InHoNets project

UPnP connectivity between Home Networks

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InHoNets

- Interconnected Broadband Home Networks
- Investigates technologies to bridge home networks.
- 2 year project, launched in March 2006
- Academic participants: HUT & TUT
- Industrial partners: Ericsson, Nokia, Elisa, Digita & YLE

Home network connectivity

- Consider the Universal Plug and Play (UPnP) devices in the home network

- User should be able to decide which devices be allowed to other home network

- Distinguish between local devices and remote devices
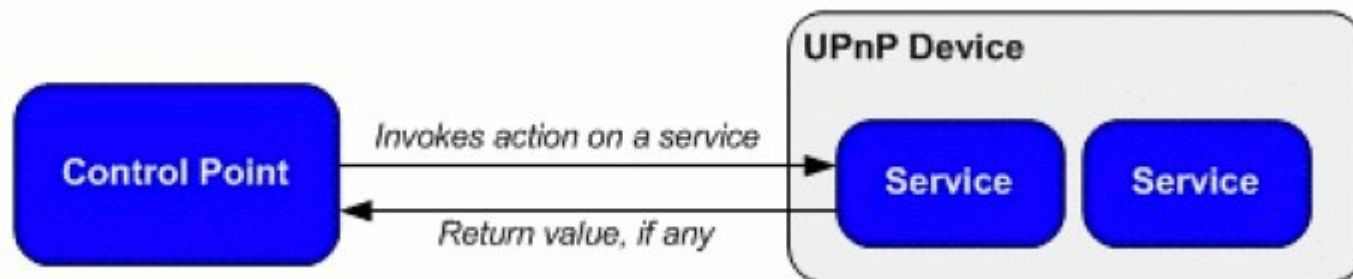
UPnP device architecture

- **Devices**
  - services and nested devices.
  - XML device description document

- **Services**

- **Control points**
  - capable of discovering and controlling other devices

UPnP Device

Control Point — Invokes action on a service → Service   Service

Return value, if any

UPnP home network

NOTIFY * HTTP/1.1
HOST: 239.255.255.250:1900
CACHE-CONTROL: max-age = seconds until
advertisement expires
LOCATION: 10.1.0.1:4500
NT: search target
....
....

10.1.0.1

UPnP device

UPnP device

UPnP Home
Network

UPnP Control point

List of UPnP devices

UPnP device

Connecting UPnP home networks

UPnP device A

10.1.1.5

UPnP Home Network 1

UPnP device B

10.1.1.6

GW

10.1.1.5

UPnP device A

10.1.1.6

UPnP device C

GW

UPnP Home Network 2

UPnP device D

10.1.1.9

GW

UPnP device B

10.1.2.5

UPnP Home Network 3

UPnP device E

10.1.2.8
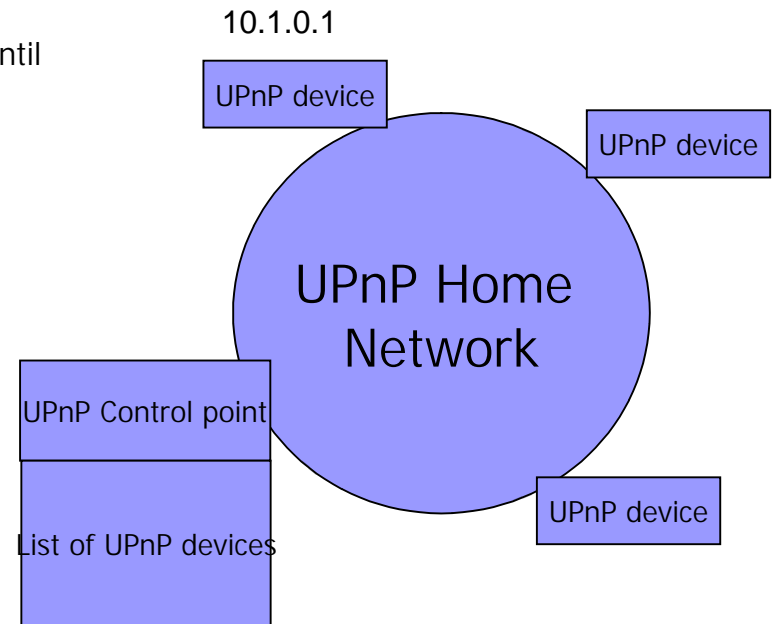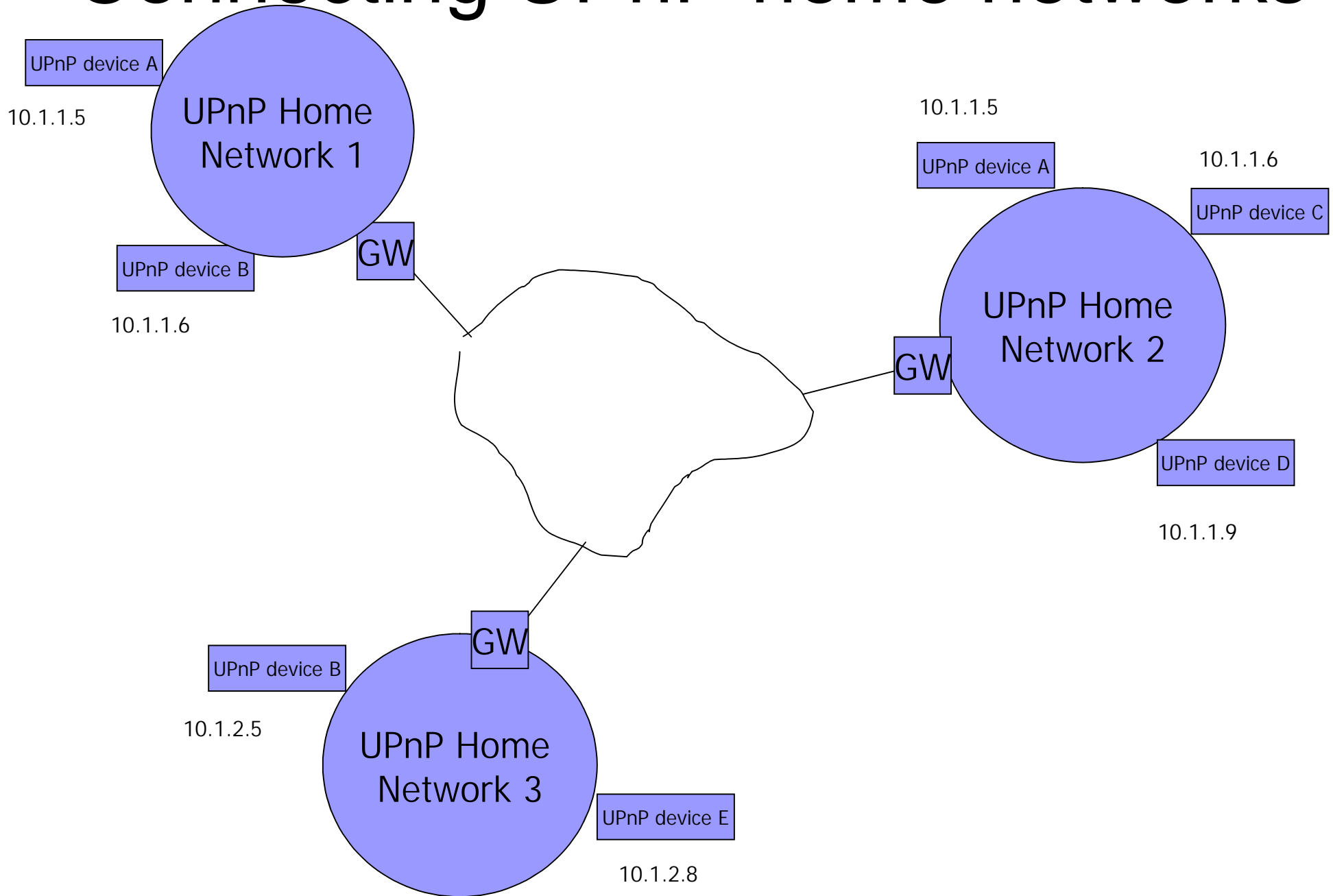
Related works

- **Intel device relay**
  - mirrors UPnP devices from one network to another

- **Philips H-2-H solution**
  - Mobilizing the internet project

Connecting UPnP home networks

UPnP device A

10.1.1.5

UPnP Home Network 1

Device A
Device B

UPnP device B

10.1.1.6

GW

10.1.1.5

UPnP device A

10.1.1.6

UPnP device C

UPnP Home Network 2

GW

UPnP device D

Device A
Device C
Device D

10.1.1.9

GW

Device B
Device E

UPnP device B

10.1.2.5

UPnP Home Network 3

UPnP device E

10.1.2.8
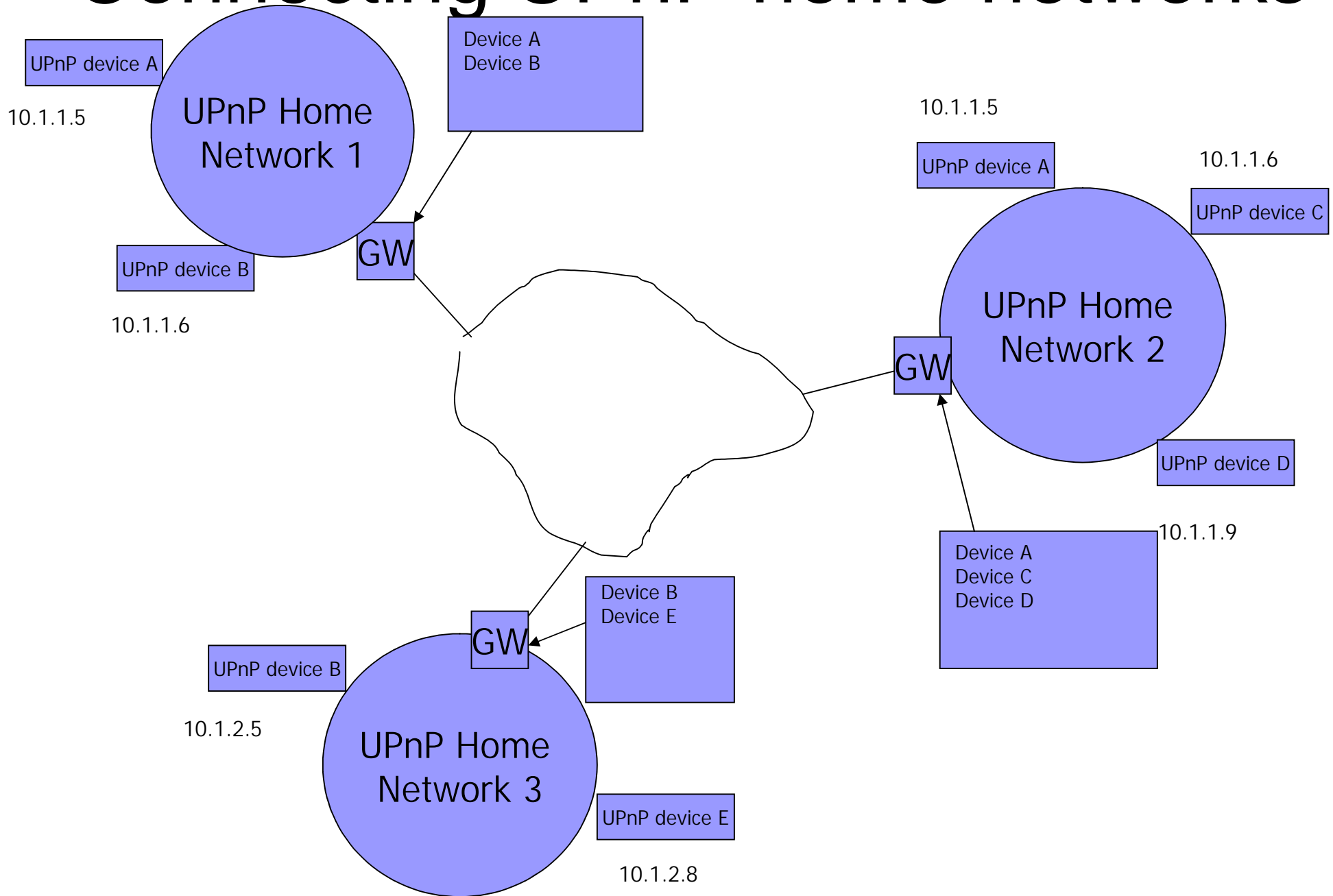
Connecting UPnP home networks

Connecting UPnP home networks

UPnP device A

10.1.1.5

UPnP Home Network 1

Device A
Device B

UPnP device B

10.1.1.6

10.1.1.5:4500=>
130.233.16.1:4500

GW

10.1.1.5

UPnP device A

10.1.1.6

UPnP device C

UPnP Home Network 2

GW

UPnP device D

Device A
Device C
Device D

10.1.1.9

GW

Device B
Device E

UPnP device B

10.1.2.5

UPnP Home Network 3

UPnP device E

10.1.2.8

Change the
proxy device
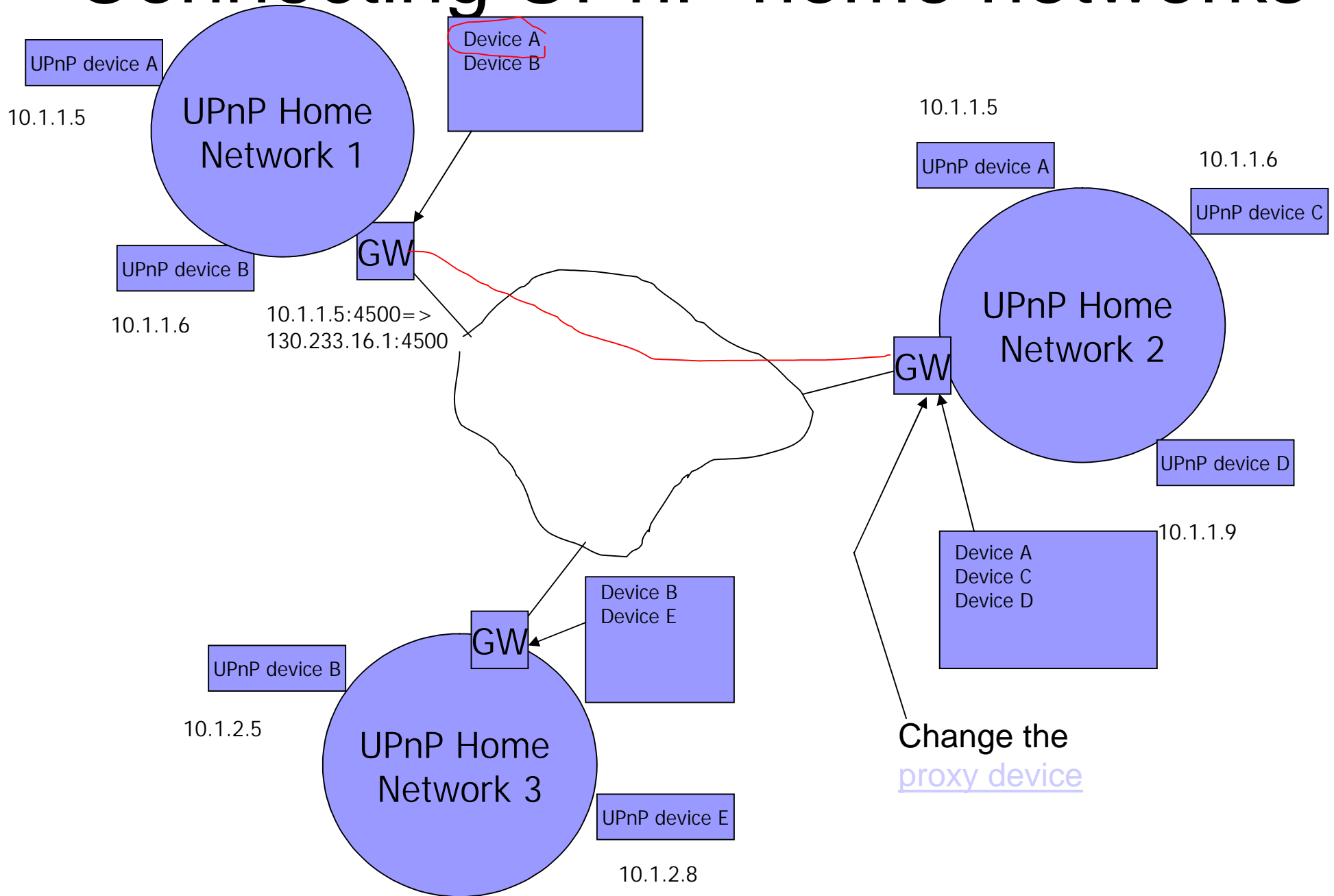
Connecting UPnP home networks
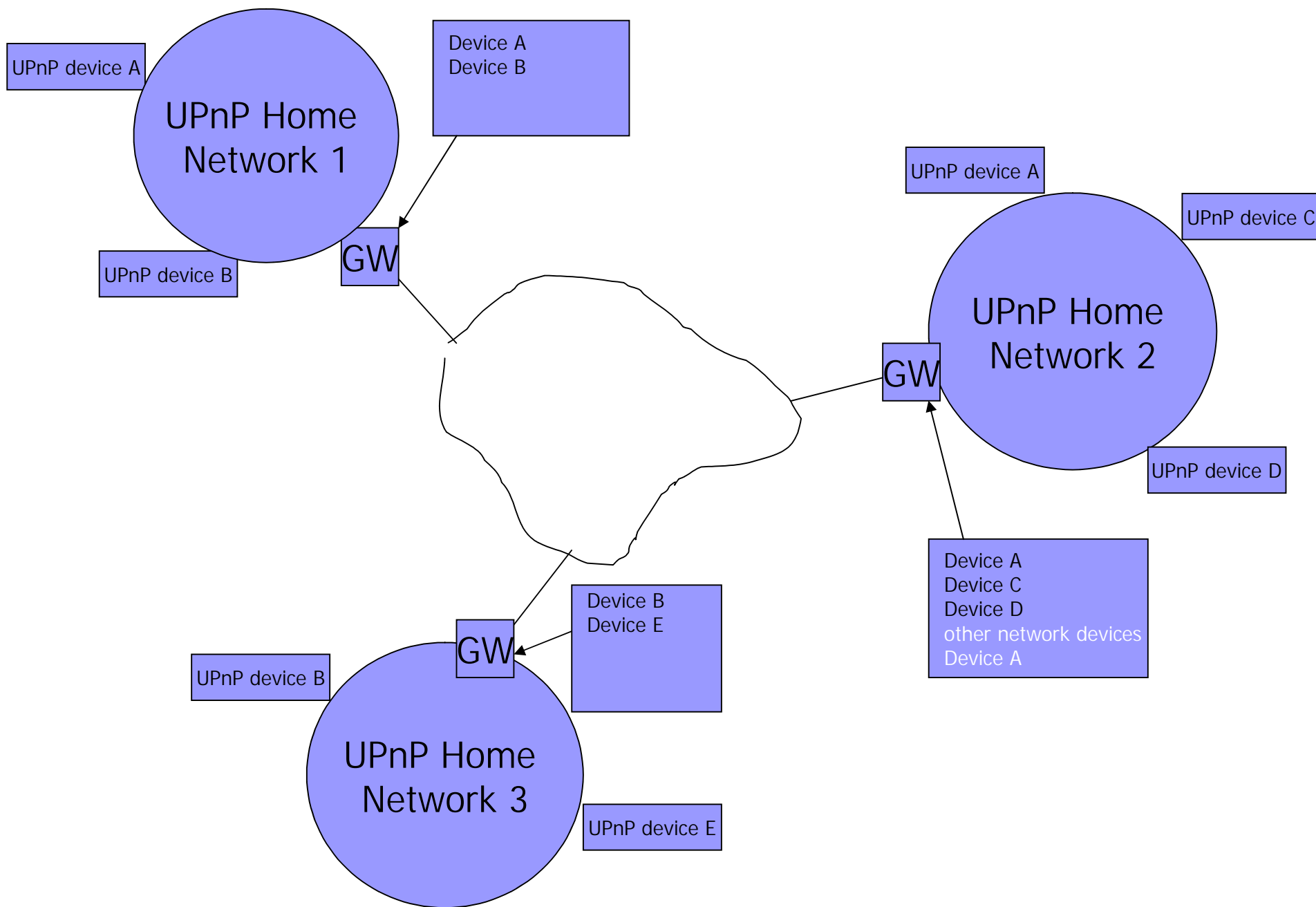
remote home network | local home network

device — gateway — gateway — control point

announce presence

request device description

send device description

request service description

send service description

Allow device

revoke announcement

request device description

request device description

send device description

send device description

announce presence

request service description

request service description

request service description

send service description

send service description

send service description

invoke action

invoke action

invoke action

Some issues

- How to form the group, i.e, how the home networks know about the other networks
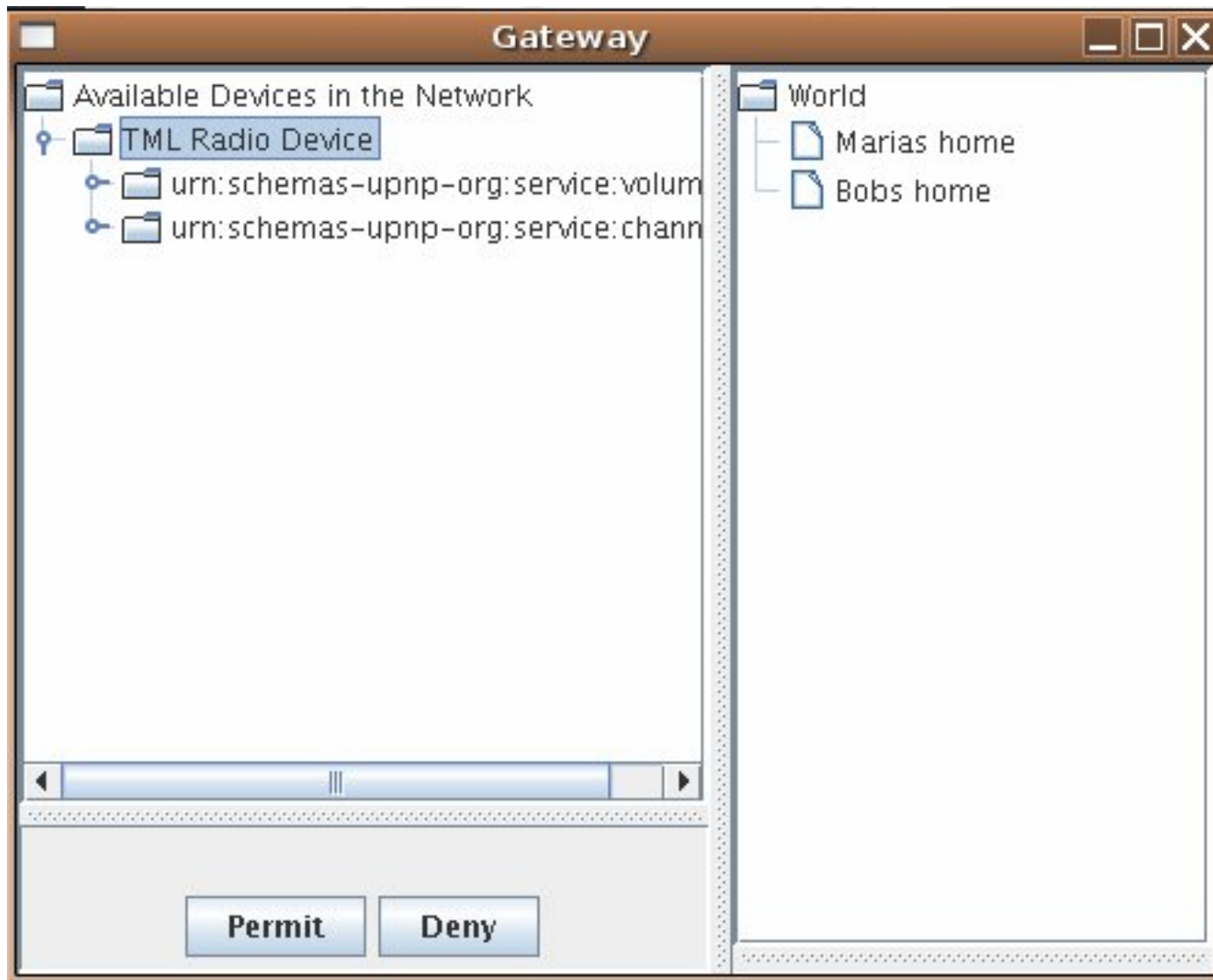
- What happens when the IP address of the gateways changed

- Is it a good idea to access the services from the main device without making a local copy

Thank you

```xml
<?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:deviceType:v</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>
    <serviceList>
      <service>
        <serviceType>urn:schemas-upnp-org:service:serviceType:v</serviceType>
        <serviceId>urn:upnp-org:serviceId:serviceID</serviceId>
        <SCPDURL>URL to service description</SCPDURL>
        <controlURL>URL for control</controlURL>
        <eventSubURL>URL for eventing</eventSubURL>
      </service>
    </serviceList>
    <deviceList>
      Description of embedded devices defined by a UPnP Forum working
      committee (if any) go here
    </deviceList>
    <presentationURL>URL for presentation</presentationURL>
  </device>
</root>
```

```xml
<?xml version="1.0" ?>
- <root xmlns="urn:schemas-upnp-org:device-1-0">
  - <specVersion>
      <major>1</major>
      <minor>0</minor>
    </specVersion>
  - <device>
      <deviceType>urn:schemas-upnp-org:device:proxy1:1</deviceType>
      <friendlyName>Other network devices</friendlyName>
      <manufacturer>TML</manufacturer>
      <manufacturerURL>http://www.tml.hut.fi</manufacturerURL>
      <modelDescription>TML Proxy Device</modelDescription>
      <modelName>Proxy</modelName>
      <modelNumber>1.0</modelNumber>
      <modelURL>http://www.tml.hut.fi</modelURL>
      <serialNumber>1288567890</serialNumber>
      <UDN>uuid:tmlProxyDevice1</UDN>
      <UPC>123456789512</UPC>
      <serviceList />
      <deviceList />
    </device>
  </root>
```

```xml
<?xml version="1.0" ?>
- <root xmlns="urn:schemas-upnp-org:device-1-0">
   - <specVersion>
       <major>1</major>
       <minor>0</minor>
     </specVersion>
   - <device>
       <deviceType>urn:schemas-upnp-org:device:proxy1:1</deviceType>
       <friendlyName>Other network devices</friendlyName>
       <manufacturer>TML</manufacturer>
       <manufacturerURL>http://www.tml.hut.fi</manufacturerURL>
       <modelDescription>TML Proxy Device</modelDescription>
       <modelName>Proxy</modelName>
       <modelNumber>1.0</modelNumber>
       <modelURL>http://www.tml.hut.fi</modelURL>
       <serialNumber>1288567890</serialNumber>
       <UDN>uuid:tmlProxyDevice1</UDN>
       <UPC>123456789512</UPC>
       <serviceList />
     - <deviceList>
       - <device>
           <deviceType>urn:schemas-upnp-org:device:radio:1</deviceType>
           <friendlyName>TML Radio Device</friendlyName>
           <manufacturer>TML</manufacturer>
           <manufacturerURL>http://www.tml.hut.fi</manufacturerURL>
           <modelDescription>TML Radio Device</modelDescription>
           <modelName>Radio</modelName>
           <modelNumber>1.0</modelNumber>
           <modelURL>http://www.tml.hut.fi</modelURL>
           <serialNumber>1234567890</serialNumber>
           <UDN>uuid:tmlRadioDevice</UDN>
           <UPC>123456789012</UPC>
         - <serviceList>
           - <service>
               <serviceType>urn:schemas-upnp-org:service:volume:1</serviceType>
               <serviceId>urn:schemas-upnp-org:serviceId:volume:1</serviceId>
               <SCPDURL>http://130.233.16.1:4500/service_volume.xml</SCPDURL>
               <controlURL>/volume</controlURL>
               <eventSubURL>/</eventSubURL>
             </service>
           </serviceList>
         </device>
       </deviceList>
     </device>
   </root>
```

back