

Some multi-year graphs

Q1: Can we measure BGP scaling?
Q2: Is the UDP/TCP ratio changing?

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July 2008

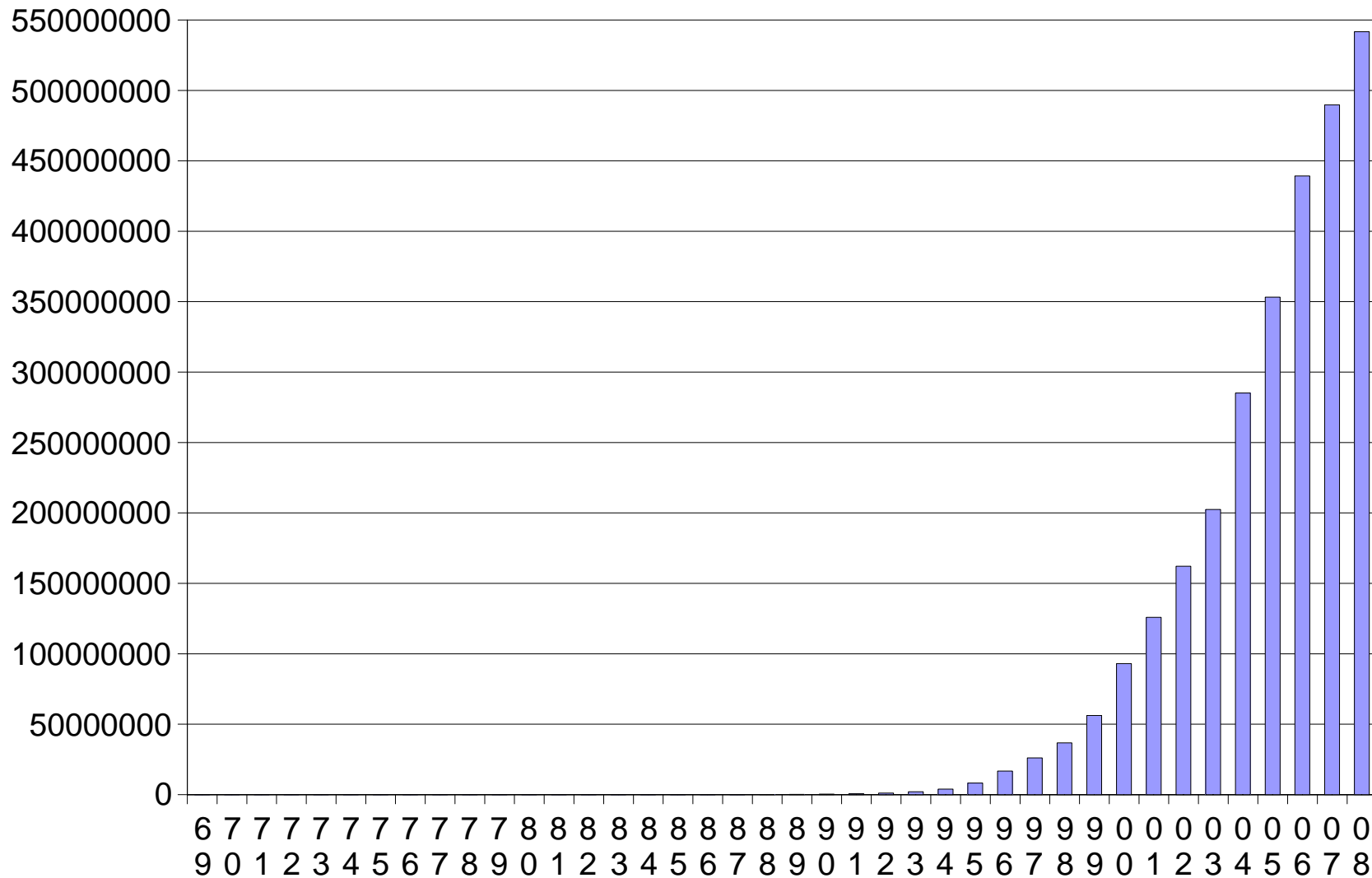
What's the BGP question again?

- Q1: Are there any interesting long-term relationships between the size of the globally addressable Internet and the size of the BGP4 system?

What data do we have?

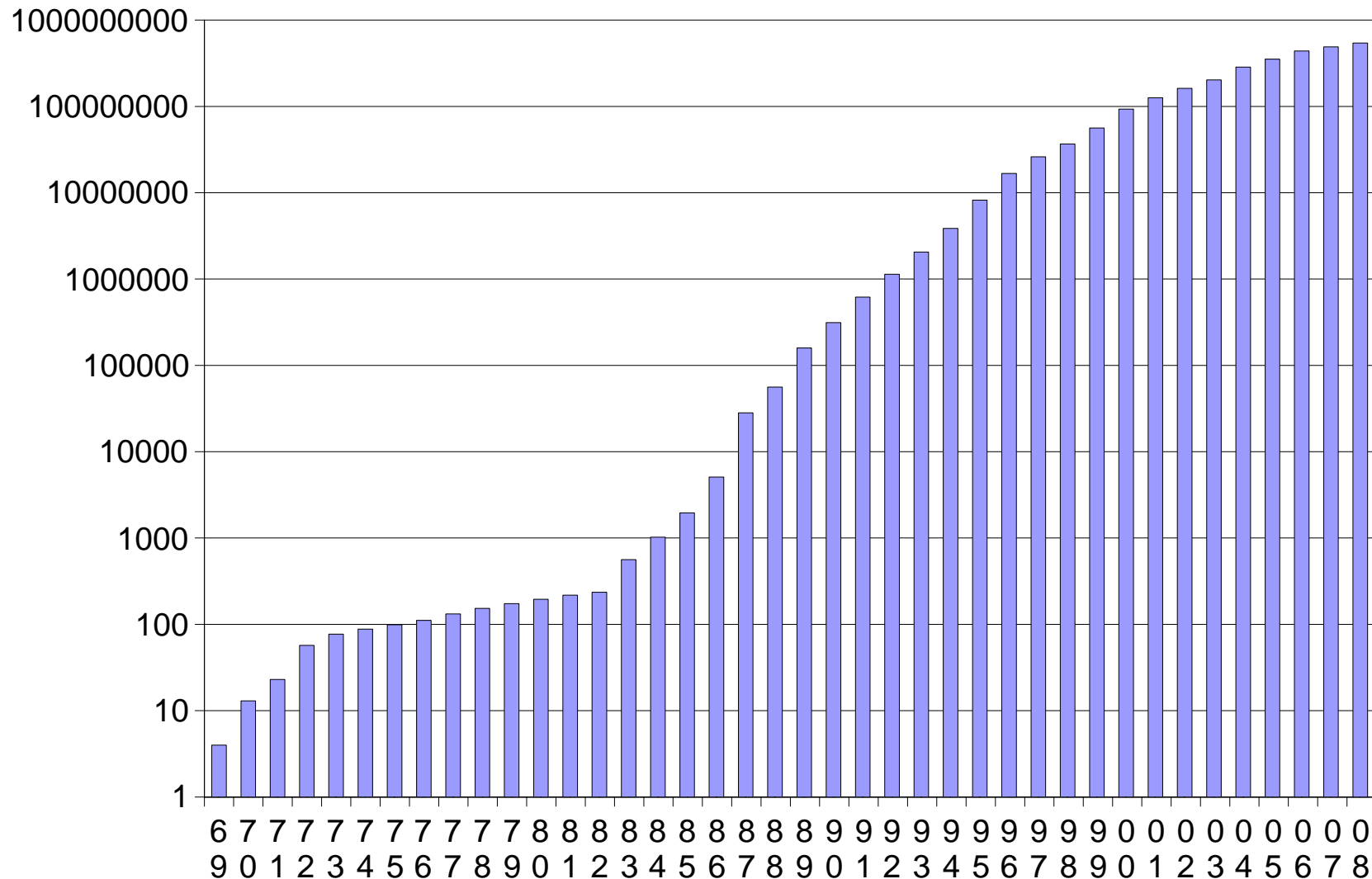
- We have BGP4 data back to 1994 and active AS data back to 1997 (thanks potaroo.net)
- We have domain count data back to 1994 (thanks ISC.org)
 - the domain count is a reasonable lower bound on the number of directly accessible IPv4 interfaces with global addresses

Domain count history

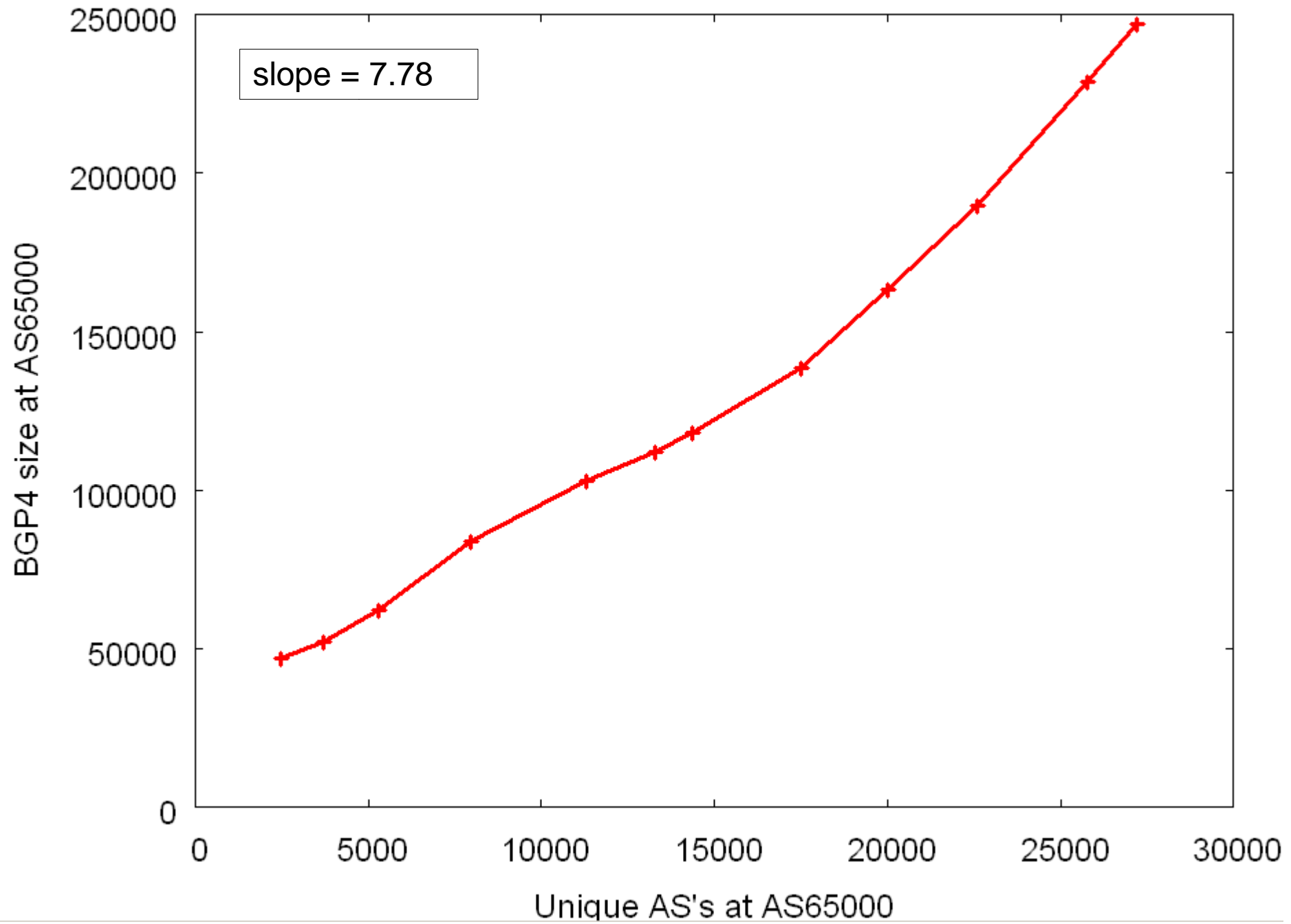


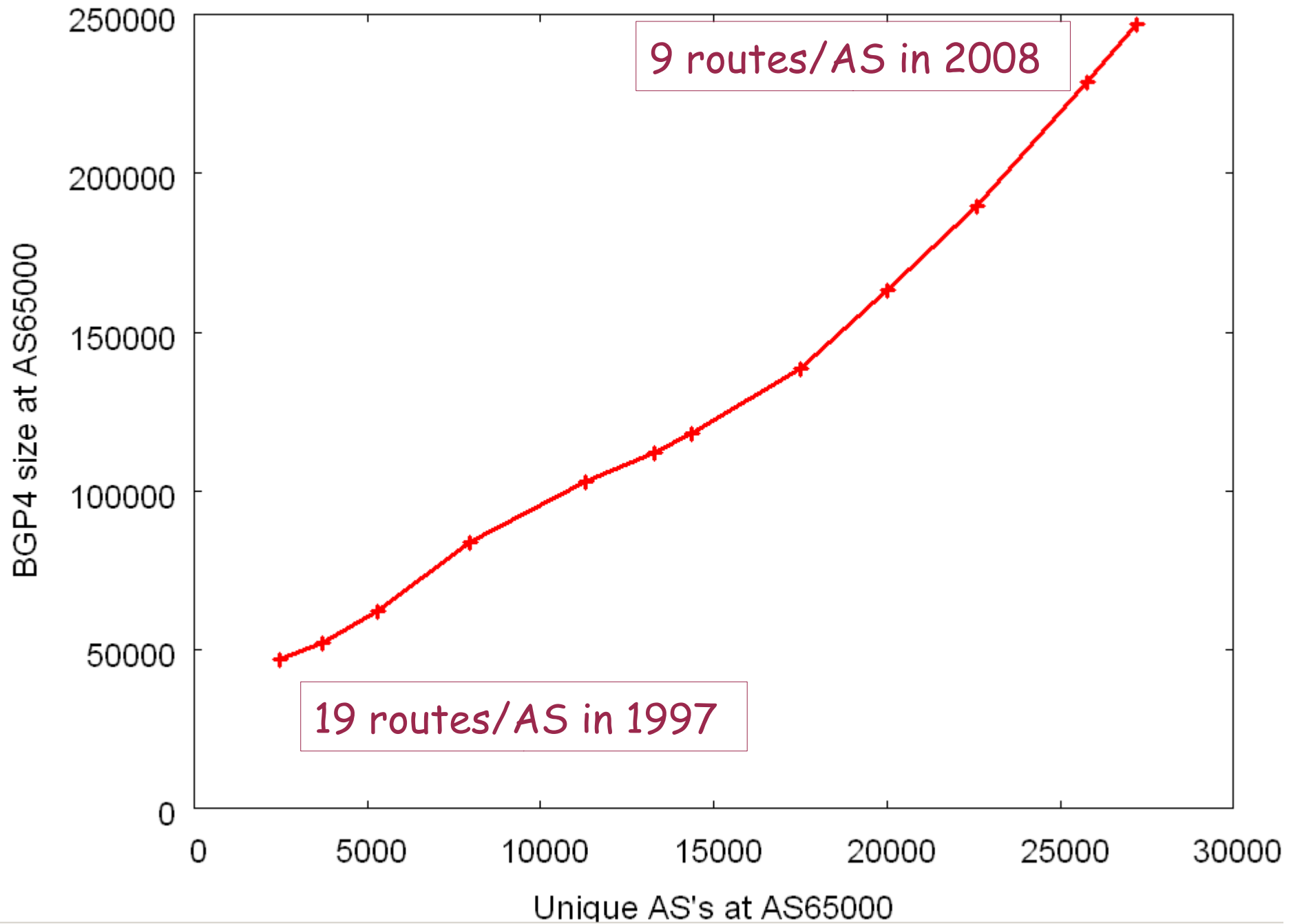
Data from <http://www.isc.org/>

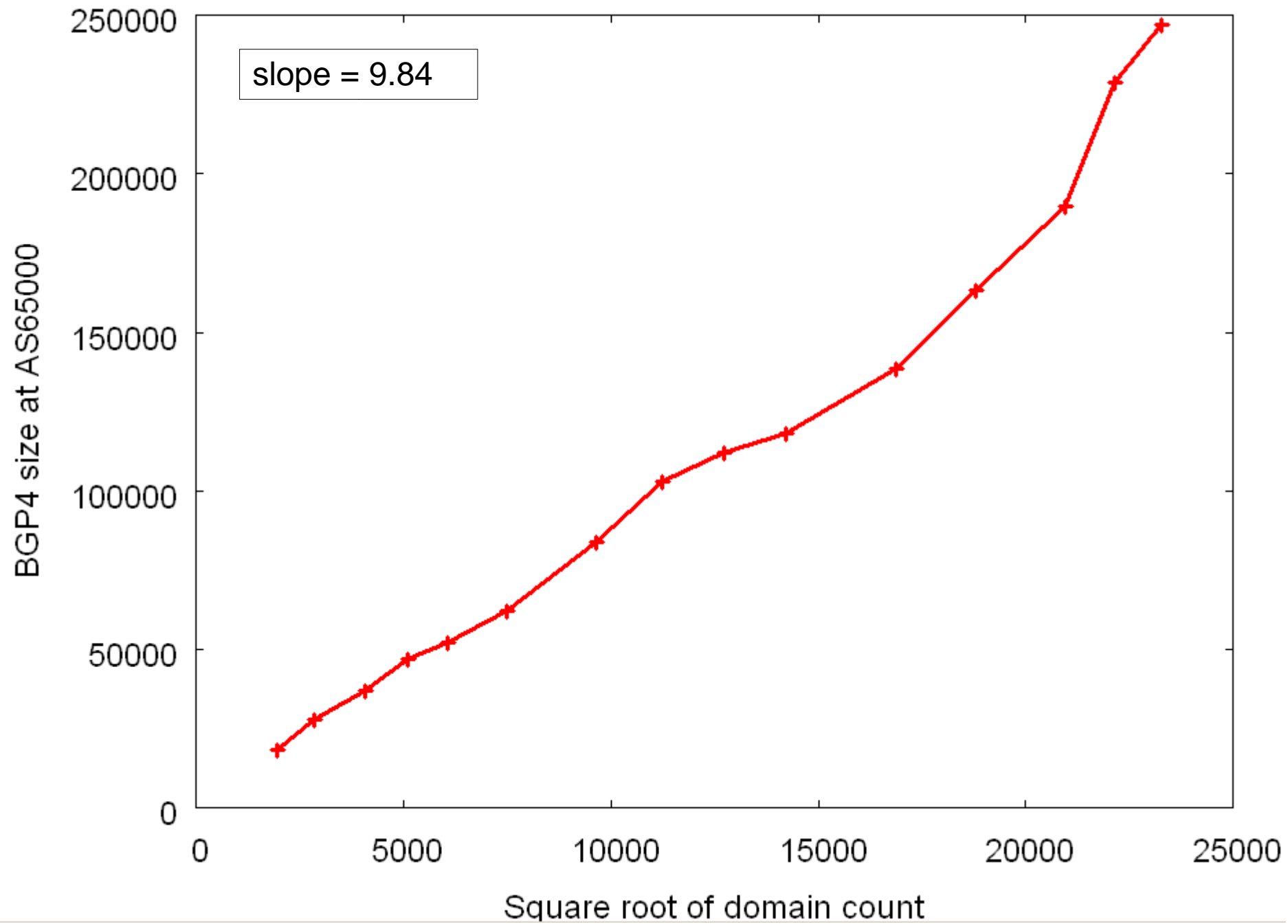
Domain count history knitted onto host count history (log scale)

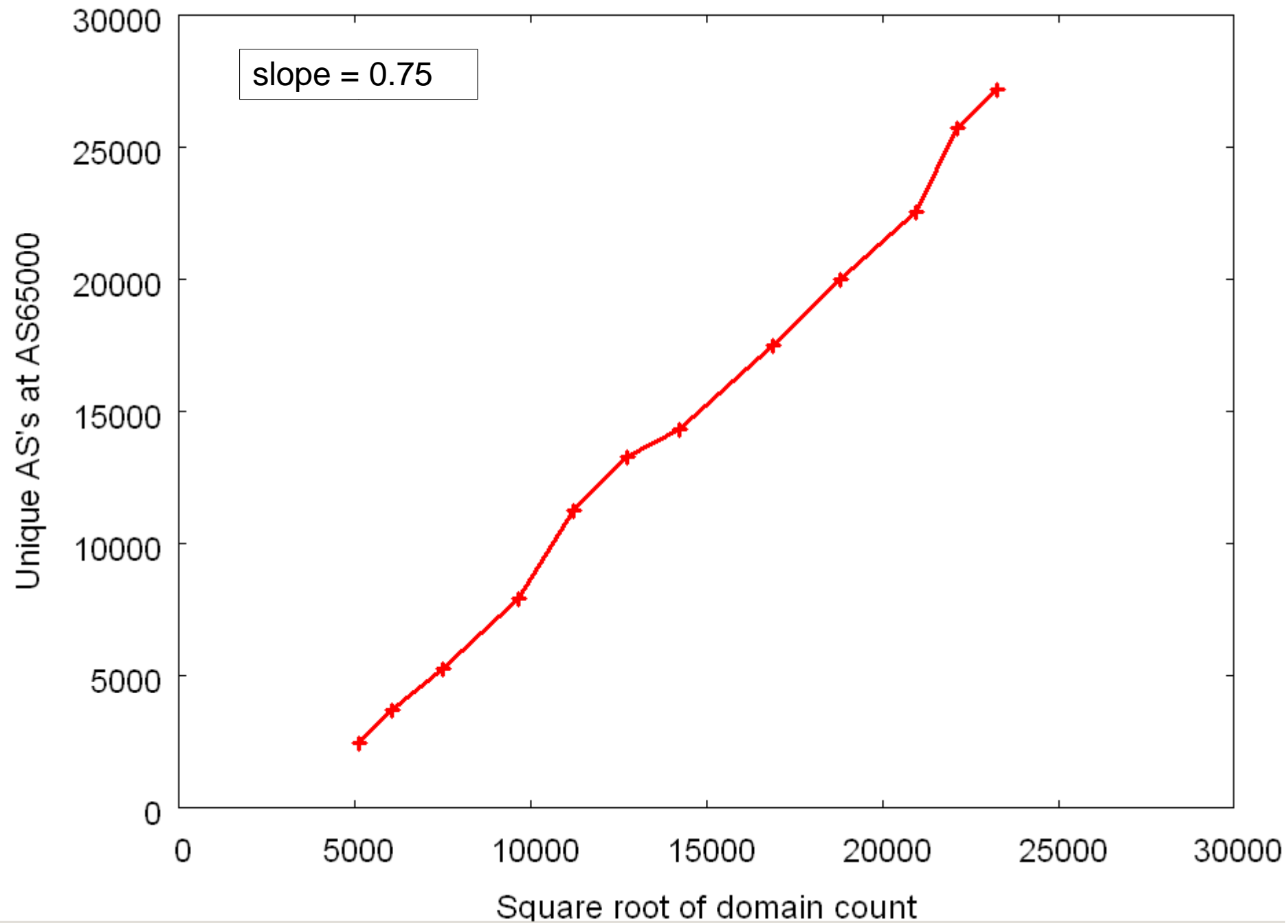


Data from <http://www.isc.org/> and other sources









Discussion

- Extrapolating these plots would be very debatable.
- However, it's interesting that despite a factor 140 growth in the size of the network since 1994, there seem to be consistent relationships.

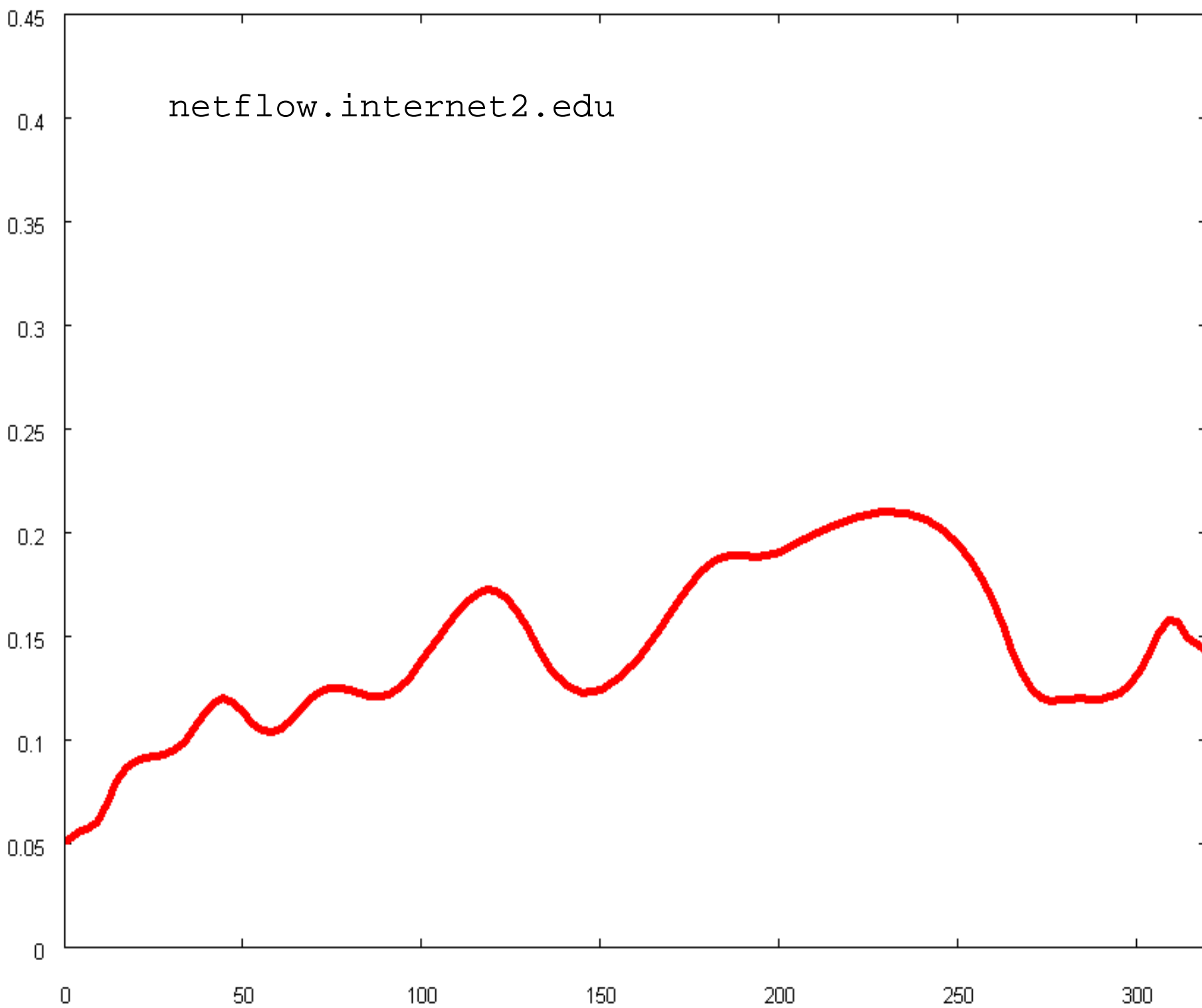
Q2: Is the ratio of UDP to TCP changing?

- Why might it be changing?
 - Because of predictions that video streams will come to dominate Internet traffic.
- We care because UDP is not congestion-controlled.
 - Changes packet size distribution, packet arrival time distribution, congestion response, drop rates.
 - All affect resource usage in switches and routers.
 - A significant change in UDP/TCP ratio may significantly change the resource tradeoff.
- *Data so far from Internet2 (thanks for the public data!) and some spot checks (thanks to several people).*

netflow.internet2.edu

UDP/
TCP
ratio
(pkts)

UDP/TCP packets



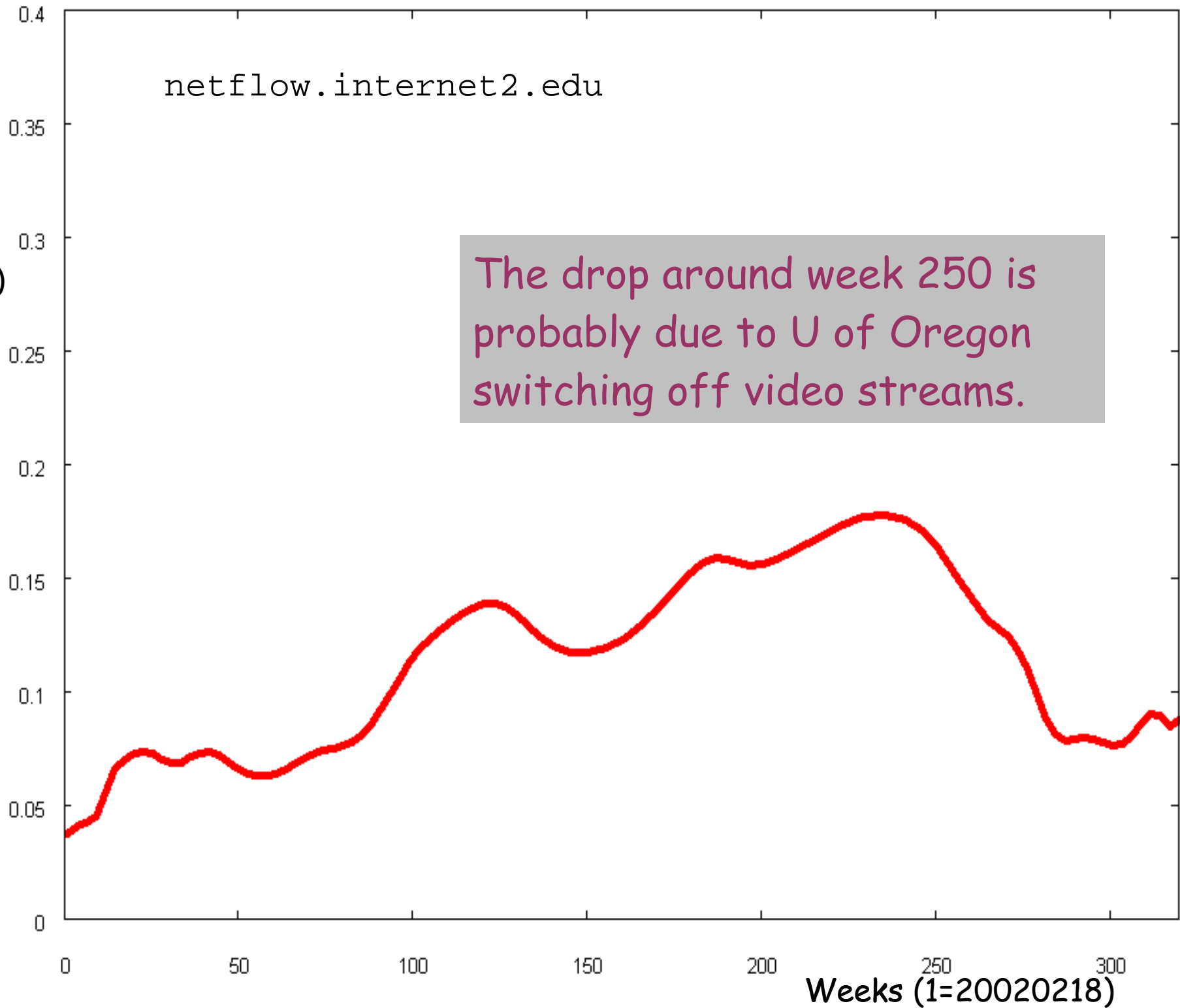
Weeks (1=20020218)

netflow.internet2.edu

UDP/
TCP
ratio
(bytes)

UDP/TCP bytes

The drop around week 250 is probably due to U of Oregon switching off video streams.



Summary

- Considering two NRENs:

	2002	2008	2007	2008
	Internet2		UNINETT	
Packets	5%	15%	8%	10%
Bytes	4%	8%	3.2%	3.9%

- NRENs are not typical of the whole Internet. Spot data from elsewhere:

	1998	2006	2008				
	FIX-W	Sweden	DE-CIX	JPNAP	Anon	NIX	LINX
Packets	14%	6.5%	15%	9%	9%	20%	19%
Bytes	5%	3%	4%	4.8%	--	6.7%	--

Discussion

- There's no doubt that UDP% is increasing on Internet2 (and probably other edu/research nets).
- No evidence that it's increasing in commercial traffic.
 - In fact, the data vary widely
- Can we conclude that growth in video is mainly going over HTTP/TCP?
 - ✓ Spot checks on popular video sites suggest: YES
- If so, what does that mean for congestion, loss, fairness, and streaming performance?
- And is DCCP likely to have any impact?

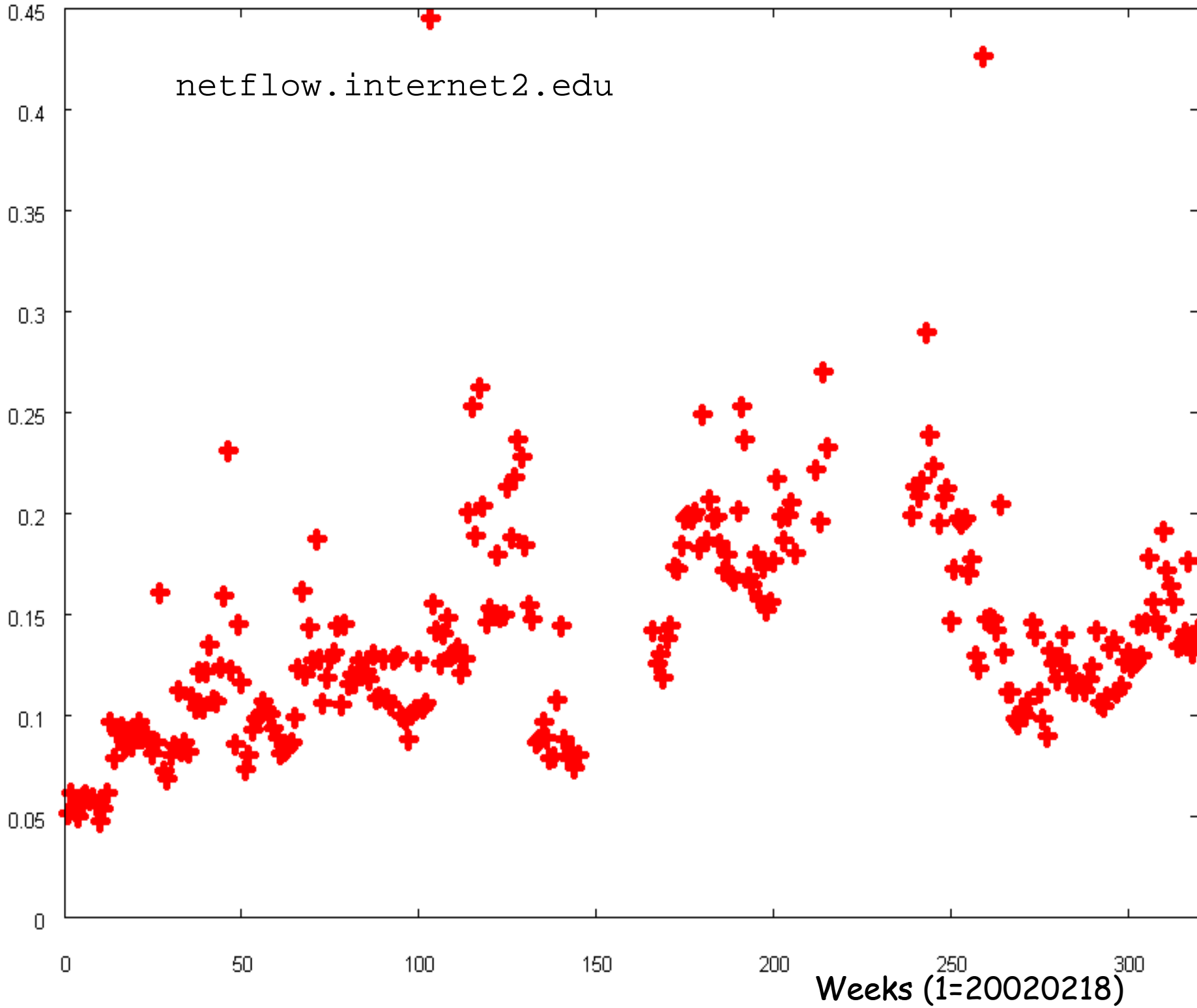
Data sources

- Internet2: <http://netflow.internet2.edu/weekly>
 - Raw graphs at <http://netflow.internet2.edu/weekly/longit>
 - Raw data (1.6MB) at <http://netflow.internet2.edu/weekly/longit/long.dat>
 - Unsmoothed ratio graphs follow
- DE/CIX: Arnold Nipper
- JPNAP: Toshinori Ishii
- NIX: Kjetil Olsen
- LINX: Mike Hughes
- FIX-WEST: CAIDA
- UNINETT: Arne Oslebo
- Sweden: Analysis of Internet Backbone Traffic, W.John & S.Tafvelin, IMC 2007.

UDP/
TCP
ratio
(pkts)

UDP/TCP packets

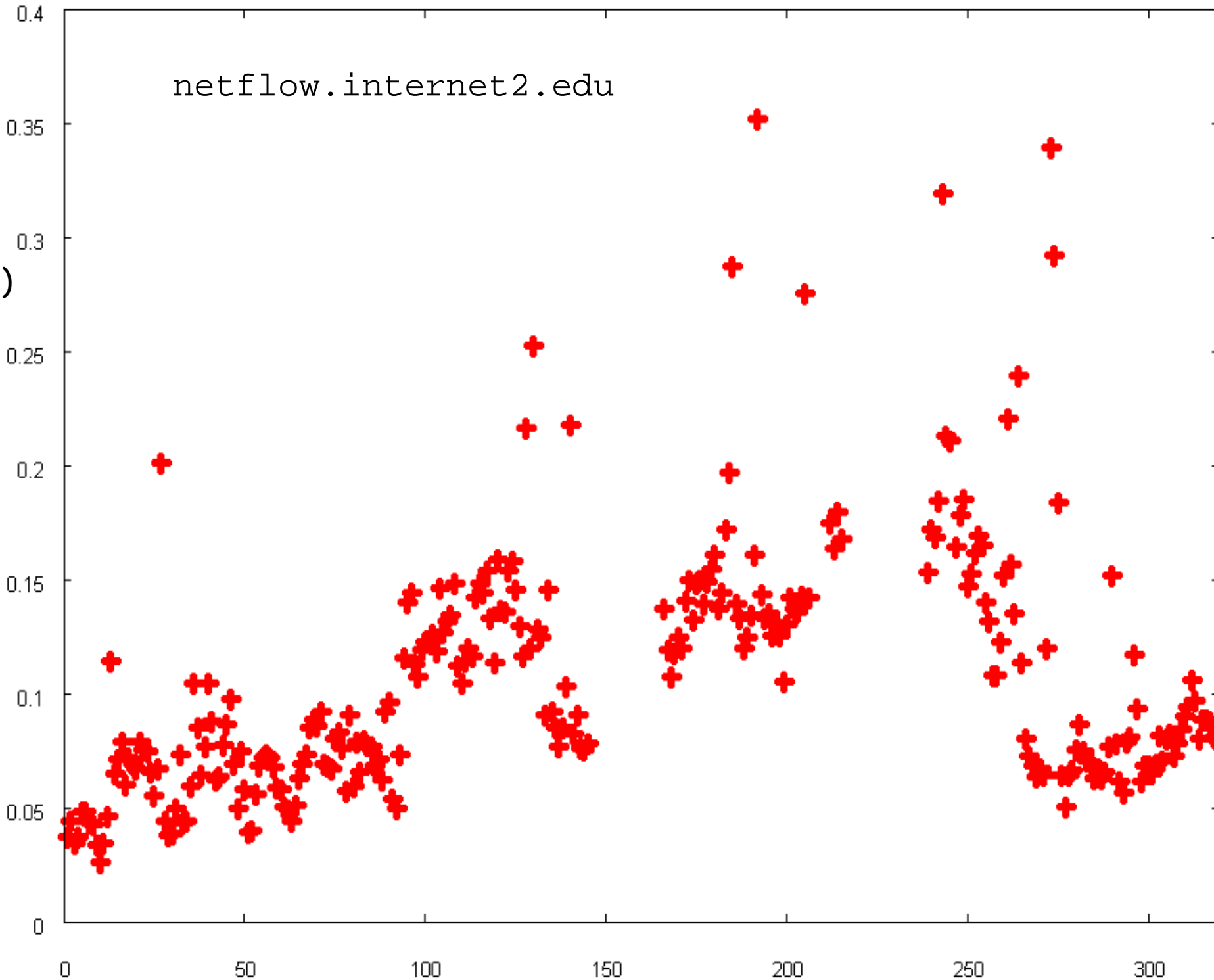
netflow.internet2.edu



netflow.internet2.edu

UDP/
TCP
ratio
(bytes)

UDP/TCP bytes



Weeks (1=20020218)