

## Christopher A. Wood

### Permanent Address

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## RESEARCH INTERESTS

Content-centric networking architectures and protocols, computer and network security and privacy, cryptographic algorithms and engineering, software engineering, and heterogeneous computing.

## EDUCATION

*Doctor of Philosophy*, Computer Science  
University of California Irvine, Irvine, CA  
Advisor: Dr. Gene Tsudik  
GPA: 4.0/4.0

2013 - 2018 (expected)

*Master of Science*, Computer Science  
Rochester Institute of Technology, Rochester, NY  
Thesis: Large Substitution Boxes with Efficient Combinational Implementations  
Advisor: Dr. Stanisław Radziszowski  
GPA: 4.0/4.0

2012 - 2013

*Bachelor of Science*, Computer Science and Software Engineering  
Rochester Institute of Technology, Rochester, NY  
Concentrations: Computational Mathematics and Computer Engineering  
Minor: Mathematics  
GPA: 3.98/4.0 (Professional Field of Study GPA: 4.0/4.0)

2008 - 2012

## PUBLICATIONS

### Journal Articles

- J-1. P. Bajorski, A. Kaminsky, M. Kurdziel, M. Lukowiak, S. Radziszowski, and C. Wood, "Stochastic Analysis and Modeling of a Tree-Based Group Key Distribution Method in Tactical Wireless Networks," to appear in *Journal of Telecommunications System & Management, Engineering Journals, OMICS Publishing Group*.
- J-2. C. A. Wood and J. Jacob, "Characterization of Small Trees Based on their  $L(2,1)$ -Span," to appear in the *AKCE International Journal of Graphs and Combinatorics*.
- J-3. M. Lukowiak, S. Radziszowski, J. Vallino, C. Wood, "Cybersecurity Education: Bridging the Gap between Hardware and Software Domains," *ACM Transactions on Computing Education*, 14(1) (2014).

### Conference Proceedings

- C-1. C. Ghali, G. Tsudik, C. A. Wood, E. Yeh, "Practical Accounting in Content-Centric Networking," *NOMS 2016, IEEE/IFIP Network Operations and Management Symposium*, April 25 - 29, 2016, Istanbul, Turkey.
- C-2. G. Tusik, E. Uzun, and C. A. Wood, "AC3N: An API and Service for Anonymous Communication in Content-Centric Networking," in *Proceedings of CCNC 2016*, Las Vegas, NV, USA. January 2016.
- C-3. C. A. Wood, S. P. Radziszowski, and M. Lukowiak, "Constructing Large S-boxes with Area Minimized Implementations," in *Proceedings of MILCOM'2015*, Tampa, FL, USA. October 2015.

- C-4. M. Mosko and C. A. Wood, "Secure Fragmentation for Content-Centric Networking," *IEEE MASS 2015 Workshop on Content-Centric Networking (CCN 2015)*, Dallas, TX, USA. October 2015. (Best paper award winner)
- C-5. C. Ghali, M. A. Schlosberg, G. Tsudik, and C. A. Wood, "Interest-Based Access Control for Information Centric Networks," in *Proceedings of ICN 2015, the 2nd ACM Conference on Information Centric Networking*, San Francisco, CA, USA. September 2015.
- C-6. C. Ghali, A. Narayanan, D. Oran, G. Tsudik, and C. A. Wood, "Secure Fragmentation for Content-Centric Networks," *NCA 2015, the 14th IEEE International Symposium on Network Computing and Applications*, Cambridge, MA, USA. September 2015.
- C-7. J. Kurihara, C. A. Wood, and E. Uzun, "An Encryption-Based Access Control Framework for Content-Centric Networking," *IFIP Networking 2015*, Toulouse, France. May 2015.
- C-8. S. Skalicky, S. Lopez, M. Lukowiak, and C. A. Wood, "Mission Control: A Performance Metric and Analysis of Control Logic for Pipelined Architectures on FPGAs," to appear in *Proceedings of the 2014 International Conference on Reconfigurable Computing and FPGAs - ReConFig 2014*, Cancun, Mexico. December 2014.
- C-9. C. A. Wood and E. Uzun, "Flexible End-to-End Content Security in CCN," *IEEE Consumer Communications and Networking Conference (CCNC 2014) Special Session: Information Centric Networking*, Las Vegas, Nevada. January 2014.
- C-10. S. Skalicky, C. A. Wood, M. Lukowiak, and M. Ryan, "High Level Synthesis: Where Are We? A Case Study on Matrix Multiplication," in *Proceedings of the 2013 International Conference on Reconfigurable Computing and FPGAs - ReConFig 2013*, Cancun, Mexico. December 2013.
- C-11. M. Lukowiak, A. Meneely, S. Radziszowski, J. Vallino, and C. Wood, "Developing an Applied, Security-Oriented Computing Curriculum," in *Proceedings of the ASEE 2012*, San Antonio, Texas. June 2012.
- C-12. C. A. Wood, "Chaos-Based Symmetric Key Cryptosystems," in *Proceedings of the 2011 International Conference on Security & Management*, Las Vegas, Nevada. July 2011.
- C-13. C. A. Wood and R. K. Raj, "Keyloggers in Cybersecurity Education," in *Proceedings of the 2010 International Conference on Security & Management*, Las Vegas, Nevada. July 2010.

### Theses

- T-1. C. A. Wood, "Large Substitution Boxes with Efficient Combinational Implementations," M.S. Thesis, Computer Science, Rochester Institute of Technology, Rochester, NY. August 2013.

### Surveys

- S-1. C. A. Wood, "Small Folkman Numbers." *Draft available online: <http://christopher-wood.com/papers/FolkmanSurvey.pdf>.*

### Technical Reports

- TR-1. M. Mosko, I. Solis, E. Uzun, and C. A. Wood, "CCNx 1.0 Protocol Architecture," Technical report, August, 2015. Available online at <http://www.ccnx.org/pubs/CCNxProtocolArchitecture.pdf>.

## TALKS AND PRESENTATIONS

- P-1. "Efficient Security Bindings for Information Centric Networks," *CCNxCon 2015, Palo Alto Research Center, Palo Alto, CA*. May 20, 2015.
- P-2. "Handling Trust Enforcement," presentation, *CCNxCon 2015, Palo Alto Research Center, Palo Alto, CA*. May 20, 2015.
- P-3. "Digital Signatures and Implicit Certificates," guest lecture for Dr. Stanislaw Radziszowski's (CS@RIT), Crypto II course, May 5, 2015.

- P-4. "On the  $L(2, 1)$  Labeling of Trees," with Jobby Jacob (presenter), *Joint Mathematics Meetings*, Baltimore, MD. January 15-18, 2014.
- P-5. "Secure Content Dissemination in Content Centric Networking," *CCNxCon 2013, Palo Alto Research Center, Palo Alto, CA*. September 5, 2013.
- P-6. "Cryptographic S-boxes," guest lecture for Dr. Stanislaw Radziszowski's (CS@RIT) Crypto II course, April 8, 2013.
- P-7. "Characterization Results for the  $L(2,1)$ -Labeling Problem on Trees," *AMS Sectional Meeting, RIT, Rochester, NY*. September 22, 2012.
- P-8. "Chaos-Based Symmetric Key Cryptosystems," *RIT Graduate Research Symposium, RIT, Rochester, NY*. July 22, 2011.
- P-9. "Layered Driver Rootkit Detection on Microsoft Windows PCs," *RIT Undergraduate Research Symposium, RIT, Rochester, NY*. August 24, 2009.

## PATENTS

- F-1. I. Solis, G. Scott, C. Wood, "Content Negotiation in CCN," filed.
- F-2. G. Scott, C. Wood, "Transport Stack Name Scheme and Identity Management," filed.
- F-3. G. Scott, C. Wood, "Flexible Command and Control In CCN," filed.
- F-4. J. Kurihara, E. Uzun, C. Wood, "Access Control Framework for Content Centric Networking," filed.
- F-5. M. Mosko, E. Uzun, C. Wood, "Trust Enforcement Framework for Content Centric Networking," filed.
- F-6. M. Mosko, I. Solis, G. Scott, C. Wood, "Order Encoded Manifests," filed.
- F-7. P. Bajorski, A. Kaminsky, M. Kurdziel, M. Lukowiak, S. P. Radziszowski, and C. Wood, "Electronic Key Management Using PKI to Support Group Key Establishment in the Tactical Environment," U.S. Patent Number 8,873,759. October 28, 2014.

## PROFESSIONAL EXPERIENCE

<i>Palo Alto Research Center</i>	September 2014 - present
Computer Science Laboratory, Palo Alto, CA	Network Software Development Engineer
<ul style="list-style-type: none"> <li>- Develop the CCNx 1.0 software stack and APIs.</li> <li>- Implement internal code measurement tools for quantifiable software quality improvements.</li> <li>- Write IETF RFC drafts for various elements of the CCN protocol.</li> <li>- Contribute to CCN-related patent portfolio.</li> </ul>	

<i>Palo Alto Research Center</i>	June 2014 - September 2014
Computer Science Laboratory, Palo Alto, CA	Security and Privacy Research Intern
<ul style="list-style-type: none"> <li>- Designed flexible manifest-based access control framework for CCNx 1.0.</li> <li>- Designed and implemented network-layer trust enforcement mechanics in CCNx 1.0.</li> <li>- Implemented various encryption-based access control primitives, including Broadcast Encryption and Proxy Re-Encryption for CCNx 1.0.</li> </ul>	

<i>Cigital, Inc.</i>	March 2014 - July 2014
Dulles, MD	Security Consultant Contractor
<ul style="list-style-type: none"> <li>- Focused on security-oriented C/C++ source code review and application architectural analyses.</li> </ul>	

<i>Palo Alto Research Center</i>	July 2013 - September 2013
Computer Science Laboratory, Palo Alto, CA	Security and Privacy Research Intern
<ul style="list-style-type: none"> <li>- Researched security and privacy aspects related to content-centric network (CCN).</li> <li>- Implemented the Green-Ateniese (pairing-based) and Chow-Weng-Yang-Deng (Schnorr- and ElGamal-based) Proxy Re-Encryption schemes in Java for use in a CCNx application.</li> </ul>	

- Studied and tested various techniques for securing content that is distributed throughout a CCN mesh for confidentiality purposes.
- Experimented with techniques for improving name privacy in CCN.

#### *Intel Corporation*

June 2012 - August 2012

Virtual & Parallel Computing Group, Folsom, CA

Graphics Software Engineer Intern

- Developed production features for tool that processes hardware specifications to generate web content and source code for VHDL and C/C++ testbeds.
- Interacted with internal customers within the VPG to utilize debug tools and environments for architecture specification and post-silicon testing.

#### *L-3 Communications*

March 2011 - August 2011

Victor, NY

Software Engineer Intern

- Designed and implemented a library and supporting drivers for the  $\mu$ -blox NEO5/6 GPS receiver driven by an Analog Devices Blackfin processor.
- Extended an existing FAT file system driver to add support for SD devices.
- Improved functionality of a CPLD controller for an embedded power supply.

#### *Rochester Software Associates*

November 2010 - March 2011

Rochester, NY

Software Engineer Intern

- Led the design, development, and documentation efforts for a new printer job management application that would service any number of jobs from clients across the network.
- Tested and debugged an existing .NET implementation of an LPD client.

#### *C Speed, LLC*

May 2010 - August 2010

Liverpool, NY

Software Engineer Intern

- Designed and implemented an internal manufacturing part supply management system.
- Implemented embedded firmware features and test routines in C, C++, and assembly for Coldfire V2 processors.

## **ACADEMIC EXPERIENCE**

#### *Advanced Cryptography*

May 5, 2015

Guest Lecturer for Dr. Stanisław Radziszowski (CS)

(RIT)

- Lectured about digital signature algorithms, ElGamal and ECDSA batch verification techniques, standard public key infrastructures, and the OMC and ECQV implicit certificate schemes.

#### *Cryptography II*

April 8, 2013

Guest Lecturer for Dr. Stanisław Radziszowski (CS)

(RIT)

- Lectured about recent research on the security and (hardware) implementation efficiency of cryptographic S-boxes.

#### *Hardware and Software Design with Cryptographic Applications*

February 2011 - May 2013

Teaching Assistant and Lecturer for Dr. Marcin Lukowiak (CE)

(RIT)

- Developed and delivered lecture material on cryptography, embedded software optimization techniques, the Impulse C high-level synthesis tool, and AES cache timing attacks.
- Assisted students with weekly assignments and graded lab and project deliverables.

#### *Computer Science I, II, and IV*

January 2009 - May 2013

Student Lab Assistant and Grader

(RIT)

- Proctored problem solving sessions and ran lab meetings with lectures of weekly material.
- Graded weekly lab assignments and midterm examinations.

### *Personal Software Engineering*

December 2011 - March 2012

Teaching Assistant for Professor Tom Reichlmayr (SE)

(RIT)

- Assisted students with in-class programming assignments and course projects.
- Graded projects written in C/C++ and Ruby (with Ruby on Rails).

### *Engineering of Software Subsystems*

September 2011 - December 2011

Teaching Assistant for Dr. James Vallino (SE)

(RIT)

- Assisted students with in-class exercises and unit questions based on a subset of the design patterns taught during the course.
- Spent time with each student team to discuss course projects, including design decisions, application of design patterns, and alternatives considered.

## **TECHNICAL SKILLS**

- Programming Languages: C/C++, C#, Java, Python, Scala, Ruby, Assembly (MIPS), JavaScript, Objective-C, Standard ML, Scheme
- Modeling Languages and Tools: VHDL, Verilog, UML, SPIN (with PROMELA), Alloy
- Specialized Software: MATLAB, Mathematica, WEKA, Magma, Sage, LLVM
- Markup Languages:  $\text{\LaTeX}$ , HTML(5), CSS3
- Web Frameworks: NodeJS, Spring MVC, Ruby on Rails

## **MEMBERSHIPS**

IEEE, Student Member  
ACM, Student Member  
SIAM, Student Member  
IACR, Student Member  
Internet Society, Member  
Tau Beta Pi, Member

## **HONORS AND ACTIVITIES**

- NSF GRFP fellowship recipient, 2014
- RIT Honors Program, 2009 – 2013
- RIT Tau Beta Pi Engineering Honors Society, 2011 – 2013
- RIT Outstanding Undergraduate Student award, selected, Winter 2012
- RIT Computer Science MS Student Delegate, selected, Winter 2012
- Recipient of Golisano College Honors research assistantship stipend, Winter 2009/2010
- Recipient of Golisano College Honors research assistantship stipend, Spring 2011
- Recipient of RIT undergraduate research award stipend, Summer 2009
- RIT Golisano College Dean's List, 2008 – 2013
- Student mentor for the FIRST LEGO League team hosted by RIT, Fall 2009 – Winter 2010
- Rochester Foodlink volunteer, Winter 2012/2013 – March 2013
- Society of Software Engineers, member, Fall 2008 – Winter 2009/2010
- RIT Electronic Gaming Society, member, Fall 2008 – Spring 2010
- RIT Intramural Flag Football Team, member, Fall 2010

## **INTERESTS**

Guitar, running, cycling, swimming, languages, and the natural sciences.