The Impact of Residential Broadband Traffic on Japanese ISP Backbones

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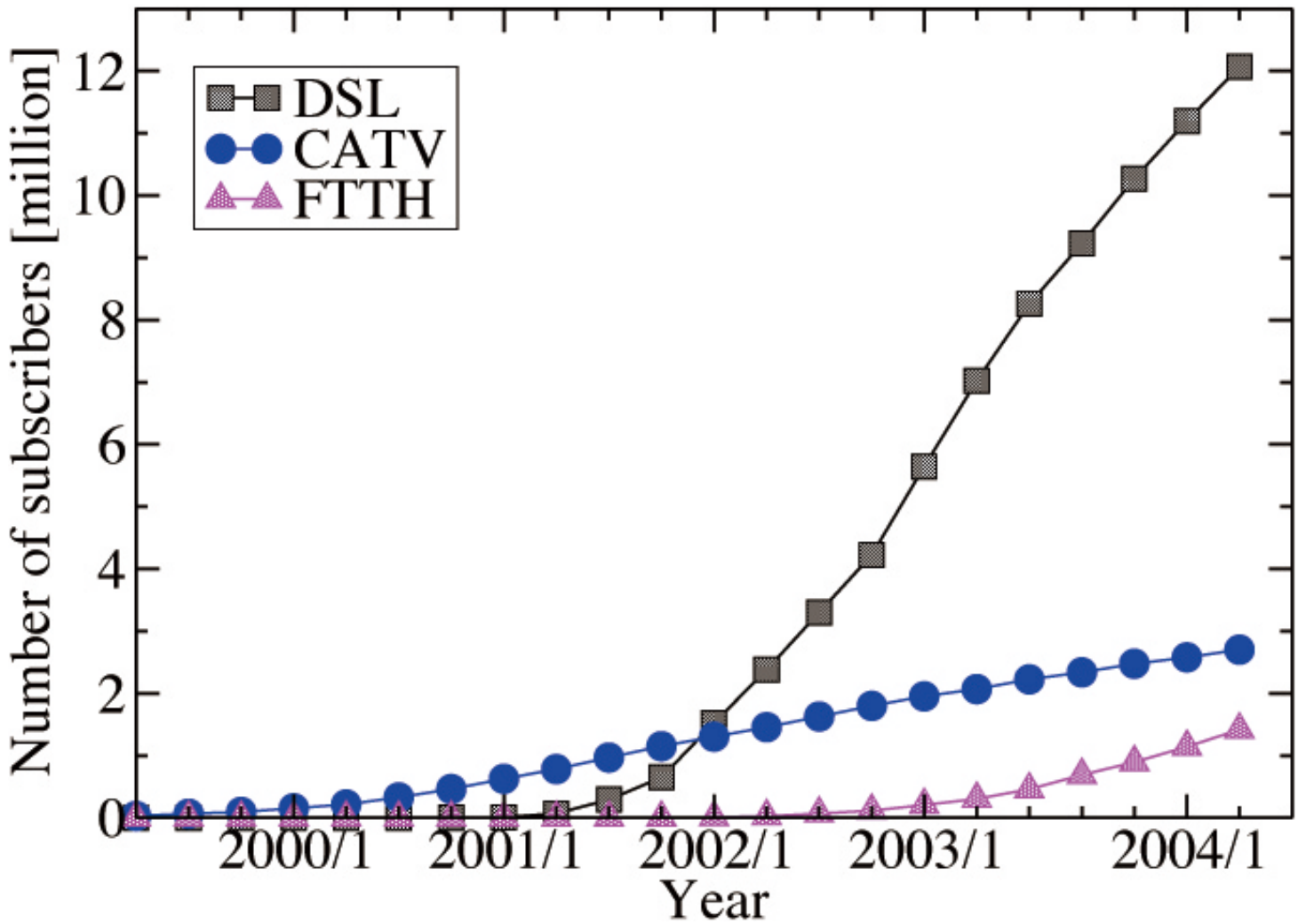
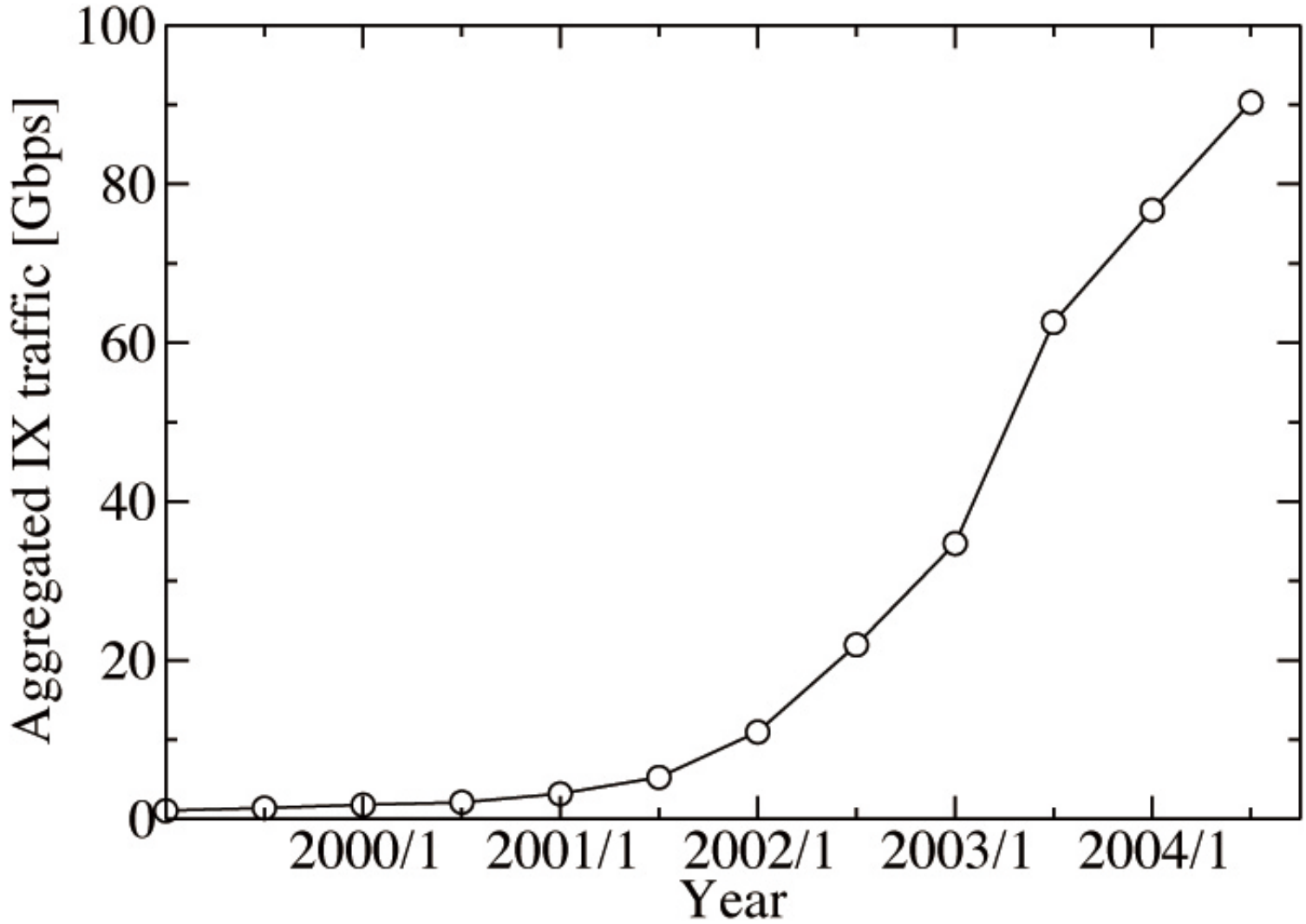
Outline

- Introduction
- Motivation
- Data collection
- Many graphs
- Conclusion
- (The details are in CCR,vol.35, no.1, 2005)

Increase in residential broadband subscribers in Japan



Traffic growth at 6 major Japanese IXes



Objective of this study

- Characterize macro-level impact of residential broadband user traffic
  - Volume, growth, and usage pattern
  - Residential users vs. academic/office users
  - Major IXes vs. private-peering
  - Regional differences

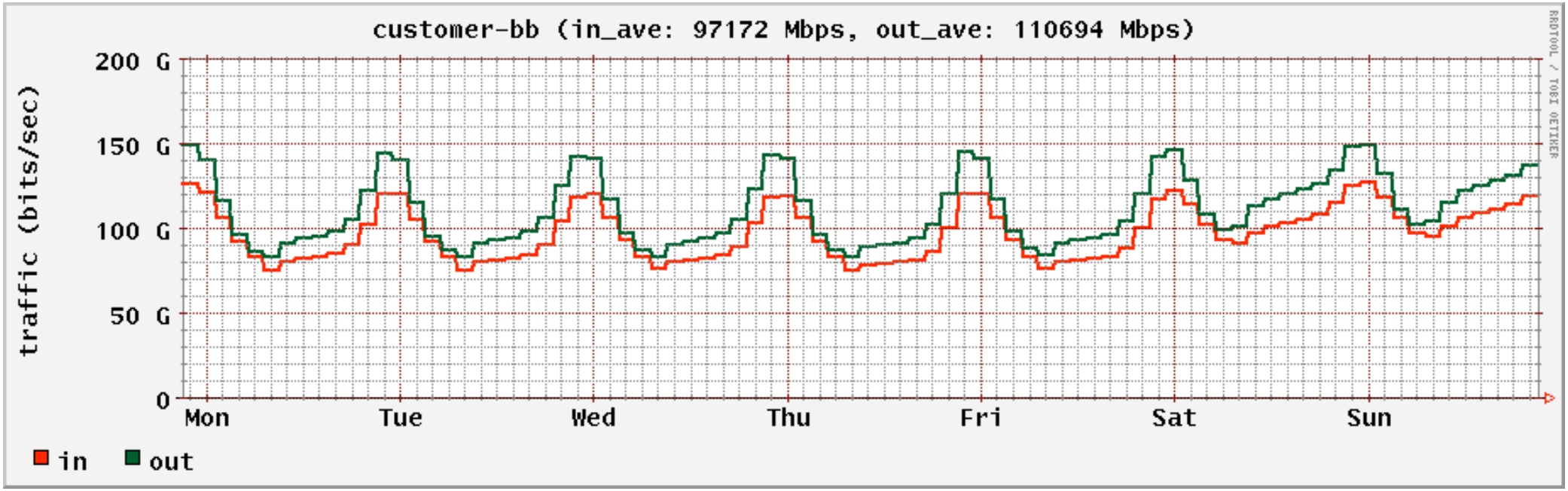
Data collection

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

Traffic groups for data collection

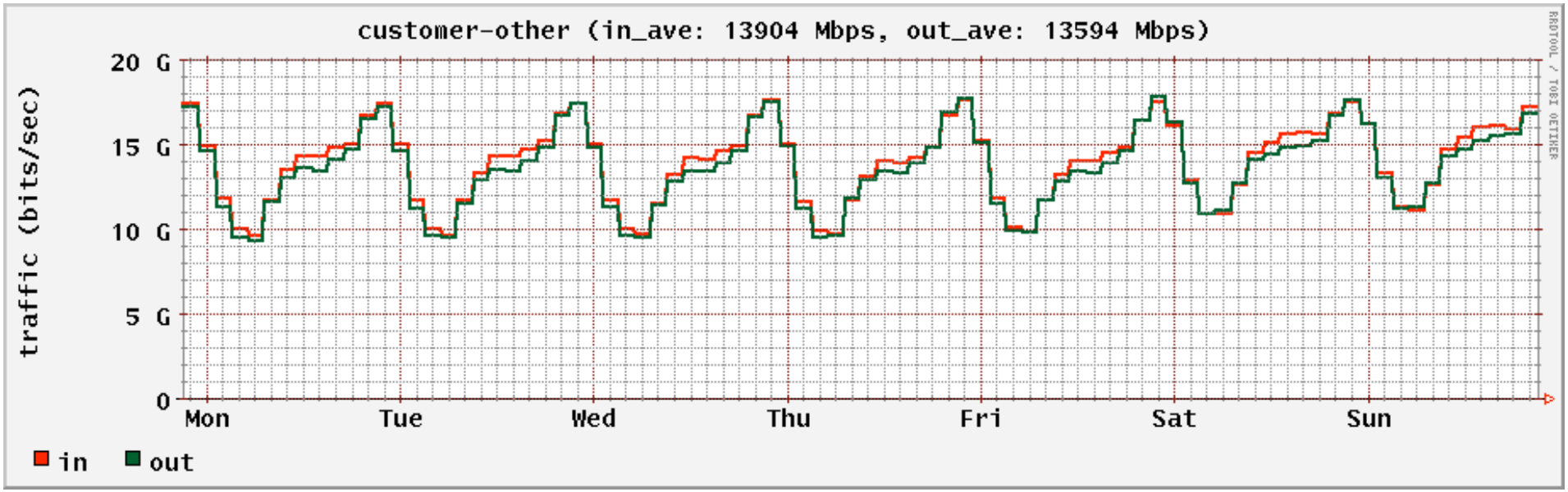
- (A1) RBB customer: ADSL/CATV/FTTH
- (A2) Non-RBB customers: leased lines, data centers, dialups
- (B1) External 6 IXes: JPNAP/JPIX/NSPIXP
- (B2) External other domestic: local IXes, private peering
- (B3) External international
- (C) Regional: 47 prefectures

(A1) RBB customer traffic



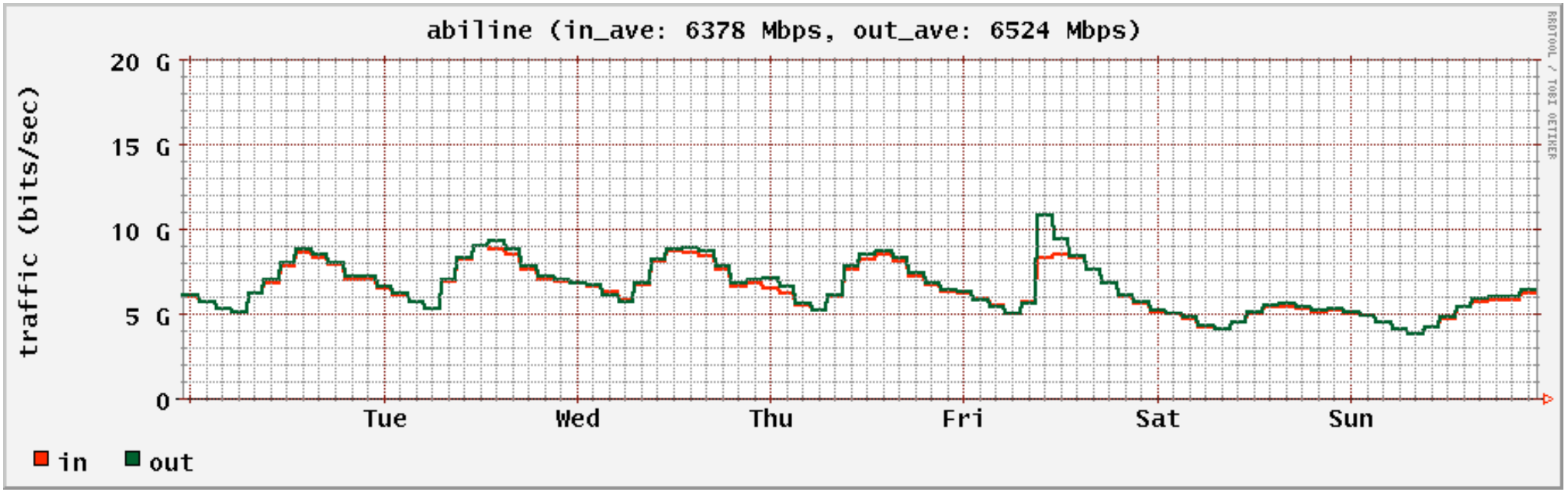
- Traffic is about 100Gbps, and 70% of traffic is constant
- Peak hours: 21:00-23:00
- Difference between weekdays and weekends
- In/out volume are almost symmetric

(A2) Non-RBB customer traffic



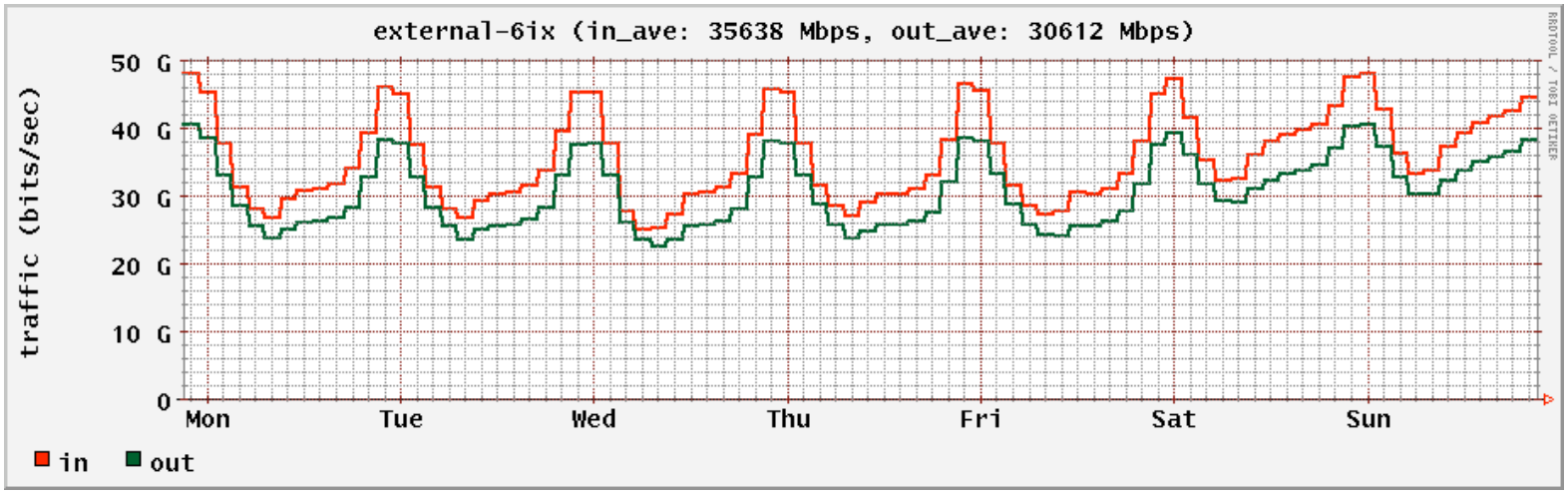
- Leased lines, data centers, dial-up users, 2nd (or 3rd) level ISPs
- Peak hours: 21:00-23:00
- Higher activity in daytime on weekdays

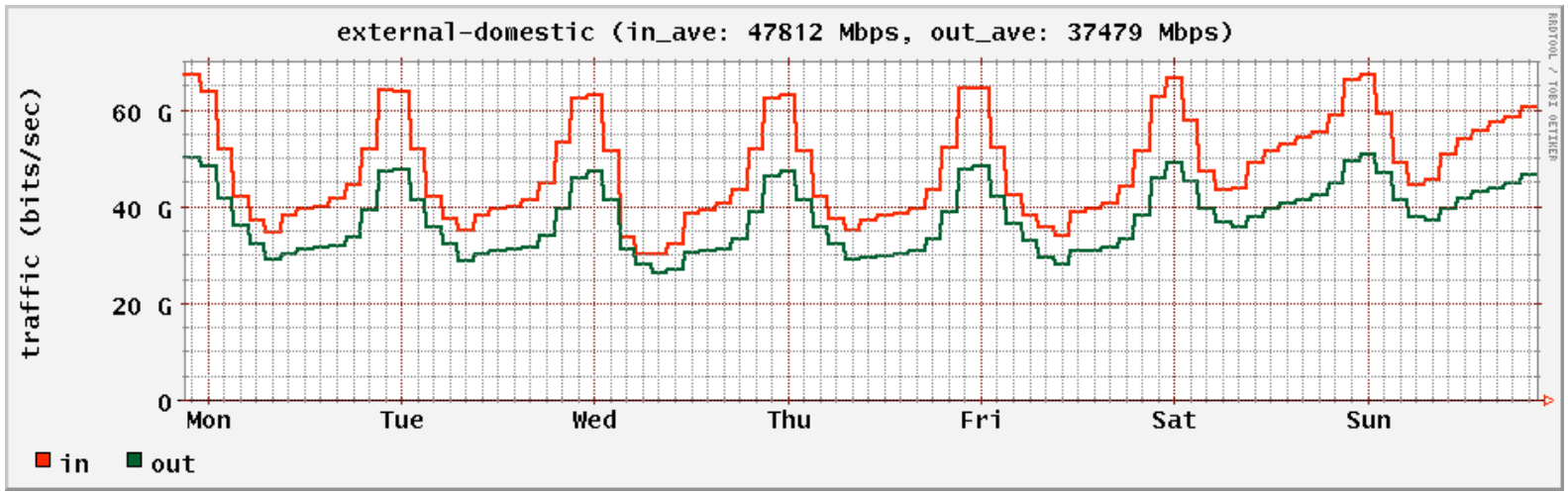
Academic traffic



- ABILINE (Internet2)
- Peak hours: 10:00-14:00
- Lower activity in weekends

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





- Both traffic are dominated by RBB customer traffic

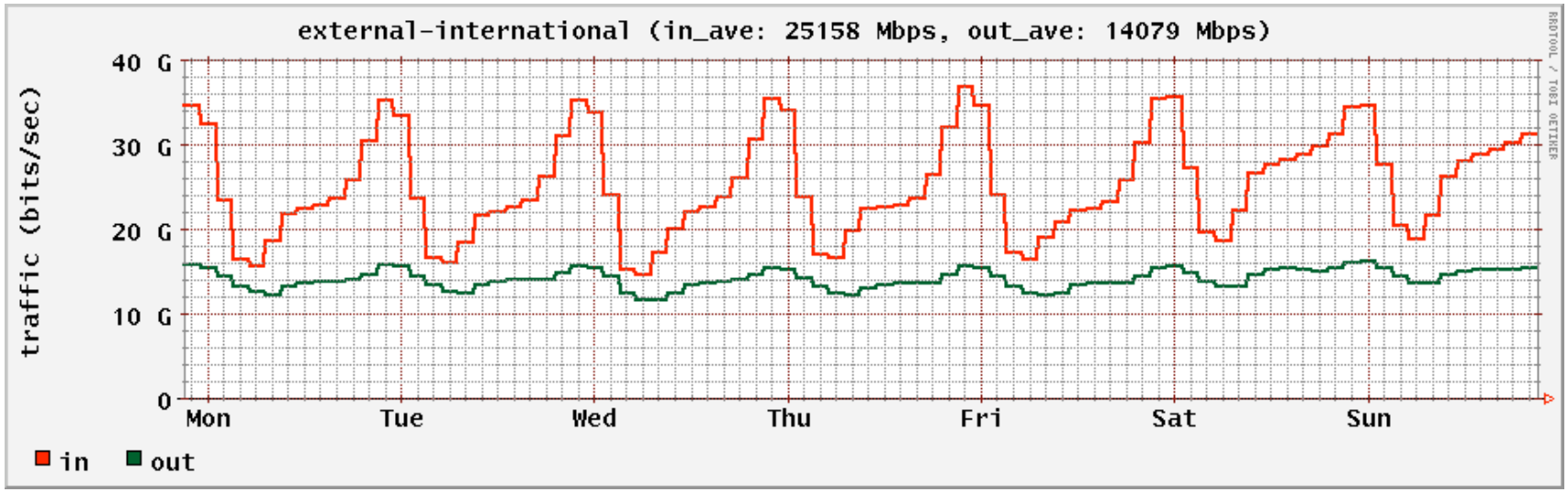
Comparison with other data

unit: Gbps

	(B1) 6 IXes (our data)	All 6 IXes (directly measured)	ratio (%)
sep	30.9	74.5	41.5
oct	31.8	77.1	41.2
nov	33.0	80.3	41.1

- Our data covers about 40% of all traffic

(B3) International traffic



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

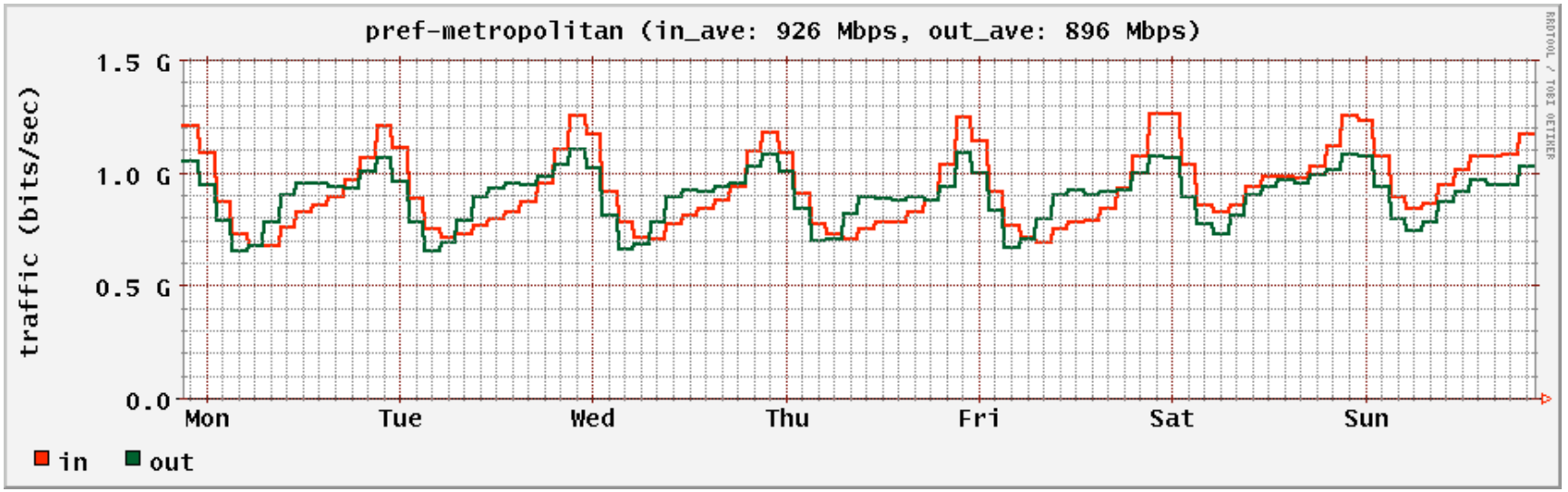
Summary of traffic groups

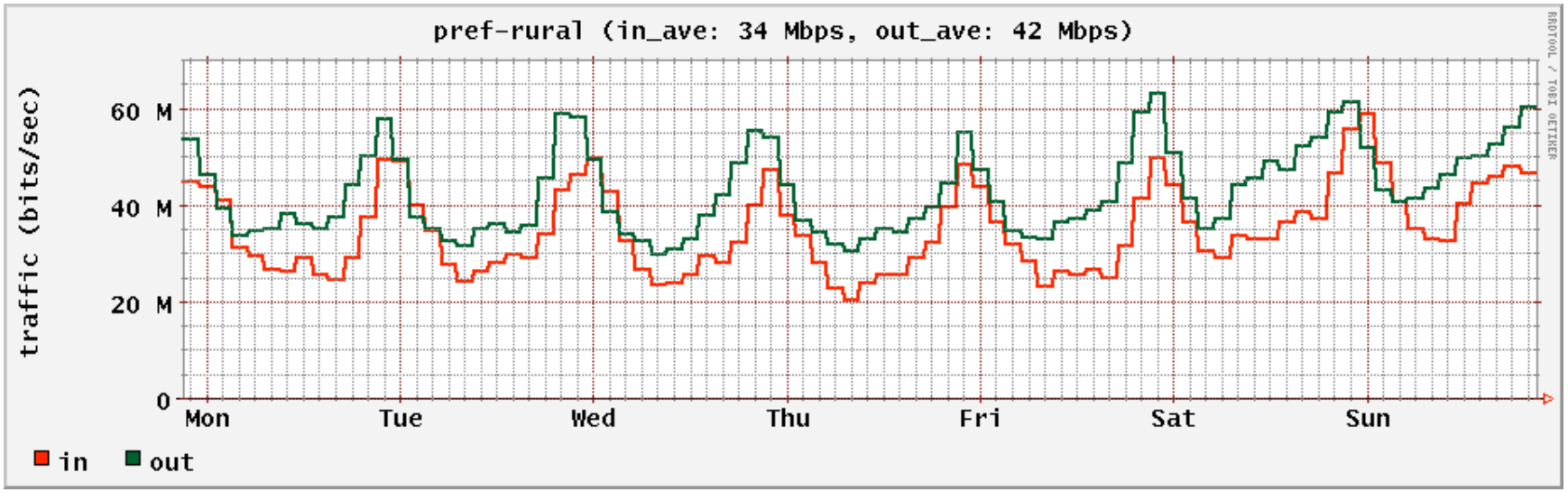
Unit: Gbps

	(A1) RBB customer	(A2) RBB other	(B1) 6IXes	(B2) Other domestic	(B3) International
	in/out	in/out	in/out	in/out	in/out
sep	98.1/118.1	14.0/13.6	35.9/30.9	48.2/37.8	25.3/14.1
oct	108.3/124.9	15.0/14.9	36.3/31.8	53.1/41.6	27.7/15.4
nov	116.0/133.0	16.2/15.6	38.0/33.0	55.1/43.3	28.5/16.7

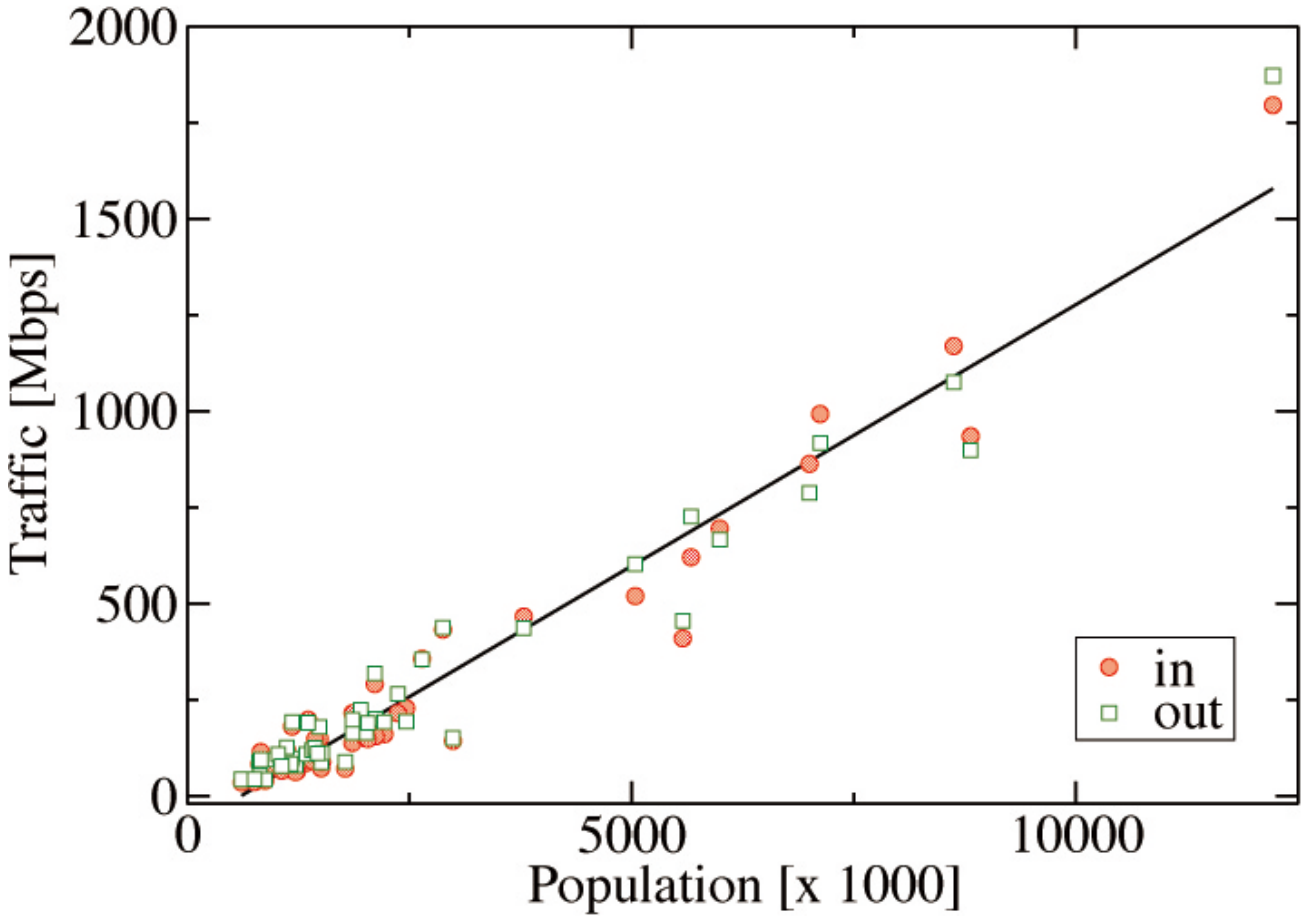
- Growth rate: 6-7% per month (= 200% per year!)
- Other domestic (private peering) is NOT negligble
- International traffic accounts for 23% of all external traffic
- RBB customer traffic in Japan is 330Gbps (= 133.0Gbps/40%)

(C) Metropolitan vs Rural (1)



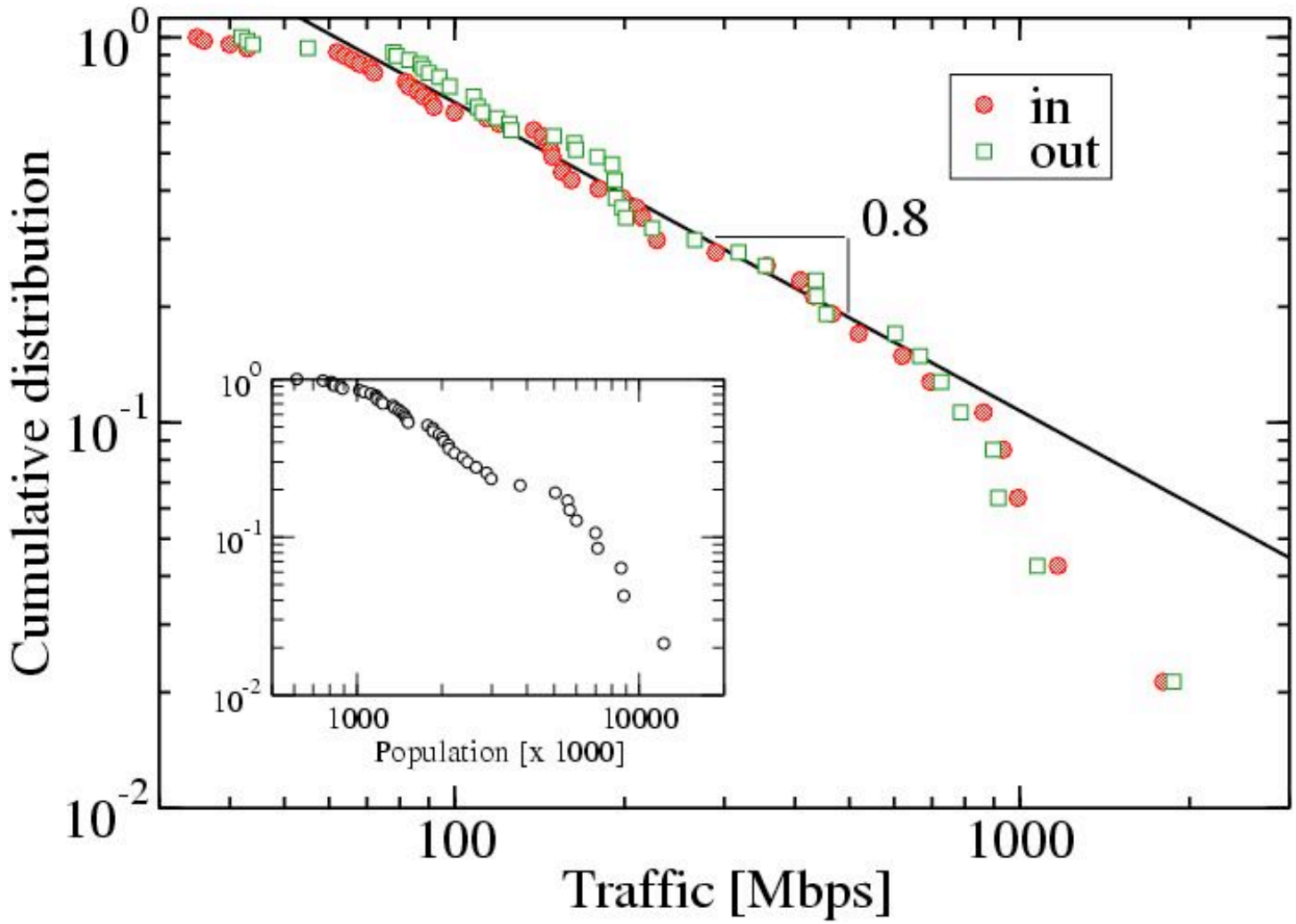


Metropolitan vs. Rural (2)

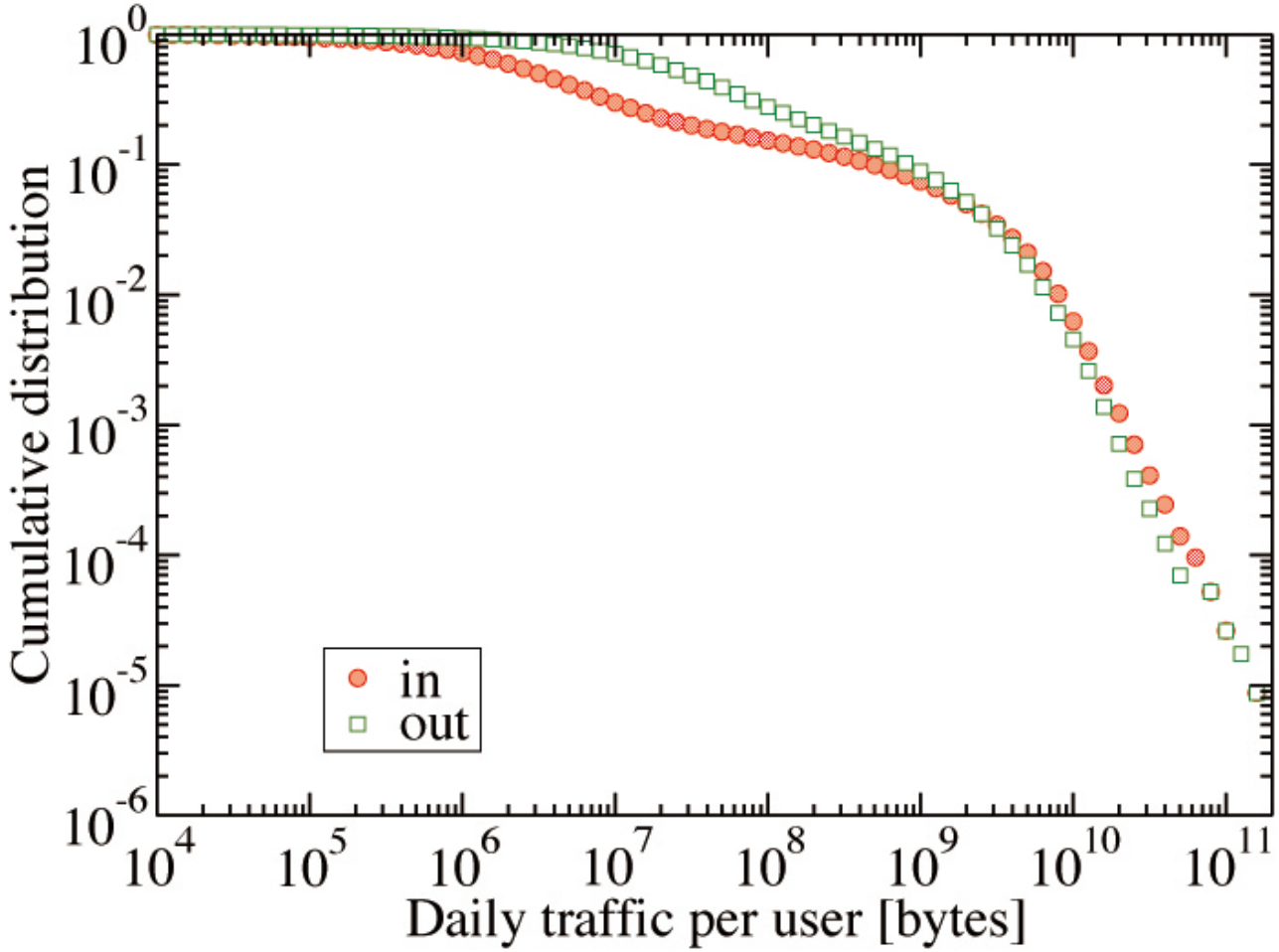


- Traffic volume is proportional to population of prefecture
- Prob. of finding a heavy user is constant

CDF of pref. traffic

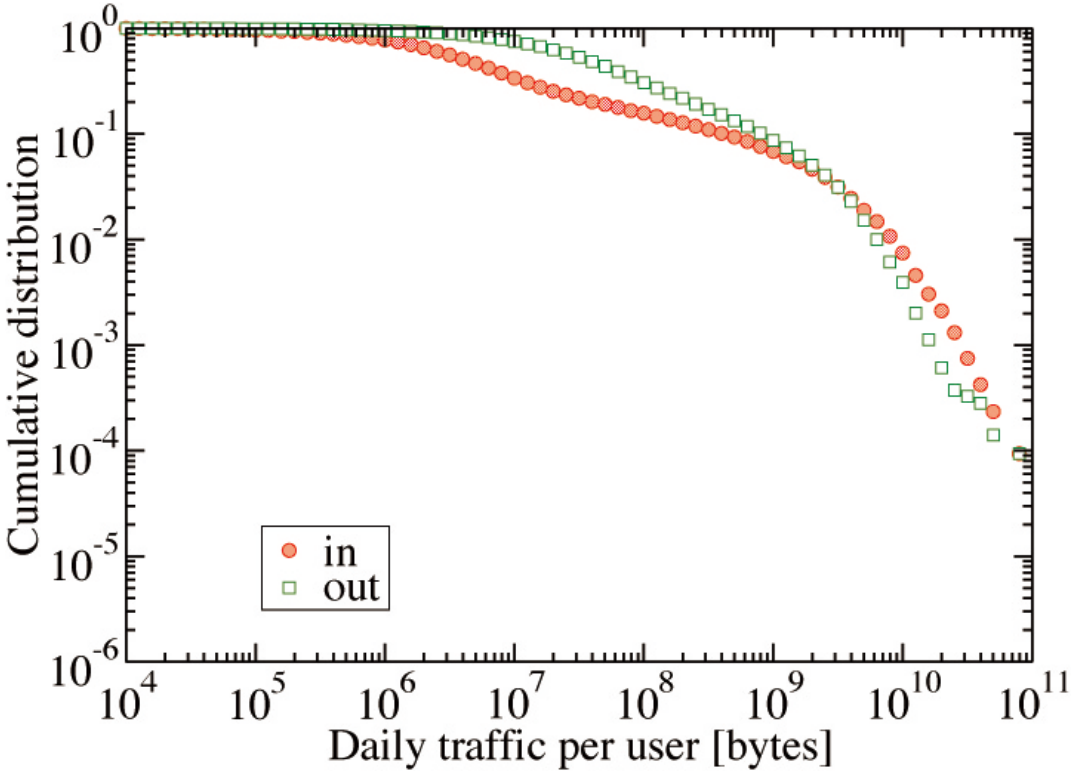


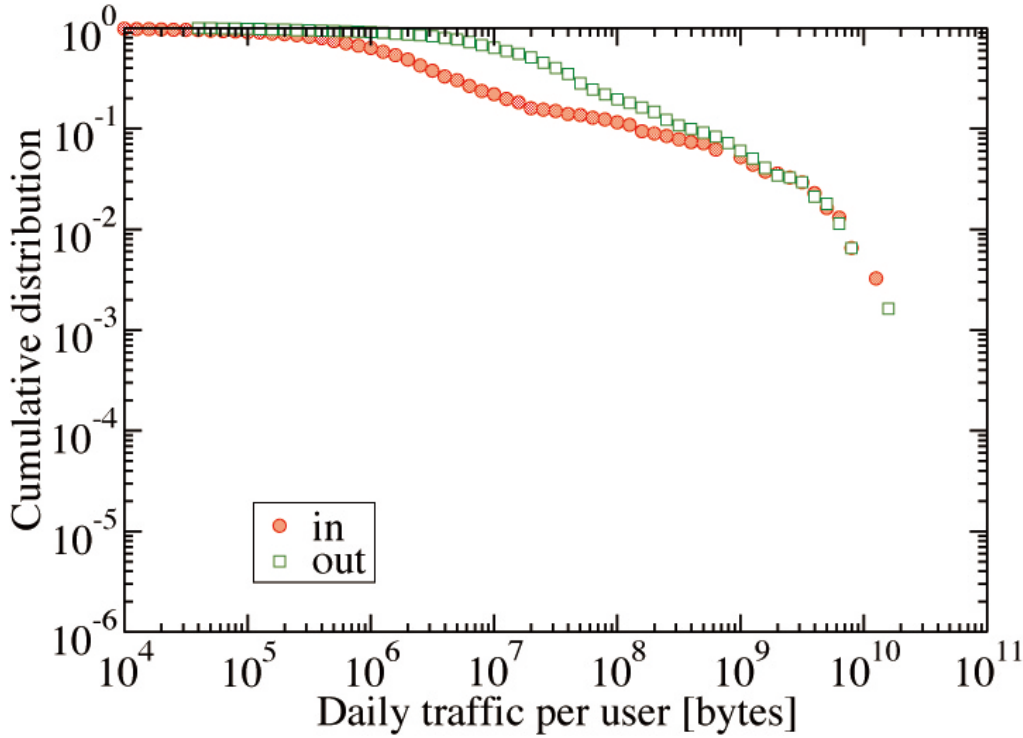
Traffic per user by NetFlow



- 96% users use less than 2.5GB/day
- Traffic is asymmetric for < 2.5GB

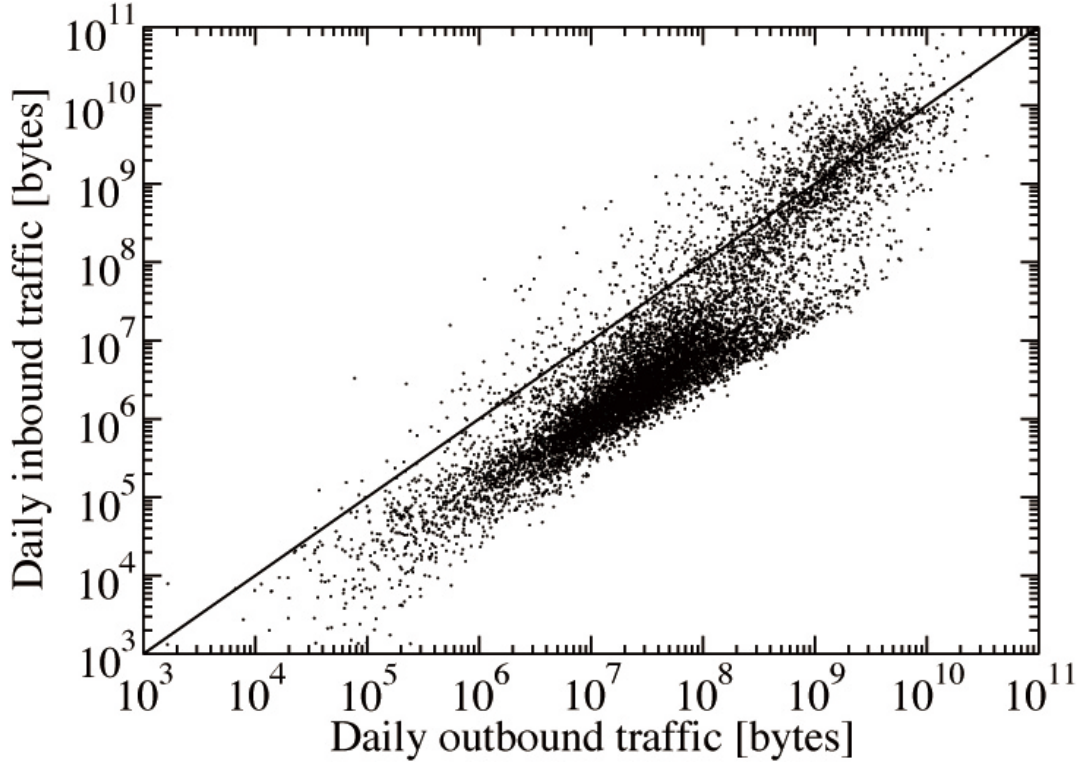
Metropolitan vs. Rural (again)





- Same behavior except for number of samples
- Prob. of finding a heavy user is the same

Symmetry of in/out traffic



- Out is 10 times larger than In in for $< 10^8$
- 2 regions appear for $> 10^8$
  - out is restricted (because of ADSL?)
  - in and out is symmetric (because of fiber?)

Summary

- We analyzed residential broadband traffic in Japanese ISPs.
- Main results:
  1. RBB traffic in Japan is about 330Gbps, and in/out traffic are symmetric
  2. Backbone is dominated by RBB traffic
  3. RBB traffic increases at 200% per year
  4. Traffic through private peering is NOT negligible
  5. RBB traffic is proportional to the population

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