IETF Standards for Geolocation and Emergency Calling

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NOTE WELL

Opinions expressed here are those of the presenter, and do not necessarily represent the consensus views of the IETF, the GEOPRIV or ECRIT WGs, or any other body.

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Agenda

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- 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

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Demand, part 1: Commercial Applications

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- **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

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- 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

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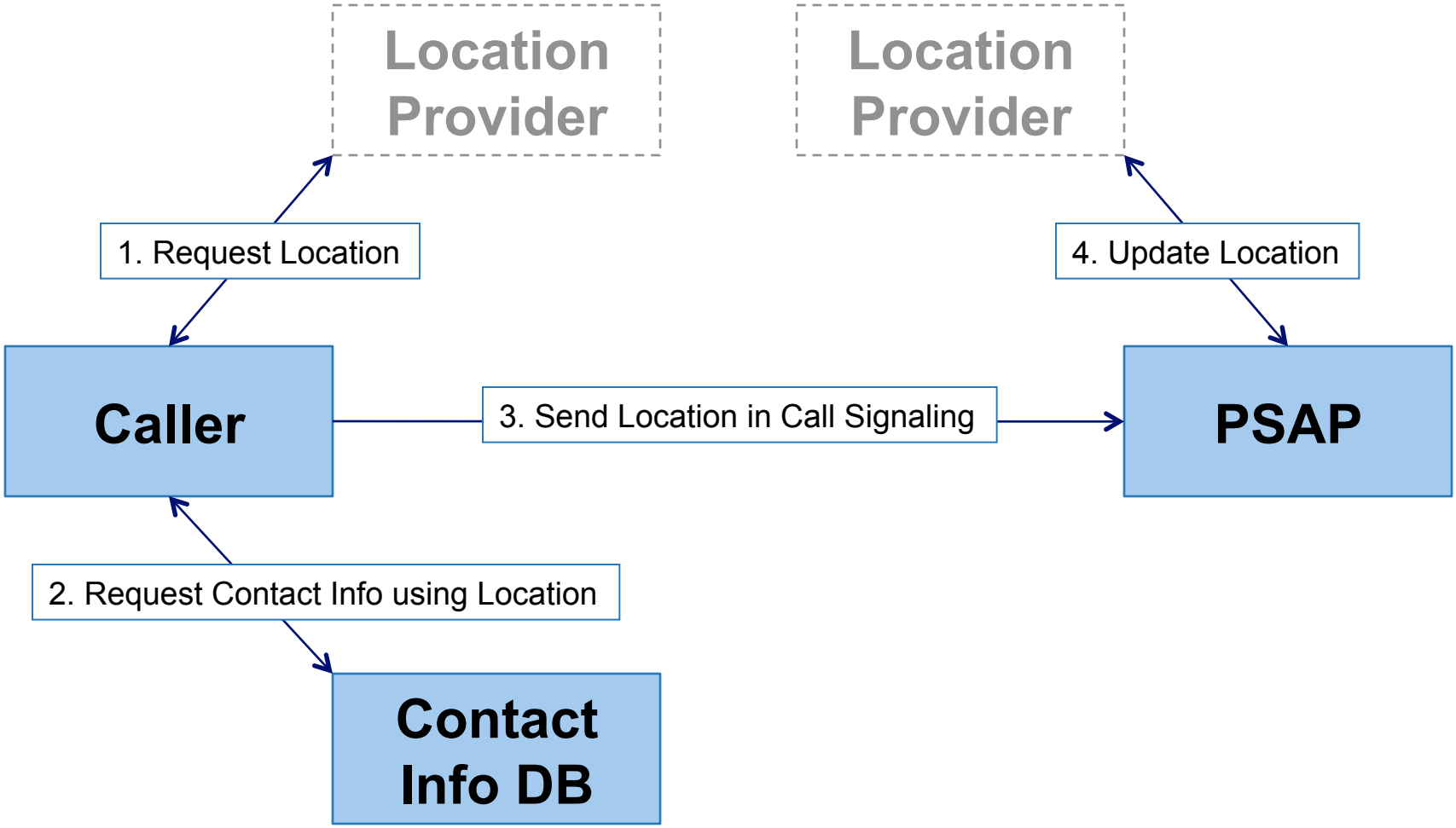

Geolocation in the ECRIT Architecture

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- 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

ECRIT Deployment Status

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- 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

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- 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

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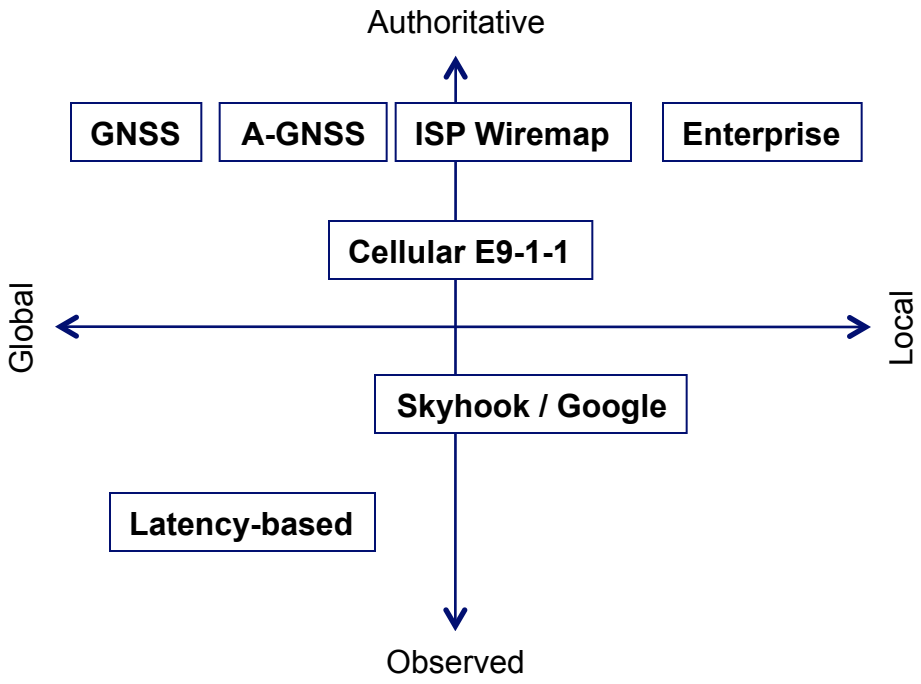
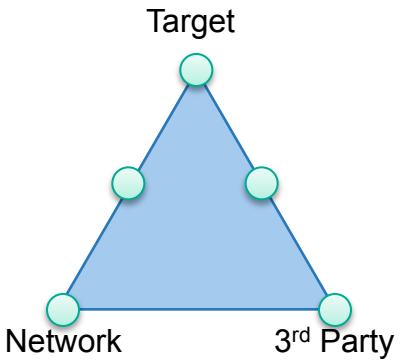
- **Autonomous: GNSS**
- **Network-Assisted:**
  - **Wireless: Trilateration from endpoint-provided measurements**
  - **Wireline: Wiremap with endpoint-provided connectivity info**
- **Network-based:**
  - **Wireless: Trilateration based on network measurements**
  - **Wireline: Wiremap with SNMP / 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

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Interoperability

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- 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

W3C Geolocation Working Group

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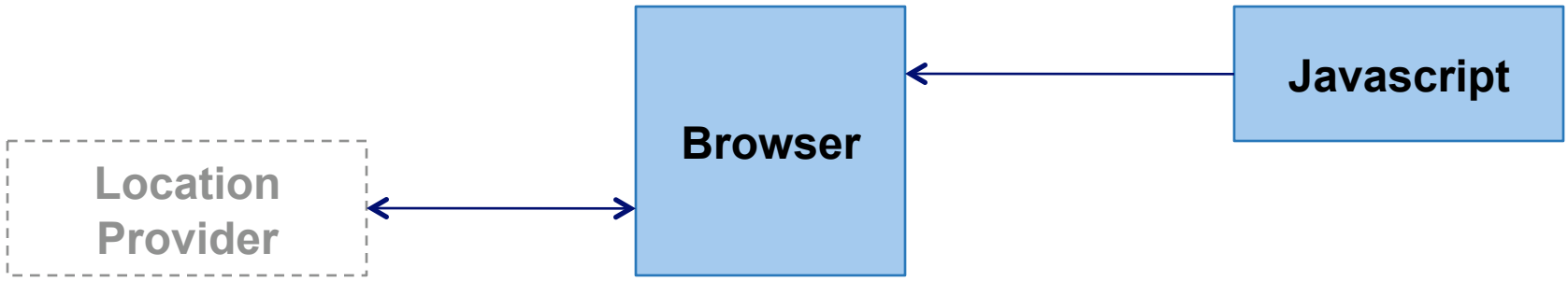
- Javascript API that allows web pages to request geolocation
  - navigator.geolocation.getCurrentPosition(…);
- How the browser gets location information is unspecified
  - Firefox uses the Google Gears service (wifi)
  - Safari Mobile uses CoreLocation (wifi + GPS)
- Web apps are beginning to take advantage of the API
  - Google maps, Flickr mobile, et al.



IETF GEOPRIV Working Group

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- 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

```
<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

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- 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 Protocols

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- "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)

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- 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" (          ; service
       "!*.!https://lis.example.org:4802/?c=ex!" ; regex
       .                                          ; 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>
```

Advanced HELD

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

<locationRequest>
  <device>
    <ip v="4">192.0.2.5</ip>
    <mac>A0-12-34-56-78-90</mac>
    <imsi>11235550123</imsi>
  </device>
  <measurements>
    <wifi>
      <neighbourWap>
        <bssid>00:17:df:aa:37:37</bssid>
        <rssi>-40</rssi>
      </neighbourWap>
    </wifi>
    <cellular>
      <servingCell>
         <nid>4723</nid>
         <sid>15892</sid>
         <baseid>12</baseid>
      </servingCell>
    </cellular>
  </measurements>
</locationRequest>
```

- **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.**

Summary

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- 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

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- 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
  - US: NENA i3 architecture <http://www.nena.org/standards/technical/voip/functional-interface-NG911-i3>
  - Canada: Canadian i2 <http://www.crtc.gc.ca/eng/archive/2006/dt2006-60.htm>
  - UK: NICC architecture still in progress; presentation to emergency services workshop here: <http://geopriv.dreamhosters.com/esw6/UK-i2-Nov-2009.ppt>
- 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