

Internet Geolocation and Location-Based Services

Richard Barnes

BBN Technologies

IETF GEOPRIV Co-Chair

Emergency Services Workshop Co-Chair

Agenda

- Geolocation is getting to be a big deal
- ISPs have a central role
- Technologies and next steps

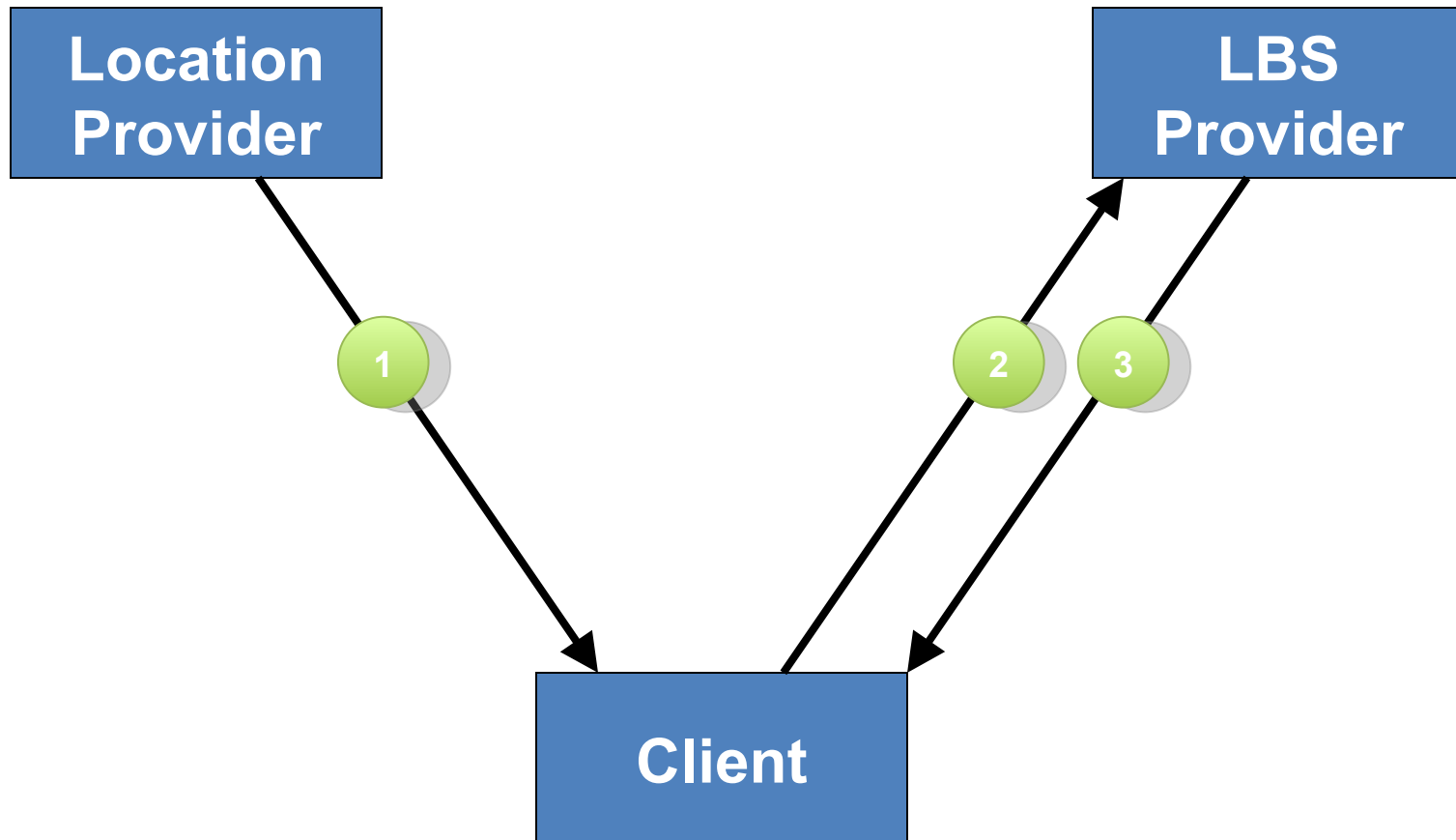
- Make static content available
- Server-side customization (CGI/PHP/ASP)
- Client-side customization (XMLHttpRequest)
- Context-awareness
 - Geolocation
 - Presence
 - Social networking

Location-Based Services

- Social networking
 - Loopt, BrightKite, Google Latitude
- Mapping/Navigation
- Asset management
- Place databases



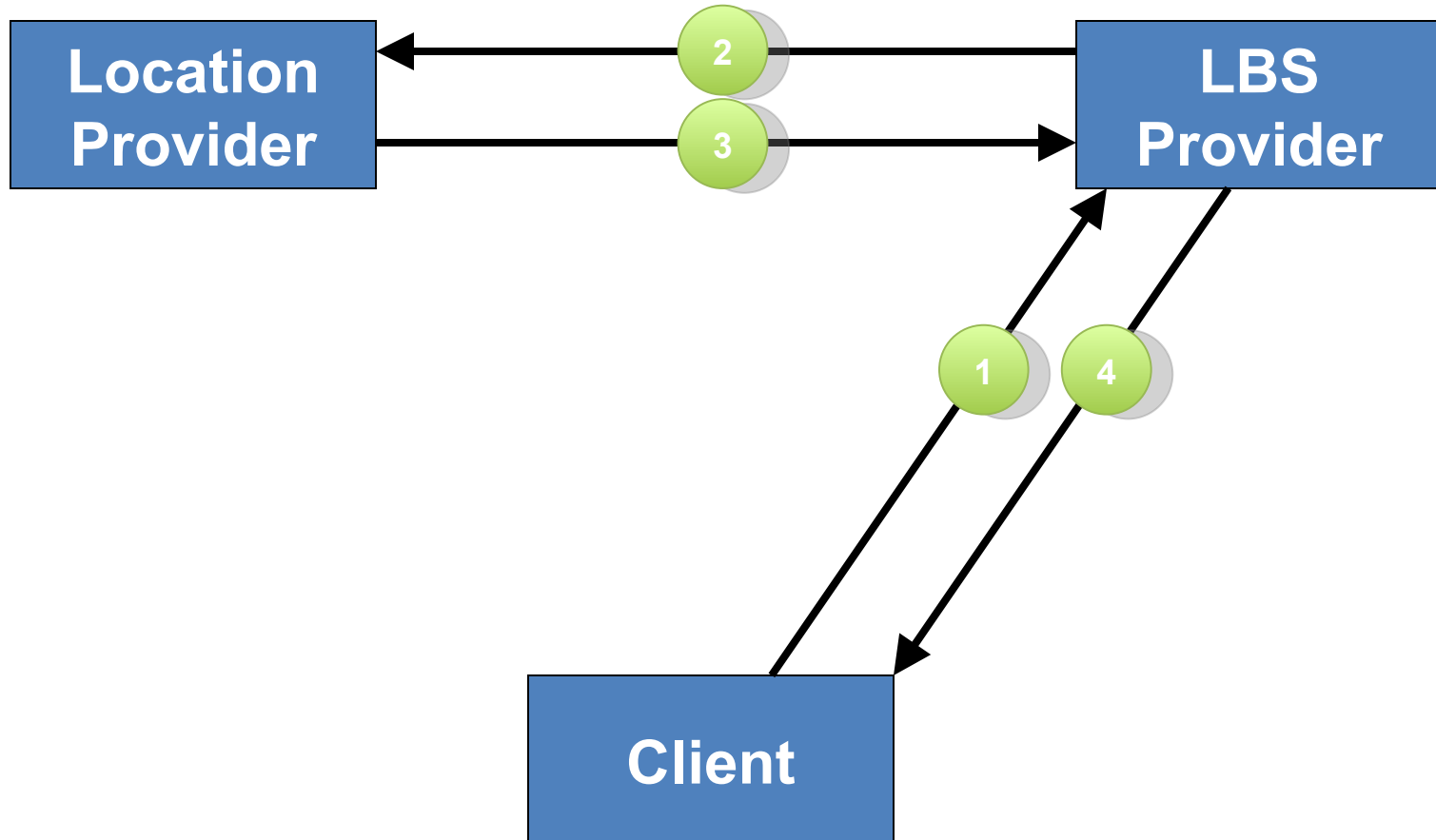
How you get a loc-based service, I



How you get a loc-based service, I

1. Location Provider provisions a client device with the device's location
2. Client provides location to LBS Provider
3. LBS Provider renders a service (map, nearby coffee, etc.)

How you get a loc-based service, II

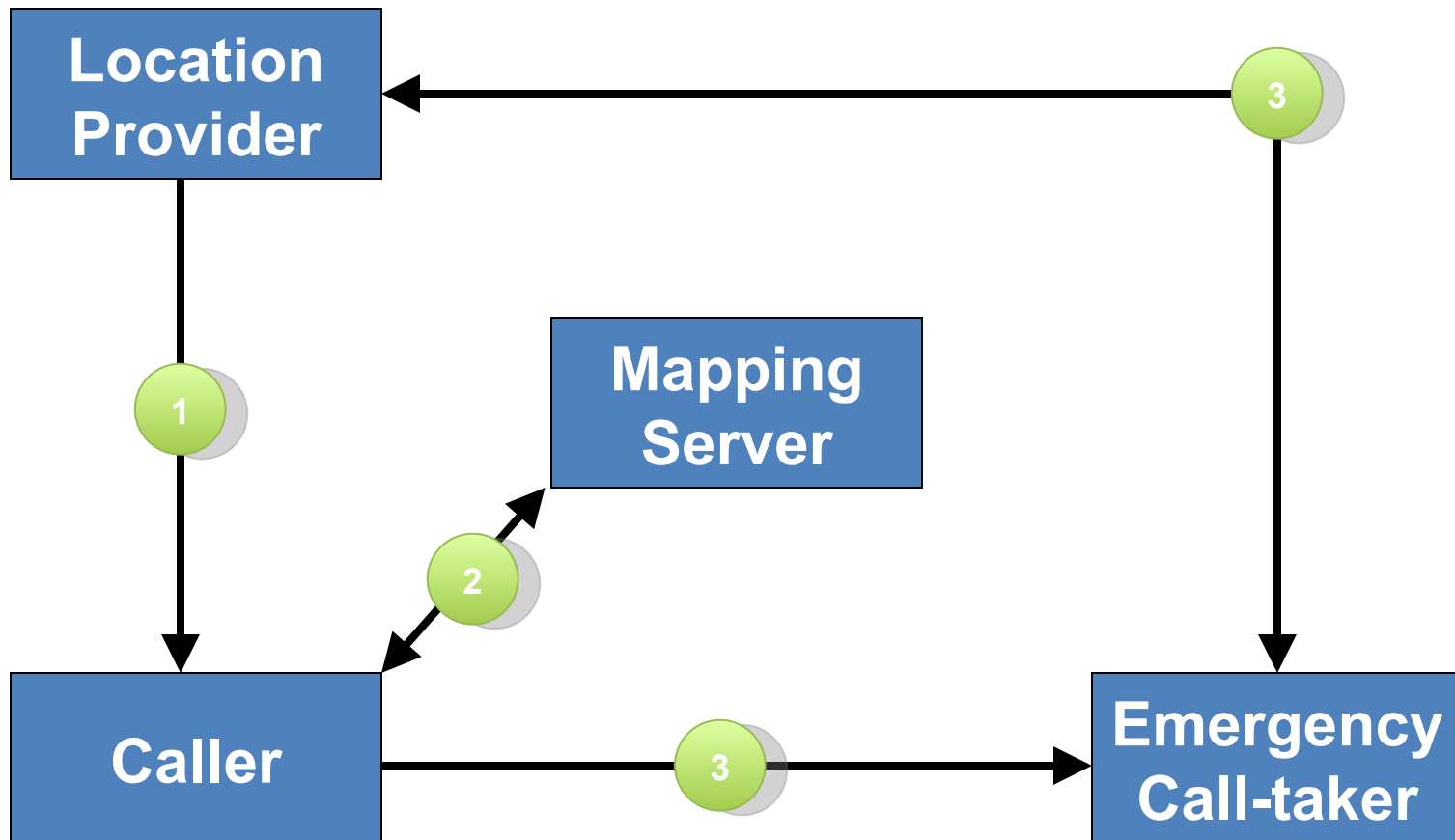


1. Client asks for a location-based service
2. LBS provider asks Location Provider for the Client's Location
 - Severe scalability risks
 - Severe privacy risks
3. Location Provider returns location
4. LBS provider renders service

VoIP Emergency Calling

- Calling for help is a critical feature of traditional telephone networks
 - 9-1-1, 1-1-2, 9-9-9, 1-2-2, etc.
- IP telephony needs to re-create this function
- Location of the caller is critical
 - To route the call to the proper responders
 - To dispatch responders to the caller
- **Emerging regulations are starting to require that ISPs provide location to customers and/or emergency authorities**

Location in Emergency Calling



Location in Emergency Calling

1. Location Provider provisions a client device with the device's location
2. Client uses that information to find what emergency authorities to call
3. Client places a call to the authorities
4. Authorities request updated location from the Location Provider

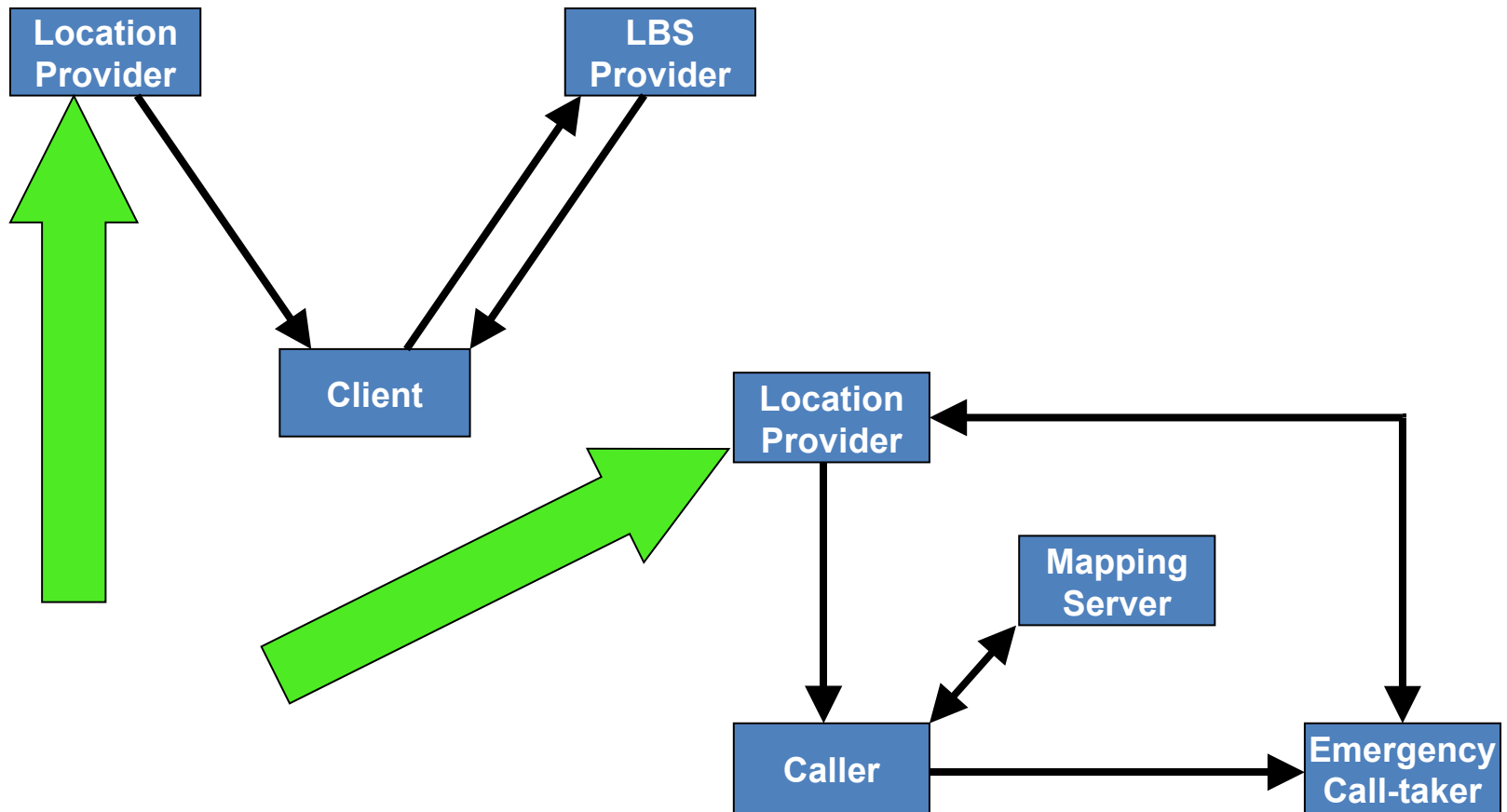
1. Commercial

- Selling access to location information
- Selling services based on location information

2. Regulatory

- Emergency calling
- Public safety applications

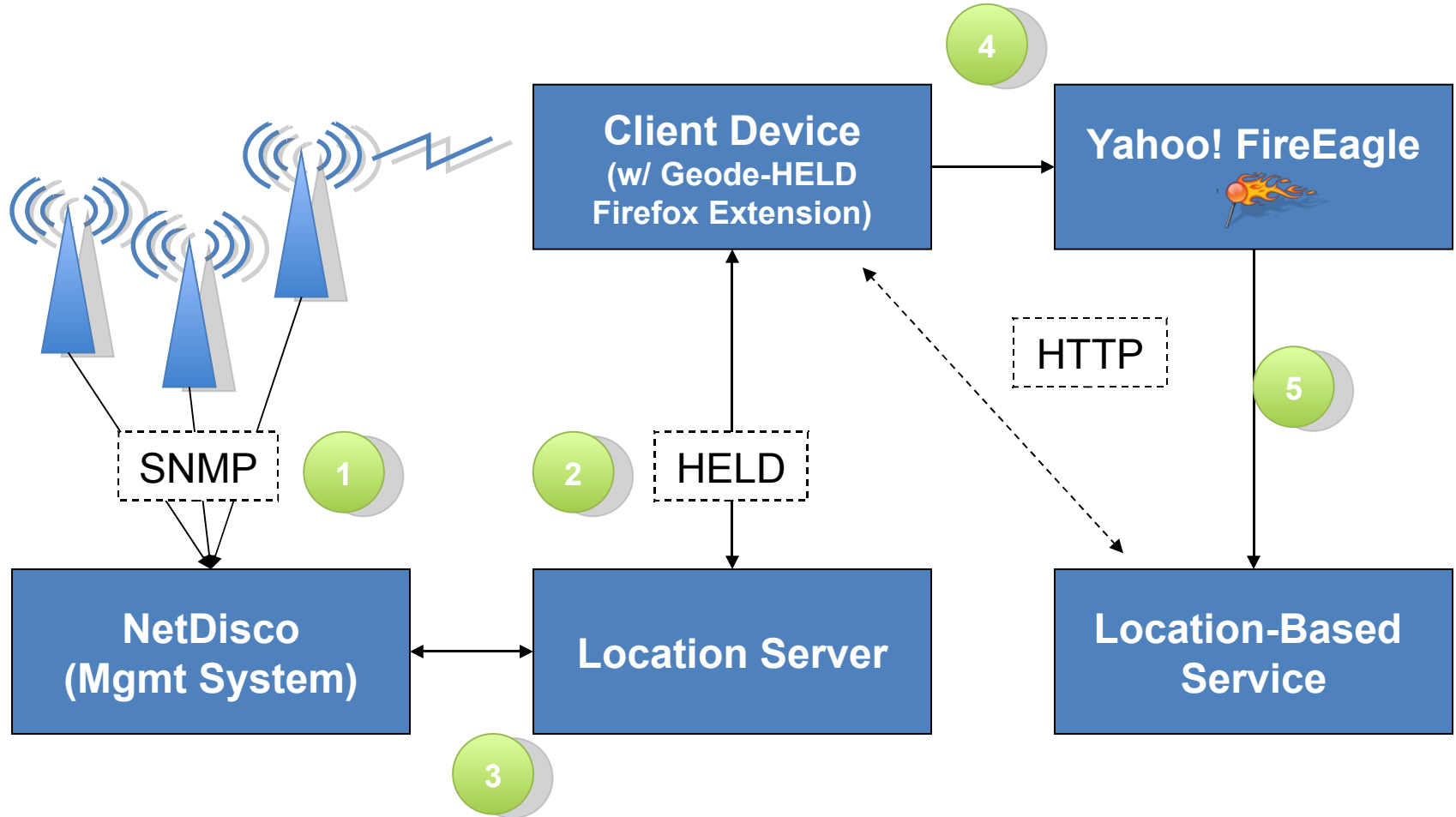
Missing Link: Location Providers



- Being a Location Provider is hard for most entities on the Internet
 - Need physical information about the client
 - The Internet purposely ignores the physical world
- However, ISPs are in a special position
 - Clients are physically connected
 - Lots of information to draw on
 - Commercial and regulatory drivers

- Wired networks:
 - DSL / FTTx: Service address databases
 - Enterprise networks: Wire maps
- Wireless networks:
 - Base station locations
 - Network measurements
 - Signal strengths from clients
 - Time of arrival of signals
 - Legacy location resources (e.g., GMSCs)

IETF LBS Example



IETF LBS Example

1. 802.11 APs update the network management system over SNMP with MAC addresses of connected clients
2. Client device queries the LS for location
3. LS queries network management system for location of client's IP address
 1. Management system determines which AP is currently serving that IP address and returns the location of that AP
 2. LS returns location to client
4. Client updates FireEagle with current position
5. FireEagle updates authorized applications

- Point solutions in the Internet today
- IETF GEOPRIV working group is working on a framework for Internet location-based services
 - Protocols for positioning and location delivery and conveyance
 - Mechanisms to discover location resources
- Working with other organizations to integrate across layers and access types
 - W3C: Web APIs to access location
 - 3GPP / OMA: Cellular broadband
 - IEEE, WiMAX Forum, etc.

How to be a Location Provider

1. Set up a way to find where your customers are located
2. Provide an interface to that location information
 - For customers to access their own location
 - For LBS providers to query for location
3. Advertise that interface to customers and/or the Internet

- DHCP options for location information
 - Geodetic coordinates: RFC 3825
 - Civic addresses: RFC 4776
- HTTP-Enable Location Delivery (HELD)
 - XML syntax over HTTP
 - Allows basic requests, plus more advanced
 - Wireless measurements (signal strength, timing)
 - Network measurements (VLAN tags, Mobile Network Codes, etc.)

- Technologies are still maturing
 - Not many commercial products support IETF location technologies
 - Expect products from multiple vendors in the next year or so, plus some major open-source projects
- However, some things you can do today
 - Provision location options in DHCP
 - Install the open-source HELD server
 - Provision server discovery records in DNS
 - Participate in the location implementer community

Set your DHCP options

Visual RFC 3825 Encoder

0. Navigate to the target area

[Go](#)

1. Choose a center point

2. Set the resolution

lat: , long:

3. Set the altitude?

Floors



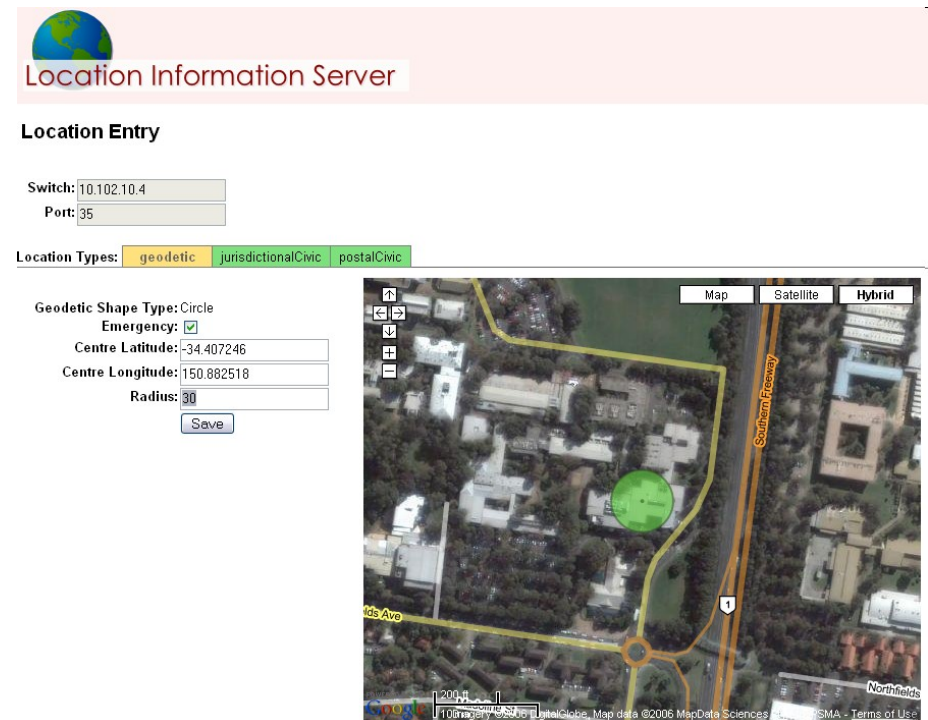
The Option:

7b:10:48:34:87:68:67:48:65:40:86:4c:27:80:00:01:00:01

```
ip dhcp pool pool1
network 192.168.0.0 /16
option 123 10:48:34:87:67:48:65:40:86:4c:27:80:00:01:00:01
```

Set up a Location Server

- Open-source (PHP/Apache/Postgres) location server available on SourceForge
 - Manual entry
 - Can query managed switches
 - Easy to plug in new location sources



References

- Mailing lists
 - IETF GEOPRIV Working Group
 - Location implementers
- Location protocols
 - HELD (discovery), with extensions for positioning:
 - Network endpoint identifiers
 - Network measurements
 - GNSS assistance
 - DHCP for civic and geodetic location, and for location URIs
- Tools
 - Geode-HELD Firefox Extension
 - DHCP Geodetic encoder
 - DHCP Civic encoder
- SIP Location conveyance
- W3C Geolocation API
- XMPP extensions for publishing and requesting location

- Location information and LBS are becoming major applications in the Internet
 - Commercial and regulatory drivers
- ISPs are in a unique position to transform Internet location
 - Accuracy and timeliness
 - Privacy management
- Some early steps you can take now

Thank you!

Richard Barnes
BBN Technologies
<rbarnes@bbn.com>

Slides at: <http://geopriv.dreamhosters.com/menog/IP-LBS-MENOG4.ppt>