# JAD NAOUS

32 Vassar St #32-G980
Cambridge, MA 02139
http://yuba.stanford.edu/~jnaous/
(650) 521-3425
jnaous@csail.mit.edu

**SUMMARY:** I started my graduate career at Stanford working with Prof. Nick McKeown on hardware development for NetFPGA, a platform for building networking hardware prototypes. I designed the modular pipeline currently in use that helped make it a successful research and teaching platform. Towards the middle of my graduate career I worked with Prof. David Mazières on a network security project called ICING where we used cryptography to implement a secure network protocol in hardware on NetFPGA. This work eventually transformed into the bulk of my PhD thesis. In my final two years at Stanford, I worked on a Web application to manage heterogeneous resources in an NSF-funded IaaS project distributed across multiple campuses. The software from that work was deployed on several campuses to manage their production networks and helped convince NSF to use OpenFlow as the IaaS's networking technology. During my postdoctoral appointment with Prof. Nickolai Zeldovich at MIT, I worked on systems to recover from attacks on Web applications and track and audit information leakage due to exploits.

## EDUCATION AND ACADEMIC POSITIONS:

03/11-*present* **Massachusetts Institute of Technology**, Cambridge, MA, USA
Postdoctoral Associate working on Web security and exploit recovery
Advisor: Nickolai Zeldovich

06/07-03/11 **Stanford University**, Stanford, CA, USA
PhD Electrical Eng concentration in Computer Networking Architecture and Security
Advisors: Nick McKeown, David Mazières
Thesis title: *Path-policy Compliant Networking and a Platform for Heterogeneous IaaS Management*

08/05-06/07 **Stanford University**, Stanford, CA, USA
MS Electrical Eng concentration in computer architecture and digital design

09/01-06/05 **McGill University,** Montreal, QC, Canada
B.Eng. Computer Engineering concentration in embedded systems, networks, and computer architecture

## PROJECTS AND EXPERIENCE:

09/09-03/11 **Student Lead on GENI (Global Environment for Network Innovation)**

- Virtualized network infrastructure for network experiments based on OpenFlow.
- Building the first modular clearinghouse to manage users and resources in a highly virtualized, dynamic, and heterogeneous infrastructure.
- Deployed at nine campuses to manage their network virtualization infrastructure.

09/08-03/11 **Student Lead on ICING Next Generation Internet Policy Framework (Incorporating Consent in the Next Generation Internet)**

- ICING is a network architecture for the next generation Internet that allows the conjunction of concerns of the various stakeholders in communications and enforces it in the data plane.
- Designed a data plane that can implement the control planes of many prior proposals.
- Implemented a prototype that runs at line-rate on NetFPGA
- Challenges in designing a data plane that binds control plane decisions to a packet's path and in securely proving and verifying a packet's provenance in the network.
- Challenges in designing protocols that use cryptography and are still amenable to a hardware implementation. Implemented several cryptographic functions in hardware: several SHA-3 candidates, several versions of AES-128, and several MAC functions.

09/08-12/10 **Software-Defined Forwarding (SDF)**

- SDF decouples the software from the hardware for routers and switches. The software makes its forwarding decisions independent of the hardware, and the SDF runtime caches them in hardware, so that new packets are forwarded entirely in hardware.
- Implemented a forwarder that can be used for SDF that can forward at 3.8Gbps and match the first 64 bytes of packets against a 32-entry TCAM on NetFPGA.

# JAD NAOUS

32 Vassar St #32-G980
Cambridge, MA 02139
http://yuba.stanford.edu/~jnaous/
(650) 521-3425
jnaous@csail.mit.edu

06/09-12/10 **Technical Consulting at X/Seed Capital**
- Advised the partners at X/Seed on a startup in datacenter networking
- Conducted an extensive survey on academic projects in security in the "Cloud"
- Participated in deal meetings

03/09-08/09 **Lead Student on ident++**
- ident++ is allows network security devices (e.g. firewalls), upon receiving new flows, to request more information from senders, receivers, and the networks between them to make better informed decisions and simplify network security policies.
- Designed protocol and policy language for ident++

06/08-09/08 **OpenFlow Implementation on NetFPGA**
- Implemented first line-rate OpenFlow switch with 32k exact match entries and 32 wildcard entries.

09/05-12/08 **NetFPGA Platform Development**
- Integrated the Xilinx Aurora Core high speed serial communication module into NetFPGA
- Built event capture system for a switch to monitor output queues with precise timestamps
- Designed the current NetFPGA 2.1 modular and extensible reference pipeline
- Built the reference 4-port NIC, switch, and IPv4 router implementations still used today
- Implemented the first version of the NetFPGA building and testing environment
- Wrote documentation for first-time users

06/07-09/07 **Graduate Internship at Agilent Technologies**
- Designed and built a NetFPGA spider that can be used around legacy switches and routers to enable IEEE-1588 synchronization across them (as transparent clocks), allowing synchronization with errors down to approximately 80ns.

07/06-12/06 **Graduate Internship at Sun Microsystems Labs**
- Worked on Sun Labs' Next Generation Switch project
- Implemented high speed testing and verification modules

09/06-12/06 **Xen Hypervisor Network Performance Research**
- Found bottlenecks in network performance in the Xen Hypervisor
- Designed and implemented an improved NIC and driver for NetFPGA to support virtualization

08/04-06/05 **Mantis Team Leadership (Walking Robot Project)**
- Negotiated with companies and obtained two major sponsorships
- Coordinated electrical and mechanical design teams

01/03-06/05 **Mantis Electrical Subsystem Design**
- Designed, manufactured, and programmed the lower two control levels

**PROGRAMMING LANGUAGES:**
- Software: C, Java, Bash scripting, C#, Perl, Python, Makefiles, PHP
- Hardware: VHDL, Verilog

**HONORS AND AWARDS:**
- CMC Electronics Inc. Scholarship for high academic achievement
- Dean's Honor List
- James McGill Award (Top 5% students)
- Alumni Prize for high academic achievement
- Ivey Foundation Scholarship for high academic achievement

# JAD NAOUS

32 Vassar St #32-G980
Cambridge, MA 02139
http://yuba.stanford.edu/~jnaous/
(650) 521-3425
jnaous@csail.mit.edu

**PUBLICATIONS:**

- "Verifying and enforcing network paths with ICING"
  Jad Naous, Michael Walfish, Antonio Nicolosi, David Mazières, Michael Miller, and Arun Seehra
  *CoNEXT 2011, Tokyo, Japan, December 2011*

- "Defining and Enforcing Transit Policies in a Future Internet"
  Jad Naous, Michael Walfish, David Mazières, Antonio Nicolosi, and Arun Seehra
  *Department of Computer Sciences, Technical Report TR-10-07, The University of Texas at Austin, February 2010.*

- "Network Security via Explicit Consent"
  Jad Naous, Michael Walfish, David Mazières, Antonio Nicolosi, and Arun Seehra
  *Department of Computer Sciences, Technical Report TR-09-12, The University of Texas at Austin, March 2009.*

- "A Policy Framework for the Future Internet"
  Arun Seehra, Jad Naous, Michael Walfish, David Mazières, Antonio Nicolosi, and Scott Shenker
  *ACM Workshop on Hot Topics in Networks (HotNets), New York, NY, October 2009.*

- "Enabling Delegation with More Information"
  Jad Naous, Ryan Stutsman, David Mazières, Nick McKeown, and Nickolai Zeldovich
  *SIGCOMM WREN Workshop, Barcelona, Spain, August 21, 2009.*

- "Spider Transparent Clock"
  John Eidson, Andrew Fernandez, Bruce Hamilton, Jad Naous, and Dieter Vook
  *ISPCS 2008, Ann Arbor, Michingan, September 22-26 2008.*

- "Implementing an OpenFlow Switch on the NetFPGA platform"
  Jad Naous, David Erickson, Adam Covington, Guido Appenzeller, and Nick McKeown
  *ANCS'08, San Jose, CA, USA, November 6-7, 2008.*

- "NetFPGA: Reusable Router Architecture for Experimental Research"
  Jad Naous, Glen Gibb, Sara Bolouki, and Nick McKeown
  *SIGCOMM PRESTO Workshop, Seattle, WA, August 2008.*

- "NetFPGA -- Open Platform for Teaching How to Build Gigabit-rate Network Switches and Routers"
  Glen Gibb, John W. Lockwood, Jad Naous, Paul Hartke, and Nick McKeown
  *IEEE Transactions on Education, 2008*

- "NetFPGA - An Open Platform for Gigabit-rate Network Switching and Routing"
  John W. Lockwood, Nick McKeown, Greg Watson, Glen Gibb, Paul Hartke, Jad Naous, Ramanan Raghuraman, and Jianying Luo
  *MSE 2007, San Diego, June 2007.*