

# THOMAS MOYER

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## EDUCATION

### **The Pennsylvania State University**

University Park, PA

PhD, Computer Science and Engineering, December 2011

Advisor: Dr. Patrick D. McDaniel

Dissertation Title: *Building Scalable Document Integrity Systems*

### **The Pennsylvania State University**

University Park, PA

MS, Computer Science and Engineering, 2009

Advisor: Dr. Patrick D. McDaniel

Thesis Title: *Scalable Web Content Attestations*

### **The Pennsylvania State University**

University Park, PA

B.S., Computer Engineering, 2006

## ACADEMIC APPOINTMENTS

**Assistant Professor**, August 2017-present

*University of North Carolina at Charlotte,*

*Department of Software and Information Systems*

Charlotte, NC

**Research Assistant**, Summer 2008 to Fall 2011

*The Pennsylvania State University, University Park, PA*

Advisor: Dr. Patrick D. McDaniel

Worked on problems in virtual machine security.

Utilized technologies for virtualization and trusted hardware to develop secure computing applications.

Worked on problems in Web security.

**Research Assistant**, Fall 2007 to Spring 2008

*The Pennsylvania State University, University Park, PA*

Advisor: Dr. Patrick D. McDaniel

Mentor: Dr. Subhabrata Sen

Worked on problems in configuration management.

Assisted in developing/testing tool for creating router configurations.

**Instructor**, Spring 2007

*The Pennsylvania State University, University Park, PA*

Department of Computer Science Engineering, Pennsylvania State University

Introduction to Algorithmic Processes (CMPSC 101)

Instructed students in program design and creation using the MS Visual Basic programming language.

## INDUSTRIAL APPOINTMENTS

**Research Scientist**, Fall 2011 to Summer 2017

*Cyber Systems and Technology Group, MIT Lincoln Laboratory, Lexington, MA*

Worked on secure system design and prototyping.

Developed prototype for protected, mobile, satellite communications terminal, including addressing information assurance requirements for multiple organizations.

Developed understanding of certification and accreditation processes used to certify information systems.

Participated in blue-team threat assessment for legacy computer systems.

Supported DoD ASD(R&E) Information Systems and Cyber Technologies office as subject matter expert in cyber security.

Developed secure data provenance architectures for large-scale enterprise systems.

#### **Summer Research Intern AT&T, Summer 2007**

*Internet and Networking Systems Research Center*, AT&T Labs Research, Florham Park, NJ

Mentor: Dr. Subhabrata Sen

Worked on problems in configuration management.

Assisted in developing internal tool for creating configurations.

#### **Systems Administrator, Spring 2004 to Summer 2007**

*Geodynamics Research Group*, The Pennsylvania State University, University Park, PA

Supervised by Dr. Kevin Furlong

Responsible for maintaining and upgrading systems and infrastructure.

Implemented an automated, platform independent, remote backup system.

Assisted with some minimal scientific programming for research.

## **PROFESSIONAL ACTIVITIES**

#### **Organizing Committee**

*2020*: IEEE Secure Development Conference (SecDev, Treasurer), IEEE Symposium on Security and Privacy (Oakland, Student PC Chair)

*2019*: IEEE Symposium on Security and Privacy (Oakland, Student PC Chair)

*2018*: IEEE Symposium on Security and Privacy (Oakland, Treasurer), Annual Computer Security Applications Conference (ACSAC, Poster and WiP Chair)

*2017*: IEEE Symposium on Security and Privacy (Oakland, Treasurer), Annual Computer Security Applications Conference (ACSAC, Poster and WiP Chair)

*2016*: Annual Computer Security Applications Conference (ACSAC, Poster and WiP Chair)

*2015*: Annual Computer Security Applications Conference (ACSAC, Poster and WiP Chair)

#### **Program Committee**

*2019*: International Conference on Science of Cyber Security (SciSec), Premier International Conference for Military Communications (MILCOM)

*2018*: Network and Distributed System Security Symposium (NDSS), USENIX Security (Security), International Workshop on Theory and Practice of Provenance (TaPP), International Conference on Science of Cyber Security (SciSec), IEEE Secure Development Conference (SecDev), Premier International Conference for Military Communications (MILCOM)

*2017*: International Conference on Availability, Reliability and Security (ARES), International Workshop on Theory and Practice of Provenance (TaPP), International Symposium on Stabilization, Safety, and Security of Distributed Systems (SSS), Premier International Conference for Military Communications (MILCOM), IEEE Secure Development Conference (SecDev)

*2016*: Annual Computer Security Applications Conference (ACSAC), International Conference on Availability, Reliability and Security (ARES), MILCOM

*2015*: Annual Computer Security Applications Conference (ACSAC), International Conference on Availability, Reliability and Security (ARES)

*2014*: Annual Computer Security Applications Conference (ACSAC), International Conference on Availability, Reliability and Security (ARES)

*2013*: Annual Computer Security Applications Conference (ACSAC), International Conference on Availability, Reliability and Security (ARES)

*2012*: Annual Computer Security Applications Conference (ACSAC), International Conference on Availability, Reliability and Security (ARES)

**Reviewer** (Years removed for brevity)

ACM Cloud Computing Security Workshop (CCSW)

ACM Computer and Communications Security Conference (CCS)

ACM Symposium on Access Control Models and Technologies (SACMAT)

ACM Transactions on Internet Technology (TOIT)

ACM Transactions on Privacy and Security (TOPS)

Annual Computer Security Applications Conference (ACSAC)

IEEE International Conference on Computer Communications (INFOCOM)

IEEE International Symposium on Hardware Oriented Security and Trust (HOST)

IEEE Security and Privacy Magazine(S&P)

IEEE Symposium on Security and Privacy (Oakland)

IEEE Transactions on Big Data (TBD)

IEEE Transactions on Dependable and Secure Computing (TDSC)

IEEE Transactions on Software Engineering (TSE)

International Conference on Information Security and Assurance (ISA)

International Conference on Information Systems Security (ICISS)

Packt Publishing Springer-Verlag Transactions on Computational Science (TCS)

USENIX Security Symposium (USENIX Security)

USENIX Workshop on Hot Topics in Security (HotSec)

Wiley Software Practice and Experience (SPE)

Workshop on Virtual Machine Security (VMSec)

### **Teaching**

ITIS 3110 – IT Infrastructure II: Design and Practice – Fall 2017, Spring 2018, Fall 2018, Spring 2019

ITIS 4010 – Topics in SIS: "Competitive Cyber Defense" – Spring 2018, Spring 2019

## **STUDENTS**

Current PhD Students

- Abdullah Al Farooq, expected Spring 2020

Current MS Students

- Jessica Marquard, expected Summer 2019
- Trevon Williams, expected Summer 2019

PhD Alumni

MS Alumni

- Anibal J. Robles Perez, Fall 2018, now PhD Student at UNC Charlotte

## **PUBLICATIONS**

### **Journal Publications**

1. Adam Bates, Dave (Jing) Tian, Grant Hernandez, Thomas Moyer, Kevin R. B. Butler, and Trent Jaeger. "Taming the Costs of Trustworthy Provenance through Policy Reduction". In: *Transactions on Internet Technology* (2017). To appear
2. Thomas Moyer, Kevin Butler, Joshua Schiffman, Patrick McDaniel, and Trent Jaeger. "Scalable Web Content Attestation". In: *IEEE Transactions on Computers* 61.5 (May 2012), pp. 686–699. DOI: 10.1109/tc.2011.60. URL: <http://dx.doi.org/10.1109/TC.2011.60>
3. Joshua Schiffman, Thomas Moyer, Trent Jaeger, and Patrick McDaniel. "Network-based Root of Trust for Installation". In: *IEEE Security & Privacy Magazine* (Jan. 2011)

4. Kevin Butler, Stephen McLaughlin, Thomas Moyer, and Patrick McDaniel. “New Security Architectures Based on Emerging Disk Functionality”. In: *IEEE Security & Privacy Magazine* (Sept. 2010)
5. William Enck, Thomas Moyer, Patrick McDaniel, Subhabrata Sen, Panagiotis Sebos, Sylke Spoerel, Albert Greenberg, Yu-Wei Eric Sung, Sanjay Rao, and William Aiello. “Configuration Management at Massive Scale: System Design and Experience”. In: *IEEE Journal on Selected Areas in Communications (JSAC)* (Apr. 2009)

## Conference Publications

6. Abdullah Al Farooq, Ehav Al-Shaer, Thomas Moyer, and Krishna Kant. “IoT<sup>2</sup>: A Formal Method Approach for Detecting Conflicts in Large Scale IoT Systems”. In: *2019 IFIP/IEEE Symposium on Integrated Network and Service Management (IM)*. 2019
7. Thomas Pasquier, Xueyuan Han, Thomas Moyer, Adam Bates, Olivier Hermant, David Eysers, Jean Bacon, and Margo Seltzer. “Runtime Analysis of Whole-System Provenance”. In: *Proceedings of the 2018 ACM SIGSAC Conference on Computer and Communications Security*. CCS ’18. Toronto, Canada: ACM, 2018, pp. 1601–1616. ISBN: 978-1-4503-5693-0. DOI: 10.1145/3243734.3243776. URL: <http://doi.acm.org/10.1145/3243734.3243776>
8. Wajih Ul Hassan, Adam Bates, and Thomas Moyer. “Towards Scalable Cluster Auditing through Grammatical Inference over Provenance Graphs”. In: *Network and Distributed System Security Symposium, NDSS 2018*. acceptance rate=21.0%. The Internet Society, 2018
9. Thomas Pasquier, Xueyuan Han, Mark Goldstein, Margo Seltzer, Thomas Moyer, David Eysers, and Jean Bacon. “Practical Whole-System Provenance Capture”. In: *Proceedings of the 8th ACM Symposium on Cloud Computing*. SOCC ’17. Sept. 2017
10. Adam Bates, Kevin Butler, Alin Dobra, Brad Reaves, Patrick Cable, Thomas Moyer, and Nabil Schear. “Transparent Web Service Auditing via Network Provenance Functions”. In: *Proceedings of the 26th International Conference on World Wide Web*. WWW ’17. acceptance rate=17.0%. Apr. 2017
11. Nabil Schear, Patric T. Cable II, Thomas Moyer, Bryan Richard, and Robert Rudd. “Bootstrapping and Maintaining Trust in the Cloud”. In: *Proceedings of the 32nd Annual Computer Security Applications Conference*. ACSAC 2016. acceptance rate=20.7%. Los Angeles, CA, USA: ACM, Dec. 2016, pp. 1–10. ISBN: 978-1-4503-3682-6. DOI: 10.1145/2818000.2818003. URL: <http://doi.acm.org/10.1145/2818000.2818003>
12. Thomas Moyer, Patric T. Cable, Karishma Chadha, Robert Cunningham, Nabil Schear, Warren Smith, Adam Bates, Kevin Butler, Frank Capobianco, and Trent Jaeger. “Leveraging Data Provenance to Enhance Cyber Resilience”. In: *1st IEEE Cybersecurity Development (SecDev)*. Nov. 2016
13. Thomas Moyer and Vijay Gadepally. “High-throughput Ingest of Data Provenance Records into Accumulo”. In: *2016 IEEE High Performance Extreme Computing Conference, HPEC*. Sept. 2016
14. Adam Bates, Dave Tian, Kevin R.B. Butler, and Thomas Moyer. “Trustworthy Whole-System Provenance for the Linux Kernel”. In: *24th USENIX Security Symposium (USENIX Security 15)*. Washington, D.C.: USENIX Association, Aug. 2015. URL: <https://www.usenix.org/conference/usenixsecurity15/technical-sessions/presentation/bates>
15. Thomas Moyer, Trent Jaeger, and Patrick McDaniel. “Scalable Integrity-Guaranteed AJAX”. in: *Proceedings of the 14th Asia-Pacific Web Conference (APWeb)*. Kunming, China, Apr. 2012
16. Boniface Hicks, Sandra Rueda, Dave King, Thomas Moyer, Joshua Schiffman, Yogesh Sreenivasan, Patrick McDaniel, and Trent Jaeger. “An Architecture for Enforcing End-to-End Access Control Over Web Applications”. In: *Proceedings of the 2010 Symposium on Access Control Models and Technologies, SACMAT ’10*. June 2010

17. Thomas Moyer, Kevin Butler, Joshua Schiffman, Patrick McDaniel, and Trent Jaeger. “Scalable Web Content Attestation”. In: *ACSAC '09: Proceedings of the 2009 Annual Computer Security Applications Conference*. acceptance rate=19.0%. Dec. 2009
18. Joshua Schiffman, Thomas Moyer, Christopher Shal, Trent Jaeger, and Patrick McDaniel. “Justifying Integrity Using a Virtual Machine Verifier”. In: *Proceedings of the 2009 Annual Computer Security Applications Conference, ACSAC '09*. acceptance rate=19.0%. Dec. 2009

## Workshop Publications

19. Warren Smith, Thomas Moyer, and Charles Munson. “Curator: Provenance Management for Modern Distributed Systems”. In: *10th USENIX Workshop on the Theory and Practice of Provenance (TaPP'18)*. London, UK: USENIX Association, July 2018
20. Mark Lemay, Wajih Ul Hassan, Thomas Moyer, Nabil Schear, and Warren Smith. “Automated Provenance Analytics: A Regular Grammar Based Approach with Applications in Security”. In: *9th USENIX Workshop on the Theory and Practice of Provenance (TaPP 2017)*. Seattle, WA: USENIX Association, 2017. URL: <https://www.usenix.org/conference/tapp17/workshop-program/presentation/lemay>
21. Adam Bates, Kevin R.B. Butler, and Thomas Moyer. “Take Only What You Need: Leveraging Mandatory Access Control Policy to Reduce Provenance Storage Costs”. In: *7th USENIX Workshop on the Theory and Practice of Provenance (TaPP 15)*. Edinburgh, Scotland: USENIX Association, July 2015. URL: <https://www.usenix.org/conference/tapp15/workshop-program/presentation/bates>
22. Joshua Schiffman, Thomas Moyer, Hayawardh Vijayakumar, Trent Jaeger, and Patrick McDaniel. “Seeding Clouds with Trust Anchors”. In: *CCSW '10: Proceedings of the 2010 ACM workshop on Cloud computing security*. ACM, Oct. 2010

## Technical Reports

23. Adam Bates, Kevin Butler, Alin Dobra, Brad Reaves, Patrick Cable, Thomas Moyer, and Nabil Schear. “Retrofitting Applications with Provenance-Based Security Monitoring”. <https://arxiv.org/abs/1609.00266>. Sept. 2016
24. Thomas Moyer and Patrick McDaniel. *Scalable Integrity-Guaranteed AJAX*. tech. rep. NAS-TR-0149-2011. Department of Computer Science and Engineering, Pennsylvania State University, University Park, PA, USA: Network and Security Research Center, Mar. 2011
25. Thomas Moyer. *USENIX Security Symposium Session Summaries*. ;login: The USENIX Magazine. Aug. 2010
26. Thomas Moyer. *USENIX Conference on Web Application Developement Session Summaries*. ;login: The USENIX Magazine. Oct. 2010
27. Joshua Schiffman, Thomas Moyer, Hayawardh Vijayakumar, Trent Jaeger, and Patrick McDaniel. *Seeding Clouds with Trust Anchors*. Tech. rep. NAS-TR-0127-2010. Department of Computer Science and Engineering, Pennsylvania State University, University Park, PA, USA: Network and Security Research Center, Apr. 2010
28. Kevin Butler, Stephen McLaughlin, Thomas Moyer, Joshua Schiffman, Patrick McDaniel, and Trent Jaeger. *Firma: Disk-Based Foundations for Trusted Operating Systems*. Tech. rep. NAS-TR-0114-2009. Department of Computer Science and Engineering, Pennsylvania State University, University Park, PA, USA: Network and Security Research Center, Apr. 2009
29. Joshua Schiffman, Thomas Moyer, Christopher Shal, Trent Jaeger, and Patrick McDaniel. *No Node Is an Island: Shamon Integrity Monitoring Approach*. Tech. rep. NAS-TR-0103-2009. Department of Computer Science and Engineering, Pennsylvania State University, University Park, PA, USA: Network and Security Research Center, Feb. 2009

30. Kevin Butler, Stephen McLaughlin, Thomas Moyer, Trent Jaeger, and Patrick McDaniel. *SwitchBlade: Policy-Driven Disk Segmentation*. Tech. rep. NAS-TR-0098-2008. Department of Computer Science and Engineering, Pennsylvania State University, University Park, PA, USA: Network and Security Research Center, Nov. 2008
31. Thomas Moyer, Kevin Butler, Joshua Schiffman, Patrick McDaniel, and Trent Jaeger. *Scalable Asynchronous Web Content Attestation*. Tech. rep. NAS-TR-0095-2008. Department of Computer Science and Engineering, Pennsylvania State University, University Park, PA, USA: Network and Security Research Center, Sept. 2008

## Invited Talks and Presentations

32. “Scalable Cluster Auditing for Resilient Systems”. University Park, PA, Sept. 2018
33. “Transparent Web Service Auditing via Network Provenance Functions”. Perth, AU, Apr. 2017
34. “Building Resilient Systems with Secure End-to-End Data Provenance”. Ithica, NY, Jan. 2017
35. “Building Resilient Systems with Secure End-to-End Data Provenance”. Worcester, MA, Jan. 2017
36. “Leveraging Data Provenance to Enhance Cyber Resilience”. Boston, MA, Nov. 2016
37. “Building Resilient Systems with Secure End-to-End Data Provenance”. Storrs, CT, Oct. 2016
38. “High-throughput Ingest of Data Provenance Records into Accumulo”. Waltham, MA, Sept. 2016
39. “Building Resilient Systems with Secure End-to-End Data Provenance”. Lexington, MA, June 2016
40. “Scalable Web Content Attestation”. Lexington, MA, Jan. 2011
41. “Building Document Integrity Systems”. University Park, PA, Aug. 2011
42. “Scalable Web Content Attestation”. Honolulu, HI, Dec. 2009
43. “Scalable Web Content Attestation”. University Park, PA, May 2009