Location-based Communication Services

Xiaotao Wu, Ron Shacham, Matthew J. Mintz-Habib, Kundan Singh, Henning Schulzrinne
Department of Computer Science
Columbia University
New York, New York 10027
xiaotaow, rs2194, mms2571, kns10, hgs@cs.columbia.edu

ABSTRACT

Our demo shows end-user-oriented location-based services based on application-layer, human understandable location descriptions.

Categories and Subject Descriptors: H.4.3 [Information Systems Applications]: Communication Applications

General Terms: Design.

Keywords: location-based services, Internet telephony

1. INTRODUCTION

Location information can introduce many new services, not only for tracking, but also for controlling communication behaviors and triggering communication actions. Previous research work on location-based services [3] give us required technologies to acquire location information and handle the network-layer location-based call routing and QoS management. We believe it is time to focus on the application-layer, human understandable location descriptions, and perform end-user-oriented location-based services.

Our demo shows how we implement location-based services in our SIP [10] based Internet telephony infrastructure called Columbia InterNet Extensible Multimedia Architecture (CINEMA) [5] and our multi-function SIP user agent called SIPC [14]. The demo consists of five parts, namely location sensing, location tracking, location-based device control, ubiquitous computing, and using location information in emergency call handling.

2. DEMO DESCRIPTION

As shown in Figure 1, when Bob enters room 7LW2, the location agent will get Bob's profile from an i-Button [12] or a radio frequency ID (RFID) carried by Bob. The location agent will then associate Bob's profile with the room number and send the information to the location server. Bob's user agent can get its own location update from the location server. The location update will trigger a device control action to turn on the lamp in the room and a resource query to find out available resources, e.g., in the demo, a Pingtel phone is available in room 7LW2. If Bob's friends are interested in Bob's location information, Bob's user agent will also send location updates to them. Bob's friends may pinpoint Bob on a map. For incoming calls, Bob's user agent may use the available resources it discovered to handle the call. For outgoing calls, Bob's user agent may put its location information in the calls. For emergency calls, the location information may help emergency call takers to easily find Bob. We detail each part of the demo below.

Location sensing: We describe locations in three ways: geospatial coordinates, civil addresses, and location attributes. Location attributes are used to describe factors of a location that may affect communication behaviors, e.g., the privacy status of a location [11]. In the demo, we only use civil addresses, but SIPC can support the other two formats. We set the civil address of the room as 7LW2. There are two ID readers in the room, a RFID reader and an i-Button reader, both connect to the serial ports of a location agent. The location agent knows the readers' location. Once the location agent gets an ID from the readers, it will map the ID to a SIP URI and send a SIP PUBLISH [7] message to update the SIP URI's location information on the location server.

Location tracking: We developed location tracking by following the SIP event notification architecture [8]. A SIP user agent can retrieve its own location or another people's location by sending SUBSCRIBE requests to the location server. The location server will use NOTIFY requests for location updates. Upon receiving a location update, SIPC can pinpoint a people on a location map.

Location-based device control: A location update can trigger many actions in a user agent, e.g., if the user agent finds the distance to its buddy is less than a certain value, it will send an instant message to its buddy automatically. In the demo, we have device control commands triggered. When Bob enters room 7LW2, his user agent will send a SIP DO [6] request to the device control gateway to turn on the lamp and the stereo in the room. The lamp is controlled through an X10 controller, and the stereo is controller through a Slink-e controller [4]. In SIPC, actions are not hardcoded, instead, it is programmable in the Language for End System Services (LESS) [15]. In the demo, we use the following script to trigger device control actions.

```
<less><EVT:notification>
 <LOC:location-switch type="civil">
  <LOC:location loc="7LW2">
   <location url="sip:irtlamp@cs....">
    <CTRL:control command="turn on"/>
   </location>
  </LOC:location>
 </LOC:location-switch>
</EVT:notification></less>
```


MM'04, October 10-16, 2004, New York, New York, USA.

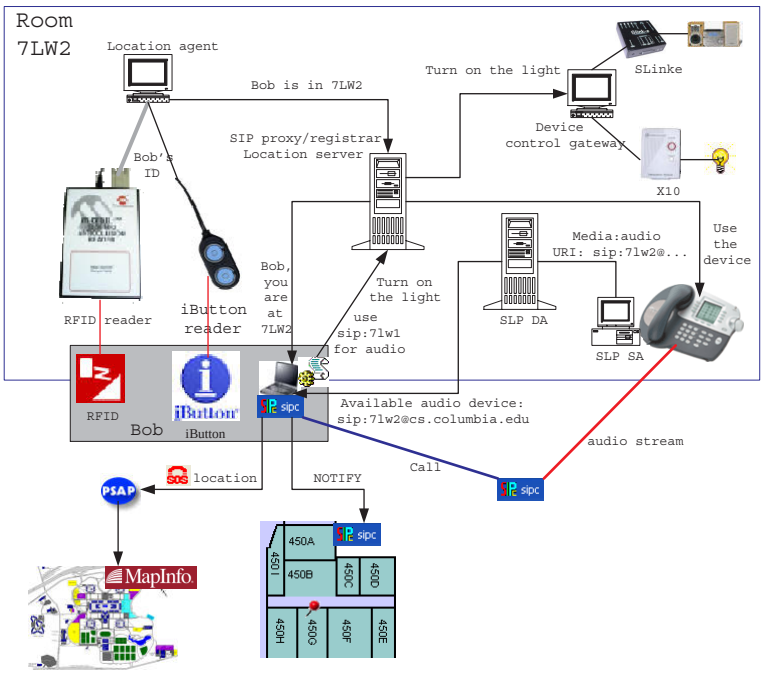

Figure 1: Location-based communication services

Ubiquitous computing: We have proposed an ubiquitous computing architecture [1] [13] that centered around open protocol standards like SIP, SLP [2] and Bluetooth technology and ongoing efforts in IETF. As shown in Figure 1, SIPC can find available resources in the environment by including location information in a SLP query [2]. SIPC can then use SIP third-party call control (3pcc) [9] to control the resources. In the demo, the available audio resource is a Pingtel phone.

Location information in emergency call handling: We are developing an emergency call handling architecture which requires location-based services. For an emergency call, SIPC will encode its location information in MIME multipart format in an INVITE request. In the architecture, SIPD, the proxy server in our CINEMA infrastructure, uses the location information to find an appropriate Public Safety Answering Point (PSAP) to route the call. Once an emergency call taker gets the call, he can pinpoint the caller on a map based on the location information. In the demo, we use MapInfo's product to pinpoint geospatial coordinates on a map.

3. REFERENCES

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