Polytechnic Institute of NYU
Department of Electrical and Computer Engineering
Tenure Promotion Package

Yong Liu

To the Referees:
Thank you for your time and effort in acting as a referee in my tenure promotion case. This package contains a brief personal statements on my performance in research and teaching. All material is also available online at
http://eeweb.poly.edu/faculty/yongliu/promotion_for_referee.html
Some sample papers are also available from there.

Thanks,

Yong Liu
Brooklyn, NY,
Fall 2010.

Contents

Yong Liu

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EDUCATION	**University of Massachusetts, Amherst**	Amherst, MA
	Ph.D. in Electrical & Computer Engineering	May, 2002
	Thesis title: *Fluid Modelling and Analysis of Some Queueing and Network Issues*	
	Advisor: Weibo Gong	
	University of Science & Technology of China	Hefei, China
	M.S.E. in Electrical & Computer Engineering	July, 1997
	Thesis title: *Distributed Computer Control Systems: Design and Applications*	
	Advisor: Guozhong Pang	
	University of Science & Technology of China	Hefei, China
	B.S.E. in Electrical & Computer Engineering	July, 1994
POSITIONS	**Polytechnic Institute of NYU[1], ECE Dept.**	Brooklyn, NY
	Assistant Professor	03/2005-Present
	University of Massachusetts, Computer Science Dept.	Amherst, MA
	Postdoctoral Research Associate, Computer Networks Group	02/2002-03/2005
	Advisors: Jim Kurose, Don Towsley	
	University of Massachusetts, ECE Dept.	Amherst, MA
	Research Assistant, Complex Systems Modelling and Control Lab	06/1998-01/2002
	Advisor: Weibo Gong	
	Bell Labs, Networking Technologies and Performance Dept.	Holmdel, NJ
	Co-op, Summer Intern	06/2000-03/2001

HONORS

Career Award, National Science Foundation, 2010;

Best Paper Award, IEEE Conference on Computer and Communications (INFOCOM) 2009 (selected from 282 accepted papers out of 1,435 submissions);

Best Paper Award, IEEE Communication Society (ComSoc) Multimedia Communications Technical Committee, 2008 (selected from papers published in IEEE ComSoc sponsored journals and conferences in 2006 & 2007);

Best Paper Award, the First Workshop on Networks for Grid Applications (GridNets), October, 2004;

Presidential Graduate Award, Chinese Academy of Sciences, July, 1997;

Guo Moruo Scholarship, the highest scholarship of University of Science & Technology of China, September, 1993;

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[1] former Polytechnic University, merged with NYU in June 2008, and changed the name to Polytechnic Institute of NYU

PUBLICATIONS

Journal Papers

- *Published or Accepted*

  1. Yong Liu,
     "Delay Bounds of Chunk-based Peer-to-Peer Video Streaming",
     in *IEEE/ACM Transactions on Networking*, Volume 18, Number 4, Pages 1195 – 1206, August 2010;

  2. Di Wu, Yong Liu and Keith Ross,
     "Modeling and Analysis of Multi-Channel P2P Live Video Systems",
     in *IEEE/ACM Transactions on Networking*, Volume 18, Number 4, Pages 1248 – 1260, August 2010;

  3. Chao Liang[2], Zhenghua Fu, Yong Liu and Chai Wah Wu,
     "iPASS: Incentivized Peer-assisted System for Asynchronous Streaming",
     in *IEEE Transactions on Parallel and Distributed Systems*, Volume 21, Number 9,
     Pages 1354 – 1367, September, 2010;

  4. Di Wu, Chao Liang, Yong Liu and Keith Ross,
     "Redesigning Multi-Channel P2P Video Systems with View-Upload Decoupling",
     accepted for publication in *ELSEVIER Computer Networks journal*;

  5. Tan Ba Le and Yong Liu,
     "On the Capacity of Hybrid Wireless Networks with Opportunistic Routing",
     in *EURASIP Journal on Wireless Communications and Networking*, Volume 2010,
     Pages 32 – 40, January 2010;

  6. Zhiyong Huang, Xiaoping Zeng, and Yong Liu,
     "Detecting and Blocking P2P Botnets through Contact Tracing Chains",
     in *International Journal of Internet Protocol Technology*, Volume 5, No.1/2, Pages 44 – 54, 2010;

  7. Chao Liang, Yang Guo and Yong Liu,
     "Investigating the Scheduling Sensitivity of P2P Video Streaming: an experimental study",
     in *IEEE Transactions on Multimedia*, Volume 11, Number 3, Pages 348 – 360, April 2009;

  8. Yong Liu, Yang Guo and Chao Liang,
     "A Survey on Peer-to-Peer Video Streaming Systems",
     in *Journal of Peer-to-Peer Networking and Applications*, (Springer), Pages 18 – 28, February, 2008;

  9. Xiaojun Hei, Yong Liu and Keith Ross,
     "IPTV over P2P Streaming Networks: the Mesh-pull Approach",
     in *IEEE Communications Magazine*, Pages 86 – 92, February, 2008;

  10. Xiaojun Hei, Yong Liu and Keith Ross,
      "Inferring Network-Wide Quality in P2P Live Streaming Systems",
      in *IEEE Journal on Selected Areas in Communications, special issue on advances in P2P streaming*,
      Volume 25, Number 9, Pages 1640 – 1654, December 2007, **awarded the Best Paper in Multimedia Communications by IEEE Communications Society in 2008**;

  11. Xiaojun Hei, Chao Liang, Jian Liang, Yong Liu and Keith Ross,
      "A Measurement Study of a Large-Scale P2P IPTV System",
      in *IEEE Transactions on Multimedia*, Volume 9, Number 8, Pages 1672 – 1687, December, 2007;

  12. Weibo Gong, Yong Liu, Vishal Misra and Don Towsley,
      "Self-Similarity and Long Range Dependence on the Internet: A second look at the evidence, origins

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[2]All my students/postdoc are underlined.

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and implications",
in *Computer Networks Journal*, Volume 48, Issue 3, Pages 377 – 399, June 2005;

13. Yong Liu, Francesco Lo Presti, Vishal Misra, Don Towsley and Yu Gu,
    "Scalable Fluid Models and Simulations for Large-Scale IP Networks",
    in *ACM Transactions on Modeling and Computer Simulation*, Vol. 14, No. 3,
    Pages 305 – 324, July 2004;

14. Yong Liu and Weibo Gong,
    "On Fluid Queueing System with Strict Priority",
    in *IEEE Transactions on Automatic Control*, Volume 48, No. 12,
    Pages 2079 – 2088, December, 2003;

15. Yong Liu and Weibo Gong,
    "Perturbation Analysis for Stochastic Fluid Queueing Systems",
    in *Discrete Event Dynamic Systems: Theory and Applications*, Volume 12, No. 4,
    Pages 391– 416, 2002;

16. Yong Liu and Guozhong Pang,
    "Reconfigurable Sequential Control in Distributed Computer Control Systems",
    in *Journal of Micro-computer Informatics [in Chinese]*, October, 1997;

- *Under Revision or Submitted*

17. Chao Liang, Miao Zhao, and Yong Liu,
    "Optimal Bandwidth Sharing in Multi-Swarm Multi-Party P2P Video Conferencing Systems",
    under major revision to *IEEE/ACM Transactions on Networking*;

18. Sha Hua, Yang Guo, Yong Liu, Hang Liu, and Shivendra Panwar,
    "Scalable Video Multicast in Hybrid 3G/Ad-hoc Networks",
    under major revision to *IEEE Transactions on Multimedia*;

19. Hao Hu, Yang Guo, and Yong Liu,
    "Peer-to-Peer Streaming of Layered Video: Efficiency, Fairness and Incentive",
    under major revision to *IEEE Transactions on Circuits and Systems for Video Technologies*;

20. Yang Guo, Chao Liang, and Yong Liu,
    "Hierarchically Clustered P2P Video Streaming: Design, Implementation, and Evaluation",
    submitted to *Computer Networks Journal*;

21. Chao Liang, Zihui Ge, and Yong Liu,
    "Joint Traffic Blocking and Routing under Network Failures and Maintenance",
    submitted to *IEEE Transactions on Parallel and Distributed Systems*;

22. Chao Liang and Yong Liu,
    "Enabling Broadcast of User-Generated Live Video without Servers",
    submitted to *Peer-to-Peer Networking and Applications*, by Springer US;

Conference Papers

- *Published or Accepted*

1. Chao Liang and Yong Liu,
   "ViVUD: Virtual Server Cluster based View-Upload Decoupling for Multi-Channel P2P Video Streaming Systems",
   to appear in the Proceedings of IEEE Global Communications Conference (GLOBECOM), 2010;

2. <u>Tan Le</u> and Yong Liu,
    "Opportunistic Overlay Multicast in Wireless Networks",
    to appear in the Proceedings of IEEE Global Communications Conference (GLOBECOM), 2010;

3. Hao Hu, Yang Guo, and Yong Liu,
    "Mesh-based Peer-to-Peer Layered Video Streaming With Taxation",
    in the Proceedings of ACM Workshop on Network and Operating System Support for Digital Audio
    and Video (NOSSDAV), Pages 27 – 32, June, 2010;

4. Zhengye Liu, Hao Hu, Yong Liu, Keith Ross, Yao Wang, and Markus Mobius,
    "P2P Trading in Social Networks: The Value of Staying Connected",
    in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM),
    Pages 2489 – 2497, March, 2010 *(Acceptance Ratio:* 17.4%*)*;

5. Yan Cai, Yong Liu, Weibo Gong and Tilman Wolf,
    "Impact of Arrival Burstiness on Queue Length: An Infinitesimal Perturbation Analysis",
    in the Proceedings of IEEE Conference on Decision and Control (CDC),
    Pages 7068 – 7073, December, 2009;

6. Sha Hua, Yang Guo, Yong Liu, Hang Liu, and Shivendra Panwar,
    "Scalable Video Multicast in Hybrid 3G/Ad-hoc Networks",
    in the Proceedings of IEEE IEEE Global Communications Conference (GLOBECOM),
    Pages 4662 – 4667, November, 2009;

7. Di Wu, Yong Liu and Keith Ross,
    "Queuing Network Models for Multi-Channel P2P Live Streaming Systems",
    in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM),
    Pages 73 – 81, April, 2009, (*Acceptance Ratio:* 19%, **sole winner of the Best Paper Award**);

8. <u>Chao Liang</u>, Zhenghua Fu, Yong Liu, and Chai Wah Wu,
    "iPASS: Incentivized Peer-assisted System for Asynchronous Streaming",
    in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM) Mini-
    Conference, Pages 2741 – 2745, April, 2009, *(Acceptance Ratio:* 26%*)*;

9. Di Wu, <u>Chao Liang</u>, Yong Liu and Keith Ross,
    "View-Upload Decoupling: A Redesign of Multi-Channel P2P Video Systems",
    in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM) Mini-
    Conference, Pages 2726 – 2730, April, 2009, *(Acceptance Ratio:* 26%*)*;

10. Sha Hua, Yang Guo, Yong Liu, Hang Liu, Shivendra S. Panwar,
    "Broadcasting over Cellular Networks: Video Quality Improvement using Scalable Video Coding
    (SVC) and Dual Mobile Interfaces",
    in IBC Conference, Amsterdam, Netherlands, September 2009;

11. <u>Tan Le</u> and Yong Liu,
    "On the Capacity of Hybrid Wireless Networks with Opportunistic Routing",
    in the Proceedings of International Conference on Wireless Algorithms, Systems and Applications,
    Pages 210 – 223, August, 2009;

12. <u>Chao Liang</u>, Yong Liu, and Keith Ross,
    "Topology Optimization in Multi-Tree Based P2P Streaming System",
    in the Proceedings of International Conference on Tools with Artificial Intelligence,
    Pages 806 – 813, November, 2009;

13. Yang Guo, <u>Chao Liang</u>, and Yong Liu,
    "Naivet vs. Sophistication: Is Random Scheduling Enough for P2P-based IPTV Service?",
    IBC Conference, Amsterdam, Netherlands, September 2008;

14. Yang Guo, Chao Liang, and Yong Liu,
    "dHCPS: Decentralized Hierarchically Clustered P2P Video Streaming",
    in the Proceedings of ACM International Conference on Image and Video Retrieval (CIVR),
    Pages 655 – 662, July, 2008;

15. Chao Liang, Yang Guo and Yong Liu,
    "Is Random Scheduling Sufficient in P2P Video Streaming?",
    in the Proceedings of the 28th International Conference on Distributed Computing Systems
    (ICDCS), Pages 53 – 60, June, 2008 *(Acceptance Ratio: 16%)*;

16. Yang Guo , Chao Liang, and Yong Liu,
    "Adaptive Queue-based Chunk Scheduling for P2P Live Streaming",
    in the Proceedings of IFIP Networking, Pages 433 – 444, May, 2008;

17. Yong Huang, Yong Liu, Weibo Gong and Don Towsley,
    "Two-level Stochastic Fluid Tandem Queuing Model for Burst Impact Analysis",
    in the Proceedings of IEEE Conference on Decision and Control (CDC),
    Pages 3042 – 3047, December, 2007;

18. Chao Liang, Yang Guo and Yong Liu,
    "Hierarchically Clustered P2P Streaming System",
    in the Proceedings of IEEE Global Communications Conference (GLOBECOM),
    Pages 236 – 241, November, 2007;

19. Chao Liang, Zihui Ge and Yong Liu,
    "Joint Traffic Blocking and Routing under Network Failures and Maintenances",
    in the Proceedings of IEEE Global Communications Conference (GLOBECOM),
    Pages 2752 – 2756, November, 2007;

20. John Buford, Angela Wang, Xiaojun Hei, Yong Liu and Keith Ross,
    "Discovery of In-Band Streaming Services in Peer-to-Peer Overlays",
    in the Proceedings of IEEE Global Communications Conference (GLOBECOM),
    Pages 242 – 247, November, 2007;

21. Yong Liu,
    "On the Minimum Delay Peer-to-Peer Video Streaming: how realtime can it be?",
    in the Proceedings of ACM Multimedia, Pages 127 – 136, September, 2007
    (Acceptance Ratio: 19%);

22. Rakesh Kumar, Yong Liu and Keith Ross,
    "Stochastic Fluid Theory for P2P Streaming Systems",
    in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM),
    Pages 919 – 927, May, 2007 *(Acceptance Ratio: 18%)*;

23. Chun Zhang, Jim Kurose, Yong Liu, Don Towsley and Michael Zink,
    "A Distributed Algorithm for Joint Sensing and Routing in Wireless Networks with Non-Steerable
    Directional Antennas",
    in the Proceedings of 14th IEEE International Conference on Network Protocols (ICNP),
    Pages 218 – 227, November, 2006 *(Acceptance Ratio: 14.2%)*;

24. Xiaojun Hei, Chao Liang, Jian Liang, Yong Liu and Keith Ross,
    "Insight into PPLive: A Measurement Study of a Large-Scale P2P IPTV System",
    WWW 2006 workshop of IPTV services over World Wide Web, May 2006;

25. Tian Bu, Yong Liu, and Don Towsley,
    "On the TCP-Friendliness of VoIP Traffic",
    in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM),
    April, 2006 *(Acceptance Ratio: 18%)*.

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26. Chun Zhang, Zihui Ge, Jim Kurose, Yong Liu, and Don Towsley,
    "Optimal Routing with Multiple Traffic Matrices: Tradeoff between Average Case and Worst Case Performance",
    in the Proceedings of 13th IEEE International Conference on Network Protocols (ICNP),
    Pages 215 – 224, November, 2005 *(Acceptance Ratio: 17%)*;

27. Yong Liu, Don Towsley, Tao Ye and Jean Bolot,
    "An Information-Theoretic Approach to Network Monitoring and Measurement",
    in the Proceedings of ACM SIGCOMM Internet Measurement Conference (IMC),
    Pages 159 – 172, October, 2005 *(Acceptance Ratio: 15%)*;

28. Yong Liu, Honggang Zhang, Weibo Gong and Don Towsley,
    "On the Interaction Between Overlay Routing and Traffic Engineering",
    in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM)'05,
    Volume 4, Pages 2543 – 2553, Miami, March 2005 *(Acceptance Ratio: 17.2%)*;

29. Chun Zhang, Yong Liu, Weibo Gong, Jim Kurose, Robert Moll and Don Towsley,
    "On Optimal Routing with Multiple Traffic Matrices",
    in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM)'05,
    Volume 1, Pages 607 – 618, Miami, March 2005. *(Acceptance Ratio: 17.2%)*

30. Songlin Cai, Yong Liu and Weibo Gong,
    "Client-Controlled Slow TCP and Denial of Service",
    in the Proceedings of IEEE Conference on Decision and Control (CDC)'04,
    Volume 1, Pages 81 – 86, December 2004.

31. Yong Liu, Yu Gu, Honggang Zhang, Weibo Gong and Don Towsley,
    "Application Level Relay for High-bandwidth Data Transport",
    in the Proceedings of the First Workshop on Networks for Grid Applications (GridNets),
    Pages 1 – 10, San Jose, October 2004, **sole winner of the Best Paper award**;

32. Honggang Zhang, Yong Liu, Weibo Gong and Don Towsley,
    "On the Interaction Between Overlay Routing and MPLS Traffic Engineering",
    in ACM/SIGCOMM, Poster Session, Portland, August 2004;

33. Yu Gu, Yong Liu and Don Towsley,
    "On Integrating Fluid Models with Packet Simulation",
    in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM)'04,
    Pages 2856 – 2866, Hong Kong, March 2004. *(Acceptance Ratio: 18.4%)*;

34. Xiang Yu, Chunming Qiao and Yong Liu,
    "TCP Implementations and False Time Out Detection in Optical Burst Switching Networks",
    in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM)'04,
    Pages 774 – 784, Hong Kong, March 2004. *(Acceptance Ratio: 18.4%)*;

35. Songlin Cai, Yong Liu and Weibo Gong,
    "Analysis of an AIMD Based Collision Avoidance Protocol in Wireless Data Networks",
    in the Proceedings of IEEE Conference on Decision and Control (CDC)'03, Volume 1,
    Pages 104 – 109, Hawaii, December 2003;

36. Yong Liu, Francesco Lo Presti, Vishal Misra, Don Towsley and Yu Gu,
    "Fluid Models and Solutions for Large-Scale IP Networks",
    in the Proceedings of ACM International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS)'03, Pages 91 – 101, San Diego, June 2003. *(Acceptance Ratio: 11.7%)*;

37. Christopher Hollot, Yong Liu, Vishal Misra and Don Towsley,
    "Unresponsive Flows and AQM Performance",

7

in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM)'03, Volume 22, No. 1, Pages 85 – 95, San Francisco, April 2003, *(Acceptance Ratio:* 20.8%*)*;

38. Yong Liu and Weibo Gong,
"Challenges to Congestion Control posed by Concurrent Downloads",
in the Proceedings of 41st IEEE Conference on Decision and Control (CDC)'02, Volume 2, Pages 2017-2022, Las Vegas, December 2002;

39. Yong Liu and Weibo Gong,
"On Fluid Queueing System with Strict Priority",
in the Proceedings of IEEE Conference on Decision and Control (CDC)'01, Volume 2, Pages 1923-1928, Orlando, December 2001;

40. Yong Liu, Weibo Gong and Prashant Shenoy,
"On the Impact of Concurrent Downloads",
in *Proceedings of Winter Simulation Conference*, Pages 1300 – 1305, Arlington, December 2001;

41. Weibo Gong, Yong Liu, Vishal Misra and Don Towsley,
"On the Tails of Web File Size Distributions",
in the Proceedings of 39th Annual Allerton Conference on Communication, Control and Computing, October 2001;

42. Yong Liu and Weibo Gong,
"Perturbation Analysis for Stochastic Fluid Queueing Systems",
in the Proceedings of IEEE Conference on Decision and Control (CDC)'99, Volume 5, Pages 4440 – 4445, Phoenix, December 1999;

- *Submitted*

43. Xiwang Yang, Yang Guo, and Yong Liu,
"Bayesian-inference Based Recommendation in Online Social Networks",
submitted to IEEE Conference on Computer and Communications (INFOCOM) 2011;

44. Zhengye Liu, Yong Liu, and Keith Ross,
"Modeling and Analysis of Peer-Assisted VoD",
submitted to IEEE Conference on Computer and Communications (INFOCOM) 2011;

45. Tan Le and Yong Liu,
"NCOM: Network Coding based Overlay Multicast in Wireless Networks",
submitted to IEEE Conference on Computer and Communications (INFOCOM) 2011;

Technical Reports

1. Yong Liu,
"Optimal Cross-layer Scheduling for Multicast in Multi-Channel Wireless Networks",
Technical Report, Polytechnic Institute of NYU, December 2009;

2. Yong Liu, Don Towsley, Jing Weng and Dennis L. Goeckel,
"An Information Theoretic Approach to Network Trace Compression",
UMass Technical Report, 2004;

3. Xiang Yu, Chunming Qiao, Yong Liu and Don Towsley,
"Performance Evaluations of TCP Traffic Transmitted over Optical Burst Switching Networks",
SUNY at Buffalo Technical Report, 2003.

RESEARCH FUNDING

- **National Science Foundation:**

  1. "CAREER: Next-Generation Peer-to-Peer Streaming: Theory and Design", under contract CNS-095368, 02/01/2010 - 01/31/2015, $450,000, sole PI;

  2. "View-Upload Decoupling: A Redesign of Multi-Channel P2P Video Systems", under contract CNS-0916734, 08/01/2009 - 07/31/2012, $400,000, PI; co-PI: Prof. Keith Ross

  3. "Economic Incentives for P2P: Theory and Design", under contract CNS-1018032, 09/01/2010 - 08/31/2013, $450,000, co-PI; PI: Prof. Keith Ross

  4. "Network X-ities: – Foundations and Applications", under contract CNS-0519998, 09/01/2005 - 08/31/2010, co-PI, collaborative project with Prof. Jim Kurose and Don Towsley from UMass, and Prof. Mung Chiang and Jennifer Rexford from Princeton; $1,300,000, $130,000 allocated to me as the sole PI in Polytechnic (through subcontract).

  Total NSF Funding Involved: $2,600,000; PI Share: $1,005,000.

- **Industrial Funding:**

  1. Thomson Corporate Research, Princeton, NJ:
     (a) "Social Networks based Recommendation System", 09/01/2009 - 05/15/2010, Thomson Collaborator: Dr. Yang Guo, Total grant $27,200, sole PI;
     (b) "Next-Generation Multimedia Content Delivery Framework", 01/05/2009 - 05/15/2009, Thomson Collaborator: Dr. Yang Guo, Hang Liu. Total grant $26,600, PI, jointly with Prof. Shiv Panwar and Yao Wang.
     (c) "Hybrid Wireless P2P Video Distribution", 09/01/2008 - 12/31/2008, Thomson Collaborators: Dr. Yang Guo and Dr. Hang Liu. PI, jointly with Prof. Shiv Panwar, $13,300 funded through WiCAT.
     (d) "Utility Maximization in P2P Layered Video Streaming", 09/01/2008-12/31/2008, Thomson Collaborator: Dr. Yang Guo. PI, jointly with Prof. Yao Wang, $13,300 funded through WiCAT.
     (e) "Hierarchically Clustered P2P Streaming Systems", 10/15/2006 - 05/31/2008, Thomson Collaborator: Dr. Yang Guo. $24,000, sole PI
     (f) Funding for Summer Interns: 2007 (1×3 months), 2008 (2×3 months), 2009 (1×3 months), 2010 (1×3 months).

  2. Huawei Technologies Co.LTD, Santa Clara, CA, Gift Funding, 09/01/2010-08/31/2011, $30,000, sole recipient;

  3. InterDigital, Long Island, NY, "Opportunistic Routing in Wireless Networks", $20,000 funded through WiCAT, 11/2009 - 05/2010, sole PI;

  4. IBM Watson Research Center, Hawthorne, NY, funding for summer intern in 2008 (1×3 months);

  5. Verizon Laboratories, Waltham, MA, "P2P Voice and Video in Verizon FiOS Networks", 01/01/2008-12/31/2008, Verizon fund $65,000, plus CATT matching fund $20,000, co-PI, joint with Prof. Shiv Panwar and Prof. Keith Ross;

  6. Huawei IP Network Research Laboratories, Nanjing, China, "Multiple-tree Multiple-stream based P2P IPTV System Design", 09/01/2007-08/31/2008, total grant $105,000, PI; joint with Prof. Keith Ross;

  Total Industrial Funding Involved: $344,400; PI Share: $204,200.

TEACHING

Table 1: Courses Taught

Semester	Course	Enrollment	Level
05' Fall	EL933: Network Measurement and Traffic Engineering	8	Grad.
06' Spring	EL5373: Internet Architecture and Protocols	62	Grad.
06' Fall	EL5363: Principles of Communication Networks	50	Grad.
	EL7363: Communications Networks II: Design and Algorithms	13	Grad.
	EL9953/CS6873 MSTN Design Project	4	Grad.
07' Spring	EE136: Communication Networks	35	Under.
	EL5373: Internet Architecture and Protocols	43	Grad.
	EL9953/CS6873 MSTN Design Project	8	Grad.
07' Fall	EL5363: Principles of Communication Networks	53	Grad.
	EL7363: Communications Networks II: Design and Algorithms	19	Grad.
	EL9953/CS6873 MSTN Design Project	19	Grad.
08' Spring	EE136: Communication Networks	28	Under.
	EL5373: Internet Architecture and Protocols	86	Grad.
	EL9953/CS6873 MSTN Design Project	13	Grad.
08' Fall	EL7363: Communications Networks II: Design and Algorithms	13	Grad.
	EL9953/CS6873 MSTN Design Project	27	Grad.
09' Spring	EL5373: Internet Architecture and Protocols	61	Grad.
	EL9953/CS6873 MSTN Design Project	11	Grad.
09' Summer	EL9953/CS6873 MSTN Design Project	4	Grad.
09' Fall	EL7363: Communications Networks II: Design and Algorithms	12	Grad.
	EL9953/CS6873 MSTN Design Project	15	Grad.
10' Spring	EE136: Communication Networks	14	Under.
	EL9953/CS6873 MSTN Design Project	16	Grad.
10' Fall	EL5373: Internet Architecture and Protocols	40	Grad.
	EL7363: Communications Networks II: Design and Algorithms	15	Grad.
	EL9953/CS6873 MSTN Design Project	4	Grad.

GRADUATE STUDENTS

PhD Dissertations

1. **Chao Liang**, PhD in EE, September 2005 – November 2010,
   Dissertation Title: "*Towards High-Performance Peer-to-Peer Media Communications: Measurement, Design and Optimization*".
   Research on the measurement of large-scale commercial P2P video streaming system, analysis and design of optimal P2P streaming scheduling, and prototyping and experimentation on the Internet.

2. **Tan Ba Le**, PhD in EE, September 2005 – December 2010,
   Dissertation Title, "*Exploiting the Gain of Opportunistic Routing in Wireless Networks*".
   Research on the gain of opportunistic routing in hybrid wireless networks, and network-coding based overlay multicast in wireless networks.

3. **Xiwang Yang**, PhD in EE, September 2008 – ,

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4. **Guibin Tian**, PhD in EE, September 2010 –,

5. **Yang Xu**, PhD in EE, September 2010 –;

Master Thesis

1. **Haigen Li**, MS in Telecommunication Networks
   Thesis Title, "P2P Video-on-Demand System", January 2009 – January 2010;

2. **Wei Chen**, MS in Telecommunication Networks
   Thesis Title, "A Measurement Study of A Commercial Grid Application", January 2008 – January 2009;

3. **Winiga Sontoua**, BS/MS in EE
   Thesis Title, "TCP Throughput Improvement Using Relay Nodes", September 2007 – June 2007;

4. **Yanwei Tang**, MS in EE (joint program with Nanjing University, China)
   Tentative Thesis Title, "Recommendation System in Online Social Networks", September 2010 – June 2011;

Current Master Students: Xueying Cheng, Di Cao, Xing Chen, Li Zhi;

Ph.D Proposal/Thesis Committee Served on:

- EE: Baris Coskun, Rakesh Kumar, Pei Liu, Tao Liu, Zhengye Liu, Chun Nie, Huizhong Sun;

- CS: Huseyin Akcan, Vassil Kriakov, Jian Liang, Angela Wang, Hao Yan, Yeling Zhang.

Advised 120+ MSTN student design projects

PROFESSIONAL SERVICE

- Tutorials Chair, ACM International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS) 2010;

- Publication/Web Chair, IEEE Workshop on High Performance Switching and Routing (HPSR) 2007;

- Technical Program Committee Member for

  - IEEE Conference on Computer and Communications (INFOCOM) 2011
  - ACM International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS) 2011
  - IEEE International Conference on Distributed Computing Systems (ICDCS) 2011
  - IEEE International Conference on Multimedia & Expo (ICME 2011)
  - IEEE Conference on Computer and Communications (INFOCOM) 2010
  - ACM Multimedia 2010
  - IEEE International Conference on Distributed Computing Systems (ICDCS) 2010
  - ACM Workshop on Network and Operating System Support for Digital Audio and Video (NOSSDAV) 2010

- IFIP International Conference on Networking (Networking) 2010
- ACM Multimedia 2009
- IEEE Conference on Computer and Communications (INFOCOM) 2009
- IEEE Global Communications Conference (GLOBECOM) 2009
- International Workshop on Peer-To-Peer Systems (IPTPS) 2009
- ACM Workshop on Network and Operating System Support for Digital Audio and Video (NOSSDAV) 2009
- International Conference on Queueing Theory and Network Applications (QTNA) 2009
- IEEE Consumer Communications and Networking Conference (CCNC) 2009
- IEEE International Conference on Distributed Computing Systems (ICDCS) 2008
- ACM International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS) 2008
- ACM Sigcomm CoNEXT 2008
- IEEE Consumer Communications and Networking Conference (CCNC) 2008
- International Conference on Computer Communications and Networks (ICCCN) 2008
- ACM SIGCOMM 2007 P2P-TV Workshop
- ACM SIGMETRICS 2007 Student Workshop
- IFIP International Symposium on Computer Performance, Modeling, Measurements and Evaluation (PERFORMANCE) 2007
- International ICST Conference on Testbeds and Research Infrastructures for the Development of Networks and Communities (TridentCom) 2007
- International Conference on Computer Communications and Networks (ICCCN) 2007
- International Conference on Computer Communications and Networks (ICCCN) 2006

- Referee for submissions to the following professional journals:

  - *IEEE/ACM Transactions on Networking*;
  - *IEEE Journal on Selected Areas in Communications*;
  - *IEEE Transactions on Multimedia*;
  - *IEEE Transactions on Automatic Control*;
  - *IEEE Transactions on Information Theory*;
  - *IEEE Transactions on Computers*;
  - *IEEE Transactions on Network and Service Management*;
  - *IEEE Transactions on Parallel and Distributed Systems*;
  - *ACM Computer Communication Review*;
  - *ACM Transactions on Multimedia Computing Communications and Applications*;
  - *Automatica*;
  - *Elsevier Computer Networks Journal*;
  - *Elsevier Computer Communications*;
  - *Elsevier Optical Switching and Networking journal*;
  - *Springer Multimedia Systems Journal*;

– *Springer Peer-to-Peer Networking and Applications Journal*;

– *IEEE Communications Magazine*;

– *IEEE Network Magazine*;

– *IEEE Internet Computing*;

– *Journal of Discrete Event Dynamic Systems*;

– *Journal of Visual Communication and Image Representation*;

SEMINAR PRESENTATIONS

- Bayesian-inference Based Recommendation in Online Social Networks, Columbia, CS, October 2010;

- Modeling and Analysis of Multi-Channel P2P Live Video Systems, University of Science and Technology of China, July 2010;

- P2P Trading in Social Networks: The Value of Staying Connected, Huazhong University of Science and Technology, China, June 2010;

- View-Upload Decoupling: A Redesign of Multi-Channel P2P Video Systems, IBM T.J. Watson Research Labs, March 2010;

- Gain of Opportunistic Routing in Hybrid Wireless Networks and Wireless Multicast, InterDigital, Long Island, NY, November 2009;

- Scalable Video Multicast in Hybrid 3G/Ad-hoc Networks, NSF WiCAT Annual Meeting, University of Virginia, November 2009;

- iPASS: Incentivized Peer-assisted System for Asynchronous Streaming, NYSTAR CATT Annual Meeting, October 2009;

- Law of Large Numbers in P2P Video Streaming, NJIT CS, October 2009;

- View-Upload Decoupling: A Redesign of Multi-Channel P2P Video Systems, WOCC, May 2009;

- Queuing Network Models for Multi-Channel P2P Live Streaming Systems, INFOCOM, April 2009;

- View-Upload Decoupling: A Redesign of Multi-Channel P2P Video Systems, INFOCOM, April 2009;

- Law of Large Numbers in P2P Video Streaming, WIN Lab, Rutgers University, November 2008;

- ISP-Centric P2P Sharing Applications, TimeWarner Cable, New York, November 2008;

- Is Random Scheduling Sufficient in P2P Video Streaming?, ICDCS, Beijing, June, 2008

- Exploring Fundamental Performance Bounds of P2P Video Streaming, Tsinghua University, Beijing, China, June, 2008

- P2P Live Video Streaming: the success and the limit, IBM T.J. Watson Research Labs, February 2008;

- P2P IPTV: current practice and future, Verizon Labs, Waltham, MA, November, 2007

- On the Minimum Delay Peer-to-Peer Video Streaming: how realtime can it be?, ACM Multimedia, September, 2007

- Large-scale P2P Video Streaming on the Internet, Huawei Corporate Research, Nanjing, China, August, 2007;

- Stochastic Fluid Theory for P2P Streaming, NYC P2P Workshop, May 2007

- Stochastic Fluid Theory for P2P Streaming, INFOCOM, Alaska, May 2007

- P2P Live Video Streaming: the success and the limit, WOCC, April 2007;

- A Measurement Study of a Large-Scale P2P IPTV System, Thomson Research Labs, Princeton, NJ, October 2006;

- Insight into PPLive: A Measurement Study of a Large-Scale P2P IPTV System, WWW 2006 workshop of IPTV services over World Wide Web, May 2006;

- On the TCP-Friendliness of VoIP Traffic, INFOCOM, Barcelona, April, 2006;

- An Information-Theoretic Approach to Network Monitoring and Measurement, IMC 2005;

DEPARTMENTAL SERVICE

- Advisor for Master of Science Telecommunication Networks Program;

- Area director for Telecommunication Network Courses;

- Serve in Department Graduate Committee;

- PhD and Master graduate student admissions;

- Director of Departmental Webteam.

- Undergraduate Mentoring

PATENTS

1. Chao Liang, Yang Guo, and Yong Liu, "Hierarchically Clustered P2P Streaming System", PU070061, Filed 04/2007, PENDING;

2. Chao Liang, Yang Guo, and Yong Liu, "Achieving Maximum Streaming Rate Using Decentralized Perfect Scheduling Algorithm", PU070154, Filed 05/2007, PENDING;

3. Yang Guo, Chao Liang, and Yong Liu, "Decentralized Hierarchically Clustered P2P Live Streaming System", PU080017, Filed 02/2008, PENDING;

4. Chao Liang, Yang Guo, and Yong Liu, "Multi-Head Hierarchically Clustered P2P Streaming System", PU080069, Filed 05/2008, PENDING;

5. Sha Hua, Yang Guo, Yong Liu, Hang Liu, and Shivendra S. Panwar, "Apparatus For Scalable Video Multicast Over Hybrid Network", PU090030, Filed 03/2009, PENDING;

6. Hao Hu, Yang Guo, and Yong Liu, "Apparatus For Peer-To-Peer Streaming Of Layered Video", PU090057, Filed 06/2009, PENDING;

7. <u>Xiwang Yang</u>, Yang Guo, and Yong Liu, "Bayesian Inference Based Recommendation In Social Network", PU100096, Filed 04/2010, PENDING;

8. Yong Liu, "Peer-to-Peer Video Streaming Technique For Reducing Or Minimizing Delays", Filed 12/2008, PENDING;

9. Yong Liu and Keith Ross, "View Upload Decoupled Peer To Peer Video Distribution Systems And Methods", Filed 12/2008, PENDING;

10. Stevan Leiden, Ayaskant Rath, Yong Liu, Shiv Panwar, and Keith Ross, "Peer-to-Peer Voice over Internet Protocol", Filed 12/2009, PENDING.

Research Statement

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My primary area of research is networking. The rapid growth and evolution of the Internet and other forms of networking, such as Peer-to-Peer (P2P), wireless and sensors networks, has continually created new challenges for networking researchers. My research goal is to analyze and improve existing and proposed protocols, and design new networks, protocols and networked applications. My research spans all network layers, from the application layer down to the physical layer. I have worked on problems in traditional IP networks, as well as newly emerging networks, such as P2P networks and online social networks. My research methodology is to combine analytical approaches, such as modelling, control, and optimization, with experimental evaluation, such as simulation and experimentation. Analytical models often provide fundamental understanding and subtle insights beyond intuition. Experimental evaluation is critical to validate analysis and answer *"what if"* questions for analytically untractable problems.

1   Research Accomplishments

In the following, I summarize my research accomplishments in three sub-areas.

Measurement, Analysis, and Design of P2P Video Streaming Systems

Key Contributions: measurement study of large-scale systems; development of analytical models and performance bounds for P2P streaming; design and prototyping of new P2P streaming solutions

Video is driving much of the innovations on the Internet. In recent years, P2P video streaming has successfully enabled large-scale video multicast on top of the "best-effort" Internet. Together with colleagues at Polytechnic Institute of NYU, I made significant research contributions on the measurement, analysis and design of P2P video systems.

We conducted the first thorough measurement study of large-scale P2P video systems. We developed passive and active measurement platforms and collected extensive traces of PPLive, one of the largest commercial P2P video streaming systems which offers hundreds of channels and attracts hundreds of thousands of users every day. Through trace analysis, we unveiled key factors leading to the successes of P2P video streaming. We also identified the performance problems of existing P2P streaming solutions. Our measurement study provide valuable inputs for research on P2P streaming and IPTV in general. Our papers are highly cited. One paper was awarded *the Best Paper in Multimedia Communications of IEEE Communications Society* in 2008.

On the theory side, we analytically studied the performance of P2P video streaming in dynamic and heterogeneous network environment. For single P2P streaming swarm, we built stochastic models to characterize the universal streaming probability under peer churn. We analytically evaluated the impact of video buffering and system size on the system-wide streaming quality. We derived the fundamental delay bounds of P2P live streaming, and showed that peer heterogeneity can be exploited to improve delay performance. The robustness of P2P streaming against variations in network bandwidth and delay are also analyzed. For P2P streaming systems offering multiple channels, we developed Jackson infinite server queuing network models. We analytically showed that existing P2P streaming designs are vulnerable to channel churn and

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heterogeneous channel popularity. We further proposed a new streaming design VUD, which radically decouples peer video upload from download. We showed that VUD can significantly improve the streaming performance of multi-channel systems. Our paper on the modeling of multi-channel P2P streaming systems is the sole winner of *the Best Paper Award in IEEE INFOCOM 2009*.

Insights obtained from our measurement and analysis allow us to design new P2P streaming solutions. We worked closely with industry on design and prototyping. In collaboration with Thomson Corporate Research, we designed a Hierarchically Clustered P2P Streaming System (HCPS) to achieve close to 100% peer uploading bandwidth utilization with dynamic peer arrivals and departures. We developed the HCPS prototype and conducted extensive experiments on the PlanetLab to investigate the scheduling sensitivity of P2P streaming. In collaboration with IBM Research, we developed a new incentive mechanism for P2P video-on-demand system. In collaboration with Verizon labs, we investigated the benefit of adopting P2P technology to transport and deliver voice and video services in the Verizon FiOS networks. In collaboration with Huawei, we studied the optimal caching strategy for multitree based P2P video streaming. Several novel ideas have been filed as patents.

Robust Network Design: the X-ities

Key Contributions: the interaction between the routing optimization of overlay networks and underlay networks; network traffic engineering under traffic variations and failures

From 2005 - 2010, I was supported by NSF grant CNS-0519998: "Network X-ities: – Foundations and Applications". The objective of this project is to design the future generation Internet to achieve good performance in the face of a complex, uncertain, error-prone, and ever-changing environment. The need for such "robust" network operation leads to a set of design considerations that we refer to as the network X-ities (since they all end in "ity"): non-fragility, manageability, diagnosability, optimizability, scalability, and evolvability.

While overlay networks improve the performance perceived by overlay users, a fundamentally important question is to understand how overlay networks might affect the operation of underlay networks. We systematically studied the interaction between the routing optimization of overlay networks and underlay networks within a game theoretic framework, and showed analytically that the selfish behavior of overlay networks can cause both huge cost increases and oscillations in underlay networks. More importantly, we have also identified cases where the interaction between the overlay and underlay networks is *inefficient*, i.e., both overlay and underlay users suffer performance degradation. The analysis has been confirmed by simulation studies. This work provides a starting point in the search for a rigorous and well-founded understanding of the interaction between overlay routing and traffic engineering. Various insights gained from this study can be used to guide the design of overlay/peer-peer networks.

Traffic Engineering (TE) determines routes for network users to minimize network cost, such as network-wide delay. Given the matrix of traffic demand between all node pairs, TE can calculate the optimal set of routes by solving a constrained optimization problem. However, in practice, the traffic demand continually changes, make it difficult to accurately estimate a traffic matrix. We studied the optimal routing with multiple traffic matrices. We extended existing methods based on a single demand matrix to find an optimal set of routes which minimize expected network cost when there are multiple traffic matrices. To address the inherent complexity of optimal routing with multiple traffic matrices, we proposed and evaluated a heuristic algorithm which gives a near optimal solution and requires much less computation.

During network failures and/or maintenance, the amount of available network resources, such as routers and links, decreases. Congestion will accumulate in some portions of the network. While re-routing can alleviate the congestion to some extent, it is often the case that user perceived delay performance degrades

due to the reduced network capacity. To meet the Service Level Agreement (SLA) with its customers, a network service provider may choose to block some traffic at network ingress points. The decision to be made is two-fold: a) how much traffic can be admitted for different customers? b) how should the admitted traffic be routed to meet the SLA? These two sub-problems are coupled together. In a joint work with AT&T research labs, we formulated it as a problem of utility maximization through joint rate control and routing. Several variations of original problem have been investigated to provide practical solutions for existing routing schemes, such as OSPF and MPLS.

In wireless sensor networks, the sensing and routing are strongly coupled through the power constraint on individual nodes. We extended previous studies on the interaction between rate control and routing in wired-line network to investigate the trade-off between sensing and routing in wireless sensor networks with directional antennas. We developed a distributed gradient-based algorithm that iteratively adjusts the per-node amount of energy allocated between sensing and communication to reach the system-wide optimum. We prove that our algorithm converges to the maximum system utility. We quantitatively demonstrate the energy balance achieved by this algorithm in a network of small, energy-constrained X-band radars, connected via point-to-point 802.11 links with directional antennas.

Modelling and Simulation of Large Scale Computer Networks

Key Contributions: development of scalable network fluid models; fluid and hybrid network simulators for large, high speed networks.

Networks, and the Internet in particular, have experienced exponential growth, becoming one of the largest engineering systems ever constructed. Understanding the behavior of this large system is of critical importance. The challenge we face is moving from a packet-based modelling abstraction to a modelling abstraction that is computationally tractable in today's networks with gigabit-rate links. Based on the previous fluid dynamic models of Transmission Control Protocols (TCP) and Active Queuing Management (AQM) schemes, we developed *topology-aware* fluid flow models to accurately abstract out the interaction between network components, such as between TCP at the network edge and AQM in network core. The proposed models are scalable with link speed and network size. It is proven to accurately capture the *average* behavior of large scale networks.

Based on the fluid flow models, we have also built a scalable network simulator that is capable of simulating large networks consisting of tens of thousands of routers and millions of TCP flows *in real time*. We also successfully integrated the fluid models with several major packet-level network simulators, such as *ns-2*, *QualNet* and *pdns*, to conduct hybrid network simulations with multi-level resolutions. Our simulators have been adopted by researchers from different areas to conduct simulations involving large scale networks.

Other than the previous areas, I have also made unique contributions to a set of challenging research problems:

- Application-level Relays for High Bandwidth Data Transport over Wide Area Networks;

- Information-theoretic Approaches for Network Measurement;

- Control-Theoretic Analysis of AQM Performance under Unresponsive Traffic;

- Statistical Analysis of the Origin of Long-range Dependency;

- Perturbation Analysis for Fluid Queuing Systems;

- Sample Path Analysis of Prioritized Fluid Queues

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2   Plan for Future Research

My past work has demonstrated my ability to conduct interdisciplinary research in large-scale networked systems. Looking into the future, I am excited by the possibilities of working on a broad range of challenging issues in various networked systems. The following is a partial list of research projects in near future.

- **Next-Generation P2P Streaming.** P2P streaming is expected to be more prevalent in the future Internet. Other than large-scale IPTV services, P2P streaming is a natural solution for distributing User Generated Content (UGC). P2P streaming is also an efficient solution for new networked applications developed around user-user interactions, such as multi-party video conferencing and Massively Multiplayer Online Games (MMOG), etc. I have been funded by the National Science Foundation (under contract CNS-0953682) to develop new theory and design for the next generation P2P streaming systems in the next five years.

- **Online Social Neworks.** The phenomenally popular online social networks, such as Facebook and Twitter, present new opportunities for networking research. Recently, we proposed a new OSN-based P2P incentive paradigm: Networked Asynchronous Bilateral Trading (NABT). NABT exploits trust between friends in OSN. It allows a peer to trade with her friends asynchronously. It also enables a peer to trade with a remote peer through intermediaries. Our preliminary results demonstrated that NABT has much higher trading efficiency than the "tit-for-tat" type of synchronous bilateral trading mechanism. We will further investigate NABT and the integration of OSN with P2P in a NSF funded project (CNS-1018032) in the next three years. In a separate project, we proposed a Bayesian-inference based recommendation system for OSNs.

- **Content Distribution in Wireless Networks.** While wireless networks have brought us the convenience of mobility and new applications, they are still hamstrung by bandwidth bottlenecks. The capacities of wireless networks are challenged by an increasing array of date-intensive network applications, such as video, music, web, and games, on the new generation multi-mode wireless devices (such as the iPhone). Unlike in wireline networks, content distribution in wireless networks is tightly coupled with operation at the lower layers. We will address the challenge of content distribution in multi-channel wireless networks by integrating application layer solutions, such as overlay multicast, content caching, and P2P sharing, with optimal cross-layer link and channel scheduling.

3   Summary

In summary, I am confident of my ability to carry out independent research. I also believe many research problems from different fields are intrinsically closely coupled and should be solved drawing on expertise from multiple disciplines. Thus, I look forward to collaborating with researchers with a wide variety of research interests. My combined experience, in electrical & computer engineering and computer science, allows me to continue to make unique research contributions in my future career.

Teaching Statement

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The goal of my academic career is not only to advance research on networking, but also to educate and prepare graduate and undergraduate students to gain a solid understanding of computer networks, no matter which profession they will choose in their future career. My teaching activities include classroom teaching at graduate and undergraduate levels, curriculum development, and student mentoring.

1   Classroom Teaching

During the past five years, I taught six different networking courses at graduate and undergraduate level.

- EE136 - Communication Networks: Spring 2007, Spring 2008, Spring 2010;

- EL5363 - Principles of Communication Networks: Fall 2006, Fall 2007;

- EL5373 - Internet Architecture and Protocols: Spring 2006, Spring 2007, Spring 2008, Spring 2009, Fall 2010;

- EL7363 - Communications Networks II: Design and Algorithms, Fall 2006, Fall 2007, Fall 2008, Fall 2009, Fall 2010;

- EL933 - Network Measurement and Traffic Engineering, Fall 2005;

- MSTN Project Courses: EL9953, EL9963, CS6873, All Semesters

Different courses focus on different subjects in networking, and have students with different background and interest. I employ different strategies to teach each of them.

EE136 is an undergraduate computer networking course. It exposes students to the fundamental principles and designs in computer networking. I believe that students learn the best when they have interest and curiosity on a subject. I always try to motivate a problem and explain a concept using real network applications and examples, which they encounter on a daily basis, but don't have a deep understanding for. To match the learning capability of undergraduate students, I constantly adjust the pace and depth of teaching using feedback collected from quizs and homeworks.

EL5363 is an entry-level graduate networking course. Since this is a core course for MSTN program, and a sequence course for MSEE program, I often have a large number (50+) of students in my class. The challenge is to cope with students with diverse backgrounds. Some students do not have any knowledge about computer networks, some students have rich experience in network management and programming. I have learned to accommodate both groups by clearly explaining basic concepts and principles to the whole class, while presenting the latest development and challenging questions to the advanced students.

EL5373 is an extremely popular course at the ECE department. It constantly attracts more than one hundred students each semester. The uniqueness of this course is to let students learn the Internet protocols by

actually "seeing" how they work in the lab. The main challenge is to integrate the lectures with the lab assignments. I work closely with the Lab TAs to examine the performance of students in lab assignments, particularly their mistakes and misunderstandings. I will then spend extra effort in the lecture to clear their doubts and help them learn better from their mistakes. To ensure students follow the lab-based learning approach, we put heavy grading weights on lab reports and lab-based exam questions.

EL7363 is an advanced network design course. I developed the syllabus targeting for master students who will choose network design and management as their future profession, PhD students whose research fields are directly or closely related to compute networking, and part-time students who are working on network administration. Network design involves modeling, optimization, and algorithm components. Based on the background of students taking this course, I choose to mainly focus on the modeling component. There is a midterm exam to test how well students master the traditional network design methodologies. The final project is open-ended. Students are encouraged to apply what they learned in class to their own research problems or network design and management projects at work. I always feel great satisfaction when students solve their problems by creatively extending network design techniques learned in class.

EL933 is a special topic course that I developed when I first joined Poly. It introduces to students the classical techniques and the most recent research activities in the field of network measurement and traffic engineering. Each week, I cover a topic by presenting three to four research papers from top conferences and journals. Students are evaluated by a final project. Even though it was only offered once, a course project of a student group eventually grew into a very fruitful research project on P2P IPTV measurement.

As the director for the Master of Science in Telecommunication Networks (MSTN) program, I shouldered the responsibility of advising more than 120 MSTN design projects over five years. Students are encouraged to take hands-on projects, such as developing new network applications, building small-scale network testbeds, and network performance evaluation using simulation tools, such as OPNET or NS, etc. For students who are not capable of or do not have access to a hands-on project, I advise them to study new networking topics beyond our courses, especially those new trends in the industry, such as data centers, cloud computing, WiMAX/LTE, etc. For small projects, students work independently under my supervision. For large projects, students work in teams. They learn the importance of project management and teamwork.

1.1 Teaching Evaluation

Table 1 presents the results of teaching evaluation conducted by the department in the last four years [1].

Table 1: Teaching Evaluation Results in Past Four Years

Semester	Course	Enrollment	Course Rating/Dept. Avg.	Instructor Rating/Dept. Avg.
07' Spring	EL5373	43	4.35/3.92	4.58/3.86
07' Fall	EL5363	53	4.65/4.3	4.71/4.34
	EL7363	19	4.67/4.3	4.6/4.34
08' Spring	EL5373	86	4.55/4.42	4.52/4.5
08' Fall	EL7363	13	4.15/4.38	4.23/4.46
09' Spring	EL5373	61	4.55/4.35	4.71/4.43
09' Fall	EL7363	12	5.0/4.34	4.9/4.5
10' Spring	EE136	14	5.0/4.24	5/4.43

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[1]Results prepared by Prof. Xiaokang Chen, ratings are in the scale of 1-5.

2   Curriculum Development

In Fall 2006, I redesigned an old graduate level course at ECE department of Polytechnic, "EL7363: Communications Networks II: Design and Algorithms". It has not been offered at Polytechnic for many years. Since Fall 2006, I have been offering it once every year. The subject of this course is network design, which consists of topology design and traffic routing taking into account dynamics in network states, such as link/node failures and traffic demand variations. Efficient design models and optimization methods are crucial to simultaneously achieve good network user performance and high savings in network deployment and maintenance. This course introduces mathematical models, design problems and optimization algorithms that can be used to guide network design practice. This course is taken by a wide range of students interested in network design, including senior undergraduate students, master students, Ph.D students and part-time students. My course slides have been adopted by the authors of the textbook as the official slides for the book.

In Fall 2005, I developed a special topic course on network measurement and traffic engineering. Networks, and the Internet in particular, have experienced exponential growth, becoming one of the largest engineering systems ever constructed. Management of this large system is of critical importance, and challenging at the same time. Measurements and models based on these measurements are integral components to understand network behavior and provide basis for better management. This course covers topics both in measurement, ranging from traffic/protocol/application characterization to anomaly detection, and in traffic engineering, including congestion control and optimal routing.

3   Student Mentoring

In my role as a mentor for graduate students, I have successfully advised and provided funding for five Ph.D. students: Chao Liang, Tan Ba Le, Xiwang Yang, Guibin Tian and Yang Xu. I have been successfully guiding a student to a research topic that matches his research interest and technical strength. Chao Liang is the winner of the Richard Rosenthal Award for ranking the first in the departmental PhD qualify exam in 2006. He has published six journal papers, ten conference papers. He has three additional pending journal revisions/submissions. He did summer Interns at Thomson Research Labs and IBM T. J. Watson Research Labs. Tan Ba Le is a PhD student originally funded by the Vietnamese government. He had some difficulty in passing the department qualify exam when he first came to me for advising. By spending more time with him, I was able to turn him around, in terms of both altitude and attitude, in about two years. Now he is highly motivated and conducting active research on opportunistic routing in wireless networks. Not only he passed the Ph.D qualify exam and area exam, he has also published one journal paper, two conference papers, with one pending conference submission. The satisfaction I felt in this case is no less than advising a more productive student, such as Chao Liang.

Other than advising Ph.D students, I also actively engage master, undergraduate, and minority students in my research projects. I have advised three MS thesis, and one BS/MS thesis. Among them, Winiga Sontoua is a minority BS/MS student. He worked with me on a TCP relay project. He learned socket programming, successfully developed a TCP relay prototype, and conducted extensive experiments on the PlanetLab. Wei Chen is a master student in the joint master program between the Polytechnic and the Southeastern University of China. Haigen Li is a master student in the joint master program between the Polytechnic and the Southern China University of Technology. Yanwei Tang is a student in the joint BS/MS program between the Polytechnic and the Nanjing University of China. In addition, I have hired many GAs from ECE and CS departments to work with me and my Ph.D students on various research projects.

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Citation Analysis

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Networking is an interdisciplinary research field. My research experience and methodology cross the boundary of Electrical Engineering, Computer Engineering, and Computer Science. As one trend in networking research community, due to the fast evolving nature of research topics, people pay more and more attention to conference publications, especially those top conferences such as INFOCOM, SIGCOMM, and SIGMETRICS, etc. As a result, top conferences are more competitive than most journals. To publish a paper in a top networking conference, authors have to do a very solid and comprehensive work, and write a lengthy paper with double column, ten or fourteen pages in nine or ten points fonts.

To faithfully reflect the impact of our papers to the networking community, I will report my citation analysis for both journal papers (using ISI Web Science) and conference papers (using Google Scholar). The acceptance ratios of selected conferences have also been reported in my CV.

1   Coauthors

During my whole research career, I am fortunate to work with a set of brilliant collaborators and publish research work in high-quality journals and highly selective top conferences. Table 2 lists in alphabetic order my co-authors in the past five years. Many research projects involve collaborative work by a group of students, postdoc, professors and researchers. The general protocol for authorship ordering that we have been following is: student/postdoc group go first, professors and researchers are in the second group; within each group, individuals are ranked by their contribution, if their contribution is comparable, they are listed in alphabetic order.

2   Journal Impact Factors

Table 1 presents the impact factors in the past three years for journals that I have published.

Table 1: Journal Impact Factors in the Past Three Years from ISI Web Science

Journal	2007	2008	2009
IEEE/ACM Transactions on Networking	1.831	2.576	2.051
IEEE Journal On Selected Areas In Communications	1.799	4.249	3.758
IEEE Transactions on Multimedia	1.518	2.288	1.822
IEEE Transactions On Automatic Control	2.824	3.293	2.556
IEEE Communications Magazine	1.704	2.799	2.466
Computer Networks	0.829	1.304	1.201
IEEE Transactions on Parallel and Distributed Systems	1.146	1.916	1.733
ACM Transactions on Modeling and Computer Simulation	-	1.029	0.684
Discrete Event Dynamic Systems: Theory & Applications	0.545	0.974	0.921

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3 Citations

In the attachment, we first report the citations of all journal and conference papers from from Google Scholar, then we report the citations of journal papers only from ISI Web science (only citations generated by other journal papers are counted).

Table 2: Coauthors in Past Five Years

Last Name	First Name	Affiliation	Project
Bolot	Jean	Researcher in Sprint Labs	Measurement
Bu	Tian	Researcher in Bell Labs	TCP-friendly VoIP
Buford	John	Researcher in Panasonic Labs	Streaming Relay
Fu	Zhenghua	Researcher in IBM Watson	P2P VoD
Ge	Zihui	Researcher in AT&T Labs	Traffic Engineering
Gong	Weibo	Professor, ECE UMass, PhD Adviser	Fluid Model, Congestion Control
Guo	Yang	Researcher, Thomson Labs	P2P & Social Networks
Hei	Xiaojun	Postdoc (Keith), CSE Poly	P2P
Hua	Sha	PhD (Shiv), ECE Poly	Wireless Video
Hu	Hao	PhD (Yao), ECE Poly	Scalable Video
Huang	Yong	PhD, ECE UMass	Fluid Queueing
Kurose	Jim	Professor, CS UMass, Postdoc Mentor	Robust Network Design
Kumar	Rakesh	PhD (Keith & Shiv), ECE Poly	P2P
Le	Tan	My PhD Student	Wireless Opportunistic Routing
Liang	Chao	My PhD Student	P2P, Traffic Engineering
Liang	Jian	PhD (Keith), CSE Poly	P2P
Liu	Hang	Researcher, Thomson Labs	P2P & Wireless Video
Misra	Vishal	Professor, CS Columbia	Fluid Model, Self-similarity
Mobius	MarKus	Professor, Economics, Harvard	P2P Incentive
Panwar	Shiv	Professor, ECE Poly	P2P, Wireless Video
Ross	Keith	Professor, CSE Poly	P2P
Towsley	Don	Professor, CS UMass, Postdoc Mentor	Fluid Model, Measurement
Wang	Angela	PhD (Keith), CSE Poly	Streaming Relay
Wang	Yao	Professor, ECE Poly	P2P Incentive
Wolf	Tilman	Professor, ECE UMass	TCP Pacing
Wu	Chai	Researcher in IBM Watson	P2P VoD
Wu	Di	Postdoc (Keith), CSE Poly	P2P
Yang	Xiwang	My PhD Student	Social Networks
Ye	Tao	Researcher in Sprint Labs	Measurement
Zhang	Chun	Researcher in IBM	Robust Network Design
Zhang	Honggang	Professor, Suffolk University	Overlay Optimization
Zink	Michael	Professor, ECE UMass	Sensor Networks

Google Scholar Citations for Yong Liu's Papers

Citations	Paper
505	Xiaojun Hei, Chao Liang, Jian Liang, Yong Liu and Keith Ross, "A Measurement Study of a Large-Scale P2P IPTV System", in IEEE Transactions on Multimedia, Volume 9, Number 8, Pages 1672 -- 1687, December, 2007
150	Rakesh Kumar, Yong Liu and Keith Ross, "Stochastic Fluid Theory for P2P Streaming Systems", in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM), Pages 919 -- 927, May, 2007 (Acceptance Ratio: 18%)
104	Yong Liu, Francesco Lo Presti, Vishal Misra, Don Towsley and Yu Gu, "Fluid Models and Solutions for Large-Scale IP Networks'', in the Proceedings of ACM International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS)'03, Pages 91 -- 101, San Diego, June 2003. (Acceptance Ratio: 11.7%)
84	Xiaojun Hei, Yong Liu and Keith Ross, "Inferring Network-Wide Quality in P2P Live Streaming Systems", in IEEE Journal on Selected Areas in Communications, special issue on advances in P2P streaming, Volume 25, Number 9, Pages 1640 -- 1654, December 2007
81	Xiang Yu, Chunming Qiao and Yong Liu, "TCP Implementations and False Time Out Detection in Optical Burst Switching Networks'', in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM)'04, Pages 774 -- 784, Hong Kong, March 2004. (Acceptance Ratio: 18.4%)
65	Christopher Hollot, Yong Liu, Vishal Misra and Don Towsley, "Unresponsive Flows and AQM Performance'', in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM)'03, Volume 22, No. 1, Pages 85 -- 95, San Francisco, April 2003, (Acceptance Ratio: 20.8%)
63	Yong Liu, Yang Guo and Chao Liang, "A Survey on Peer-to-Peer Video Streaming Systems", in Journal of Peer-to-Peer Networking and Applications, (Springer), Pages 18 -- 28, February, 2008
59	Xiaojun Hei, Yong Liu and Keith Ross, "IPTV over P2P Streaming Networks: the Mesh-pull Approach", in IEEE Communications Magazine, Pages 86 -- 92, February, 2008
54	Yong Liu, "On the Minimum Delay Peer-to-Peer Video Streaming: how realtime can it be?", in the Proceedings of ACM Multimedia, Pages 127 -- 136, September, 2007 (Acceptance Ratio: 19%)
50	Weibo Gong, Yong Liu, Vishal Misra and Don Towsley, "On the Tails of Web File Size Distributions'', in the Proceedings of 39th Annual Allerton Conference on Communication, Control and Computing, October 2001
48	Yu Gu, Yong Liu and Don Towsley, "On Integrating Fluid Models with Packet Simulation'', in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM)'04, Pages 2856 -- 2866, Hong Kong, March 2004. (Acceptance Ratio: 18.4%)
44	Weibo Gong, Yong Liu, Vishal Misra and Don Towsley, "Self-Similarity and Long Range Dependence on the Internet: A second look at the evidence, origins and implications'', in Computer Networks Journal, Volume 48, Issue 3, Pages 377 -- 399, June 2005
37	Yong Liu, Honggang Zhang, Weibo Gong and Don Towsley, "On the Interaction Between Overlay Routing and Traffic Engineering'', in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM)'05, Volume 4, Pages 2543 -- 2553, Miami, March 2005 (Acceptance Ratio: 17.2%)

Google Scholar Citations for Yong Liu's Papers

33	Yong Liu, Francesco Lo Presti, Vishal Misra, Don Towsley and Yu Gu, "Scalable Fluid Models and Simulations for Large-Scale IP Networks'', in ACM Transactions on Modeling and Computer Simulation, Vol. 14, No. 3, Pages 305 -- 324, July 2004
32	Chun Zhang, Zihui Ge, Jim Kurose, Yong Liu, and Don Towsley, "Optimal Routing with Multiple Traffic Matrices: Tradeoff between Average Case and Worst Case Performance", in the Proceedings of 13th IEEE International Conference on Network Protocols (ICNP), Pages 215 -- 224, November, 2005 (Acceptance Ratio: 17%)
32	Chun Zhang, Yong Liu, Weibo Gong, Jim Kurose, Robert Moll and Don Towsley, "On Optimal Routing with Multiple Traffic Matrices'', in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM)'05, Volume 1, Pages 607 -- 618, Miami, March 2005. (Acceptance Ratio: 17.2%)
30	Di Wu, Yong Liu and Keith Ross, "Queuing Network Models for Multi-Channel P2P Live Streaming Systems", in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM), Pages 73 -- 81, April, 2009, (Acceptance Ratio: 19%, bf sole winner of the Best Paper Award)
27	Yong Liu and Weibo Gong, "Perturbation Analysis for Stochastic Fluid Queueing Systems'', in Discrete Event Dynamic Systems: Theory and Applications, Volume 12, No. 4, Pages 391-- 416, 2002
27	Chao Liang, Yang Guo and Yong Liu, "Is Random Scheduling Sufficient in P2P Video Streaming?", in the Proceedings of the 28th International Conference on Distributed Computing Systems (ICDCS), Pages 53 -- 60, June, 2008 (Acceptance Ratio: 16%)
25	Yong Liu, Yu Gu, Honggang Zhang, Weibo Gong and Don Towsley, "Application Level Relay for High-bandwidth Data Transport'', in the Proceedings of the First Workshop on Networks for Grid Applications (GridNets), Pages 1 -- 10, San Jose, October 2004, bf sole winner of the Best Paper award
24	Di Wu, Chao Liang, Yong Liu and Keith Ross, "View-Upload Decoupling: A Redesign of Multi-Channel P2P Video Systems", in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM) Mini-Conference, Pages 2726 -- 2730, April, 2009, (Acceptance Ratio: 26%)
21	Yang Guo , Chao Liang, and Yong Liu, "Adaptive Queue-based Chunk Scheduling for P2P Live Streaming", in the Proceedings of IFIP Networking, Pages 433 -- 444, May, 2008
18	Yong Liu, Weibo Gong and Prashant Shenoy, "On the Impact of Concurrent Downloads'', in Proceedings of Winter Simulation Conference, Pages 1300 -- 1305, Arlington, December 2001
16	Yong Liu, Don Towsley, Tao Ye and Jean Bolot, "An Information-Theoretic Approach to Network Monitoring and Measurement", in the Proceedings of ACM SIGCOMM Internet Measurement Conference (IMC), Pages 159 -- 172, October, 2005 (Acceptance Ratio: 15%)
15	Tian Bu, Yong Liu, and Don Towsley, "On the TCP-Friendliness of VoIP Traffic", in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM), April, 2006 (Acceptance Ratio: 18%)

Google Scholar Citations for Yong Liu's Papers

14	Chun Zhang, Jim Kurose, Yong Liu, Don Towsley and Michael Zink, "A Distributed Algorithm for Joint Sensing and Routing in Wireless Networks with Non-Steerable Directional Antennas", in the Proceedings of 14th IEEE International Conference on Network Protocols (ICNP), Pages 218 -- 227, November, 2006 (Acceptance Ratio: 14.2%)
12	Yong Liu and Weibo Gong, "On Fluid Queueing System with Strict Priority", in IEEE Transactions on Automatic Control, Volume 48, No. 12, Pages 2079 -- 2088, December, 2003
11	Chao Liang, Yang Guo and Yong Liu, "Hierarchically Clustered P2P Streaming System", in the Proceedings of IEEE Global Communications Conference (GLOBECOM), Pages 236 -- 241, November, 2007
7	Songlin Cai, Yong Liu and Weibo Gong, "Analysis of an AIMD Based Collision Avoidance Protocol in Wireless Data Networks", in the Proceedings of IEEE Conference on Decision and Control (CDC)'03, Volume 1, Pages 104 -- 109, Hawaii, December 2003
6	Chao Liang, Zhenghua Fu, Yong Liu, and Chai Wah Wu, "iPASS: Incentivized Peer-assisted System for Asynchronous Streaming", in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM) Mini-Conference, Pages 2741 -- 2745, April, 2009, (Acceptance Ratio: 26%)
5	Chao Liang, Yang Guo and Yong Liu, "Investigating the Scheduling Sensitivity of P2P Video Streaming: an experimental study", in IEEE Transactions on Multimedia, Volume 11, Number 3, Pages 348 -- 360, April 2009
5	Yang Guo, Chao Liang, and Yong Liu, "dHCPS: Decentralized Hierarchically Clustered P2P Video Streaming", in the Proceedings of ACM International Conference on Image and Video Retrieval (CIVR), Pages 655 -- 662, July, 2008
4	John Buford, Angela Wang, Xiaojun Hei, Yong Liu and Keith Ross, "Discovery of In-Band Streaming Services in Peer-to-Peer Overlays", in the Proceedings of IEEE Global Communications Conference (GLOBECOM), Pages 242 -- 247, November, 2007
3	Yong Huang, Yong Liu, Weibo Gong and Don Towsley, "Two-level Stochastic Fluid Tandem Queuing Model for Burst Impact Analysis", in the Proceedings of IEEE Conference on Decision and Control (CDC), Pages 3042 -- 3047, December, 2007
3	Xiaojun Hei, Chao Liang, Jian Liang, Yong Liu and Keith Ross, "Insight into PPLive: A Measurement Study of a Large-Scale P2P IPTV System", WWW 2006 workshop of IPTV services over World Wide Web, May 2006
2	Yan Cai, Yong Liu, Weibo Gong and Tilman Wolf, "Impact of Arrival Burstiness on Queue Length: An Infinitesimal Perturbation Analysis", in the Proceedings of IEEE Conference on Decision and Control (CDC), Pages 7068 -- 7073, December, 2009
2	Tan Le and Yong Liu, "On the Capacity of Hybrid Wireless Networks with Opportunistic Routing", in the Proceedings of International Conference on Wireless Algorithms, Systems and Applications, Pages 210 -- 223, August, 2009
2	Chao Liang, Yong Liu, and Keith Ross, "Topology Optimization in Multi-Tree Based P2P Streaming System", in the Proceedings of International Conference on Tools with Artificial Intelligence, Pages 806 -- 813, November, 2009
1	Yong Liu, "Delay Bounds of Chunk-based Peer-to-Peer Video Streaming", in IEEE/ACM Transactions on Networking, Volume 18, Number 4, Pages 1195 -- 1206, August 2010

Google Scholar Citations for Yong Liu's Papers

1	Zhengye Liu, Hao Hu, Yong Liu, Keith Ross, Yao Wang, and Markus Mobius, "P2P Trading in Social Networks: The Value of Staying Connected", in the Proceedings of IEEE Conference on Computer and Communications (INFOCOM), Pages 2489 -- 2497, March, 2010 (Acceptance Ratio: 17.4%)
1	Sha Hua, Yang Guo, Yong Liu, Hang Liu, and Shivendra Panwar, "Scalable Video Multicast in Hybrid 3G/Ad-hoc Networks", in the Proceedings of IEEE IEEE Global Communications Conference (GLOBECOM), Pages 4662 -- 4667, November, 2009
1	Yong Liu and Weibo Gong, "Challenges to Congestion Control posed by Concurrent Downloads", in the Proceedings of 41st IEEE Conference on Decision and Control (CDC)'02, Volume 2, Pages 2017-2022, Las Vegas, December 2002
0	Chao Liang, Zhenghua Fu, Yong Liu and Chai Wah Wu, "iPASS: Incentivized Peer-assisted System for Asynchronous Streaming", in IEEE Transactions on Parallel and Distributed Systems, Volume 21, Number 9, Pages 1354 -- 1367, September, 2010
0	Tan Ba Le and Yong Liu, "On the Capacity of Hybrid Wireless Networks with Opportunistic Routing", in EURASIP Journal on Wireless Communications and Networking, Volume 2010, Pages 32 -- 40, January 2010
0	Zhiyong Huang, Xiaoping Zeng, and Yong Liu, "Detecting and Blocking P2P Botnets through Contact Tracing Chains", in International Journal of Internet Protocol Technology, Volume 5, No.1/2, Pages 44 -- 54, 2010
0	Hao Hu, Yang Guo, and Yong Liu, "Mesh-based Peer-to-Peer Layered Video Streaming With Taxation", in the Proceedings of ACM Workshop on Network and Operating System Support for Digital Audio and Video (NOSSDAV), Pages 27 -- 32, June, 2010
0	Chao Liang, Zihui Ge and Yong Liu, "Joint Traffic Blocking and Routing under Network Failures and Maintenances", in the Proceedings of IEEE Global Communications Conference (GLOBECOM), Pages 2752 -- 2756, November, 2007
0	Songlin Cai, Yong Liu and Weibo Gong, "Client-Controlled Slow TCP and Denial of Service", in the Proceedings of IEEE Conference on Decision and Control (CDC)'04, Volume 1, Pages 81 -- 86, December 2004

Record 1 of 12

Author(s): Hei, XJ (Hei, Xiaojun); Liang, C (Liang, Chao); Liang, J (Liang, Jian); Liu, Y (Liu, Yong); Ross, KW (Ross, Keith W.)

Title: A measurement study of a large-scale P2P IPTV system

Source: IEEE TRANSACTIONS ON MULTIMEDIA, 9 (8): 1672-1687 DEC 2007

Times Cited: 92

ISSN: 1520-9210

DOI: 10.1109/TMM.2007.907451

Record 2 of 12

Author(s): Hei, XJ (Hei, Xiaojun); Liu, Y (Liu, Yong); Ross, KW (Ross, Keith W.)

Title: Inferring network-wide quality in P2P live streaming systems

Source: IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, 25 (9): 1640-1654 DEC 2007

Times Cited: 21

ISSN: 0733-8716

DOI: 10.1109/JSAC.2007.071204

Record 3 of 12

Author(s): Gong, WB; Liu, Y; Misra, V; Towsley, D

Title: Self-similarity and long range dependence on the internet: a second look at the evidence, origins and implications

Source: COMPUTER NETWORKS, 48 (3): 377-399 JUN 21 2005

Times Cited: 20

ISSN: 1389-1286

Record 4 of 12

Author(s): Hei, XJ (Hei, Xiaojun); Liu, Y (Liu, Yong); Ross, KW (Ross, Keith W.)

Title: IPTV over P2P streaming networks: The mesh-pull approach

Source: IEEE COMMUNICATIONS MAGAZINE, 46 (2): 86-92 FEB 2008

Times Cited: 11

ISSN: 0163-6804

Record 5 of 12

Author(s): Liu, Y; Gong, WB

Title: Perturbation analysis for stochastic fluid queueing systems

Source: DISCRETE EVENT DYNAMIC SYSTEMS-THEORY AND APPLICATIONS, 12 (4): 391-416 OCT 2002

Times Cited: 5

ISSN: 0924-6703

Record 6 of 12

Author(s): Liu, Y; Gong, WB

Title: On fluid queueing systems with strict priority

Source: IEEE TRANSACTIONS ON AUTOMATIC CONTROL, 48 (12): 2079-2088 DEC 2003

Times Cited: 4

Record 7 of 12

Author(s): Liang, C (Liang, Chao); Guo, Y (Guo, Yang); Liu, Y (Liu, Yong)

Title: Investigating the Scheduling Sensitivity of P2P Video Streaming: An Experimental Study

Source: IEEE TRANSACTIONS ON MULTIMEDIA, 11 (3): 348-360 APR 2009

Times Cited: 1

Record 8 of 12

Author(s): Liu, Y (Liu, Yong)

Title: Delay Bounds of Chunk-Based Peer-to-Peer Video Streaming

Source: IEEE-ACM TRANSACTIONS ON NETWORKING, 18 (4): 1195-1206 AUG 2010

Times Cited: 0

Record 9 of 12

Author(s): Wu, D (Wu, Di); Liu, Y (Liu, Yong); Ross, KW (Ross, Keith W.)

Title: Modeling and Analysis of Multichannel P2P Live Video Systems

Source: IEEE-ACM TRANSACTIONS ON NETWORKING, 18 (4): 1248-1260 AUG 2010

Times Cited: 0

Record 10 of 12

Author(s): Wu, D (Wu, Di); Liang, C (Liang, Chao); Liu, Y (Liu, Yong); Ross, KW (Ross, Keith W.)

Title: Redesigning multi-channel P2P live video systems with View-Upload Decoupling

Source: COMPUTER NETWORKS, 54 (12): 2007-2018 Sp. Iss. SI AUG 26 2010

Times Cited: 0

Author(s): Liang, C (Liang, Chao); Fu, ZH (Fu, Zhenghua); Liu, Y (Liu, Yong); Wu, CW (Wu, Chai Wah)

Title: Incentivized Peer-Assisted Streaming for On-Demand Services

Source: IEEE TRANSACTIONS ON PARALLEL AND DISTRIBUTED SYSTEMS, 21 (9): 1354-1367 SEP 2010

Times Cited: 0

ISSN: 1045-9219

DOI: 10.1109/TPDS.2009.167

Record 12 of 12

Author(s): Le, T (Le, Tan); Liu, Y (Liu, Yong)

Title: On the Capacity of Hybrid Wireless Networks with Opportunistic Routing

Source: EURASIP JOURNAL ON WIRELESS COMMUNICATIONS AND NETWORKING: Art. No. 202197 2010

Times Cited: 0

ISSN: 1687-1499

Article Number: 202197

DOI: 10.1155/2010/202197

NYU·poly
POLYTECHNIC INSTITUTE OF NYU

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May 27, 2009

Professor Yong Liu
Polytechnic Institute of NYU
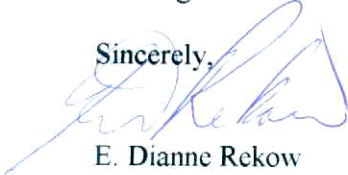Department of Electrical and
Computer Engineering

Dear Yong,

Your 2nd reappointment as Assistant Professor, Electrical and Computer Engineering has been approved. I especially applaud your success for the best paper in IEEE on Multimedia Communications. Your teaching load and diversity of courses is valued. In the future it would be helpful if teaching evaluations could be included in your review materials. However, both the TAC and I share concerns regarding your productivity. The primary source of your funding while at Poly has been from industry and that surely deserves applause. However, you are aware, I'm sure, that funding from peer reviewed, especially federal funding agencies carries substantially higher value in tenure decisions. I urge you to continue aggressively seeking those funds. I also urge you to continue providing evidence of your strengths as an independent investigator through publications in high impact journals and conference papers.

I understand the challenges of balancing all these demands. To help on that front I am asking you (and all as yet tenured faculty) to select a mentoring committee. Please work with your department head to make your selection. I recommend that your mentoring committee consist of at least three senior faculty members, at least one of which will be from outside your department but who can help you traverse potential political and intellectual landscapes overall. Ideally another member should be a senior faculty member from another external institution which can give both Poly and you a sense of measures of success in at least one other institution. You should meet with this committee at least once each semester to measure progress. A written report of the discussions and strategic plan for advancement should be submitted to and reviewed by me and the department head.

Thank you for the contributions you have already made to Poly. I look forward to seeing many exciting new ones in the future.

Sincerely,

E. Dianne Rekow
Provost

lp

cc: J.Chao
       M. Sanchez
       R. Thorsen/Academic Affairs
       TAC

Response to Comments from the Second Reappointment Letter

Yong Liu
ECE Dept.
Polytechnic Institute of NYU

First of all, I would like to thank the department and university tenure and appointment committee, Prof. Chao and Provost Rekow for their valuable comments for my second reappointment review. While I appreciate the positive comments on my teaching, research, and publication, I am particularly grateful on the advices on further improvements to demonstrate the ability to perform and sustain independent research through publications of impact in high quality journals as well as demonstrating an ability to secure funding to support and sustain such research.

In the past one and half year after I received the second reappointment letter, I have made great efforts to address those comments.

I. NSF Funding.

There was a concern that my major funding source was from industry. While we continue to collaborate with industrial companies through CATT and WiCAT, we have been actively pursuing funding from the National Science Foundation. I am happy to report that we secured three new NSF grants in this time periods:

1. "CAREER: Next-Generation Peer-to-Peer Streaming: Theory and Design", under contract CNS-095368, 02/01/2010 - 01/31/2015, $450,000, sole PI;

2. "View-Upload Decoupling: A Redesign of Multi-Channel P2P Video Systems", under contract CNS-0916734, 08/01/2009 - 07/31/2012, $400,000, PI; co-PI: Prof. Keith Ross

3. "Economic Incentives for P2P: Theory and Design", under contract CNS-1018032, 09/01/2010 - 08/31/2013, $450,000, co-PI; PI: Prof. Keith Ross

II. Independence of Work.

There was a suggestion to demonstrate the independence of work. The previously mentioned NSF CAREER award demonstrates the community's recognition of me as an independent junior faculty. I served as the tutorial chair of ACM Sigmetrics 2010, which is the flagship conference of ACM on measurement and performance evaluation of compute systems. I was nominated for the prestigious rising star award of the ACM Sigmetrics community in 2009. I have also been invited to the technical program committee of many top conferences, such as Infocom, Sigmetrics, Multimedia, etc.

While I continue my current collaborations with colleagues at Polytechnic and collaborators from outside, I am also working closely with my students on several challenging research topics independently. I have successfully provided funding and advised five PhD students in my research group. They are working on a wide range of challenging problems, such as opportunistic routing in wireless networks, recommendation in online social networks, and P2P video conferencing, etc. Our recent work have led to publications and submissions to top journals and conferences in this one and half year period:

1. Yong Liu,
"Delay Bounds of Chunk-based Peer-to-Peer Video Streaming",
in IEEE/ACM Transactions on Networking, Volume 18, Number 4, Pages 1195 -- 1206, August 2010;

2. Chao Liang, Zhenghua Fu, Yong Liu and Chai Wah Wu,
"iPASS: Incentivized Peer-assisted System for Asynchronous Streaming",
in IEEE Transactions on Parallel and Distributed Systems, Volume 21, Number 9, Pages 1354 -- 1367, September, 2010;

3. Chao Liang, Miao Zhao, and Yong Liu,
"Optimal Bandwidth Sharing in Multi-Swarm Multi-Party P2P Video Conferencing Systems", under major revision to IEEE/ACM Transactions on Networking;

4. Chao Liang, Yang Guo and Yong Liu,
"Investigating the Scheduling Sensitivity of P2P Video Streaming: an experimental study", in IEEE Transactions on Multimedia, Volume 11, Number 3, Pages 348 -- 360, April 2009;

5. Chao Liang and Yong Liu,
"ViVUD: Virtual Server Cluster based View-Upload Decoupling for Multi-Channel P2P Video Streaming Systems", to appear in the Proceedings of IEEE Global Communications Conference (GLOBECOM), 2010;

6. Chao Liang, Zihui Ge, and Yong Liu,
"Joint Traffic Blocking and Routing under Network Failures and Maintenance",
submitted to IEEE Transactions on Parallel and Distributed Systems;

7. Chao Liang and Yong Liu,
Enabling Broadcast of User-Generated Live Video without Servers",
submitted to Peer-to-Peer Networking and Applications, by Springer US;

8. Yang Guo, Chao Liang, and Yong Liu,
"Hierarchically Clustered P2P Video Streaming: Design, Implementation, and Evaluation", submitted to Computer Networks Journal;

9. Tan Ba Le and Yong Liu,
"On the Capacity of Hybrid Wireless Networks with Opportunistic Routing",
in EURASIP Journal on Wireless Communications and Networking, Volume 2010, Pages 32 -- 40, January 2010;

10. Tan Le and Yong Liu,
"On the Capacity of Hybrid Wireless Networks with Opportunistic Routing",
in the Proceedings of International Conference on Wireless Algorithms, Systems and Applications, Pages 210 -- 223, August, 2009;

11. Tan Le and Yong Liu,
"Opportunistic Overlay Multicast in Wireless Networks",
to appear in the Proceedings of IEEE Global Communications Conference (GLOBECOM), 2010;

12. Tan Le and Yong Liu,
"NCOM: Network Coding based Overlay Multicast in Wireless Networks",
submitted to IEEE Conference on Computer and Communications (INFOCOM) 2011;

13. Xiwang Yang, Yang Guo, and Yong Liu,
"Bayesian-inference Based Recommendation in Online Social Networks",
submitted to IEEE Conference on Computer and Communications (INFOCOM) 2011;

Since I joined Polytechnic, I have also been active in obtaining industrial funding through CATT and WiCAT. The work of my research group has been well appreciated by industry. We have established good connections with industrial research labs, including AT&T, Huawei, IBM, InterDigital, Thomson, and Verizon. I was also invited to give talks in other Universities and research labs, such as Columbia, WINLAB of Rutgers University, IBM research center, Tsinghua University, Verizon Labs, etc.

III. Mentoring Committee

I was asked to form a mentoring committee. With the help of Department head Jonathan Chao, we formed my committee: Prof. Phyllis Frankl (CSE, Poly), Prof. Vishal Misra (CS, Columbia), and Prof. Shiv Panwar (ECE, Poly). We had a formal meeting on 12/23/2009 to review my progress towards tenure. I also talked to them offline to get advices and feedbacks.

The committee was generally satisfied with the progress that I have made to address the review comments from the second re-appointment. They encouraged me to keep up and continue to do good research. There are several suggestions from the Mentoring Committee.

1. Give talks in universities/companies to make researchers in the field, including potential letter writers, aware of your work, prepare a good talk to reflect the flavor and strength of your research, and your achievements.

2. Vishal suggested to networking with other researchers in the field by going to more conferences, where many top researchers in the field will attend.

3. Shiv suggested to give a talk in the department seminar, to make sure faculty in other areas know your work.

4.Phyllis suggested to keep track of students with positive feedbacks about your teaching. Letters from them will be supportive for the teaching evaluation.

EL 7363   Communications Networks II: Design and Algorithms

Instructor: Yong Liu
Date: Monday 3:00-5:40pm, Fall 2010,   **Classroom:** RH 702
Prerequisites: EL5363 or equivalent,
Related Courses: EL6233, EL7353, CS6033, CS6043

Course Description and Outline:
Network design consists of topology design and traffic routing taking into account dynamics in network states, such as link/node failures and traffic demand variations. Efficient design models and optimization methods are crucial to simultaneously achieve good network user performance and high savings in network deployment and maintenance. This course introduces mathematical models, design problems and optimization algorithms that can be used to guide network design practice. The follows is a tentative list of subjects to be covered:
1. Network Design Problem Modeling
2. Optimization Methods
3. Multi-Commodity Flow Routing
4. Location and Topological Design
5. Fair Network
6. Resilient Network Design
7. Robust Network Design
8. Multi-Layer Networks

Text Book:
"Routing, Flow, and Capacity Design in Communication and Computer Networks", Michal Pióro, Deepankar Medhi
ISBN: 0125571895, Publisher: Morgan Kaufmann (July 1, 2004)
http://www.amazon.com/gp/product/0125571895

Reference Books:
1. "Data Networks (2nd Edition)", D. Bertsekas and R. Gallager.
2. "Telecommunications Network Design Algorithms", A. Kershenbaum.
3. "Network Optimization: Continuous and Discrete Models", D. Bertsekas.
4. "Introduction to Algorithms", T. Cormen, C. Leiserson, R. Rivest, C. Stein.
5. "Introduction to Linear Optimization", D. Bertsimas and J. N. Tsitsiklis
6. "Convex Optimization", S. Boyd and L. Vandenberghe
7. "Integer Programming", L.Wosley.

Grading:
Homework: 20 Points;   Midterm: 40 Points;   Final/Project: 40 Points

Contact:
1. email: yongliu@poly.edu
2. web: http://eeweb.poly.edu/faculty/yongliu
3. office: LC 258, ext. 3959
4. office hours: 1-3pm, Monday.

EL 933 Network Measurement and Traffic Engineering
Instructor: Yong Liu
3 Credits

Room RH702

Overview

Networks, and the Internet in particular, have experienced exponential growth, becoming one of the largest engineering systems ever constructed. Management of this large system is of critical importance, and challenging at the same time. Measurements and models based on these measurements are integral components to understand network behavior and provide basis for better management. This seminar covers topics both in measurement, ranging from traffic/protocol /application characterization to anomaly detection, and in traffic engineering, including congestion control and optimal routing. The follows is the list of subjects to be covered:

1. Internet Traffic Analysis: self-similarity and long-range dependency

2. Packet Loss/Delay Characterization: statistical models

3. Packet Probing: capacity available bandwidth estimation

4. Network Tomography: inference from the edge

5. Anomaly Detection: worm, DDoS attacks, link failures

6. Traffic Matrix Estimation: existing and new approaches

7. Distributed Measurement: network of network sensors

8. Network Routing: optimal routing in a changing world

9. Overlay Routing: application level routing adaptation

10. Congestion Control: a closed-loop analysis

Prerequisites

EL536 or equivalent, elementary probability course

Grading

Students will be evaluated by class participation and a final project. The final project can be either a study of a paper from major networking conferences and journals or student's original work on network measurement and traffic engineering. For both cases, a presentation and a term paper is required.

A list of conferences:

[Internet Measurement Conference (IMC)](#)
[Passive & Active Measurement Workshop (PAM)](#)
[ACM Special Interest Group on Data Communications (SIGCOMM)](#)
[IEEE Conference on Computer and Communications (INFOCOM)](#)
[ACM International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS)](#)
[IEEE International Conference on Network Protocols (ICNP)](#)

Reference Books

1. "Data Networks (2nd Edition)", D. Bertsekas and R. Gallager.

2. "Computer Networking, a top down approach featuring the Internet (3rd edition)", James F. Kurose and Keith W. Ross.

3. "Nonlinear Programming", Dimitri P. Bertsekas.

4. "The Mathematics of Internet Congestion Control", R. Srikant.

Course Material

Class 1:   Introduction [slides in pdf](#)

Class 2:   Internet Traffic Analysis [slides in pdf](#)

- W. Leland, M. Taqqu, W. Willinger, D. Wilson. "[On the Self-Similar Nature of Ethernet Traffic (Extended Version),](#)" IEEE/ACM Transactions on Networking, 2(1):1-15, February 1994.
- V. Paxson, S. Floyd. "[Wide-Area Traffic: The Failure of Poisson Modeling,](#)" IEEE/ACM Transactions on Networking, 3(3):226-244, June 1995.
- M.E. Crovella, A. Bestavros. "[Self-Similarity in World Wide Web Traffic: Evidence and Possible Causes,](#)" IEEE/ACM Transactions on Networking, 5(6):835--846, December 1997.

Class 3:   Network Status Characterization: packet loss and delay [slides handout in pdf](#)

- M. Yajnik, S.B. Moon, J. Kurose, D. Towsley "[Measurement and Modeling of the Temporal Dependence in Packet Loss](#)" Proc. IEEE/INFOCOM 1999 (New York, NY, March 1999).
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