

Advanced Topics in Computer Networking

WS2010/11

Introduction

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Overview

- Basic concepts: Gain experience in **Reading, Writing and Presenting** research ideas in English
- Learn **knowledge** about new and emerging research topics and technologies in networking
- Organize **discussions, exchange ideas, experiences** between students and researchers

Research: Different Aspects

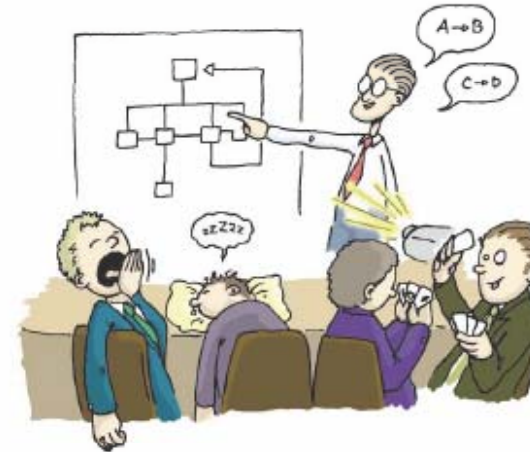
Problem selection



Research Methodology



Presentation



What we plan to do?

- It's **research-oriented**. Therefore, the main focus will be course project and paper reading.
- It's **Seminar**, so we will....Discuss, Discuss and Discuss with prepared reading materials
- Every week (November - January), we discuss **one** paper
- Final "formal" discussions in January (formal presentations, Q&A)

How to evaluate?

- Part I: Session participation (40%)
 - Including questioning, attendance, paper presentation, paper reviews
 - Opportunity to practice everyone's presentation & reading skills!
- Part II: formal final presentation (30%)
- Part III: 12-15 pages essay (30%)

Main Topics

- P2P Networking
 - Internet Geometry
 - Distributed Hash Table
- Online Social Networking
 - Facebook, Twitter, LinkedIn...

Detailed Lecture Plans (1)

- 05.11.2010 [Session 0]
 - Course Introduction (how to read, write....)
 - Invited talk by Prof. Tilman Wolf
- 12.11.2010 [Session 1]: Peer-to-Peer Networking
 - Paper reading
- 19.11.2010 [Session 2]: Peer-to-Peer Networking
 - Paper reading
- 26.11.2010 [Session 3]: Peer-to-Peer Networking
 - Paper reading
- 03.12.2010 [Session 4]: Peer-to-Peer Networking
 - Paper reading

Lecture plans (2)

- 10.12.2010 [Session 5]: No class
- 17.12.2010 [Session 6]: Peer-to-Peer Networking
 - Paper reading
 - Decisions on assigning papers for the final presentation!
 - Introduction of online social networking
- 07.01.2011 [Session 7]: Online Social Networking
 - Paper reading
- 14.01.2011 [Session 8]: Online Social Networking
 - Paper reading
- 21.01.2011 [Session 9]: Online Social Networking
 - Paper reading
- 28.01.2011 [Final presentation]

Seminar Preparation and Process

- Before the seminar (Wednesday 23:59):
 - Read the selected paper
 - Prepare the review of the paper and send it to (E-mail: yang.chen@cs.uni-goettingen.de):
 - Summary of the paper
 - pros and cons of the paper (your conclusion)
 - With the title '[ATCN10] XXX'
- During the seminar:
 - one is chosen for giving a presentation of the paper.
 - And the list of pros and cons is discussed by all the participant
 - Debate between two groups

How to read

- Preparation: pencil, paper photocopy of article
- Decide what to read: read title, abstract
- Rough round: what're the major points?
 - Introduction, conclusion and first paragraph of the main work
 - React to the what you read: write down/put note
- Read in depth:
 - build a structure of the problem/system
 - challenge/verify the credibility of the idea: do the assumption, method, statistics & conclusion sound?
 - construct your own example
- Summarize what you read

Slides of the paper

- Would be really helpful for understanding of the paper ...
 - Enter the name of the paper author (and/or Project name, Univ.) in Google
 - Access the webpage
 - You may find the **slides** (and/or **Project Homepage**)there!
- **Sometimes not available** ☹️

Paper review and discussion

- Major **contributions** of the paper
- **Differences** from related work
- Sparking ideas and techniques proposed in the paper
- Weaknesses
 - technical errors, unrealistic assumptions, unanswered questions, limited measurements
- Ways to improve the paper technically
 - To overcome above weaknesses
- Interesting topics discussed in its future work
- Ideas for extending the work

Presentation

Give clear presentation of your work



How to present

- Read the article beforehand, sketch your impressions about the author's idea
- Decide which is the **best idea** in the paper
 - Write it down and justify with a line sentence
- Figure out how to get your audience as quickly as possible to the point where they can understand this idea
- Elaborate the idea **in details**
 - Background, proof, benefits/difference over others
- Summary: thinking/justification of the paper in your own words

Essay

- Title
- Abstract: a broad overview of the report, end with a short statement of the major results of your investigation
- Introduction (or Motivation of the work): expands the abstract, get specific about your investigation
- Related work: unlikely invented sth completely new
- Methodology/Technical approach: what's important idea of the work? Bring your reader to the method
- Advantages and improvements of the work
- Results: testing of "implemented" method
- Future thoughts along the direction (has the problem fully resolved?)

How to cite references

- If a new term appears in your context for the first time, try to explain with your own words, and better cite a reference which can explicitly explain it
 - If an approach is new but presented by others, cite the corresponding paper
 - If a figure or data is copied from other resource, please cite them
- => improper/missing references are depreciated and regarded as unethical**

Networking Research: Resources (1)

- Academic Journals: well-established results
 - IEEE/ACM ToN: top journal in the field
 - IEEE JSAC: special issues
 - Elsevier ComNet
 - ACM/Kluwer WINET, IEEE ToW/TMC, Kluwer MONET, Wiley WCMC: wireless/mobile domain
 - ACM CCR, MC2R: fast reviewed paper
- Magazines: tutorials/surveys
 - IEEE ComMag, IEEE Network, IEEE Internet Computing

Networking Research: Resources (2)

- Good Conferences: fast, peer-reviewed papers
 - USENIX SOSP, NSDI, OSDI
 - ACM SIGCOMM
 - ACM MOBICOM, ACM MOBIHOC, ACM MOBISYS, ACM CoNEXT
 - IEEE INFOCOM,
 - IEEE ICNP, IEEE ICDCS
 - IEEE/IFIP IWQoS
 - ACM SIGMETRICS, IMC, PERFORMANCE
- Q: How to find good ones from tons of resources?
 - IEEE, ACM sponsored ones normally may be better than others
 - Papers from top labs/univs: **MIT, Berkeley, Stanford, CMU, Princeton, Cambridge**, Caltech, UIUC, GIT, Cornell, UCLA, Washington, UPenn, UMass, Columbia; ETHZ, Karlsruhe, TUM; Bell Labs, AT&T Labs, IBM, MSR, Intel research, etc.

Networking Research: Resources (cont.)

- Hmm... it's not easy to remember so many names before starting this seminar
- Is there some way **easier**? Yes!
 - Many researchers have provided something useful for everyone
 - Also, we will introduce one conference per week in this seminar

http://grid.hust.edu.cn/call/

Call For Papers of Semrex - Mozilla Firefox

http://grid.hust.edu.cn/call/

Search

Most Recent Call for Papers

Event	Location	Publisher	Deadline	Rank	SIF
ICSAP'10	Bangalore, India	IEEE	Oct. 20, 2009	★★★	
ICCSN'10	Singapore	IEEE	Oct. 20, 2009	★★★	
AINA'10	Perth, Australia	IEEE	Oct. 23, 2009	★★★	12.24
ICACT'10	Phoenix Park, Korea	IEEE	Oct. 24, 2009	★★★	
WWW'10	Raleigh, North Carolina, USA	ACM	Oct. 26, 2009	★★★★★	1.04
ICNP'10	Cancun, Mexico	IEEE	Oct. 27, 2009	★★★	2.28
INTENSIVE'10	Cancun, Mexico	IEEE	Oct. 27, 2009	★★★	
ICAS'10	Cancun, Mexico	IEEE	Oct. 27, 2009	★★★	1.52
ETCS'10	Wuhan, China	IEEE	Oct. 30, 2009	★★★	
ICCSA'10	Fukuoka, Japan	IEEE/LNCS	Oct. 31, 2009	★★★	18.16
CSCWD'10	Shanghai, China	IEEE	Oct. 31, 2009	★★★	4.82
ARC'10	Bangkok, Thailand	LNCS	Nov. 1, 2009	★★★	0.15
CSO'10	Huangshan (Yellow) Mountain, Anhui, China	IEEE	Nov. 1, 2009	★★★	
MobiOpp'10	Pisa, Italy	ACM	Nov. 1, 2009	★★★	
CCGrid'10	Melbourne, Victoria, Australia	IEEE	Nov. 2, 2009	★★★★	6.49
Sigmetrics'10	Columbia University, NY, USA	ACM	Nov. 2, 2009	★★★★★	4.28
SBP'10	Bethesda, MD, USA	Springer	Nov. 6, 2009	★★★	
SustainIT'10	San Jose, CA, USA	USENIX	Nov. 9, 2009	★★★★	
FSE'10	Seoul, Korea	LNCS	Nov. 9, 2009	★★★★	3.02
VEE'10	Pittsburgh, PA, USA	ACM	Nov. 9, 2009	★★★★★	0.38
ICN'10	Menures, The Three Valleys, French Alps, France	IEEE	Nov. 10, 2009	★★★	6.67
WowMoM'10	Montreal, QC Canada	IEEE	Nov. 11, 2009	★★★	4.09
ICBE'10	Guangzhou, China	IEEE	Nov. 15, 2009	★★★	
Ada-Europe'10	Valencia, Spain	LNCS	Nov. 16, 2009	★★★★	0.15
ICDCS'10	Genoa, Italy	IEEE	Nov. 16, 2009	★★★★★	15.12
WIAMIS'10	Desenzano del Garda, Italy	IEEE	Nov. 20, 2009	★★★	
ICTTA'10	Bali Island, Indonesia	IEEE	Nov. 20, 2009	★★★	
ICCEA'10	Bali Island, Indonesia	IEEE	Nov. 20, 2009	★★★	
ICKD'10	Bali Island, Indonesia	IEEE	Nov. 20, 2009	★★★	

Useful Linkings
Computer Conference Ranking
Libra

Stars

<http://citeseerx.ist.psu.edu/stats/venues?y=2007>

Statistics - Venue Impact Factors - Mozilla Firefox

http://citeseerx.ist.psu.edu/stats/venues?y=2007

CiteSeer^x beta

Documents | Authors | Tables 7

Include Citations | Advanced Search | Help

Most Cited Articles | Most Cited Citations | Most Cited Authors | Venue Impact Ratings

Estimated Venue Impact Factors. Generated from documents in the CiteSeer^x database as of March 20, 2008. This list is automatically generated and may contain errors.

Impact is estimated based on Corfield's traditional impact factor.

Choose Window: | 1992 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | **2007**

Only venues with at least 25 articles are shown. Venue details obtained from DBLP by Michael Ley. Only venues contained in DBLP are included.

1. POPL **0.45**
2. OSDI **0.43**
3. PLDI **0.4**
4. ACH Conference on Computer and Communications Security **0.39**
5. SSP **0.37**
6. NSDI **0.37**
7. CSFW **0.33**
8. ASPLOS **0.32**
9. SIGCOMM **0.31**
10. RAID **0.31**
11. EuroSys **0.3**
12. FAST **0.3**
13. TCC **0.26**
14. IPTPS **0.26**
15. CGO **0.25**
16. CRYPTO **0.25**
17. VMCAI **0.25**
18. TACAS **0.25**
19. SAS **0.23**
20. CAV **0.22**
21. ESOP **0.22**
22. LCTES **0.2**
23. USENIX Annual Technical Conference, General Track **0.19**
24. EUROCRYPT **0.17**
25. Public Key Cryptography **0.17**

Impact
Factor

<http://www.cs.ucsb.edu/~almeroth/conf/stats/>

Event Name	Year	Submitted	Accepted	% Accepted	Tracks	Attendees
	1983	50	34	68.0%	1	???
	1984	70	33	47.1%	2	???
	1985	???	???	???	1	???
	1986	125	45	36.0%	2	???
	1987	94	42	44.7%	2	???
	1988	116	32	27.6%	1	???
	1989	94	29	30.9%	1	???
	1990	102	31	30.4%	1	???
	1991	128	28	21.9%	1	???
	1992	126	27	22.0%	1	???
	1993	149	28	18.8%	1	???
	1994	94	29	30.9%	1	???
	1995	143	30	21.0%	1	400
Siccomm (ACM)	1996	162	27	16.7%	1	???
	1997	213	24	11.3%	1	???
	1998	226	27	12.0%	1	???
	1999	190	24	12.6%	1	???
	2000	238	26	10.9%	1	407
	2001	283	23	11.3%	1	550
	2002	300	25	8.33%	1	???
	2003	319	33	10.3%	1	???
	2004	340	31	9.11%	1	???
	2005	255	27	10.6%	1	???
	2006	298	37	12.4%	1	???
	2007	258	35	13.6%	1	???
	2008	288	35	12.2%	1	619
	2009	270	27	10.0%	1	???
Event Name	Year	Submitted	Accepted	% Accepted	Tracks	Attendees
	1989	136	22	16.1%	1	???
	1990	102	23	22.5%	1	???
	1991	???	20	??%	1	???
	1992	108	20	18.5%	1	???
	1993	???	22	??%	1	???
	1994	110	25	22.7%	1	???
	1995	123	27	21.9%	1	???
	1996	110	24	21.8%	1	???

Acceptance
Ratio

Other Course Materials

Main literatures:

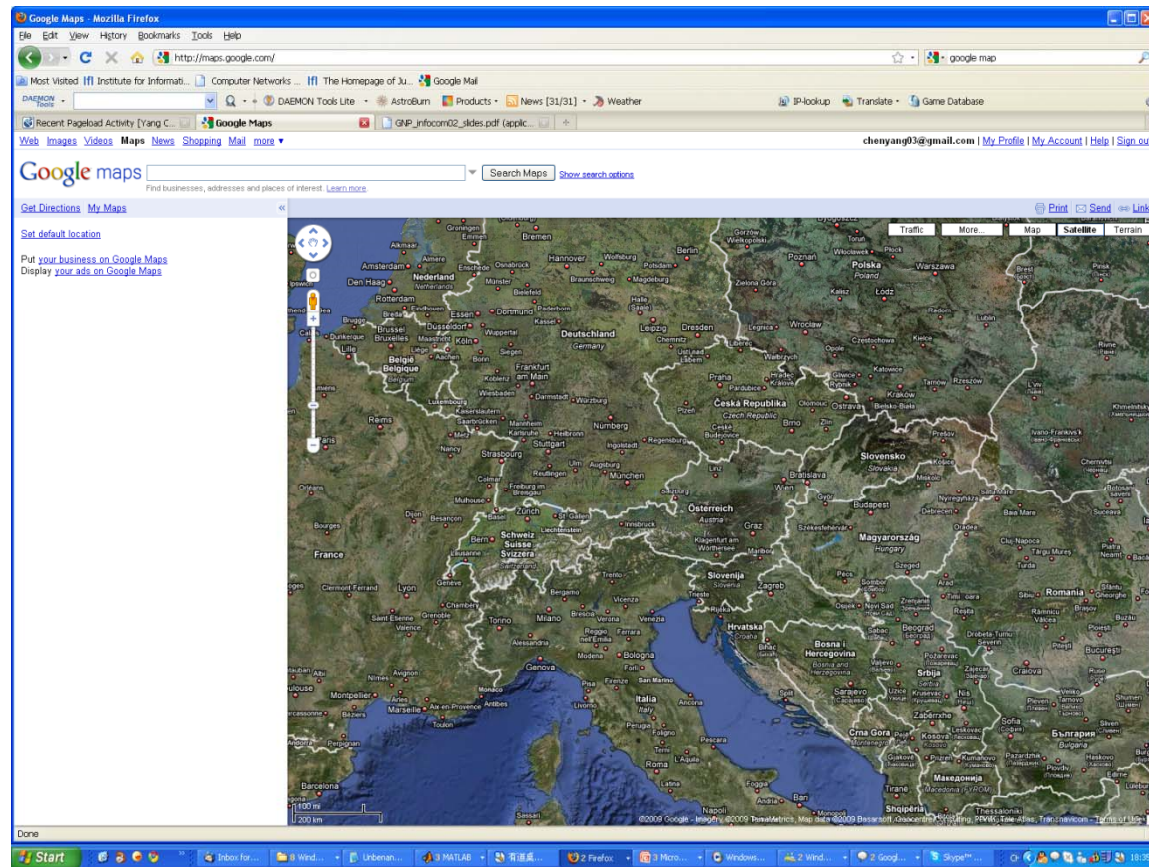
- Selected recent papers (mostly from afore-mentioned resources, will be uploaded in studIP as required).

Background reading - so many textbooks:

- Kurose & Ross: *Computer Networking - A Top-Down Approach Featuring the Internet*, 2nd ed.
- Schiller: *Mobile Communications*, 2nd ed.
- Peterson & Davie: *Computer Networks - A System Approach*. 2nd ed.
- Hofmann & Beaumont: *Content Networking: Architecture, Protocols and Practices*.

Introduction to Internet Geometry

World Map (Location in the Earth)



How to locate a place in the world?

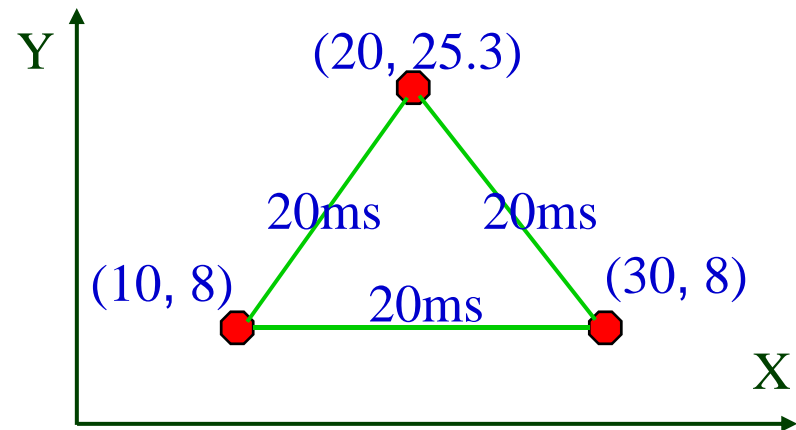
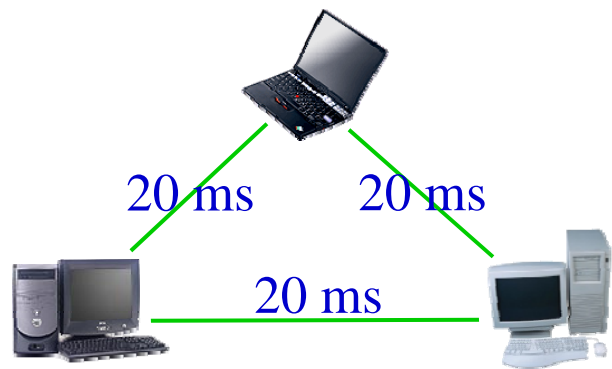
- Longitude
- Latitude

- With these two numbers (coordinate), the location of a certain place can be identified

- Can we assign the coordinate to Internet hosts?

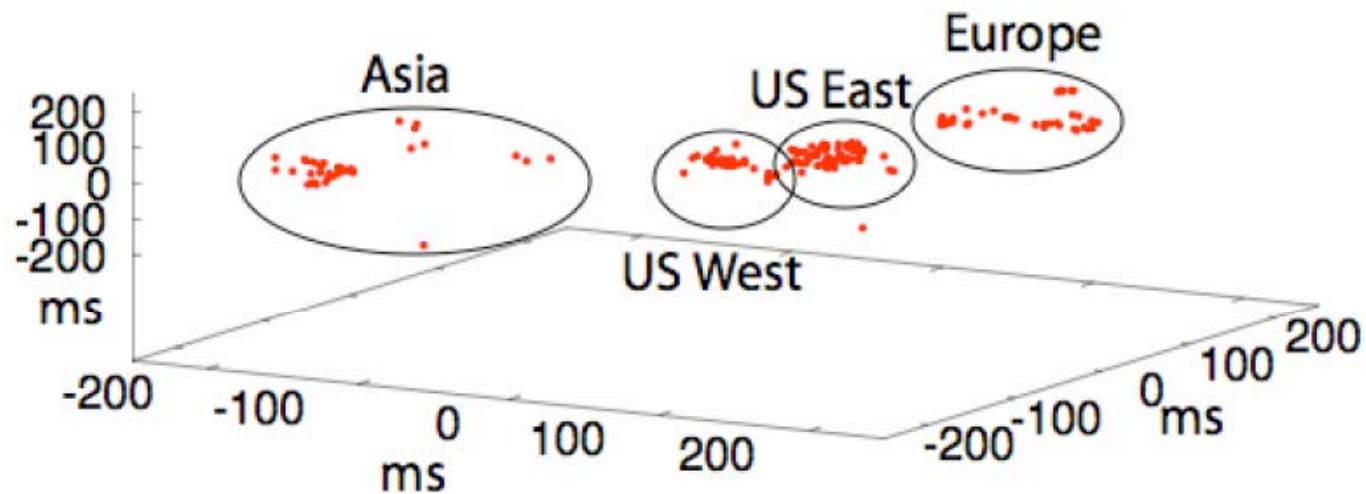
Internet Coordinates

- Mapping Internet nodes into a Geometric space (e.g. Euclidean space) while preserving the distances (delays)



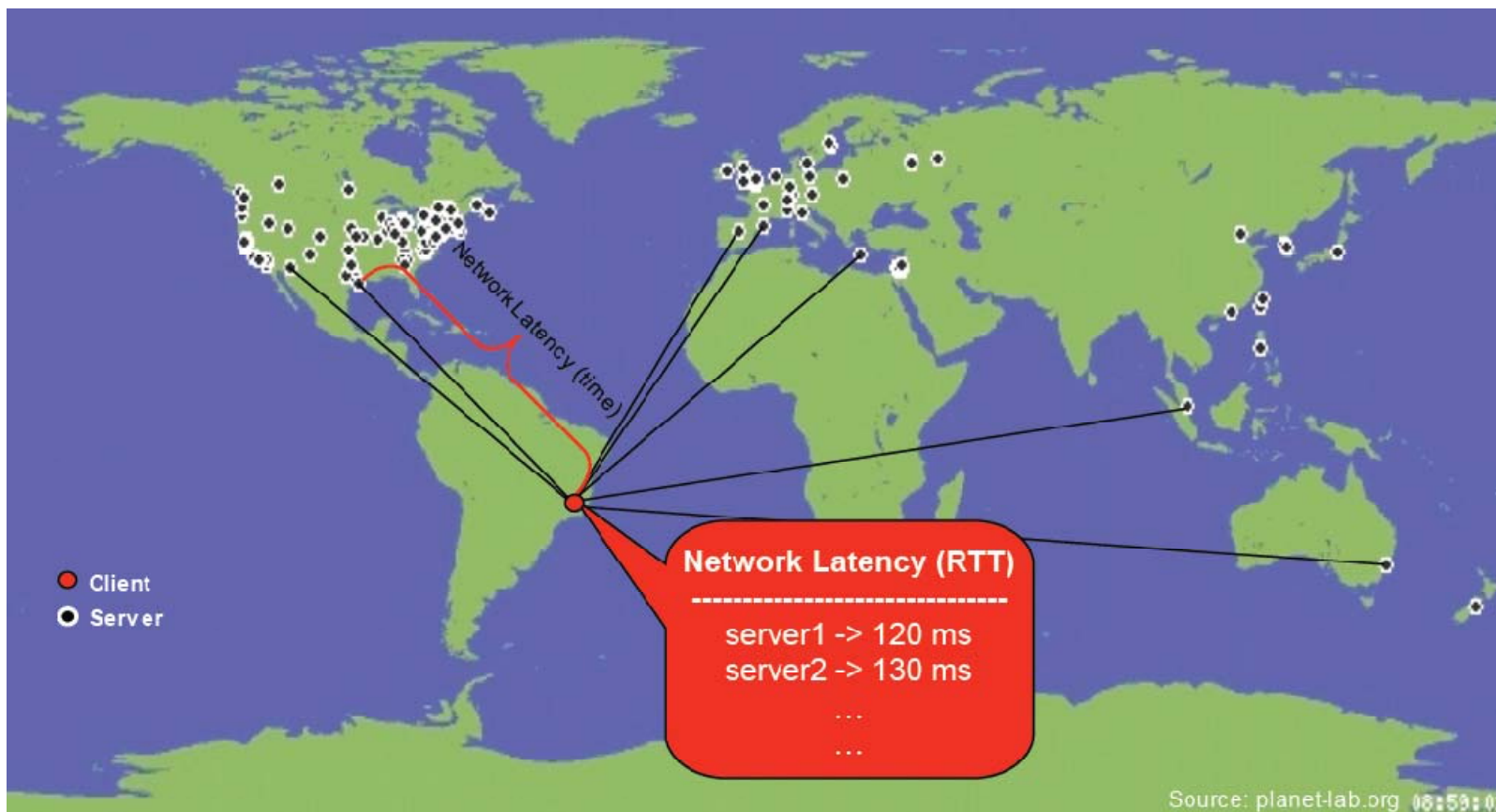
Internet Map

Network Coordinates of 226 PlanetLab Nodes



- Points represent locations of PL nodes in 3-d relative coordinate space

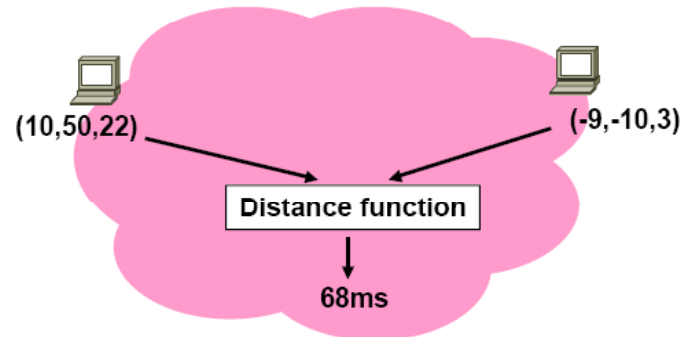
Internet Map



Distance Prediction

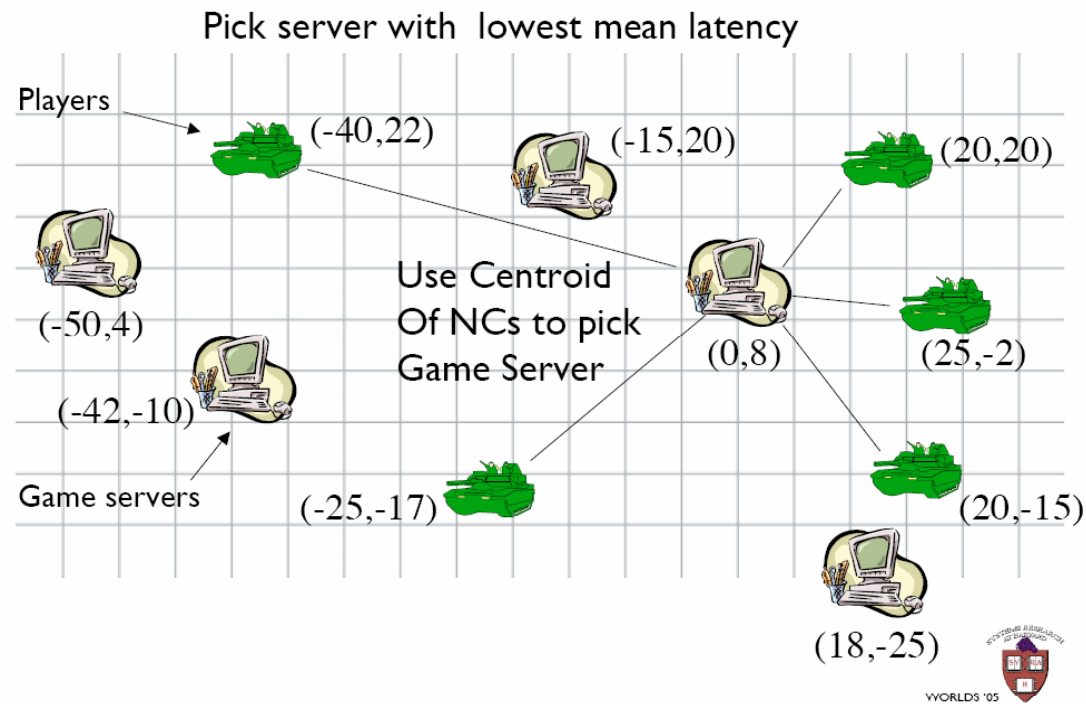
Can this Problem be Solved with a Peer-to-Peer Architecture?

- Flip the problem: Can end hosts maintain “coordinates” that describe their network locations?
- End hosts exchange coordinates to compute distance
 - High performance, high scalability



Application 1

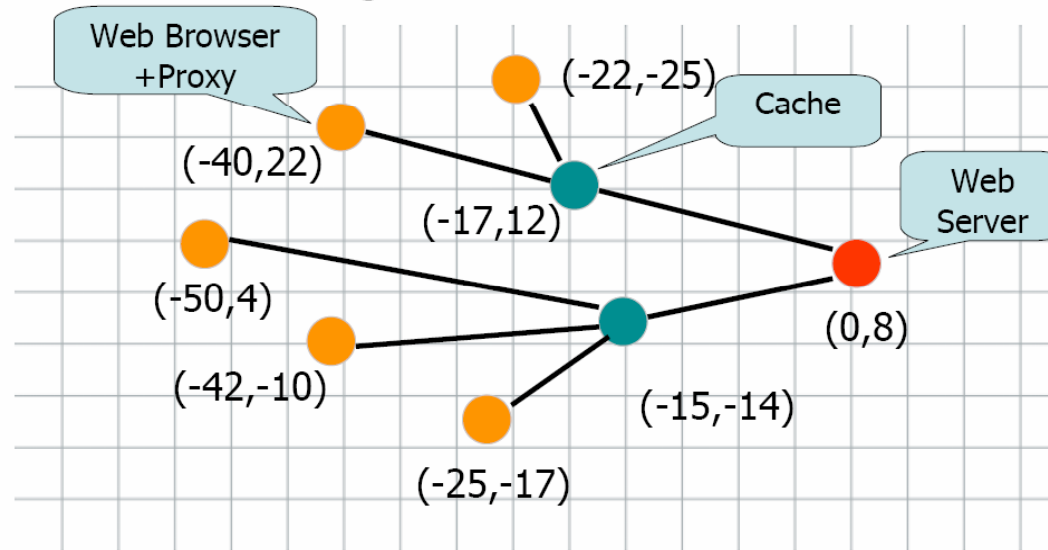
Coordinates Simplify Distributed Systems Problems



Application 2

Locality-aware Web Cache

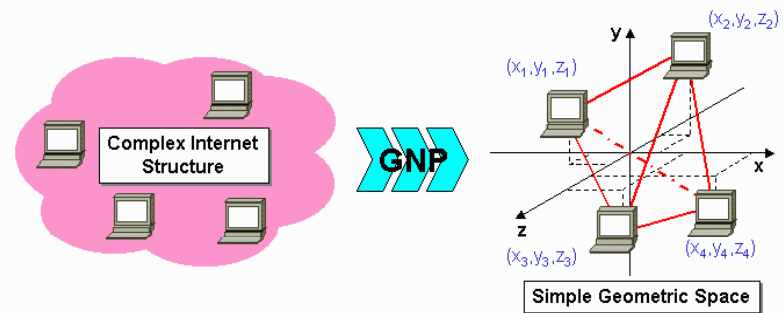
Route message toward web server's location



Routes converge at cache points

Paper Reading (This week)

- T. S. E. Ng and H. Zhang. Predicting Internet Network Distance with Coordinates-based Approaches. In Proc. of IEEE INFOCOM, 2002.



Project Homepage

Global Network Positioning (GNP)

[GNP Overview](#)

[Applications of GNP](#)

[Papers/Talks](#)

[Related Work](#)

[GNP Software](#)

Read comments to [engineering@cs.cmu.edu](#) or [www-who](#) List modified: Thu Mar 14 13:07:03 EDT 2002

GNP Overview

Achieving high performance is a key challenge in building large-scale globally-distributed network services and applications such as distributed content hosting services, overlay network multicast, content addressable overlay networks, and peer-to-peer file sharing such as Napster and Gnutella. This is because these systems have a lot of flexibility in choosing their communication paths, and they must select these paths intelligently based on network performance as the Internet is a highly diverse place. For example, in a peer-to-peer file sharing application, a client ideally wants to know the available bandwidth between itself and all the peers that have the wanted file. Unfortunately, although dynamic network performance characteristics such as available bandwidth and latency are the most relevant to applications and can be accurately measured on-demand, the huge number of wide-area-spanning end-to-end paths that need to be considered in these distributed systems makes performing on-demand network measurements impractical because it is too costly and time-consuming.

To bridge the gap between the contradicting goals of performance optimization and scalability, we believe a promising approach is to attempt to predict the **network distance** (i.e., round-trip propagation and transmission delay, a relatively stable characteristic) between hosts, and use this as a first-order discriminating metric to greatly reduce or eliminate the need for on-demand network measurements. Therefore, the critical problem is to devise techniques that can predict network distance **accurately, scalably, and in a timely fashion**.

Global Network Positioning (GNP) is a solution designed to achieve these goals. The key idea is to represent the complex structure of the Internet by a simple geometric space (e.g. an N -dimensional Euclidean space). In this representation, each host in the Internet is characterized by its position in the geometric space with a set of geometric coordinates. If the representation is accurate, then the easily computable geometric distances between hosts in this geometric space can accurately approximate the Internet network distances, and no actual network measurements are required. In extensive Internet experiments, we have found that by using a 7-dimensional Euclidean space, in 90% of the cases, GNP can predict the Internet distances among a globally distributed set of hosts with less than 50% error. The accuracy is even higher when the hosts are restricted to within a single Autonomous System.

Key distinguishing properties:

- **Peer-to-peer architecture friendly:** GNP can naturally be incorporated into peer-to-peer applications since end hosts can easily maintain geometric coordinates that characterize their locations in the Internet.
- **High prediction accuracy:** To the best of our knowledge, GNP has the highest accuracy among proposed Internet distance prediction methods, including Triangulated Hierarchies and IDMaps, when a light-weight infrastructure is used (i.e. when the number of Landmarks/Tracers/Base nodes used is on the order of 10). GNP prediction error in most cases is less than 50%.
- **Extremely fast:** When an end host discovers the identities of other end hosts in a peer-to-peer application, their pre-computed coordinates can be piggybacked, thus network distances can essentially be computed instantaneously by the end host. There is no additional communication delay whatsoever. The off-line computation of host coordinates is also very simple and fast.
- **Highly scalable:** Another benefit of GNP is that coordinates are highly efficient in summarizing a large amount of distance information. For example, in a multi-party application, the distances of all paths between K hosts can be efficiently communicated by K sets of coordinates of D numbers each (i.e. $O(KD)$ of data), as opposed to $K(K-1)/2$ individual distances (i.e., $O(K^2)$ of data). Thus, this approach is able to trade local computations for significantly reduced communication overhead, achieving higher scalability.
- **Structured representation:** The geometric coordinates of hosts generated by GNP describe a simple and yet highly structured representation of the complex Internet topology. Many algorithms can then take advantage of this structure to perform topologically aware operations on the Internet in a scalable fashion. See our [applications section](#) for some examples.

Any questions...

- Feel free to drop me e-mail

yang.chen@cs.uni-goettingen.de

Backup Slides

Choice of dissemination means

Forums

- Journals:
 - Well established NEW Results
- International conferences
 - New Results, Broad Audience
- Topical conferences
 - New Results, Selected Audience
- Workshops
 - Work in progress, New Ideas

Format

- Paper
 - Short (5-8), long (9-30pg)
- Abstract
 - 1pg, extended (2-3pg)
- Oral presentation
 - Short (10-