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Internet Geolocation and Location-Based Services

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Agenda

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- Internet location-based services
- Roles and tools for ISPs
- Deployment models
- Demo!

Evolution of IP Geolocation

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- Traditional location-based applications have been“server-side”
  - Content localization
  - Ad targeting
  - Content restriction / taxation
  - Low fidelity, low user visibility
- Increasingly, apps are “client-side”
  - Social networking
  - Navigation / place-finding
  - Augmented reality
  - VoIP emergency calling
  - High accuracy, high visibility

MaxMind®

QUOVA®
LOCATION MATTERS

Google™ Latitude

places.ae

loopt®

Layar

Protocol patterns

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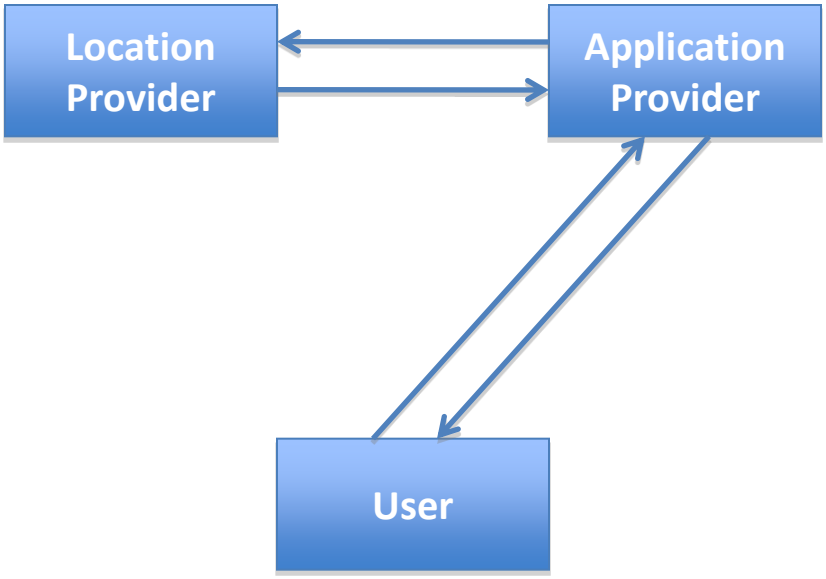
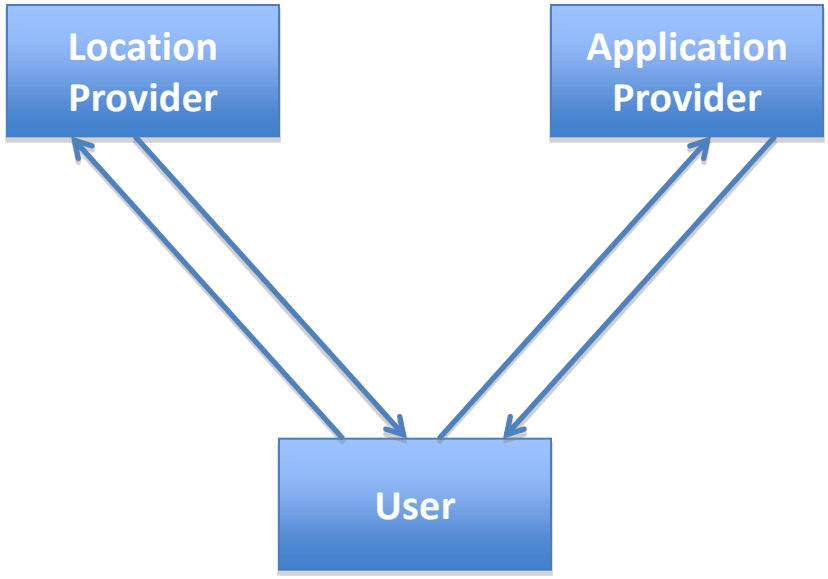
Server Side:



Client Side:



How does the Location Provider figure out where the User is?

How do applications and users find good location providers?

A Role for ISPs

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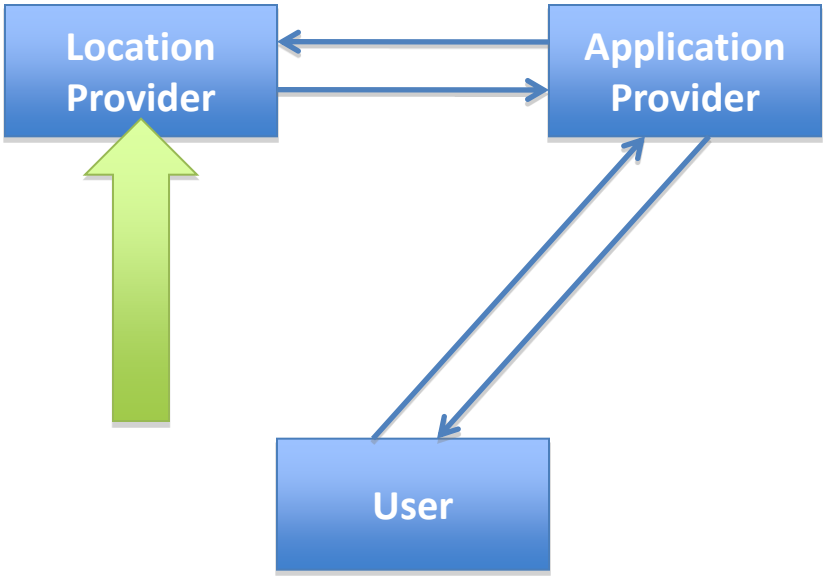
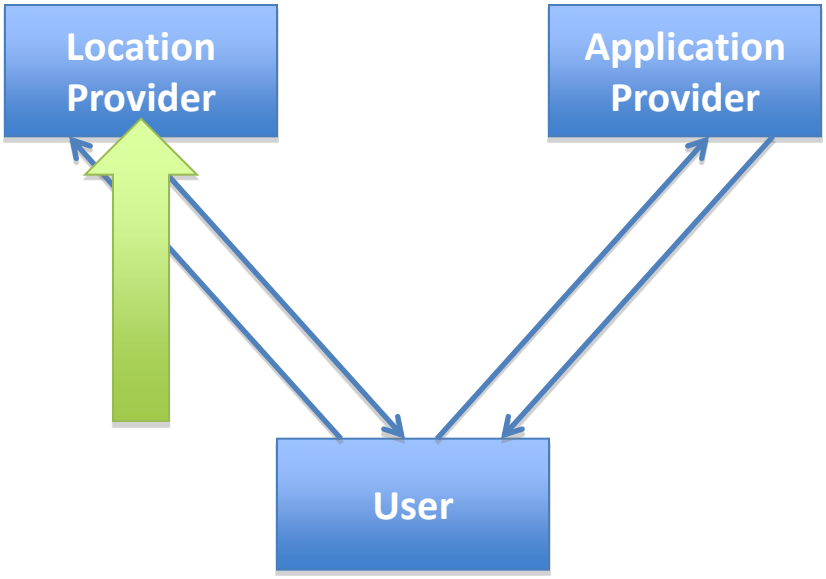
Server Side:



Client Side:



How does the Location Provider figure out where the User is?

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A Role for ISPs

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- ISPs are naturally in a position to act as location providers
  - Figure out where their subscribers are
  - Advertise that information to subscribers and applications
- In addition, there are incentives
  - Better service for users
  - Potential to charge for location
  - Possible regulatory requirements

IETF LBS Example

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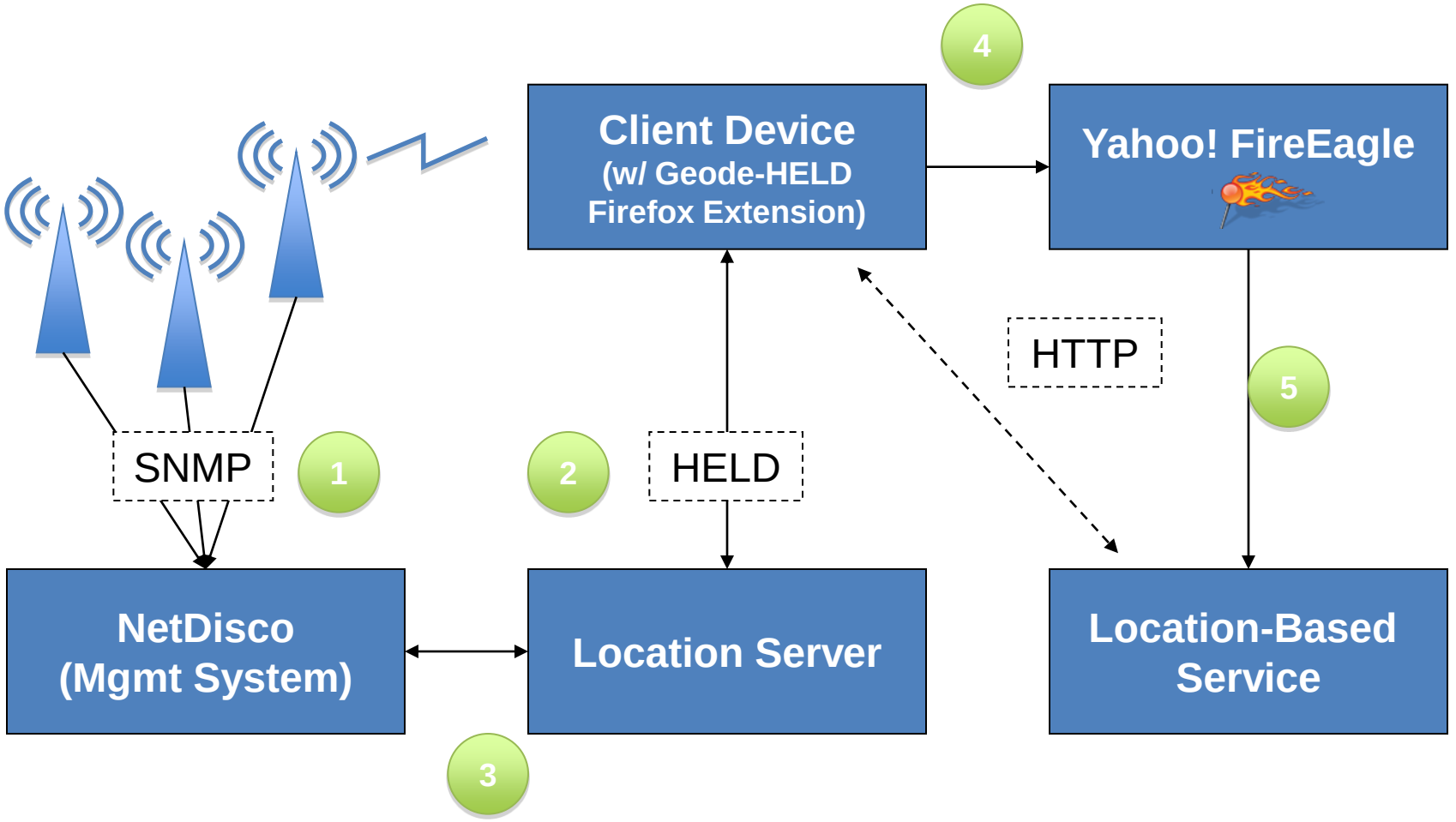

IETF LBS Example

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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

Internet Location Technologies

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- Point solutions in the Internet today
  - Global databases that provide low-quality data
  - High-quality sources with very limited coverage
- 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: Javascript API to access location
  - 3GPP / OMA: Cellular broadband
  - IEEE, WiMAX Forum, etc.

How to be a Location Provider

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1. Get information on where end hosts are located – even roughly
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

Providing Access to Location

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- 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.)

Advertising Location Services

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- DHCP: Just add the option
- HELD requires explicit discovery
  - DHCP option for hosts on a network
  - DNS NAPTR records for the rest of the world

```
zonea.example.com.
IN NAPTR 100 10 "u" "LIS:HELD" (          ; service
    ”!.*!http://lis.example.com:4802/!” ; regex
    .                                     ; replacement
)
```

Deployment Models

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- Three key questions for deployment
  - Who provides location information?
  - Who provides the location service?
  - How does the client find the service?
- Three basic models
  - ISP Direct: ISP operates the whole thing
  - ISP Outsourced: ISP delegates location services to another entity (e.g., a physical access network)
  - Third Party: ISP not involved at all

Demo scenario

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- HELD server that can draw on multiple sources of location
  - Database of prefix locations
  - MaxMind GeoLite City
- Demo process:
  - Use HELD client to view MaxMind location
  - Provision location for our prefix
  - Use HELD client to view provisioned location

Demo setup

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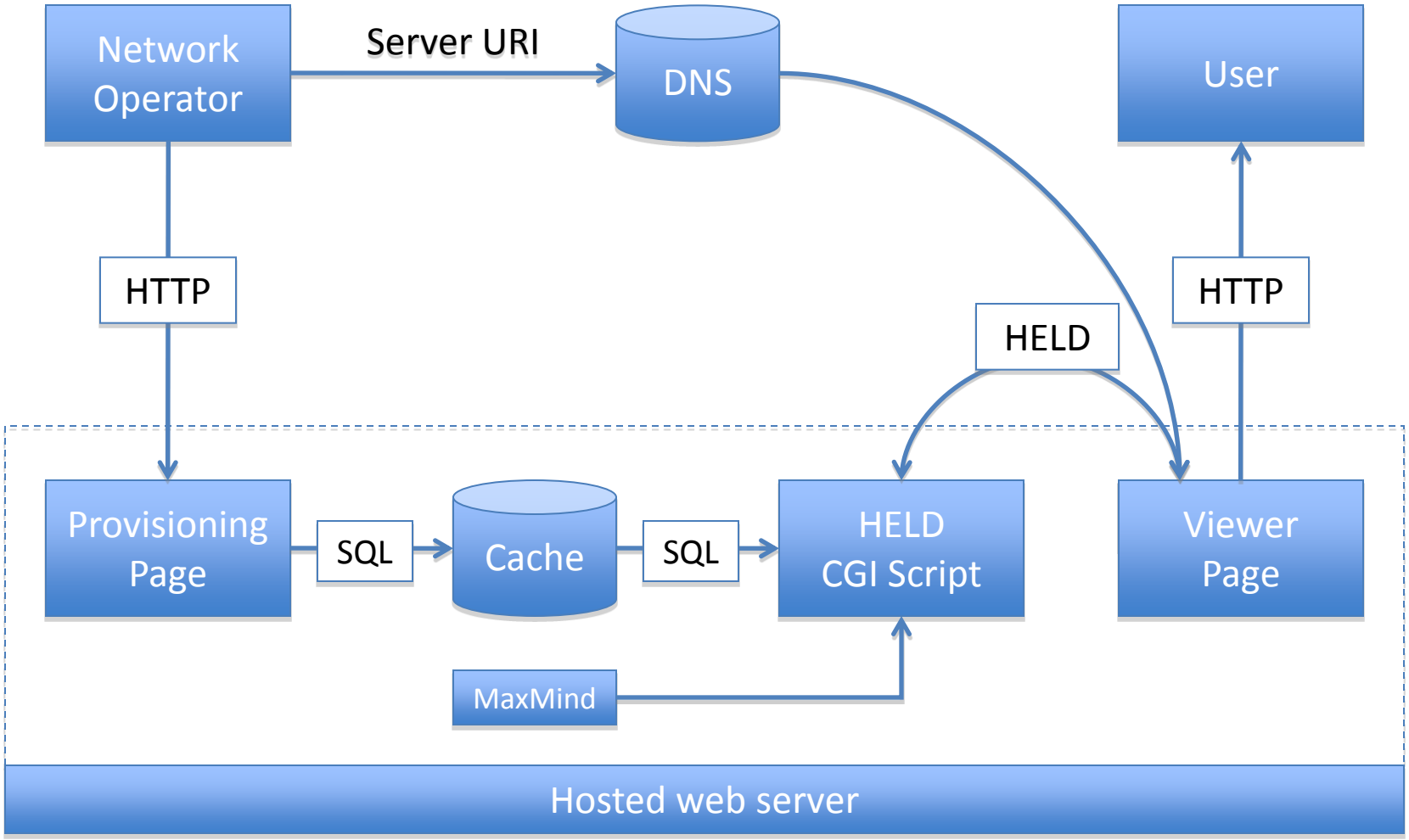

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Demo!

Existing Tools

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- DHCP
  - Most DHCP servers support arbitrary options
  - Encoder available on the web
- HELD
  - Open source PHP HELD server / Java client
  - Internet Geolocation Toolkit
  - Source for today's demo
  - Provision LIS discovery records in DNS

Summary

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- Location information and LBS are becoming even more significant applications in the Internet
- ISPs are in a unique position to transform Internet location
  - Accuracy and timeliness
  - Privacy management
- Some early steps you can take now
- Several different deployment models available

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Thank you!

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References

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- Mailing lists
  - IETF GEOPRIV Working Group
  - Location implementors
- 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