DAVID HAY

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(Last Updated: November 2010)

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Education

Ph.D. in Computer Science, Technion IIT, Israel (2001-2007)
Graduated from the direct Ph.D. track in April 2007.
Dissertation Title: *"Competitive Evaluation of Switch Architectures"*.
Advisor: Prof. Hagit Attiya

B.A. in Computer Science, Technion IIT, Israel (1998-2001)
Graduated summa cum laude.

Academic Appointments

- Senior Lecturer (tenure-track) in School of Computer Science and Engineering, The Hebrew University, Jerusalem, Israel (Since October 2010)
- Postdoctoral research scientist in the department of Electrical Engineering, Columbia University, NY, USA (October 2009-October 2010)
- Post-doc fellow in the department of Electrical Engineering, Politecnico di Torino, Turin, Italy (March 2008-October 2009)
- Post-doc fellow in Ben Gurion University of the Negev, Be'er Sheva, Israel (September 2007-February 2008)
- Adjunct Lecturer, the Interdisciplinary Center, Hertzelia (October 2007-February 2008)
- Lecturer at the Department of Computer Science, Technion - IIT (2006-2007)
- Teaching Assistant at the Department of Computer Science, Technion - IIT (2001-2006)

Recent Research Interests and Activities

My research is in **network algorithmics**—an interdisciplinary systems approach, focused on algorithmic thinking, that addresses contemporary and future network processing bottlenecks at or between networking devices (primarily, routers and switches). In particular, I was recently investigating the following subjects:

- Packet Classification
- Usage and implementation of *Ternary Content Addressable Memories* in networks
- Optical packet switches and networking
- Network reliability and survivability
- Energy-efficient networks (*"Green Networking"*)

Industrial Experience

Summer Intern in the *Data Center Business Unit,* Cisco Systems, San Jose, CA (July-October 2006)
This group headed by Dr. Flavio Bonomi, and is currently part of Cisco Research:

- Designed and developed light-weight simulation tool that allows performing large simulation at the network level.
- Studied efficient and fast algorithms to handle multicast traffic at the switch level, which are especially important for video/audio streaming.

Researcher and developer at IBM Haifa Research Labs (1999-2002)
Held a student position and then a staff member position at the *"System Applications"* and *"Industry Value Solutions"* departments. I worked on the research prototype of the *WebSphere Telecom Application Server*, *IBM Medical Content Management*, and *IBM Clinical Genomics*. These projects involve the design and implementation of large real-time, scalable and fault-tolerant systems that interface with other IBM and third-party products.

Supervising Graduate Students

- Josef Hai (Yossi) Kanizo (Technion), PhD, in progress. (Primary supervisor: Dr. Isaac Keslassy).

Awards and Honors

- The Legacy Heritage Fund ("Morasha") award of the Israel Science Foundation (2010)
- Best GLOBECOM paper award (2009)
  Optical Networks and Systems Symposium. One of the 14 best papers among 1204 accepted papers in 11 symposia.

- Runner-up for the best INFOCOM paper award (2009)

  One of the best 3 papers in the conference, out of 282 accepted papers and 1435 total submissions.

- Runner-up for the best WONS paper award (2009)
- Research fellowship for junior researchers (2008)

  This fellowship is given for two years by Politecnico di Torino, Regione Piemonte and the CRT foundation

- Intel prize for excellent Ph.D. Students (2006)
- Special prize for excellent Ph.D. Students (2006)
- The Wolf Foundation prize for excellent M.Sc. Students (2004)
- Technion award for outstanding teaching assistant (three times, 2002, 2003, 2006)
- Technion scholarship for excellent graduate students (2001)
- Technion scholarship for excellent undergraduate students in computer science (2001)
- President's list of distinguished students, Technion (five times, 1998-2001)
- Dean's list of distinguished Computer Science students (1999)

Professional Activities

- Co-organizer of the Israel Networking Seminar, 2011.
- Technical program committee member of INFOCOM 2011, HPSR 2011, WONS 2011, ICC 2011, Hot Interconnects 2011, FOMC 2011, INFOCOM 2010, WONS 2010, INFOCOM-WiP 2010, HPSR 2010, ICCCN 2010, and ICC 2011.
- Referee for *the Journal of the ACM*, *IEEE/ACM Transactions on Networking*, *SIAM Journal of Discrete Mathematics*, *IEEE Transactions on Parallel and Distributed Systems*, *IEEE Transactions on Mobile Computing*, *IEEE Transactions on Computers*, *Computer Networks*, *Computer Communications*, *Ad-Hoc Networks*, *Distributed Computing*, and *Acta Informatica*.
- Reviewer in the following conferences: INFOCOM (2009), SPAA (2008), ANCS (2009), PODC (2007, 2008), IPDPS (2004, 2006, 2010), ICDCS (2005, 2006, 2008), SC (2004), WEA (2006), DISC (2006), OPODIS (2006, 2009), ESA (2008), WCNC (2009), HPSR (2009), ISCC (2009), and EUNICE (2009).

Grants

As Principal Investigator

- The Legacy Heritage Fund ("Morasha") program of the Israel Science Foundation, 2010-212. 226,750 USD, "Protecting Networks from Large-Scale Physical Attacks and Disasters".

The program encourages the re-absorption in universities of Israeli researchers returning to Israel after a post-doc training abroad. The grant is intended for building a research laboratory (133,000 USD) and supporting research for the first 3 years (31,250 USD per year).

As Senior Personnel/Research Fellow

- European Research Council, 2010-2014, 990,600 EUR, "Deep Packet Inspection of Next Generation Network Devices".
  Research Fellow. PI: Dr. Anat Bremler-Barr.

- National Science Foundation, 2010-2012, 454,000 USD, "TC: Small: Collaborative Research: Protecting Networks from Large-Scale Physical Attacks and Disasters".
  Senior Personnel. PIs: Prof. Gil Zussman, Prof. Eytan Modiano, and Prof. Alon Efrat.

- Check Point Software Technologies Ltd., 2010-2011, 50,000 NIS. "Deep Packet Inspection (DPI) with a Small Memory Footprint: Software Approach to CompactDFA Implementation"
  Jointly (as a contributor) with Dr. Anat Bremler-Barr.

- COLOR 2009, 11,800 Euros. "CRAS QUIDEM: Communication, Routing And Scheduling under QUasI DEterministic Mobility"
  Joint grant of INRIA Sophia Antipolis Maestro team and the Telecommunication Networks Group of Politecnico di Torino.

List of Publications

Papers in Refereed Journals

[J1] Hagit Attiya and David Hay. "The Inherent Queuing Delay of Parallel Packet Switches." *IEEE Transaction of Parallel and Distributed Systems (TPDS)*, 17(9):1048-1056, September 2006.

[J2] Hagit Attiya and David Hay. "Randomization does not Reduce the Queuing Delay of Parallel Packet Switches." *SIAM Journal on Computing*, 37(5):1613-1636, February 2008.

[J3] David Hay and Gabriel Scalosub. "Jitter Regulation for Multiple Streams." *ACM Transactions on Algorithms (TALG)*, 6(1), 2009.

[J4] Hagit Attiya, David Hay and Isaac Keslassy. "Packet-Mode Emulation of Output-Queued Switches." *IEEE Transactions on Computers*, 59(10):1378-1391, October 2010.

[J5] Anat Bremler-Barr, David Hay, Danny Hendler and Ron M. Roth. "PEDS: Parallel Error Detection Scheme for TCAM Devices." *IEEE/ACM Transactions on Networking*. 18(5):1665-1675, October 2010.

[J6] Andrea Bianco, David Hay and Fabio Neri. "Crosstalk-preventing Scheduling in AWG-based Switches." Accepted for publication in *IEEE/ACM Transactions on Networking*.

Papers in Refereed Conferences

[C1] Pankaj Agarwal, Alon Efrat, Shashidhara Ganjugunte, David Hay, Swaminathan Sankararaman, and Gil Zussman. "The Resilience of WDM Networks to Probabilistic Geographical Failures". To appear in *the 30th IEEE International Conference on Computer Communications (INFOCOM)*, 2011.

[C2] Utku Acer, Paolo Giaccone, David Hay, Giovanni Neglia, and Saed Tarapiah: "Timely Data Delivery in a Realistic Bus Network". To appear in *the 30th IEEE International Conference on Computer Communications (INFOCOM) Mini-conference*, 2011.

[C3] Pankaj Agarwal, Alon Efrat, Shashidhara Ganjugunte, David Hay, Swaminathan Sankararaman, and Gil Zussman. "Network Vulnerability to Single, Multiple, and Probabilistic Physical Attacks". In *IEEE Military Communications Conference (MILCOM)*, pages 1947-1952, October 2010.

[C4] Yossi Kanizo, David Hay and Isaac Keslassy. "Hash Tables With Finite Buckets Are Less Resistant To Deletions." In *the 48th Annual Allerton Conference on Communication, Control, and Computing*, 2010.

[C5] Andrea Bianco, Luca Giraudo and David Hay. "Optimal Resource Allocation for Disaster Recovery." To appear in *IEEE Global Communications Conference (GLOBECOM)*, 2010.

[C6] Anat Bremler-Barr, David Hay and Yaron Koral. "CompactDFA: Generic State Machine Compression for Scalable Pattern Matching." In *the 29th IEEE International Conference on Computer Communications (INFOCOM)*, 2010.

[C7] Andrea Bianco, David Hay and Fabio Neri. "Crosstalk-preventing Scheduling in AWG-based Switches." In *IEEE Global Communications Conference (GLOBECOM)*, 2009. **Best Paper Award**. (This is the preliminary version of [J6].)

[C8] Anat Bremler-Barr, David Hay, Danny Hendler and Ron M. Roth. "PEDS: Parallel Error Detection Scheme for TCAM Devices." In *the 28th IEEE International Conference on Computer Communications (INFOCOM)*, pages 1296-1304, April 2009. **Best Paper Award Runner-up**. (This is the preliminary version of [J5].)

[C9] Yossi Kanizo, David Hay, Isaac Keslassy. "The Crosspoint-Queued Switch." In *the 28th IEEE International Conference on Computer Communications (INFOCOM)*, pages 729-737, April 2009.

[C10] Yossi Kanizo, David Hay, Isaac Keslassy. "Optimal Fast Hashing." In *the 28th IEEE International Conference on Computer Communications (INFOCOM)*, pages 2500-2508, April 2009.

[C11] Anat Bremler-Barr, David Hay, Danny Hendler and Boris Farber. "Layered Interval Codes for TCAM-based Classification." In *the 28th IEEE International Conference on Computer Communications (INFOCOM)*, pages 2500-2508, April 2009. Earlier (poster) version appeared in *ACM SIGMETRICS*, pages *445-446*, 2008.

[C12] David Hay and Paolo Giaccone. "Optimal Routing and Scheduling for Deterministic Delay Tolerant Networks." In *the 6th annual conference on wireless on demand network systems and services (IEEE WONS)*, pages *27-34*, February 2009. **Best Paper Award Runner-up**.

[C13] Hagit Attiya, David Hay and Isaac Keslassy. “Packet-Mode Emulation of Output-Queued Switches.” In *the 18th ACM Symposium on Parallelism in Algorithms and Architectures (SPAA)*, pages *138-147*, July 2006. (This is the preliminary version of [J4].)

[C14] Hagit Attiya, David Hay and Jennifer L. Welch. “Optimal Clock Synchronization under Energy Constraints in Wireless Ad-hoc Networks.” In *the 9th International Conference on Principles of Distributed Systems (OPODIS)*, pages *221-234*, December 2005.

[C15] David Hay and Gabriel Scalosub. “Jitter Regulation for Multiple Streams.” In *the 13th Annual European Symposium on Algorithms (ESA)*, pages *496-507*, October 2005. (This is the preliminary version of [J3].)

[C16] Hagit Attiya and David Hay. “Randomization does not Reduce the Queuing Delay of Parallel Packet Switches.” In *the 17th ACM Symposium on Parallelism in Algorithms and Architectures (SPAA)*, pages *11-20*, July 2005. (This is the preliminary version of [J2].)

[C17] Hagit Attiya and David Hay. “The Inherent Queuing Delay of Parallel Packet Switches.” In *the 3rd IFIP International Conference of Theoretical Computer Science (TCS)*, pages *139-152*, August 2004. A revue paper appeared in *the 16th ACM Symposium on Parallelism in Algorithms and Architectures (SPAA)*, June 2004. (This is the preliminary version of [J1].)

Papers under Submission

[I1] Yossi Kanizo, David Hay and Isaac Keslassy. “Maximum bipartite matching size and application to cuckoo hashing”. Submitted.

[I2] Gabriel Kliot, David Hay and Roy Friedman. “Jittering Broadcast Transmissions in MANETs: Quantification and Implementation Strategies.” Submitted.

[I3] Yossi Kanizo, David Hay and Isaac Keslassy. “Energy-Constrained Balancing.” Submitted.

Patents

[P1] Anat Bremler-Barr, David Hay, Danny Hendler and Ron M. Roth. “TCAM with Fast Error Detection”. U.S. Provisional Patent Application No. 61/130,129. May 2008.

[P2] David Hay, Danny Hendler and Roie Zivan. “A System and Method for Determining an Anonymous User-Centric Cross Community Reputation”. European Patent Application No. 09012254.0-2212. September 2009.

[P3] David Hay, Danny Hendler. “Accountable Anonymous Peer-to-Peer Interactions”. Under submission. 2008.