Residential broadband traffic in Japan

(PAM2009 Industry panel)

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National Institute of Informatics/
WIDE Project

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About our data

- Characterization of nation-wide residential broadband traffic in Japan since 2004, with 6 ISPs, academia, and MIC.
  - 6 major ISPs (share 43%) : IIJ, KDDI, K-Opticom, NTT Com., Softbank BB, Softbank Telecom
  - Data: SNMP (from 6 ISPs) and sampled Netflow (from 1 ISP)

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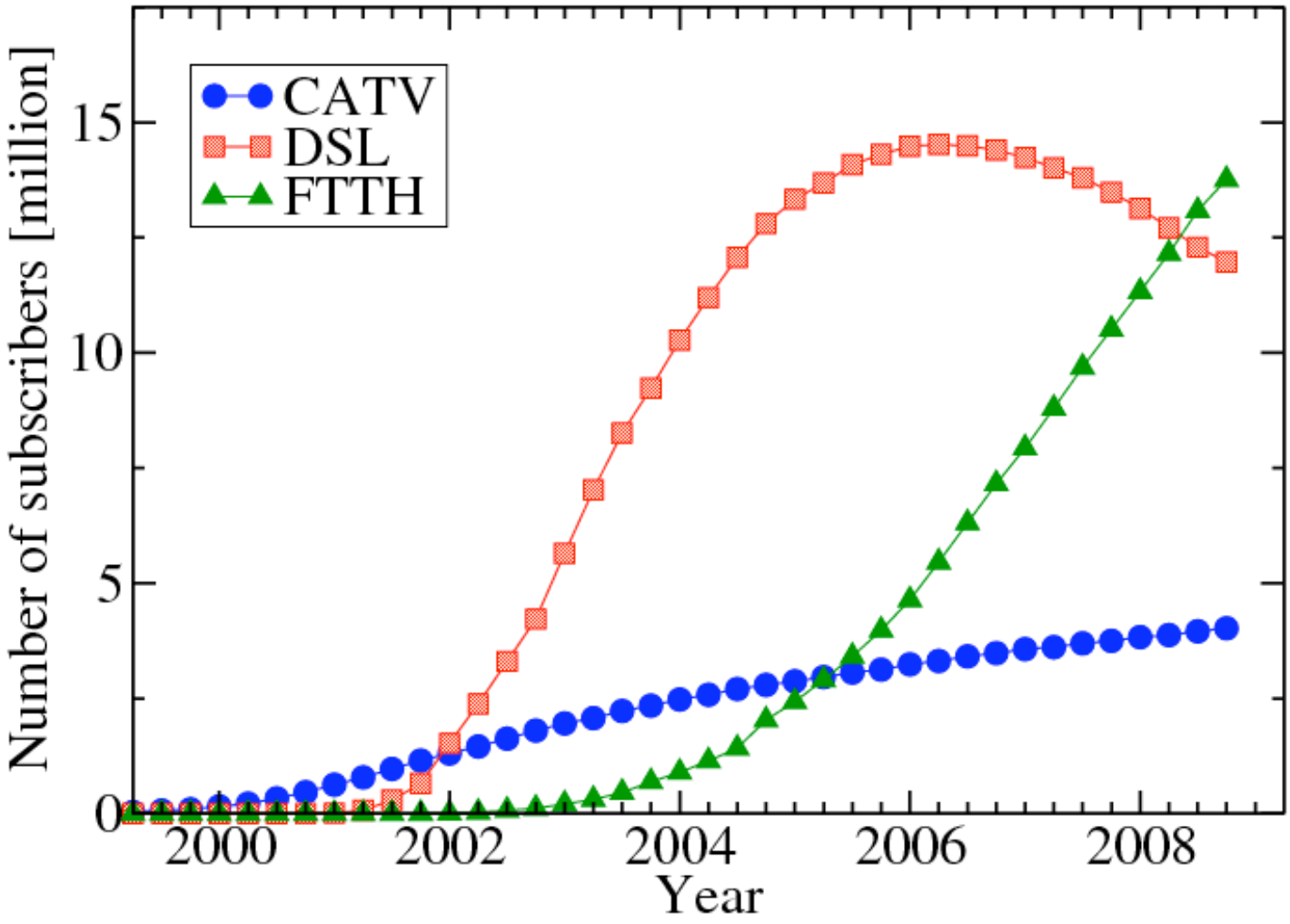
#broadband subscribers

by MIC



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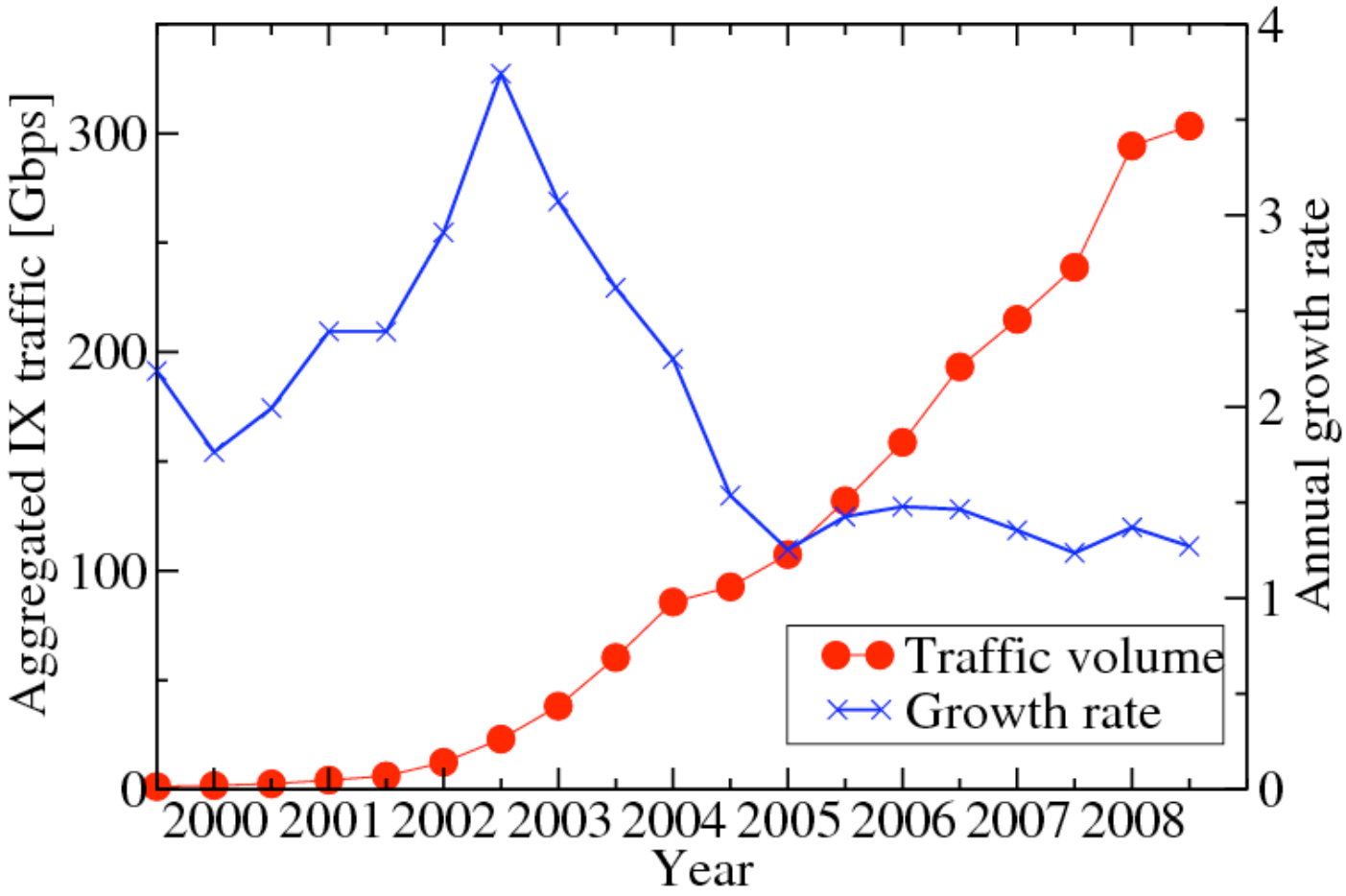
Growth of major IXes traffic

by JPIX/JPNAP/NSPIXP



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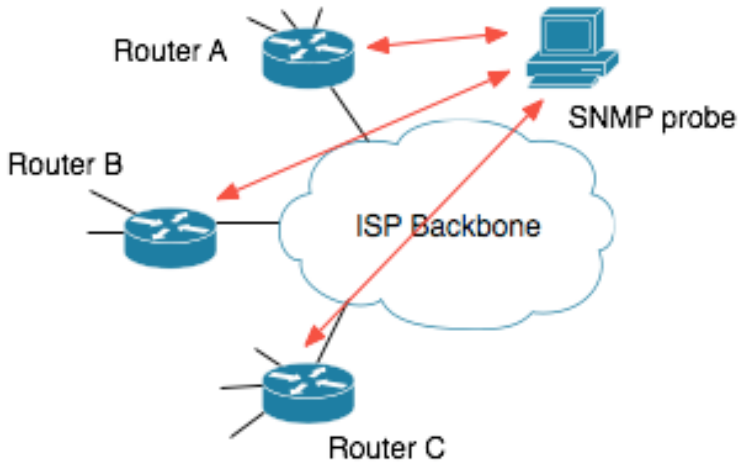
Traffic collection

- All ISPs collect SNMP data (MRTG/RRDTools)
  - 1 month byte counter data (2hour bin) of all interfaces
- Sum up related interface data in 6 ISPs
  - traffic class and direction



Router A: IF A: 3192/2312
Router A: IF B: 1234/1134
Router A: IF C: 4192/3321
Router A: IF D: 5123/1092

Router B: IF A: 3212/1111
Router B: IF B: 9500/3211
Router B: IF C: 8412/7912

Router C: IF A: 1232/0900
Router C: IF B: 4311/1324
Router C: IF C: 0300/2401
Router C: IF D: 2321/1221

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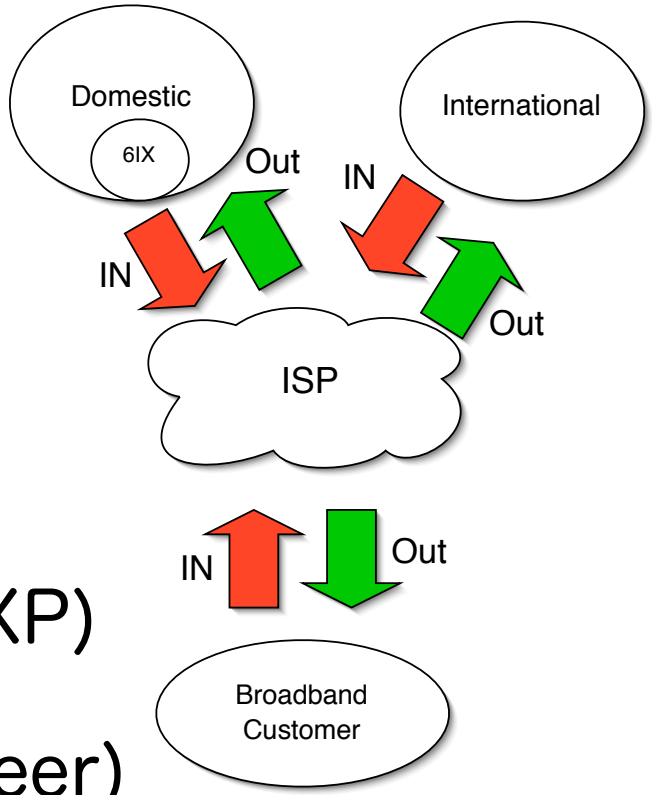
Traffic class and direction

- View from ISP side
  - Customer edge (A)
    - A1: RBB customer
  - ISP edge (B)
    - B1: 6IXes (JPIX/JPNAP/NSPIXP)
    - B2: Other Domestic (private peer)
    - B3: International



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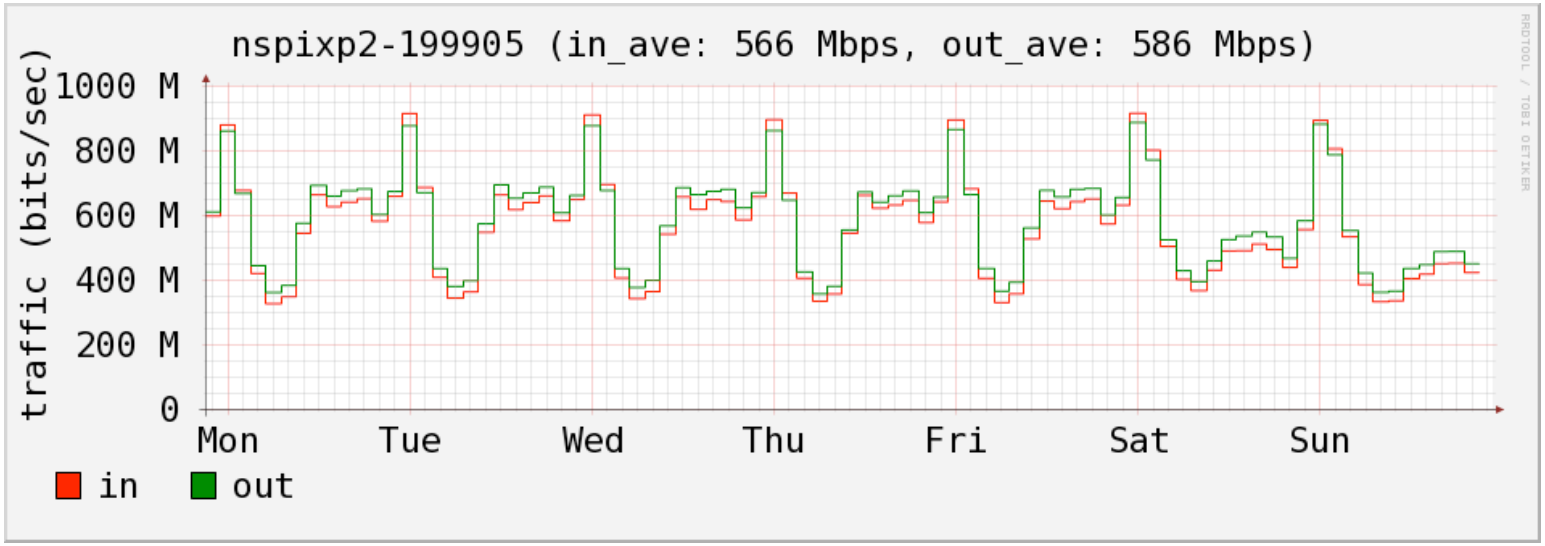
Pre-broadband age

at NSPIXP, May1999



- Indifferentiable jump at 11pm
  - measured (usage-based) rate service in daytime
  - flat rate service in night (23:00-8:00)

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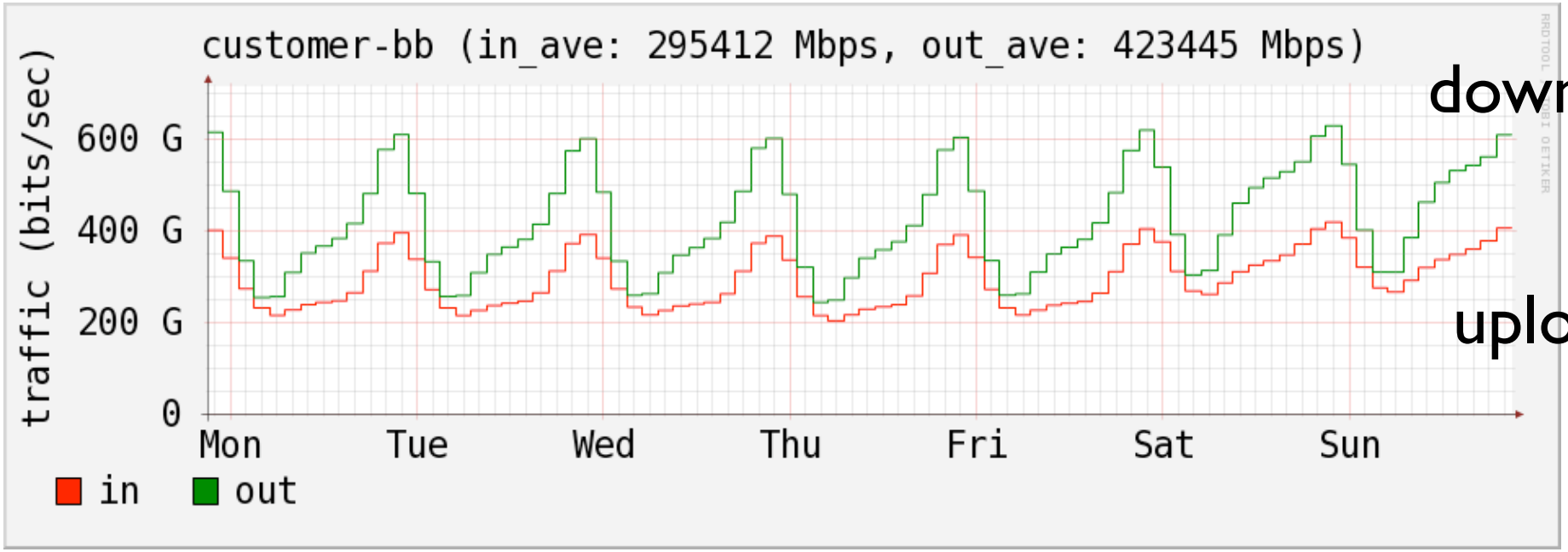
Residential broadband traffic

Nov. 2008



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upload

- Full flat-rate service
  - Peak shifts to prime time (9pm-11pm)!
  - High activity in weekend
- 40% is constant

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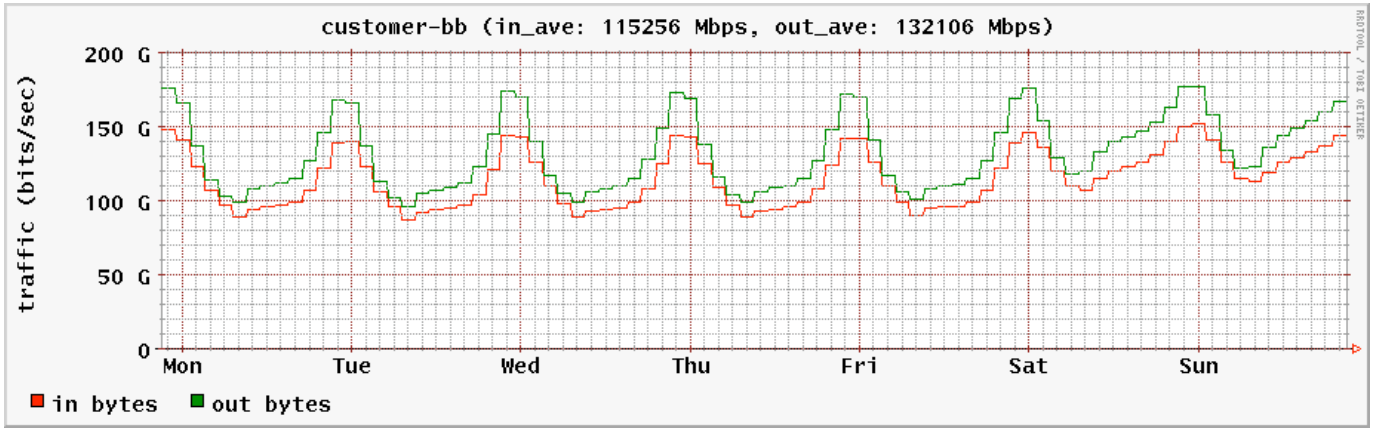
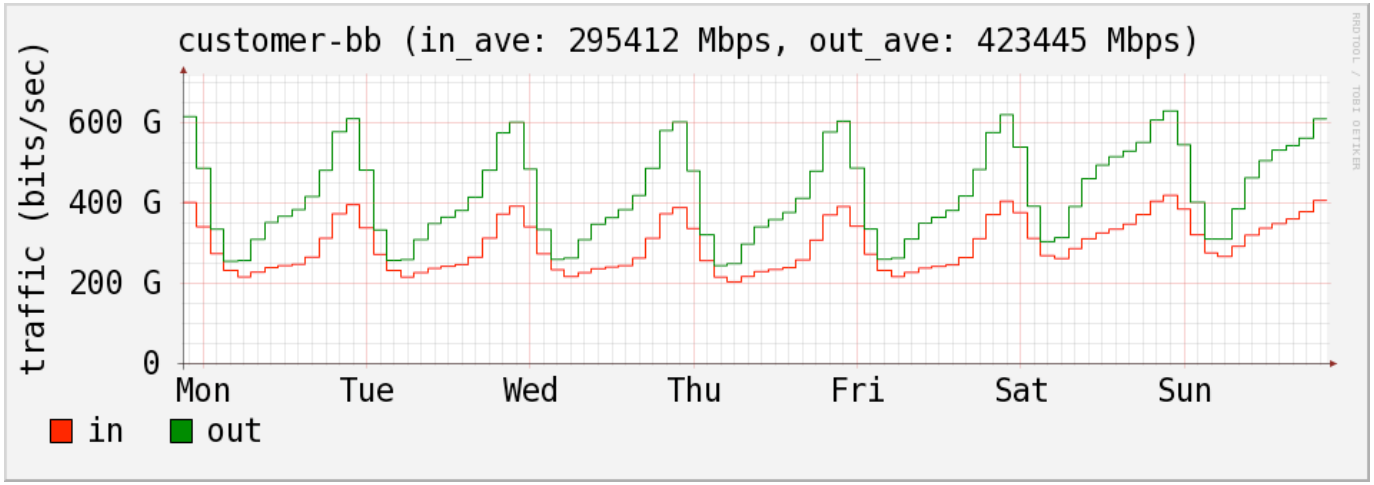
Evolution of user traffic

2004



2008



- Decrease of constant part
- Symmetric to asymmetric in/out traffic

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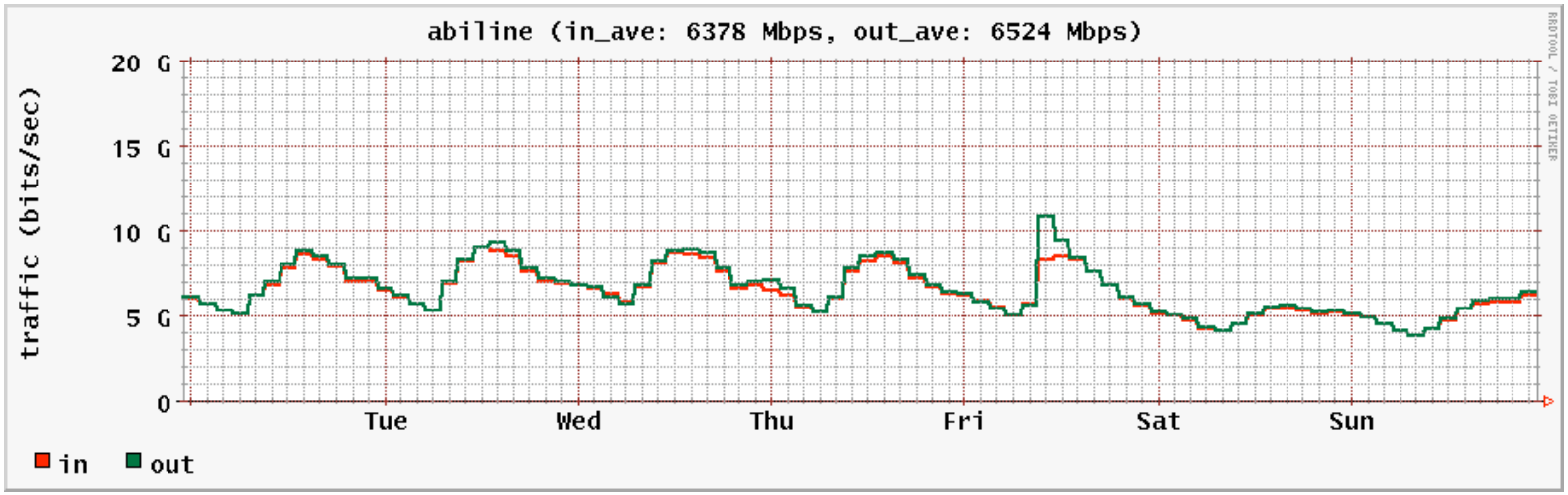
Academic traffic



- Internet2 backbone data
- high activity in daytime during weekday

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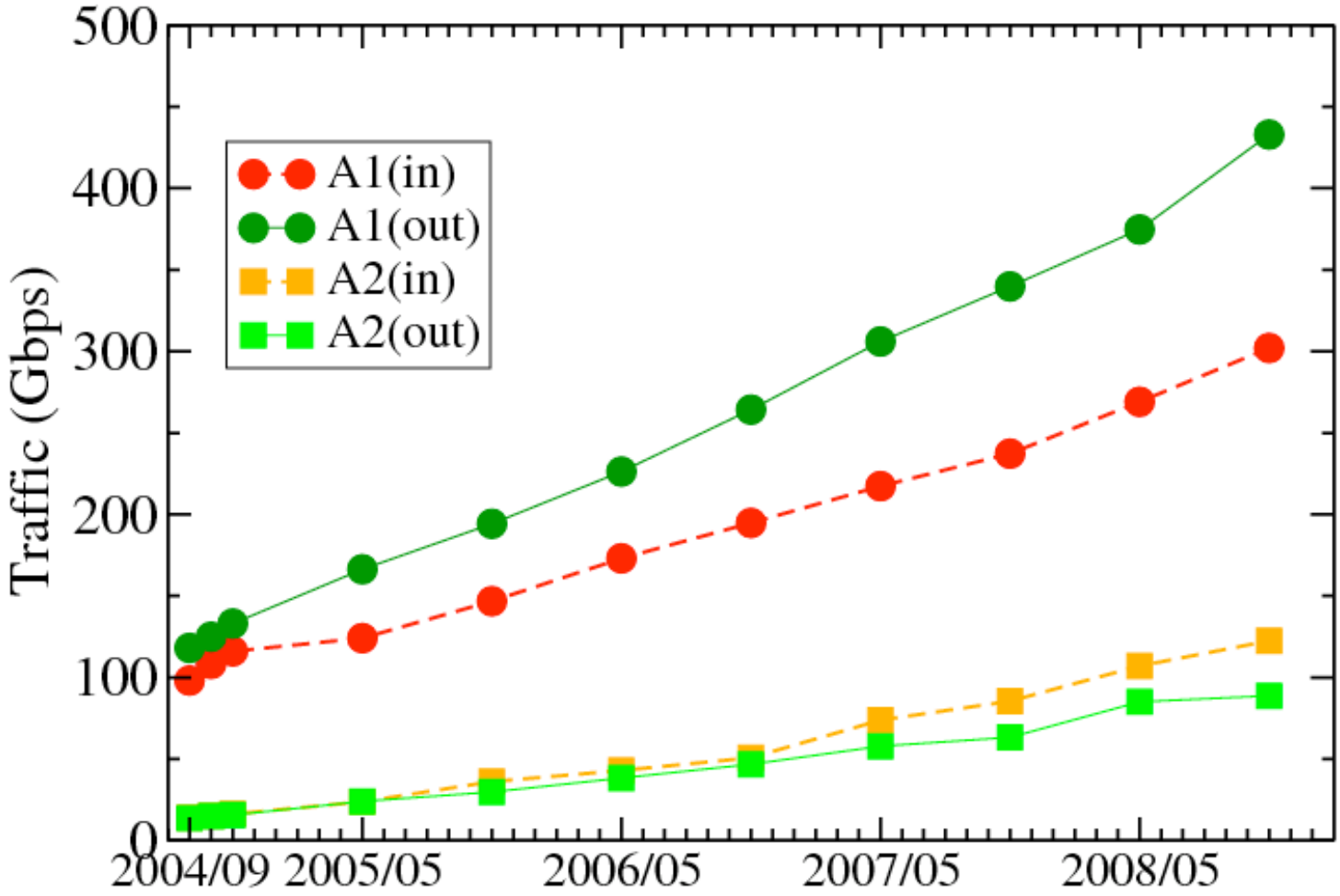
Traffic growth of residential user



- Growth rate: 20-30%/year

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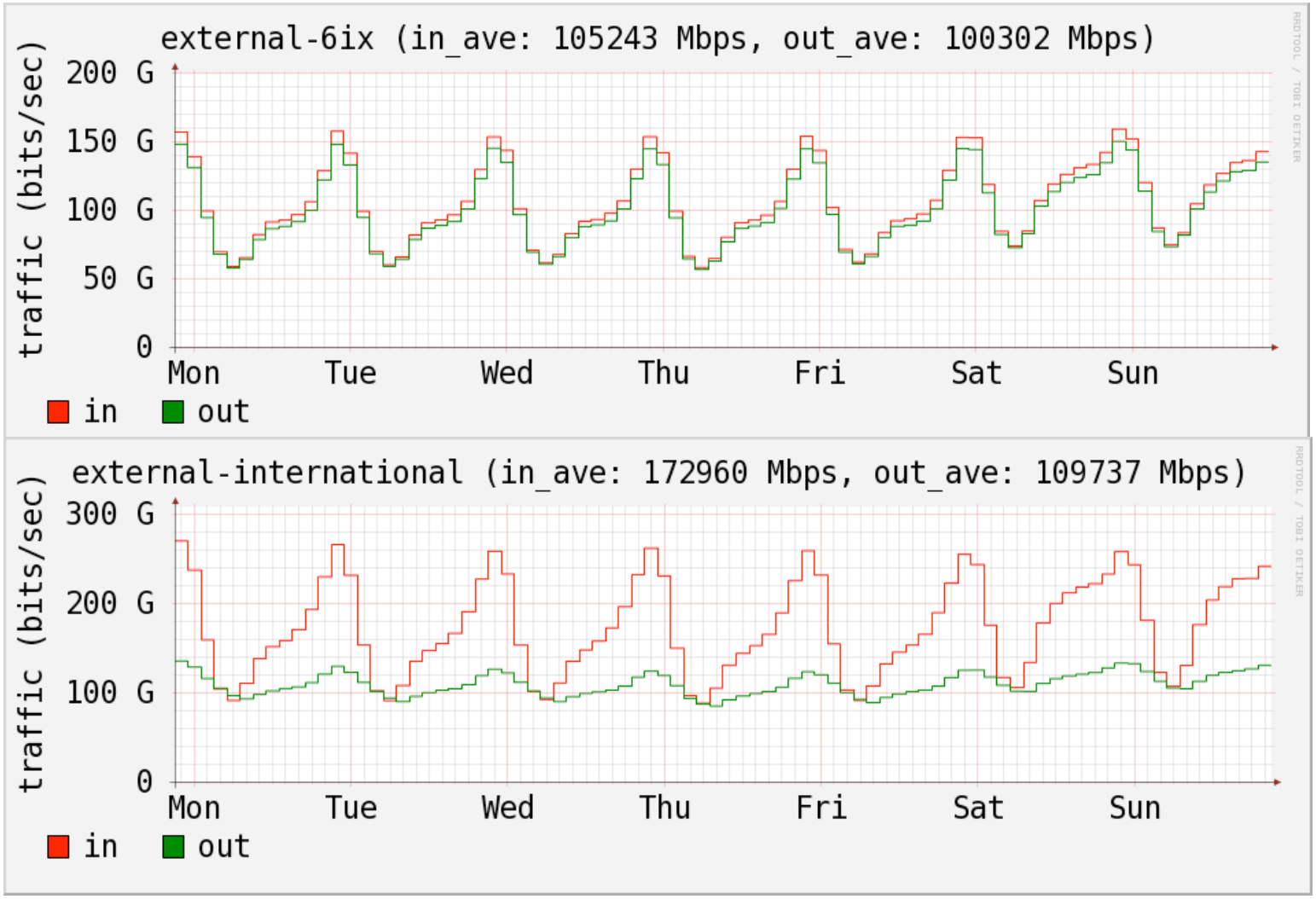
Domestic & International



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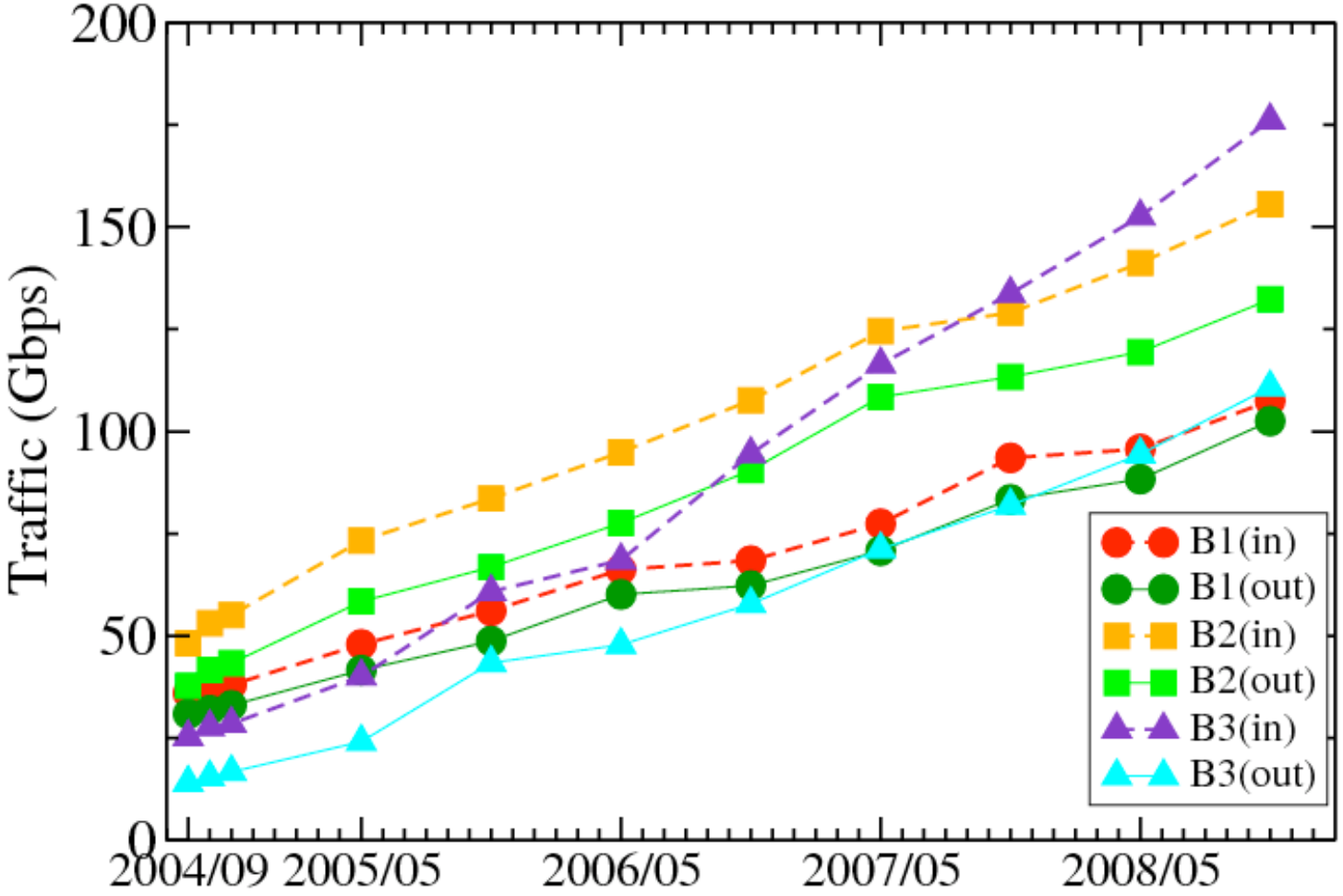
Growth of domestic/ international traffic



6IXes

private peer

intr.

- Domestic: 30%/year
- International: 100%/year

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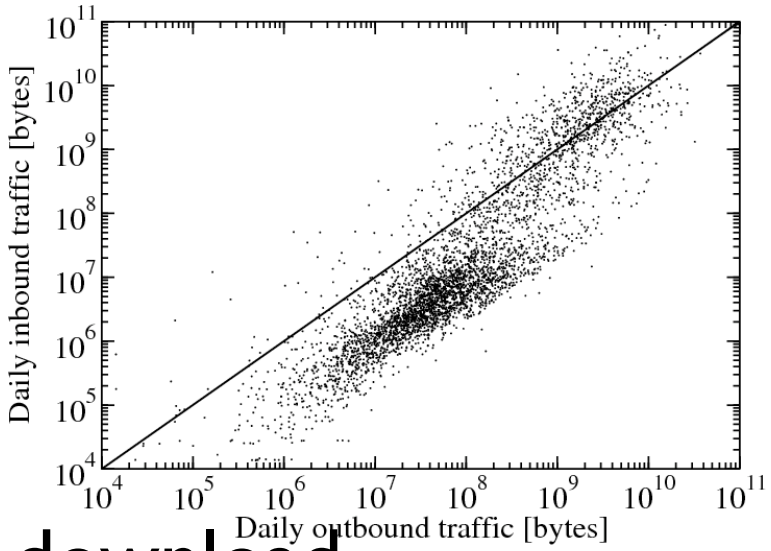
In/Out daily traffic per user

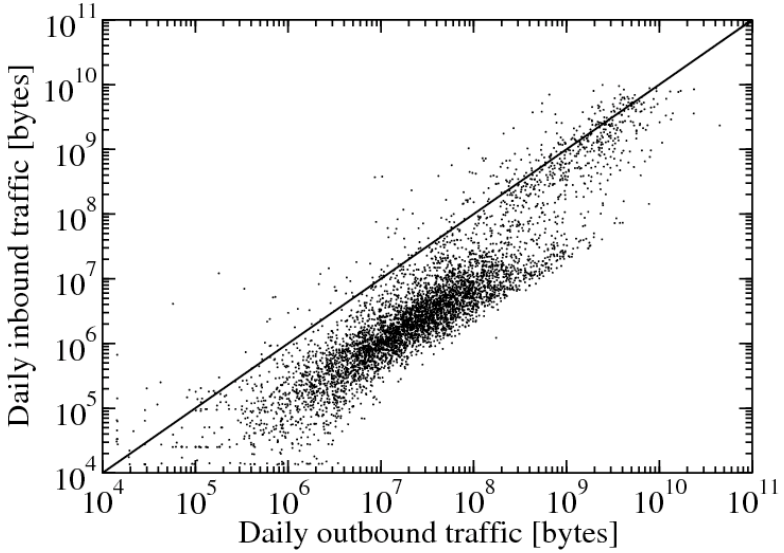
by netflow data

upload

Fiber user



DSL user



download

- Light user: download/upload ≒ 10
- Heavy user: download/upload ≒ 1

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Traffic matrix (2005)

src\dst	ALL	RBB	Dom	Intr
ALL	100.0	84.8	11.1	4.1
RBB	77.0	62.2	9.8	3.9
Dom	18.0	16.7	1.1	0.2
Intr	5.0	4.8	0.2	0.0

- Characterized by GeoIP database
- RBB-RBB (i.e., P2P) accounts for 62.2%

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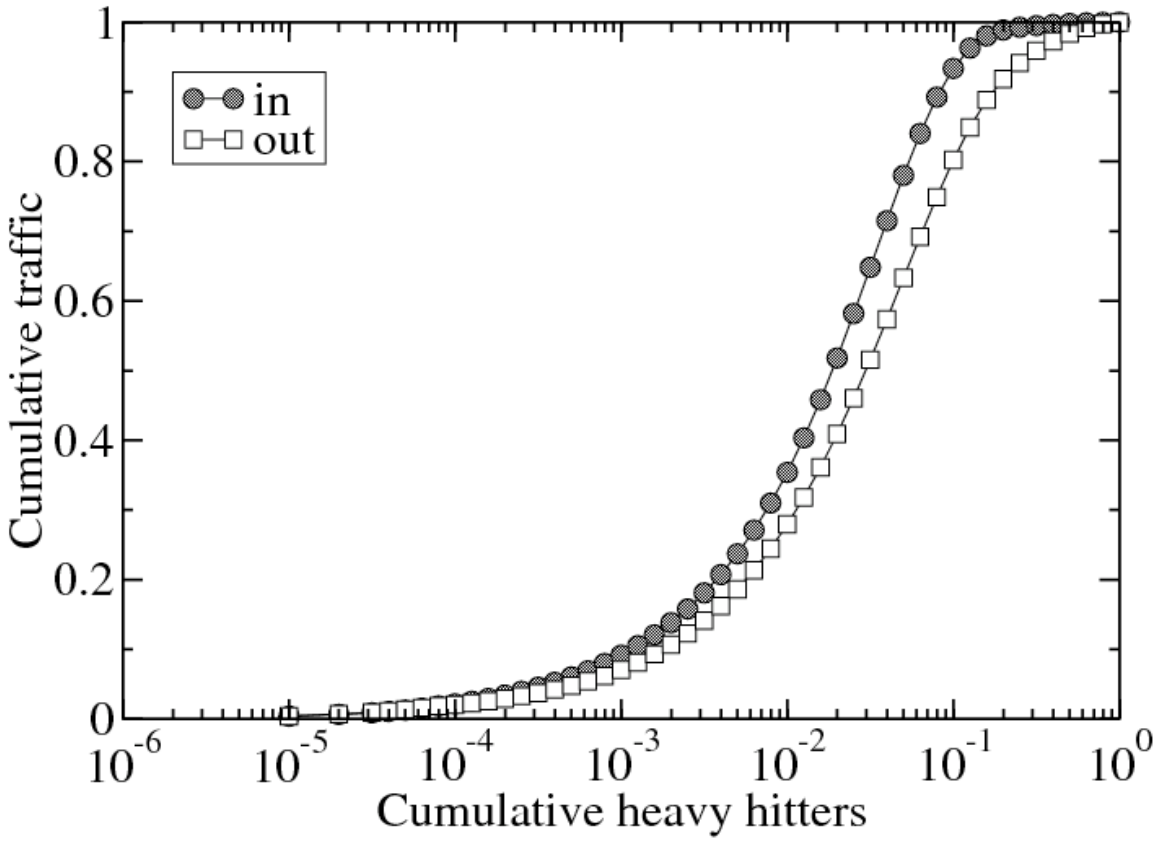
Elephants & Mice



- Top 4% users consume 75% volume!

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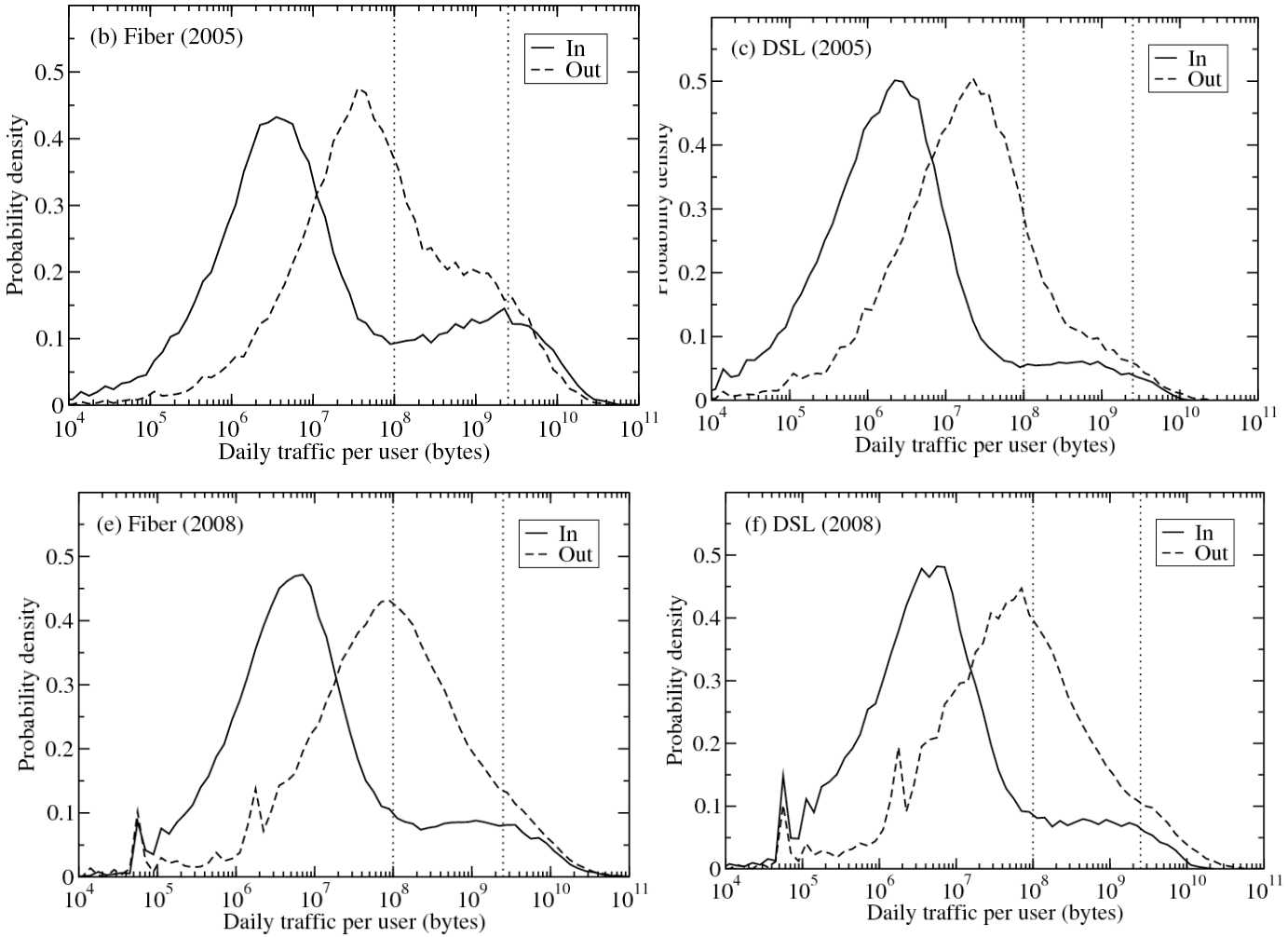
Daily traffic per user



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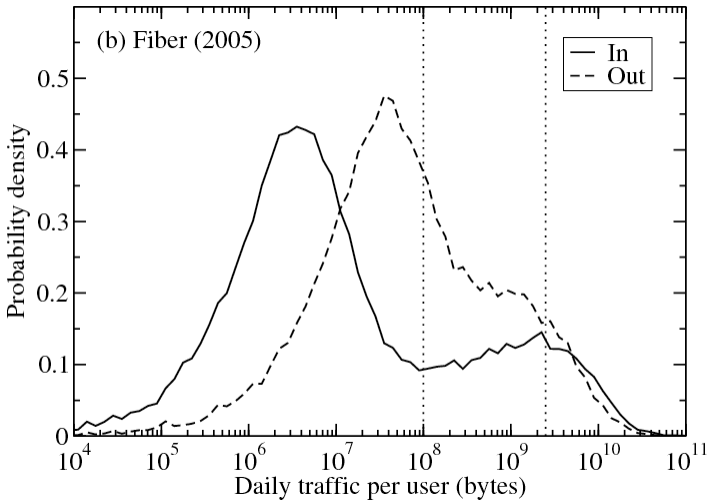
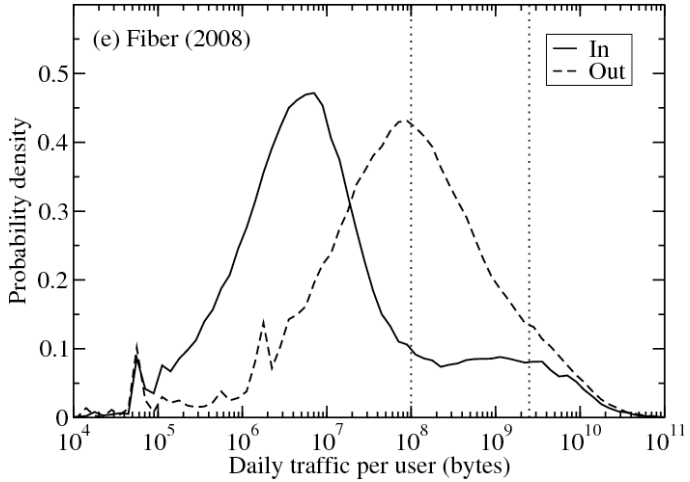
Daily traffic per user





- 2 heavy-tailed distributions
  - mode: 50MB and 2.3GB (2005)
- Lognormal distribution
  - Dist. of income/company size

$$p(x) = \frac{1}{x\sqrt{2\pi\sigma^2}} \exp\left(\frac{-(\log x - \mu)^2}{2\sigma^2}\right)$$

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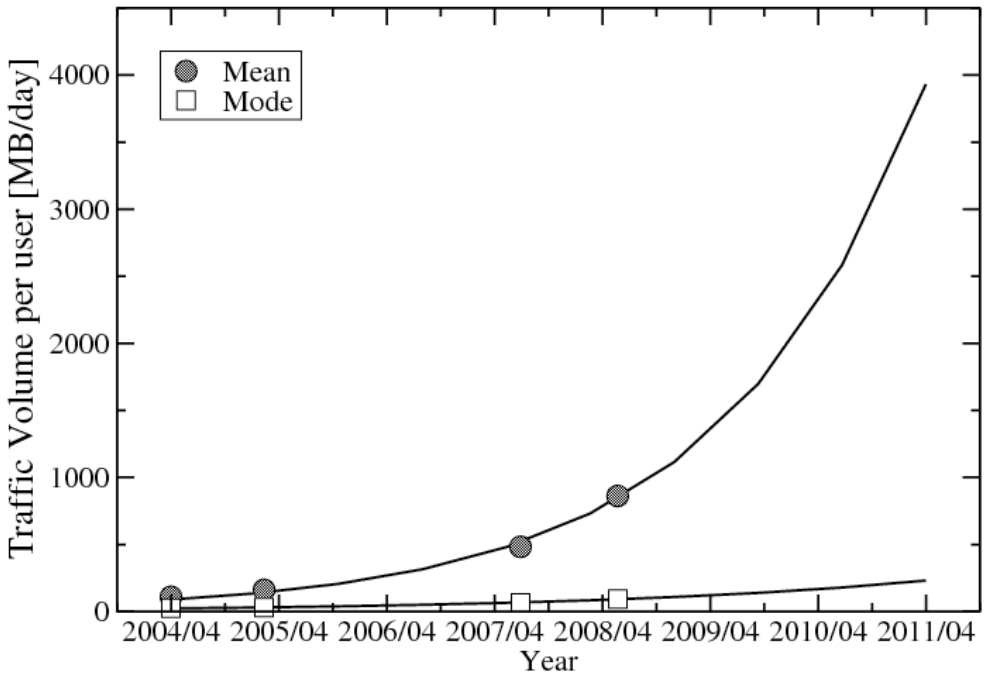
Estimation of traffic growth for “light user”



- Estimation by lognormal distribution
- Jul 2011: 248MB(mode), 4.4GB(mean)

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Protocol breakdown

- 2005:
  - http: 9.3%
  - ftp-data: 0.9%
  - port > 1024: 82%
- 2008:
  - http: 17.8%
  - ftp-data: 0.24%
  - port > 1024: 78%

- Majority is still P2P
- Increase of HTTP
  - Video (e.g., youtube)
  - BW consuming application (e.g., google map)

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Summary

- Traffic growth: 20-30%/year (domestic), 100% (international)
- Top 4% users accounts for 75% volume
- Majority is still P2P, but increase of http traffic

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Reference

- K.Cho, K.Fukuda, H.Esaki, A.Kato, The Impact and Implications of the Growth in Residential User-to-User Traffic (Proc. ACM SIGCOMM 2006)
- K.Fukuda, Towards Modeling of Traffic Demand of Node in Large Scale Network (Proc. IEEE ICC 2008)
- K.Cho, K.Fukuda, H.Esaki, A.Kato, Observing Slow Crustal Movement in Residential User Traffic (Proc. ACM CoNext2008)

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