

David M. Nicol

Director, Information Trust Institute
Herman M. Dieckamp Endowed Chair of Engineering
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Education

Ph.D	Computer Science	University of Virginia	1985
M.S.	Computer Science	University of Virginia	1983
B.A.	Mathematics (Phi Beta Kappa)	Carleton College	1979

Employment

<i>Director, Information Trust Institute</i> January 2011–present.	<i>University of Illinois at Urbana-Champaign</i>
<i>Director, Advanced Digital Sciences Centre (Singapore)</i> September 2017 –present.	<i>University of Illinois at Urbana-Champaign</i>
<i>Herman M. Dieckamp Endowed Chair of Engineering</i> August 2020–present.	<i>University of Illinois at Urbana-Champaign</i>
<i>Franklin W. Woeltge Professor of Electrical and Computer Engineering</i> September 2012–August 2020.	<i>University of Illinois at Urbana-Champaign</i>
<i>Professor of Electrical and Computer Engineering</i> September 2003–2012.	<i>University of Illinois at Urbana-Champaign</i>
<i>Professor of Computer Science</i> 1998–2003.	<i>Dartmouth College</i>
<i>Associate Professor of Computer Science</i> 1996–1998. Vice Chair : July 1999-June 2000.	<i>Dartmouth College</i>
<i>Associate Professor of Computer Science</i> 1992–1996. // Sabbatical—Fall 1993 through Spring 1994 : Institute for Computer Application Studies, and Carleton College.	<i>College of William and Mary</i>
<i>Assistant Professor of Computer Science</i> 1987–1992.	<i>College of William and Mary</i>
<i>Staff Scientist</i> 1985–1987.	<i>ICASE, NASA Langley Research Center</i>

Honors and Awards

Named Herman M. Dieckamp Endowed Chair of Engineering, 2020.

Best Paper Award, ACM SigSIM Conference Principles of Advanced Discrete Simulation, 2020

Named Franklin W. Woeltge Professor of Electrical and Computer Engineering, 2012.

Best Paper Award, Conference on Principles of Advanced and Distributed Simulation, 2012.

“Reconocimiento Especial”, Tecnológico De Monterrey, (honoring my text-book “Discrete-Event Systems Simulation”), 2010.

Best Paper Award, Malware 2010.

Best Paper Award, Conference on Principles of Advanced and Distributed Simulation, 2008.

ACM SIGSIM Distinguished Contributions Award, inaugural winner, 2007.

Fellow of the ACM, 2006.

Best Paper Award, Conference on Principles of Advanced and Distributed Simulation, 2005.

Best Paper Award, IPSI-2004 Studencia Conference, 2004.

IEEE Fellow, 2003.

Marion and Jason Whiting Fellowship for study at Oxford University, 2000.

Best Paper Award, 9th Annual Conference on Parallel and Distributed Simulation, 1995.

Alumni Fellowship Award, given by the William and Mary Society of the Alumni for excellence in teaching, 1992.

Great Performer’s Award (1980), Employee Excellence Award (1982) Control Data Corporation.

Advisory Activities

- Cyber External Advisory Board* *National Renewable Energy Laboratories*
Advise on future strategic directions with respect to cyber-security. 2020-present.
- Energy/Homeland Security Advisory Board* *Sandia National Laboratories*
Review Sandia programs in energy and homeland security, advise on future strategic directions. 2019-present.
- Executive Board* *Winter Simulation Conference*
Representing ACM, served on Board making all financial decisions concerning the annual Winter Simulation Conference (approx 600 attendees each year). 2009-2018.
- Steering Commmittee* *MASCOTS*
2012-2016
- Steering Commmittee* *Workshop on Principles of Advanced and Distributed Simulation.*
2005-2009, 2015-present.
- Advisory/Evaluation Board* *Pacific Northwest National Laboratory*
Served on external review team evaluating PNNL's program in Asymmetric Resilient Cybersecurity, 2012-2015.
- Evaluation Board* *Los Alamos National Laboratory*
Served on external review team evaluating LANL's program in Computational Physics and Applied Mathematics, 2010, 2103. Led subgroup on simulation technologies.
- Advisory Board* *Institut National de Recherche en Informatique et Automatique (INRIA)*
Assessed proposed multi-year research program on understanding and management of large scale instructure for distributed computing.
2008.
- Advisory Board* *Institut National de Recherche en Informatique et Automatique (INRIA)*
Led team of international experts in assessing 11 INRIA multi-year research programs in high performance computing on distributed Grid networks, 2008.
- Advisor* *Department of Homeland Security*
Assessment of DHS program in process modeling of coupled critical infrastructures, 2006.
- Evaluator* *NASA*
Assessment of a proposed NASA standard for simulation model development, experimental design, documentation, and reporting, 2006.
- Consultant* *Sandia National Laboratories*
Aid in design of distributed simulation language and toolset for internal Sandia use, study of distributed simulations of DoE complex enterprise systems, study of utility of fluid based communication models, design of wireless systems in critical infrastructure communications. 1996-2006.
- Consultant* *National Science Foundation*
Assess research proposals in the areas of high performance computing, performance evaluation, and computer/communication security. 1987-present.
- Consultant* *GRCI Corporation*
Assist system architect Emmet Beeker in GRCI contract proposal development for high performance analytic military simulations. 2000-2003.
- Developer* *Supercomputing 99, 00, 01, and 02 Conferences*
Developed, maintained and operated web sites for technical conference and tutorial submission, management, and evaluation. Provide technical assistance for authors, reviewers, and program committee. People I trained for the Supercomputing contract have turned this into a business.

Consultant *Universities Space Research Association*
Assisted USRA in preparation of \$5M/year proposal to NASA for development of a Research Center in Earth Sciences. 1999.

Executive Committee *Virginia/ICASE/Langley Program in High Performance Computing and Communication*
1995-1996.

Science Council *Center of Excellence in Space Data and Information Science, NASA Goddard Space Center*
Served on CESDIS technical oversight board, making program recommendations to NASA Goddard. Member 1995-1999. Served as chair, 1998-1999.

Consultant *ATT Research*
Worked with Albert Greenberg and Boris Lubachevsky on problems in parallel simulation of computer and communication networks. 1992-1996.

Consultant *IBM Research*
Worked with Phil Heidelberger on problems in parallel simulation of computer and communication networks. 1992-1996.

Consultant *Institute for Computer Applications in Science and Engineering*
Did basic research in control and modeling of high performance computations motivated by problems of interest to NASA, particularly reliability modeling. Developed and managed a visitors program for ICASE in performance and reliability analysis. 1987-1996.

Professional Activities

EDITORIAL ACTIVITIES

Editor-in-Chief, *IEEE Security and Privacy*, 2018-present

Associate Editor, *ACM Transactions on Modeling and Performance Evaluation of Computer Systems*, 2015-2017

Editor-in-Chief, *ACM Transactions on Computer Modeling and Simulation*, 1997-2003.

Area Editor, *ACM Transactions on Computer Modeling and Simulation*, 1996-1997.

Associate Editor, *ACM Transactions on Computer Modeling and Simulation*, 1990-1996.

Associate Editor, *ORSA Journal on Computing*, 1990-1997.

CONFERENCE ORGANIZATION

General Chair, Winter Simulation Conference 2006.

General Chair, Workshop on Principles of Advanced and Distributed Simulation, 2005.

Program Chair, 2001 MASCOTS conference.

Program Chair, 1996 ACM Sigmetrics Conference.

Tools Chair, 1995 Petri Net and Performance Modeling Conference.

Tutorial Chair, 1994 ACM Sigmetrics Conference.

Publicity/Exhibits Chair, 1992 ORSA Conference on the Interface of Operations Research and Computer Science.

General Chair, 1990 Workshop on Parallel and Distributed Simulation.

Program Chair, 1989 Workshop on Parallel and Distributed Simulation.

Program Committee, PADS (1992-2002), Winter Simulation Conference (1989, 1991), ACM Sigmetrics (1991-1993, 1998-1999, 2002), MASCOTS (2002), Communication Networks and Distributed Systems Modeling Conference (2002), International Performance, Computing and Communications Conference (2002). There are surely others. I've lost count.

PROFESSIONAL MEMBERSHIPS

IEEE, Fellow.

ACM, Fellow.

IFIPS Working Group 7.3 (for performance evaluation).

Research Interests

Analysis of computer and communication systems, particularly with respect to trust metrics and their evaluation; quantitative methods for security evaluation. Modeling and simulation methodologies.

Funding

PI and co-PI on \$158,173,609 of awarded support since 1988.

AWARDED

Electric Power Research Institute , \$75,000, 2019-2020	PI
<i>Datasets for the Assessment of Cyber Incident Detection Tools,</i>	
DARPA , \$18,800,000, 2016-2020	co-PI
<i>Cyber-Physical Experimentation Environment for RADICS,</i>	
Boeing Corporation , \$1,000,000, 2015-present	PI
<i>Trusted Software Center,</i>	
Department of Energy , \$24,500,000, 2015-2020,	PI
<i>Cyber Resilient Energy Delivery Consortium,</i>	
Department of Homeland Security , \$20,000,000, 2015-2020	PI
<i>Center of Excellence in Resilient Critical Infrastructures</i>	
Intel Corporation , \$63,345, 2014-2014,	PI
<i>Security Model for the Intel Chesser Open Analytics Platform</i>	
National Security Agency , \$7,904,494, 2014-present	PI
<i>Science of Security for Systems, co-PI : William Sanders, José Meseguer</i>	
National Science Foundation , \$50,000, 2014-2014	PI
<i>I-Corps: Innovation Corps Training for NPView Network Security Leadership</i>	
Department of Energy , \$1,100,000, 2013-2016	co-PI
<i>Software Defined Networking Project, PI: Rakesh Bobba</i>	
Department of Energy , \$930,000, 2013-2016	co-PI
<i>Secure Policy Based Configuration Framework, PI: Tim Yardley</i>	
Army Research Office , \$2,052,597, 2013-2014	PI
<i>Lablet for Science of Security, co-PI : William Sanders, José Meseguer</i>	
Office of Naval Research , \$603,742, 2013-2016	co-PI
<i>Integrating Security in Real Time Embedded Systems, PI: Sibam Mohan</i>	
National Science Foundation , \$5,071,180, 2013-2017	co-PI
<i>Illinois Cyber Security Scholars Program (ICSSP) Renewal, PI: Roy Campbell</i>	
Department of Homeland Security , \$750,000, 2012-2014	PI
<i>A Tool for Compliance and Depth of Defense Metrics</i>	
National Science Foundation , \$548,720, 2012-2016	co-PI
<i>Program in Digital Forensics, PI: Roy Campbell</i>	
Idaho National Laboratories , \$50,000, 2012-2013	PI
<i>Situational Awareness Integration for NetAPT Sophia via IF-MAP</i>	

<i>David M. Nicol (Funding)</i>	7
Korean Electronics and Telecommunications Research Institute , \$500,000, 2011-2013 <i>Security for the Smart Grid</i>	PI
National Security Agency , \$964,670, 2011-2012 <i>Tablet for Science of Security</i> , co-PI : William Sanders, José Meseguer	PI
Dept. of Naval Research , \$1,192,650, 2010-2012 <i>Center for Assured Critical Application and Infrastructure Security</i> co-PI : William Sanders	PI
Illinois Dept. of Commerce and Economic Opportunity , \$4,500,000, 2010-2015 <i>Illinois Center for a Smarter Electric Grid (ICSEG)</i> co-PIs : Thomas Overbye, William Sanders, Peter Sauer	co-PI
Rockwell-Collins , \$660,000, 2008-2011 <i>COTS Architecture for Multi-level Security</i> , co-PI : William Sanders	PI
Boeing , \$3,482,351 , 2011-2013 <i>Trusted Software Center</i>	PI
State of Illinois , \$4,500,000 co-PIs : Tom Overbye, William Sanders, Peter Sauer	co-PI <i>Illinois Center for a Smarter Electric Grid</i>
Honeywell , \$570,000, 2010-2014	PI <i>RBAC Driven Least Privilege Architecture for Control Systems</i>
Air Force , \$83,800, 2009-2010 <i>DURIP : Timing Traffic Analysis Testbed</i> , co-PI : William Sanders, Negar Kiyavash, Todd Coleman	co-PI
NSF , \$1,500,000, 2008-2013, <i>Illinois Cyber Security Scholars Program</i> , co-PI : Roy Campbell	co-PI
EPRI , \$50,000, 2008-2009 <i>Evaluation of Secure Authentication Supplement of the DNP3 Specification</i> , co-PI : William Sanders, Himanshu Khurana	co-PI
I3P/DHS , \$500,000, 2007-2009 <i>Global Policy for Survivable Process Control Networks</i> co-PI : William Sanders	PI
I3P/DHS , \$600,000, 2007-2009 <i>End-to-End Assessment of Identity Management Systems</i> co-PI : William Sanders, Carl Gunter	PI
NSF , \$500,000, 2008-2011 <i>CT-ISG: Traffic Analysis : Attacks, Defenses, and Fundamental Limits</i> , co-PIs : Nikita Borisov, Todd Coleman, Negar Kiyavash	co-PI
Dept. of Energy , \$250,000 2008-2009 <i>Trustworthy Communication Architecture for Converged SCADA Applications</i> , co-PIs : William Sanders, Himanshu Khurana	co-PI
NSF , \$412,000, 2006-2009 <i>Survivable Trust for Critical Infrastructure: Detecting and Preventing Attacks with Vulnerability Signatures</i> , co-PIs : William Sanders, Nikita Borisov	co-PI
NSF , \$7,500,000, 2005-2010 <i>Trustworthy Cyber Infrastructure for the Power Grid</i> , co-PIs : William Sanders, Ravi Iyer, Roy Campbell, Peter Sauer	co-PI

- I3P**, \$240,000, 2005-2007 co-PI
Unifying Stakeholders and Security Programs to Address SCADA Vulnerability and Infrastructure Interdependencies
 co-PI : William Sanders
- Boeing**, \$484,000, 2005-2009 co-PI
Algorithms for Quantifying Security and Survivability, co-PI : William Sanders
- NSF**, \$360,000, 2002-2005 co-PI
Survivable Trust for Critical Infrastructure
 co-PIs : Sean Smith, Chris Hawblitzel
- Mellon Foundation**, \$1,649,977, 2002-2003 co-PI
Transforming Academic Computing with Public Key Infrastructure
 PI : Sean Smith
 Co-PIs : Bob Brentrup, Larry Levine
- Department of Justice**, \$18,000,000, 2002-2003 PI
Institute for Security Technology Studies
Institute for Information Infrastructure Protection
- Department of Justice**, \$15,000,000, 2000-2001 co-PI
Institute for Security Technology Studies
 PI Susan Prager, Provost of Dartmouth College
 Co-PIs : Lewis Duncan, George Cybenko, Joseph Henderson
- Internet2 and ATT**, \$200,000, 2000-2002 co-PI
Internet2 PKILab
 Co-PIs : Sean Smith, Larry Levine
- DARPA**, \$1,700,000, 2000-2003 PI
Spatio-Temporal Dynamics of the Global Internet
- NSF**, \$1,400,000, 1998-2003 PI
Systems Science for Physical Geometric Algorithms
 NSF Research Infrastructure award
 Co-PIs : David Kotz, Dan Rockmore, Bruce Donald
- NSF**, \$224,000, 1998-2001 PI
A Fluid Methodology and Tool for Complex Large-Scale Networks
- DARPA**, \$3,310,931, 1996-1999 co-PI
Scalable Self-Organizing Simulations
 co-PI : Andrew Ogielski
- NSF**, \$1,500,000, 1995-1998 co-PI
Simulations Of Integrated Communications Systems
 co-PIs: Andrew Ogielski, Richard Fujimoto, Diane Souvaine
- NSF**, \$125,918 co-PI
Acquisition of a Parallel Graphics Computer for Inter-disciplinary Research
- NASA**, \$20,000, 1995-1996 PI
Reliability Interface Tool Extension
- CACC**, \$16,000, 1995-1996 PI
Integrated Modeling
- Center for Innovative Technology**, \$39,989, 1995 PI
Integrated Environment for performance, reliability, and availability modeling

<i>David M. Nicol (Funding)</i>	9
NASA , \$135,000, 1992-1995 <i>Parallel Algorithms for the Simulation and Analysis of Discrete Time Petri Nets</i>	PI
NSF , \$131,000, 1992-1995 <i>Static and Dynamic Load Balancing of Parallel Discrete-Event Simulations on Distributed Memory Architectures</i>	PI
NASA , \$57,500, 1989-1992 <i>Parallelization of Performance Tools</i>	PI
NASA , \$110,000, 1990-1993 <i>The Reliability Estimation System Testbed</i>	PI
NSF , \$104,000, 1989-1992 <i>Automated Methods for Run-Time Performance Optimization of Sparse and Irregular Numerical Applications</i>	PI
US Army , \$178,000, 1988-1991 <i>Reliable Real-Time Processing of Sensor Data in Embedded Avionics Computing Systems</i> Co-PIs : Steve Park, Phil Kearns	co-PI
NASA , \$105,000, 1990-1992 <i>Writing Software for 2010</i> co-PI: Keith Miller	co-PI
NASA , \$78,745, 1989-1990 <i>Parallelization of ERBE Data Processing</i>	PI
Center for Innovative Technology , \$39,000, 1989-1990 <i>Parallelization of Performability Design Tools</i>	PI
NASA , \$25,000, 1989-1990 <i>Hypercube Equipment Grant</i>	PI
DFL Ltd. , \$25,000, 1988-1989 <i>Mapping Issues in Parallel Simulations</i>	PI

Publications

PH.D. DISSERTATION

1. David M. Nicol
The Automated Partitioning of Simulations for Parallel Execution
Ph.D. thesis, University of Virginia, August 1985.

BOOKS

1. Jerry Banks, John Carson, Barry Nelson and David Nicol
Discrete-Event System Simulation.
Prentice-Hall, 3rd Edition (2000), 4th Edition (2005), 5th Edition (2009)

Journal Publications

- [1] T. Abdelzaher, J. Han, Y. Hao, A. Jing, D. Liu, S. Liu, H.H. Nguyen, D.M. Nicol, H. Shao, T. Wang, S. Yao, Y. Zhang, O. Malik, S. Dipple, J. Flamino, F. Buchanan, S. Cohen, G. Komiss, and B. Szymanski. Multiscale online media simulation with SocialCube.
- [2] D. M. Nicol. The value of useless academic research to the cyberdefense of critical infrastructures. *IEEE Security Privacy*, 18(1):4–7, 2020.
- [3] Kartik Palani and David M. Nicol. An anatomy of trust in public key infrastructure. *ACM SIGMETRICS Performance Evaluation Review*, 4(4):4–7, 2020.
- [4] Hellen Maziku, Sachin Shetty, and David M. Nicol. Security risk assessment for SDN-enabled smart grids. *Computer Communications*, 133:1 – 11, 2019.
- [5] Jereme Lamps, Vignesh Babu, David M. Nicol, Vladimir Adam, and Rakesh Kumar. Temporal integration of emulation and network simulators on Linux multiprocessors. *ACM Trans. Model. Comput. Simul.*, 28(1):1:1–1:25, January 2018.
- [6] T. Abdelzaher, N. Ayanian, T. Basar, S. Diggavi, J. Diesner, D. Ganesan, R. Govindan, S. Jha, T. Lepoint, B. Marlin, K. Nahrstedt, D. Nicol, R. Rajkumar, S. Russell, S. Seshia, F. Sha, P. Shenoy, M. Srivastava, G. Sukhatme, A. Swami, P. Tabuada, D. Towsley, N. Vaidya, and V. Veeravalli. Toward an Internet of battlefield things: A resilience perspective. *Computer*, 51(11):24–36, 2018.
- [7] Gurcan Comert, Jacquan Pollard, David M. Nicol, Kartik Palani, and Vignesh Babu. Modeling cyber attacks at intelligent traffic signals. *Transportation Research Record*, 2672(1):76–89, 2018.
- [8] Jingwei Huang and David M. Nicol. An anatomy of trust in public key infrastructure. *International Journal of Critical Infrastructure*, 13(2/3):238–258, 2017.
- [9] K.R. Davis, R. Bertier, S. Zonouz, G. Weaver, R.B. Bobba, E. Rogers, P. Sauer, and D.M. Nicol. Cyber-physical security assessment (CyPSA) for electric power systems. *The Bridge (IEEE-EKN)*, 112(2):8–19, May 2016.
- [10] Dong Jin and David M. Nicol. Parallel simulation and virtual-machine-based emulation of software-defined networks. *ACM Trans. Model. Comput. Simul.*, 26(1):8:1–8:27, December 2015.
- [11] Dong (Kevin) Jin, Yuhao Zheng, and David M. Nicol. A parallel network simulation and virtual time-based network emulation testbed. *J. Simulation*, 8(3):206–214, 2014.
- [12] Sean Peisert, Jonathan Margulies, David M. Nicol, Himanshu Khurana, and Chris Sawall. Designed-in security for cyber-physical systems. *IEEE Security & Privacy*, 12(5):9–12, 2014.

- [13] Nils Ole Tippenhauer, William G. Temple, An Hoa Vu, Binbin Chen, David M. Nicol, Zbigniew Kalbarczyk, and William H. Sanders. Automatic generation of security argument graphs. *CoRR*, abs/1405.7475, 2014.
- [14] Jingwei Huang and David M. Nicol. Trust mechanisms for cloud computing. *Journal of Cloud Computing*, 2(1):1–9, April 2013.
- [15] Y. Zheng, D.M. Nicol, D. Jin, and N. Tanaka. A virtual time system for virtualization-based network emulations and simulations. *Journal of Simulation*, 6(3):205–213, August 2012.
- [16] David M. Nicol. Hacking the lights out : The computer virus threat to the electrical grid. *Scientific American*, 305(1):70–75, July 2011.
- [17] J. Huang and D.M. Nicol. An approach to formal semantics based calculus of trust. *IEEE Internet Computing*, 14(5):38–46, Sept./Oct. 2010.
- [18] David M. Nicol, Matt Davis, and Tom Overbye. A testbed for power system security evaluation. *International Journal of Information and Computer Security*, 2009.
- [19] David M. Nicol and Nabil Schear. Models of privacy preserving traffic tunneling. *Simulation : Transactions of the Society for Modeling and Simulation International*, 85(9):589–607, 2009.
- [20] Hamed Okhravi and David M. Nicol. Application of trusted network technology to industrial control networks. *International Journal of Critical Infrastructure Protection*, 2009.
- [21] Hamed Okhravi and David M. Nicol. Evaluation of patch management strategies. *International Journal of Computational Intelligence : Theory and Practice*, 3(2):103–111, December 2008.
- [22] David M. Nicol, William H. Sanders, Sankalp Singh, and Mouna Seri. Useable global network access policy for process control systems. *IEEE Security & Privacy*, 6(6):30–36, Nov.-Dec. 2008.
- [23] David M. Nicol. Efficient simulation of Internet worms. *ACM Transactions on Modeling and Computer Simulation*, 18(2):5:1–5:32, 2008.
- [24] M. Liljenstam, D.M. Nicol, Y. Yuan, G. Yan, and J. Liu. Rinse: the real-time interactive network simulation environment for network security exercises. *Simulation : Transactions of the Society for Modeling and Simulation International*, 82(1):43–59, Jan. 2006.
- [25] D.M. Nicol G. Yan. High performance simulation of low-resolution network flows. *Simulation : Transactions of the Society for Modeling and Simulation International*, 82(1):21–42, Jan. 2006.
- [26] M. Zhao, S.W. Smith, and D. M. Nicol. The performance impact of BGP security. *IEEE Network*, pages 42–48, November/December 2005.
- [27] David M. Nicol. Modeling and simulation in security evaluation. *IEEE Security and Privacy*, pages 71–74, September/October 2005.
- [28] J. Liu, Y. Yuan, D. Nicol, R. Gray, C. Newport, D. Kotz, and L. Perrone. Empirical validation of wireless models in simulations of ad hoc routing protocols. *Simulation : Transactions of the Society for Modeling and Simulation International*, 81(4):307–323, 2005.
- [29] David M. Nicol, William H. Sanders, and Kishor S. Trivedi. Model-based evaluation: From dependability to security. *IEEE Trans. on Dependability and Security*, 1(1):48–65, 2004.
- [30] David M. Nicol, Sean Smith, and Meiyuan Zhao. Evaluation of efficient security for BGP route announcements using parallel simulation. *Simulation Practice and Theory*, 12(3-4):187–216, 2004.
- [31] David M. Nicol and Guanhua Yan. Discrete-event fluid modeling of TCP background traffic. *ACM TOMACS*, 14(3):211–250, 2004.
- [32] Weizhen Mao and David M. Nicol. On k-ary n-cubes : Theory and applications. *Discrete Applied Mathematics*, 129(1):171–193, 2003.

- [33] David M. Nicol. Utility analysis of network simulators. *International Journal of Simulation : Systems, Science, and Technology*, 2003.
- [34] David Nicol and Jason Liu. Composite synchronization for parallel discrete event simulation. *IEEE Transactions on Parallel and Distributed Systems*, 13(5):433–446, May 2002.
- [35] Heidi Ammerlahn, David Nicol, Michael Goldsby, and Michael Johnson. A geographically distributed enterprise system. *Future Generation Computer Systems*, 17(2):135–146, October 2000.
- [36] Gianfranco Ciardo, David Nicol, and Kishor Trivedi. Simulation of fluid stochastic Petri nets. *IEEE Transactions on Software Engineering*, 25(2):207–217, March/April 1999.
- [37] James Cowie, David Nicol, and Andy Ogielski. Modeling the global Internet. *IEEE Computing in Science and Engineering*, 1(1):42–50, Jan.-Feb. 1999.
- [38] Brian Premore and David Nicol. Transformation of ns TCP models to TED. *ACM Performance Evaluation Review*, 25(4):40–48, March 1998.
- [39] Graham Horton, David Nicol, V. Kulkarni, and Kishor Trivedi. Fluid stochastic Petri nets: Theory applications and solution techniques. *European Journal of Operational Research*, 105(1):184–201, February 1998.
- [40] Gianfranco Ciardo, David Nicol, and Josh Gluckman. Distributed state space generation of discrete-state stochastic models. *INFORMS Journal on Computing*, 10(1):82–93, January 1998.
- [41] Tom Cormen and David Nicol. Performing out-of-core FFTs on parallel disk systems. *Parallel Computing*, 24(1):5–20, January 1998.
- [42] Tom Cormen and David Nicol. Out-of-core FFTs with parallel disks. *ACM Performance Evaluation Review*, 25(3):3–12, December 1997.
- [43] Scott Leutenegger and David Nicol. Efficient bulk-loading of gridfiles. *IEEE Transactions on Knowledge and Data Engineering*, 9(3):410–420, May/June 1997.
- [44] Shahid Bokhari and David Nicol. Balancing contention and synchronization on the Intel Paragon. *IEEE Concurrency*, 5(2):74–84, April-June 1997.
- [45] David Nicol and Gianfranco Ciardo. Automated parallelization of discrete state-space generation. *Journal of Parallel and Distributed Computing*, 47:153–167, 47 1997.
- [46] Phillip Dickens, David Nicol, and Philip Heidelberger. Parallelized direct execution simulation of message passing programs. *IEEE Transactions on Parallel and Distributed Systems*, 7(10):1090–1105, October 1996.
- [47] Phillip Dickens, David Nicol, Paul Reynolds, and Mark Duva. Analytic comparison of bounded time warp and yawns. *ACM Transactions on Modeling and Computer Simulation*, 6(4):297–320, October 1996.
- [48] David Nicol and Philip Heidelberger. Parallel execution for serial simulators. *ACM Transactions on Modeling and Computer Simulation*, 6(3):210–242, July 1996.
- [49] David Nicol and Weizhen Mao. On bottleneck partitioning of k -ary n -cubes. *Parallel Processing Letters*, 6(6):389–399, June 1996.
- [50] David Nicol, Rahul Simha, and Don Towsley. Static assignment of complex tasks using stochastic majorization. *IEEE Transactions on Computers*, 45(6):730–741, June 1996.
- [51] David Nicol. Conference program management using the Internet. *IEEE Computer*, 29(3):112–113, March 1996.
- [52] Weizhen Mao and David Nicol. Isomorphic routing on torodial meshes. *ORSA Journal on Computing*, 8(1):63–73, Winter 1996.
- [53] David Nicol and Philip Heidelberger. A comparative study of parallel algorithms for simulating continuous time Markov chains. *ACM Transactions on Modeling and Computer Simulation*, 5(4):326–354, October 1995.

- [54] David Nicol. Automated parallel simulation of timed Petri-nets. *Journal of Parallel and Distributed Computing*, 29(1):60–74, August 1995.
- [55] David Nicol and Dan Palumbo. Reliability analysis of complex models using SURE bounds. *IEEE Transactions on Reliability*, 44(1):46–53, March 1995.
- [56] Gianfranco Ciardo, David Nicol, and Larry Leemis. On the minimum of a set of independent geometrically distributed random variables. *Statistics and Probability Letters*, 23:313–326, 1995.
- [57] David Nicol. Non-committal barrier synchronization. *Parallel Computing*, 21:529–549, 1995.
- [58] David Nicol, Dan Palumbo, and Michael Ulrey. Integrating reliability analysis with a performance tool. *Communications in Reliability Maintainability and Supportability*, 1995.
- [59] David Nicol and Richard Fujimoto. Parallel simulation today. *Annals of Operations Research*, 53:249–286, December 1994.
- [60] David Nicol. Rectilinear partitioning of irregular data parallel computations. *Journal of Parallel and Distributed Computing*, 23(2):119–134, November 1994.
- [61] David Nicol, Albert Greenberg, and Boris Lubachevsky. Massively parallel algorithms for trace-driven cache simulations. *IEEE Transactions on Parallel and Distributed Systems*, 5(8):849–859, August 1994.
- [62] Alok Choudhary, Bhagirath Harahari, David Nicol, and Rahul Simha. Assignment of processors for pipeline computations. *IEEE Transactions on Parallel and Distributed Systems*, 5(4):439–445, April 1994.
- [63] Bruno Gaujal, Albert Greenberg, and David Nicol. A sweep algorithm for massively parallel simulation of circuit-switched networks. *Journal of Parallel and Distributed Computing*, 18(4):484–500, August 1993.
- [64] Philip Heidelberger and David Nicol. Conservative parallel simulation of Markov chains using uniformization. *IEEE Transactions on Parallel and Distributed Systems*, 4(8):906–921, August 1993.
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- [260] D. Bergman and D. M. Nicol. *A Testbed for Evaluation of Power Grid Cyber-Infrastructure*. CRC Press, June 2012.
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Keynote Addresses and Invited Talks

KEYNOTE ADDRESSES

- 2020: *The Challenges of Repeatability and Fidelity of Cyber-Physical Digital Twins*, AsiaSim, Singapore, Sept. 2019
- 2019: *Challenges in Quantifying An Adversaries Cyber Access to Critical Infrastructure*, 14th Int'l Conference on Critical Information Infrastructures Security", Linköping, Sweden, Sept. 2019
- 2018: *Cyber-security and Information Sharing at ITI and CIRI*, Automotive ISAC Cyber-Security Summit, Detroit, MI September 2018
- 2018: *Challenges in Risk Assessment of Critical Infrastructures to Network Insecurity*, 2nd ACM SIGMETRICS International Workshop on Critical Infrastructure Network Security, Irvine CA, May 2018
- 2018: *The Role of Modeling and Simulation in the Study of IOT Security*, 1st International Workshop on Security and Privacy for the Internet of Things, April 2018, Orlando, FL
- 2017: *Assessing the Risk to Marine Systems of Interconnected Cyber Systems*, 2017 Marine Risk Symposium, Tuffin, Ohio, Nov. 2017
- 2016: *Risk Assessment of Cyber Access to Physical Infrastructure in Cyber-Physical Systems*, ACM International Workshop on Cyber-Physical System Security, Xi'an, China, May, 2016
- 2012: *Exploiting Uncertainty and Error to Accelerate Simulations*, SIMULTECH 2012, Rome, Italy
- 2012: *Questioning Temporal Fidelity in View of Uncertainty Quantification*, 2012 Conference on Principles of Advanced and Distributed Simulation.
- 2011: *Wrestling With Reality – Integrating New Security Solutions into Existing Control Systems*, 4th International Symposium on Resilient Control Systems, August 2011.
- 2011: *Towards Connectivity Metrics for Cyber-Security*, 2011 CACR Higher Education Cyber-Security Summit, April 2011.
- 2010: *Securing the Perimeter : Challenges in Enforcing Global Access Control*, 6th Annual Cyber Security and Information Intelligence Workshop, Oak Ridge National Labs, April 2010.
- 2009: *Melding Power Devices, Electrical Simulation, and Computer Simulation (A Testbed for Power System Security Evaluation)*, SIMUTools'09 (2nd International Conference on Simulation Tools and Techniques).
- 2005: *Models and Analysis of Active Worm Defense*, International Workshop on Mathematical Methods, Models and Architectures for Computer Networks Security, St. Petersburg, Russia.
- 2003: *Multiscale Modeling and Simulation of Worm Effects on the Internet Routing Infrastructure*, Performance Tools 2003 Conference, Urbana, IL.
- 2003: *Network Security Research using High Performance Simulation*, 7th Workshop on Distributed Supercomputing (SOS7), Durango, CO.
- 1999: *Simulation : The 3rd Leg of Science*, CESDIS Workshop on Simulation, NASA Goddard Research Center, Greenbelt, MD.
- 1997: *Parallel Simulation : So Who Cares?*, 1997 Conference on Parallel and Distributed Simulation. Lockenhaus, Austria.
- 1997: *Parallel Simulation : Past, Present, Future*, Annual Simulation Symposium, Atlanta, GA.

OTHER INVITED TALKS

- Cyber-security Metrics Supporting Risk Assessment of Critical Infrastructures, INFORMS Conference on Security, Monterey, CA, Feb. 2020
- Repeatability, Fidelity, Computational Complexity, and Uncertainty Quantification in Risk Assessment of Cyber Access to Critical Infrastructures, Sandia National Laboratories, June 2019

Academic Research and its Impact on Industry, American Fuel and Petrochemical Manufacturers Operations and Process Technology Summit, San Antonio, TX, Oct. 2019

2019: *A Trustworthy and Secure Cyber Plexus*, Nanyang Technical University, Singapore, Jan. 2019

2018: *Research Problems in Cyber Resiliency for Critical Infrastructures*, National Science and Technology Council's Critical Infrastructure Security and Resiliency Workshop, Feb. 2018

2018: *A CREATE Programme for a Trustworthy and Secure Cyber-Plexus*, ADSC-iTrust Workshop on Cyber-Security in Critical Infrastructures, January 2018

2016: *Risk Assessment of Cyber-Physical Systems*, Coast Guard Research and Development Center, December 2016.

2016: *"The Ransomware in the Power Grid—Threats and Responses*, Computational Cybersecurity in Compromised Environments (C3E), October 2016.

2016: *Cyber-security issues in Integrating Renewable Energy into the Grid*, ISEE Energy Conference, Sept. 2016

2016: *Addressing the Root Cause of Cyber Insecurity*, Modern Solutions Cyber-security Conference, Chicago May 2016

2009: *Challenges in Simulating Large Scale Networks* University of Richmond

2009: *Models of Privacy Preserving Cover Traffic*, University of Notre Dame