

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 25<sup>th</sup> Feb. and 16<sup>th</sup> 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.

- 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

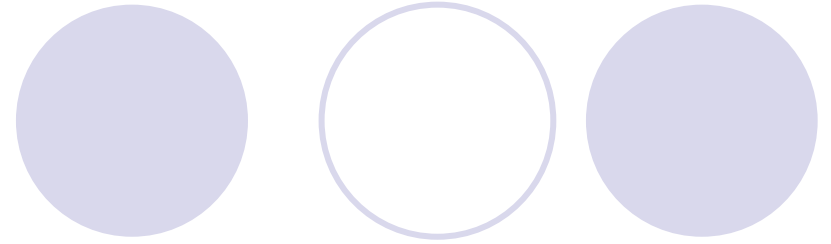
- Measured Dialup RTT by ping to PPP peering address

- Use minimal RTT as Dialup RTT

- Actual RTT

- = 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

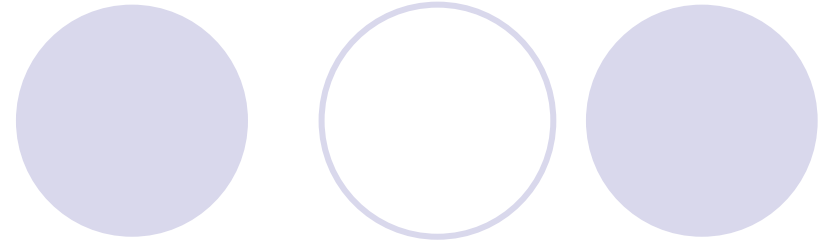
- SINGAPORE

- 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

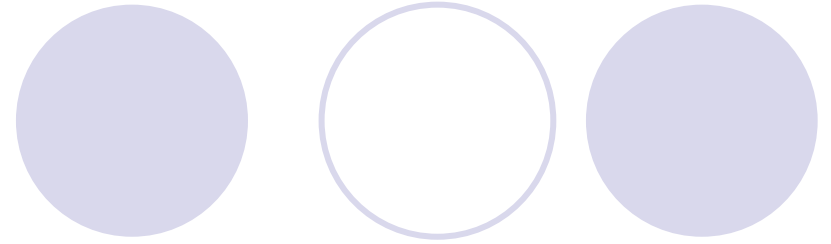
- SINGAPORE

- 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

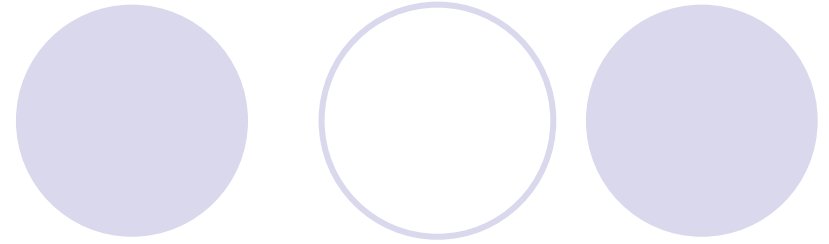
- SINGAPORE

- 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

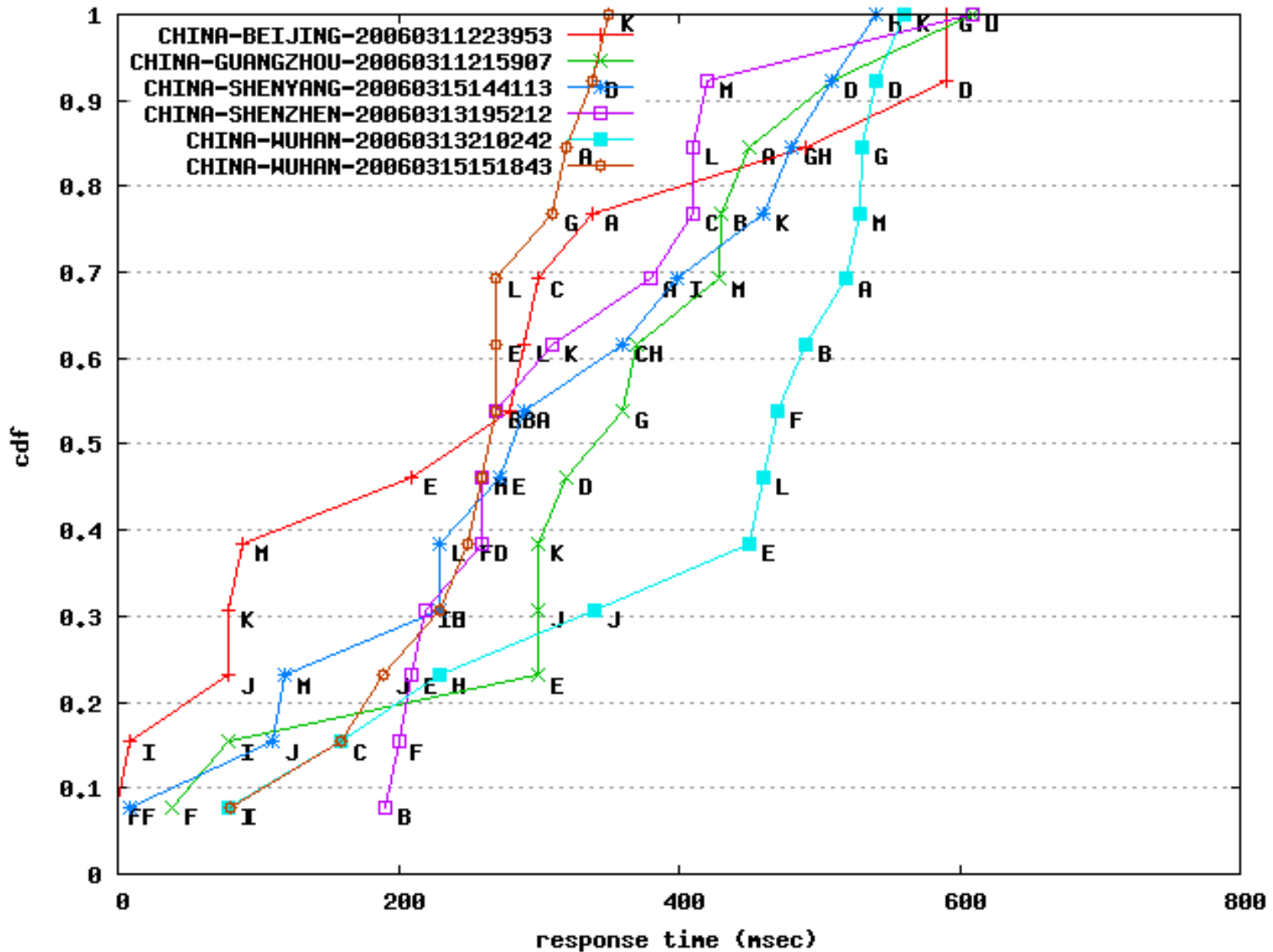
- M-x, M-d

- SRI LANKA

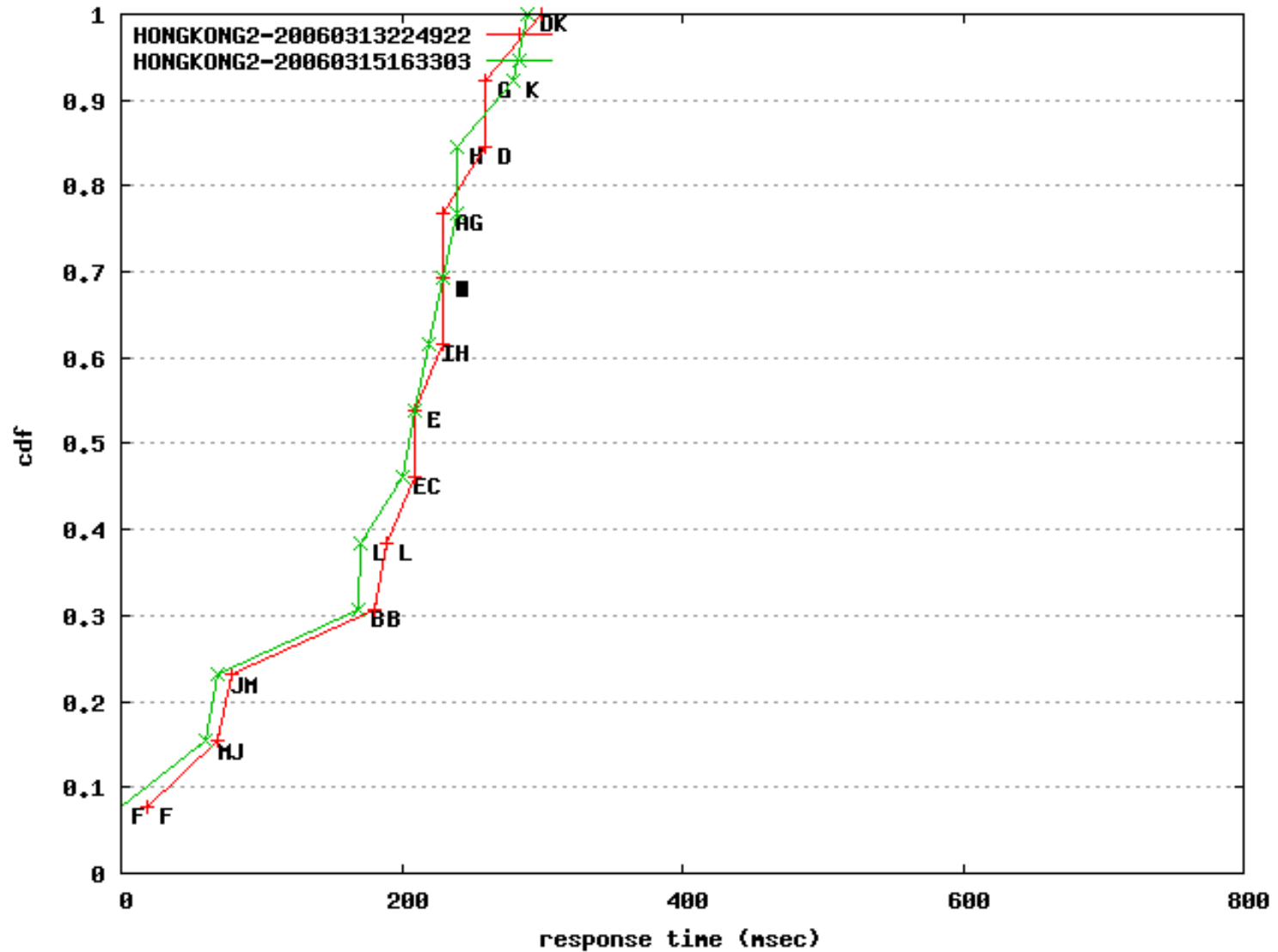
- M-d



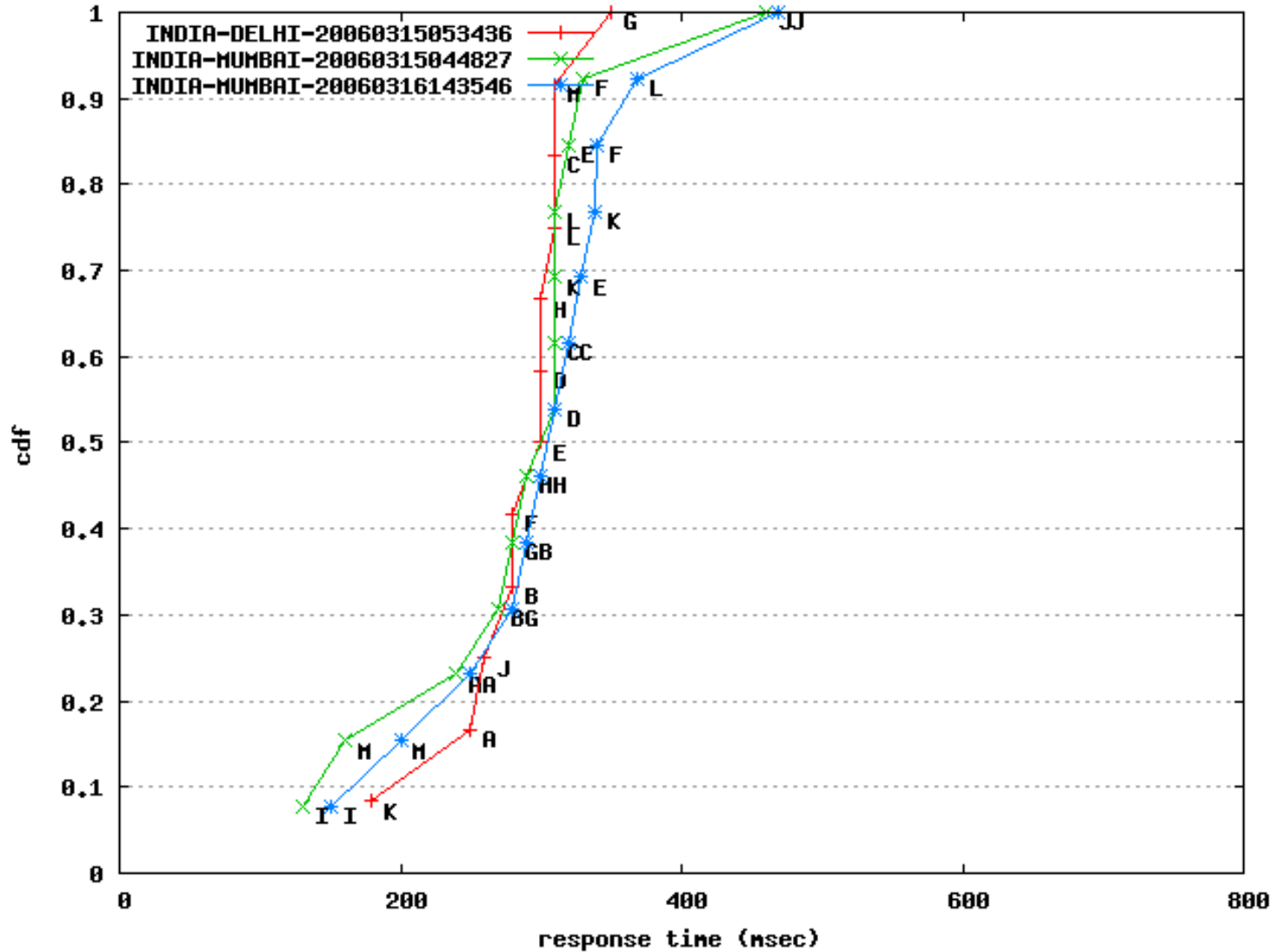
# RTT results from CHINA



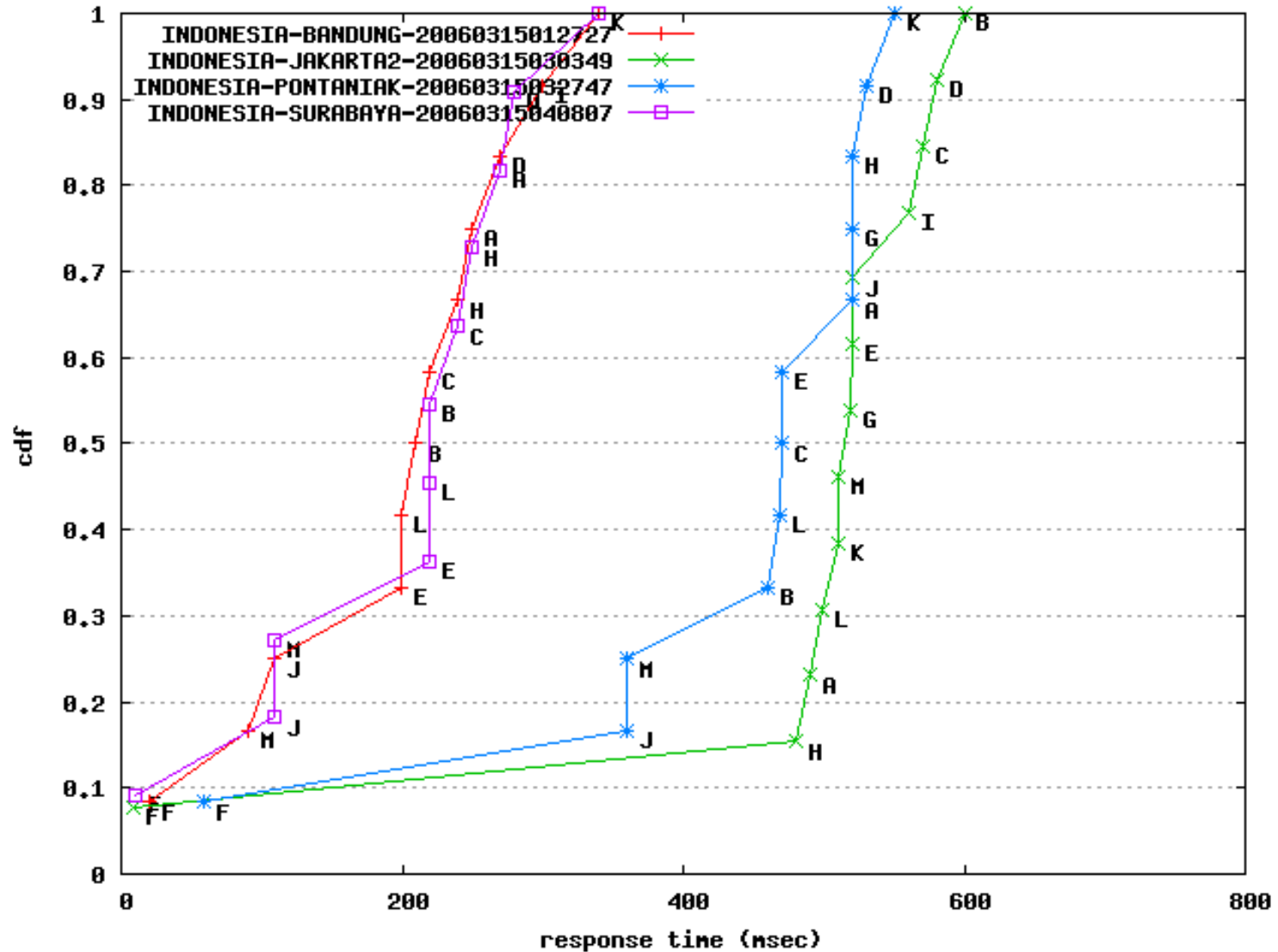
# RTT results from Hong Kong



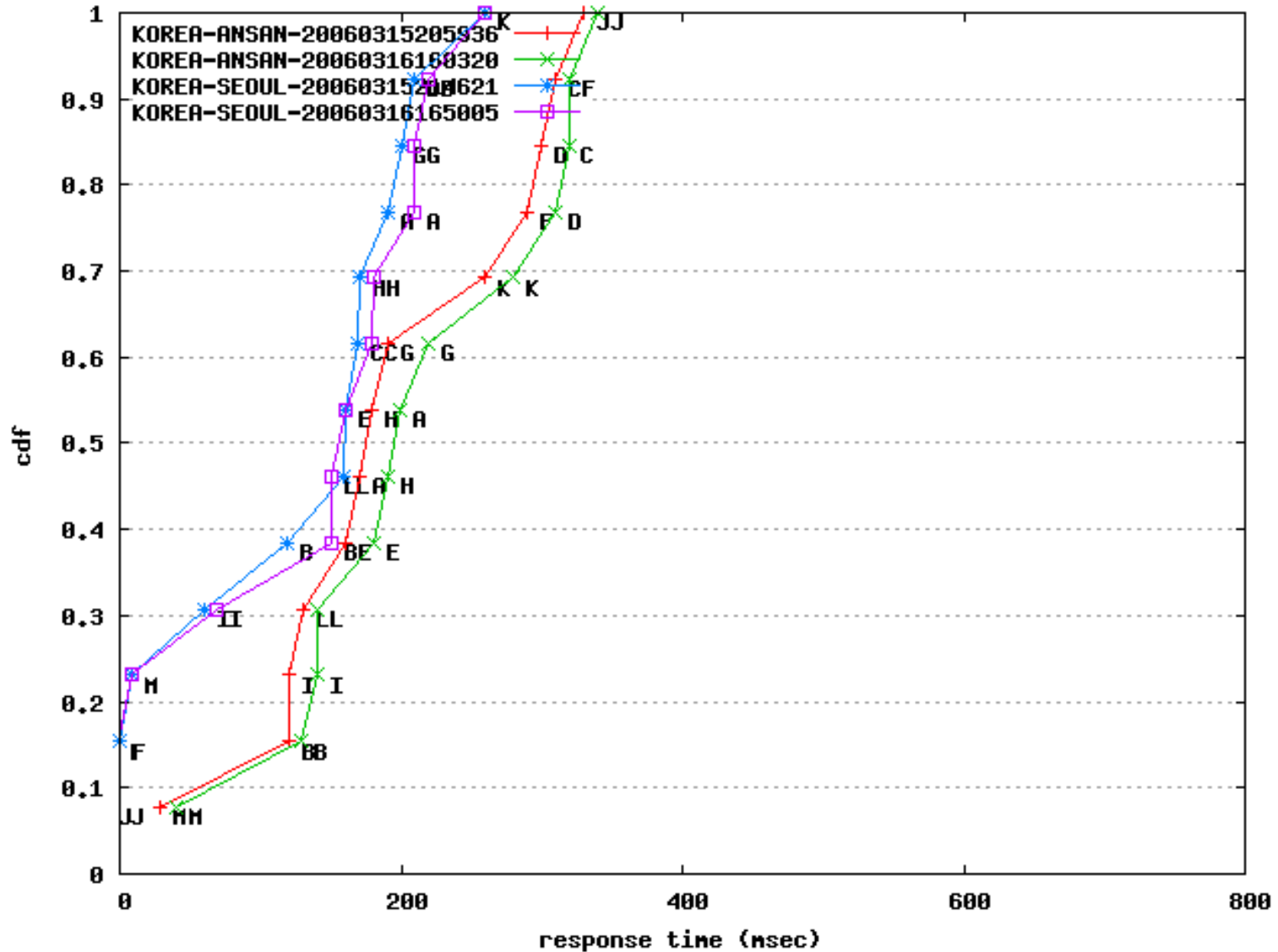
# RTT results from INDIA



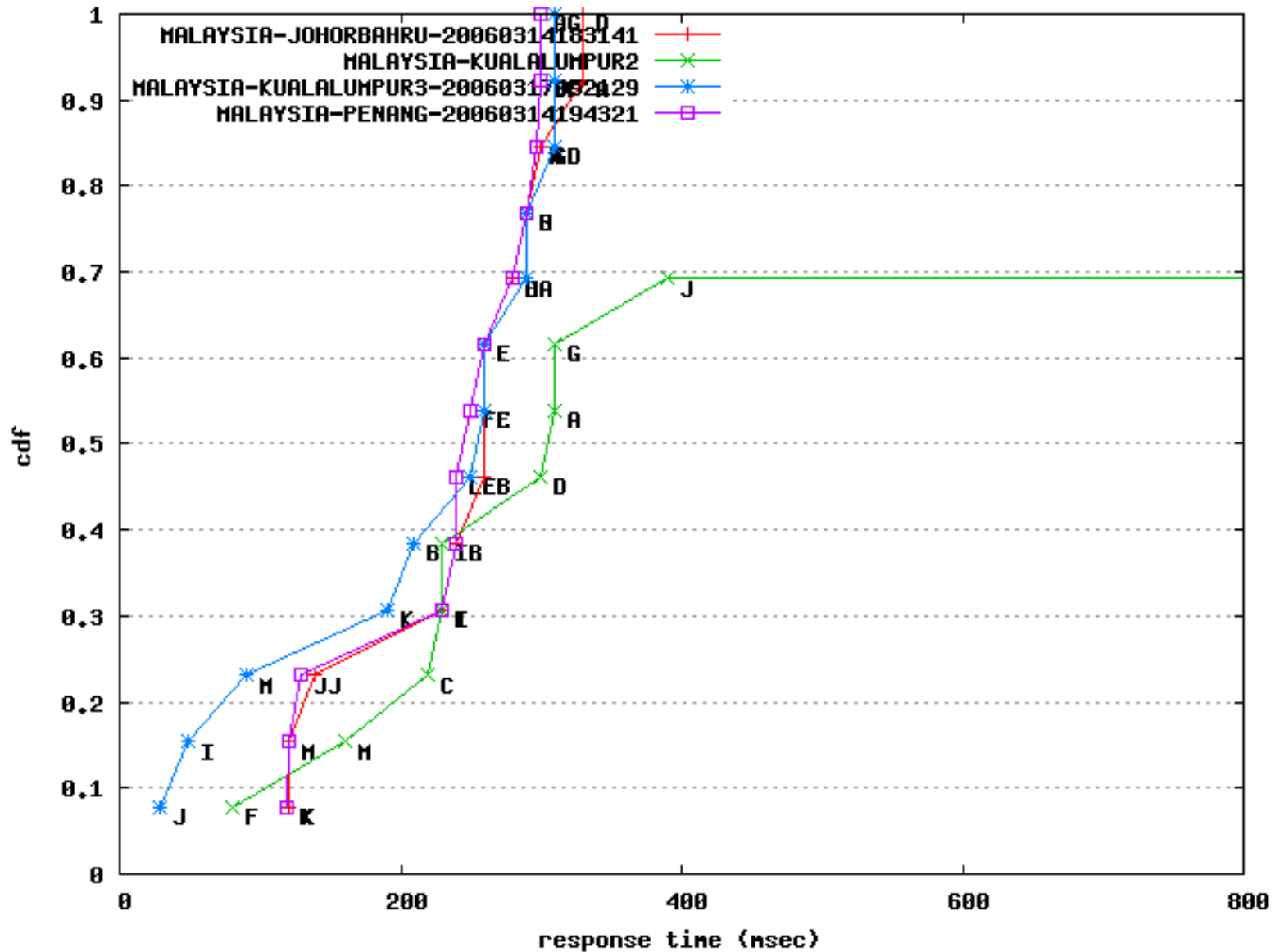
# RTT results from INDONESIA



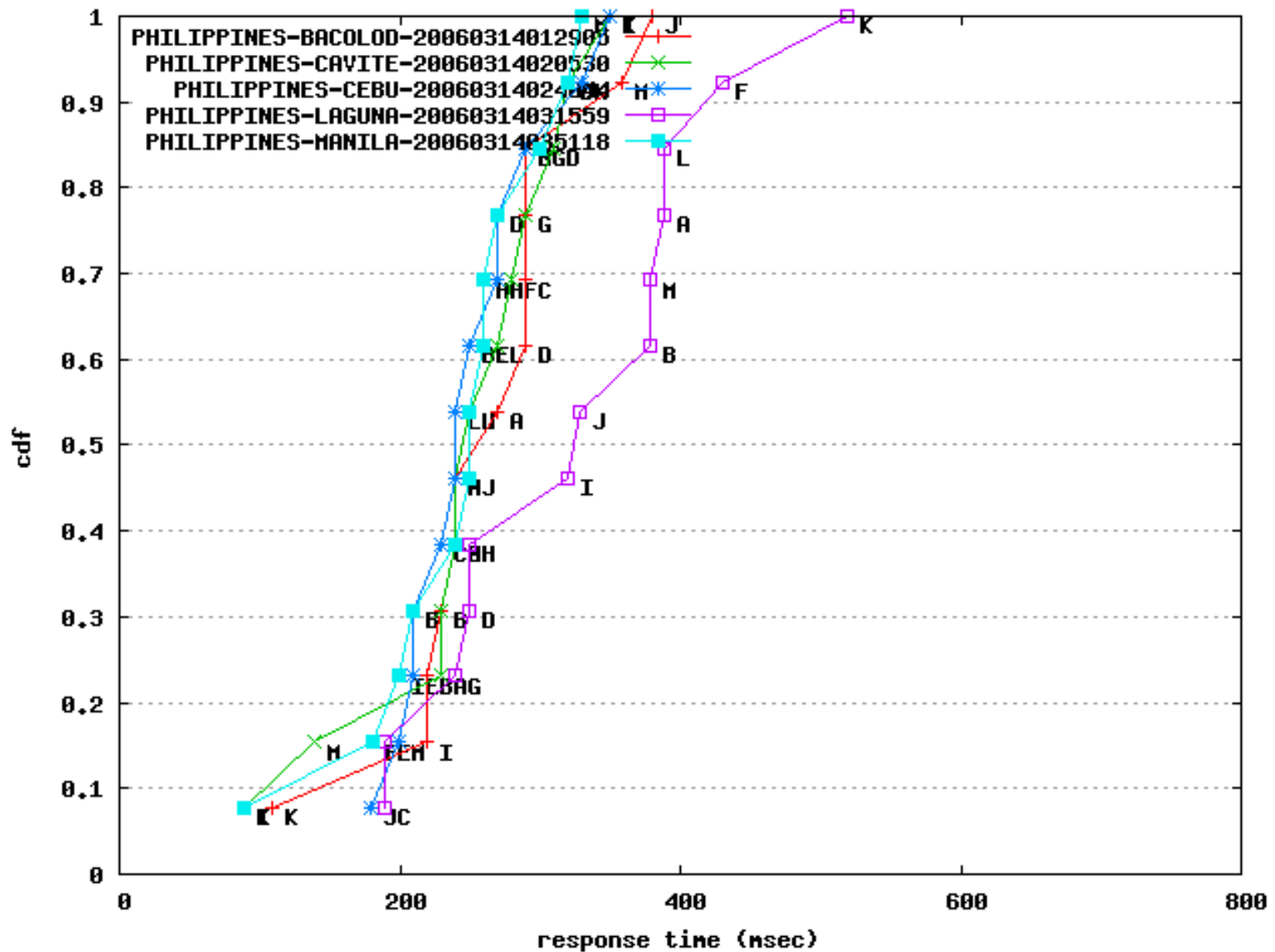
# RTT results from KOREA



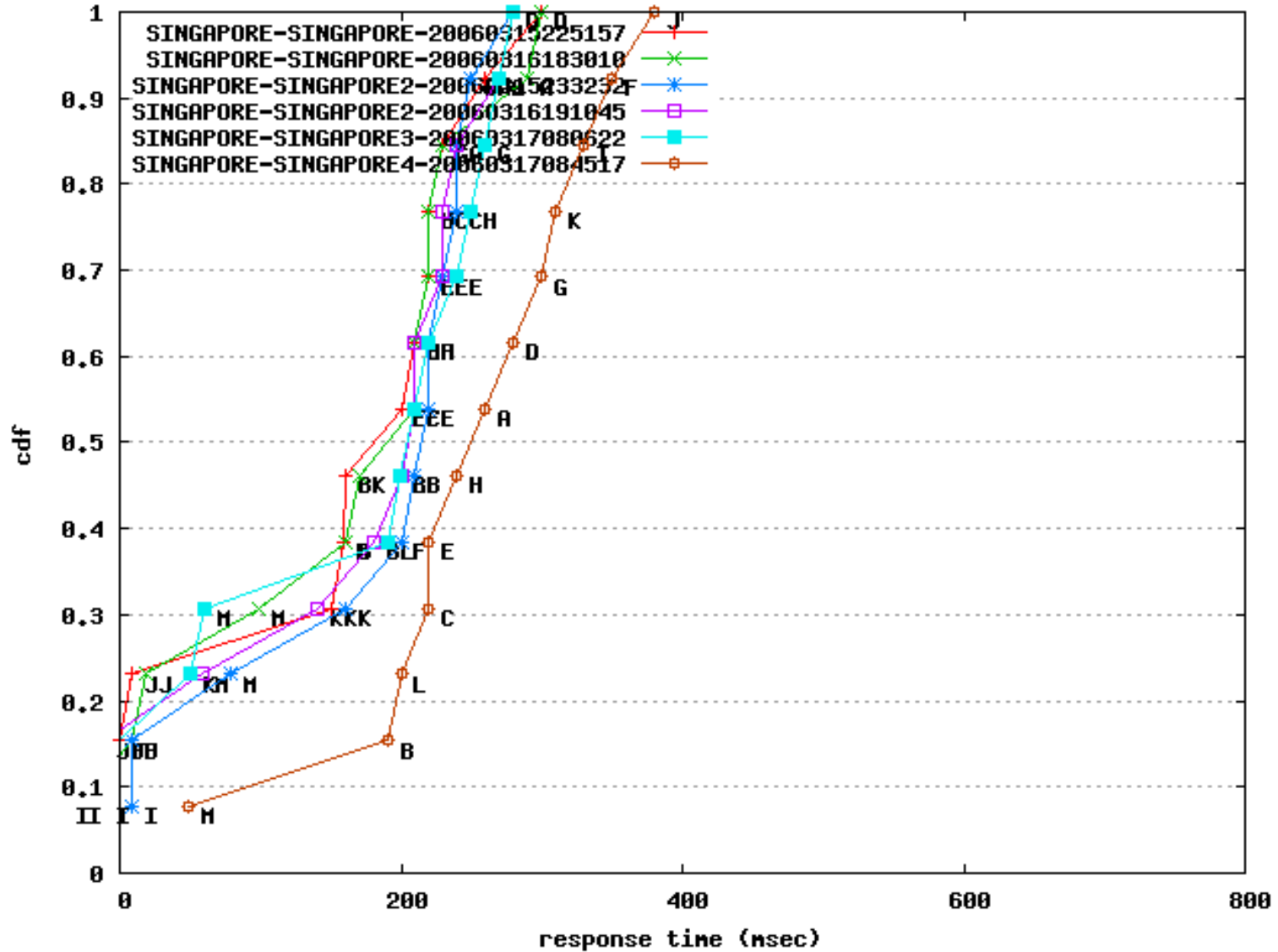
# RTT results from MALAYSIA



# RTT results from PHILIPPINES

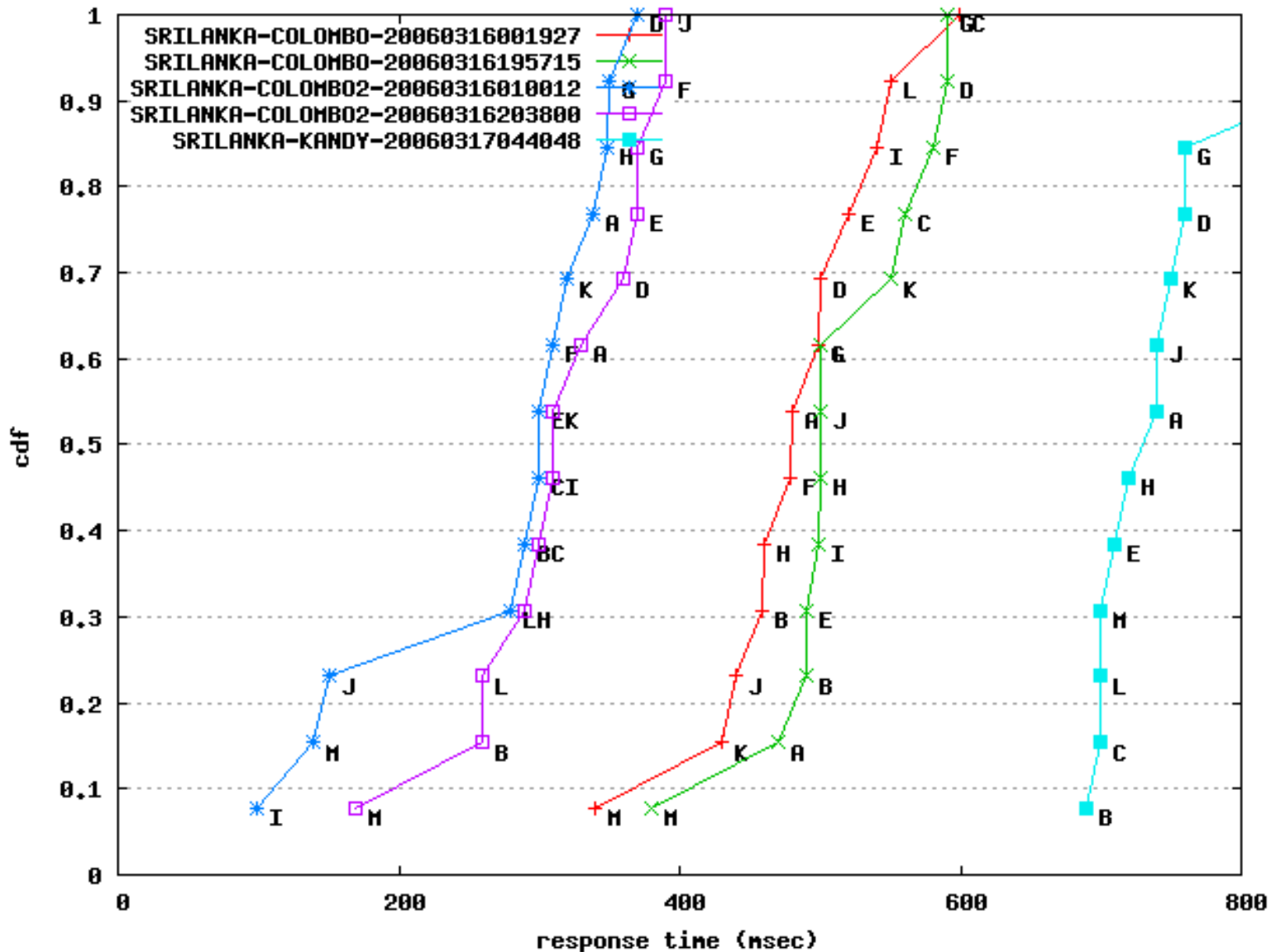


# RTT results from SINGAPORE

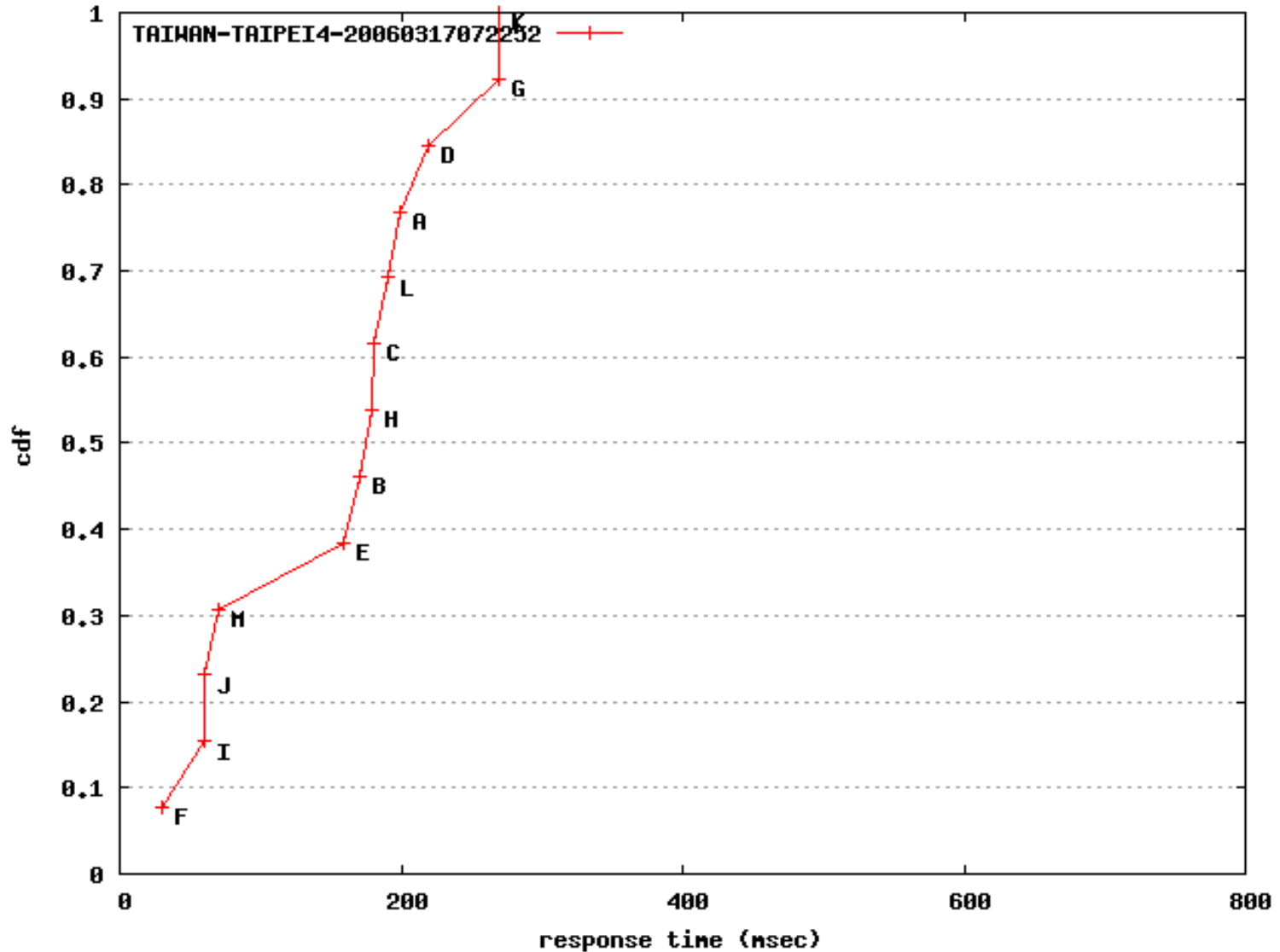




# RTT results from Sri Lanka



# 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.