DNS based IP NetLocation Service

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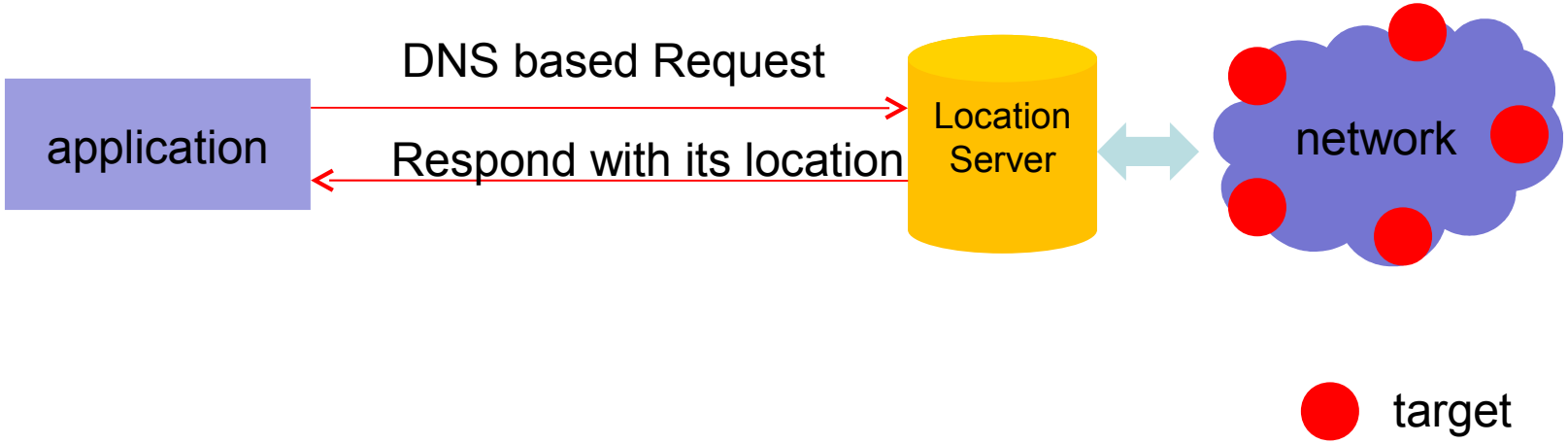
What is network location service

- To provide the target's position in the network given its IP address
- It focuses on network location instead of geographic location



What is network location

- The target's location in the network, it provides information like:
  - Which ISP the target belongs to
  - Which AS it belongs to
  - Which layer it lies at
  - Which regional network it is in
- Not like Geographic location information which contains:
  - City, Street, Building…

Why we need network location information

- Content Distribution Network optimization
  - When a user want to get a service, CDN has to decide which server is nearest to the user
  - The wider CDN covers, the more important location service is
- Peer to peer application optimization
  - When a new peer joins the overlay network and launches a service, tracker has to determine which nodes are better to be used as its peers
  - The most important information needed by tracker is about how peers are distributed in the whole network

Characteristics of NetLocation Information

- Facilitate proximity evaluation
- It does not need to be very precise. But still be quite useful given the rough information
- Location Information maintained by ISPs is precise enough for traffic optimization

Relevant work in IETF

- GeoPriv work group
  - Defined a framework for geographic location service
  - Try to provide a universal and comprehensive solution, thus a little bit complicated
  - The request key is more than just IP address
  - Has proposed to use HTTP and DHCP as transport protocols

Difference with GeoPriv

- Scope to serve
  - GeoPriv tries to cover all possible applications
  - NetLocation just provides IP based query
- Participants
  - GeoPriv involves several participants such as targets(devices), LIS, rule makers and etc.
  - NetLocation service emphasizes the simplicity the main players are ISPs and Internet Registry
- Implementation difficulty
  - Just for NetLocation service, GeoPriv seems too complicated

A concrete example in P2P downloading

- Some facts:
  - P2P overlay network has millions of nodes distributed world-widely
  - Tracker needs to get peer's location information from different ISPs
  - Tracker wants to use the same interface to communicate with different ISPs
  - Tracker does not want complicated configurations for location service
  - Tracker needs well-formed results to facilitate processing

With GeoPriv solution

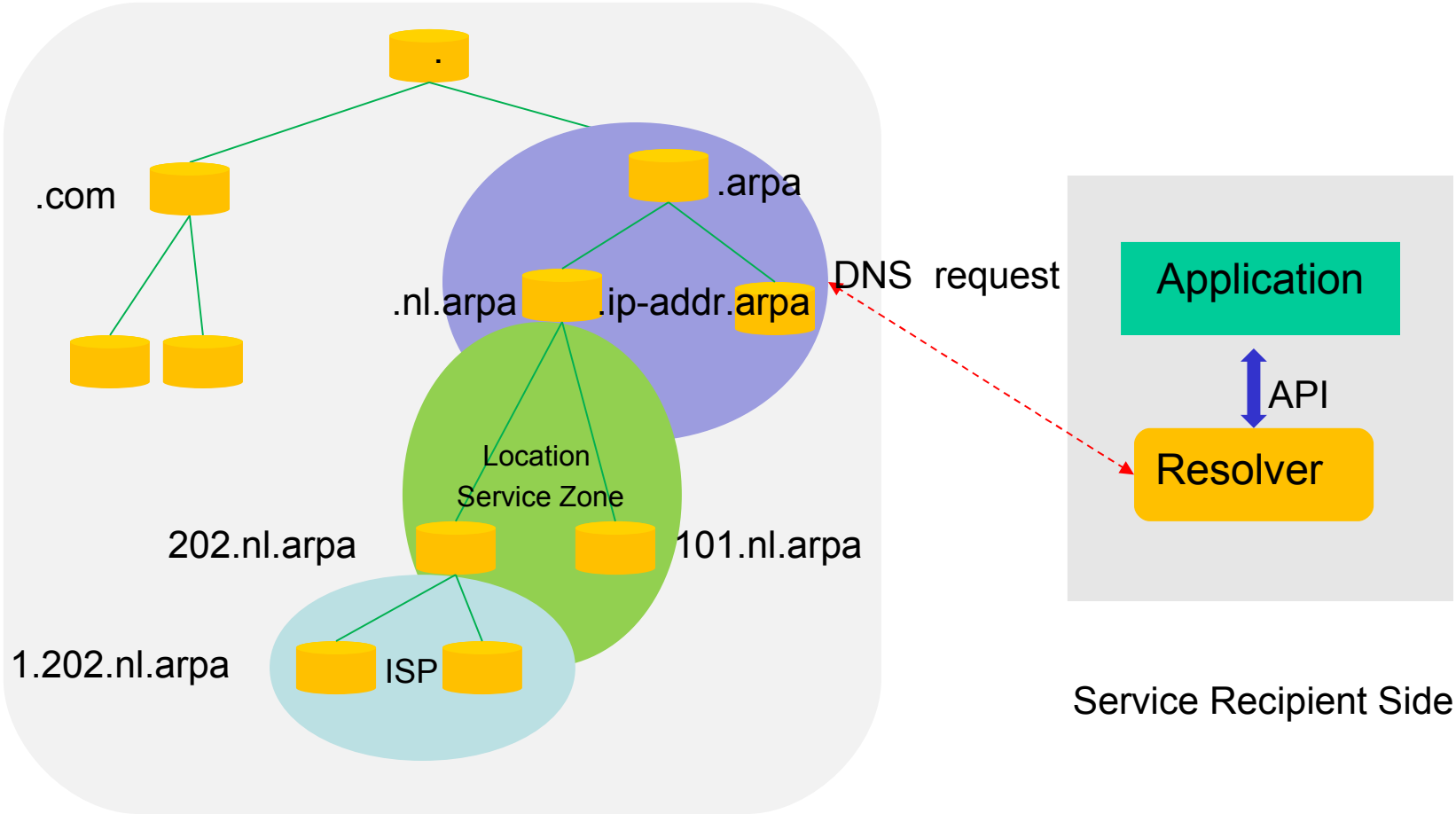
- Issues
  - How many LISs tracker needs to communicate
  - How many interfaces tracker needs to implement for different ISPs
  - Tracker needs to evaluate peers' location very quickly. HTTP seems too heavy for this purpose.
  - XML based processing is not light enough

With DNS based solution

- Almost zero configuration for tracker
- No particular protocol needed
- Fast proximity estimation using fixed and formatted location code instead of textual description
- DNS protocol is very light and easy to process

Solution of DNS based location service

- Use .nl.arpa for netlocation service



Solution of DNS based location service

- Create a new domain under .arpa, say it nl.arpa
- The whole location records are organized into different zones in reverse DNS style
  - For instance: location record for address 1.2.3.4 is written as ‘4.3.2.1.nl.arpa A location_info’ in database
- Clients which need location service will send a query with domain name as ‘4.3.2.1.nl.arpa.’ using resource type PTR

How should location information be presented

- Textual description
  - Use plain text to describe the location like ‘China, Guangdong, Guangzhou, BAS1’
  - Easy to read for human but hard to handle for computer
- Numbered coding
  - Use number to accurately define the location like ‘country_code.ISP_code.prov_code.city_code.district_code.BAS_code’
  - Hard to read but easy to process for computer

Binary presentation for location information

16bit	16bit	16bit	16bit	16bit	16bit	16bit	16bit	16bit	16bit
M	M	M	M	M	O	O	O	O	O
Country	ISP	Prov/State	City	District	AS	Agg_router	Acc_router	Reserved1	Reserved2

- Give a number to each field instead of textual description
- Notation
  - M: Mandatory
  - O: Optional
  - AS: Autonomous System
  - Agg_router: Aggregator router
  - Acc_router: Access router

Ascii Presentation in DNS response

- Hexadecimal digits for each field, separated by '.'

- Example: 1A.2B.3C.4D.5E.0.0.0.0 will be the location information to appear in DNS response with
  - Country code = 1A
  - ISP code = 2B
  - Province/State code = 3C
  - City code = 4D
  - District code = 5E
  - Other codes = 0

Location Code format considerations

- A natural way to represent the target's location in network
- The field can be empty if it can not be determined
- It is quite easy to evaluate the proximity given a collection of targets
- Current P2P systems are using such format for traffic optimization

Security and privacy consideration

- Access to NetLocaction service can be controlled by ipaddress-based filter on DNS
- Precision can be controlled by ISPs
- Location information just represents the position in the network, not necessarily geographic place
- Location information does not carry any identity of end user

Summary

- NetLocation service uses DNS as transport protocol
- NetLocation service uses a new domain called nl.appa
- The records are organized and processed like reverse DNS protocol
- NetLocation service uses fixed code format to represent the location
- NetLocation service implements access control by deploying IP filter on DNS servers
- NetLocation service is different from GeoPriv in terms of scope and implementation

Thank you!