



Multimedia Routing on OSGi Platforms



Multimedia Routing Index

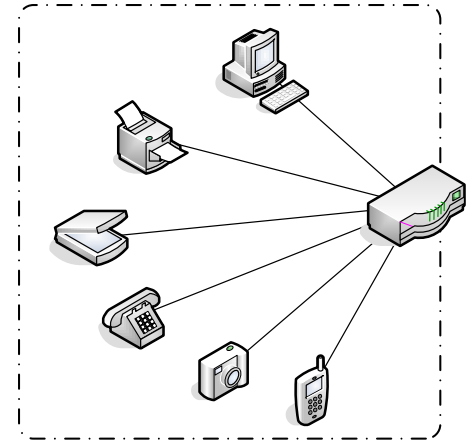
- Introduction
- Architecture
- Multimedia Pins
- Categories
- Multimedia Filters
- Browsing Pins
- Connection Setup
- Conclusions

Introduction

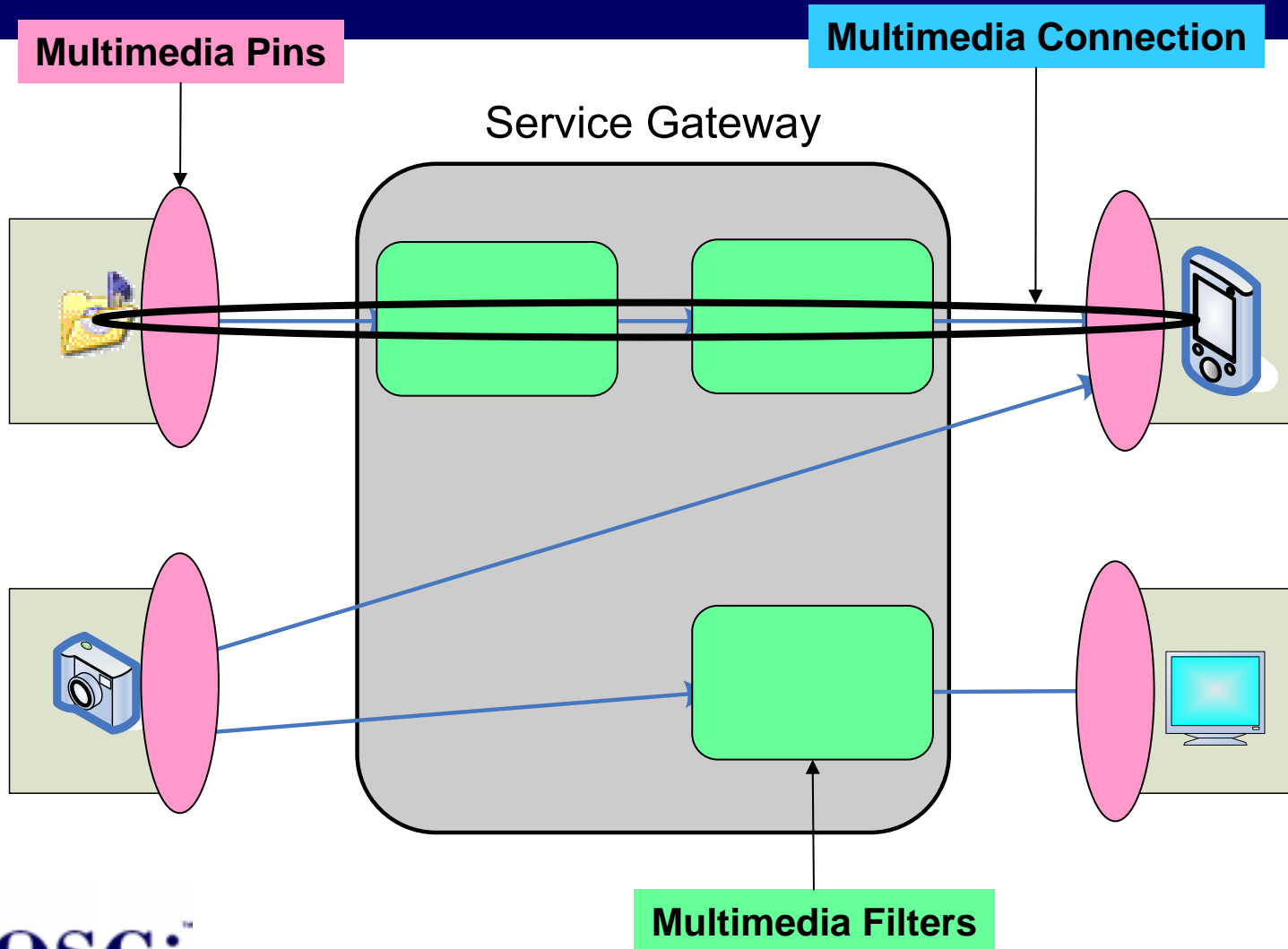
- Setting up data flows among multimedia devices connected to a Service Gateway
 - User: gets the best from their multimedia devices
 - Provider: broader range of target devices for his services

Multimedia Routing Concept

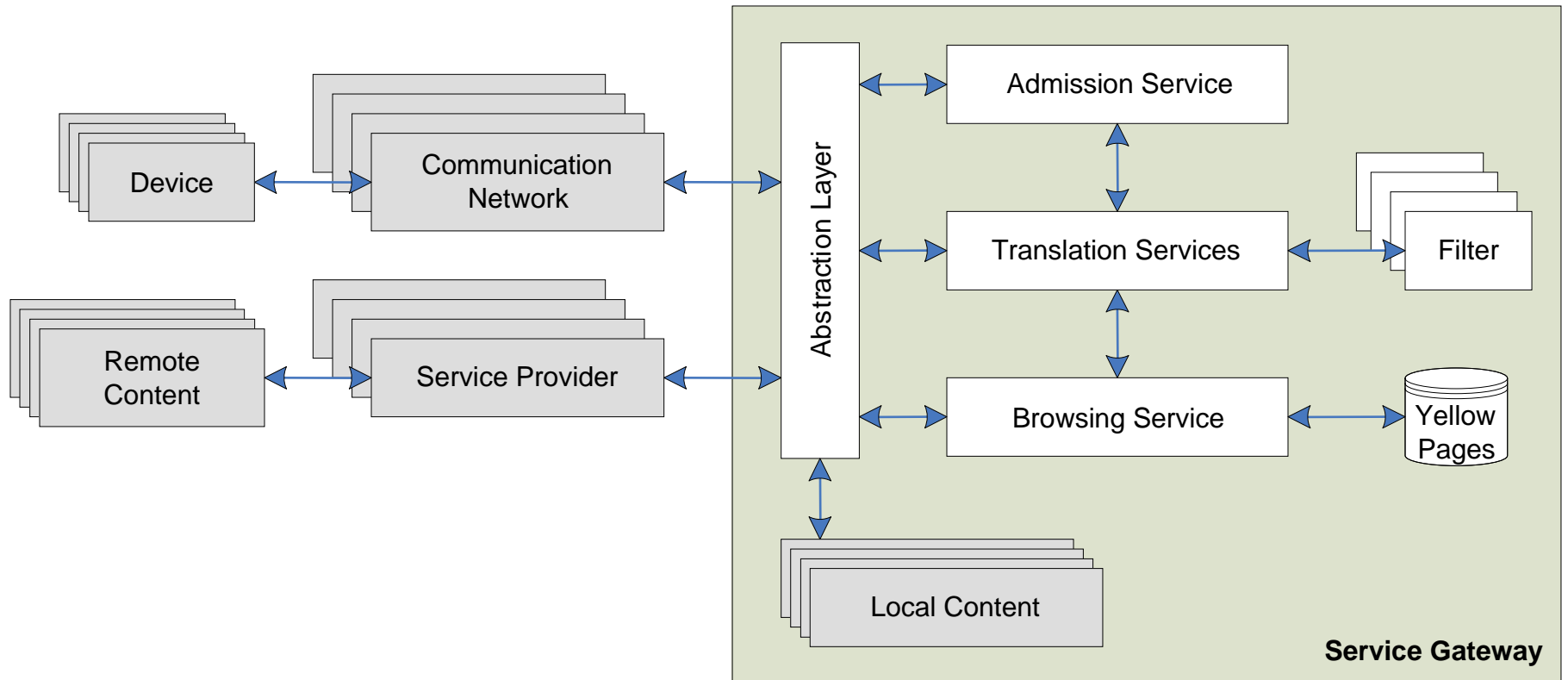
- Service Gateway as the interconnection and integration point
 - Takes data from a source
 - Do processing
 - Send result to target
 - Connection Manager monitors
 - Available bandwidth
 - Available computing power on the gateway



Multimedia Routing Example



Architecture



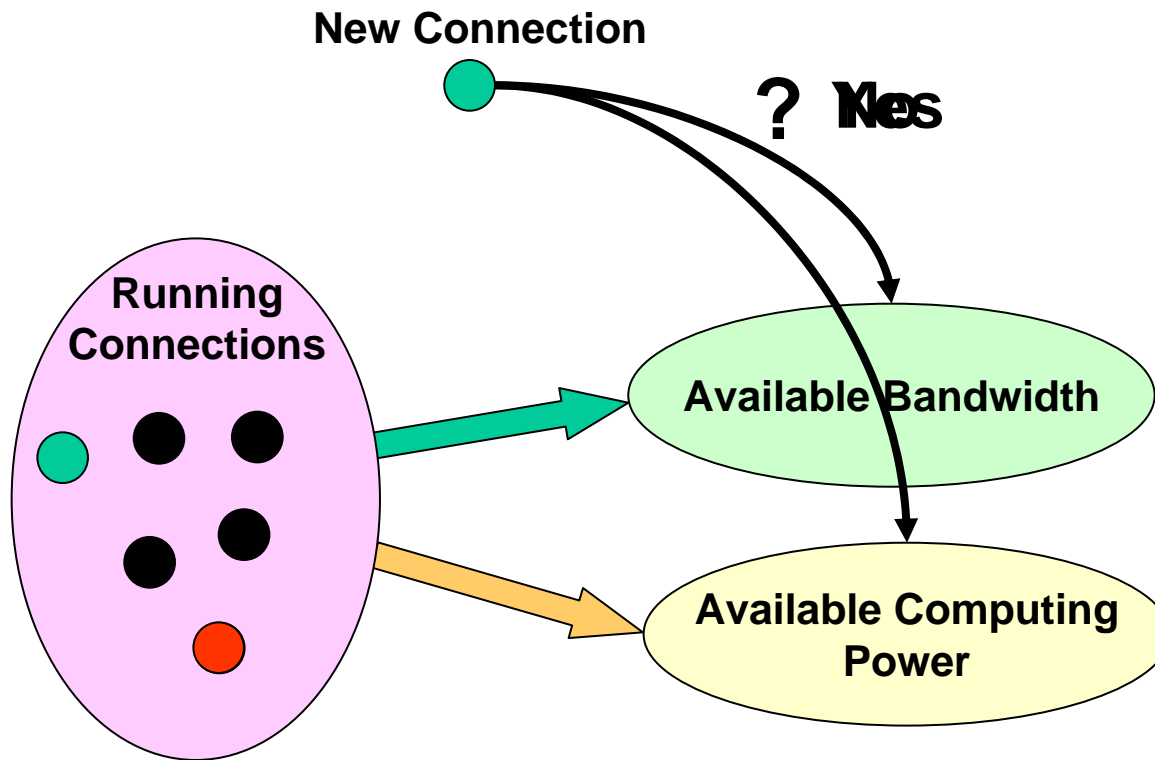
Browser Service

- Querying for multimedia sources and targets (multimedia pins)
- Classified in *Categories*
 - Description through *Properties*
- Registering devices capabilities
 - Returns only pins that are compatible with the query parameter
 - Taxonomies for standard media types

Translation Service

- Goal: Seamless connection between heterogeneous devices
- Media Data Translation
- Event and Timing Translation
- Conversion through concatenation of filters
 - Filter chaining
 - Reusable filters

Admission Service



Multimedia Routing Index

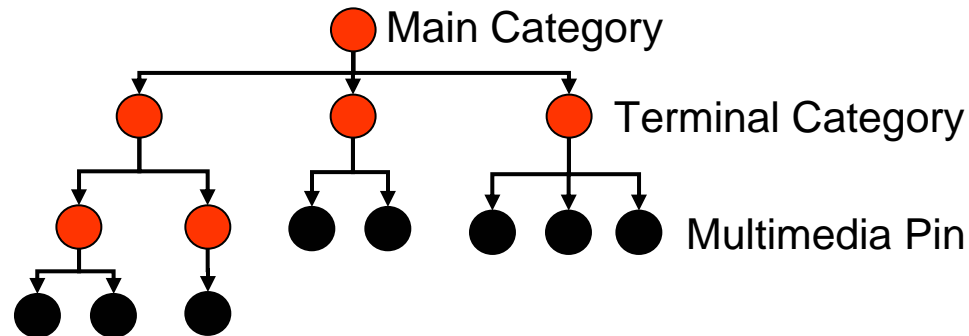
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Multimedia Pins

- Abstract representation of multimedia *producers* and *consumers*
 - Microphone/loudspeaker, movie/TV
 - Virtual entities: no direct relation to a physical device is required (i.e. stored song)
- Referenced using URL Schemes
 - `immpin://` and `ommpin://`
- Objectives
 - Hide internal complexity of the different multimedia sources and devices
 - Support quick and easy interaction of interconnect devices

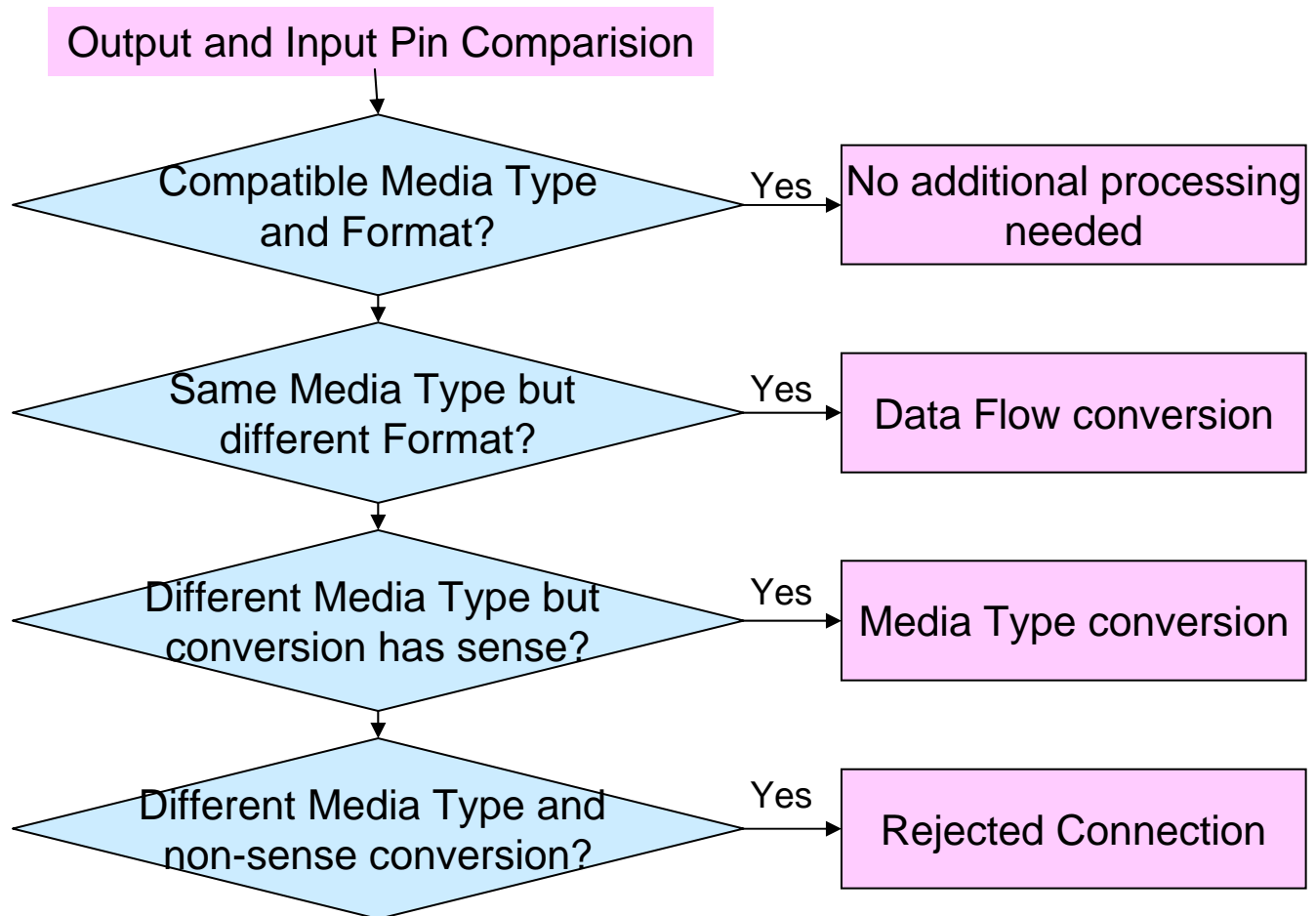
Multimedia Pin Categories

- Multimedia Pin Categorization
 - Grouping and Management in a hierarchical form
 - Remote update of some branches allowed on demand



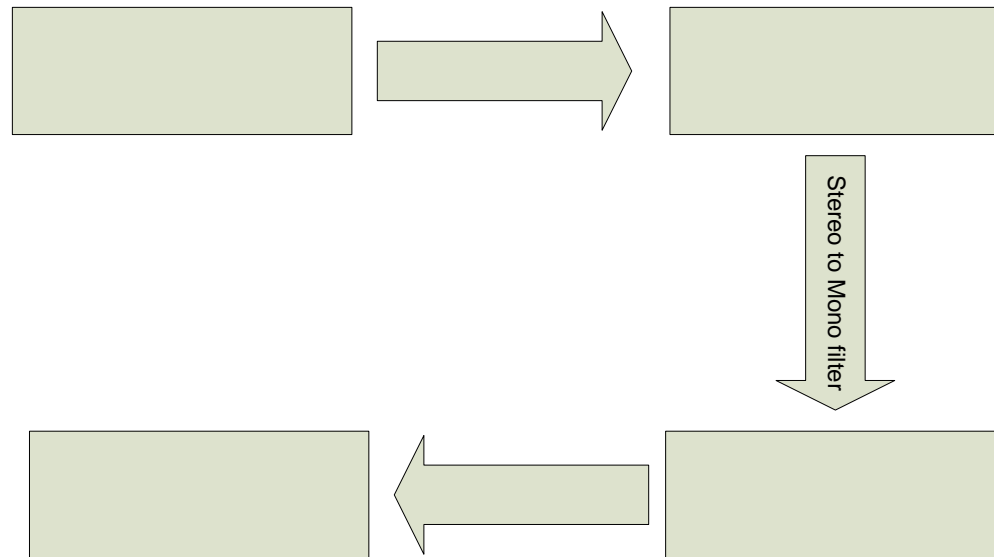
- Multimedia Pin Priorities
 - Numerical value given at register time
 - Helps on the automatic selection of the best pin

Multimedia Conversion Filters



Cascading Filters

- Playing back a MP3 song stored on a local jukebox into a portable Bluetooth-enabled mono OGG-Vorbis music player



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New URL schemes

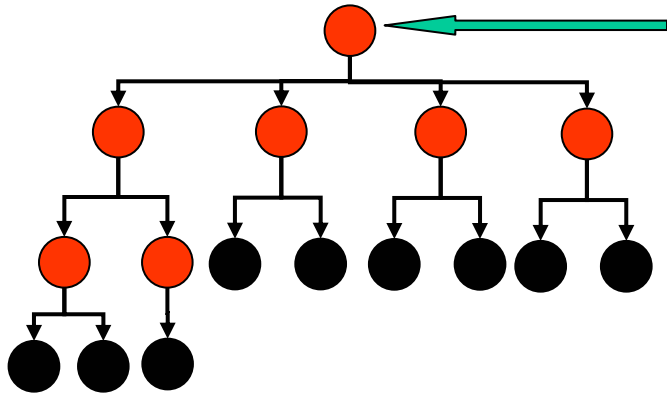
- Point to input or output multimedia pins
 - Category information is included
 - Or they can point to a whole category
 - If the URL ends with a backslash (\)

```
immpin://./Living%20Room/Speakers/1
```

```
ommpin://./VideoDoor/Mic
```

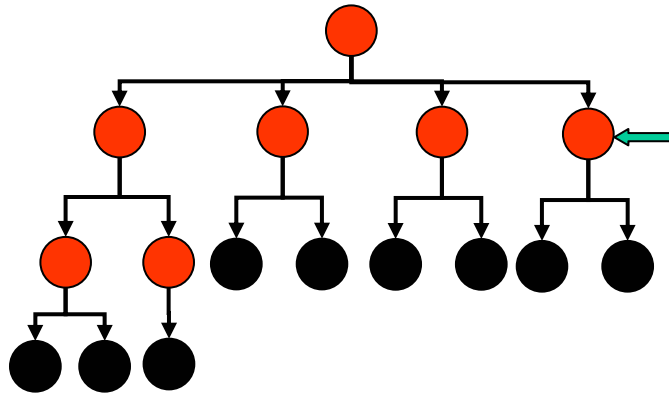
- Opening a multimedia pin
 - Output: Start sending media data
 - Input: Waits for incoming media data

Browsing the Catalog



```
<?xml version="1.0" encoding="ISO-8859-1"?>
<category targeturl="immpin://./Living%20Room/">
  <caption>Living Room</caption>
  <description>Living Room devices</description>
  <subcategory targeturl="immpin://./Living%20Room/TV/">
    <caption>TV-set</caption>
    <description>TV-set at the Living Room</description>
  </subcategory>
  <subcategory targeturl="immpin://./Living%20Room/Speakers/">
    <caption>Speakers</caption>
    <description>
      Stereo speakers at the Living Room
    </description>
  </subcategory>
  <subcategory targeturl="immpin://./Living%20Room/HiFi">
    <caption>Hi-Fi</caption>
    <description>HiFi-set at the Living Room</description>
  </subcategory>
  <subcategory targeturl="immpin://./Living%20Room/DVDRec">
    <caption>DVD Video Recorder</caption>
    <description>DVD Video Recorder</description>
  </subcategory>
</category>
```

Browsing the Catalog



```
<?xml version="1.0" encoding="ISO-8859-1"?>
<category targeturl="immpin://./Living%20Room/Speakers/">
  <caption>Speakers</caption>
  <description>
    Stereo speakers at the Living Room
  </description>
```

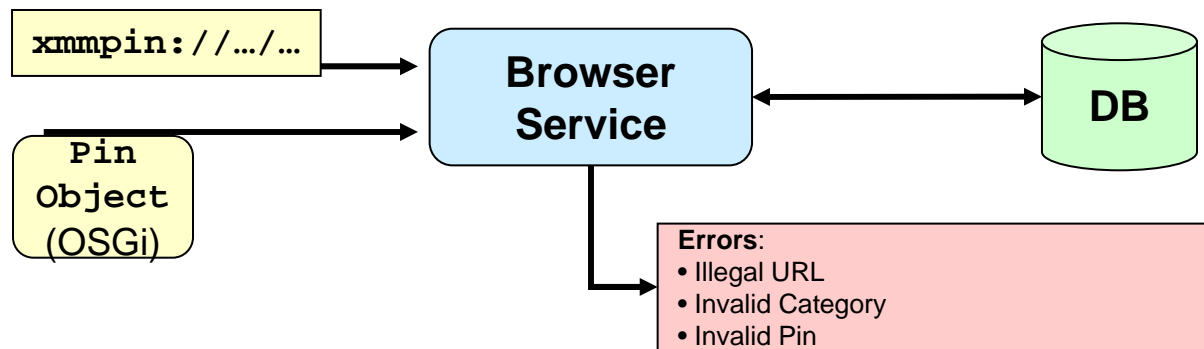
```
<pin targeturl="immpin://./Living%20Room/Speakers/1" priority="10">
  <caption>PCM audio input</caption>
  <content>
    <audio format="PCM">
      <bitspersample>16</bitspersample>
      <samplerate>44100</samplerate>
      <numchannels>2</numchannels>
    </audio>
  </content>
</pin>
```

```
<pin targeturl="immpin://./Living%20Room/Speakers/2" priority="9">
  <caption>MP3 audio input</caption>
  <content>
    <audio format="MPEG_layer3">
      <bitrate>*</bitrate>
      <samplerate>*</samplerate>
      <numchannels>1</numchannels>
      <numchannels>2</numchannels>
    </audio>
  </content>
</pin>
```

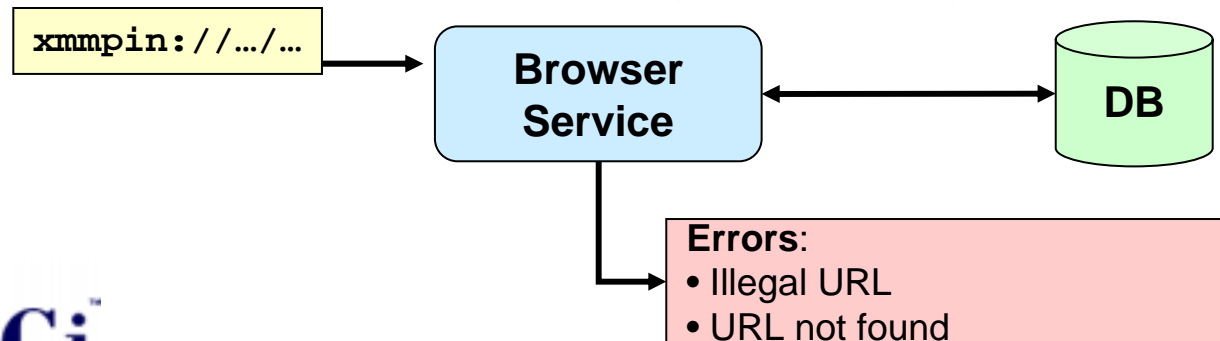
```
</category>
```

Browser Service Functionality

- Multimedia Pin Registering

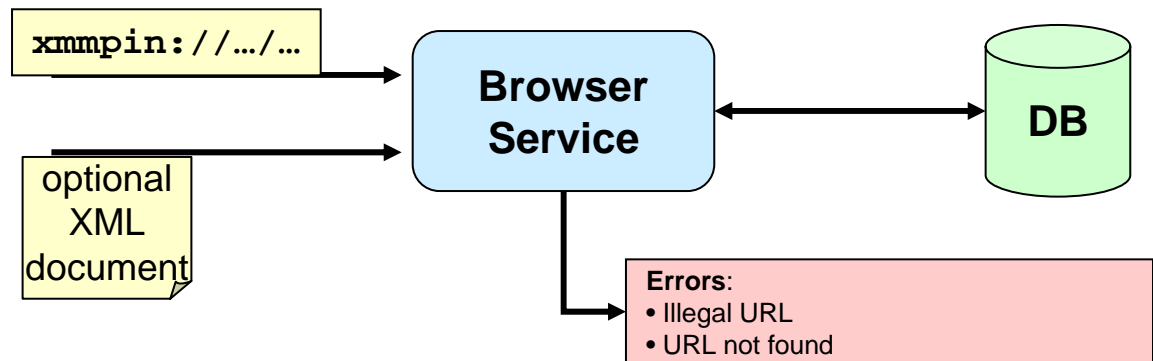


- Multimedia Pin Unregistering



Browser Service Functionality

- Pin Querying



- **Extensibility:** categories can be virtual so querying is only done when needed

- Call-back for those categories supported on the Abstraction Layer

- **Filtering:** return only matching pins

- A string containing a pattern is passed to the query

Query Results Filtering

- Checking that the XML tags of the filter are supported on the result

Output Pin (Pattern Filter)

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<pin targeturl="ommpin:///VideoDoor/Mic" priority="1">
  <content>
    <audio format="MPEG_layer3">
      <bitrate>48</bitrate>
      <samplerate>11025</samplerate>
      <numchannels>1</numchannels>
    </audio>
  </content>
</pin>
```

Input Pin

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<pin targeturl="immpin:///Sound/StereoSpeakers"
      priority="9">
  <content>
    <audio format="MPEG_layer3">
      <bitrate>24-320</bitrate>
      <samplerate>11025,22050,44100</samplerate>
      <numchannels>2</numchannels>
    </audio>
  </content>
</pin>
```

Mismatch

Query Results Filtering

- Checking that the XML tags of the filter are supported on the result

Output Pin (Pattern Filter)

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<pin targeturl="ommpin:///VideoDoor/Mic" priority="1">
  <content>
    <audio format="MPEG_layer3">
      <bitrate>48</bitrate>
      <samplerate>11025</samplerate>
      <numchannels>1</numchannels>
    </audio>
  </content>
</pin>
```

Input Pin

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<pin targeturl="inmpin:///Sound/MonoSpeaker"
      priority="8">
  <content>
    <audio format="MPEG_layer3">
      <bitrate>24-320</bitrate>
      <samplerate>11025,22050,44100</samplerate>
      <numchannels>1</numchannels>
    </audio>
  </content>
</pin>
```

OK

Multimedia Pin Properties Format

- Caption, description and contents
 - Three content types: audio, video and mux
- Audio pin sample:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<pin targeturl="..." priority="...">
  <caption>...</caption>
  <description>...</description>
  <content>
    <audio format="formatID">
      <parameter1>value_of_parameter1</parameter1>
      ...
    </audio>
  </content>
</pin>
```

Multimedia Pin Properties Format

```
<?xml version="1.0" encoding="ISO-8859-1"?>  
<pin targeturl="..." priority="...">  
  <caption>...</caption>  
  <description>...</description>  
  <content>
```

Mux type sample

```
    <mux format="muxFormatID">
```

```
      <audio format="audioFormatID1">
```

```
        <parameter1>value_of_parameter1</parameter1>
```

```
        ...
```

```
      </audio>
```

```
      <audio format="audioFormatID2">
```

```
        <parameter1>value_of_parameter1</parameter1>
```

```
        ...
```

```
      </audio>
```

```
      <video format="videoFormatID">
```

```
        <parameter1>value_of_parameter1</parameter1>
```

```
        ...
```

```
      </video>
```

```
    </mux>
```

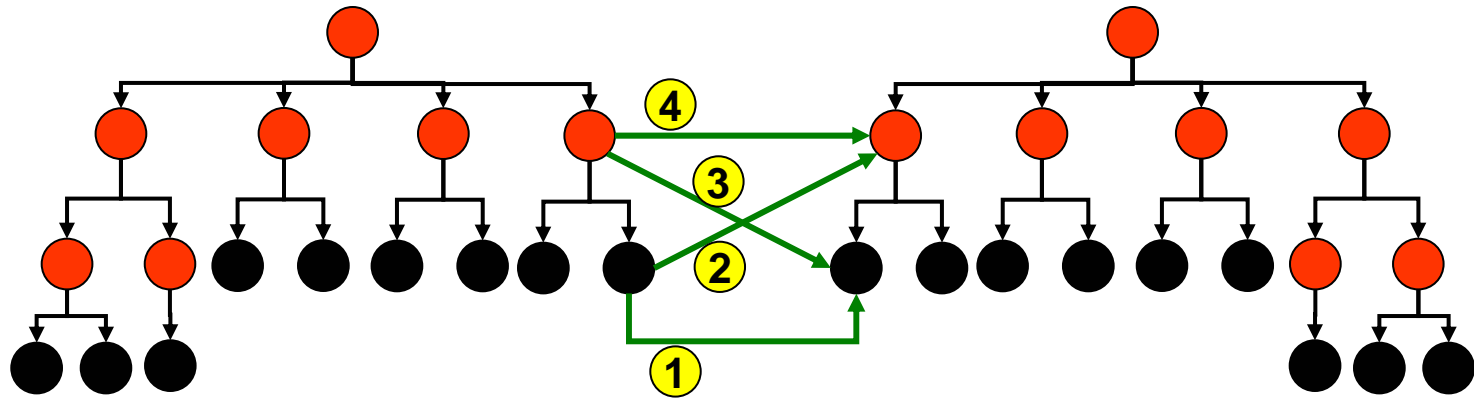
```
  </content>
```

```
</pin>
```

Multimedia Routing Index

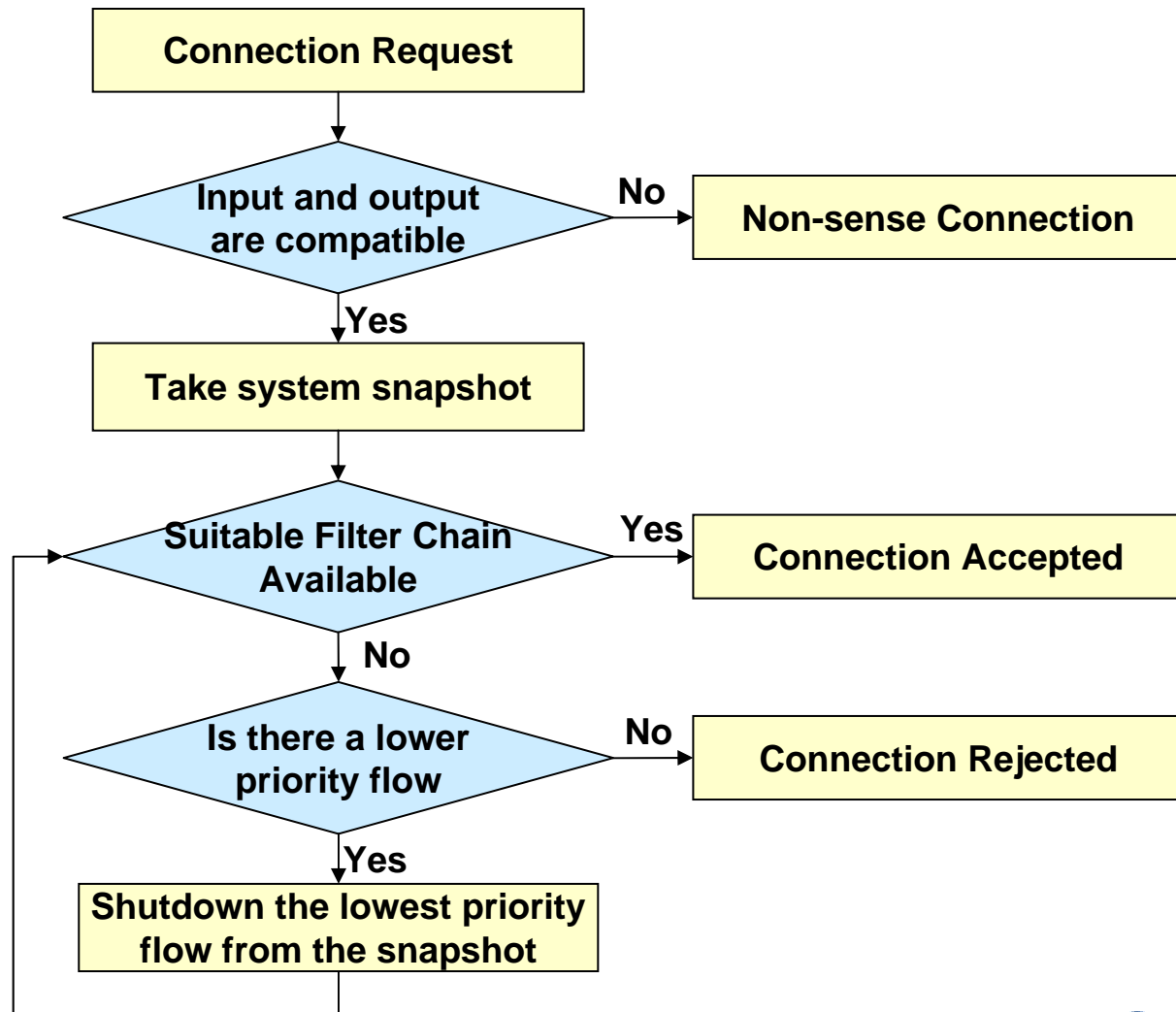
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Setting Up a Connection



1. Output Multimedia Pin to Input Multimedia Pin
2. Output Multimedia Pin to Input Terminal Category
3. Output Terminal Category to Input Multimedia Pin
4. Output Terminal Category to Input Terminal Category

Admission Service Algorithm



Multimedia Flow Control

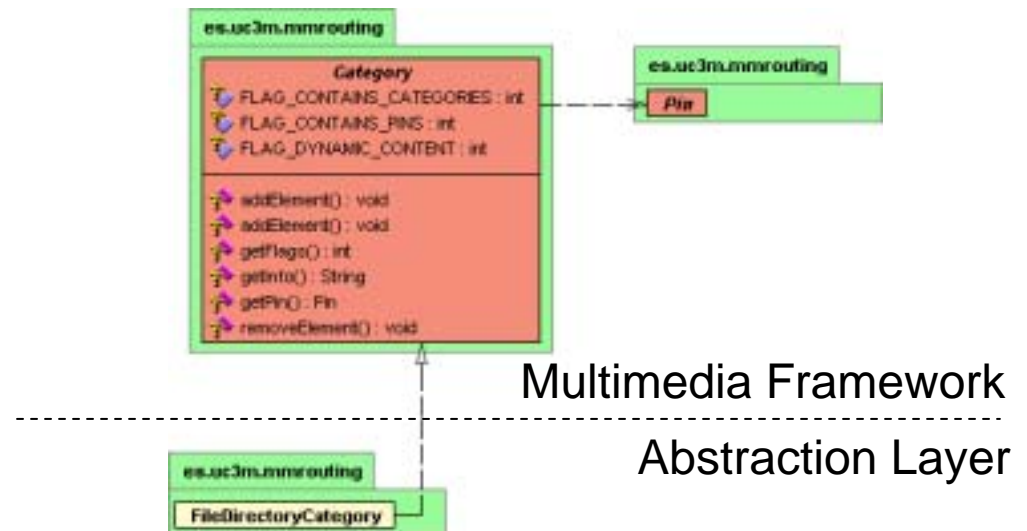
- Standard Commands will be defined
 - Pause, Stop, Rewind, etc.
- Commands depend on Media Type
 - Audio: volume control
 - Stored Media: position control
- Supported command can be queried
- Can be issued by either side of the connection or by external processes

Category Interface

- Category encapsulation
 - Those classes implementing the interface will be located on the *Abstraction Layer* (call-back mechanism)

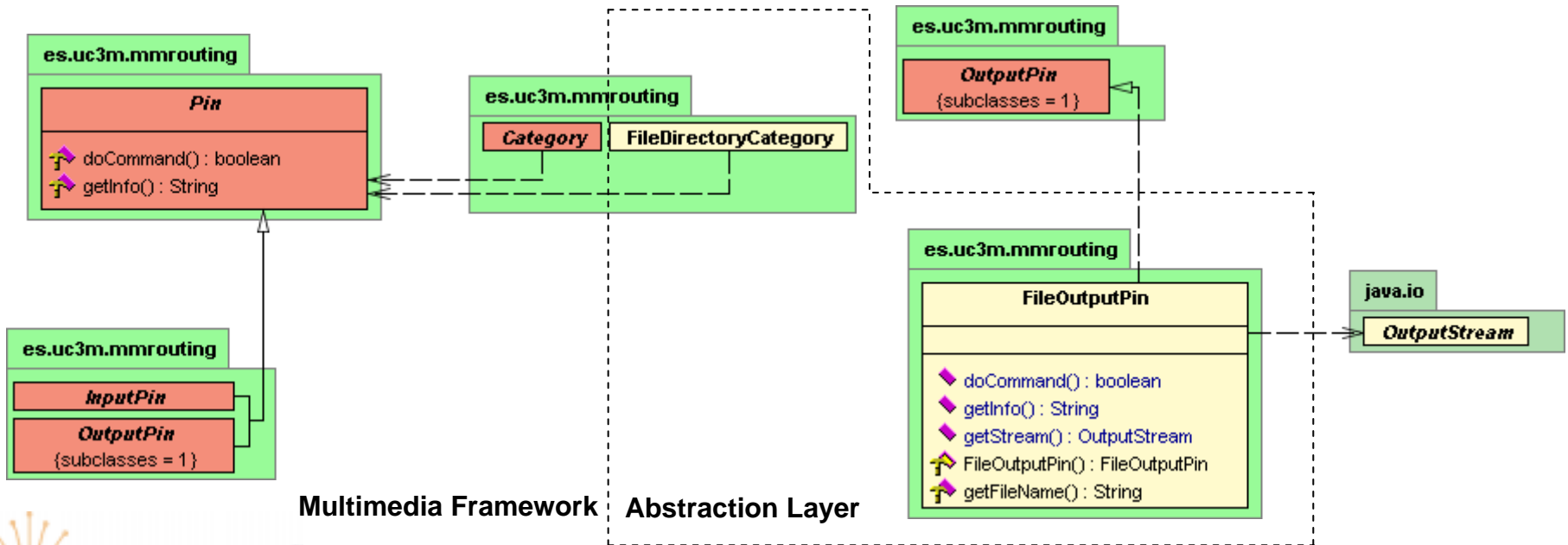
Example:

FileDirectoryCategory implements a category that wraps a folder in the filesystem.



Pin Interface

- Encapsulate a multimedia pin
 - Those classes implementing it will be located in the *Abstraction Layer* (device specific)



Future Lines

- First prototype
 - Connection of a mobile device with the gateway for audio playback
- Define standard category classes
- Define standard command and measures units for multimedia data flow control.
- Define filters for the Translation Services
- Implement the Admission Service



Questions?



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