on Control.
800-899	*TBD*	*(Specified by UPnP vendor.)*

2.4.5. SetPlayProgram

Sets the behavior of the player over tracks as it is playing, i.e., whether the player plays each track once or repeats, whether in sequence or randomly.

2.4.5.1. Arguments

Takes a value for the PlayProgram state variable.

Argument(s)	Direction	relatedStateVariable
Program	IN	PlayProgram

2.4.5.2. Effect on State

Sets the PlayProgram state variable to it's input argument. (It does not change any other state variables.) That is,

ASSIGN(PlayProgram, *value of IN argument Program*)

2.4.5.3. Errors

errorCode	errorDescription	Description
402	Invalid Args	See UPnP Device Architecture section on Control.
501	Action Failed	See UPnP Device Architecture section on Control.
800-899	*TBD*	*(Specified by UPnP vendor.)*

2.4.6. GetPlayProgram

Queries for the play program behavior.

2.4.6.1. Arguments

Returns the value of the PlayProgram state variable.

Argument(s)	Direction	relatedStateVariable
Program	OUT [R]	PlayProgram

[R] Return value.

2.4.6.2. Effect on State

(None.)

2.4.6.3. Errors

errorCode	errorDescription	Description
402	Invalid Args	See UPnP Device Architecture section on Control.
501	Action Failed	See UPnP Device Architecture section on Control.
800-899	*TBD*	*(Specified by UPnP vendor.)*

2.4.7. GetDiscInfo

Queries for information about the CD currently in the disc tray. It is an error if there is no CD in the disc tray or if the door is open.

2.4.7.1. Arguments

Returns the value of the DiscTOC and DiscNumberOfTracks state variables.

Argument(s)	Direction [1]	relatedStateVariable
TOC	OUT	DiscTOC
NumberOfTracks	OUT	DiscNumberOfTracks

[1] (None of the OUT arguments are marked as a return value.)

2.4.7.2. Effect on State

(None.)

2.4.7.3. Errors

errorCode	errorDescription	Description
402	Invalid Args	See UPnP Device Architecture section on Control.
501	Action Failed	See UPnP Device Architecture section on Control.
701	No Disc	See Common Error Codes below.
703	Door Open	See Common Error Codes below.
711	No Tracks	See Common Error Codes below.
712	Too Many Tracks	See Common Error Codes below.
800-899	*TBD*	*(Specified by UPnP vendor.)*

2.4.8. SelectTrack

Play continues according to play program from the specified track. If currently playing, play stops and restarts at the beginning of this track. It is an error if there is no CD in the disc tray or if the door is open.

2.4.8.1. Arguments

Takes a value for the number of the track to be selected.

Argument(s)	Direction	relatedStateVariable
Number	IN	TrackNumber

2.4.8.2. Effect on State

Sets the value of the TrackNumber state variable to the in argument, and sets the value of other track information state variables to the corresponding values of the track. (Does not change any other state variables.) That is,

ASSIGN(TrackNumber, Number)
ASSIGN(TrackDuration, *duration of the track numbered Number*)

2.4.8.3. Errors

errorCode	errorDescription	Description
402	Invalid Args	See UPnP Device Architecture section on Control. [1]
501	Action Failed	See UPnP Device Architecture section on Control.
701	No Disc	See Common Error Codes below.
703	Door Open	See Common Error Codes below.

711	No Tracks	See Common Error Codes below. [2]
712	Too Many Tracks	See Common Error Codes below. [2]
800-899	*TBD*	*(Specified by UPnP vendor.)*

[1] If the track to be selected, provided as an input argument, is less than 1 or greater than the number of tracks on the CD.
[2] If the CD itself has too few or too many tracks.

2.4.9. NextTrack

Advances play to the next track according to the play program. If play program is ordered, this action selects the next highest numbered track, where next wraps to the first track if the current track is the last one. If play program is random, this action selects a random track. If currently playing, play stops and restarts at the beginning of the new track. It is an error if there is no CD in the disc tray or if the door is open.

2.4.9.1. Arguments

(None.)

2.4.9.2. Effect on State

Same as SelectTrack, where Number is the next track number as determined by the play program.

2.4.9.3. Errors

Same as SelectTrack.

2.4.10.PrevTrack

Same as NextTrack except it selects a previous track according to the play program, where previous wraps to the last track if the play program is ordered and the current track is the first one.

2.4.10.1.Arguments

(None.)

2.4.10.2.Effect on State

Same as SelectTrack, where Number is the previous track number as determined by the play program.

2.4.10.3.Errors

Same as SelectTrack.

2.4.11.GetTrackInfo

Queries for the value of track number and track duration. It is an error if there is no CD in the disc tray or if the door is open.

2.4.11.1.Arguments

Returns the values of the TrackNumber, and TrackDuration state variables.

Argument(s)	Direction [1]	relatedStateVariable
Number	OUT	TrackNumber
Duration	OUT	TrackDuration

[1] (None of the OUT arguments are marked as a return value.)

2.4.11.2.Effect on State

(None.)

2.4.11.3.Errors

errorCode	errorDescription	Description
402	Invalid Args	See UPnP Device Architecture section on Control.
501	Action Failed	See UPnP Device Architecture section on Control.
701	No Disc	See Common Error Codes below.
703	Door Open	See Common Error Codes below.
711	No Tracks	See Common Error Codes below.
712	Too Many Tracks	See Common Error Codes below.
800-899	*TBD*	*(Specified by UPnP vendor.)*

2.4.12.Non-Standard Actions Implemented by an UPnP Vendor

To facilitate certification, non-standard actions implemented by an UPnP vendor should be included in this service template. The UPnP Device Architecture lists naming requirements for non-standard actions (cf. section on Description).

2.4.13.Relationships Between Actions

The actions defined herein may be called in any order.

Relationships between standard action(s) defined herein and any non-standard action(s) is TBD.

2.4.14.Common Error Codes

The following table lists error codes common to actions for this service type. If an action results in multiple errors, the most-specific error should be returned.

errorCode	errorDescription	Description
401	Invalid Action	See UPnP Device Architecture section on Control.
402	Invalid Args	See UPnP Device Architecture section on Control.
404	Invalid Var	See UPnP Device Architecture section on Control.
501	Action Failed	See UPnP Device Architecture section on Control.
600-699	TBD	Common action errors. Defined by UPnP Forum Technical Committee.
701	No Disc	There is no CD in the disc tray.
703	Door Open	The disc tray door is open.
711	No Tracks	There are no audio tracks on the CD.

errorCode	errorDescription	Description
712	Too Many Tracks	There are more than 255 audio tracks on the CD.
800-899	*TBD*	*(Specified by UPnP vendor.)*

2.5. Theory of Operation

To automatically play a CD when it has been inserted, a control point subscribes to eventing from DiscChange:1 and receives an event when a new CD has been inserted in the disc tray. The control point sends the action to play.

```
// Subscribe to eventing for DiscChange:1
// Receive event when new CD is inserted
// Invoke Play
//
```

To allow a user to find out how much time is left to play in the current track, a control point subscribes to eventing and receives an event whenever the track changes. This event includes the duration of the new track. The control point initializes and maintains its own count down timer.

```
// Subscribe to eventing for PlayCD:1
// Receive event when track changes
// Restart countdown timer
//   Initial value is track duration from track change event
//
```

3. XML Service Description

```
<?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 CD -->
      <name>Play</name>
    </action>
    <action> <!-- suspect play -->
      <name>Pause</name>
    </action>
    <action> <!-- stop playing and reset -->
      <name>Stop</name>
    </action>
    <action> <!-- are we playing now? -->
      <name>GetPlayMode</name>
      <argumentList>
        <argument>
          <name>Mode</name>
          <relatedStateVariable>PlayMode</relatedStateVariable>
          <direction>out</direction>
          <retval />
        </argument>
      </argumentList>
    </action>
    <action> <!-- change the program -->
      <name>SetPlayProgram</name>
      <argumentList>
        <argument>
          <name>Program</name>
          <relatedStateVariable>PlayProgram</relatedStateVariable>
          <direction>in</direction>
        </argument>
      </argumentList>
    </action>
    <action> <!-- what program are we following? -->
      <name>GetPlayProgram</name>
      <argumentList>
        <argument>
          <name>Program</name>
          <relatedStateVariable>PlayProgram</relatedStateVariable>
          <direction>out</direction>
          <retval />
        </argument>
      </argumentList>
    </action>
    <action> <!-- what CD is in the tray? -->
      <name>GetDiscInfo</name>
      <argumentList>
        <argument>
          <name>TOC</name>
          <relatedStateVariable>DiscTOC</relatedStateVariable>
          <direction>out</direction>
```

```
        </argument>
        <argument>
          <name>NumberOfTracks</name>
          <relatedStateVariable>
            DiscNumberOfTracks
          </relatedStateVariable>
          <direction>out</direction>
        </argument>
      </argumentList>
    </action>
    <action> <!-- play a specific track -->
      <name>SelectTrack</name>
      <argumentList>
        <argument>
          <name>Number</name>
          <relatedStateVariable>TrackNumber</relatedStateVariable>
          <direction>in</direction>
        </argument>
      </argumentList>
    </action>
    <action> <!-- play the next track in the program -->
      <name>NextTrack</name>
    </action>
    <action> <!-- play the previous track in the program -->
      <name>PrevTrack</name>
    </action>
    <action> <!-- what track are we playing? -->
      <name>GetTrackInfo</name>
      <argumentList>
        <argument>
          <name>Number</name>
          <relatedStateVariable>TrackNumber</relatedStateVariable>
          <direction>out</direction>
        </argument>
        <argument>
          <name>Duration</name>
          <relatedStateVariable>TrackDuration</relatedStateVariable>
          <direction>out</direction>
        </argument>
      </argumentList>
    </action>
    <!-- Declarations for other actions implemented by an -->
    <!--   UPnP vendor (if any) go here. -->
  </actionList>
  <serviceStateTable>
    <stateVariable sendEvents="yes">
      <name>PlayMode</name>
      <dataType>string</dataType>
      <allowedValueList>
        <allowedValue>PLAY</allowedValue>
        <allowedValue>PAUSE</allowedValue>
        <allowedValue>STOP</allowedValue>
      </allowedValueList>
      <defaultValue>STOP</defaultValue>
    </stateVariable>
    <stateVariable sendEvents="yes">
      <name>PlayProgram</name>
      <dataType>string</dataType>
```

```
      <allowedValueList>
        <allowedValue>ONCE_IN_ORDER</allowedValue>
        <allowedValue>REPEAT_IN_ORDER</allowedValue>
        <allowedValue>ONCE_RANDOM</allowedValue>
        <allowedValue>REPEAT_RANDOM</allowedValue>
      </allowedValueList>
      <defaultValue>ONCE_IN_ORDER</defaultValue>
    </stateVariable>
    <stateVariable sendEvents="yes">
      <name>DiscTOC</name>
      <dataType>string</dataType>
    </stateVariable>
    <stateVariable sendEvents="yes">
      <name>DiscNumberOfTracks</name>
      <dataType>ui1</dataType>
      <allowedValueRange>
        <minimum>0</minimum> <!-- 0 means no CD in tray -->
        <maximum>255</maximum>
        <step>1</step>
      </allowedValueRange>
    </stateVariable>
    <stateVariable sendEvents="yes">
      <name>TrackNumber</name>
      <dataType>ui1</dataType>
      <allowedValueRange>
        <minimum>0</minimum> <!-- 0 means no CD in tray -->
        <maximum>255</maximum>
        <step>1</step>
      </allowedValueRange>
    </stateVariable>
    <stateVariable sendEvents="yes">
      <name>TrackDuration</name>
      <dataType>time</dataType> <!-- 0:00 means no CD in tray -->
    </stateVariable>
    <!-- Declarations for other state variables implemented by an -->
    <!--   UPnP vendor (if any) go here. -->
  </serviceStateTable>
</scpd>
```

4. Test

TBD.