

On the Topological Distribution of Interdomain Traffic: the stub-ISP's viewpoint

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The Internet Today

A large network :

- more than 160,000,000 hosts
- divided into more than 13,000 ASs
- about 120,000 routes in the BGP tables
- about 90 % of the ASs are stubs (non-transit)

Existing studies on Interdomain Traffic

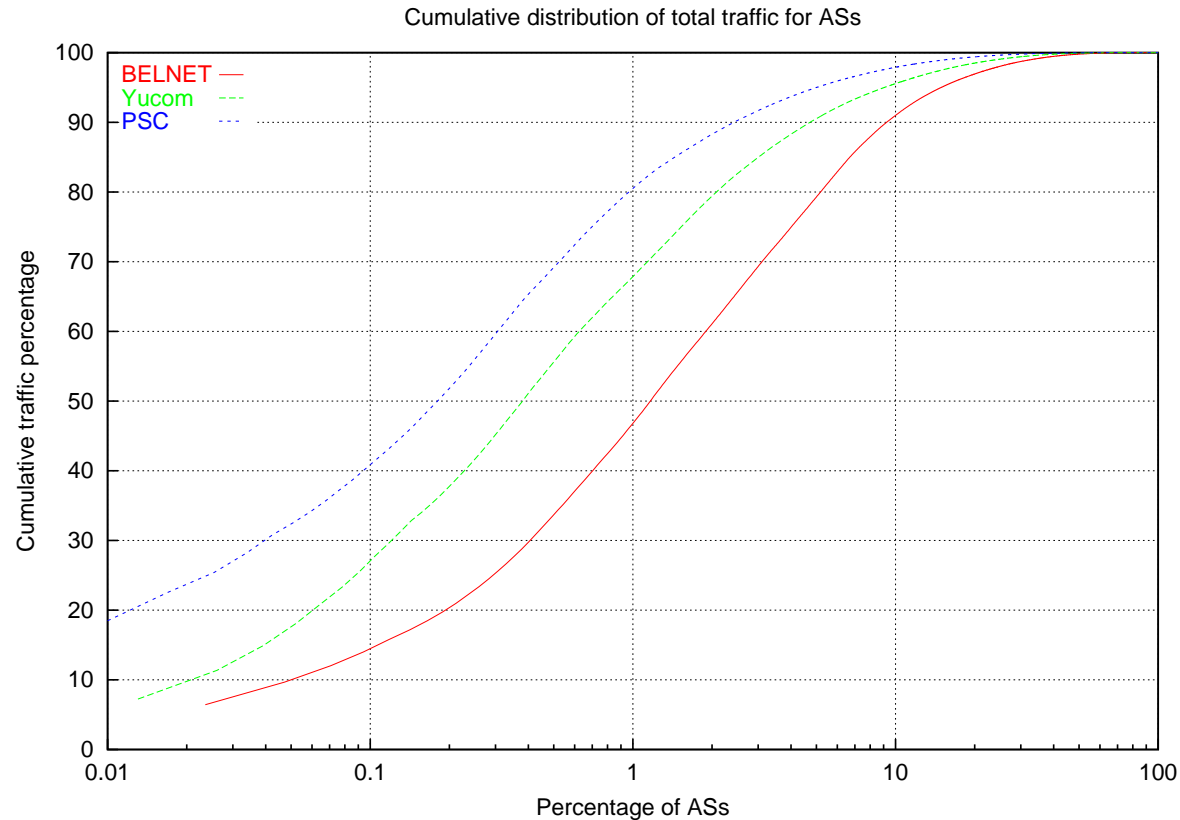
- Kleinrock et al. (1976) : first study of traffic between sites in the ARPANET
- Fang and Peterson : Inter-AS traffic patterns and characteristics (Globecom'99)
- Uhlig and Bonaventure : The macroscopic behavior of Interdomain traffic (available on INFONET Group website)

Existing studies on Interdomain Traffic Engineering

- Uhlig and Bonaventure : On the implications of traffic characteristics on interdomain traffic engineering (ETT, January '02)
- Nick Feamster and Jennifer Rexford : Network-wide BGP route prediction for traffic engineering (SPIE ITCOM, August '02). Also see Jennifer Rexford's web site at ATT...
- Quoitin , Uhlig and Bonaventure: Using redistribution communities for interdomain traffic engineering (QOFIS, October '02)
- Infonet group (Quoitin, Uhlig, Pelsser, Swinnen, Bonaventure) : Interdomain traffic engineering with BGP (IEEE Comm. Mag., January '03)

Interdomain Traffic Characteristics (1)

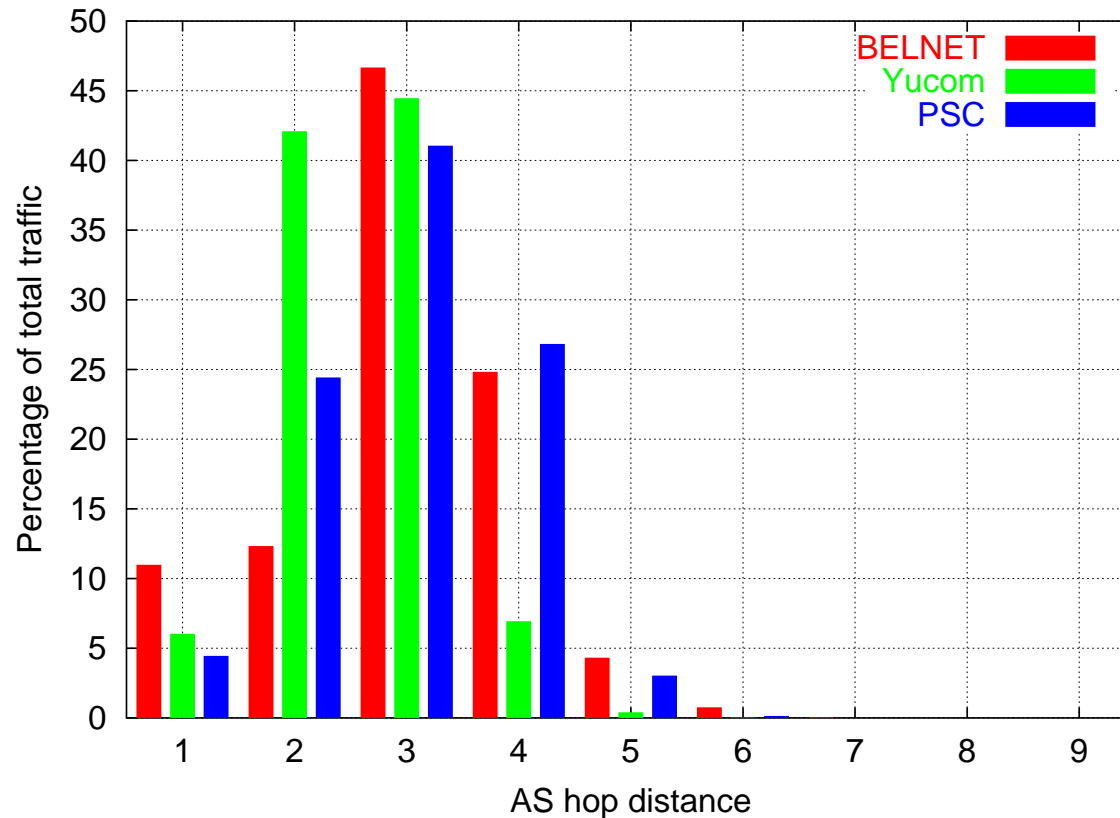
How much traffic from/to how many ASs ?



Most traffic comes from/goes to 100 to 1000 ASs.

Interdomain Traffic Characteristics (2)

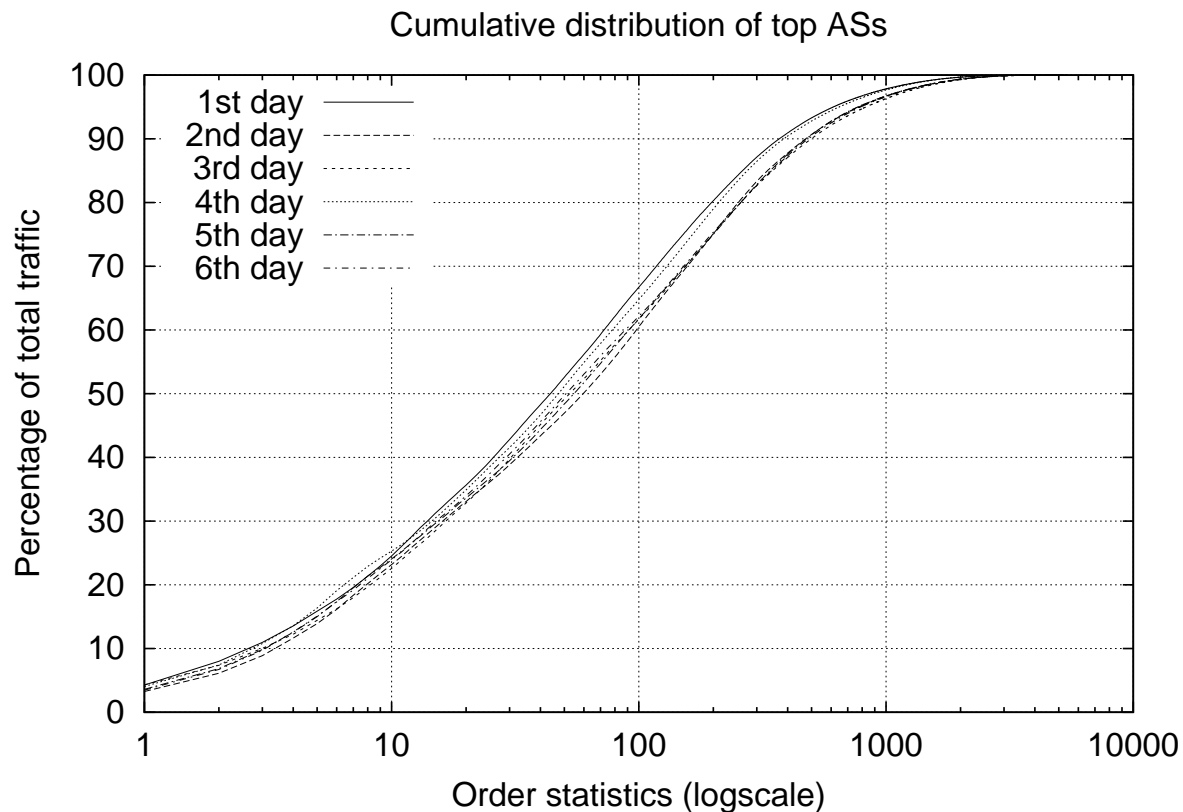
How much traffic from/to how far ?



Most traffic comes from/goes to 2-4 AS hops.

Day-to-day traffic stability (1)

Do top ASs represent a stable concept in terms of traffic capture ?



Day-to-day traffic stability (2)

How well do yesterday's top ASs "predict" today's top ASs ?

Day	Top 10	Top 100	Top 1000
1 → 2	5	70	773
2 → 3	9	79	819
3 → 4	8	64	723
4 → 5	7	58	713
5 → 6	9	74	821

Summary

We know that

- few interdomain sources/destinations are responsible for most traffic
- they are not very far in terms of ASs
- they're relatively stable...

What *could* we do?

1. better study interdomain traffic (characterization)
: dynamics with time, topological correlation
within interdomain traffic
2. develop traffic engineering tools : leverage
knowledge from point 1 to reduce cost of
interdomain traffic (outgoing is “easy”, incoming
very difficult)
3. think about the future : is it going to change and
how ? new applications, changes in economic
context...

What *can* **WE** do ?

- launch interdomain monitoring projects everywhere (networkers)
- study the existing data available on the web (data analysts)
- increase collaboration between networking and other fields like signal processing, statistics, optimization,...

Some ongoing efforts...

- Abry, Veitch and others using wavelet analysis (since mid '90s) to understand traffic dynamics
- CAIDA, RIPE, ITA: efforts to collect data (still insufficient)
- ACM Sigcomm : Sigcomm Internet measurement workshop since '01

Some personal efforts...

- collect interdomain traffic data from as many ISPs as possible : takes a lot of time to gather and analyze but necessary, without data no understanding.
- wavelets (and scaling) can tell us about the dynamics : what are the important variables, what are the statistical properties of these variables,...
- optimization techniques to tell us what we can do at interdomain level : currently using GAs to find optimal “traffic cost-BGP config” tradeoff