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A Watcher's Paradize.

UPnP and SIP, creating addressability to Home Devices.

- **Abstract.**

The emergence of Electronic mail and Instant Messengers has made possible unique identities for internet users. The evolution of VoIP has changed the way people communicate today, bringing with it a rich set of Multimedia features, turning the Plain Old Instant Messengers into more powerful communication entities. Technologies like Broadband – 'Always connected', have changed the Usage model of the Internet, by Internet users compared to Dial-up connections which were used traditionally.

"Presence on the Internet" has been an integral part of our daily life, and in this fast changing world, there seems to be a need to define presence for all the "Entities" we interact with or rely on in our daily lives. Internet Presence of Internet users (Buddies/ Colleagues etc) are readily available via Instant Messengers, where one can express his/her availability to communicate (Online/Offline/On the Phone etc), Mood , Place type (Meeting / Driving / Lunch/ Movie etc.), communication modes to reach the user like E-mail/ IM/ Phone etc. There has not been any Presence Information available of devices back home of Internet Users, like Television, water heater, Backyard camera or any device for that matter. **This document addresses how the "Presence and Services of Devices" can be distributed over the Public Internet to Watchers interested in knowing them, using the already existing /evolving technologies on the Internet.**

- **Presence for Devices.**

"If you do not have the right information, you are just another person with an Opinion"

We do not have the Presence Information of most of the "Entities" that we interact with in our daily life, more often than not. For Ex.: We do not know the status of any of the devices that are back home, even though enough Presence information could be generated and distributed to watchers. This Presence information could as well include information on the "Services" exposed by the Entity. This information could be used for attempting "Operations" on the Entities. The information provided should be substantial enough to help the Operator to initiate signaling procedures towards the entity.

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- **Problem Description.**

    - "Presence and Services" of devices have always been restricted within the home network.
    - There is no standard way of distributing Presence information of Devices, to people who are interested in watching them.
    - Multimedia capable devices back home are not available to users outside their homes.

Protocols Involved.

Central to the idea of distributing Presence and Services of devices requires an Event driven Presence Framework. The Protocol of choice for Home Devices has always been UPnP, and has been accepted by leading device manufacturers around the world. UPnP is designed to work in a Local Area Network for advertising Presence and service information of Devices. To get the Device information to Internet Users, there has to be a standard protocol which can address all the problems listed in the Problem description above.

We propose a framework which is a combination of widely accepted protocols to overcome the problem.

SIP (The Session Initiation Protocol) in conjunction with **UPnP**, has the capability to address all the problems listed above. It has a well defined Presence Framework, for Event Notification, State Publication, Event State Subscription and the capability to initiate, modify and tear down Multimedia sessions. In reality, SIP is the most widely used VoIP protocol today for Multimedia sessions, both on Wired and Wireless Data networks.

Designing a framework to accomplish "**Presence for devices**", it would be appropriate to have devices speak their native language (**UPnP**) and the **Watchers/Internet users** their own (**SIP** – The Session Initiation Protocol). This begs for an intermediary, which can talk the Watcher's Language as well as understand the Devices language. A Component (From now on called the ***Device manager***) would no doubt be required to talk and listen to Devices. It could retrieve the Services available on the Devices, their Current status and PUBLISH it to a SIP Presence Server, which could in turn NOTIFY the SUSBCRIBE'd users.

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The Product – ***Device Manager.***

Fig. 1

The main role of the Device Manager is to collect information about UPnP devices in the Home Network and publish them to the Internet using SIP.
The Device Manager would have the following Hardware and Software Requirements:

- Hardware
  - Microprocessor.
  - WLAN interface.
  - Ethernet interface (optional).
  - RAM.
  - FLASH memory.
- Software
  - Embedded Linux/ Any RTOS.
  - UPnP stack. (Intel SDK)
  - SIP stack. (Osip – an open source SIP stack)
  - HTTP stack (Ghttp – an open HTTP stack)
  - Ortp – Open RTP (Real time transport protocol) stack.

Configuration:

The Device manager has a configuration page, which can be accessed trough HTTP. It provides an interface to the Home Network users to configure the Devices, like for example setting SIP URI (Uniform Resource Identifiers), Display Names etc.(**Static Configuration**) for the devices at home.

For Ex: The TV in the Drawing Room in John's house, could be configured to be called as sip:tv_hall@johnshome.com , with a Displayname "Tv – Hall ".

On the other hand, for Devices which have not been configured through the Web interface, the Device Manager, dynamically generates unique SIP URI's, by extracting information from certain fields in the UPnP Device advertisements (**Dynamic Configuration**).

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Fig. 2 (above): A snapshot of the **SIP** User Agent, when the TV comes online.

Fig. 3 (above): A snapshot of the **SIP** User Agent, when the user clicks on the TV.

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The Device Manager stores all the devices in XCAP (e**X**tensible **C**onfiguration **A**ccess **P**rotocol) format. **XCAP** introduces the notion of **Resource Lists** and **Resource List Services.**

SIP's Event Publication/Notification framework, uses the following methods:

SUBSCRIBE: Subscribing for Event Notifications.

PUBLISH: For PUBLISH'ing event state.

NOTIFY: For sending Event Notifications, to SUBSCRIBE'd users

Typically, SIP User Agents, would SUBSCRIBE to a single URI for SUBSCRIB'ing to all the devices at home. For Ex.: An RLS would have the following format:

```
<?xml version="1.0" encoding="UTF-8"?>
  <rls-services xmlns="urn:ietf:params:xml:ns:rls-services"
     xmlns:rl="urn:ietf:params:xml:ns:resource-lists"
     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <service uri="sip:home_devices@johnshome.com">
     <list name="home_devices">
       <rl:entry uri="sip:tv@johnshome.com"/>
       <rl:entry uri="sip:backyard_cam@johnshome.com"/>
     </list>
     <packages>
       <package>presence</package>
     </packages>
   </service>
  </rls-services>
```

SUBSCRIBE'ing to sip:home_devices@johnshome.com , would create virtual Subscriptions to sip:tv@johnshome.com and sip:backyard_cam@johnshome.com, thus decreasing the overhead of creating individual subscriptions for each device and reducing the Network traffic. Once the Subscription is accepted by the Device Manager, the User Agent starts getting Notifications, for all the devices in the list, home_devices. Alternatively, The Service Element can also contain a child Element called <resource-list> , which points to a List in the Resource List document.

For Ex:

```
<service uri="sip:mybuddies@example.com">
<resource-list>http://xcap.example.com/resource-
lists/users/joe/index/~~/
   resource-lists/list%5b@name=%22l1%22%5d</resource-list>
</service>
```

Conclusion.

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Based on the above we would like to re-iterate and highlight the basic idea of this proposal and the scope for future work, and important milestones reached.

- Giving each UPnP device a unique addressable identity on the Internet.
- SIP, which is widely used in Instant Messengers like Windows Messenger, Google Talk (next version of Google Talk is supposed to use SIP.), is the desired protocol for use on the Internet side, and has the concept of URI's to uniquely identify a resource on the Internet.
- Developing a framework for UPnP and SIP to interoperate. SIP inherently has capabilities for signaling and controlling multimedia sessions. This helps in Multimedia capable devices at home being available to people interested in initiating Multimedia sessions with those devices.
- Need to have an XML format to convey the capabilities of the Device, which would eventually be a part of the Service Notifications (Need further investigation, as to whether it is possible to extend the existing XML formats, to suit this need)

Milestones reached:

- Simulated a UPnP device (An X'mas star) , and mapped it to a yahoo id, which would show status messages as to what the X'mas star is doing (like ON/ OFF or BLINK etc) to all the people who have the X'mas star id , on their buddy list. Buddies of the X'mas star can operate the star, by sending appropriate messages to switch it on/off/blink , the Commands can be learnt by sending a text message saying "help" to the X'mas star Id. (Open source Library – libyahoo2 was used to log in to yahoo , and set the status messages accordingly). A control Point and Device stack were generated to simulate the UPnP action using ***Intel*** **UPnP** Tools.
- SIP User Agent (Please refer the snapshots above , Fig 2 & 3) integration, which demonstrates the use of SIP URI's for devices, and gives the notion of Online/Offline when the Device Manager gets Device advertisements/ Bye-bye's from the devices in the internal home network.
- An **Electronic Picture Frame** simulation, where authorized users can send JPEG/GIF images (URL's pointing to JPEG/GIF images) to the Picture frame id , and the Picture frame will load the image , by retrieving it from the domain in the url. (Done using Yahoo messenger Id's,Work is on to do it through SIP, in a more standard way .). We could simulate this setup using an LFP (Local Flat Panel) as the UPnP enabled Electronic picture frame, the laptop ran the Device stack (UPnP) for the Electronic Picture frame and the Control Point (UPnP) ran on another system.

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