

Trends in Japanese Residential Traffic

ISOC Panel on Internet Bandwidth: Dealing with Reality

Kenjiro Cho (IIJ/WIDE)

November 10 2009



about me

Kenjiro Cho

- ▶ senior researcher at IJ, a commercial ISP in Japan
- ▶ a board member of WIDE, a research consortium in Japan

involved in residential traffic measurement since 2004

- ▶ data analysis of IJ's traffic
- ▶ data collection from other ISPs
- ▶ publications/talks on Japanese residential traffic

residential broadband subscribers in Japan

30.9 million broadband subscribers as of June 2009

- ▶ reached 63% of households, increased by only 3% in 2008

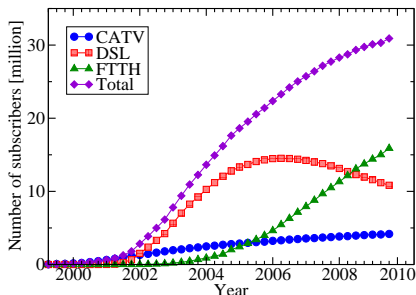
- ▶ FTTH:15.9 million, DSL:10.8 million, CATV:4.2 million

shift from DSL to FTTH

- ▶ 100Mbps bi-directional fiber access costs 40USD/month

 - ▶ 200M/100M, 1G/1G also available

- ▶ 60% of Internet traffic in Japan is residential traffic



residential broadband subscribers in Japan

data collection experiences

our data collection with 6 ISPs started in 2004

- ▶ covering 42% of Japanese traffic
- ▶ voluntary effort by ISPs

to answer concerns about rapid growth of residential traffic

- ▶ ISPs' concerns are often not shared by other parties because no data is available
 - ▶ e.g., technologies, fairness, profitability
- ▶ although most ISPs internally measure their traffic
 - ▶ data is seldom made available to others
 - ▶ measurement methods and policies differ from ISP to ISP

what is specific to Japan?

- ▶ high penetration of fiber access leads to a larger skew in bandwidth usage among users

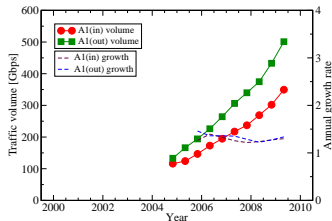
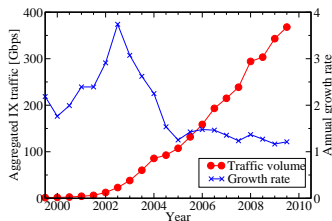
traffic growth

why is traffic growth important?

- ▶ one of the key factors driving research, development and investment in technologies and infrastructures
- ▶ what is crucial is the balance between demand and supply
 - ▶ network capacity also grows 50% per year by various sources

traffic growth of the peak rate at major Japanese IXes

- ▶ modest growth of about 40% per year since 2005
- ▶ the number for residential traffic is similar: 30% per year

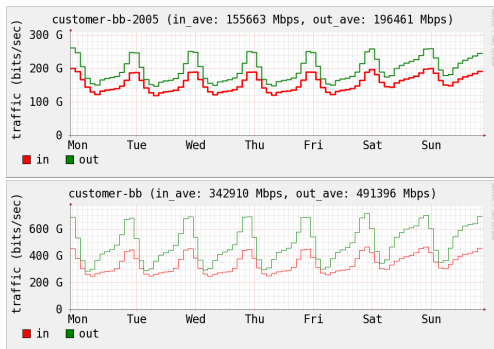


traffic growth at the major Japanese IXes (left) and residential broadband (right)

changes in residential traffic patterns

- ▶ data: aggregated interface counters from 6 ISPs
 - ▶ in/out from ISP's view
- ▶ traffic patterns by home users (peak at 21:00-23:00)
- ▶ 2005: in/out were almost equal (dominated by file-sharing)
- ▶ 2009: outbound (download to users) became larger

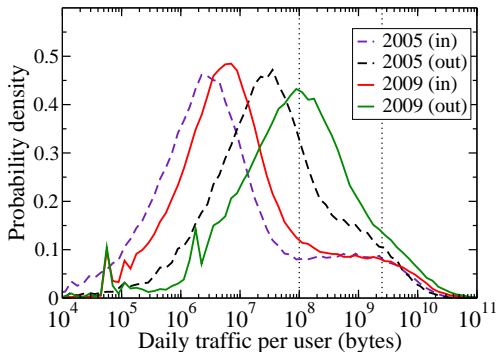
indicates a shift from p2p file-sharing to content services



weekly residential traffic: 2005(top) 2009(bottom)

increasing daily traffic volume per user

- ▶ data: Sampled NetFlow from IJ
- ▶ roughly log-normal distribution
 - ▶ with another small peak for heavy-hitters
- ▶ increase in download volume is larger
 - ▶ out mode: from 32MB/day to 114MB/day
 - ▶ in mode: from 3.5MB/day to 6MB/day

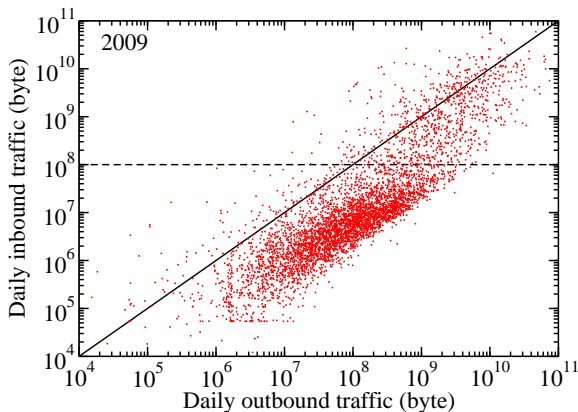


probability distribution of daily traffic per user (2005 vs. 2009)

individual users have different traffic mix

2 clusters: client-type users and peer-type heavy-hitters

- ▶ no clear boundary: heavy-hitters/others, client-type/peer-type
- ▶ most users use both client-server and p2p style applications



in/out volumes per user in 2009

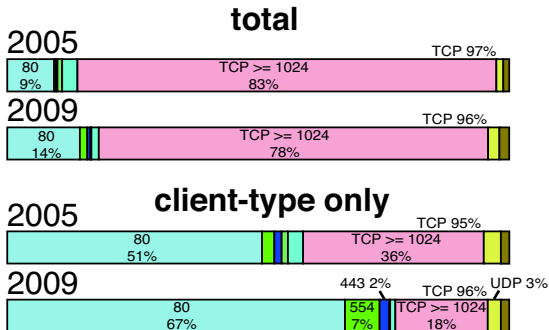
protocol/port usage

extract client-type users with threshold: 100MB/day upload

- ▶ to observe differences in protocol/port usage
- ▶ port number: $\min(\text{sport}, \text{dport})$
 - ▶ well-known ports for client-server, dynamic ports for p2p

observations

- ▶ dominated by TCP dynamic ports (but each port is tiny)
- ▶ TCP port 80 is increasing (again)



key observations

- ▶ growth of Japanese residential traffic
 - ▶ stable at around 30% per year for the last 5 years
- ▶ shift in traffic patterns
 - ▶ p2p file-sharing is still dominant in volume
 - ▶ but a shift to content services is clear
 - ▶ individual users have diverse traffic mix

other observations

- ▶ high penetration of fiber access in Japan
 - ▶ leading to a larger skew in bandwidth usage among users
- ▶ congestion issues in increasing mobile wireless access
- ▶ higher growth in international traffic

it is difficult to predict future traffic

- ▶ significantly impacted by the behavior of heavy-hitters
 - ▶ technical factors: content caching, CDN, QoS
 - ▶ economic factors: access cost, capacity/equipment costs
 - ▶ political/social factors: net-neutrality, content management

references

- [CFEK2008] K. Cho, K. Fukuda, H. Esaki, and A. Kato.
Observing Slow Crustal Movement in Residential User Traffic.
ACM CoNEXT2008, Madrid, Spain, Dec. 2008.
- [CFEK2006] K. Cho, K. Fukuda, H. Esaki, and A. Kato.
The impact and implications of the growth in residential user-to-user traffic.
ACM SIGCOMM2006, Pisa, Italy, Aug. 2006.
- [Cisco2008a] Cisco.
visual networking index – forecast and methodology, 2007-2012.
June 2008.
- [Cisco2008b] Cisco.
Approaching the zettabyte era.
June 2008.
- [Odlyzko2008] A. M. Odlyzko.
Minnesota Internet traffic studies.
<http://www.dtc.umn.edu/mints/home.html>.
- [TeleGeography2007] TeleGeography Research.
Global Internet Geography.
2007.
- [MFPA2009] G. Maier, A. Feldmann, V. Paxson, and M. Allman.
On Dominant Characteristics of Residential Broadband Internet Traffic.
IMC2009, Chicago, IL, Nov. 2009.