Broadband traffic analysis (update)

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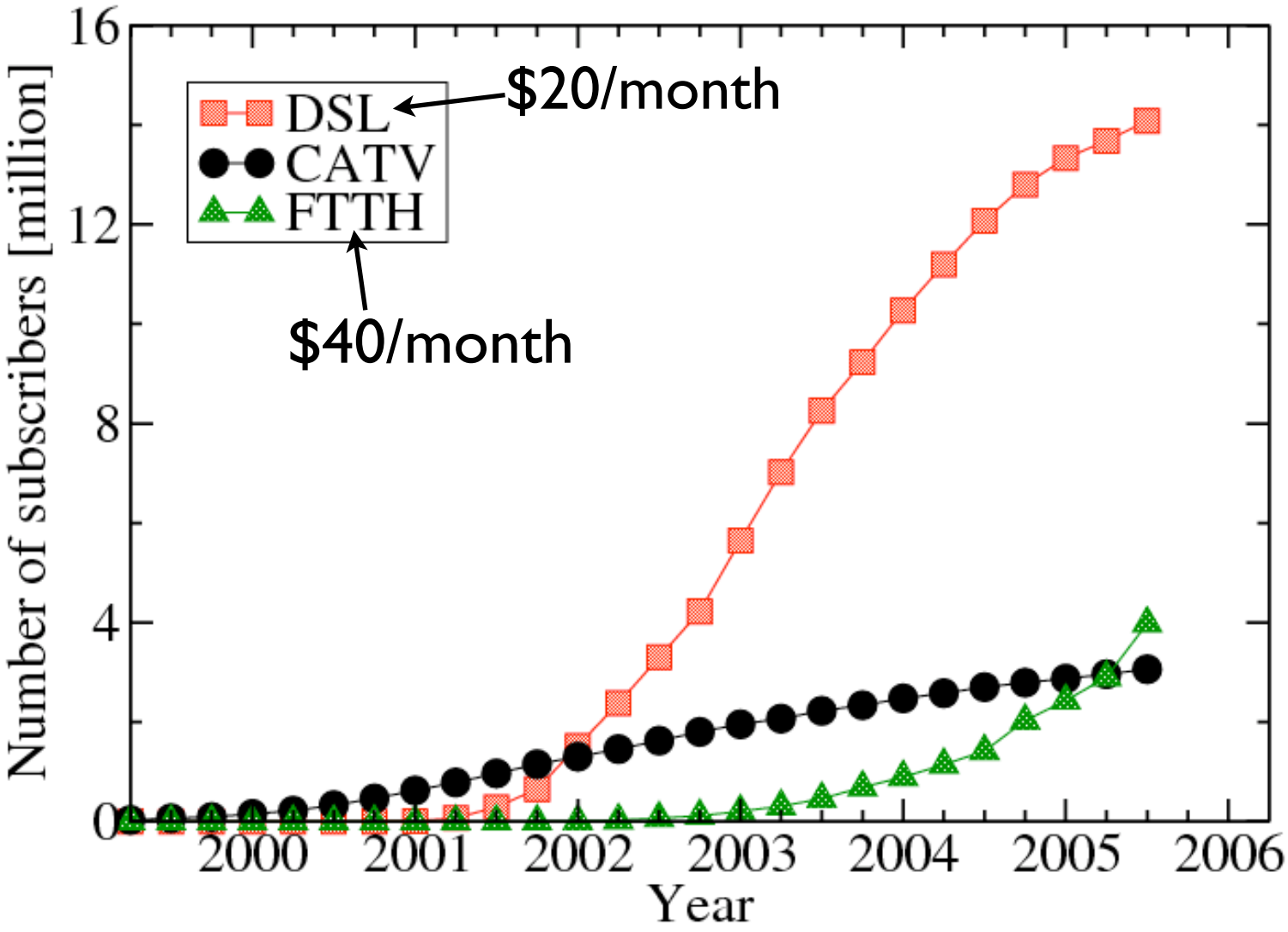
Outline

- Macro-level residential user traffic
  - traffic pattern and growth
- Flow-level residential user traffic
  - differences between fiber/dsl users
  - traffic matrix

Findings

- JP RBB traffic = 468Gbps (Nov.2005)
- Traffic growth = 37-100%/year
- 4% heavy hitters generates > 2.5GB/day
- No clear boundaries between heavy hitters and normal users
- 62% traffic is between users

Increase of residential broadband subscribers in Japan



43%

#households(2005) = 49 millions

Data for macro-analysis

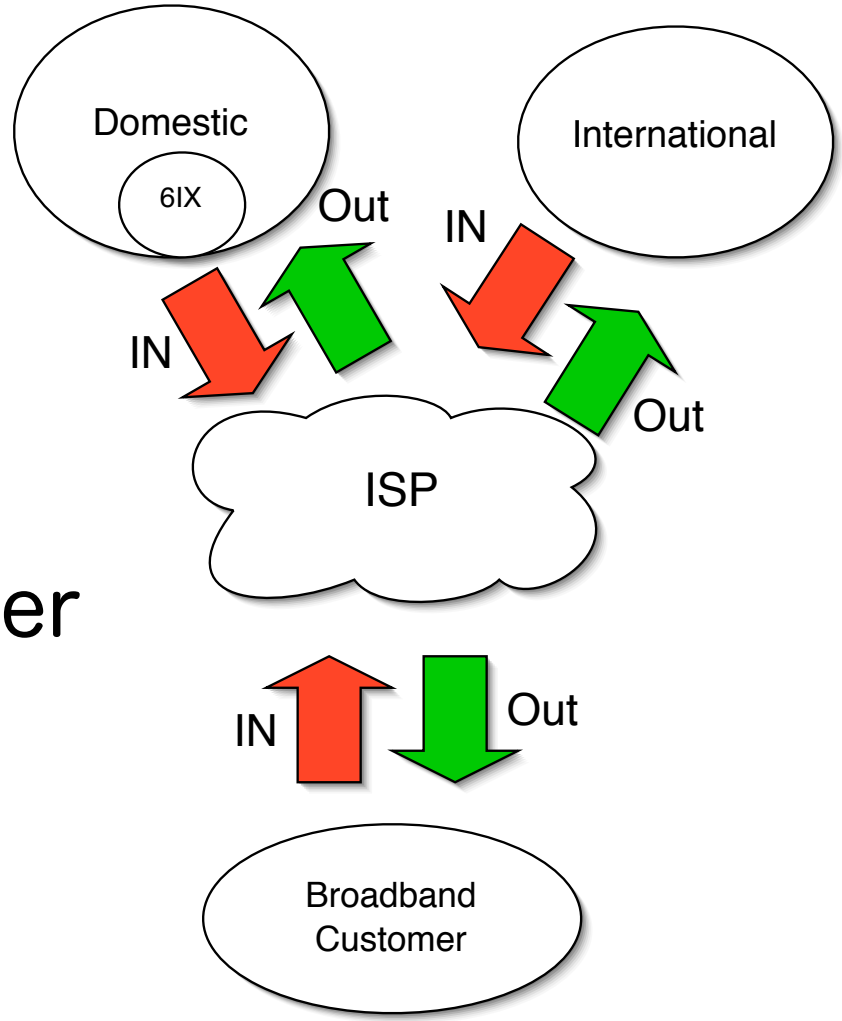
- 7 major Japanese ISPs (iij, japan telecom, kddi, k-opticom, ntt-c, poweredcom, ybb)
- Duration: 2004:Sep, Oct, Nov, 2005:May, Nov
- Raw data: 1-month mrtg/rrdtools (2h. bin) data per interface in a router
- We reconstructed aggregated traffic time series from 7 ISP's data each for 6 categories

Traffic groups

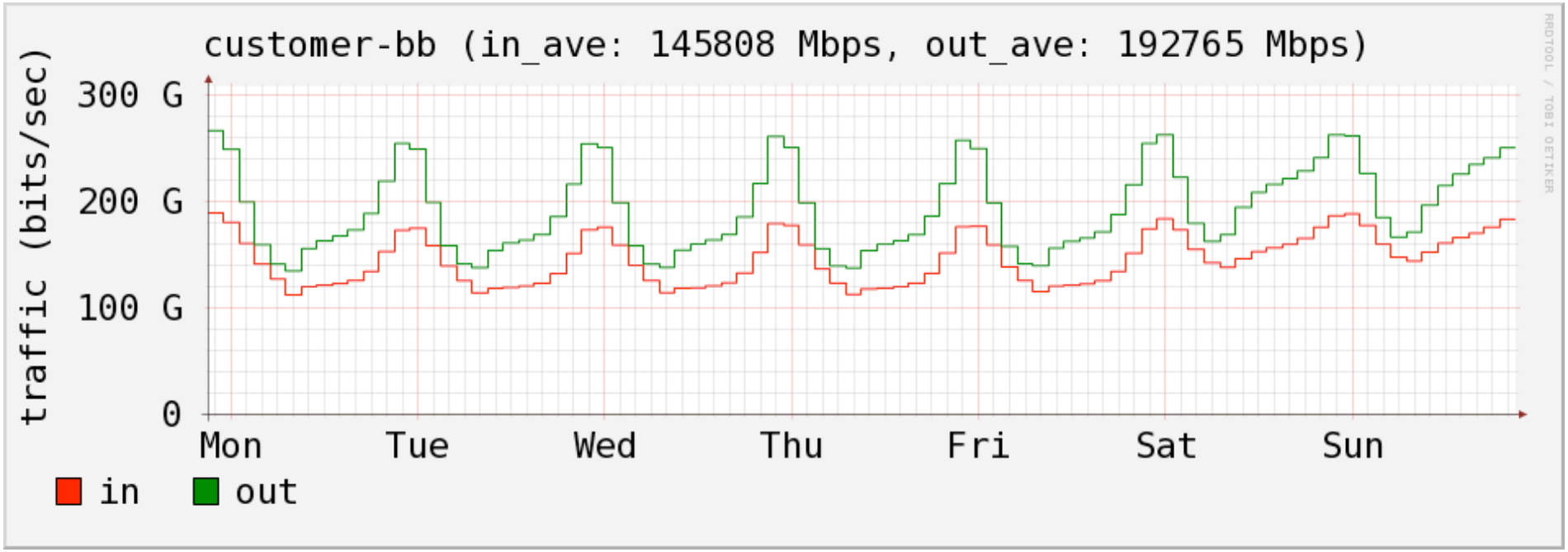
- (A1) RBB customer: ADSL/CATV/FTTH
- (A2) Non-RBB customers: leased lines, data centers, dialups
- (B1) External 6 IXes: JPNAP/JPIX/NSPIXP
- (B2) External other domestic: local IXes, private peering
- (B3) External international
- (C) Regional: 47 prefectures

Directions of traffic

- view from ISP side
- Ex) A1 (RBB customer)
  - IN: upload from customer
  - OUT: download to customer

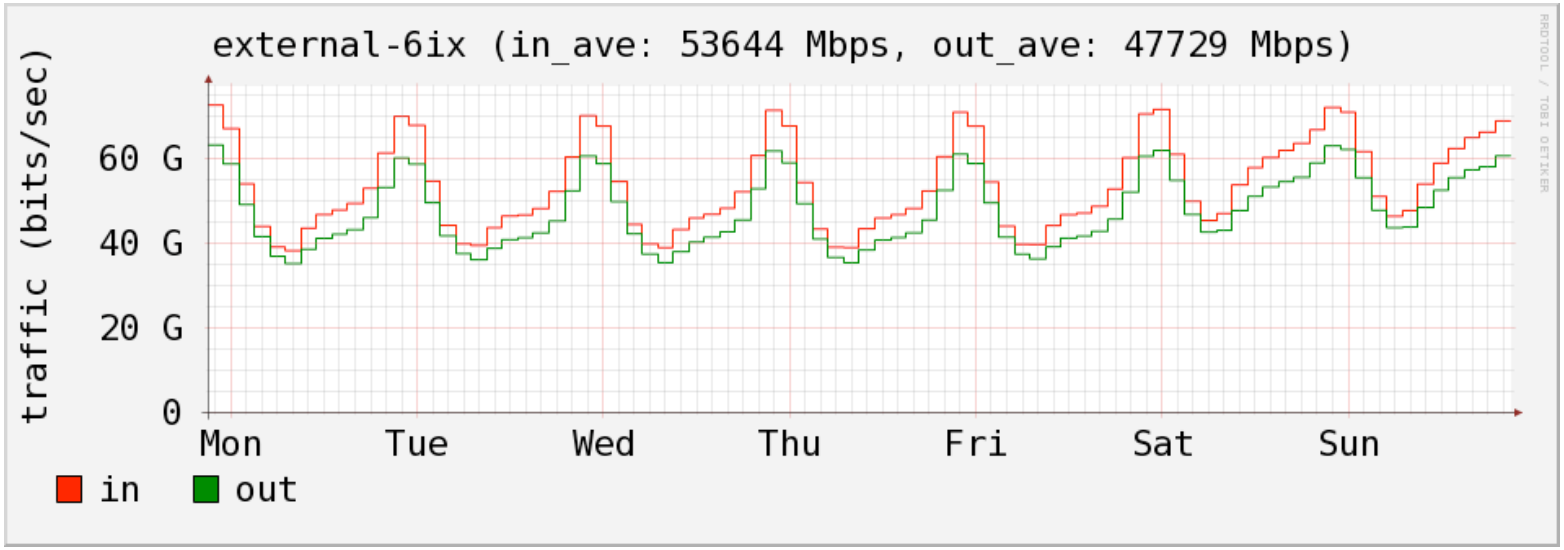


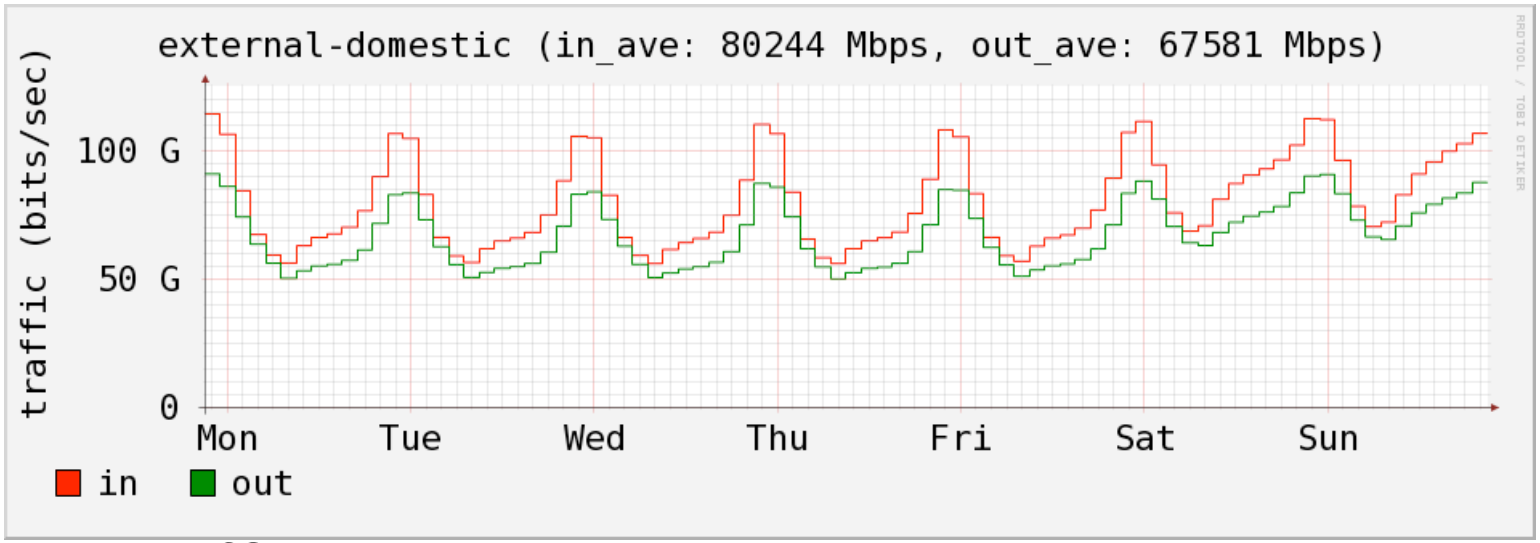
(A1) RBB customer traffic



- 70% of traffic is constant
- Peak hours: 21:00-23:00
- Difference between weekdays and weekends
- In/out volume are almost symmetric

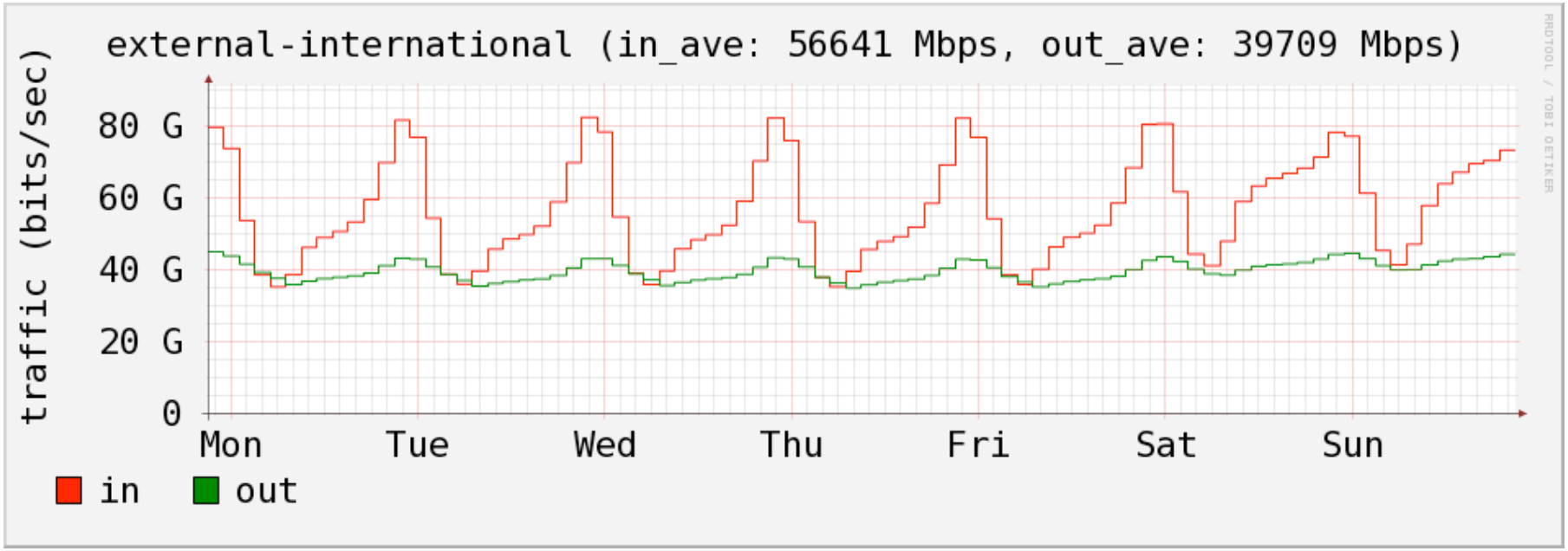
(B1&B2) 6 major IXes & other domestic traffic





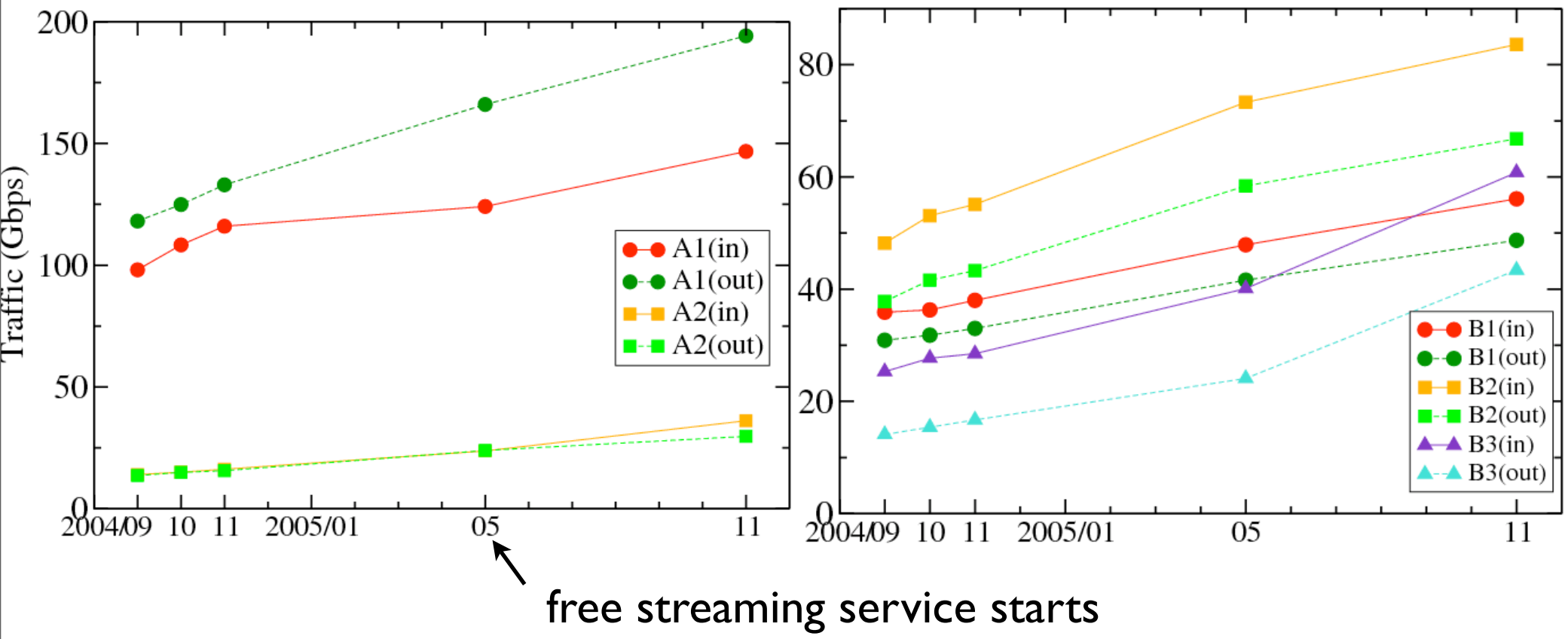
- Both traffic are dominated by RBB customer traffic

(B3) International traffic



- In/Out traffic are asymmetric
- Triggered from domestic side

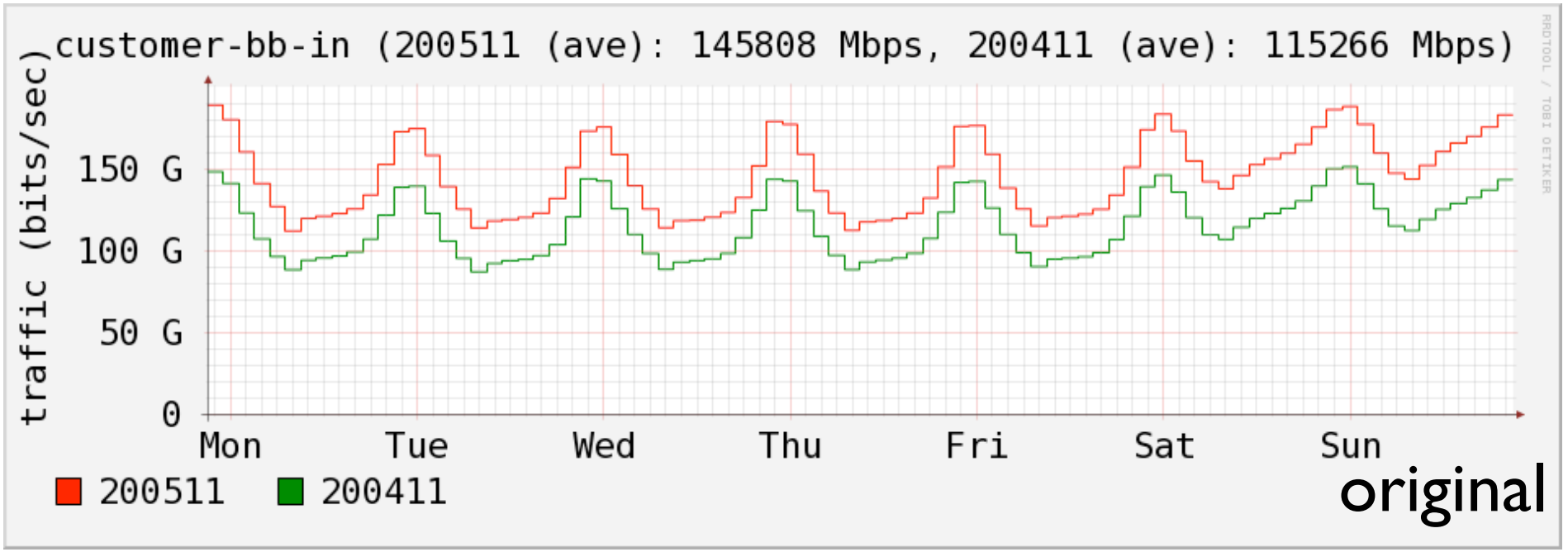
Growth of traffic

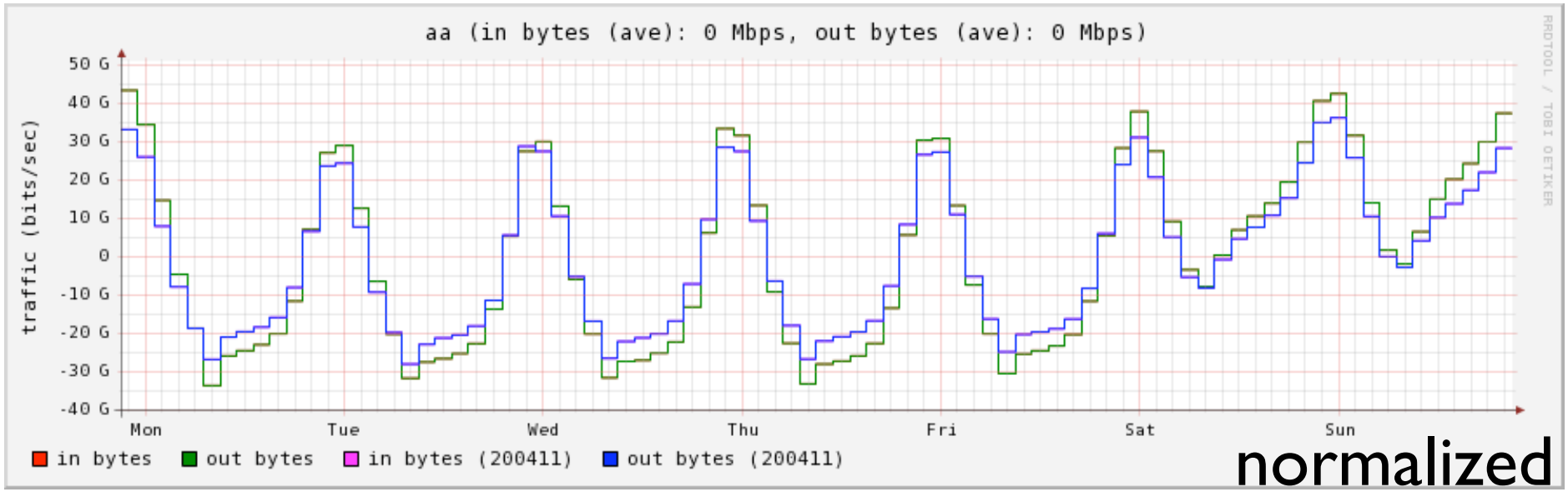


free streaming service starts

- Growth rate:
  - 37%/year for bb-customer (A1)
  - 100%/year for international (B3)

Traffic growth (A1 in)

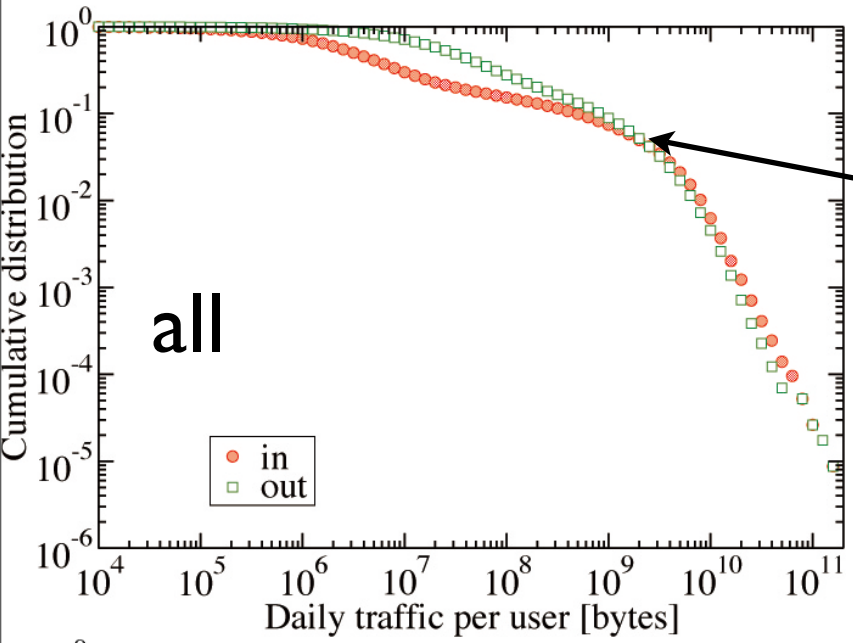




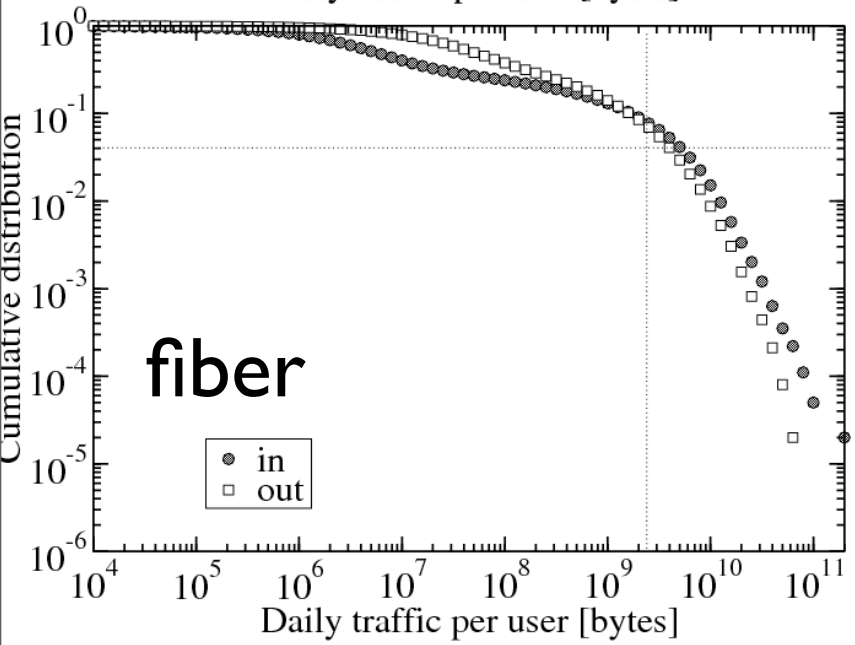
Data for micro-analysis

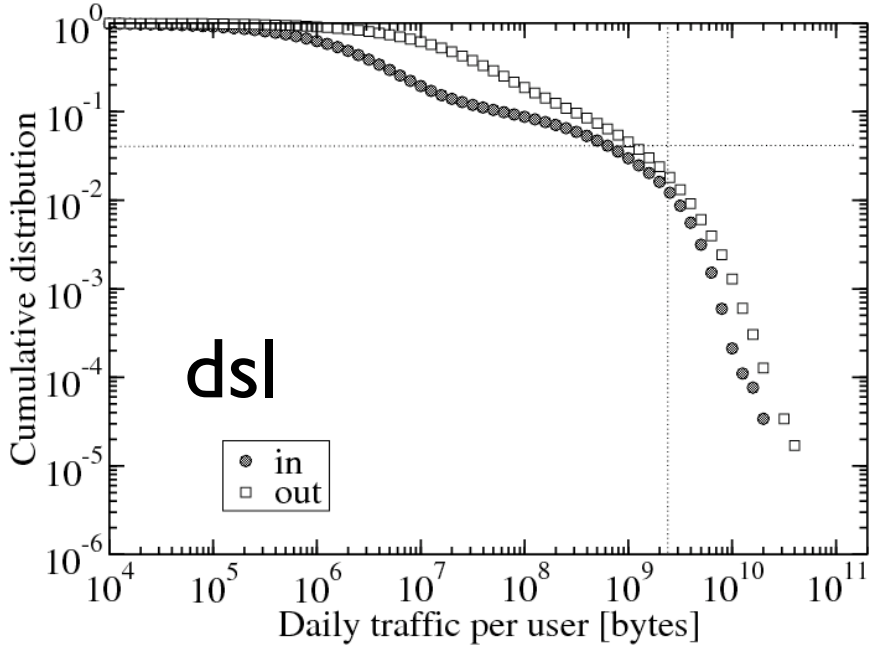
- Sampled NetFlow data from 1 ISP
- 1-week logs (2005 feb/jul)
- Fiber/DSL customers

Traffic per user by netflow



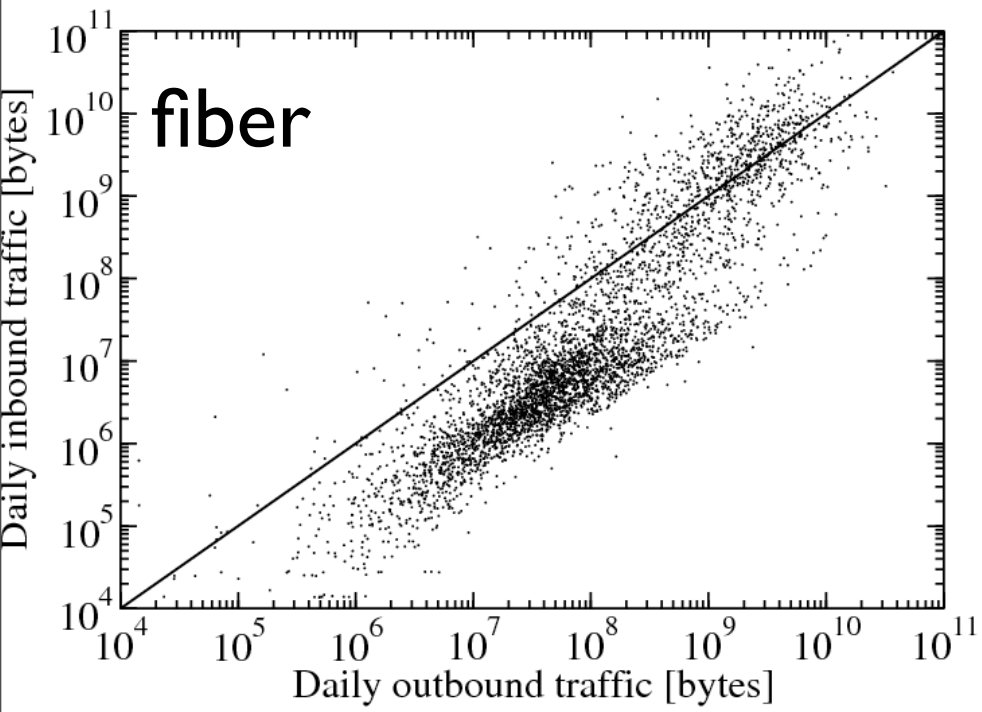
- top 4% uses >2.5GB/day
- fiber decays slower

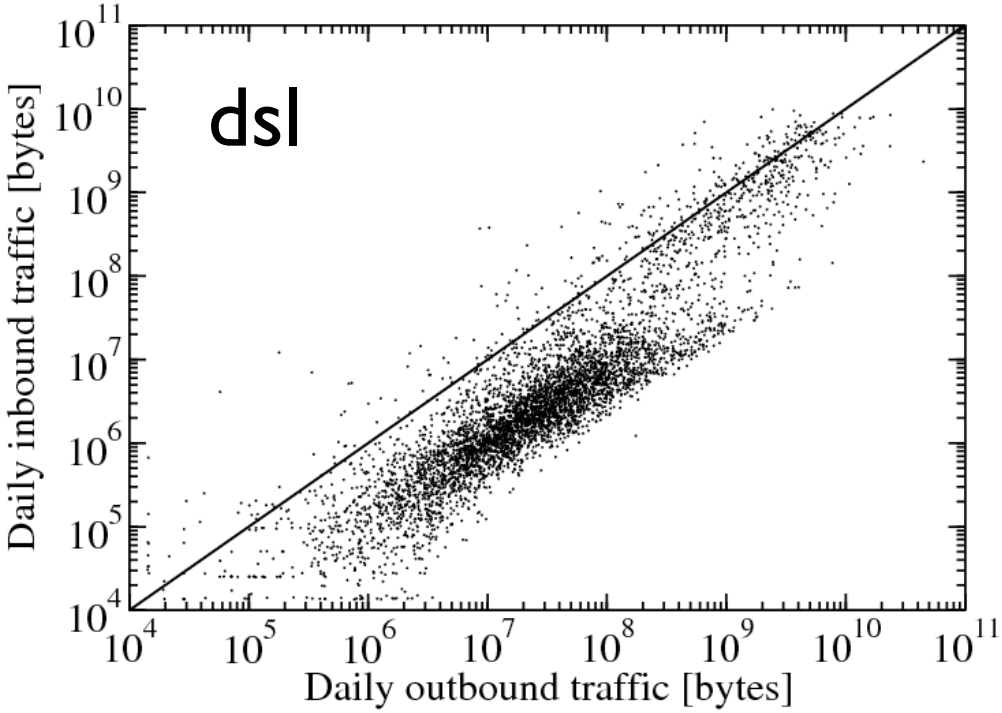




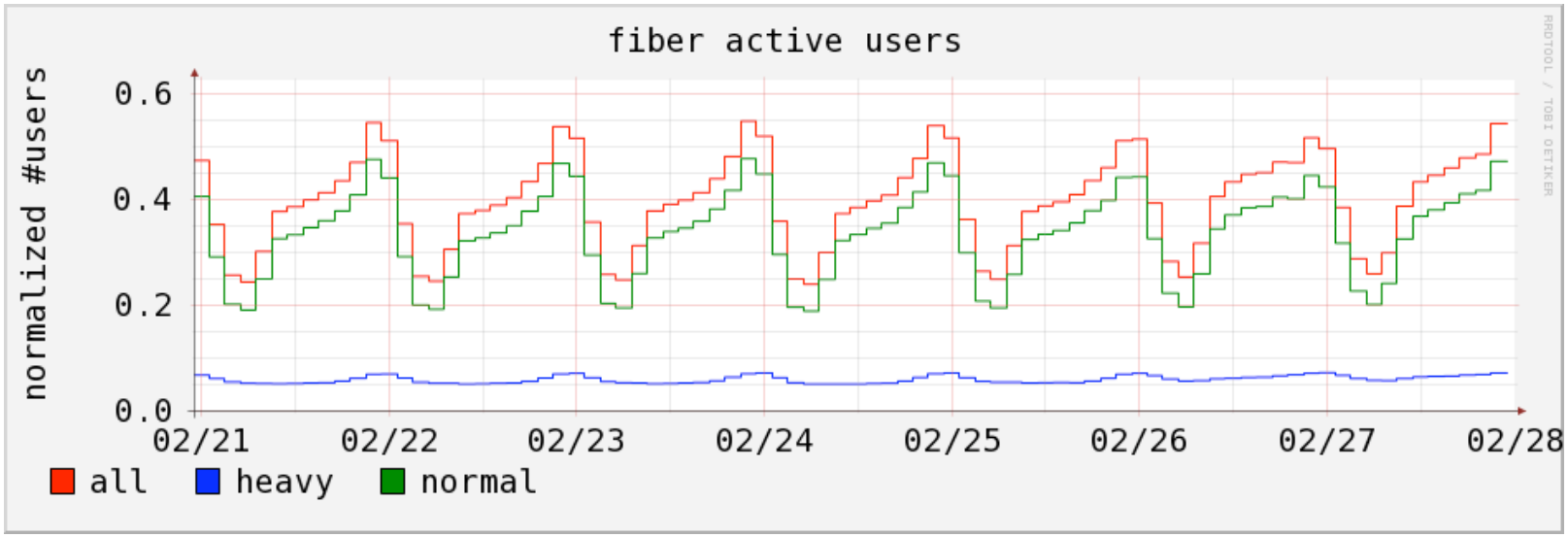
inbound and outbound

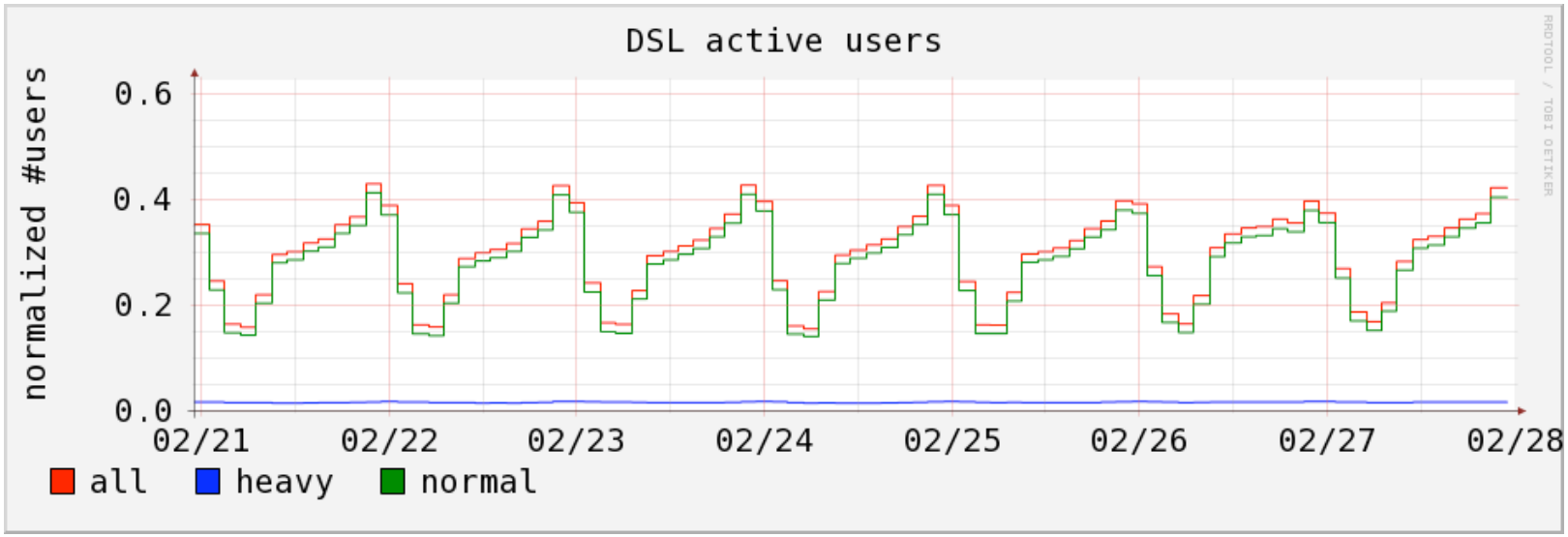
- 2 clusters
- no clear difference between fiber and dsl



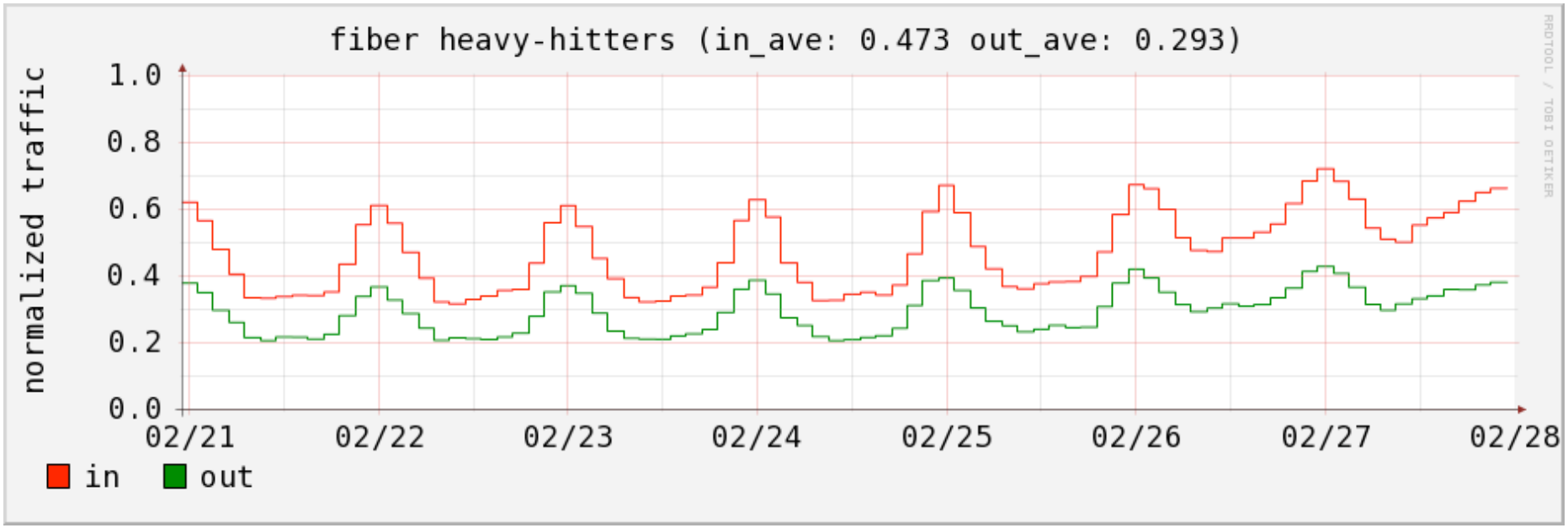


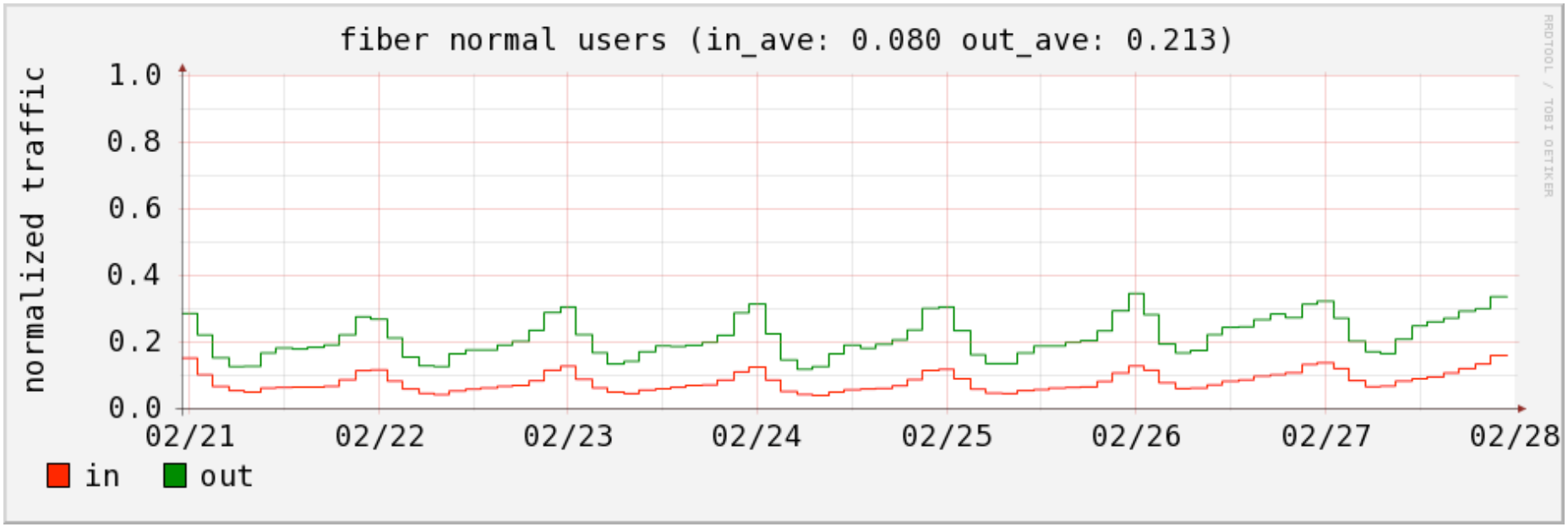
Number of active users



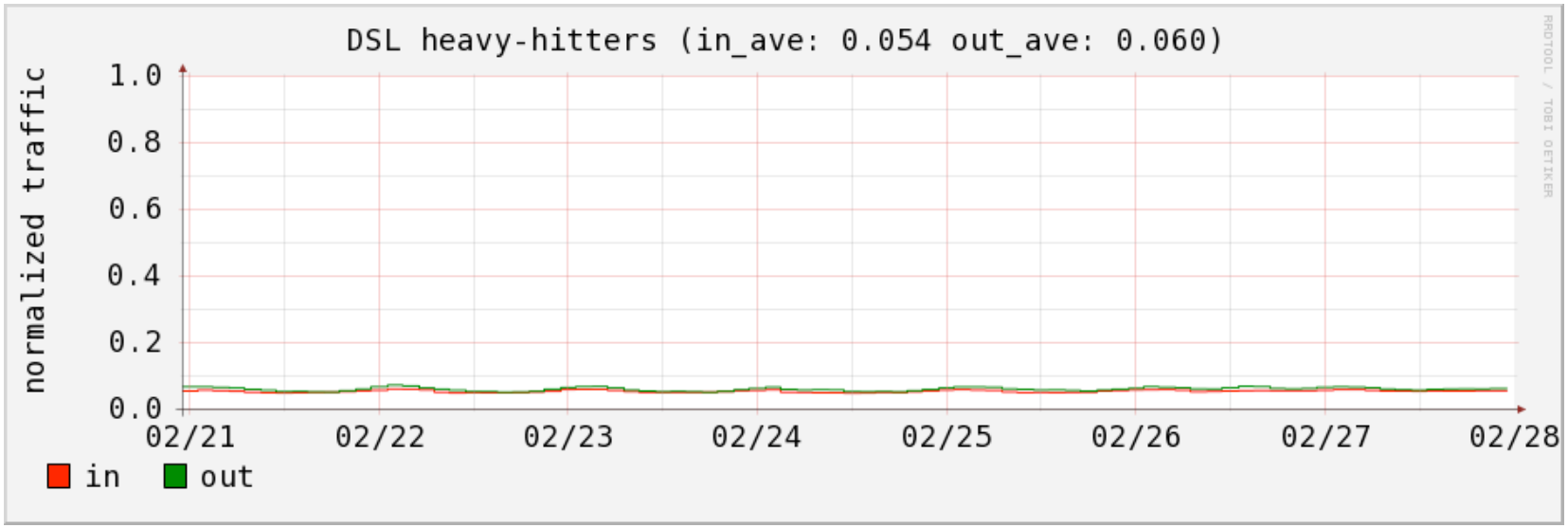


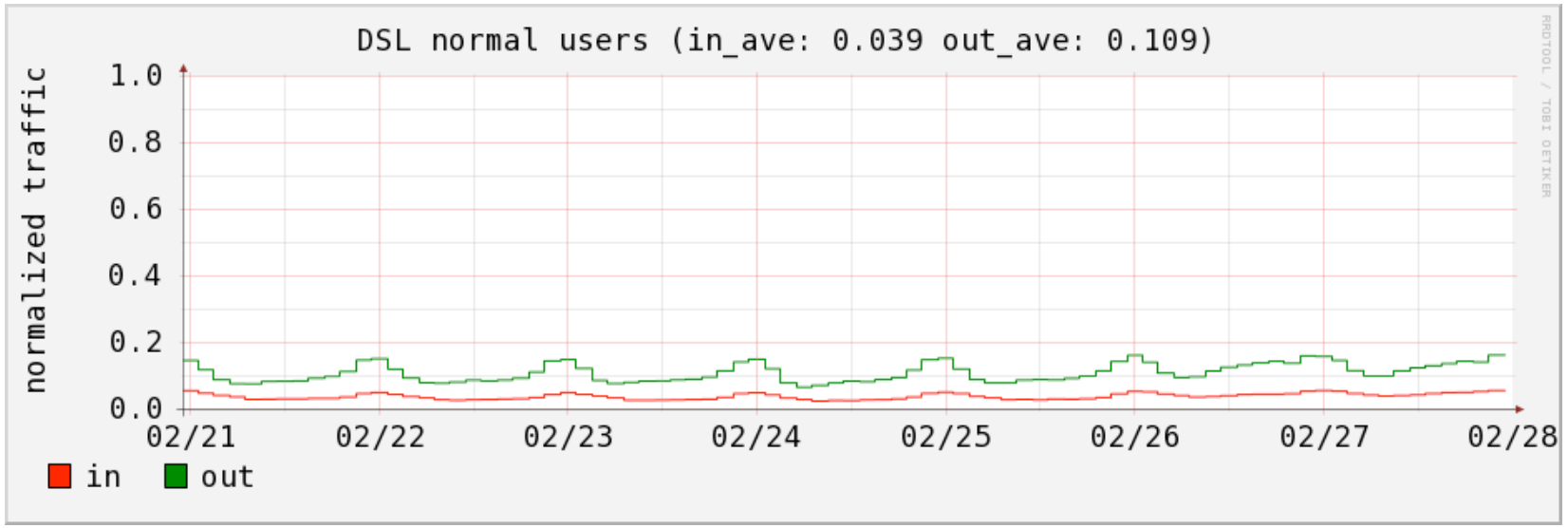
fiber traffic





dsl traffic


DSL heavy-hitters (in_ave: 0.054 out_ave: 0.060)
normalized traffic
1.0
0.8
0.6
0.4
0.2
0.0
02/21
02/22
02/23
02/24
02/25
02/26
02/27
02/28
in
out
RRDTOOL / TOBI OETIKER


DSL normal users (in_ave: 0.039 out_ave: 0.109)
normalized traffic
1.0
0.8
0.6
0.4
0.2
0.0
02/21
02/22
02/23
02/24
02/25
02/26
02/27
02/28
in
out
RRDTOOL / TOBI OETIKER

Protocol breakdown

- http: 9.3%
- ftp-data: 0.9%
- port > 1024: 82%

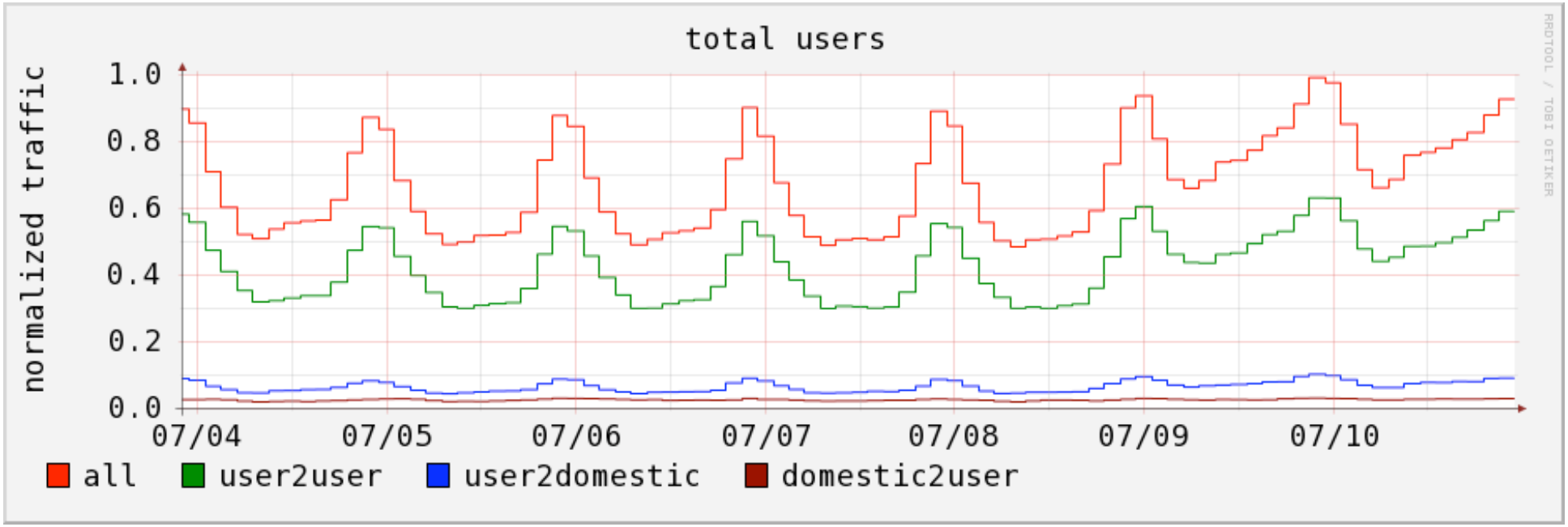
p2p flow identification by transport header?

Traffic matrix

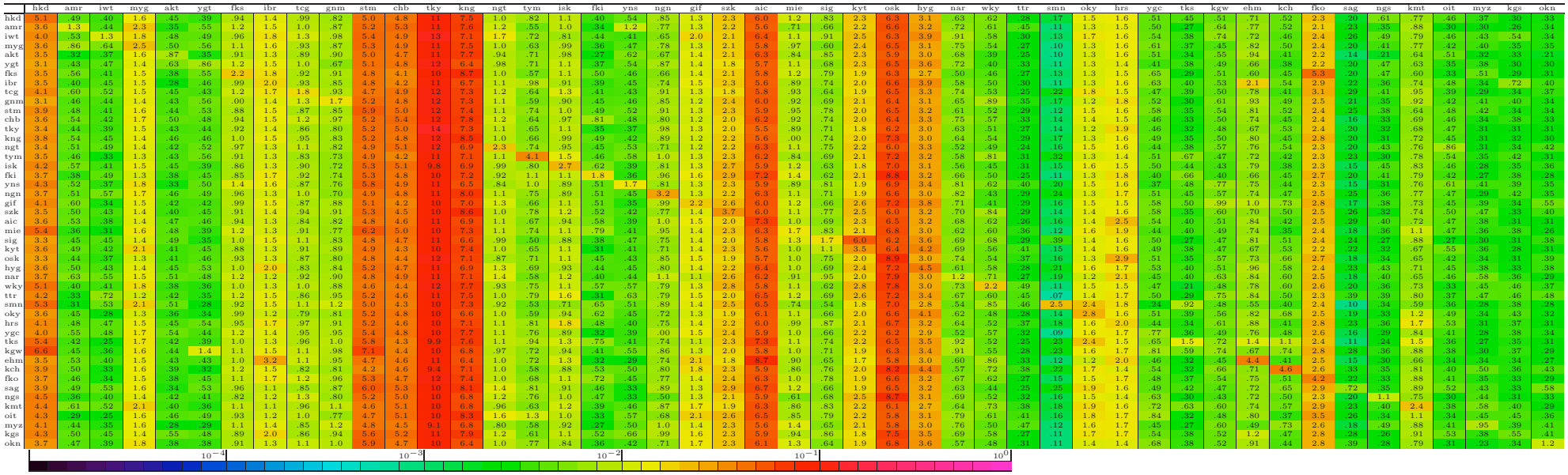
src\dst	ALL	RBB	Dom	Intr
ALL	100.0	84.8	11.1	4.1
RBB	77.0	62.2	9.8	3.9
Dom	18.0	16.7	1.1	0.2
Intr	5.0	4.8	0.2	0.0

- RBB: Residential broadband traffic
- Dom: Data center, leased line traffic
- Intr: International traffic

weekly traffic



Traffic matrix in prefecture



- Normalized by src
- Concentrates to metropolitan areas
- Weak correlation within a prefecture, but no correlation with neighbors

Summary

- Traffic growth = 37-100%/year
- JP RBB traffic = 468Gbps
- 4% heavy hitters generates > 2.5GB/day
- No clear boundaries between heavy hitters and normal users
- 62% traffic is between users

Concluding remarks

- Future work
  - Improve the accuracy
  - Compare with traffic in other countries
  - Microscopic analysis
    - Locality of flows & application types
- Collect 1 month’s data at 6 month intervals