

# Next-Generation IP Geolocation Standards and Next Steps

Richard Barnes

BBN

NANOG53

# **I. THE WORLD TODAY**

# The Overall Situation

- Lots of applications want to know where users are physically located
  - “Location-Based Services”
  - Content localization and advertising
  - Location-based access control
  - Fraud mitigation
- Current techniques are unreliable
- Information from the network helps a lot



# IP Geolocation Scavenging

- “Third party” – IP-geo databases
  - WHOIS scraping
  - Network topology mapping (traceroutes, etc.)
  - Select purchases of ISP information
- “First party” – Geolocation APIs
  - GPS
  - WiFi/Cell databases (wardriving/purchase)
  - User registration

# Performance Properties

- IP-Geo databases show a lot of variability<sup>1</sup>
  - Accuracy varies from 1km to 100s of km
  - Lots of dependence on network type
  - **No coverage of IPv6**
- Mobile location APIs do well with GPS
  - Performance of databases an open question
  - Anecdotal poor performance, especially outside of urban areas
- Fixed networks require user registration

1. CAIDA study from NMMC: <http://goo.gl/09Xhy>

# Fixing failures

- Web forms or emails per database
  - <http://nanog.cluepon.net/index.php/GeolP>
- Emails to NANOG mailing list (~1-5 per month):

From: Dan White  
To: [nanog@nanog.org](mailto:nanog@nanog.org)  
Subject: Youtube Geolocation

We're experiencing very poor quality with You Tube, and it appears we're subject to a **bad entry within a geolocation database** somewhere.  
[...]

However, we've never experienced redirection problems with Google before (we always land at [www.google.com](http://www.google.com)), so I'm not sure where to take our trouble. **The page at [url] isn't of much help as it assumes the problem is google.com redirection.**

Are there any contacts at Youtube who could provide some assistance?

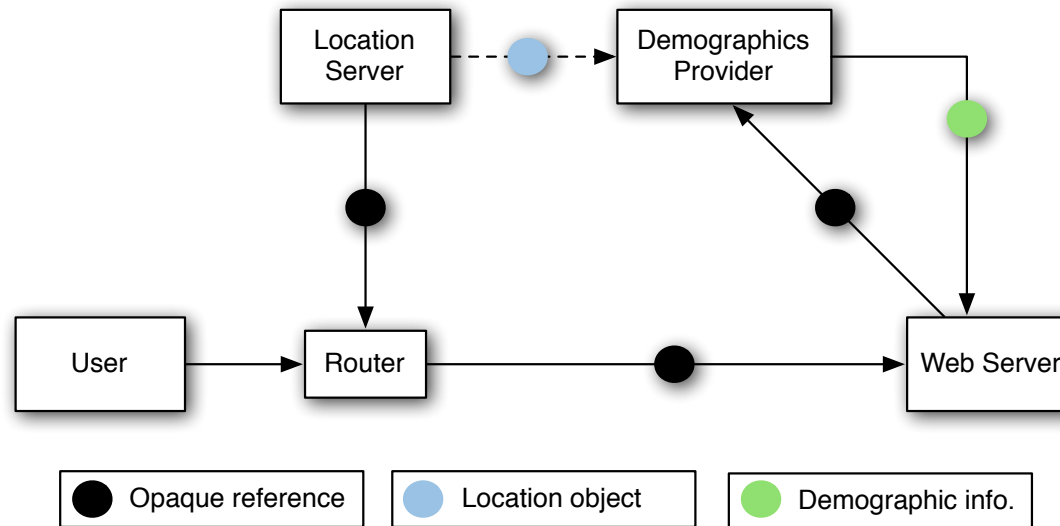
## **II. A NEW HOPE**

# Operator Interaction

- Today, operators have no way to feed information into the geolocation process
  - Applications get degraded service
  - Operators get unhappy subscribers
- There are some maturing technologies for creating this interface
  - APIs and injection
  - GEOPRIV



# Example 1: Feeva / Bering Media



- Transparent proxy in a router chassis inject encrypted location into an HTTP header
- Users can only request privacy out of band
- Users can't even detect when location is sent

# Example 2: GSMA OneAPI

- Cellular operators' way of opening up network information resources
  - Geolocation, SMS, charging, etc.
  - User authorization via OAuth
- Doesn't provide a way to figure out the right OneAPI server for a given subscriber
  - If I'm Farmville running on an end device, which operator do I need to talk to?



OneAPI

# GEOPRIV

- IETF effort to improve IP geolocation
- Create a location service for the Internet
  - Simple to wrap around existing location resources
  - Scalable to the Internet (dynamic discovery)
  - Explicit considerations for user privacy
- Basic story: Allow subscribers to discover and query a server for their local network

# How GEOPRIV Works

- Discovery: DHCP + NAPTR [RFC5986]
  - Fall-back on NAPTR in Reverse DNS [draft-ietf-geopriv-res-gw-lis-discovery]

```
example.com. IN NAPTR 100 10 "u" "LIS:HELD"  
"!.*!https://lis.example.org:4802/!" .
```

- Protocol: HTTP-Enabled Location Delivery
  - XML over HTTP to discovered URI

# First-party HELD

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

```
<locationRequest>
  <measurements
    time="2008-04-29T14:33:58">
      <cellular/>
      <wifi/>
      <dhcp-rai>
        <giaddr>::ffff:192.0.2.158</giaddr>
        <circuit>108b</circuit>
      </dhcp-rai>
      <dsl>
        <stag>613</stag>
        <ctag>1097</ctag>
      </dsl>
    </measurements>
  </locationRequest>
```

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

```
<locationResponse>
  <locationUriSet>[...]</locationUriSet>
  [...]
  <gs:Circle>
    <gml:pos>42.389984 -71.1471</gml:pos>
    <gs:radius>10</gs:radius>
  </gs:Circle>
  <ca:civicAddress>
    <ca:country>US</ca:country>
    <ca:A1>MA</ca:A1>
    <ca:A3>Cambridge</ca:A3>
    <ca:PC>02138</ca:PC>
    <ca:HNO>10</ca:HNO>
    <ca:STS>Moulton St</ca:STS>
    <ca:BLD>5</ca:BLD>
    <ca:ROOM>123</ca:SEAT>
  </ca:civicAddress>
  [...]
</locationResponse>
```

# Third-party HELD

POST / HTTP/1.1  
Host: lis.example.org:4802  
Content-Type: application/held+xml

```
<locationRequest>
  <device>
    <ip v="4">192.0.2.5</ip>
    <ip v="6">2001:0DB8::2:5</ip>
    <tcpport>51393</tcpport>
    <msisdn>11234567890</msisdn>
  </device>
</locationRequest>
```

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

```
<locationResponse>
  <locationUriSet>[...]</locationUriSet>
  [...]
  <gs:Circle>
    <gml:pos>42.389 -71.147</gml:pos>
    <gs:radius>300</gs:radius>
  </gs:Circle>
  <ca:civicAddress>
    <ca:country>US</ca:country>
    <ca:A1>MA</ca:A1>
    <ca:A3>Cambridge</ca:A3>
    <ca:PC>02138</ca:PC>
    <ca:HNO>10</ca:HNO>
    <ca:STS>Moulton St</ca:STS>
  </ca:civicAddress>
  [...]
</locationResponse>
```

# Privacy

- Geolocation is obviously sensitive information about users
  - Especially when it's authoritative and precise
- GEOPRIV has a detailed architecture [RFC6280], but there are some short cuts
  - Only provide location information to the device being located
  - Only provide rough location to third parties
- Ultimately, an operational decision, not a technological one

# **III. STATUS AND DEPLOYMENT**



# Deployment and Next Steps

- Right now, chicken and egg problem
- Clear interest from application side
  - Google, MaxMind, Quova, Mozilla
  - Potential FCC/regulatory interest from NG911
- Several open-source HELD implementations (perl, php, Android, ...)
- Initial work being done on “Geo-WHOIS”
  - Prototyping in RIPE, proposed in APNIC
  - Brief ARIN discussion in Open Policy Hour

# RIPE Geo-WHOIS prototype

Object data

inetnum	10.0.0.0 - 10.0.255.255	+	?		
netname	geoloctest	+	?		
descr	test object for geolocation	✓	+	?	
country	NL	✓	+	?	
geoloc	52.37559917665907 4.888916015625	🏠	+	🗑	?
language	NL	✓	+	🗑	?
language	EN	✓	+	🗑	?

# Act Now!

- Prototype a location service
  - Look at what location-relevant resources are in your network
  - Fit them together so that you can provide an address or coordinates for an IP address
  - Add a HELD interface to this script
    - Ask me about open source code
    - Perl, Java, PHP, ...
  - Provision reverse DNS records
- Come to the ARIN Open Policy Hour

# References

- CAIDA IP Geo Comparison: [http://www.caida.org/publications/presentations/2011/nmmc\\_geocompare/nmmc\\_geocompare.pdf](http://www.caida.org/publications/presentations/2011/nmmc_geocompare/nmmc_geocompare.pdf)
- IETF GEOPRIV Working Group
  - <http://tools.ietf.org/html/rfc5985>
  - <http://tools.ietf.org/html/rfc5986>
  - <http://tools.ietf.org/html/rfc6155>
  - <http://tools.ietf.org/html/rfc6280>
  - <http://tools.ietf.org/html/draft-ietf-geopriv-held-measurements>
  - <http://tools.ietf.org/html/draft-ietf-geopriv-res-gw-lis-discovery>
- IETF ECRIT Working Group
  - <http://tools.ietf.org/html/draft-ietf-ecrit-framework>
  - <http://tools.ietf.org/html/draft-ietf-ecrit-phonebcf>
  - <http://tools.ietf.org/html/draft-ietf-ecrit-rough-loc>

# Thanks!

Richard Barnes  
<rbarnes@bbn.com>