

Active measurements to Root
DNS servers
especially from Asian countries

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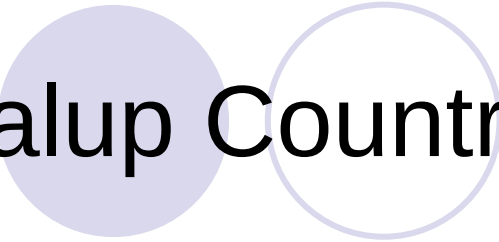
Probing

- Use dnsprobe with dialup connection
- 1 probe – 30 min
 - Running three dnsprobe processes
- Probed between 25th Feb. and 16th Mar.
- Measured
 - RTT
 - Stability
 - Anycast Entity

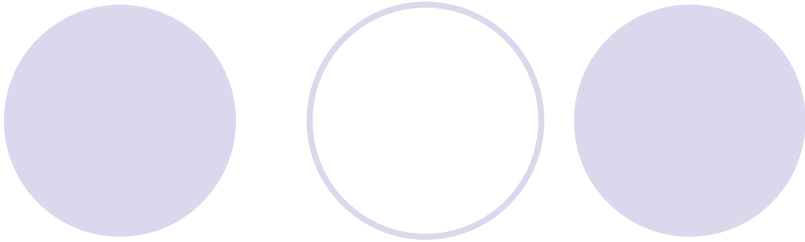
Selection of Dialup Points

- 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
- HONGKONG
- INDIA
- INDONESIA
- KOREA
- MALAYSIA
- MONGOLIA

- 
- NEPAL
 - PAKISTAN
 - PHILIPPINES
 - SINGAPORE
 - SRILANKA
 - TAIWAN

Details of Dialup Points (1)

- CHINA

- Cernet Online Information Tech. Ltd.

- Beijing
 - Shenyang
 - Suzhou
 - Xiamen

- China Netcom Corporation Ltd.

- Guanghou
 - 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.

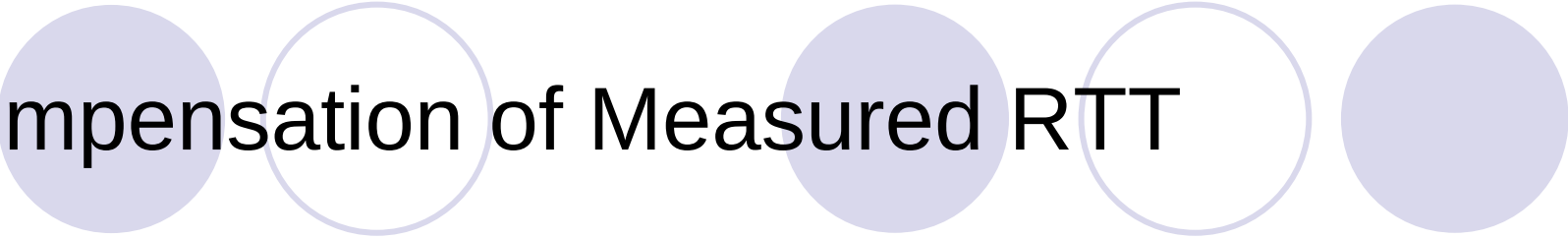
Details of Dialup Points (6)

● 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

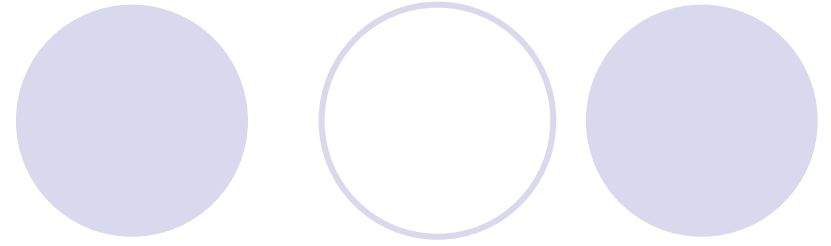
- Measured Dialup RTT by ping to PPP peering address

- Use minimal RTT as Dialup RTT

- Actual RTT

- = Measured RTT – 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}

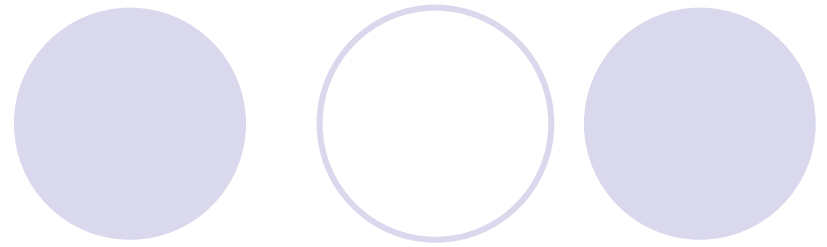
- SINGAPORE

- 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

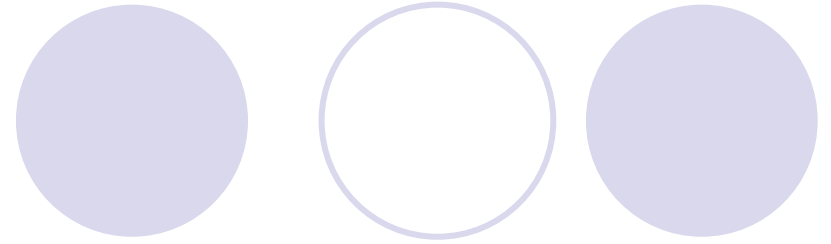
- SINGAPORE

- 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

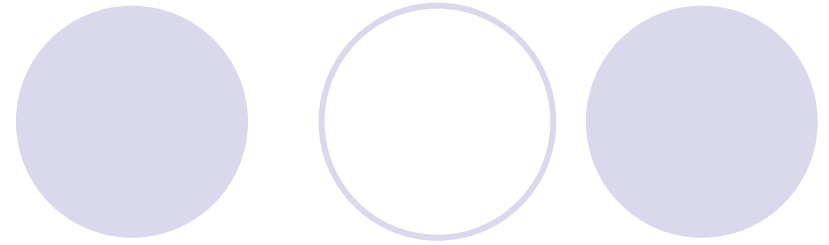
- SINGAPORE

- jns-mgtld, jns-elsyd

- SRI LANKA

- jns-jgtld, jns-kr, jns-lgtld

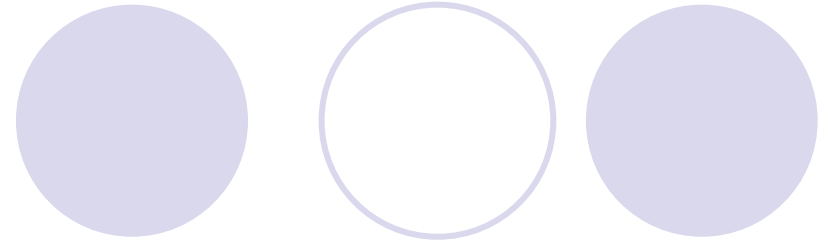
Anycast of K-root



- 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

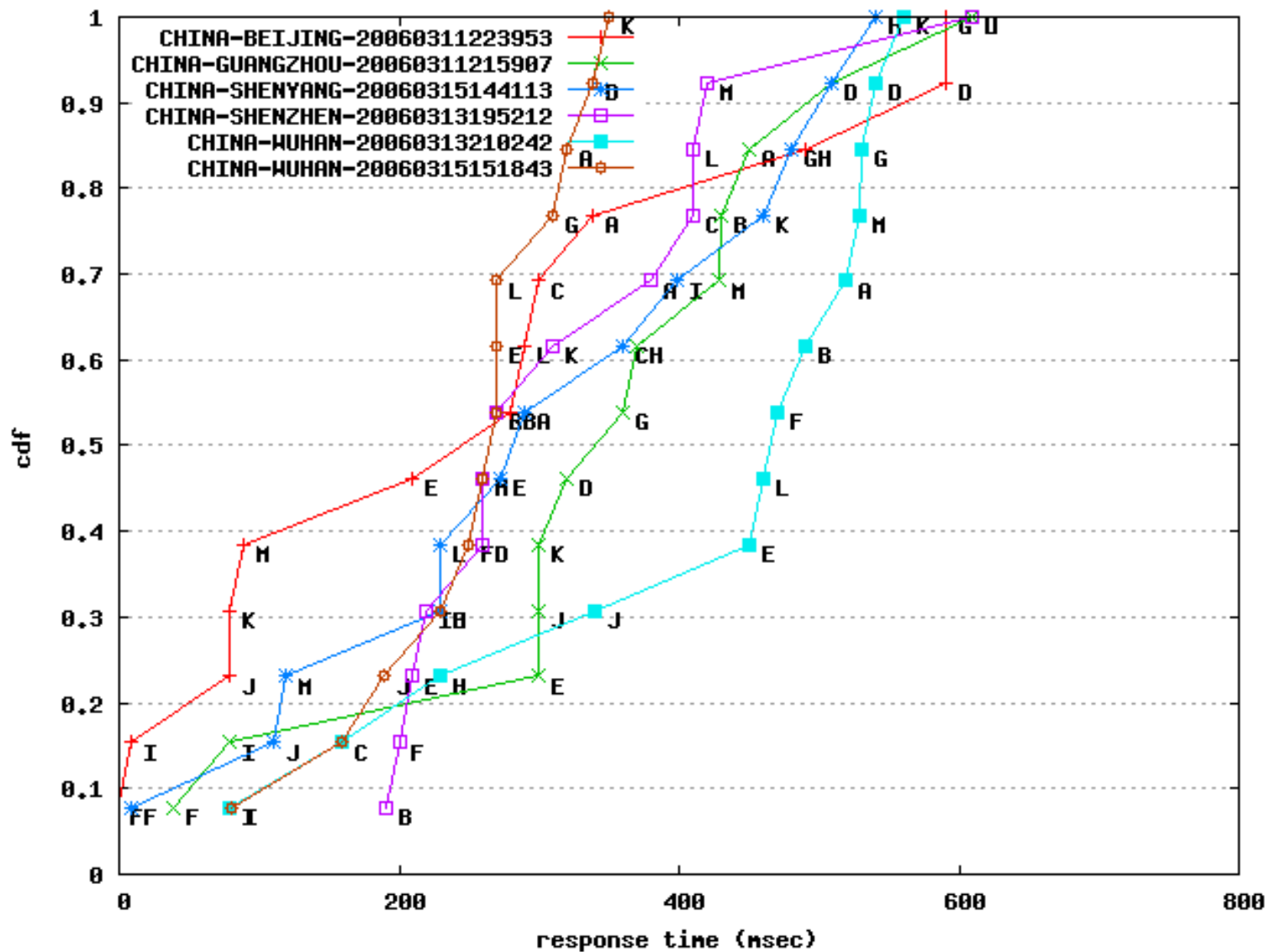
- SINGAPORE

- M-x, M-d

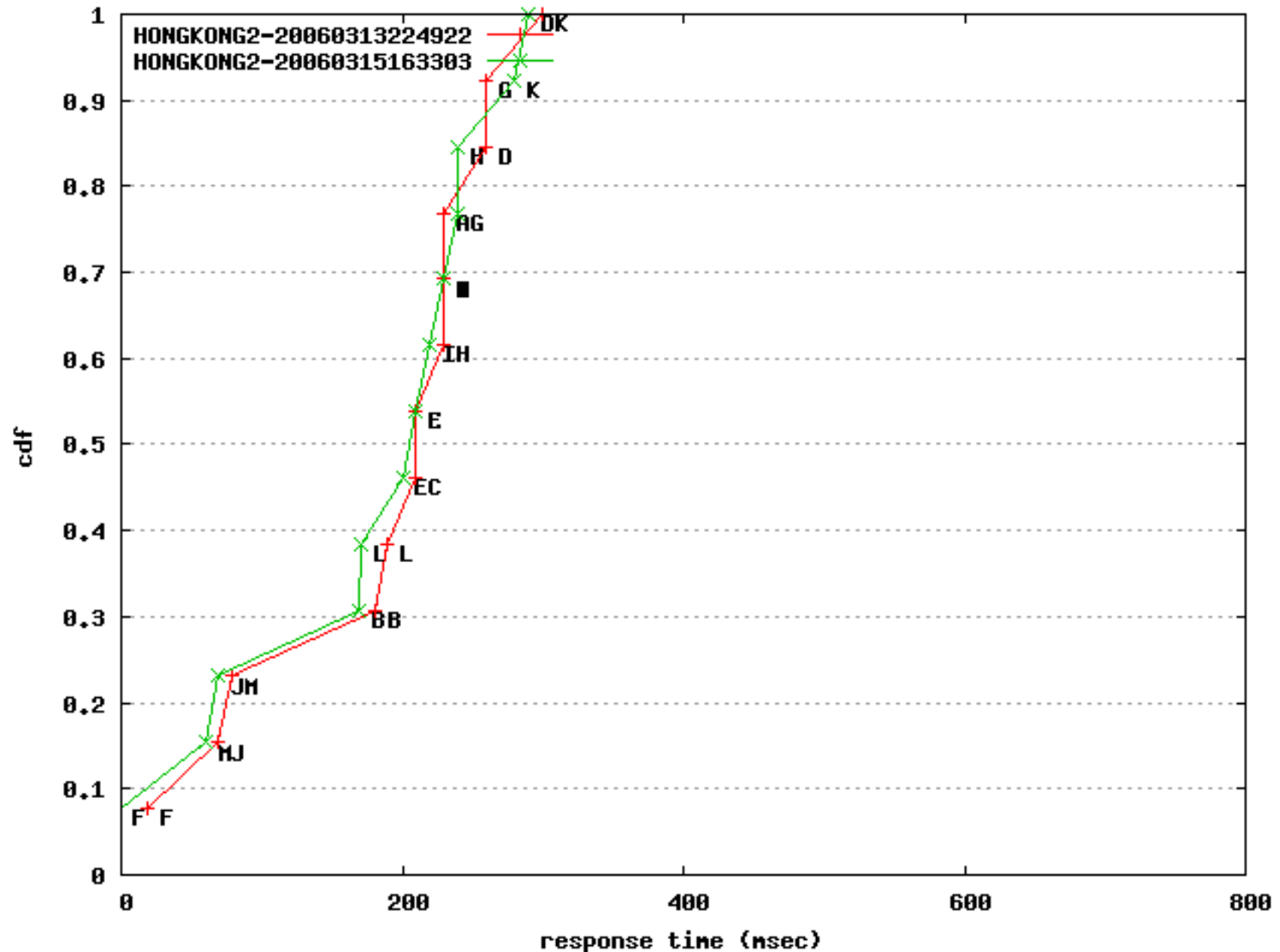
- SRI LANKA

- M-d

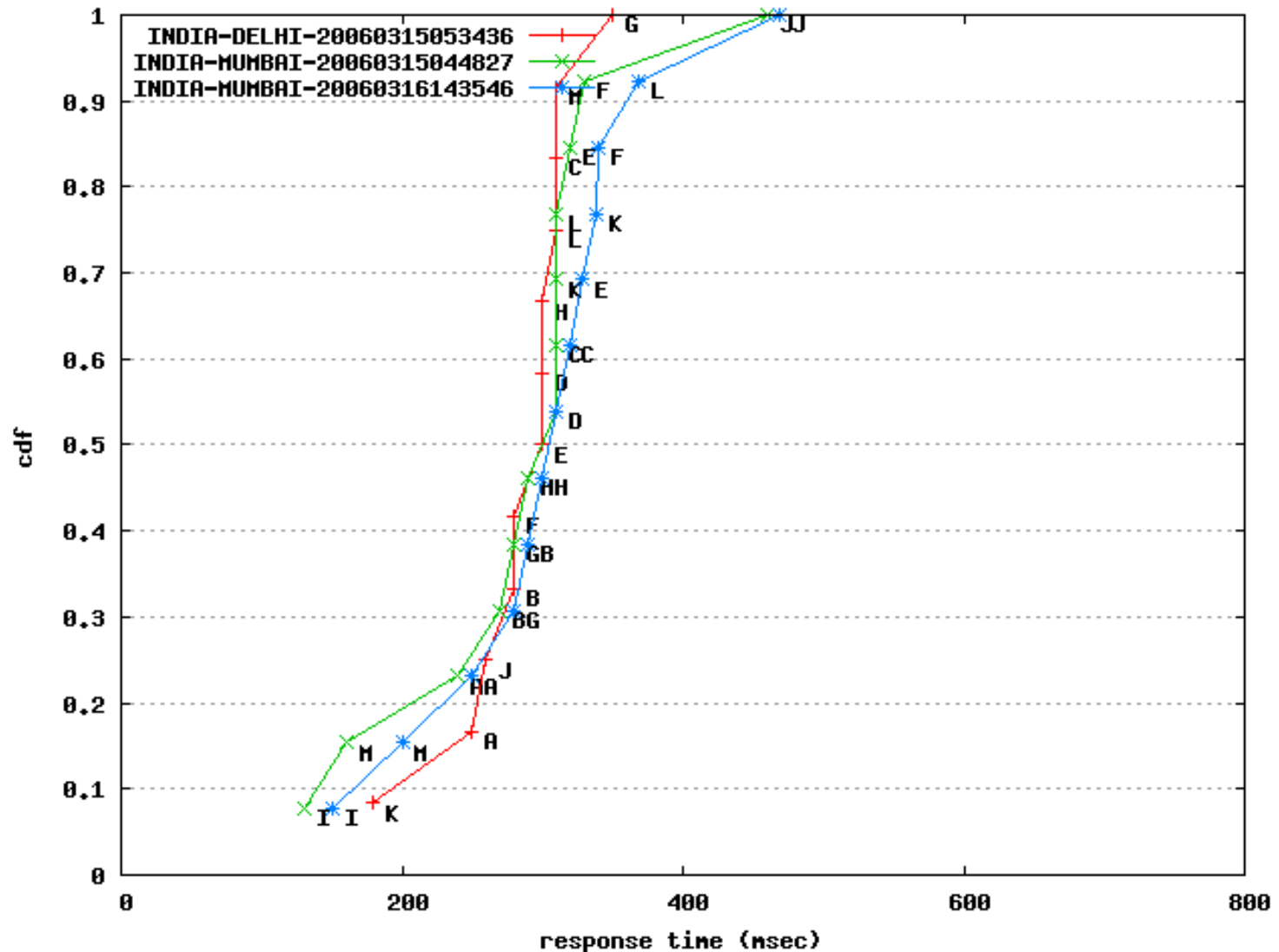
RTT results from CHINA



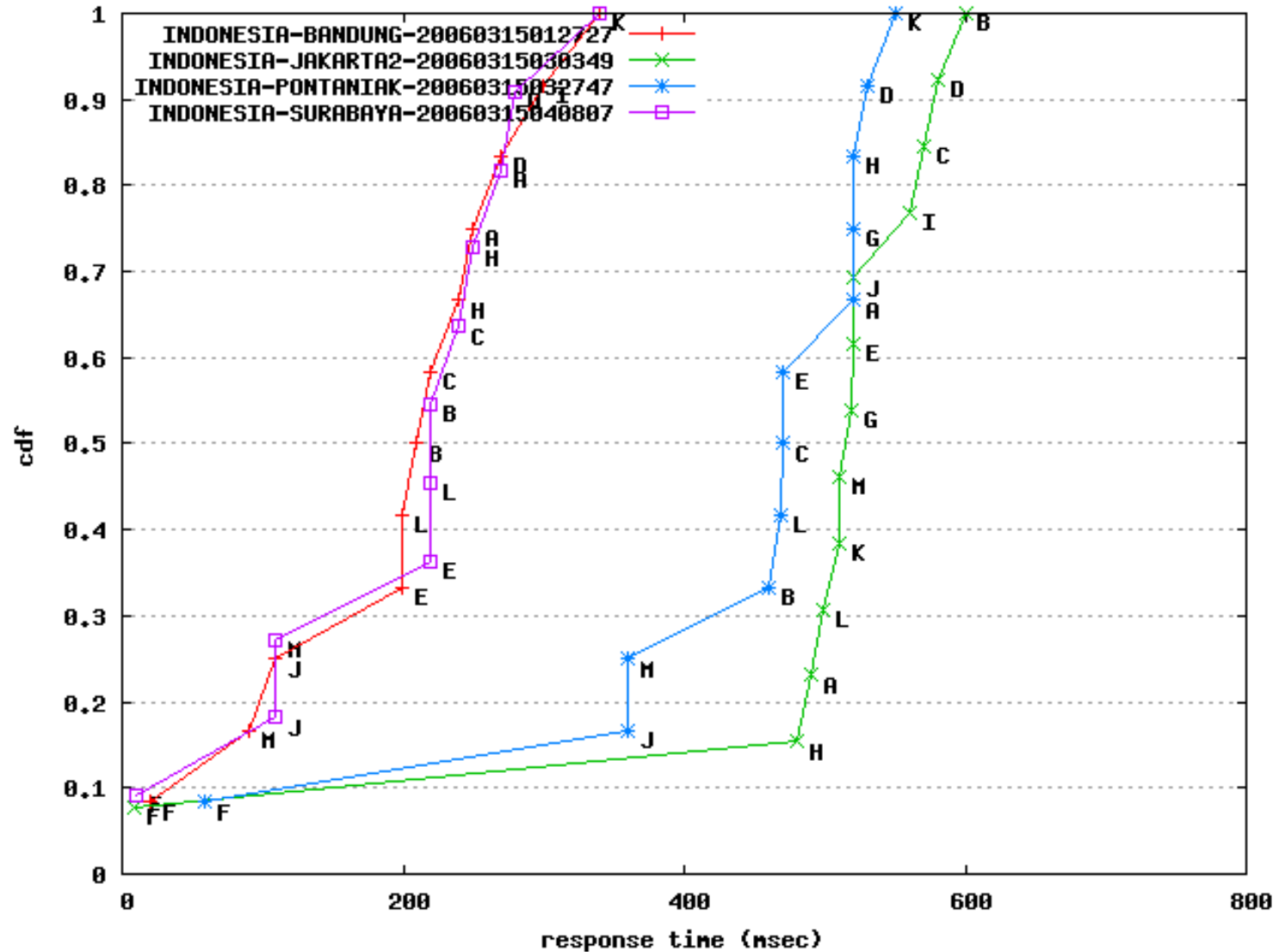
RTT results from Hong Kong



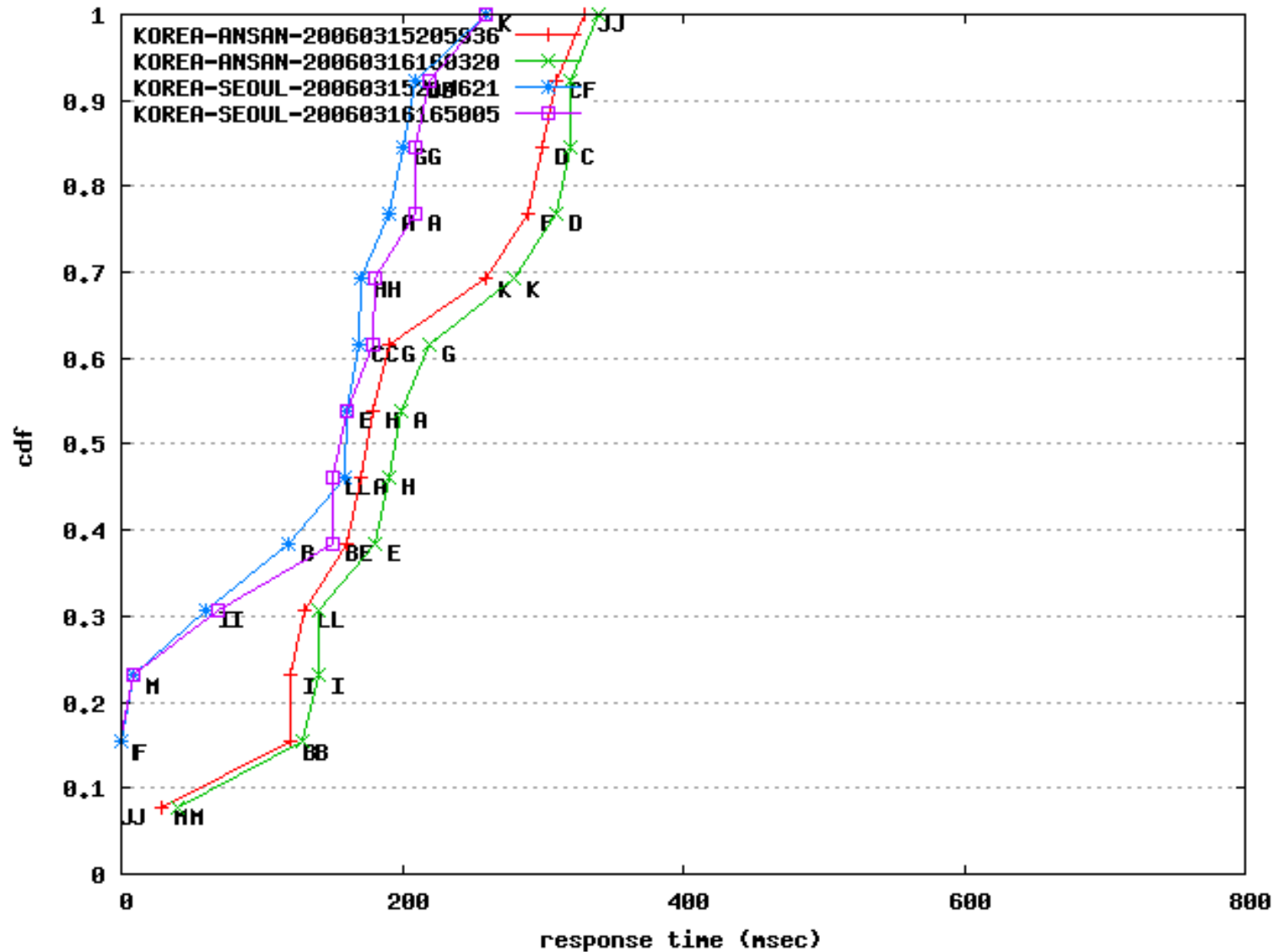
RTT results from INDIA



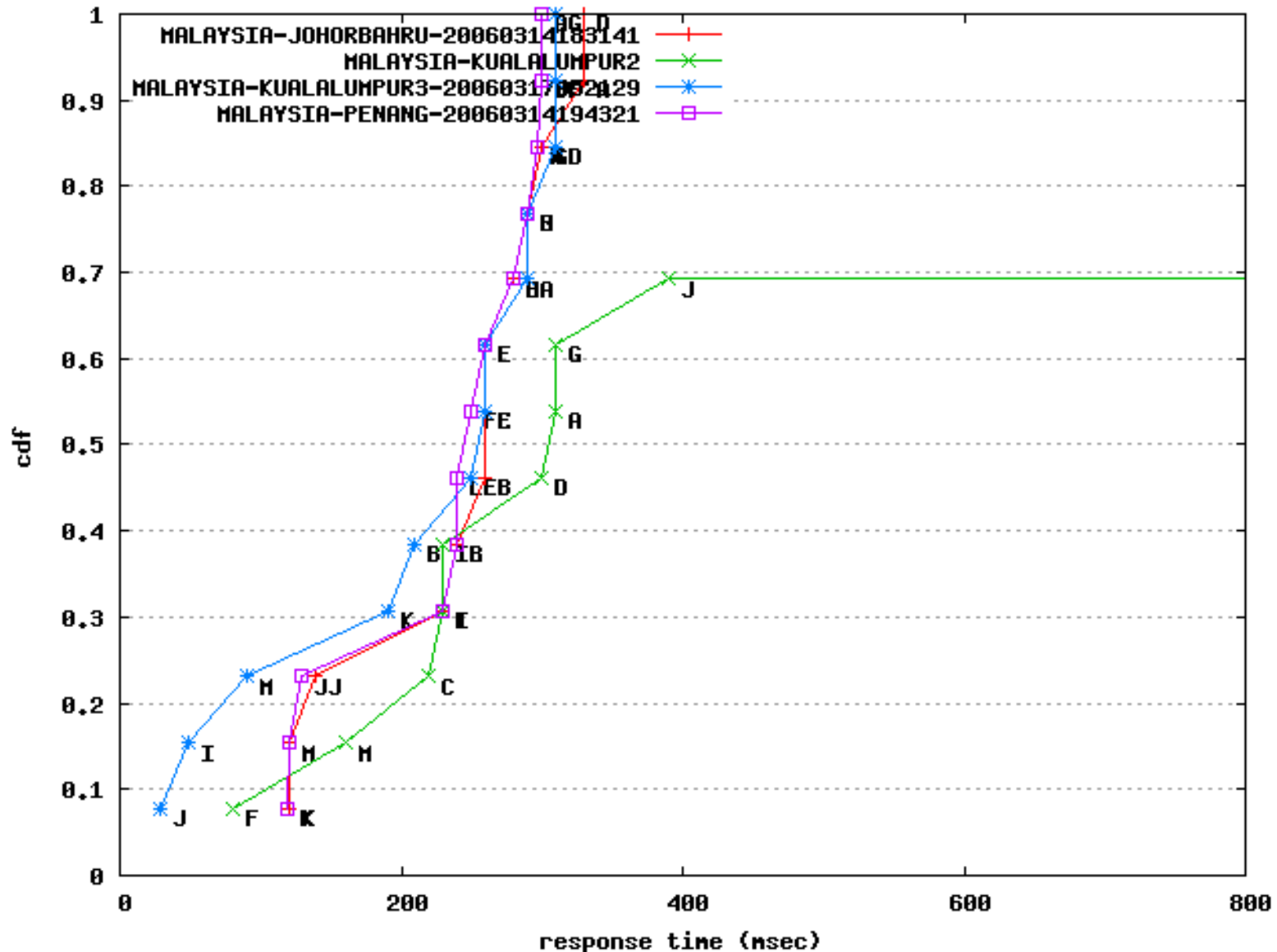
RTT results from INDONESIA



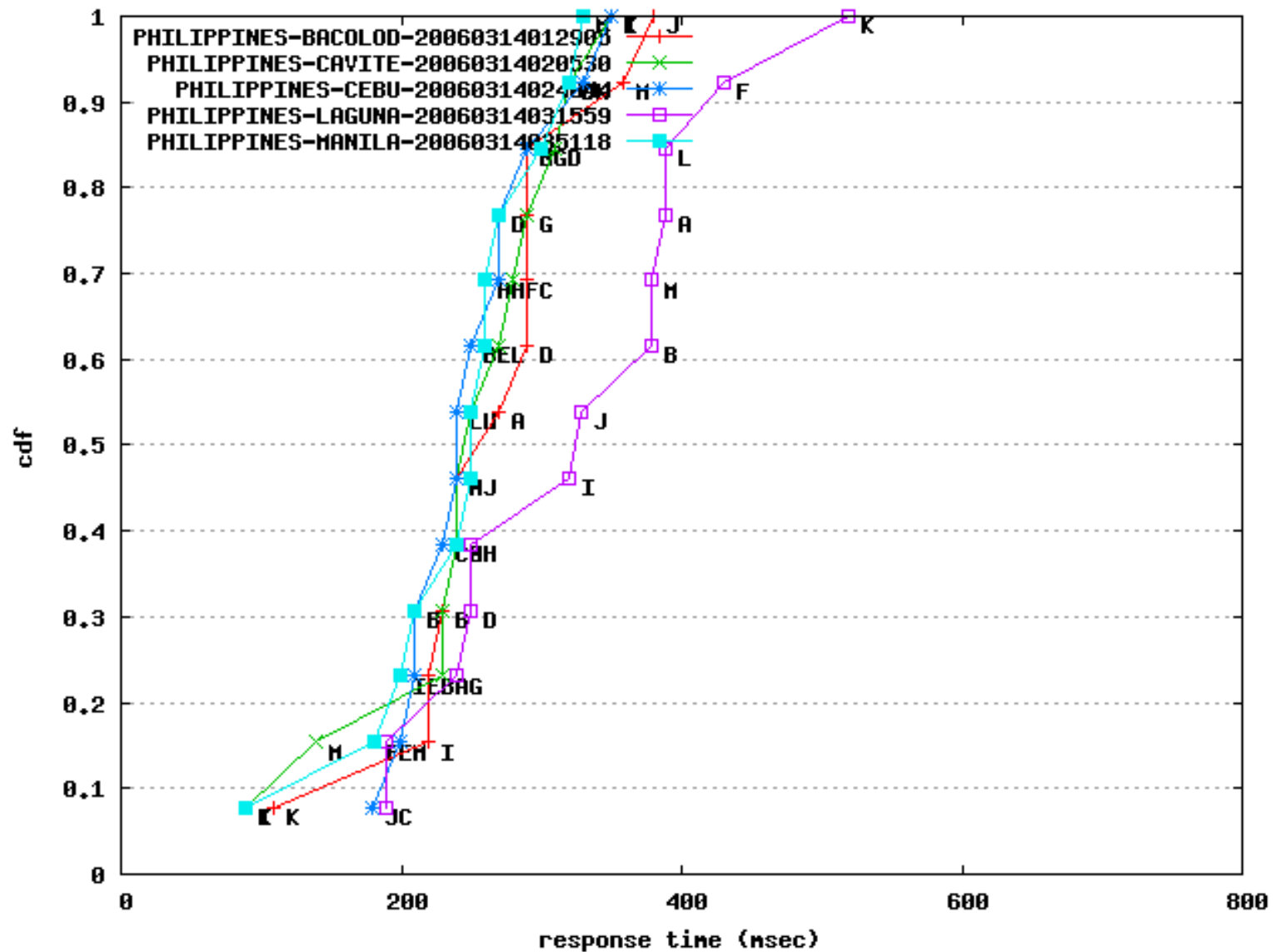
RTT results from KOREA



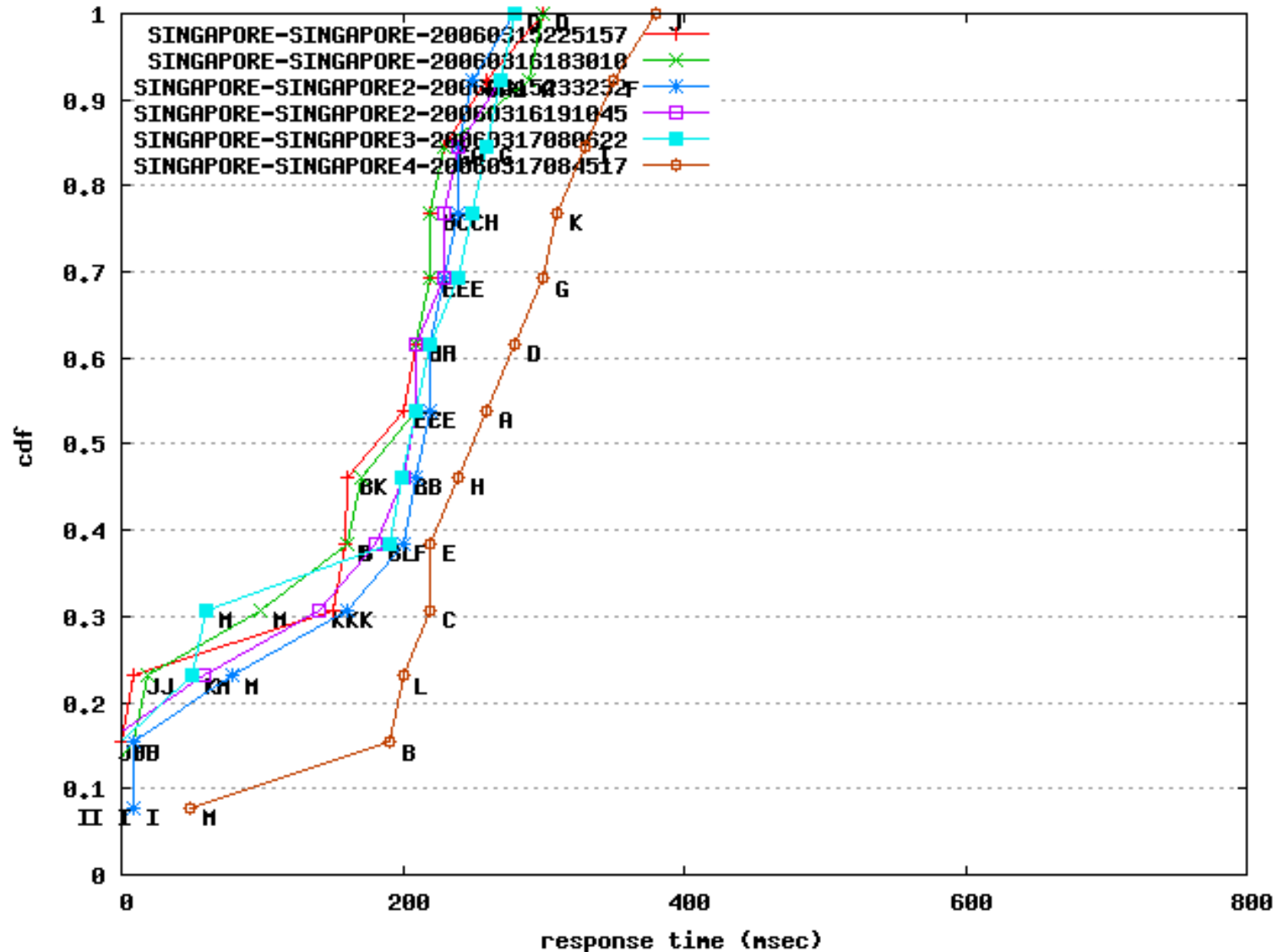
RTT results from MALAYSIA



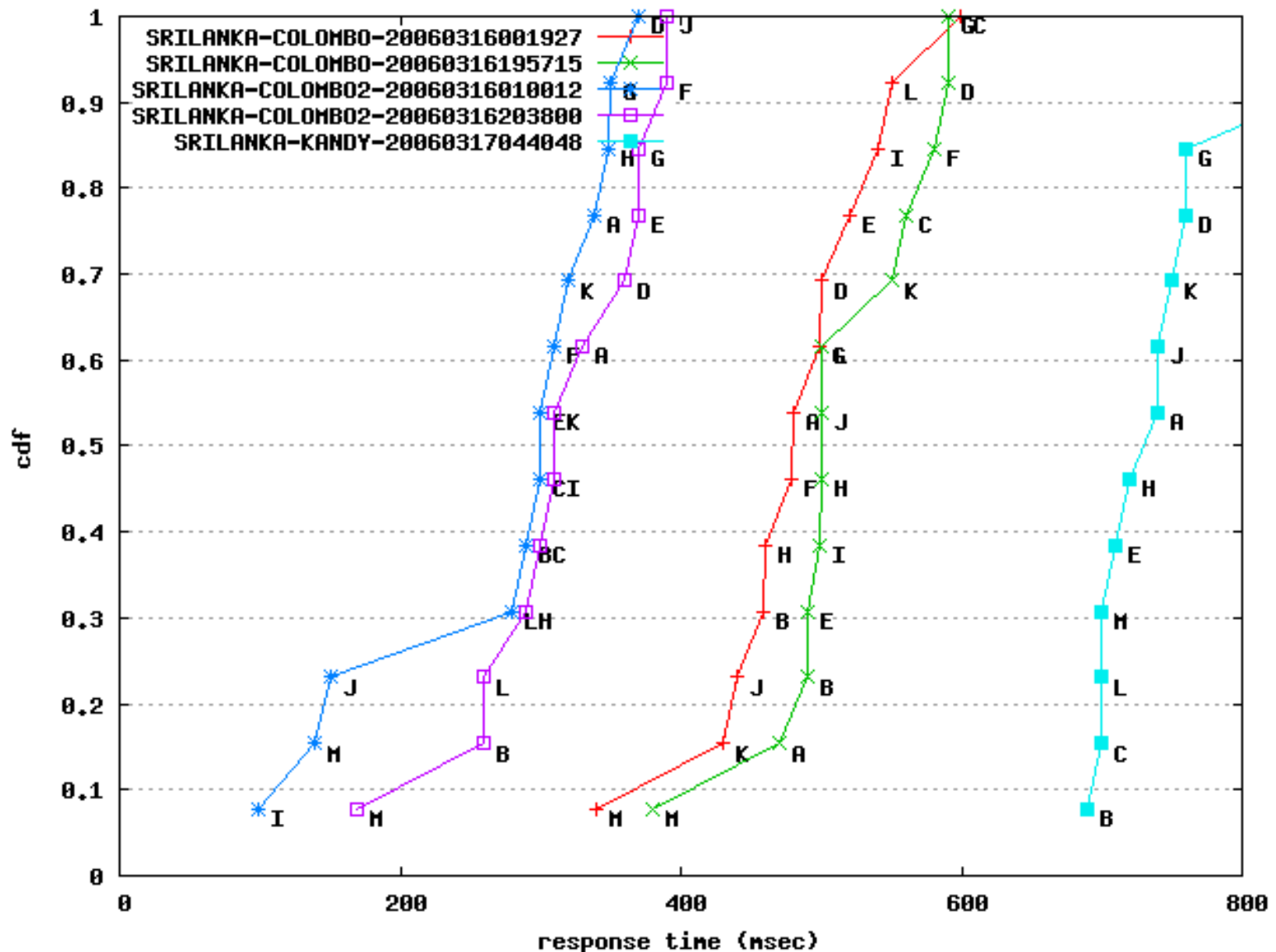
RTT results from PHILIPPINES



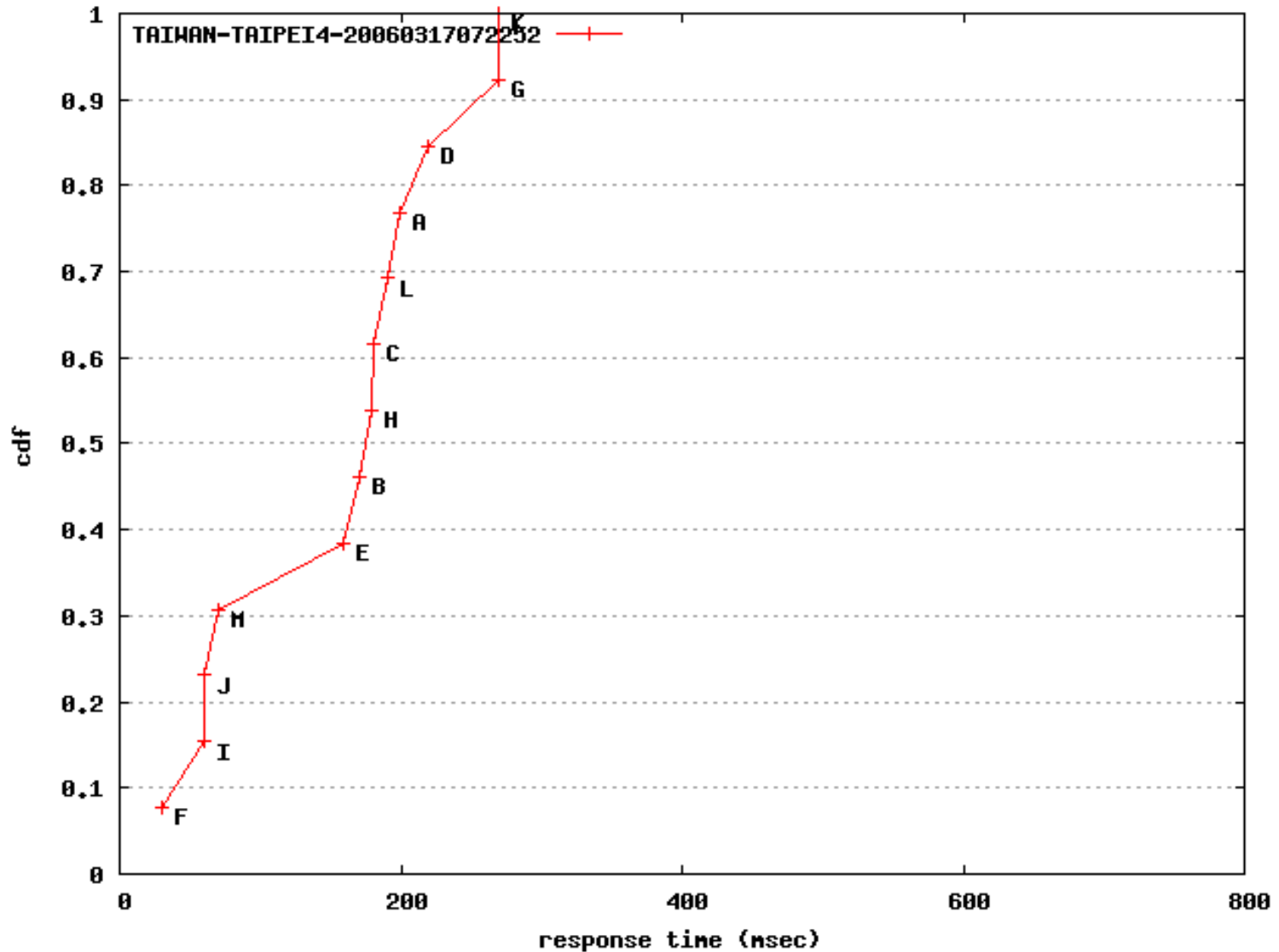
RTT results from SINGAPORE



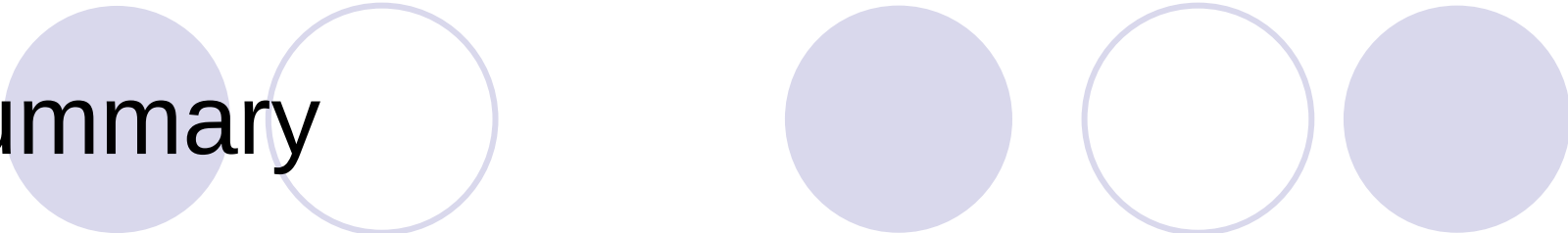
RTT results from Sri Lanka



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.