Active measurements to Root DNS servers especially from Asian countries

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Use dnsprobe with dialup connection

1 probe – 30 min

- Running three dnsprobe processes

Probed between 25\textsuperscript{th} Feb. and 16\textsuperscript{th} Mar.

Measured

- RTT
- Stability
- Anycast Entity
Selection of Dialup Points

Selected Dialup Points following priority:
1. Country
2. ISP
3. City

Some countries prohibited dialup connection from outside. (in-country only)
- Vietnam
- Laos
- North Korea (I’m not sure there is access point)
Dialup Countries

- Bangladesh
- Cambodia
- China
- Hong Kong
- India
- Indonesia
- Korea
- Malaysia
- Mongolia

- Nepal
- Pakistan
- Philippines
- Singapore
- Sri Lanka
- Taiwan
Details of Dialup Points (1)

- CHINA
  - Cernet Online Information Tech. Ltd.
    - Beijing
    - Shenyang
    - Suzhou
    - Xiamen
  - China Netcom Corporation Ltd.
    - Guangzhou
    - Wuhan
  - Divixian com Limited.
    - Shenzhen
Details of Dialup Points (2)

- **Hong Kong**
  - Hong Kong Broadband Network Ltd.
  - Diyixian com Limited.
  - PCCW IMS Limited.

- **INDIA**
  - HCL Infinet Ltd.
    - Delhi, Nasik
  - Pacific Internet India Private Limited.
    - Mumbai
Details of Dialup Points (3)

**INDONESIA**
- CBNNET PT CYBERINDO
  - Bandung
- IndoInternet
  - Jakarta
- UniNet
  - Jakarta
- PT Centrin
  - Pontaniak
- IM2
  - Surabaya

**KOREA**
- Hanaro Telecom
  - Ansan
- Inet Hosting Inc.
  - Seoul
Details of Dialup Points (4)

- MALAYSIA
  - Malaysia Online
    - Johor Bahru
    - Penang
  - Asia Connection Corporation
    - Kuala Lumpur
  - Pacific Internet (Malaysia) Sdn. Bhd.
    - Kuala Lumpur

- Nepal
  - Mos.com
    - Biratnagar
    - Kathmandu
Details of Dialup Points (5)

PHILIPPINES
- Bayantel, Inc.
  - Bacolod
  - Cebu
- Innove Communications, Inc.
  - Cavite
- Pacific Internet Philippines, Inc.
  - Laguna
- Infodyne, Inc.
  - Manila

SINGAPORE
- Qala Singapore Pte Ltd.
- Singapore Telecom.
- StarHub Pte Ltd.
- T-Systems Singapore Pte Ltd.
Details of Dialup Points (6)

- CAMBODIA
  - Eureka Online (Pvt) Limited.
    - Colombo
  - MTM Networks Pvt. Ltd.
    - Colombo
  - Lanka Internet Services Limited.
    - Kandy

- TAIWAN
  - Taiwan Telecommunication Network Services Co., Ltd.
    - Taipei
  - Diyixian.com Limited
    - Taipei
Compensation of Measured RTT

- **Dialup RTT**
  - Measured Dialup RTT by ping to PPP peering address
  - Use minimal RTT as Dialup RTT

- **Actual RTT**
  \[ \text{Actual RTT} = \text{Measured RTT} - \text{Dialup RTT} \]
Anycast of F-root

- CHINA
  - pek1\(\{a,b\}\), pao1a

- Hong Kong
  - hkg1a

- INDIA
  - pao1b, lga1a

- INDONESIA
  - cgk1\(\{a,b\}\)

- TAIWAN
  - hkg1a

- KOREA
  - sfo2b, sel1a

- MALAYSIA
  - pao1a, hkg1b, ams1b

- PHILIPPINES
  - pao1\(\{a,b\}\)

- SINGAPORE
  - pao1\(\{a,b\}\), sin1a, ams1a

- SRI LANKA
  - pao1b, ams1b
Anycast of I-root

- CHINA
  - s1.bei, s1.bkx

- Hong Kong
  - s1.bkx

- INDIA
  - s1.bkx, timeout

- INDONESIA
  - s1.gen, timeout, timeout

- TAIWAN
  - s1.bkx

- KOREA
  - s1.tok, s1.bkx

- MALAYSIA
  - s1.pix, s1.bkx

- PHILIPPINES
  - s1.pix, s1.tok, s1.ams

- SINGAPORE
  - s1.bkx, s1.sin, s1.gen

- SRI LANKA
  - s1.pix, s1.bkx, s1.ank
Anycast of J-root

- CHINA
  - jns-jgtld, jns-kr
- Hong Kong
  - jns-jgtld
- INDIA
  - jns-eliad, jns-elsyd
- INDONESIA
  - jns-kr
- TAIWAN
  - jns-kr
- KOREA
  - jns-hgtld, jns-kr
- MALAYSIA
  - jns-jgtld, jns-elsyd, jns-mgtld
- PHILIPPINES
  - jns-elsyd, jns-eliad, jns-kr
- SINGAPORE
  - jns-mgtld, jns-elsyd
- SRI LANKA
  - jns-jgtld, jns-kr, jns-lgtld
Anycast of K-root

- CHINA
  - k1.tokyo, k2.linx, k1.linx
- Hong Kong
  - k2.denic
- INDIA
  - k2.delhi, k1.delhi
- INDONESIA
  - k2.linx
- TAIWAN
  - k2.denic

- KOREA
  - k2.linx
- MALAYSIA
  - k1.tokyo, k1.denic, k2.linx
- PHILIPPINES
  - k1.tokyo, k1.denic
- SINGAPORE
  - k2.linx, k2.tokyo
- SRI LANKA
  - k2.tokyo, k2.linx
Anycast of M-root

- CHINA
  - M-d
- Hong Kong
  - M-d
- INDIA
  - M-cdg, M-d
- INDONESIA
  - M-d
- TAIWAN
  - M-d
- KOREA
  - M-d
- MALAYSIA
  - M-d, M-x
- PHILIPPINES
  - M-cdg, M-x, M-d
- SINGAPORE
  - M-x, M-d
- SRI LANKA
  - M-d
RTT results from CHINA
RTT results from Hong Kong
RTT results from INDIA
RTT results from INDONESIA
RTT results from KOREA
RTT results from MALAYSIA
RTT results from PHILIPPINES
RTT results from SINGAPORE
RTT results from Sri Lanka
RTT results from TAIWAN
Summary

- Anycasting
  - Expected coverage?
  - Timeout problem of I-root
- F-root works fine
  - Indonesia, Hong Kong, China, Taiwan
- F, I, J, K, M
  - Anycast roots have better reachability than non-Anycast roots from Asian countries
  - Reachability from Asian countries may be improved by anycasting
  - M has advantage of physical location for Asian countries.