IETF Standards for Geolocation and Emergency Calling

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Agenda

- Location supply and demand
  - Current and emerging location-based applications
  - Current and emerging sources of location information
- The quest for a Grand Unified Theory
Supply and Demand
Demand, part 1: Commercial Applications

- Since time immemorial: Web site localization
  - Relatively coarse precision requirements
  - Incorrect geolocation has low impact

- Mobile applications have started from the opposite direction
  - High-precision location available (GPS / cellular / wifi)
  - Applications critically depend on highly precise location

- Demand for highly-precise, highly-accurate location is increasing
  - Mobile applications moving to the desktop
  - Location-based advertising and market analysis
Demand, part 2: VoIP Emergency Calling

- Calling for help is a critical function of the telephone network, so as more voice is over IP, there’s a desire to replicate that function.

- Critical requirement is context resolution
  - Where is the caller?
  - What are the appropriate emergency resources for that location?

- The ECRIT architecture thus enables emergency calls by having the caller do two additional steps:
  - Figure out where it is
  - Request contact information for the responsible Public Safety Answering Point (PSAP)
Geolocation in the ECRIT Architecture

1. Request Location
2. Request Contact Info using Location
3. Send Location in Call Signaling
4. Update Location

Caller

Location Provider

Location Provider

Contact Info DB

PSAP
Location is needed for two purposes:
- Routing calls to the correct PSAP
- Dispatching emergency responders to the location of the emergency

Architecture doesn’t specify how location is determined, just standard interface for client

General idea that location information is provided by the local IP network to which a caller is connected
- Physical connection to caller facilitates geolocation
- Bootstrap off of DHCP to discover local location server
Main driver for deployment of location resources required by ECRIT appears to be national regulation as opposed to commercial interests

National architectures are starting to mature, based on ECRIT

- US: NENA i2 / i3 architectures
- Canada: “Canadian i2” architecture
- UK: NICC architecture
- Expect regulations to emerge late this year, with compliance deadlines in 2011

Ongoing Emergency Services Workshop series attempting to facilitate global interoperability
Demand: Summary

- Commercial and emerging regulatory forces driving interest in location information about Internet hosts.

- Commercial applications are increasingly driving market demand for high-quality geolocation:
  - User-facing applications: Mapping, social networking, augmented reality, etc.
  - Infrastructural applications: Advertising, market analysis, network coverage analysis.

- Regulatory frameworks for enabling VoIP emergency calling will require geolocation at two levels:
  - Provided to user for call routing
  - Provided to PSAP for emergency response.
Supply: Geolocation Techniques

- **Autonomous:** GNSS
- **Network-Assisted:**
  - Wireless: Trilateration from endpoint-provided measurements
  - Wireline: Wiremap with endpoint-provided connectivity info
- **Network-based:**
  - Wireless: Trilateration based on network measurements
  - Wireline: Wiremap with SNMP / DHCP info
- **Third-party:**
  - Topology estimation
  - A-GPS
Supply: An Attempt at Taxonomy

Positioning mechanisms vary along several dimensions
- Source of information
- Scope of coverage
- Entities involved

These factors impact the usability of the positioning mechanism in question
- Precision
- Accuracy
- Timeliness
- Protocol requirements
The Quest for a Grand Unified Theory
General Internet engineering principles have special importance due to the inherent limitations of geolocation services

- Dynamic discovery: Applications should be able to find the best location service for the circumstances
- Interoperability: Applications need to be able to talk to multiple different location services

Starting to see some movement toward common platforms for Internet geolocation and location-based applications

- W3C Geolocation WG: Javascript API for web location
- IETF GEOPRIV WG
  - Internet geolocation protocols in general
  - Privacy protections for geolocation
Javascript API that allows web pages to request geolocation
- navigator.geolocation.getCurrentPosition(…);

How the browser gets location information is unspecified
- Firefox uses the Google Gears service (wifi)
- Safari Mobile uses CoreLocation (wifi + GPS)

Web apps are beginning to take advantage of the API
- Google maps, Flickr mobile, et al.
IETF GEOPRIV Working Group

- GEOPRIV produces protocols and data formats to support geolocation and privacy
- Interoperable data formats
  - Location Object (PIDF-LO)
  - Privacy Rules
- Protocols for “location configuration”
  - Internet-general → goal to support many positioning systems
  - Generalization to third-party requests for location
Location Objects

- Geodetic location information
  - Geospatial Markup Language
  - Simplified GML profile
- Civic location information
  - XML type/value pairs
- Basic privacy rules
  - How long the object can be retained
  - Whether the recipient can retransmit the object
  - Reference to additional rules

```xml
<presence entity="pres:sample@example.com">
  <tuple id="0851">
    <status>
      <gp:geopriv>
        <gp:location-info>
          <gs:Circle>
            <gml:pos>48.14 16.94</gml:pos>
            <gs:radius>250</gs:radius>
          </gs:Circle>
          <ca:civicAddress>
            <ca:country>AT</ca:country>
            <ca:A1>Wien</ca:A1>
          </ca:civicAddress>
        </gp:location-info>
        <gp:usage-rules>
          <gp:retransmission-allowed>yes</gp:retransmission-allowed>
          <gp:retention-expiry>2010-02-07T21:02:00Z</gp:retention-expiry>
        </gp:usage-rules>
      </gp:geopriv>
    </status>
    <timestamp>2008-08-19T19:42:55Z</timestamp>
  </tuple>
</presence>
```
Privacy Rules

- Presence systems and geolocation systems both require rules for managing access to information, so GEOPRIV worked with the SIMPLE WG to develop a rules syntax

- “Common-policy”: General framework for access control permissions
  - Conditions: Who can have access to the controlled information
  - Transformations: What version of the information they should get

- “Geopriv-policy”: Geolocation-specific privacy features [draft-ietf-geopriv-policy]
  - Conditions: Grant access based on location
  - Transformations: Control granularity of location
“Location configuration” is the process by which a host learns its location from an Internet location provider.

DHCP options allow configuration alongside network parameters:
- Geodetic information in an ad-hoc binary format
- Civic information in a binary type/value format (same as PIDF-LO)
- Location URIs

HELD is an XML/HTTP protocol that support more advanced scenarios.
Basic HELD (with Discovery)

- Endpoint gets local access domain name from DHCP
- Endpoint queries DNS for NAPTR service “LIS:HELD”
- Endpoint sends HTTP POST request to URI from NAPTR
- Server returns PIDF-LO and/or location URI

```
access-net.example.org
IN NAPTR 100 10 "u" "LIS:HELD" ( 1; service
  "!*https://lis.example.org:4802/?c=ex!" 2; regex
  . 3; replacement
)
```

```
POST /?c=ex HTTP/1.1
Host: lis.example.org:4802
Content-Type: application/held+xml

<locationRequest>
  <locationType exact="true">
    geo locationURI
  </locationType>
</locationRequest>
```

```
HTTP/1.1 200 OK
Content-Type: application/held+xml

<locationResponse>
  <!-- PIDF-LO document -->
  <locationUriSet expires="2006-01-01T13:00:00.0Z">
    <locationURI>
      http://lis.example.org:4802/?d=12345
    </locationURI>
  </locationUriSet>
</locationResponse>
```
HELD is intended to be extensible to support more advanced geolocation use cases

Third-party requests
- Extensions to add identifiers (IP/MAC address, IMSI/MSISDN)
- LIS Discovery records can be re-used for third-party location service discovery (e.g., by including in the reverse-DNS tree)

Positioning using network information
- Wifi, Cellular, et al.
There is increasing diversity in the Internet geolocation arena
- Many different applications are using geolocation, with different communications requirements and quality trade-offs
- An increasing number of positioning techniques are being applied to Internet hosts

Things are beginning to move toward interoperability
- Web standard for distributing location to web applications
- Internet standards for location formats and protocols
  - Common location and privacy rule formats
  - DHCP configuration for basic network location delivery
  - HELD for dynamic discovery and advanced use cases
References

- For IETF documents, use: http://tools.ietf.org/html/<doc-name>

- IETF ECRIT WG: http://tools.ietf.org/wg/ecrit/
  - draft-ietf-ecrit-phonebcp
  - draft-ietf-ecrit-framework
  - draft-ietf-ecrit-rough-loc

- Emergency services architectures
  - Canada: Canadian i2 <http://www.crtc.gc.ca/eng/archive/2006/dt2006-60.htm>

- W3C Geolocation WG: http://www.w3.org/2008/geolocation/

- IETF GEOPRIV WG: http://tools.ietf.org/wg/geopriv/

- PIDF-LO: RFC3693, RFC 4119, RFC 5491

- Privacy rules: RFC4745, draft-ietf-geopriv-policy

- DHCP Location: RFC 3825, RFC 4776, draft-ietf-geopriv-rfc3825bis, draft-ietf-geopriv-dhcp-lbyr-uri-option

- HELD: draft-ietf-geopriv-http-location-delivery
  - draft-ietf-geopriv-lis-discovery
  - draft-ietf-geopriv-held-identity-extensions
  - draft-thomson-geopriv-held-measurements