Understanding the Internet Topology

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Joint work with Damien Fay (Camb), Andrew Moore (Camb), Richard Mortier (Vipadia), Steve Uhlig (TU Delft) and Miguel Rio (UCL)
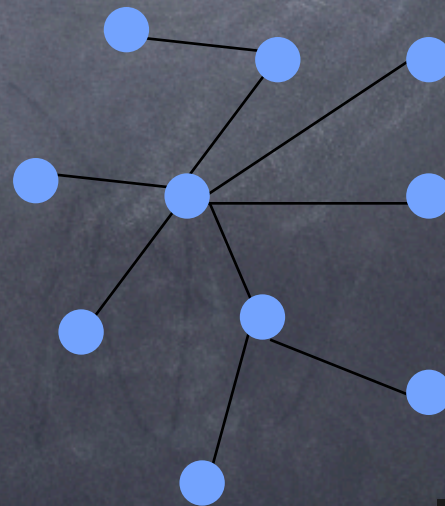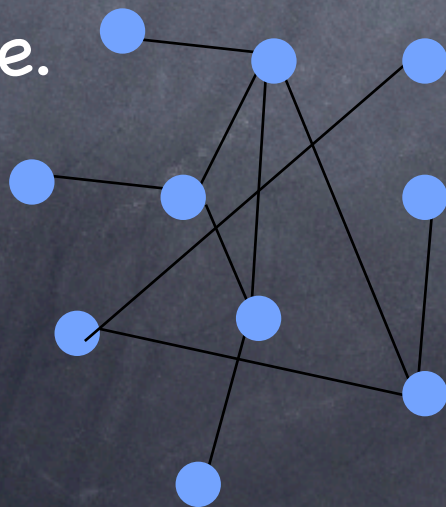
No researcher is an island... ((Hamed to Eiko Yoneki, MSN'07))

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Presentation Outline

- Problem description

- Metrics

- Data

- Evolution

- Conclusions.

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Overall goal

- How 'similar' are these two graphs/topologies?

- How do we define similarity:

- Link count,

- Node degree distribution,

- Centrality,

- Edit distance.

Overall goal

- The graphs we examine are different:

- we seek to validate 'Internet like' topologies not Internet topologies.

- Given a metric this can then be used to determine optimum parameters of a topology generator.

- Validation: it is difficult to validate a metric as this would require a metric!

- Important for analysis of economics of the Internet, locating optimum locations for IXPs and CDN network peering points.

Related work

- Network Topology Generators: Degree-Based vs. Structural. Hongsuda Tangmunarunkit, Walter Willinger, Ramesh, Govindan Sugih Jamin, Scott Shenker. Computer Communication Review, 2002

- Observing the evolution of internet as topology. Ricardo V. Oliveira, Beichuan Zhang, Lixia Zhang, SIGCOMM 2007

- A quantitative comparison of graph-based models for Internet topology. E. W. Zegura, K. L. Calvert, and M. J. Donahoo. IEEE/ACM Transactions on Networking (TON), 5(6):770–783, (1997).
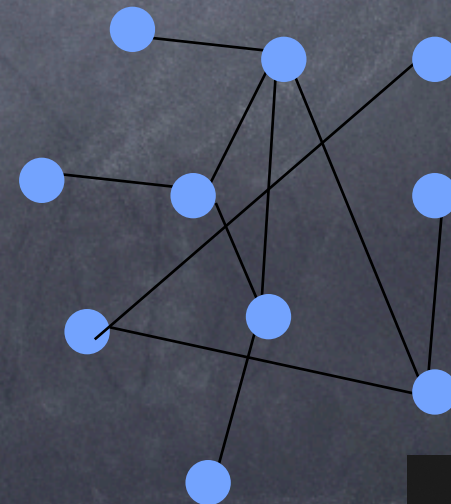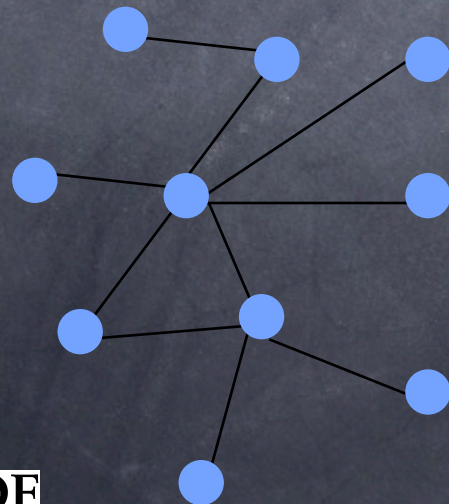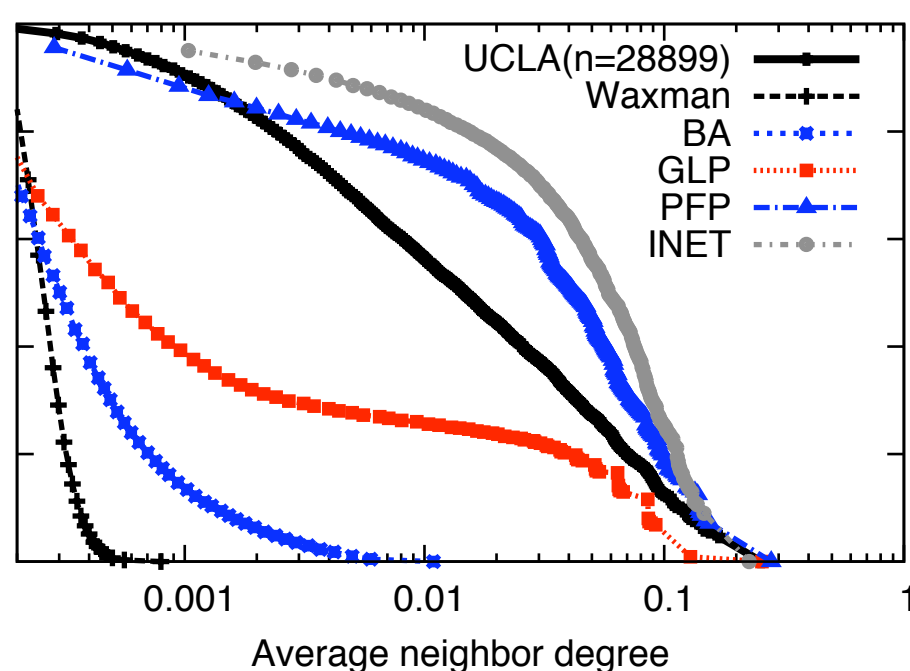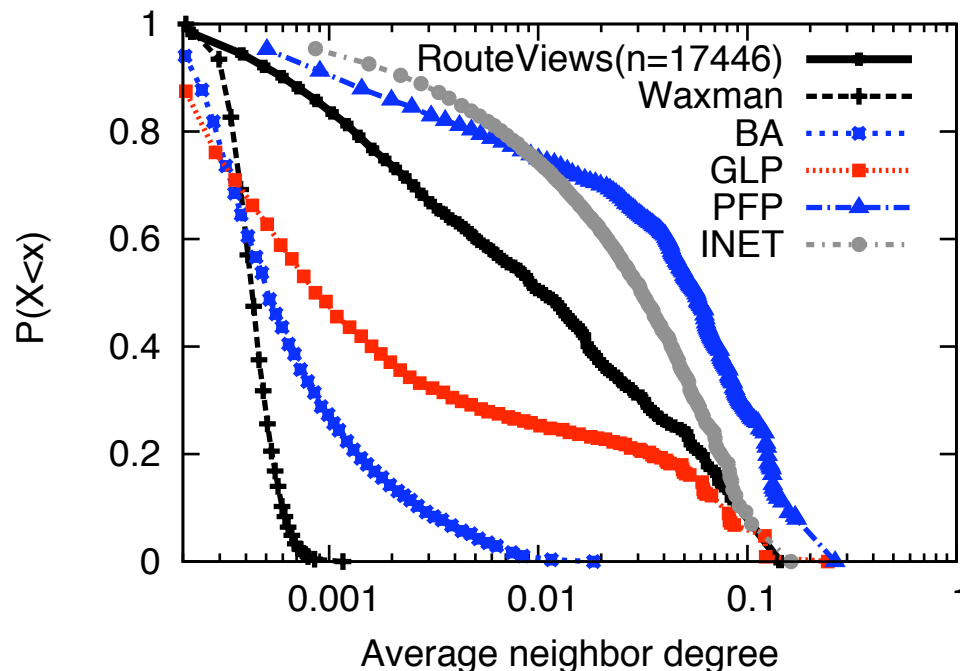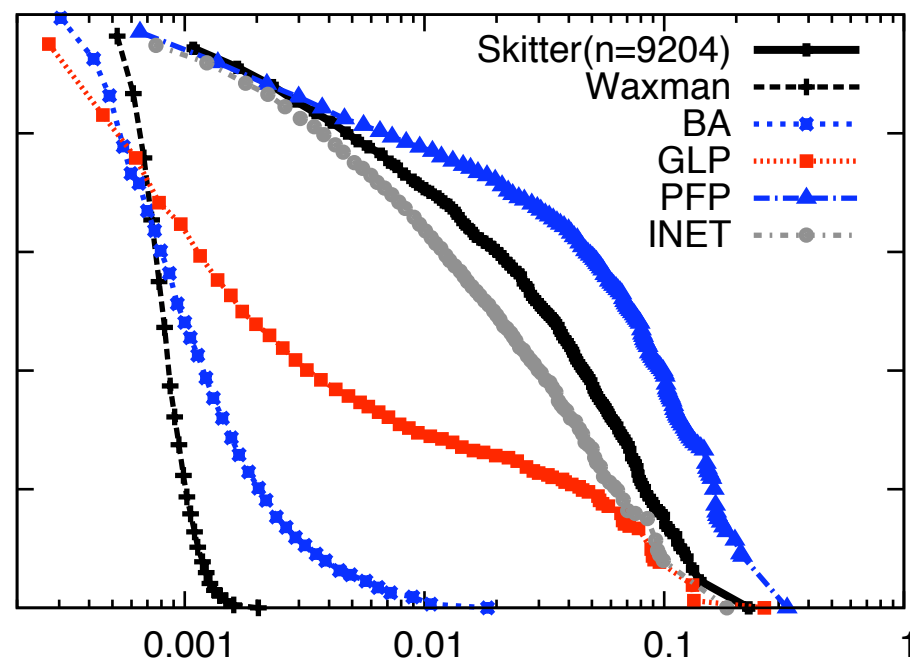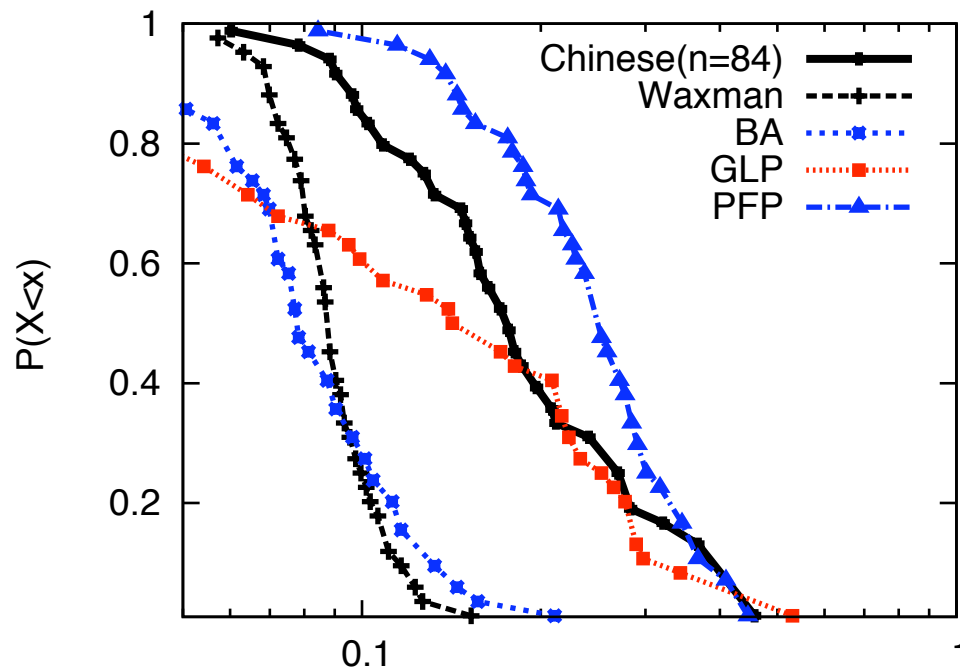
Internet AS topology models

- We compare 5 topology generators:

- The Waxman model

- The 2nd Barabasi and Albert Model (BA2)

- The Generalised Linear Preference model (GLP)

- The INET model

- Positive Feedback Preference model (PFP)

- To 4 data set for the internet at AS level:

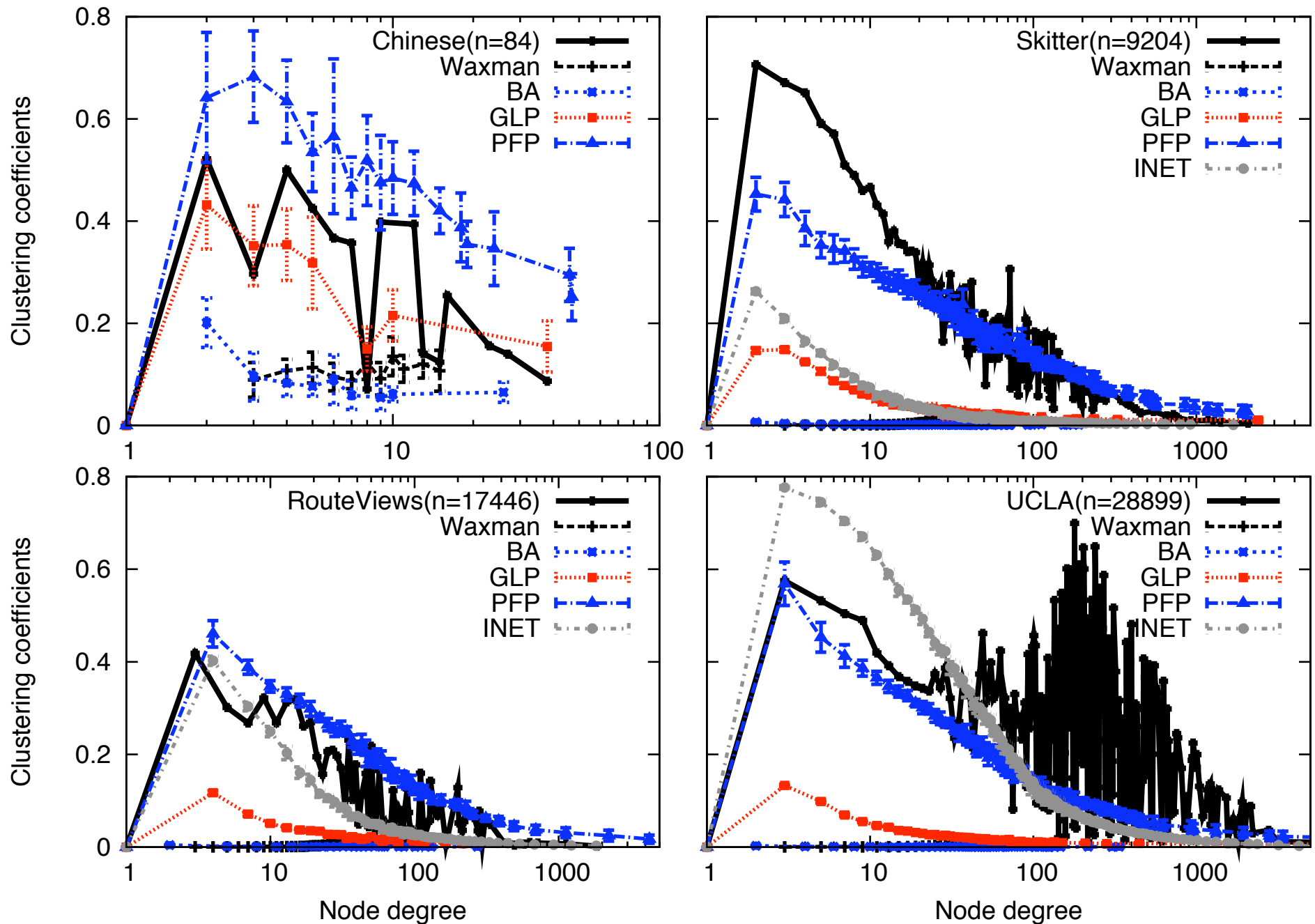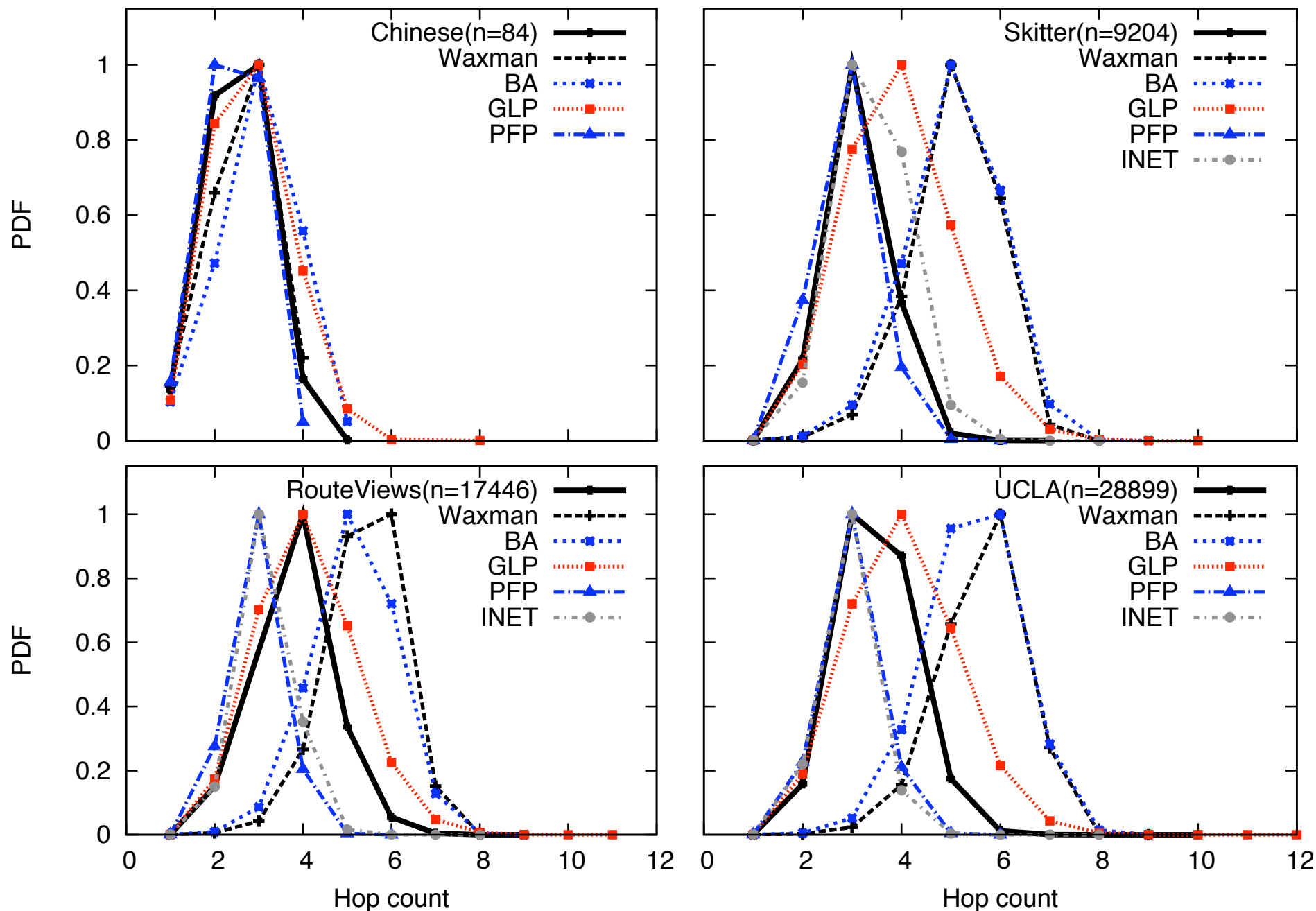- Chinese, Skitter, Routeviews and UCLA
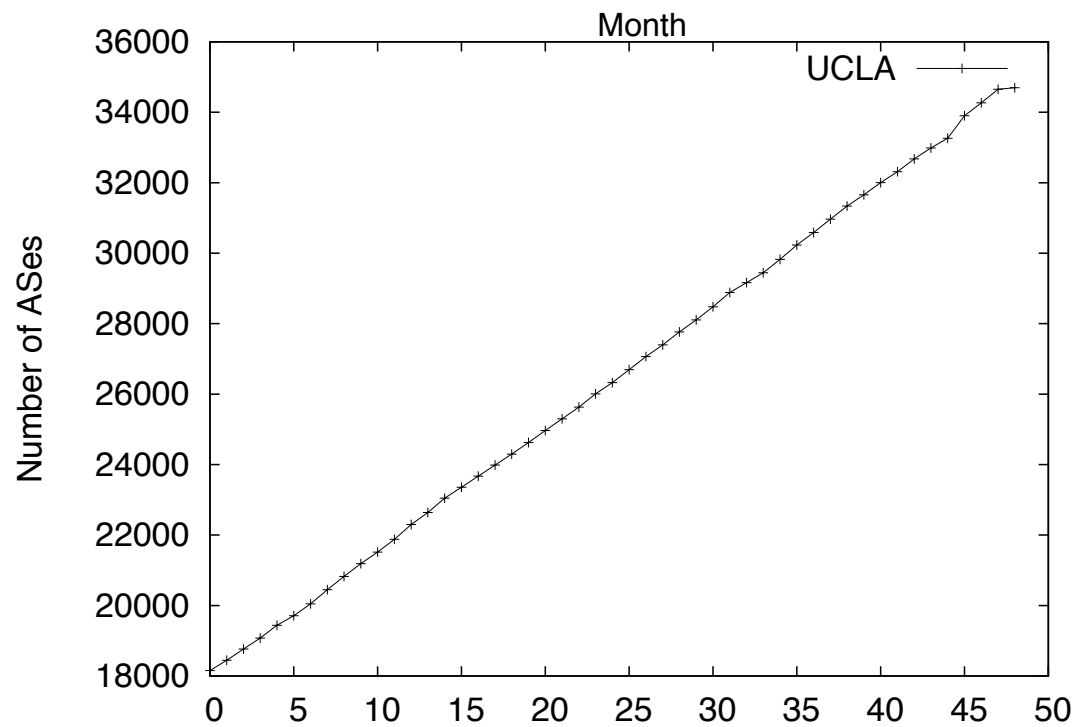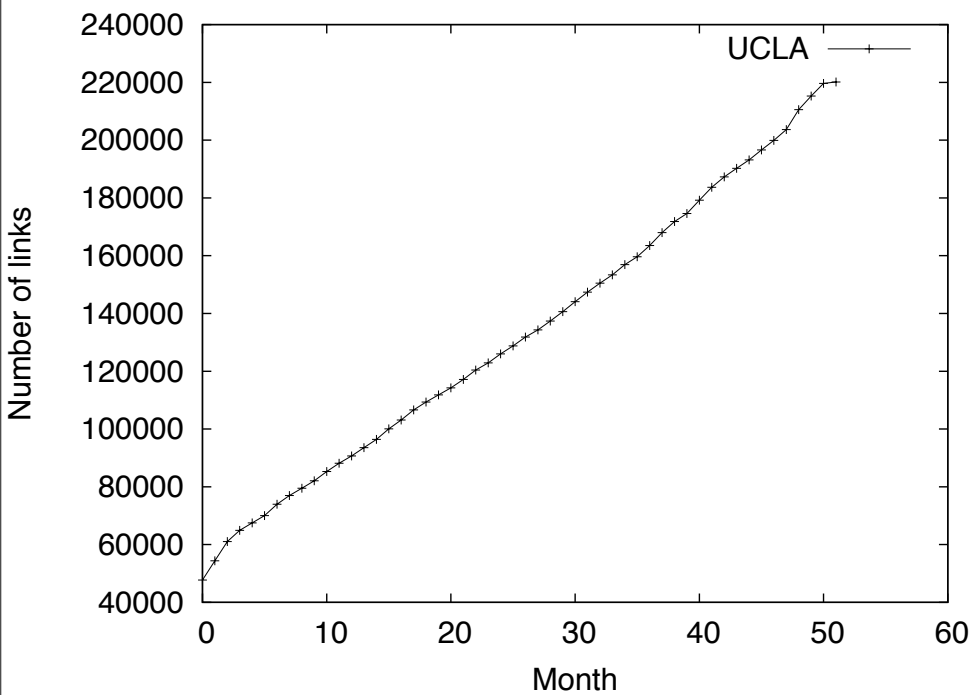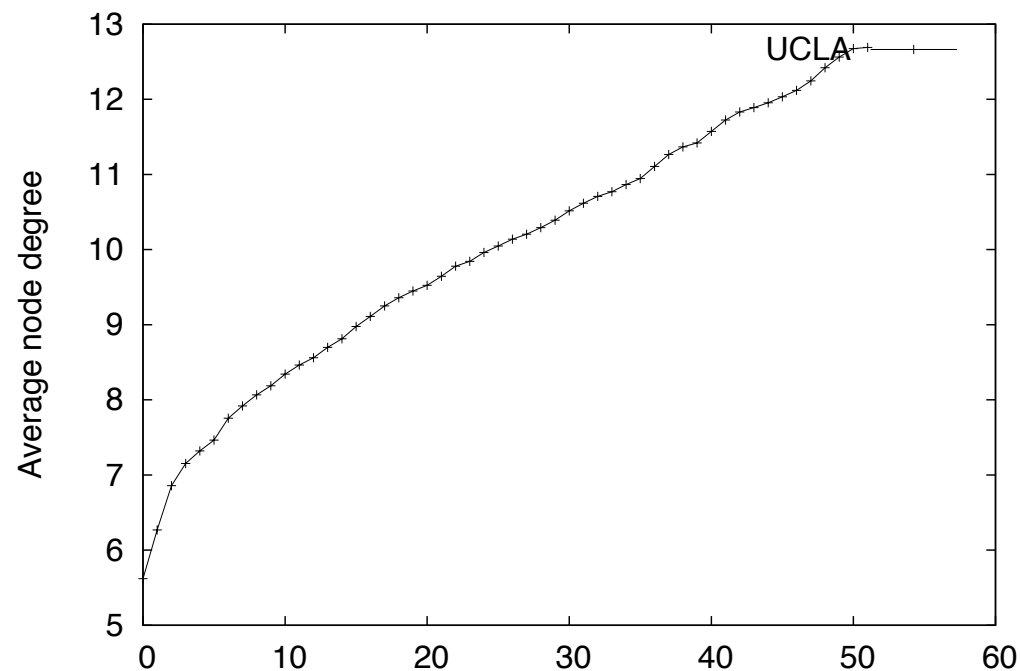
Degree distribution
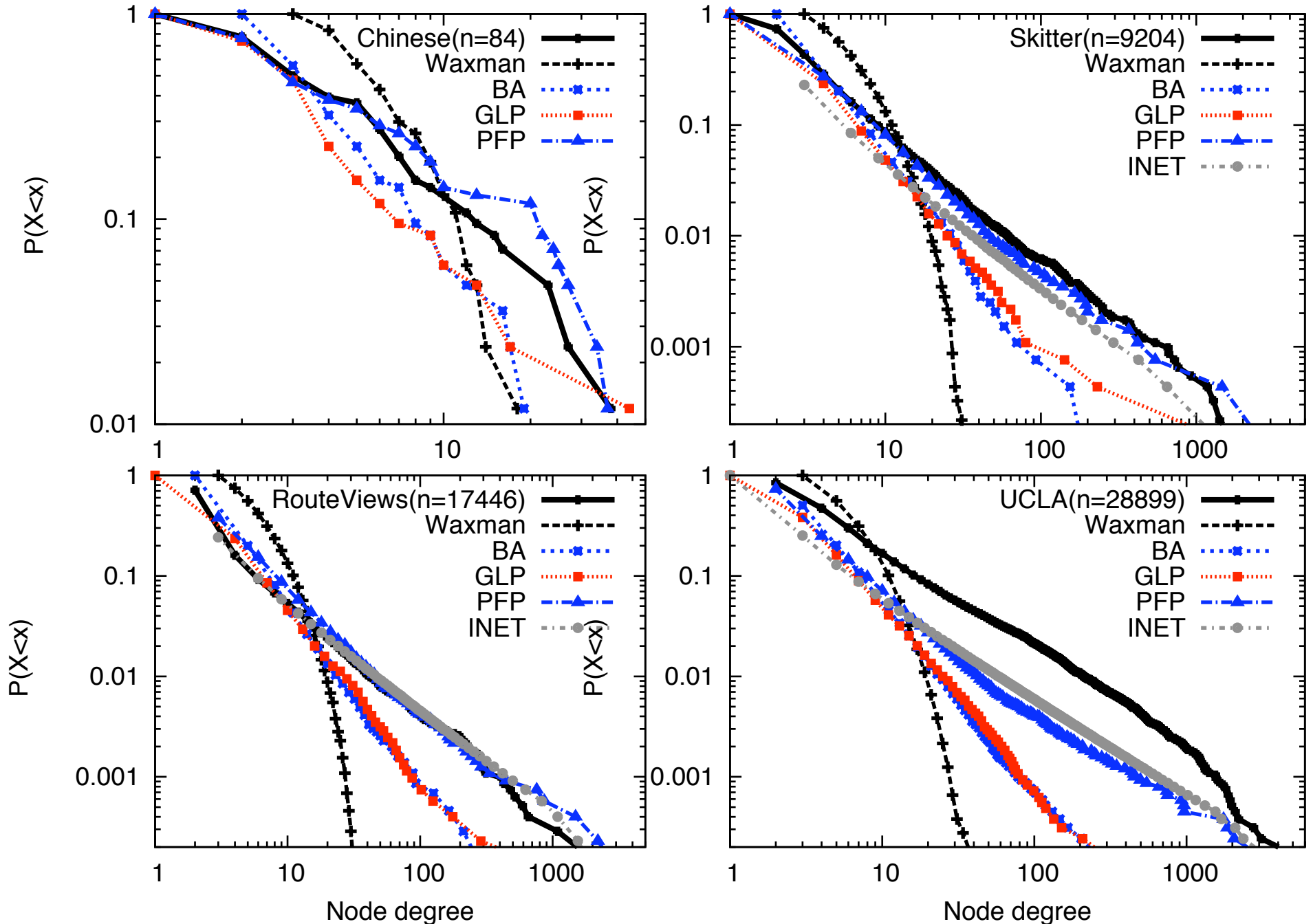
Average neighbor degree

Clustering Coefficients

Shortest path distributions
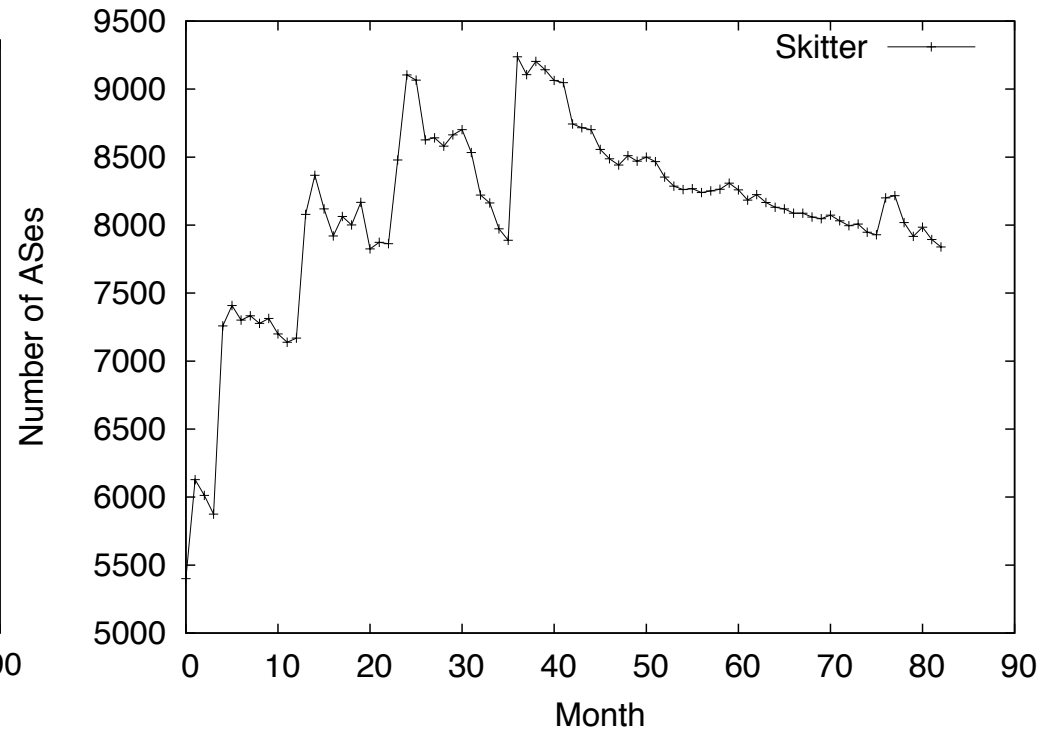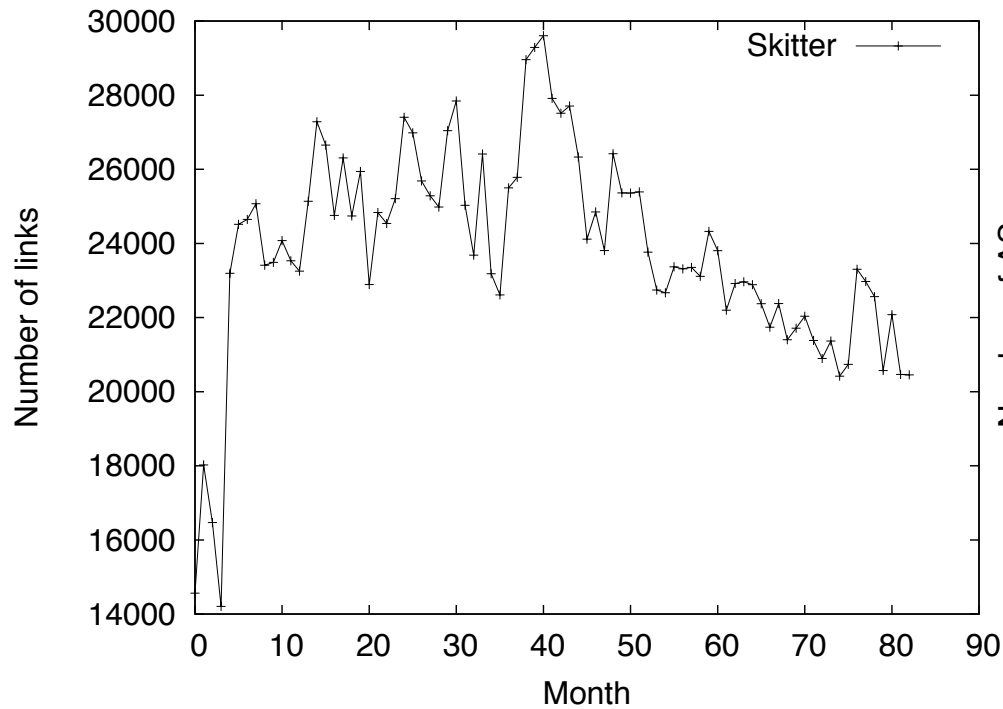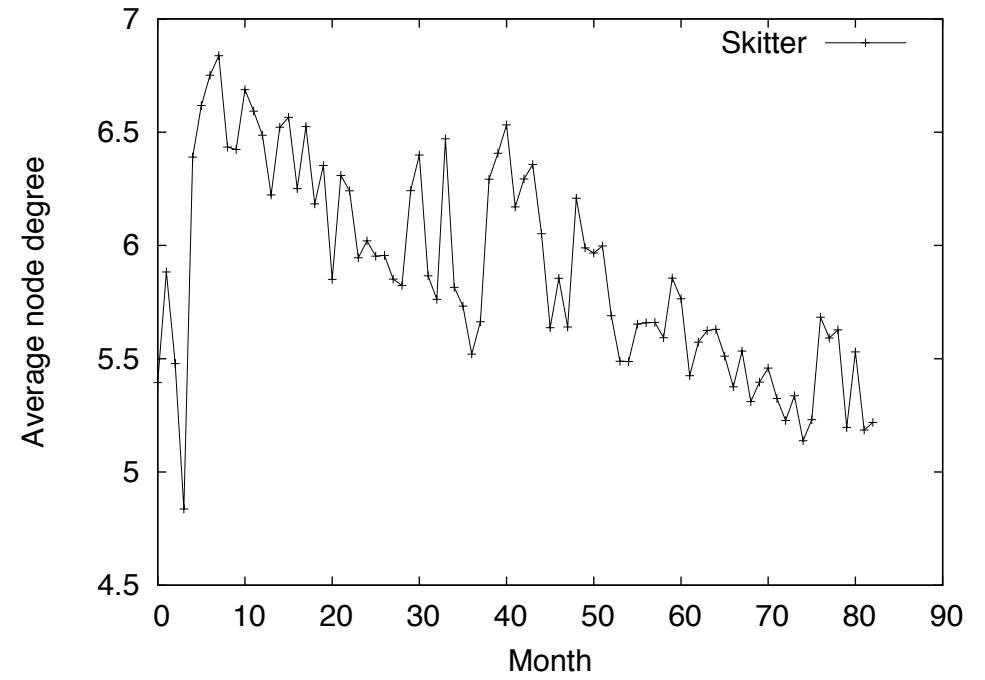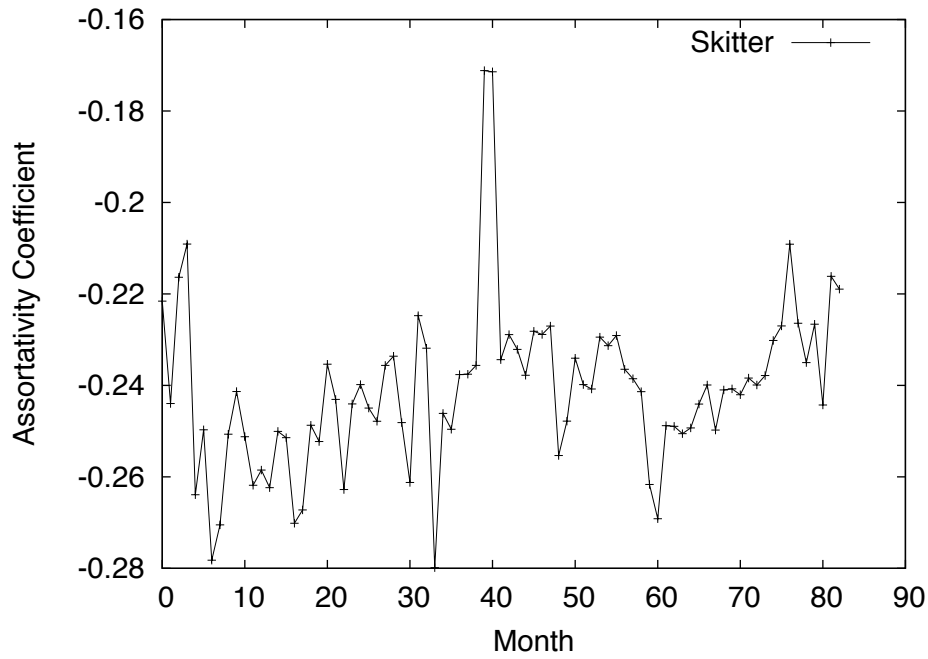
Internet Evolution
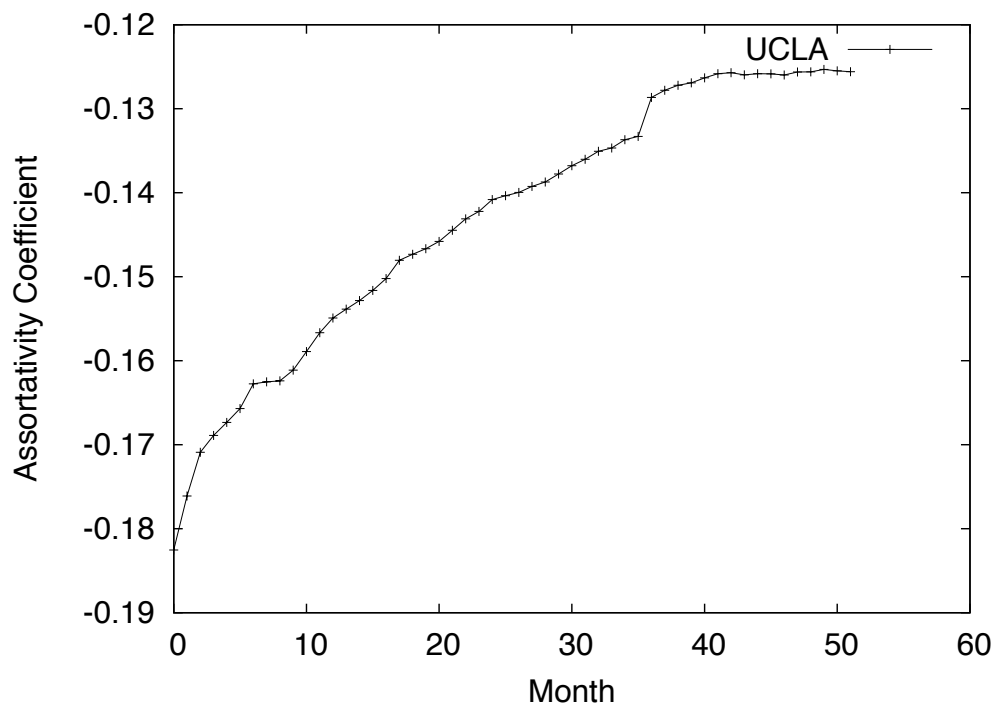
Internet Evolution

Conclusions

- Careful choice of metrics

- Internet topology is evolving.. look out for our papers

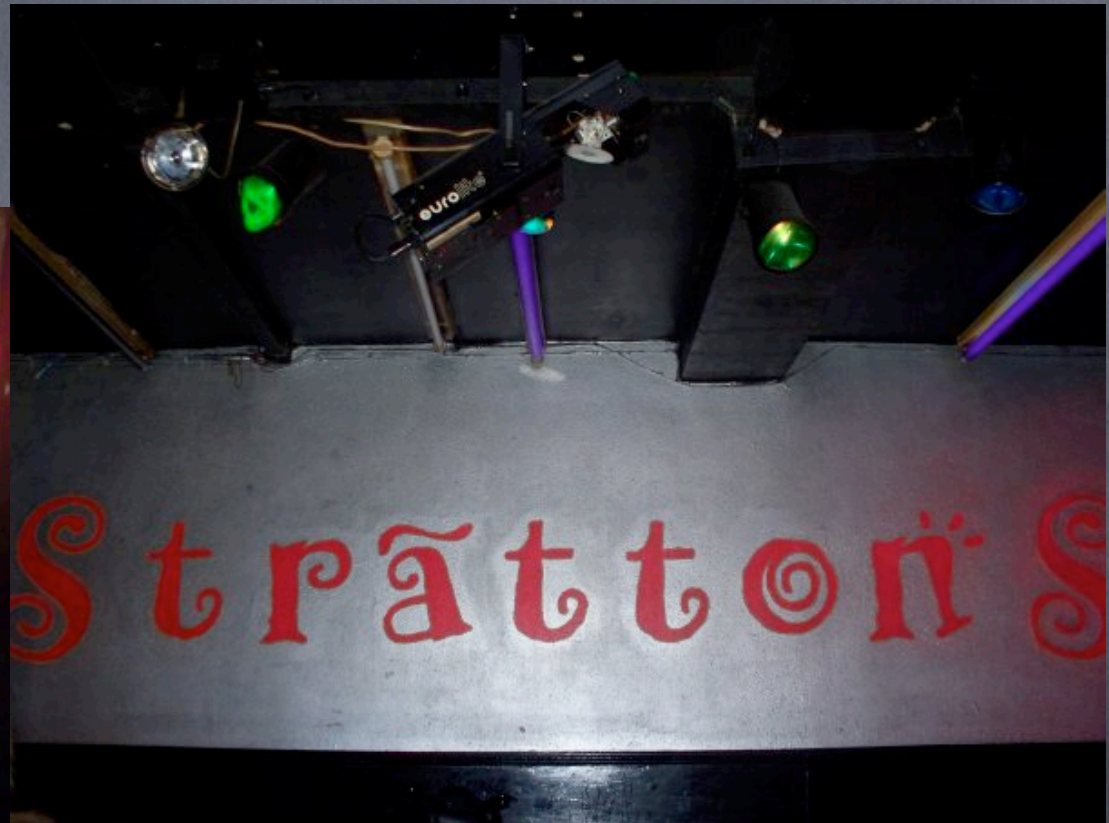- Simulations can be subject to wrong assumptions

Hamed Haddadi, Gianluca Iannaccone, Andrew Moore, Richard Mortier, Miguel Rio, "Network Topologies: Inference, Modelling and Generation", IEEE Communications Surveys and Tutorials, Volume 10, Number 2, 2008

Hamed Haddadi, Damien Fay, Steve Uhlig, Andrew Moore, Richard Mortier, Almerima Jamakovic, Miguel Rio, "Tuning Topology Generators Using Spectral Distributions", SPEC International Performance Evaluation Workshop 2008, Springer Lecture Notes in Computer Science, Volume 5119, June 2008, Darmstadt, Germany

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Questions?

Now.....

or at Sticky Carpets??

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