Behavior analysis of DNS Anycast in 2008

-- Annual Report of Gulliver Project --

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Introduction

- Gulliver Project
  - DNS Active Measurement Project
  - [http://gulliver.wide.ad.jp/](http://gulliver.wide.ad.jp/)
- Probes DNS reachability from worldwide locations
  - RTT, Query Timeout, Anycast ID
- 27 Probe Locations as of Mar. 2009
- Targets
  - Root DNS Servers
  - ccTLD DNS Servers
  - in-addr.arpa DNS Servers
Analysis

- Measurement Span

- Targets
  - Root DNS Servers

- RTT distribution
  - “Average” and “Mode” are nearly equal
  - RTT values are not distributed largely
Average v.s. Mode RTT Values

RTT (ms)

Probe Points #

RTT (ms)

Average

Mode
Categorize Root DNS by Anycasting

- Root DNS Servers be categorized by its operation policy
  - Type-1: Non Anycasted
    - A, B, D, E, G, H
  - Type-2: Anycasted
    - C, M, L
  - Type-3: Heavily Anycasted
    - F, I, J, K

- Is there any relation ???
  - Anycast Changes
  - RTT
  - Query Timeout
RTT distribution of D-ROOT (University of Maryland)

RTT distribution of M-ROOT (WIDE Project)

0 – 3 : US & S.US
4 – 8 : EU & Africa
9 – 17 : ASIA
RTT distribution of F-ROOT (ISC)

0 : US
1 : US
2 : US
3 : BR
4 : FR
5 : IT
6 : NL
7 : KE
8 : KE
9 : LK
10 : MY
11 : TH
12 : TH
13 : TW
14 : JP
15 : JP
16 : JP
17 : JP
18 : NZ

0 – 3 : US & S.US
4 – 8 : EU & Africa
9 – 17 : ASIA
Distributions

D-ROOT

F-ROOT

M-ROOT

# of queries

RTT (ms)

Probe Point

# of queries
Matrix of RTT (mode)
RTT & StdDev

- Africa (Kenya) and Asian probes show larger RTT values
- StdDev of Asian probes are not so large
- Kenya probes show large StdDev values
Matrix of Query Timeout (Scale Changed)
DNS Query Timeout

- Kenya and several Asian probes show over 1% timeout rate
- Probes which show over 10% timeout rate
  - KR, KE, FR
  - FR -> F : Problem ?
  - KE : High Timeout Rate
Matrix of Anycast ID Changes

Type-3

Type-2

Type-1

US(1)
US(16)
US(22)
BR(3)
FR(7)
IT(19)
NL(25)
KE(26)
LK(18)
MY(15)
TH(21)
TH(10)
TW(24)
KR(14)
JP(2)
JP(12)
JP(13)
NZ(20)

A
B
D
E
G
H
C
M
F
I
J
K

(times)

- 40000-50000
- 30000-40000
- 20000-30000
- 10000-20000
- 0-10000

40000-50000
30000-40000
20000-30000
10000-20000
0-10000
Type-I Anycast ID

- **Inside Sites**
  - Load Balancing …
- **B**
  - b1.isi.edu
  - b2
  - b3
- **H**
  - H1
  - H2
  - H3
- **G**
  - g.root-servers.net
  - g.root-servers2.net
- **A**
  - ns10-aroot
  - ns11-aroot
  - ns12-aroot
  - ns13-aroot
  - ns14-aroot
  - ns15-aroot …..
Anycast Changes
(Only Anycast Root)
A, B, G, H show load balancing of Hosts
F/J ROOT has a lot of of Anycast sites.
  ◦ F(46), J(52) locations as of Feb. 2009
2 Types of Anycast
  ◦ Global Anycast
    • Announce Prefixes globally by BGP
    • J uses global anycast at many sites
  ◦ Local Anycast
    • Announce Prefixes locally by BGP(NO-EXPORT)
    • F uses local anycast at many sites
Relation?

- Anycast Changes
- RTT
- Query Timeout

![Graph showing RTT (RTT(ms)) over time with dates ranging from 08-Jan-01 to 09-May-01. The graph includes bars for RTT (ms), Anycast Changes, and Timeout. The x-axis represents the dates.]
Anycast v.s. Timeout

Probes at a few anycast changes show HIGH Timeout Rate?
RTT v.s. Anycast

RTT : Daily Average
Probes at Smaller RTT show HIGH Timeout Rate ??

RTT vs. Timeout

RTT : Daily Average
Continuous Works

- Anycast v.s. Timeout
  - No direct relation
  - Need more analysis
- More Analysis
  - ccTLD and in-addr.arpa
- More Server
  - gTLD
- http://gulliver.wide.ad.jp/
Need Partners

- Could you accommodate our measurement box?
- One global IPv4 (IPv6) address is required.
- If you accommodate, we will issue login account on our member page. You can get a lot of measurement data from the page.