

Evergrow Final Review WP 1a & 2c

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DIMES - The big pictures



**In four years we created an infrastructure
that will have a long term impact on
research**

- **Many people use DIMES data world wide**
- **Some people run their own experiments**
- **Some people are debating the DIMES approach**

Papers Using DIMES data



Papers by the DIMES team:

- Shai Carmi, Shlomo Havlin, Scott Kirkpatrick, Yuval Shavitt, and Eran Shir. "A Model of Internet Topology Using k-shell Decomposition" Proceedings of the National Academy of Sciences USA (PNAS), 104(27):11150--11154, July 3, 2007
- Yuval Shavitt and Yaron Singer. Beyond Centrality - Classifying Topological Significance using Backup Efficiency and Alternative Paths. New Journal of Physics. A shorter version appears at IFIP NETWORKING 2007.
- Dima Feldman and Yuval Shavitt. An Optimal Median Calculation Algorithm for Estimating Internet Link Delays from Active Measurements. End to end monitoring workshop (E2EMON), Munich, Germany, May 2007.
- Yuval Shavitt and Eran Shir. DIMES: Let the Internet Measure Itself. In Michael H.W. Weber, editor, "Distributed & Grid Computing - Science Made Transparent for Everyone. Principles, Applications and Supporting Communities". Tectum Verlag, to appear Q2, 2008.
- Yuval Shavitt, Eran Shir, and Udi Weinsberg. A Near-Deterministic AS Relationships Inference Algorithm, submitted.
- Dima Feldman and Yuval Shavitt. Automatic Large Scale Generation of Internet PoP Level Maps, submitted.
- Yuval Shavitt and Yaron Singer. Trading Potatoes in Distributed Multi-Tier Routing Systems, submitted.

Papers Using DIMES data



Papers by EVERGROW partners:

- [E. Marinari, R. Monasson and G. Semerjian. An algorithm for counting circuits: Application to real-world and random graphs](#)
- Cosmin Arad, Ozair Kafray, Ali Ghodsi and Seif Haridi. GODS: Global Observatory for Distributed Systems. SICS Technical Report T2007:10
- Danny Bickson and Dahlia Malkhi. A unifying framework for rating users and data items in Peer-to-Peer and social networks. PPNA journal. Accepted, January 2008.
- S Carmi, R Cohen, D Dolev. Searching complex networks efficiently with minimal information. Europhys. Lett, 2006

Papers Using DIMES data



Papers by other researchers

- Harsha V. Madhyastha, Thomas Anderson, Arvind Krishnamurthy, Neil Spring and Arun Venkataramani. A structural approach to latency prediction. Proceedings of the 6th ACM SIGCOMM conference on Internet measurement table of contents, Rio de Janeiro, Brazil
- Ricardo V. Oliveira, Beichuan Zhang and Lixia Zhang. Observing the evolution of internet AS topology. ACM SIGCOMM Computer Communication Review
- Reuven Cohen, Mira Gonen and Avishai Wool. Bounding the Bias of Tree-Like Sampling in IP Topologies. Proc. Euro. Conference on Complex Systems (ECCS), Dresden, Germany, 2007
- M. Faloutsos. Public real data repositories and measurement tools ACM SIGCOMM Computer Communication Review archive
- Alvarez-Hamelin, Jose Ignacio; Dall'Asta, Luca; Barrat, Alain; Vespignani, Alessandro. *k*-core decomposition: a tool for the analysis of large scale Internet graphs. arXiv:cs/0511007v2 [cs.NI]
- Shai Carmi, Zhenhua Wu, Eduardo Lopez, Shlomo Havlin, and H. Eugene Stanley. "Transport between multiple users in complex networks". Eur. Phys. J. B 57, 165-174

Milestones and Deliverables



Deliverable:

- D.1a.4 Models of Internet topology
- D.2c.2 Data definition and filters
- D.2c.3 Bias issues

Milestones in the Deliverable:

- M.1a-3.4 Maps with additional measures
Unidirectional measurements.
Detailed router level map.

Main activities



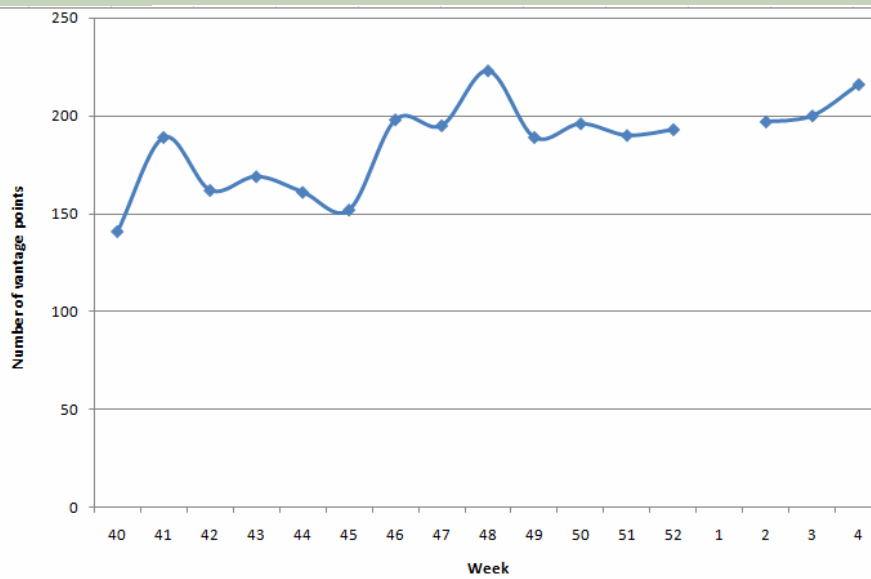
Engineering

- DIMES re-engineering: making the project stable
- Hardware upgrade: storage & computing power
- New agent (ver 0.5.0)

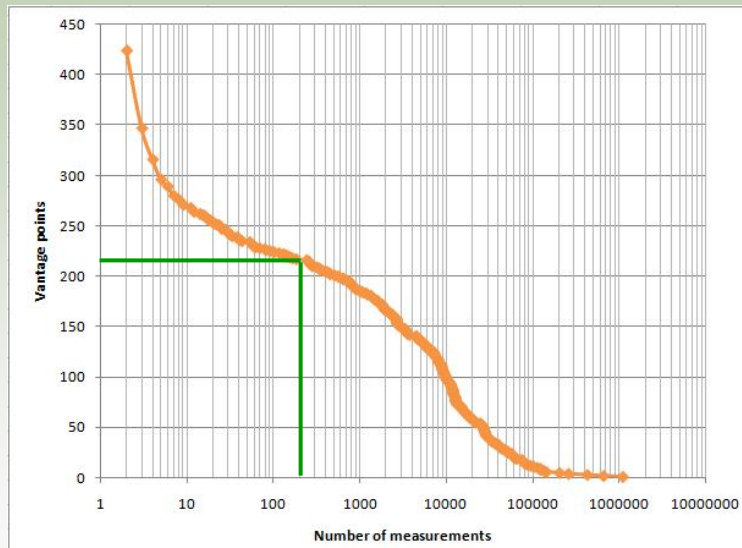
Scientific

- DIMES data analysis: *k*-core, importance measures, bias, anonymous router identification.
- Generation of PoP level maps
- DIMES Internet distance service
- Near-deterministic Type of Relationships (ToR) algorithm
- Visualization tools
- DIMES-ETOMIC unidirectional measurements

Stability of Vantage Points



How to count vantage points?



Week 4, 2008

DIMES Contribution



Table 1: Filtering effect on topology

Filter	Total Topology		DIMES Topology		Edges Origin		
	ASes	Edges	ASes	Edges	DIMES	RouteViews	Both
None	27284	76372	19068	51633	19578	24739	32055
Dates	27277	66815	18378	39343	10021	27472	29322
ASes	27279	68997	18708	42478	12203	26519	30275
VPs	27283	75935	18733	43790	19141	24745	32049

~18% increase

DIMES Contribution

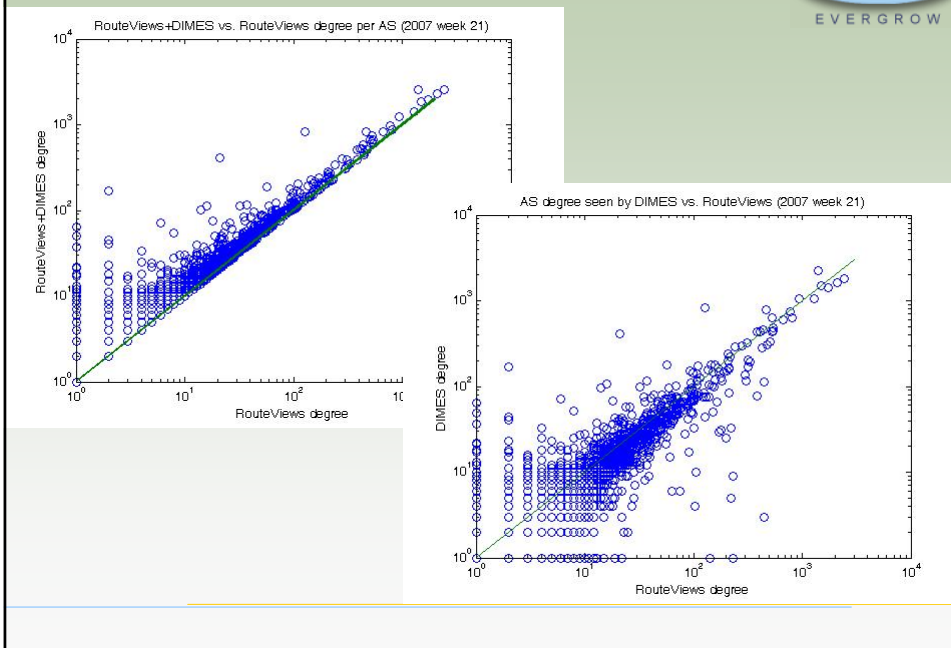


Interconnection between the top k -core ASes

Green - DIMES only
Blue - RouteViews only
Red - both



Where links are added?



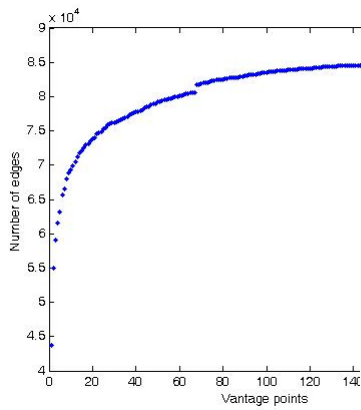
Diminishing return



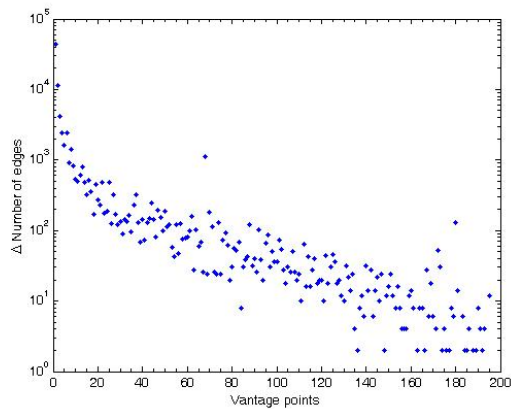
- [Chen et al 02], [Bradford et al 01]: when you combine more and more points of view the return diminishes very fast
- What have they missed?
 - The mass of the tail is significant



Diminishing return?



Ordered by topology size

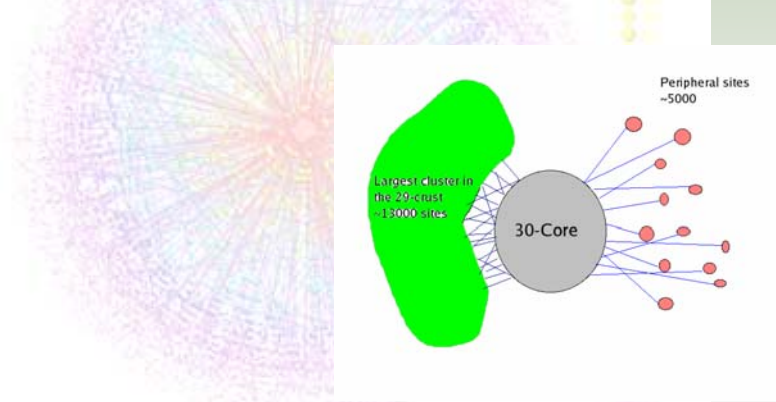


filtered week 3, 2008

k-core Analysis



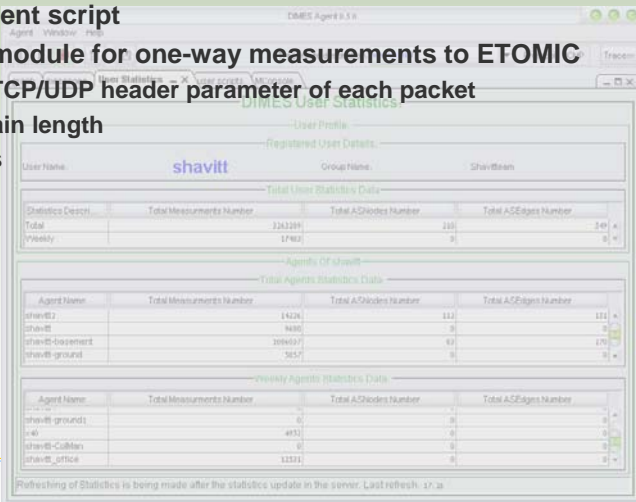
- A new definition of the Internet core
- More global – less North American biased
- Most of the Internet stay connected without the core
 - We need mechanism design to enable use of these connections



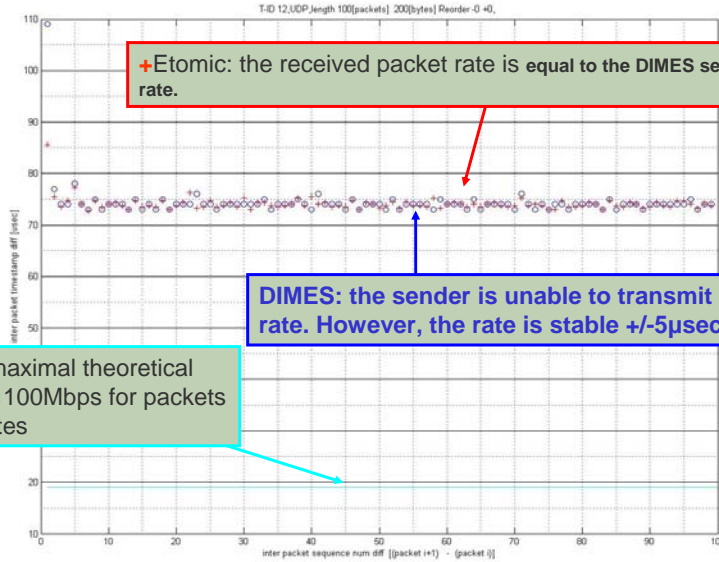
Agent Ver. 0.5.0



- Many bug fixes
- Statistic tab and other user oriented features
- Default measurement script
- New packet-train module for one-way measurements to ETOMIC
 - Control over IP, TCP/UDP header parameter of each packet
 - Packet length, train length
 - Inter-packet gaps



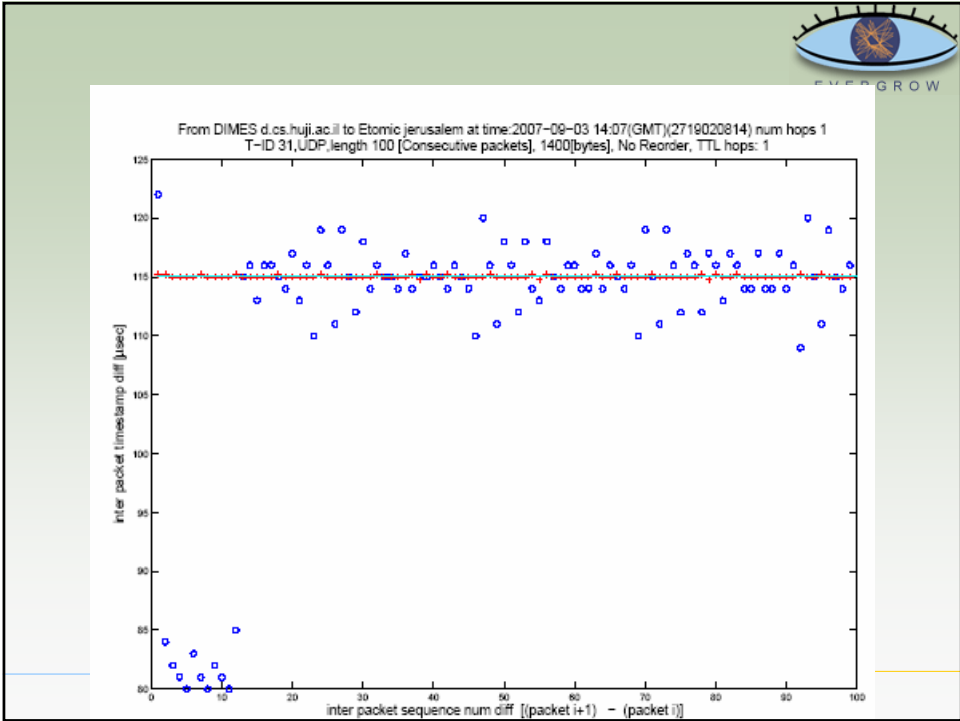
Can s/w based emission work?

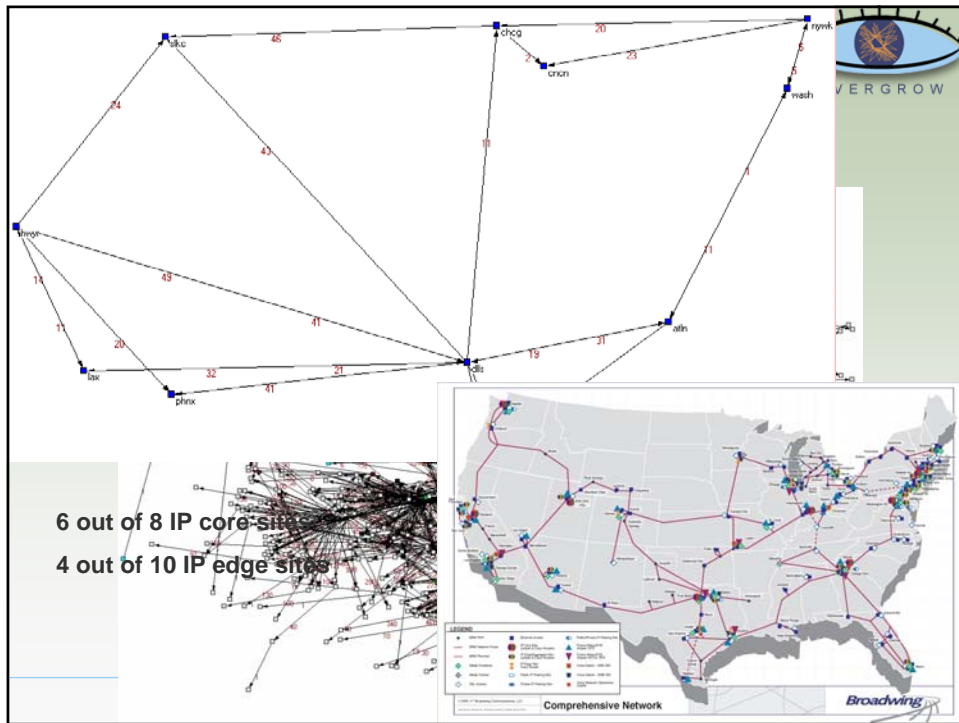


+EtoMic: the received packet rate is equal to the DIMES sending rate.

DIMES: the sender is unable to transmit at line rate. However, the rate is stable +/-5µsec

-The maximal theoretical rate @100Mbps for packets 200bytes



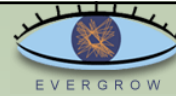


Post-Evergrow activities



- FP7's MOMENT: integrate DIMES database with other European projects and allow scientists an easy interface to the data.
- FP7's OneLab II: implement Paris-traceroute in DIMES and run large scale experiments, and develop an interface to integrate DIMES with the European PlanetLab infrastructure.
- Bi-national collaboration with FER, Zagreb
- Israel Science Foundation center of knowledge: study the Internet as a complex system.

Dissemination



Active participation in workshops:

- **From Measurement to Control. FIRE workshop, Zurich , Switzerland, March 2007.**
- **Panelist and session chair at IEEE E2EMON Workshop 2007, Munich, Germany, May, 2007. Panel on Challenges of Distributed Monitoring. Paper presentation.**
- **Studying the Internet complex structure with DIMES. Complex Networks Conference Italy - Israel 2007, Tel Aviv, October 2007.**
- **Building an Internet Distance Map at the PoP level. Theoretical Aspects and Models of Large, Complex and Open Information Networks, Turin, Italy, November 2007.**