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 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 Control point
List of UPnP devices
UPnP Home Network
UPnP device
UPnP device
Connecting UPnP home networks

UPnP Home Network 1
- UPnP device A
- UPnP device B
- GW

UPnP Home Network 2
- UPnP device A
- UPnP device C
- UPnP device D
- GW

UPnP Home Network 3
- UPnP device B
- GW
- UPnP device E
- GW

Network addresses:
- 10.1.1.5
- 10.1.1.6
- 10.1.2.5
- 10.1.2.8
- 10.1.1.9
- 10.1.1.10
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 Home Network 1
- UPnP device A
- UPnP device B

UPnP Home Network 2
- UPnP device A
- UPnP device C
- UPnP device D

UPnP Home Network 3
- UPnP device A
- UPnP device B
- UPnP device E

Connecting UPnP devices:
- 10.1.1.5
- 10.1.1.6
- 10.1.2.5
- 10.1.2.8
- 10.1.2.9
Connecting UPnP home networks

UPnP Home Network 1

UPnP device A
10.1.1.5

UPnP device B
10.1.1.6

UPnP Home Network 2

UPnP device A
10.1.1.5

UPnP device C
10.1.1.6

UPnP device D
10.1.1.9

UPnP Home Network 3

Device A
10.1.2.5

Device B
10.1.2.8

UPnP device E

Connecting UPnP home networks

UPnP Home Network 1
- UPnP device A: 10.1.1.5
- UPnP device B: 10.1.1.6

UPnP Home Network 2
- UPnP device A: 10.1.1.5
- UPnP device C: 10.1.1.9
- UPnP device D: 10.1.1.6

UPnP Home Network 3
- UPnP device B: 10.1.2.5
- Device B: 10.1.2.8
- UPnP device E: 10.1.2.5

GW
- 10.1.1.5:4500 => 130.233.16.1:4500

Change the proxy device
Connecting UPnP home networks

UPnP Home Network 1
- UPnP device A
- UPnP device B
- Device A
- Device B

UPnP Home Network 2
- UPnP device A
- UPnP device C
- UPnP device D
- Device A
- Device C
- Device D
- other network devices

UPnP Home Network 3
- UPnP device B
- Device A
- Device B
- Device E

GW

GW

GW
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 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:y</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:y</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 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:proxy:1:1</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>
  </deviceList />
  <deviceList />
</device>
</root>
<?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:proxy:1:1</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 />
  </device>
  <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>