

Assistant Professor  
Computer Sciences Department  
University of Wisconsin-Madison  
1210 West Dayton Street  
Madison, Wisconsin 53706-1685  
608-262-7971  
*estan@cs.wisc.edu*

# Cristian Estan

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## Research interests

Computer networking with emphasis on network security and the algorithmic and architectural aspects of in-network processing required for controlling traffic.

## Education

<b>Ph.D.</b> , Computer Science and Engineering University of California, San Diego	October 2003
<b>M.Sc.</b> , Computer Science Technical University of Cluj-Napoca, Romania	June 1996
<b>Engineer</b> (5 year program), Computer Science Technical University of Cluj-Napoca, Romania	June 1995

## Awards and Honors

NSF CAREER award in 2006

Best paper award at ACSAC 2006

UCSD CSE Ph.D. dissertation award 2004

SIGCOMM 2002 paper forwarded to IEEE Transactions on Networking (5 out of 25 SIGCOMM papers selected)

Internet Measurement Conference 2003 paper forwarded to IEEE Transactions on Networking (4 out of 19 full IMC papers selected)

## Publications

### *Journal papers*

Cristian Estan, George Varghese, Michael Fisk, "Bitmap Algorithms for Counting Active Flows on High Speed Links", *IEEE/ACM Transactions on Networking*, October 2006

Cristian Estan, George Varghese, "New Directions in Traffic Measurement and Accounting: Focusing on the Elephants, Ignoring the Mice", *ACM Transactions on Computer Systems*, August 2003

### *Conference and workshop papers*

Daniel Luchaup, Randy Smith, Cristian Estan, Somesh Jha, "Multi-Byte Regular Expression Matching with Speculation", *International Symposium On Recent Advances In Intrusion Detection*, September 2009 (17 papers accepted)

Lorenzo De Carli, Yi Pan, Amit Kumar, Cristian Estan, Karthikeyan Sankaralingam, “PLUG: Flexible Lookup Modules for Rapid Deployment of New Protocols in High-speed Routers”, *SIGCOMM*, August 2009 (acceptance ratio 27/270=10%)

Neelam Goyal, Justin Ormont, Randy Smith, Karthikeyan Sankaralingam, Cristian Estan, “Signature Matching in Network Processing Using SIMD/GPU Architectures”, *International Symposium on Performance Analysis of Systems and Software*, April 2009 (acceptance ratio 24/86=28%)

Shijin Kong, Randy Smith, Cristian Estan “Efficient Signature Matching with Multiple Alphabet Compression Tables”, *SecureComm*, September 2008 (acceptance ratio 26/123=21%)

Randy Smith, Cristian Estan, Somesh Jha, “Deflating the Big Bang: fast and scalable deep packet inspection with variable-extended automata”, *SIGCOMM*, August 2008 (acceptance ratio 36/288=12.5%)

Randy Smith, Cristian Estan, Somesh Jha, “XFA: Faster signature matching with extended automata”, *IEEE Symposium on Security and Privacy (Oakland)*, May 2008 (acceptance ratio 28/249=11.2%)

Joseph Chabarek, Joel Sommers, Paul Barford, Cristian Estan, David Tsiang, Steve Wright , “Power Awareness in Network Design and Routing”, *Infocom*, April 2008 (acceptance ratio 236/1152=20.5%)

Randy Smith, Cristian Estan, Somesh Jha, “Backtracking Algorithmic Complexity Attacks Against a NIDS”, *Annual Computer Security Applications Conference*, **Best paper award**, December 2006 (acceptance ratio 40/134=29.9%)

Cristian Estan, Aditya Akella, Suman Banerjee, “Achieving Good End-to-End Service Using Bill-Pay”, *Fifth Workshop on Hot Topics in Networking (HotNets-V)*, November 2006 (acceptance ratio 23/114=20.2%)

Gary Pack, Jaeyoung Yoon, Eli Collins, Cristian Estan, “On Filtering of DDoS Attacks Based on Source Address Prefixes”, *Second International Conference on Security and Privacy in Communication Networks (SecureComm)*, August 2006 (acceptance ratio 32/126=25.4%)

Cristian Estan, Jeffrey F. Naughton, “End-biased Samples for Join Cardinality Estimation”, *International Conference on Data Engineering*, April 2006 (acceptance ratio 89/456=19.5%)

Cristian Estan, Garret Magin, “Interactive Traffic Analysis and Visualization with Wisconsin Netpy”, *USENIX Large Installation System Administration Conference*, December 2005 (acceptance ratio 24/53=45.3%)

Ramana Rao Kompella, Cristian Estan “The Power of Slicing in Internet Flow Measurement”, *Internet Measurement Conference*, October 2005 (acceptance ratio 24/148=16.2%)

Ken Keys, David Moore, Cristian Estan, “A Robust System for Accurate Real-Time Summaries of Internet Traffic”, *SIGMETRICS*, June 2005 (acceptance ratio 31/238=13.0%)

Sumeet Singh, Cristian Estan, George Varghese, Stefan Savage, "Automated worm fingerprinting", *OSDI, December 2004* (acceptance ratio 27/193=14.0%)

Cristian Estan, Ken Keys, David Moore and George Varghese, "Building a better NetFlow", *SIGCOMM, August 2004* (acceptance ratio 31/340=9.1%)

George Varghese and Cristian Estan, "The Measurement Manifesto", *HotNets-II Workshop on Hot Topics in Networks, November 2003* (acceptance ratio 23/119=19.3%), short paper

Cristian Estan, George Varghese, Mike Fisk, "Bitmap Algorithms for Counting Active Flows on High Speed Links", *Internet Measurement Conference, October 2003* (acceptance ratio 33/109=30.3%)

Cristian Estan, Stefan Savage and George Varghese, "Automatically Inferring Patterns of Resource Consumption in Network Traffic", *SIGCOMM, August 2003* (acceptance ratio 33/319=10.3%)

Cristian Estan and George Varghese, "Data Streaming in Computer Networking", *Workshop on Management and Processing of Data Streams, June 2003* (acceptance ratio 17/36=47.2%), short paper

Cristian Estan and George Varghese, "New Directions in Traffic Measurement and Accounting", *SIGCOMM, August 2002* (acceptance ratio 30/300=10%)

### ***Presentations and other notable work***

Cristian Estan, Suman Banerjee, Aditya Akella and Yi Pan, "From dumb pipes to rivers of money: a network payment system", *UW CS technical report 1635, May 2008*

Cristian Estan, "Data plane algorithms in routers: from prefix lookup to deep packet inspection", *presentation at the DIMACS Tutorial on Algorithms for Next Generation Networks, August 2007*

Cristian Estan, "AutoFocus: A Tool for Automatic Traffic Analysis", talk at the 29<sup>th</sup> meeting of the North American Network Operators' Group, October 2003

Cristian Estan, "Computer Network Design", *text used for laboratory sections at Technical University of Cluj-Napoca since 1997*

### **Extramural research funding**

December 2007: Gift from Cisco Systems through Cisco Collaborative Research Initiative, in support of work on "High performance signature matching" (shared with Somesh Jha) – \$97,000

July 2007 - June 2010: NSF grant 0716538 "CT-ISG: Alternate representation of NIDS/NIPS signatures for fast matching" (co-PI Somesh Jha) – \$350,000,

October 2006 - September 2008: NSF grant 0627102 "NeTS-FIND: Design for Manageability in the Next Generation Internet" (as co-PI, PI Paul Barford, co-PI Suman Banerjee) – \$650,000

October 2006: Gift from Cisco Systems through University Research Program, in support of work on "High performance intrusion prevention in software" – \$90,000

July 2006 - June 2011: *NSF grant 0546585 "CAREER: Extracting network usage information from traffic"* – \$430,000

## Patents

Cristian Estan, Karu Sankaralingam, “Lookup Engine with Programmable Memory Topology”, filed by Wisconsin Alumni Research Foundation in March 2009

Cristian Estan, Randy Smith, Somesh Jha, “Using Extended Finite Automata to Match Multiple Complex Signatures”, filed by Wisconsin Alumni Research Foundation in February 2008

George Varghese, Sumeet Singh, Stefan Savage and Cristian Estan, “Detecting Public Network Attacks Using Signatures and Fast Content Analysis”, filed by UCSD in April 2004

Xun Wilson Huang, Cristian Estan and S. Keshav, “Method and System to Provide Multiple Virtual Superusers in an Operating System”, U.S. patent 7,219,354

## Teaching

**Algorithmic Design for Fast Network Systems** last taught in Spring 2008

This is a new graduate-level class I started at University of Wisconsin-Madison focusing on the algorithmic problems of building fast routers, switches and servers. The class is mostly based on George Varghese’s book “Network Algorithmics: An Interdisciplinary Approach to Designing Fast Networked Devices” which is used as a textbook. The class also covers some recent research papers. This class is popular with graduate students who plan to work in industry and with those whose area is computer networking.

**Web Programming** last taught in Fall 2007

This is a new undergraduate class I designed at University of Wisconsin-Madison. This class offers a hands-on introduction to current technologies used for developing sophisticated web applications (HTML, C#, ASP.NET, SQL, JavaScript, XML, CSS, HTTP, and web services) and a deep understanding of some key concepts behind large, distributed client-server systems. With the only prerequisites being “introduction to programming” and “introduction to data structures”, this class is well-suited for students interested only in a CS minor, or for those who want a taste of the more applied side of computer science (databases, networking, systems) before committing to the major. Almost half of the students who took the class were sophomores, and many were not CS majors.

**Introduction to Computer Networks** last taught in Spring 2007

This is the traditional undergraduate networking class. I used as textbook “Computer Networks: A Systems Approach” by Peterson and Davie. The class is a comprehensive introduction to computer networking with programming assignments ranging from simple socket programming to group projects involving thousands of lines of code. The class is taken mostly by undergraduates in their senior year, but there are always some graduate students also.

**Advanced Computer Networks** last taught in Fall 2006

This is the traditional graduate-level networking class taken by graduate students interested in doing research in networking or related areas. The class involves reading the most important research papers in computer networking and a major project. The final reports of the projects often turn into submissions to academic conferences.

## Professional Experience

**Netsift, Inc**, San Diego, CA June 2004 – August 2004  
*Software developer*

As one of the first employees of this startup that built on my thesis work at UCSD, I participated in the design and implementation of a novel network security system that quickly detects unknown worms. The system works by analyzing packet contents at high speeds to detect behavior typically associated with worms. Netsift was acquired in June 2005 by Cisco Systems for \$30 million.

**Ensim Corporation**, Sunnyvale, CA July 1999 – August 2000  
*Software developer*

One of first 15 employees, worked on Ensim's first product which implemented virtual servers sharing one computer (with performance superior to VMware) by intercepting system calls. Co-invented a mechanism for isolating the root users of various virtual servers sharing a physical machine. Ported memory allocation functions; wrote scripts to ensure seamless interoperability with popular applications. Also worked on a second product implementing management and configuration for applications such as web, email and DNS for multiple users sharing a single server; designed most of the system and application configuration solutions; wrote backend scripts in perl.

**Internet Node – Technical U. of Cluj-Napoca, Romania** Dec. 1995 – June 1998  
*Technical director* April 1997 – June 1998

Ran a major hub (connecting tens of universities and high schools) of the Romanian Educational Network RoEduNet; kept network and services running, planned network growth, selected equipment to buy, etc.

*Network engineer* December 1995 – April 1997

Administered network equipment such as Cisco and Linux routers, VLAN-capable Ethernet switches, and modems; administered Linux, AIX and Solaris servers running web, email, DNS, ftp, etc.

## Professional Activities

Program Committee member for SIGCOMM 2010, 2008

Program Committee member for SecureComm 2009

Program Committee member for Internet Measurement Conference in 2008, 2006

Program Committee member for IEEE LANMAN 2008

Committee member for SIGCOMM student poster session 2007

Program Committee member for HotNets in 2006

Program Committee member for ICNP in 2006

Program Committee member for CoNext in 2006

Program Committee member VizSec in 2006

NSF panels 1 in 2008, 3 in 2006, 1 in 2005

Reviewer for IEEE Transactions on Networking 2009, 2008, 2007, 2006, 2005

Reviewer for INFOCOM 2009, 2002

Reviewer for ICDCS 2009

Reviewer for Passive and Active Measurement Conference PAM 2009, 2007  
Reviewer for ACM Computer Communications Review 2008  
Reviewer for IEEE Journal in Selected Areas in Communications in 2005  
Reviewer for SIGCOMM 2005  
Reviewer for NSDI 2005  
Reviewer for Internet Measurement Conference 2003  
Reviewer for Internet Measurement Workshop 2002  
Reviewer for IEEE Network  
Member of Association for Computing Machinery  
Member of the USENIX Association