



## Professor Ravi Sandhu

University of Texas at San Antonio

*Executive Director and Founder, Institute for Cyber Security*

*Lutcher Brown Endowed Chair in Cyber Security*

*Professor of Computer Science (College of Science)*

*Professor of ECE (College of Engg.) and ISTM (College of Bus.), Courtesy Appointments*

## Contact

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## Degrees

Degree	Major	University	Year
Ph.D.	Computer Science	Rutgers University, New Jersey	1983
M.S.	Computer Science	Rutgers University, New Jersey	1980
M.Tech.	Computer Technology	Indian Institute of Technology, New Delhi	1976
B.Tech.	Electrical Engineering	Indian Institute of Technology, Bombay	1974

## Academic Career

- **Univ. of Texas at San Antonio**, 2007 onwards: Full Prof. and Endowed Chair (Cyber Security).
- **George Mason University**, 1995-2007: Full Prof., 1989-1995: Assoc. Prof. (Information Security).
- **Ohio State University**, 1983-1989: Assistant Professor, 1982-1983: Instructor (Computer Science).

## Career Focus and Goals

My career has focused on high impact research, practice and education in cyber security starting with my doctoral thesis. Effective cyber security requires science, engineering, business, policy and people skills. My goal is to instill this culture in the cyber-security discipline and provide leadership in all elements.

## Professional Recognition

- **Citations and Impact.** (Based on Google Scholar) 15,000+ citations. #1 paper in access control with 4300+. My h-index is 56 (56 papers with 56 or more citations).
- **AAAS Fellow, 2008.** “For distinguished contributions to cyber security, including seminal role-based access control and usage control models, and for ... leadership in research journals and conferences.”
- **ACM SIGSAC Outstanding Contribution Award, 2008.**
- **IEEE Computer Society Technical Achievement Award, 2004.** “For outstanding and pioneering contributions to information security including innovation of the RBAC model and usage control.”
- **IEEE Fellow 2002.** “For contributions to the field of information and system security.”
- **ACM Fellow 2001.** “For technical contributions to the field of info. and system security, notably access control models and systems, and professional leadership in research journals and conferences.”
- **George Mason University 2001.** Outstanding research award.
- **Best Paper Awards 1992 and 1998.** NIST/NSA National Computer Security Conference.

## Highly Cited Papers at Google Scholar Include Role-Based Access Control (RBAC)

- Role-Based Access Control Models, IEEE Comp., 29(2):38-47, 1996. 4300+ hits. #1 in access control.
- Proposed NIST Std. for RBAC. ACM TISSEC, 4(3):224-274, 2001. 1600+ hits.
- The NIST Model for Role-Based Access Control. 5<sup>th</sup> ACM RBAC:47-63, 2000. 500+ hits.
- The ARBAC97 Model for Role-Based Admin. of Roles. ACM TISSEC, 2(1):105-135, 1999. 400+ hits.
- Configuring RBAC to Enforce MAC and DAC. ACM TISSEC, 3(2):85-106, 2000. 400+ hits.
- Role-Based Authorization Constraints Specification. ACM TISSEC, 3(4):207-226, 2000. 300+ hits
- 12 other RBAC papers with 100+ hits.

## Usage Control

- The UCON<sub>ABC</sub> Usage Control Model, ACM TISSEC, 7(1):128-174, 2004. 300+ hits.

## Access Control Tutorials

- Access Control: Principles and Practice. IEEE Communications, 32(9): 40-48, 1994. 500+ hits.
- Lattice-Based Access Control Models. IEEE Computer, 26(11): 9-19, 1993. 500+ hits.

## Access Control Earlier Models

- Task-based Authorization Controls. 11<sup>th</sup> IFIP 11.3 Data and Application Sec.:262-275, 1997. 300+ hits.
- The Typed Access Matrix Model. 13<sup>th</sup> IEEE Security and Privacy (Oakland):122-136, 1992. 200+ hits.
- Toward a Multilevel Secure Relational Data Model, SIGMOD:50-59, 1991. 200+ hits.
- Transaction Control Expressions for Separation of Duties. 4<sup>th</sup> ACSAC:282-286, 1988. 150+ hits.
- Crypto. Implementation of a Tree Hierarchy for Access Control. IPL, 27(2):95-98, 1988. 150+ hits.
- The Schematic Protection Model, Journal of the ACM, 35(2):404-432, 1988. 100+ hits.

## Research Highlights

- **Statistics:** 200+ papers (with 70+ co-authors), 23 USA patents, 16 PhD graduates, 35+ research grants.
- **Sponsors:** include NSF, NSA, NRO, NRL, AFOSR, NIST, DARPA, ARDA, AFOSR, Sandia, State Dept., DOE, IRS, RADC, FAA, Intel, Northrop Grumman, Lockheed Martin, ITT, Verizon.
- **Ongoing research initiatives include:** Secure information sharing, Social networking security, Secure data provenance, Malware mitigation, Secure cloud computing, Trust models, RBAC, UCON.
- **Earlier research:** My research on RBAC has been instrumental in establishing it as the preferred form of access control, including its acceptance as an ANSI/NIST standard in 2004. My earlier research on numerous access control models remains influential and state-of-the-art. My newer models such as UCON and group-centric secure information sharing are gaining influence.

## Professional Leadership Includes

- Editor-in-Chief, IEEE Transactions on Dependable and Secure Computing (TDSC), 2010 onwards.
- Founding General Chair, ACM Conf. on Data and Applications Security and Privacy (CODASPY), 2011.
- Founding Editor-in-Chief, ACM Transactions on Information & Systems Security (TISSEC), 1997-2004.
- Chairman, ACM Special Interest Group on Security Audit and Control (SIGSAC), 1995-2003.
- Security Editor, IEEE Internet Computing, 1998-2004.
- Conference Founder: ACM CCS (1993), ACM SACMAT (1995), ACM CODASPY (2011).
- Conference Steering Committees: ACM CCS (1993-2003 Chair, 2003-2007 Member), ACM SACMAT (1995-2008 Chair), IEEE CSF (1992-2008 Member), ACM CODASPY (2010 onwards Chair).
- Conference Program Chair: IEEE CSF (1991, 1992), ACM CCS (1993, 1994, 2002), ACM SACMAT (1995), ACSAC (1996), IFIP WG 11.3 (1996), ACM CSAW (2007), ACM AsiaCCS (2011), ACM CODASPY (2012)
- Conference General Chair: IEEE: CSF (93, 94), ACM: CCS (96), SACMAT (01, 02), CODASPY (11).

## Entrepreneurial and Consulting Career

- TriCipher Inc., 2000-2010, Chief Scientist and Co-Founder (Acquired by VMware in 2010).
- Consultant to numerous organizations including: McAfee, Trusted Information Systems, National Institute of Standards and Technology, Verizon, SETA Corporation, Argonne National Laboratory, Singapore Management University, Northrop Grumman, Integris Health.

## Teaching Career

- I was the principal architect for the MS and PhD in Information Security and Assurance at George Mason University, where I personally developed and taught the core courses and multiple electives.
- I have presented short courses, tutorials and invited lectures all over the world including Asia, Australia, Europe, North America and South America.

## Personal

- US Citizen, 1991. Born in India. Schooled at Doon School, IITs and Rutgers. Married with two sons.

## Sponsored Research Grants

### Currently Active

1. Managing the Assured Information Sharing Life Cycle (AISL)  
Principal Investigator: Ravi Sandhu  
Sponsor: *Air Force Office of Scientific Research, MURI, 2008-2013*  
Partners: U. of Maryland-BC, U. of Michigan, U. of Illinois-UC, Purdue U., UT Dallas
2. IAPD: A Framework for Integrated Adaptive and Proactive Defenses against Stealthy Botnets  
Principal Investigators: Shouhuai Xu and Ravi Sandhu  
Sponsor: *Air Force Office of Scientific Research, 2009-2012*  
Partners: Georgia Tech
3. SNGuard: Securing Dynamic Online Social Networks  
Principal Investigator: Ravi Sandhu  
Sponsor: *National Science Foundation, 2008-2012*  
Partners: Penn. State Univ., Arizona State Univ., Univ. of North Carolina-Charlotte
4. Institute for Cyber Security Founding Grant  
Principal Investigator: Ravi Sandhu  
Sponsor: *State of Texas Emerging Technology Fund, 2007-2011*
5. STARS Grant for Establishing Institute for Cyber Security Laboratory  
Principal Investigator: Ravi Sandhu  
Sponsor: *University of Texas System, 2007-2011*

### Completed

6. A Systematic Defensive Framework for Combating Botnets  
Principal Investigator: Ravi Sandhu  
Sponsor: *Office of Naval Research, 2009-2010*  
Partners: Purdue U., UT Dallas, Texas A&M, U. of Wisconsin
7. Secure Knowledge Management: Models and Mechanisms  
Principal Investigator: Ravi Sandhu  
Sponsor: *National Science Foundation, 2005-2009*
8. Deploying Secure Distributed Systems using LaGrande Technology: Models, Architectures and Protocols  
Principal Investigator: Ravi Sandhu  
Sponsor: *Intel Research Council, 2004-2009*
9. Information Operations Across Infospheres  
Principal Investigator: Ravi Sandhu  
Sponsor: *Air Force Office of Scientific Research, 2006-2008*  
Partner: UT Dallas
10. Usage Control Models, Architectures and Mechanisms Based on Integrating Authorizations, Obligations and Conditions  
Principal Investigator: Ravi Sandhu  
Sponsor: *National Science Foundation, 2003-2006*
11. Next Generation Authentication and Access Control for the FAA

- Principal Investigator: Ravi Sandhu  
Sponsor: *Federal Aviation Administration, 2004-2005*
12. Flexible Policy Models and Architectures for Client and Server-assured Document Access Controls  
Principal Investigator: Roshan Thomas, McAfee Research, Network Associates  
Investigator: Ravi Sandhu  
Sponsor: *Advanced Research and Development Agency, 2003-2005*
  13. Scalable Authorization in Distributed Systems  
Principal Investigator: Ravi Sandhu  
Sponsor: *National Science Foundation, 1999-2002*
  14. Sonora: Secure Metadata Models and Architectures  
Principal Investigator: Ravi Sandhu  
Co-Investigator: Larry Kerschberg  
Sponsor: *Northrop Grumman, 2001-2002*
  15. Secure Objects  
Principal Investigator: Ravi Sandhu  
Co-Investigators: Larry Kerschberg and Edgar Sibley  
Sponsor: *National Reconnaissance Office and National Security Agency, 2000-2001*
  16. Security and Containment Policy for the Attack Sensing, Warning and Response Laboratory  
Principal Investigator: Ravi Sandhu  
Sponsor: *National Security Agency, 1999-2000*
  17. Secure Role-Based Workflow Systems  
Principal Investigator: Ravi Sandhu  
Sponsor: *Naval Research Laboratory, 1999*
  18. Control and Tracking of Information Dissemination  
Principal Investigator: Ravi Sandhu  
Sponsor: *Lockheed Martin, 1999*
  19. Distributed Role-Based Access Control Models and Architectures  
Principal Investigator: Ravi Sandhu  
Sponsor: *Sandia National Laboratories, 1999*
  20. Role-Based Access Control on the Web  
Principal Investigator: Ravi Sandhu  
Sponsor: *National Security Agency, 1998-99*
  21. Secure Remote Access  
Principal Investigator: Ravi Sandhu  
Sponsor: *National Security Agency, 1998*
  22. Agent-Based Systems  
Principal Investigators: Ravi Sandhu, Prasanta Bose, Elizabeth White  
Sponsor: *National Security Agency, 1998*
  23. Multi-Layered Countermeasures to Vulnerabilities in Networked Systems  
Principal Investigator: Ravi Sandhu  
Sponsor: *National Security Agency, 1996-97*
  24. Role-Based Access Control: Phase II  
Principal Investigator: Ed Coyne, SETA Corporation

Investigators: Ravi Sandhu, Charles Youman (SETA)  
Sponsor: *National Institute of Standards and Technology*, 1995-97

25. Task-based Authorizations: A New Paradigm for Access Control  
Principal Investigator: Roshan Thomas, Odyssey Research Associates  
Investigator: Ravi Sandhu  
Sponsor: *Defense Advanced Research Projects Agency*, 1995-97
26. A Pragmatic Approach to the Design and Analysis of Composite Secure Systems  
Principal Investigator: Ravi Sandhu  
Sponsor: *National Security Agency*, 1994-97
27. Design of Multilevel Secure Relational Databases  
Principal Investigator: Ravi Sandhu  
Sponsor: *National Security Agency*, 1994-96
28. Role-Based Access Control: Phase I  
Principal Investigator: Hal Feinstein, SETA Corporation  
Investigators: Ravi Sandhu, Ed Coyne (SETA), Charles Youman (SETA)  
Sponsor: *National Institute of Standards and Technology*, 1994
29. Architectures for Type-Based Distributed Access Control  
Principal Investigator: Ravi Sandhu  
Sponsor: *National Security Agency*, 1993-96
30. Privacy Models and Policies  
Principal Investigator: Andrew Sage, George Mason University  
Investigators: Ravi Sandhu, Sushil Jajodia and Paul Lehner  
Sponsor: *Internal Revenue Service*, Tax Systems Modernization Institute, 1995
31. Derivation, Modeling, and Analysis of Access Control Systems  
Principal Investigators: Ravi Sandhu and Paul Ammann  
Sponsor: *National Science Foundation*, 1992-95
32. Unified Security Models for Confidentiality and Integrity  
Principal Investigator: Ravi Sandhu  
Sponsor: *National Security Agency*, 1992-94
33. Foundations of Multilevel Secure Object-Oriented Databases  
Principal Investigator: Ravi Sandhu  
Sponsor: *National Security Agency*, 1992-94
34. Polyinstantiation in Multilevel Relations  
Principal Investigator: Sushil Jajodia  
Co-Principal Investigator: Ravi Sandhu  
Sponsor: *Rome Air Development Center*, Department of Defense, 1992
35. Models, Mechanisms and Methods for Integrity Policies  
Principal Investigator: Ravi Sandhu  
Sponsor: *National Security Agency*, 1989-92
36. Analysis of Updates of Multilevel Relations  
Principal Investigator: Sushil Jajodia  
Co-Principal Investigator: Ravi Sandhu  
Sponsor: *Rome Air Development Center*, Department of Defense, 1990-91

## PhD Advisees

1. Ram Krishnan, *Group-Centric Secure Information Sharing Models*, Fall 2009. (Co-advisor: Daniel Menasce.)
2. David A. Wheeler, *Fully Countering Trusting Trust through Diverse Double-Compiling*, Fall 2009. (Co-advisor: Daniel Menasce.)
3. Venkata Bhamidipati, *Architectures and Models for Administration of User-Role Assignment in Role Based Access Control*, Fall 2008. (Co-advisor: Daniel Menasce.)
4. Zhixiong Zhang, *Scalable Role and Organization Based Access Control and Its Administration*, GMU, Spring 2008. (Co-advisor: Daniel Menasce.)
5. Xinwen Zhang, *Formal Model and Analysis of Usage Control*, GMU, Summer 2006. (Co-advisor: Francesco Parisi-Presicce.)
6. Mohammad Abdullah Al-Kahtani, *A Family of Models for Rule-Based User-Role Assignment*, GMU, Spring 2004.
7. Jaehong Park, *Usage Control: A Unified Framework for Next Generation Access Control*, GMU, Summer 2003.
8. Ezedin Barka, *Framework for Role-Based Delegation Models*, GMU, Summer 2002.
9. Pete Epstein, *Engineering of Role/Permission Assignments*, GMU, Spring 2002.
10. Qamar Munawar, *Administrative Models for Role-Based Access Control*, GMU, Spring 2000.
11. Gail-Joon Ahn, *The RCL 2000 Language for Role-Based Authorization Constraints*, GMU, Fall 1999.
12. Joon Park, *Secure Attribute Services on the Web*, GMU, Summer 1999.
13. Phillip Hyland, *Concentric Supervision of Security Applications: An Assurance Methodology*, GMU, Spring 1999.
14. Tarik Himdi, *A Scalable Extended DGSA Scheme for Confidential Data Sharing in Multi-Domain Organizations*, GMU, Spring 1998.
15. Srinivas Ganta, *Expressive Power of Access Control Models Based on Propagation of Rights*, GMU, Summer 1996.
16. Roshan Thomas, *Supporting Secure and Efficient Write-Up in High-Assurance Multilevel Object-Based Computing*, GMU, Summer 1994.

## USA Patents

1. *Augmented Single Factor Split Key Asymmetric Cryptography-Key Generation and Distributor*. Ravi Ganesan, Ravi Sandhu, Andrew Cottrell and Kyle Austin. USA Patent 7,895,437. February 22, 2011.
2. *Flexible and Adjustable Authentication in Cyberspace*. Ravi Sandhu, Ravi Ganesan, Andrew Cottrell, Tim Renshaw, Brett Schoppert and Kyle Austin. USA Patent 7,886,346. February 8, 2011.
3. *Protecting One-Time-Passwords Against Man-in-the-Middle Attacks*. Ravi Ganesan, Ravi Sandhu, Andrew Cottrell, Brett Schoppert and Mihir Bellare. USA Patent 7,840,993. November 23, 2010.
4. *Secure Login Using Single Factor Split Key Asymmetric Cryptography and an Augmenting Factor*. Ravi Ganesan, Ravi Sandhu, Andrew Cottrell and Kyle Austin. USA Patent 7,734,912. June 8, 2010.
5. *Secure Login Using Augmented Single Factor Split Key Asymmetric Cryptography*. Ravi Ganesan, Ravi Sandhu, Andrew Cottrell and Kyle Austin. USA Patent 7,734,911. June 8, 2010.
6. *Multifactor Split Asymmetric Crypto-key with Persistent Key Security*. Ravi Sandhu, Brett Schoppert, Ravi Ganesan, Mihir Bellare and Colin deSa. USA Patent 7,734,045. June 8, 2010.
7. *Multiple Factor Private Portion of an Asymmetric Key*. Ravi Sandhu, Brett Schoppert, Ravi Ganesan, Mihir Bellare and Colin deSa. USA Patent 7,630,493. December 12, 2009.
8. *Asymmetric Key Pair Having a Kiosk Mode*. Ravi Sandhu, Brett Schoppert, Ravi Ganesan, Mihir Bellare and Colin deSa. USA Patent 7,599,493. October 6, 2009.
9. *Technique for Providing Multiple Levels of Security*. Ravi Sandhu, Brett Schoppert, Ravi Ganesan, Mihir Bellare and Colin deSa. USA Patent 7,596,697. September 29, 2009.
10. *Secure Login Using a Multifactor Split Asymmetric Crypto-Key with Persistent Key Security*. Ravi Sandhu, Brett Schoppert, Ravi Ganesan, Mihir Bellare and Colin deSa. USA Patent 7,571,471. August 4, 2009.
11. *Technique for Asymmetric Crypto-Key Generation*. Ravi Sandhu, Brett Schoppert, Ravi Ganesan, Mihir Bellare and Colin deSa. USA Patent 7,565,527. July 21, 2009.
12. *Laddered Authentication Security Using Split Key Asymmetric Cryptography*. Ravi Sandhu, Colin deSa and Karuna Ganesan. USA Patent 7,447,903. November 4, 2008. (Continuation of 7,069,435.)
13. *Authentication Protocol Using a Multi-Factor Asymmetric Key Pair*. Ravi Sandhu, Brett Schoppert, Ravi Ganesan, Mihir Bellare and Colin deSa. USA Patent 7,386,720. June 10, 2008.
14. *System and Apparatus for Storage and Transfer of Secure Data on Web*. Ravi Sandhu and Joon Park. USA Patent 7,293,098. November 6, 2007. (Continuation of 6,985,953.)
15. *Method and System for Authorizing Generation of Asymmetric Crypto-Keys*. Ravi Sandhu, Colin deSa and Karuna Ganesan. USA Patent 7,149,310. December 12, 2006.
16. *System and Method for Authentication in a Crypto-System Utilizing Symmetric and Asymmetric Crypto-Keys*. Ravi Sandhu, Colin deSa and Karuna Ganesan. USA Patent 7,069,435. June 27, 2006.
17. *System and Method for Generation and Use of Asymmetric Crypto-Keys Each Having a Public Portion and Multiple Private Portions*. Ravi Sandhu, Colin deSa and Karuna Ganesan. USA Patent 7,065,642. June 20, 2006.

18. *One Time Password Entry to Access Multiple Network Sites.* Ravi Sandhu, Colin deSa and Karuna Ganesan. USA Patent 7,055,032. May 30, 2006.
19. *Secure Communications Network With User Control of Authenticated Personal Information Provided to Network Entities.* Ravi Sandhu, Colin deSa and Karuna Ganesan. USA Patent 7,017,041. March 21, 2006.
20. *System and Apparatus for Storage and Transfer of Secure Data on Web.* Ravi Sandhu and Joon Park. USA Patent 6,985,953. January 10, 2006.
21. *A System and Method for Crypto-key Generation and Use in Cryptosystem.* Ravi Sandhu, Colin deSa and Karuna Ganesan. USA Patent 6,970,562. November 29, 2005.
22. *High Security Cryptosystem.* Ravi Sandhu, Colin deSa and Karuna Ganesan. USA Patent 6,940,980. September 6, 2005.
23. *A System and Method for Password Throttling.* Ravi Sandhu, Colin deSa and Karuna Ganesan. USA Patent 6,883,095. April 19, 2005.

## PUBLICATIONS

### Journal Publications

1. Moo Nam Ko, Gorrell Cheek, Mohamed Shehab and Ravi Sandhu, "Social-Networks Connect Services." *IEEE Computer*, Volume 43, Number 8, August 2010, pages 37-43. **Cover Article.**
2. Xinwen Zhang, Masayuki Nakae, Michael Covington and Ravi Sandhu, "Toward a Usage-Based Security Framework for Collaborative Computing Systems." *ACM Transactions on Information and System Security*, Volume 11, Number 1, Article 3, Feb. 2008, pages 1-36.
3. David Ferraiolo, Rick Kuhn and Ravi Sandhu, "RBAC Standard Rationale: Comments on "A Critique of the ANSI Standard on Role-Based Access Control"." *IEEE Security & Privacy*, Volume 5, Number 6, Nov.-Dec. 2007, pages 51-53.
4. Sejong Oh, Ravi Sandhu and Xinwen Zhang, "An Effective Role Administration Model Using Organization Structure." *ACM Transactions on Information and System Security*, Volume 9, Number 2, May 2006, pages 113-137.
5. Elisa Bertino, Latifur Khan, Ravi Sandhu and Bhavani Thuraisingham, "Secure Knowledge Management: Confidentiality, Trust, and Privacy." *IEEE Transactions on Systems, Man and Cybernetics, Part A: Systems and Humans*, Volume 36, Number 3, May 2006, pages 429-438.
6. Ravi Sandhu, Xinwen Zhang, Kumar Ranganathan and Michael J. Covington, "Client-side Access Control Enforcement Using Trusted Computing and PEI Models." *Journal of High Speed Networks*, Volume 15, Number 3, 2006, Pages 229-245 (Special issue on Managing security policies: Modeling, verification and configuration).
7. Xinwen Zhang, Francesco Parisi-Presicce, Ravi Sandhu and Jaehong Park, "Formal Model and Policy Specification of Usage Control." *ACM Transactions on Information and System Security*, Volume 8, Number 4, November 2005, pages 351-387.
8. Xinwen Zhang, Songqing Chen, and Ravi Sandhu, "Enhancing Data Authenticity and Integrity in P2P Systems." *IEEE Internet Computing*, Volume 9, Number 6, November-December 2005, pages 42-49.

9. Elisa Bertino and Ravi Sandhu. "Database Security-Concepts, Approaches, and Challenges." *IEEE Transactions on Dependable and Secure Computing*, Volume 2, Number 1, March 2005, pages 2-19.
10. Jaehong Park and Ravi Sandhu. "The UCON<sub>ABC</sub> Usage Control Model." *ACM Transactions on Information and System Security*, Volume 7, Number 1, February 2004, pages 128-174.
11. Ravi Sandhu, "Good-Enough Security: Toward a Pragmatic Business-Driven Discipline ." *IEEE Internet Computing*, Volume 7, Number 1, January-February 2003, pages 66-68.
12. David F. Ferraiolo, Ravi Sandhu, Serban Gavrila, D. Richard Kuhn and Ramaswamy Chandramouli. "Proposed NIST Standard for Role-Based Access Control." *ACM Transactions on Information and System Security*, Volume 4, Number 3, August 2001, pages 224-274.
13. Joon Park, Ravi Sandhu and Gail-Joon Ahn. "Role-Based Access Control on the Web." *ACM Transactions on Information and System Security*, Volume 4, Number 1, February 2001, pages 37-71.
14. Gail-Joon Ahn and Ravi Sandhu. "Decentralized User Group Assignment in Windows NT." *Journal of Systems and Software*, Volume 56, Issue 1, February 2001, pages 39-49.
15. Gail-Joon Ahn and Ravi Sandhu. "Role-Based Authorization Constraints Specification." *ACM Transactions on Information and System Security*, Volume 3, Number 4, November 2000, pages 207-226.
16. Joon Park and Ravi Sandhu, "Secure Cookies on the Web." *IEEE Internet Computing*, Volume 4, Number 4, July 2000, pages 36-45.
17. Sylvia Osborn, Ravi Sandhu and Qamar Munawer. "Configuring Role-Based Access Control to Enforce Mandatory and Discretionary Access Control Policies." *ACM Transactions on Information and System Security*, Volume 3, Number 2, May 2000, pages 85-106.
18. Ravi Sandhu, Venkata Bhamidipati and Qamar Munawer. "The ARBAC97 Model for Role-Based Administration of Roles." *ACM Transactions on Information and System Security*, Volume 2, Number 1, February 1999, pages 105-135.
19. Ravi Sandhu and Venkata Bhamidipati, "Role-Based Administration of User-Role Assignment: The URA97 Model and its Oracle Implementation." *Journal of Computer Security*, Volume 7, 1999, pages 317-342.
20. Gail-Joon Ahn and Ravi Sandhu, "Towards Role-Based Administration in Network Information Services." *Journal of Network and Computer Applications*, Volume 22, Number 3, July 1999, pages 199-213.
21. Ravi Sandhu and Fang Chen. "The Multilevel Relational Data Model." *ACM Transactions on Information and System Security*, Volume 1, Number 1, November 1998, pages 93-132.
22. Ravi Sandhu, Edward Coyne, Hal Feinstein and Charles Youman, "Role-Based Access Control Models." *IEEE Computer*, Volume 29, Number 2, February 1996, pages 38-47.
23. Ravi Sandhu and Pierangela Samarati, "Authentication, Access Control and Audit." *ACM Computing Surveys*, 50th anniversary commemorative issue, Volume 28, Number 1, March 1996, pages 241-243.
24. Roshan Thomas and Ravi Sandhu, "A Secure Trusted Subject Architecture for Multilevel Object-Oriented Databases." *IEEE Transactions on Knowledge and Data Engineering*, Volume 8, Number 1, February 1996, pages 16-31.
25. Ravi Sandhu and Pierangela Samarati, "Access Control: Principles and Practice." *IEEE Communications*, Volume 32, Number 9, September 1994, pages 40-48.

26. Ravi Sandhu, "Lattice-Based Access Control Models." *IEEE Computer*, Volume 26, Number 11, November 1993, pages 9-19. **Cover Article.**
27. Roshan Thomas and Ravi Sandhu, "A Kernelized Architecture for Multilevel Secure Object-Oriented Databases Supporting Write-Up." *Journal of Computer Security*, Volume 2, Number 3, 1993, pages 231-275.
28. Ravi Sandhu and Gurpreet Suri, "A Distributed Capability-Based Architecture for the Transform Model." *Computers & Security*, Volume 12, Number 3, May 1993, pages 285-303.
29. Paul Ammann and Ravi Sandhu, "The Extended Schematic Protection Model." *Journal of Computer Security*, Volume 1, Number 4, 1992, pages 335-383.
30. Ravi Sandhu, "Lattice-Based Enforcement of Chinese Walls." *Computers & Security*, Volume 11, Number 8, December 1992, pages 753-763.
31. Ravi Sandhu and Sushil Jajodia, "Eliminating Polyinstantiation Securely." *Computers & Security*, Volume 11, Number 6, October 1992, pages 547-562.
32. Ravi Sandhu, "Undecidability of Safety for the Schematic Protection Model with Cyclic Creates." *Journal of Computer and System Sciences*, Volume 44, Number 1, February 1992, pages 141-159.
33. Ravi Sandhu, "Expressive Power of the Schematic Protection Model." *Journal of Computer Security*, Volume 1, Number 1, 1992, pages 59-98.
34. Ravi Sandhu and Sushil Jajodia, "Integrity Principles and Mechanisms in Database Management Systems." *Computers & Security*, Volume 10, Number 5, August 1991, pages 413-427.
35. Ravi Sandhu, "Recognizing Immediacy in an NTree and its Application to Protection Groups." *IEEE Transactions on Software Engineering*, Volume 15, Number 12, December 1989, pages 1518-1525.
36. Ravi Sandhu, "The Demand Operation in the Schematic Protection Model." *Information Processing Letters*, Volume 32, Number 4, September 1989, pages 213-219.
37. Ravi Sandhu, "The Reflected Tree Hierarchy for Protection and Sharing." *Information Processing Letters*, Volume 30, Number 1, January 1989, pages 21-26.
38. Ravi Sandhu, "Nested Categories for Access Control." *Computers & Security*, Volume 7, Number 6, December 1988, pages 599-605.
39. Ravi Sandhu, "The NTree: A Two Dimension Partial Order for Protection Groups." *ACM Transactions on Computer Systems*, Volume 6, Number 2, May 1988, pages 197-222.
40. Ravi Sandhu, "The Schematic Protection Model: Its Definition and Analysis for Acyclic Attenuating Schemes." *Journal of the ACM*, Volume 35, Number 2, April 1988, pages 404-432.
41. Ravi Sandhu, "Cryptographic Implementation of a Tree Hierarchy for Access Control." *Information Processing Letters*, Volume 27, Number 2, February 1988, pages 95-98.

## Publications in Collections

42. Zhixiong Zhang, Xinwen Zhang, and Ravi Sandhu, "Towards a Scalable Role and Organization Based Access Control Model with Decentralized Security Administration." *Handbook of Research on Social*

*and Organizational Liabilities in Information Security*, edited by M. Gupta and R. Sharman, IGI Global, pages 94-117, 2009.

43. Munir Majdalawieh, Francesco Parisi-Presicce and Ravi Sandhu, "RBAC Model for SCADA." *Innovative Algorithms and Techniques in Automation, Industrial Electronics and Telecommunications*, Springer, pages 329-335, 2007.
44. Ravi Sandhu, "Role-Based Access Control." *Advances in Computers*, Volume 46, (M. Zelkowitz editor), Academic Press, pages 237-286, 1998.
45. Ravi Sandhu and Pierangela Samarati, "Authentication, Access Control and Intrusion Detection." In *The Computer Science and Engineering Handbook*, CRC Press, 1997, pages 1929-1948.
46. Ravi Sandhu and Sushil Jajodia, "Integrity Mechanisms in Database Management Systems." In *Information Security: An Integrated Collection of Essays, Volume 1*, (Abrams, M.A., Podell, H.J. and Jajodia, S., editors), IEEE Computer Society Press, 1994, pages 617-634.
47. Sushil Jajodia and Ravi Sandhu, "Toward A Multilevel Secure Relational Data Model." In *Information Security: An Integrated Collection of Essays, Volume 1*, (Abrams, M.A., Podell, H.J. and Jajodia, S., editors), IEEE Computer Society Press, 1994, pages 460-492.
48. Sushil Jajodia, Ravi Sandhu and Barbara Blaustein, "Solutions to the Polyinstantiation Problem." In *Information Security: An Integrated Collection of Essays, Volume 1*, (Abrams, M.A., Podell, H.J. and Jajodia, S., editors), IEEE Computer Society Press, 1994, pages 493-529.
49. Sushil Jajodia, Boris Kogan and Ravi Sandhu, "A Multilevel-Secure Object-Oriented Data Model." In *Information Security: An Integrated Collection of Essays, Volume 1*, (Abrams, M.A., Podell, H.J. and Jajodia, S., editors), IEEE Computer Society Press, 1994, pages 596-616.
50. Ravi Sandhu, "Relational Database Access Controls Using SQL." In *Handbook of Information Security Management (1994-95 Yearbook)*, (Ruthberg, Z.A. and Tipton, H.F., editors), Auerbach Publishers, 1994, pages 145-160.
51. Ravi Sandhu and Sushil Jajodia, "Data and Database Security and Controls." In *Handbook of Information Security Management*, (Ruthberg, Z.A. and Tipton, H.F., editors), Auerbach Publishers, 1993, pages 481-499.

## Conference Publications

52. Ravi Sandhu, "The Challenge of Data and Application Security and Privacy (DASPY): Are We Up to It?" In *Proceedings 1<sup>st</sup> ACM Conference on Data and Application Security and Privacy (CODASPY)*, San Antonio, Texas, February 21-23, 2 pages. (Inaugural Keynote Talk.)
53. Ravi Sandhu, Ram Krishnan and Gregory White, "Towards Secure Information Sharing Models for Community Cyber Security." In *Proceedings 6<sup>th</sup> IEEE International Conference on Collaborative Computing: Networking, Applications and Worksharing (CollaborateCom)*, Chicago, Illinois, October 9-12, 2010, 6 pages.
54. Jaehong Park, Yuan Cheng and Ravi Sandhu, "Towards A Framework for Cyber Social Status Based Trusted Open Collaboration." In *Proceedings of the 5th IEEE International Workshop on Trusted Collaboration (TrustCol 2010)*, Chicago, Illinois, October 9, 2010, 8 pages.

55. Ravi Sandhu, Raj Boppana, Ram Krishnan, Jeff Reich, Todd Wolff and Josh Zachary, "Towards a Discipline of Mission-Aware Cloud Computing." In *Proceedings of the 2nd ACM-CCS Cloud Computing Security Workshop (CCSW 10)*, Chicago, Illinois, October 08, 2010, pages 13-17.
56. Ravi Sandhu, Ram Krishnan, Jianwei Niu and William Winsborough, "Group-Centric Models for Secure and Agile Information Sharing." In *Proceedings 5th International Conference, on Mathematical Methods, Models, and Architectures for Computer Network Security, MMM-ACNS 2010*, St. Petersburg, Russia, September 8-10, 2010, pages 55-69. Published as Springer Lecture Notes in Computer Science Vol. 6258, Computer Network Security (Igor Kottenko and Victor Skormin, editors), 2010.
57. Jose Morales, Erhan Kartaltepe, Shouhuai Xu and Ravi Sandhu, "Symptoms-Based Detection of Bot Processes." In *Proceedings 5th International Conference, on Mathematical Methods, Models, and Architectures for Computer Network Security, MMM-ACNS 2010*, St. Petersburg, Russia, September 8-10, 2010, pages 229-241. Published as Springer Lecture Notes in Computer Science Vol. 6258, Computer Network Security (Igor Kottenko and Victor Skormin, editors), 2010.
58. Jose Andre Morales, Areej Al-Bataineh, Shouhuai Xu and Ravi Sandhu, "Analyzing and Exploiting Network Behaviors of Malware." In *Proceedings 6<sup>th</sup> International ICST Conference on Security and Privacy in Communication Networks (SecureComm 2010)*, September 7-9, 2010, Singapore, pages 20-34. Published as Springer Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering Vol. 50, Security and Privacy in Communication Networks (S. Jajodia and J. Zhou, editors), 2010.
59. Shouhuai Xu, Haifeng Qian, Fengying Wang, Zhenxin Zhan, Elisa Bertino and Ravi Sandhu, "Trustworthy Information: Concepts and Mechanisms." In *Proceedings 11<sup>th</sup> International Conference on Web-Age Information Management (WAIM 2010)*, Jiuzhaigou, China, July 15-17, 2010, pages 398-404. Published as Springer Lecture Notes in Computer Science Vol. 6184, Web-Age Information Management (Chen, L., Tang, C., Yang, J. and Gao, Y., editors), 2010.
60. Erhan Kartaltepe, Jose Andre Morales, Shouhuai Xu and Ravi Sandhu, "Social Network-Based Botnet Command-and-Control: Emerging Threats and Countermeasures." In *Proceedings of the 8th International Conference on Applied Cryptography and Network Security (ACNS 2010)*, Beijing, China, June 22-25, 2010, pages 511-528. Published as Springer Lecture Notes in Computer Science Vol. 6123, Applied Cryptography and Network Security (Jianying Zhou and Moti Yung, editors), 2010.
61. Ravi Sandhu, "The PEI Framework for Application-Centric Security." In *Proc. 5th IEEE International Conference on Collaborative Computing: Networking, Applications and Worksharing (CollaborateCom)*, Crystal City, Virginia, November 11-14, 2009, pages 1-5.
62. Ram Krishnan, Ravi Sandhu, Jianwei Niu and William Winsborough, "Towards a Framework for Group-Centric Secure Collaboration." In *Proc. 5th IEEE International Conference on Collaborative Computing: Networking, Applications and Worksharing (CollaborateCom)*, Crystal City, Virginia, November 11-14, 2009, pages 1-10.
63. Jose Morales, Areej Al-Bataineh, Shouhuai Xu and Ravi Sandhu, "Analyzing DNS Activities of Bot Processes." In *Proc. 4th IEEE International Conference on Malicious and Unwanted Software (Malware 2009)*, Montreal, Quebec, Canada, October 13-14, 2009, pages 98-103.
64. Ram Krishnan and Ravi Sandhu, "A Hybrid Enforcement Model for Group-Centric Secure Information Sharing." *Proc. IEEE International Conference on Computational Science and Engineering (CSE-09)*, Vancouver, Canada, August 29-31, 2009, pages 189-194.
65. Qun Ni, Shouhuai Xu, Elisa Bertino, Ravi Sandhu and Weili Han, "An Access Control Language for a General Provenance Model." *Proc. 6<sup>th</sup> VLDB Workshop on Secure Data Management (SDM'09)*,

August 28, 2009, Lyon, France, pages 68-88. Published as Springer Lecture Notes in Computer Science Vol. 5776, SDM 2009 (W. Jonker and M. Petković, editors), 2009.

66. Shouhuai Xu, Ravi Sandhu and Elisa Bertino, "TIUPAM: A Framework for Trustworthiness-Centric Information Sharing." *Proc. 3<sup>rd</sup> IFIP WG 11.11 International Conference on Trust Management (IFIPTM)*, Purdue University, West Lafayette, June 15-19, 2009, pages 164-175. Published as Springer IFIP Advances in Information and Communication Technology Vol. 300, Trust Management III (E. Ferrari, N. Li, E. Bertino and Y. Karabulut, editors), 2009.
67. Shouhuai Xu, Qun Ni, Elisa Bertino and Ravi Sandhu, "A Characterization of the Problem of Secure Provenance Management." *Proc. IEEE International Conference on Intelligence and Security Informatics (ISI-2009): Workshop on Assured Information Sharing (WAIS)*, Dallas, Texas, June 8-11, 2009, pages 310-314.
68. Ram Krishnan, Ravi Sandhu, Jianwei Niu and William Winsborough, "Formal Models for Group-Centric Secure Information Sharing." *Proc. 14<sup>th</sup> ACM Symposium on Access Control Models and Technologies (SACMAT)*, Stresa, Italy, June 3-5, 2009, pages 115-124.
69. Ravi Sandhu, "The PEI Framework for Application-Centric Security." In *Proceedings of the 1<sup>st</sup> IEEE International Workshop on Security and Communication Networks (IWSCN)*, Trondheim, Norway, May 20-22, 2009, 6 pages.
70. Ram Krishnan and Ravi Sandhu, "Enforcement Architecture and Implementation Model for Group-Centric Information Sharing." In *Proceedings of the 1<sup>st</sup> IEEE International Workshop on Security and Communication Networks (IWSCN)*, Trondheim, Norway, May 20-22, 2009, 8 pages.
71. Justin Leonard, Shouhuai Xu, and Ravi Sandhu, "A First Step Towards Characterizing Stealthy Botnets." *Proc. of 4<sup>th</sup> International Conference on Availability, Reliability and Security (ARES)*, Fukuoka Institute of Technology, Fukuoka, Japan, March 16-19, 2009, pages 106-113.
72. Justin Leonard, Shouhuai Xu, and Ravi Sandhu. "A Framework for Understanding Botnets." *Proc. of 3<sup>rd</sup> International Workshop on Advances in Information Security (WAIS at ARES)*, Fukuoka Institute of Technology, Fukuoka, Japan, March 16-19, 2009, pages 917-922.
73. Ram Krishnan, Ravi Sandhu, Jianwei Niu and William Winsborough, "A Conceptual Framework for Group-Centric Secure Information Sharing." *Proc. 4<sup>th</sup> ACM Symposium on Information, Computer and Communications Security (AsiaCCS)*, Sydney, Australia, March 10-12, 2009, pages 384-387.
74. Ram Krishnan, Jianwei Niu, Ravi Sandhu and William Winsborough, "Stale-Safe Security Properties for Group-Based Secure Information Sharing." *Proc. 6<sup>th</sup> ACM-CCS Workshop on Formal Methods in Security Engineering (FMSE)*, Alexandria, Virginia, October 27, 2008, pages 53-62.
75. Tim Finin, Anupam Joshi, Lalana Kagal, Jianwei Niu, Ravi Sandhu, William Winsborough and Bhavani Thuraisingham, "ROWLBAC: Representing Role Based Access Control in OWL." *Proc. 13<sup>th</sup> ACM Symposium on Access Control Models and Technologies (SACMAT)*, Estes Park, Colorado, June 11-13, 2008, pages 73-82.
76. Xinwen Zhang, Jean-Pierre Seifert and Ravi Sandhu, "Security Enforcement Model for Distributed Usage Control." *Proc. 2<sup>nd</sup> IEEE International Conference on Sensor Networks, Ubiquitous, and Trustworthy Computing (SUTC)*, Taichung, Taiwan, June 11-13, 2008, pages 10-18. **Keynote Lecture.**
77. Vana Kalogeraki, Dimitrios Gunopulos, Ravi Sandhu and Bhavani Thuraisingham, "QoS Aware Dependable Distributed Stream Processing." *Proc. 11<sup>th</sup> IEEE Symposium on Object Oriented Real-Time Distributed Computing (ISORC)*, Orlando, Florida, May 5-7, 2008, pages 69-75.

78. Ravi Sandhu and Venkata Bhamidipati, "The ASCAA Principles for Next-Generation Role-Based Access Control." *Proc. 3<sup>rd</sup> International Conference on Availability, Reliability and Security (ARES)*, Barcelona, Spain, March 4-7, 2008, pages xxvii-xxxii. **Keynote Lecture.**
79. Xinwen Zhang, Dongyu Liu, Songqing Chen, Zhao Zhang and Ravi Sandhu, "Towards Digital Rights Protection in BitTorrent-like P2P Systems." *Proc. 15<sup>th</sup> SPIE/ACM Multimedia Computing and Networking (MMCN)*, San Jose, CA USA, January 30-31, 2008, pages 68180F 1-12.
80. Manoj Sastry, Ram Krishnan and Ravi Sandhu, "A New Modeling Paradigm for Dynamic Authorization in Multi-domain Systems." *Proc. Fourth International Conference on Mathematical Methods, Models, and Architectures for Computer Network Security, MMM-ACNS*, Saint Petersburg, Russia, September 13-15, 2007. Published as Springer-Verlag Communications in Computer and Information Science, Volume 1, pages 153-158.
81. Shouhuai Xu and Ravi Sandhu, "A Scalable and Secure Cryptographic Service." *Proc. 21<sup>st</sup> IFIP WG 11.3 Working Conf. on Data and Applications Security*, Redondo Beach, CA, July 8-11, 2007, pages 144-160. Published as Springer-Verlag Lecture Notes in Computer Science Vol. 4602, Data and Applications Security XXI (S. Barker and G. Ahn, editors), 2007.
82. Baoxian Zhao, Ravi Sandhu, Xinwen Zhang and Xiaolin Qin, "Towards a Times-Based Usage Control Model." *Proc. 21<sup>st</sup> IFIP WG 11.3 Working Conf. on Data and Applications Security*, Redondo Beach, CA, July 8-11, 2007, pages 227-242. Published as Springer-Verlag Lecture Notes in Computer Science Vol. 4602, Data and Applications Security XXI (S. Barker and G. Ahn, editors), 2007.
83. Ezedin Barka and Ravi Sandhu, "Framework for Agent-Based Role Delegation." *Proc. IEEE International Conference on Communications (ICC)*, Glasgow, Scotland, June 24-28, 2007, pages 1361-1367.
84. Min Xu, Xuxian Jiang, Ravi Sandhu and Xinwen Zhang, "Towards a VMM-based Usage Control Framework for OS Kernel Integrity Protection." *Proc. 12<sup>th</sup> ACM Symposium on Access Control Models and Technologies (SACMAT)*, June 20-22, 2007, Sophia Antipolis, France, pages 71-80.
85. Ram Krishnan, Ravi Sandhu and Kumar Ranganathan, "PEI Models towards Scalable, Usable and High-Assurance Information Sharing." *Proc. 12<sup>th</sup> ACM Symposium on Access Control Models and Technologies (SACMAT)*, June 20-22, 2007, Sophia Antipolis, France, pages 145-150.
86. Xinwen Zhang, Michael J. Covington, Songqing Chen and Ravi Sandhu, "SecureBus: Towards Application-Transparent Trusted Computing with Mandatory Access Control." *Proc. 2<sup>nd</sup> ACM Symposium on Information, Computer and Communications Security (AsiaCCS)*, Singapore, March 20-22, 2007, pages 117-126.
87. Zhixiong Zhang, Xinwen Zhang and Ravi Sandhu, "ROBAC: Scalable Role and Organization Based Access Control Models." In *Proceedings of the 1<sup>st</sup> IEEE International Workshop on Trusted Collaboration (TrustCol 2006)*, Atlanta, Georgia, November 17, 2006, 9 pages.
88. Xinwen Zhang, Francesco Parisi-Presicce and Ravi Sandhu, "Towards Remote Policy Enforcement for Runtime Protection of Mobile Code Using Trusted Computing", *Proc. 1<sup>st</sup> International Workshop on Security (IWSEC)*, Kyoto, Japan, October 23-24, 2006, pages 179-195. Published as Springer-Verlag Lecture Notes in Computer Science Vol. 4266, Advances in Information and Computer Security (Yoshiura et al, editors), 2006.
89. Xinwen Zhang, Masayuki Nakae, Michael J. Covington and Ravi Sandhu, "A Usage-Based Authorization Framework for Collaborative Computing Systems." *Proc. 11<sup>th</sup> ACM Symposium on Access Control Models and Technologies (SACMAT)*, Lake Tahoe, CA, June 7-9, 2006, pages 180-189.

90. Ravi Sandhu, Kumar Ranganathan and Xinwen Zhang, "Secure Information Sharing Enabled by Trusted Computing and PEI Models." *Proc. 1<sup>st</sup> ACM Symposium on Information, Computer, and Communication Security (AsiaCCS)*, Taipei, Taiwan, March 21-24, 2006, pages 2-12. **Keynote Lecture.**
91. Xinwen Zhang, Ravi Sandhu, and Francesco Parisi-Presicce, "Safety Analysis of Usage Control Authorization Models." *Proc. 1<sup>st</sup> ACM Symposium on Information, Computer, and Communication Security (AsiaCCS)*, Taipei, Taiwan, March 21-24, 2006, pages 243-354.
92. Masayuki Nakae, Xinwen Zhang and Ravi Sandhu, "A General Design towards Secure Ad-hoc Collaboration." *Proc. 1<sup>st</sup> ACM Symposium on Information, Computer, and Communication Security (AsiaCCS)*, Taipei, Taiwan, March 21-24 2006, page 358.
93. Ravi Sandhu and Xinwen Zhang, "Peer-to-Peer Access Control Architecture Using Trusted Computing Technology." *Proc. 10<sup>th</sup> ACM Symposium on Access Control Models and Technologies (SACMAT)*, Stockholm, June 1-3, 2005, pages 147-158.
94. Ezedin Barka and Ravi Sandhu, "Role-Based Delegation Model/ Hierarchical Roles (RBDM1)." *Proc. 20<sup>th</sup> Annual Computer Security Applications Conference*, Tucson, Arizona, December 6-10, 2004, pages 396-404.
95. Mohammad Al-Kahtani and Ravi Sandhu, "Rule-Based RBAC with Negative Authorization." *Proc. 20<sup>th</sup> Annual Computer Security Applications Conference*, Tucson, Arizona, December 6-10, 2004, pages 405-415.
96. Ravi Sandhu, "A Perspective on Graphs and Access Control Models." *Proc. 2nd International Conference on Graph Transformation (ICGT)*, Rome (Italy), September 28 - October 2, 2004. Published as Springer-Verlag LNCS Vol. 3256, pages 2-12. **Keynote Lecture.**
97. Jaehong Park, Xinwen Zhang and Ravi Sandhu, "Attribute Mutability in Usage Control." *18th Annual IFIP WG 11.3 Working Conference on Data and Applications Security*, Sitges, Spain, July 25-28, 2004, pages 1-10.
98. Roshan Thomas and Ravi Sandhu, "Towards a Multi-Dimensional Characterization of Dissemination Control." *Proc. 5<sup>th</sup> IEEE International Workshop on Policies for Distributed Systems and Networks*, Yorktown Heights, June 7-9, 2004, pages 197-200.
99. Xinwen Zhang, Jaehong Park, Francesco Parisi-Presicce and Ravi Sandhu, "A Logical Specification for Usage Control." *Proc. 9<sup>th</sup> ACM Symposium on Access Control Models and Technologies (SACMAT)*, New York, June 2-4, 2004, pages 1-10.
100. Shouhuai Xu, W.R. Nelson and Ravi Sandhu, "Enhancing Anonymity via Market Competition." *Proceedings Information Technology: Coding and Computing (ITCC)*, April 5-7 2004, Vol 1, pages:30-34.
101. Roshan Thomas and Ravi Sandhu, "Models, Protocols, and Architectures for Secure Pervasive Computing: Challenges and Research Directions." *Proc. IEEE Workshop on Pervasive Computing and Communications Security (PERSEC)*, Orlando, Florida, March 14, 2004, pages 164-168.
102. Ravi Sandhu and Jaehong Park, "Usage Control: A Vision for Next Generation Access Control." *Proc. Computer Network Security: Second International Workshop on Mathematical Methods, Models, and Architectures for Computer Network Security, MMM-ACNS*, Saint Petersburg, Russia, September 21-23, 2003. Published as Springer-Verlag Lecture Notes in Computer Science 2776, pages 17-31.
103. Xinwen Zhang, Jaehong Park, and Ravi Sandhu, "Schema Based XML Security: RBAC Approach." *Proc. 17th IFIP WG11.3 Working Conference on Data and Application Security*, Estes Park, Colorado,

U.S.A. August 4-6, 2003, published as Database Security XVII: Status and Prospects, (S. di Vimercati and Indrakshi Ray, editors), Kluwer.

104. Mohammad Al-Kahtani and Ravi Sandhu. "Induced Role Hierarchies with Attribute-Based RBAC." *Proc. 8<sup>th</sup> ACM Symposium on Access Control Models and Technologies*, Como, Italy, June 2-3, 2003.
105. Sejong Oh, Ravi Sandhu and Xinwen Zhang. "PBDM: A Flexible Delegation Model in RBAC." *Proc. 8<sup>th</sup> ACM Symposium on Access Control Models and Technologies*, Como, Italy, June 2-3, 2003.
106. Shouhuai Xu and Ravi Sandhu. "Two Efficient and Provably Secure Schemes for Server-Assisted Threshold Signatures." *Proceedings of Cryptographers' Track at the RSA Conference*, San Francisco, California, April 13-17, 2003. Published as Springer-Verlag Lecture Notes in Computer Science, Volume 2612, pages 355-372.
107. Mohammad Al-Kahtani and Ravi Sandhu, "A Model for Attribute-Based User-Role Assignment." *Proc. 17<sup>th</sup> Annual Computer Security Applications Conference*, Las Vegas, Nevada, December 9-13, 2002, pages 353-362.
108. Jaehong Park and Ravi Sandhu, "Originator Control in Usage Control." *Proc. 3<sup>rd</sup> IEEE International Workshop on Policies for Distributed Systems and Networks*, Monterey, California, June 5-7, 2002, pages 60-66.
109. Sejong Oh and Ravi Sandhu, "A Model for Role Administration Using Organization Structure." *Proc. 7<sup>th</sup> ACM Symposium on Access Control Models and Technologies*, Monterey, California, June 2-4, 2002, pages 155-162.
110. Jaehong Park and Ravi Sandhu, "Towards Usage Control Models: Beyond Traditional Access Control." *Proc. 7<sup>th</sup> ACM Symposium on Access Control Models and Technologies*, Monterey, California, June 2-4, 2002, pages 57-64.
111. Ravi Sandhu, Mihir Bellare and Ravi Ganesan, "Password-Enabled PKI: Virtual Smartcards versus Virtual Soft Tokens." *Proc. 1<sup>st</sup> Annual PKI Research Workshop*, Gaithersburg, Maryland, April 24-25, 2002.
112. Shouhuai Xu and Ravi Sandhu, "Authenticated Multicast Immune to Denial-of-Service Attack." *Proc. 17<sup>th</sup> ACM Symposium on Applied Computing*, Madrid, Spain, March 10-14, 2002, pages 196-200.
113. Pete Epstein and Ravi Sandhu, "Engineering of Role-Permission Assignments." *Proc. 16<sup>th</sup> Annual Computer Security Applications Conference*, New Orleans, Louisiana, December 10-14, 2001, pages 127-136.
114. Joon Park, Gail-Joon Ahn and Ravi Sandhu, "Role-based Access Control on the Web Using LDAP." *Proc. 15th IFIP WG11.3 Working Conference on Database and Application Security*, Niagara on the Lake, Ontario, Canada, July 15-18, 2001, pages 19-30. Published as Database Security XV: Status and Prospects, (D. Spooner, editor), Kluwer 2002.
115. Savith Kandala and Ravi Sandhu, "Secure Role-Based Workflow Models." *Proc. 15th IFIP WG11.3 Working Conference on Database and Application Security*, Niagara on the Lake, Ontario, Canada, July 15-18, 2001, pages 45-58. Published as Database Security XV: Status and Prospects, (D. Spooner, editor), Kluwer 2002.
116. Ravi Sandhu, "Future Directions in Role-Based Access Control Models." *Proc. Mathematical Methods, Models and Architectures for Computer Networks Security*, Saint Petersburg, Russia, May 21-23, 2001, Lecture Notes in Computer Science, Volume 2052, pages 22-26. **Keynote Lecture.**

117. Jaehong Park, Ravi Sandhu and James Schifalacqua, "Security Architectures for Controlled Digital Information Dissemination." *Proc. 16<sup>th</sup> Annual Computer Security Applications Conference*, New Orleans, Louisiana, December 11-15, 2000, pages 224-233.
118. Ezedin Barka and Ravi Sandhu, "Framework for Role-Based Delegation Models." *Proc. 16<sup>th</sup> Annual Computer Security Applications Conference*, New Orleans, Louisiana, December 11-15, 2000, pages 168-176.
119. Joon Park and Ravi Sandhu, "Binding Identities and Attributes Using Digitally Signed Certificates." *Proc. 16<sup>th</sup> Annual Computer Security Applications Conference*, New Orleans, Louisiana, December 11-15, 2000, pages 120-127.
120. Venkata Bhamidipati and Ravi Sandhu, "Push Architectures for User-Role Assignment." *Proceedings 23<sup>rd</sup> National Information Systems Security Conference*, Baltimore, October, 2000, pages 89-100
121. Ezedin Barka and Ravi Sandhu, "A Role-Based Delegation Model and Some Extensions." *Proceedings 23<sup>rd</sup> National Information Systems Security Conference*, Baltimore, October, 2000, pages 101-110.
122. Ravi Sandhu, "Engineering Authority and Trust in Cyberspace: The OM-AM and RBAC Way." *Proc. 5<sup>th</sup> ACM Workshop on Role-Based Access Control*, Berlin, Germany, July 26-28, 2000, pages 111-119.
123. Ravi Sandhu, David Ferraiolo and Richard Kuhn, "The NIST Model for Role-Based Access Control: Towards A Unified Standard." *Proc. 5<sup>th</sup> ACM Workshop on Role-Based Access Control*, Berlin, Germany, July 26-28, 2000, pages 47-63.
124. Gail-Joon Ahn, Myong Kang, Joon Park and Ravi Sandhu, "Injecting RBAC to Secure a Web-Based Workflow System." *Proc. 5<sup>th</sup> ACM Workshop on Role-Based Access Control*, Berlin, Germany, July 26-28, 2000, pages 1-10.
125. Ravi Sandhu and Qamar Munawer, "The ARBAC99 Model for Administration of Roles." *Proc. 15<sup>th</sup> Annual Computer Security Applications Conference*, Scottsdale, Arizona, December 6-10, 1999.
126. Ravi Sandhu and Qamar Munawer, "Simulation of the Augmented Typed Access Matrix Model (ATAM) using Roles." *Proc. INFOSEC99 International Conference on Information Security*, Shanghai, China, October 11-13, 1999.
127. Gail Ahn and Ravi Sandhu, "The RSL99 Language for Role-Based Separation of Duty Constraints." *Proc. 4<sup>th</sup> ACM Workshop on Role-Based Access Control*, Fairfax, Virginia, October 28-29, 1999, pages 43-54.
128. Pete Epstein and Ravi Sandhu, "Towards a UML Based Approach to Role Engineering." *Proc. 4<sup>th</sup> ACM Workshop on Role-Based Access Control*, Fairfax, Virginia, October 28-29, 1999, pages 135-143.
129. Joon Park and Ravi Sandhu, "RBAC on the Web by Smart Certificates." *Proc. 4<sup>th</sup> ACM Workshop on Role-Based Access Control*, Fairfax, Virginia, October 28-29, 1999, pages 1-9.
130. Joon Park and Ravi Sandhu, "Smart Certificates: Extending X.509 for Secure Attribute Services on the Web," *Proceedings 22<sup>nd</sup> National Information Systems Security Conference*, Crystal City, October 18-21, 1999, pages 337-348.
131. Joon Park, Ravi Sandhu and SreeLatha Ghanta, "RBAC on the Web by Secure Cookies." *Proc. 13<sup>th</sup> IFIP WG11.3 Working Conference on Database and Application Security*, Seattle, WA, USA, July 26-28, 1999, published as Database Security XIII: Status and Prospects, (V. Atluri and J. Hale, editors), Kluwer 2000, pages 41-54.

132. Savith Kandala and Ravi Sandhu, "Extending the BFA Workflow Authorization Model to Express Weighted Voting." *Proc. 13th IFIP WG11.3 Working Conference on Database and Application Security*, Seattle, WA, USA, July 26-28, 1999, published as Database Security XIII: Status and Prospects, (V. Atluri and J. Hale, editors), Kluwer 2000, pages 109-126.
133. Phillip Hyland and Ravi Sandhu, "Concentric Supervision of Security Applications: A New Security Management Paradigm," *Proc. Fourteenth Annual Computer Security Applications Conference*, Scottsdale, Arizona, December 7-11, 1998.
134. Ravi Sandhu and Qamar Munawer, "The RRA97 Model for Role-Based Administration of Role Hierarchies," *Proc. Fourteenth Annual Computer Security Applications Conference*, Scottsdale, Arizona, December 7-11, 1998.
135. Ravi Sandhu and Gail-Joon Ahn, "Group Hierarchies with Decentralized User Assignment in Windows NT," *Proc. International Association of Science and Technology for Development (IASTED) Conference on Software Engineering*, Las Vegas, Nevada, Oct. 28-31, 1998.
136. Ravi Sandhu, "Role Activation Hierarchies." *Proc. Third ACM Workshop on Role-Based Access Control*, Fairfax, Virginia, October 22-23, 1998, pages 33-40.
137. Ravi Sandhu and Venkata Bhamidipati, "An Oracle Implementation of the PRA97 Model for Permission-Role Assignment." *Proc. Third ACM Workshop on Role-Based Access Control*, Fairfax, Virginia, October 22-23, 1998, pages 13-21.
138. Ravi Sandhu and Qamar Munawer, "How to do Discretionary Access Control Using Roles." *Proc. Third ACM Workshop on Role-Based Access Control*, Fairfax, Virginia, October 22-23, 1998, pages 47-54.
139. Ravi Sandhu and Joon Park, "Decentralized User-Role Assignment for Web-based Intranets." *Proc. Third ACM Workshop on Role-Based Access Control*, Fairfax, Virginia, October 22-23, 1998, pages 1-12.
140. Philip Hyland and Ravi Sandhu, "Management of Network Security Applications," *Proc. 21st National Information Systems Security Conference*, Crystal City, October 5-8, 1998, pages 154-165.
141. Ravi Sandhu and Gail-Joon Ahn, "Decentralized Group Hierarchies in UNIX: An Experiment and Lessons Learned," *Proc. 21st National Information Systems Security Conference*, Crystal City, October 5-8, 1998, pages 486-502.
142. Chandramouli Ramaswamy and Ravi Sandhu, "Role-Based Access Control Features In Commercial Database Management Systems," *Proc. 21st National Information Systems Security Conference*, Crystal City, October 5-8, 1998, pages 503-511. **Best Paper Award.**
143. Tarik Himdi and Ravi Sandhu, "Lattice-Based Models for Controlled Sharing of Confidential Information in the Saudi Hajj System." *Proc. Thirteenth Annual Computer Security Applications Conference*, San Deigo, California, December 8-12, 1997.
144. Ravi Sandhu, Venkata Bhamidipati, Edward Coyne, Srinivas Ganta and Charles Youman, "The ARBAC97 Model for Role-Based Administration of Roles: Preliminary Description and Outline." *Proc. Second ACM Workshop on Role-Based Access Control*, Fairfax, Virginia, November 6-7, 1997.
145. Ravi Sandhu and Venkata Bhamidipati, "The URA97 Model for Role-Based Administration of User-Role Assignment." *Proc. 11th IFIP WG11.3 Working Conference on Database and Application Security*, Lake Tahoe, California, 10-13 August 1997, published as Database Security, XI: Status and Prospects, (T.Y. Lin and Shelly Qian, editors), Chapman & Hall, pages 166-181.

146. Roshan Thomas and Ravi Sandhu, "Task-based Authorization Controls (TBAC): Models for Active and Enterprise-Oriented Authorization Management." *Proc. 11th IFIP WG11.3 Working Conference on Database and Application Security*, Lake Tahoe, California, 10-13 August 1997, published as Database Security XI: Status and Prospects, (T.Y. Lin and Shelly Qian, editors), Chapman & Hall 1998, pages 262-275.
147. Ravi Sandhu, "Role Hierarchies and Constraints for Lattice-Based Access Controls." *Proc. Fourth European Symposium on Research in Computer Security*, Rome, Italy, September 25-27, 1996, pages 65-79. Published as Springer-Verlag Lecture Notes in Computer Science, Computer Security-ESORICS96 (Elisa Bertino et al, editors), 1996.
148. Ravi Sandhu, "Access Control: The Neglected Frontier." *Proc. First Australasian Conference on Information Security and Privacy*, Wollongong, NSW, Australia, June 23-26, 1996, pages 219-227. Published as Springer-Verlag Lecture Notes in Computer Science, Information Security and Privacy (Josef Pieprzyk and Jennifer Seberry, editors), 1996. **Keynote Lecture.**
149. Ravi Sandhu, "Issues in RBAC." *Proc. First ACM Workshop on Role-Based Access Control*, Gaithersburg, Maryland, November 30-December 1, 1995, pages I.21-24.
150. Ravi Sandhu, "Roles versus Groups." *Proc. First ACM Workshop on Role-Based Access Control*, Gaithersburg, Maryland, November 30-December 1, 1995, pages I.25-26.
151. Ravi Sandhu, "Rationale for the RBAC96 Family of Access Control Models." *Proc. First ACM Workshop on Role-Based Access Control*, Gaithersburg, Maryland, November 30-December 1, 1995, pages II.1-8.
152. Fang Chen and Ravi Sandhu, "Constraints for Role Based Access Control." *Proc. First ACM Workshop on Role-Based Access Control*, Gaithersburg, Maryland, November 30-December 1, 1995, pages II.39-46.
153. Jeremy Epstein and Ravi Sandhu, "NetWare 4 as an Example of Role Based Access Control." *Proc. First ACM Workshop on Role-Based Access Control*, Gaithersburg, Maryland, November 30-December 1, 1995, pages II.71-82.
154. Fang Chen and Ravi Sandhu, "The Semantics and Expressive Power of the MLR Data Model." *Proc. 16<sup>th</sup> IEEE Symposium on Research in Security and Privacy*, Oakland, California, May 8-10, 1995, pages 128-142.
155. Ravi Sandhu, Edward Coyne, Hal Feinstein and Charles Youman, "Role-Based Access Control: A Multi-Dimensional View." *Proc. Tenth Annual Computer Security Applications Conference*, Orlando, Florida, December 5-9, 1994, pages 54-62.
156. Ravi Sandhu and Srinivas Ganta, "On the Expressive Power of the Unary Transformation Model." *Proc. Third European Symposium on Research in Computer Security*, Brighton, UK, November 7-9, 1994, pages 301-318. Published as Springer-Verlag Lecture Notes in Computer Science, Vol 875, Computer Security-ESORICS94 (Dieter Gollmann, editor), 1994.
157. Roshan Thomas and Ravi Sandhu, "Supporting Object-based High-assurance Write-up in Multilevel Databases for the Replicated Architecture." *Proc. Third European Symposium on Research in Computer Security*, Brighton, UK, November 7-9, 1994, pages 403-428. Published as Springer-Verlag Lecture Notes in Computer Science, Vol 875, Computer Security-ESORICS94 (Dieter Gollmann, editor), 1994.
158. Ravi Sandhu and Hal Feinstein, "A Three Tier Architecture for Role-Based Access Control." *Proc. 17th NIST-NCSC National Computer Security Conference*, Baltimore, MD, October 11-14, 1994, pages 34-46.

159. Paul Ammann and Ravi Sandhu, "One-Representative Safety Analysis in the Non-Monotonic Transform Model." *Proceedings of the 7th IEEE Computer Security Foundations Workshop*, Franconia, NH, June 1994, pages 138-149.
160. Roshan Thomas and Ravi Sandhu, "Conceptual Foundations for a Model of Task-based Authorizations." *Proceedings of the 7th IEEE Computer Security Foundations Workshop*, Franconia, NH, June 1994, pages 66-79.
161. Ravi Sandhu and Srinivas Ganta, "On the Minimality of Testing for Rights in Transformation Models." *Proc. 15<sup>th</sup> IEEE Symposium on Research in Security and Privacy*, Oakland, California, May 16-18, 1994, pages 230-241.
162. Roshan Thomas and Ravi Sandhu, "Towards a Task-Based Paradigm for Flexible and Adaptable Access Control in Distributed Applications." *Proc. 1992-1993 ACM SIGSAC New Security Paradigms Workshops*, Little Compton, RI, 1993, pages 138-142.
163. Ravi Sandhu and Srinivas Ganta, "Expressive Power of the Single-Object Typed Access Matrix Model." *Proc. Ninth Annual Computer Security Applications Conference*, Orlando, Florida, December 6-10, 1993, pages 184-194.
164. Roshan Thomas and Ravi Sandhu, "Concurrency, Synchronization, and Scheduling to Support High-assurance Write-up in Multilevel Object-based Computing," *Proc. of the OOPSLA-93 Conference Workshop on Security for Object-Oriented Systems*, Washington, DC, USA, 26 September 1993. Published as *Security for Object-Oriented Systems*, (B. Thuraisingham, R. Sandhu and T.C. Ting, editors), Springer-Verlag 1993, pages 218-228.
165. Ravi Sandhu and Sushil Jajodia, "Referential Integrity in Multilevel Secure Databases." *Proc. 16th NIST-NCSC National Computer Security Conference*, Baltimore, MD, Sept. 20-23, 1993, pages 39-52.
166. Roshan Thomas and Ravi Sandhu, "Discretionary Access Control in Object-oriented Databases: Issues and Research Directions." *Proc. 16th NIST-NCSC National Computer Security Conference*, Baltimore, MD, Sept. 20-23, 1993, pages 63-74.
167. Roshan Thomas and Ravi Sandhu, "Task-Based Authorization: A Paradigm for Flexible and Tailorable Access Control in Distributed Applications." *Proc. 16th NIST-NCSC National Computer Security Conference*, Baltimore, MD, Sept. 20-23, 1993, pages 409-415.
168. Ravi Sandhu, "On Five Definitions of Data Integrity." *Proc. 7th IFIP WG11.3 Working Conference on Database Security*, Lake Guntersville, Alabama, USA, 12-15 September 1993, published as *Database Security VII: Status and Prospects*, (Keefe, T. and Landwehr, C.E., editors), Elsevier 1994, pages 257-267.
169. Roshan Thomas and Ravi Sandhu, "Towards a Unified Framework and Theory for Reasoning about Security and Correctness of Multilevel Transactions." *Proc. 7th IFIP WG11.3 Working Conference on Database Security*, Lake Guntersville, Alabama, USA, 12-15 September 1993, published as *Database Security VII: Status and Prospects*, (Keefe, T. and Landwehr, C.E., editors), Elsevier 1994, pages 309-328.
170. Ravi Sandhu and Srinivas Ganta, "On Testing for Absence of Rights in Access Control Models." *Proc. IEEE Computer Security Foundations Workshop VI*, Franconia, New Hampshire, June 1993, pages 109-118.

171. Paul Ammann and Ravi Sandhu, "Implementing Transaction Control Expressions by Checking for Absence of Access Rights." *Proc. Eighth Annual Computer Security Applications Conference*, San Antonio, Texas, December 1992, pages 131-140.
172. Ravi Sandhu and Sushil Jajodia, "Polyinstantiation for Cover Stories." *Proc. Second European Symposium on Research in Computer Security*, Toulouse, France, November 1992, pages 307-328. Published as Springer-Verlag Lecture Notes in Computer Science, Vol 648, Computer Security-ESORICS92 (Deswarte, Y., Eizenberg, G., and Quisquater, J.-J., editors), 1992.
173. Ravi Sandhu, "A Lattice Interpretation of the Chinese Wall Policy." *Proc. 15th NIST-NCSC National Computer Security Conference*, Baltimore, MD, October 1992, pages 329-339.
174. Ravi Sandhu and Gurpreet Suri, "Implementation Considerations for the Typed Access Matrix Model in a Distributed Environment." *Proc. 15th NIST-NCSC National Computer Security Conference*, Baltimore, MD, October 1992, pages 221-235. **Best Paper Award**
175. Roshan Thomas and Ravi Sandhu, "Implementing the Message Filter Object-Oriented Security Model without Trusted Subjects." *Proc. 6<sup>th</sup> IFIP WG11.3 Working Conference on Database Security*, Vancouver, British Columbia, Canada, 19-21 August 1992, published as Database Security VI: Status and Prospects, (Thuraisingham, B. and Landwehr, C.E., editors), North-Holland 1993, pages 15-34.
176. Paul Ammann, Richard Lipton and Ravi Sandhu, "The Expressive Power of Multi-Parent Creation in Monotonic Access Control Models." *Proc. IEEE Computer Security Foundations Workshop V*, Franconia, New Hampshire, June 1992, pages 148-156.
177. Ravi Sandhu, "The Typed Access Matrix Model." *Proc. 13<sup>th</sup> IEEE Symposium on Research in Security and Privacy*, Oakland, California, May 1992, pages 122-136.
178. Ravi Sandhu and Gurpreet Suri, "Non-monotonic Transformations of Access Rights." *Proc. 13<sup>th</sup> IEEE Symposium on Research in Security and Privacy*, Oakland, California, May 1992, pages 148-161.
179. John McDermott, Sushil Jajodia and Ravi Sandhu, "A Single-Level Scheduler for the Replicated Architecture for Multilevel Secure Databases." *Proc. Seventh Annual Computer Security Applications Conference*, San Antonio, Texas, December 1991, pages 2-11.
180. Paul Ammann, Ravi Sandhu and Gurpreet Suri, "A Distributed Implementation of the Extended Schematic Protection Model." *Proc. Seventh Annual Computer Security Applications Conference*, San Antonio, Texas, December 1991, pages 152-164.
181. Ravi Sandhu, Roshan Thomas and Sushil Jajodia, "Supporting Timing Channel Free Computations in Multilevel Secure Object-Oriented Databases." *Proc. 5th IFIP WG11.3 Working Conference on Database Security*, Shepherdstown, West Virginia, USA, 4-7 November 1991, published as Database Security V: Status and Prospects, (Landwehr, C.E. and Jajodia, S., editors), North-Holland 1992, pages 297-314.
182. Ravi Sandhu and Sushil Jajodia, "Honest Databases That Can Keep Secrets." *Proc. 14th NIST-NCSC National Computer Security Conference*, Washington, D.C., October 1991, pages 267-282.
183. Ravi Sandhu and Gurpreet Suri, "A Distributed Implementation of the Transform Model." *Proc. 14th NIST-NCSC National Computer Security Conference*, Washington, D.C., October 1991, pages 177-187.
184. Ravi Sandhu, Roshan Thomas and Sushil Jajodia, "A Secure Kernelized Architecture for Multilevel Object-Oriented Databases." *Proc. IEEE Computer Security Foundations Workshop IV*, Franconia, New Hampshire, June 1991, pages 139-152.

185. Edgar Sibley, Bret Michael and Ravi Sandhu, "A Case Study of Security Policy for Manual and Automated Systems." *Proc. 6<sup>th</sup> Annual Conference on Computer Assurance (COMPASS 91)*, Gaithersburg, Maryland, June 1991, pages 63-68.
186. Sushil Jajodia and Ravi Sandhu, "Toward a Multilevel Secure Relational Data Model." *Proc. 17<sup>th</sup> ACM SIGMOD International Conference on Management of Data*, Denver, Colorado, May 1991, pages 50-59.
187. Paul Ammann and Ravi Sandhu, "Safety Analysis for the Extended Schematic Protection Model." *Proc. 12<sup>th</sup> IEEE Symposium on Research in Security and Privacy*, Oakland, California, May 1991, pages 87-97.
188. Sushil Jajodia and Ravi Sandhu, "A Novel Decomposition of Multilevel Relations into Single-Level Relations." *Proc. 12<sup>th</sup> IEEE Symposium on Research in Security and Privacy*, Oakland, California, May 1991, pages 300-313.
189. Sushil Jajodia, Ravi Sandhu and Edgar Sibley, "Update Semantics for Multilevel Relations." *Proc. Sixth Annual Computer Security Applications Conference*, Tucson, Arizona, December 1990, pages 103-112.
190. Paul Ammann and Ravi Sandhu, "Extending the Creation Operation in the Schematic Protection Model." *Proc. Sixth Annual Computer Security Applications Conference*, Tucson, Arizona, December 1990, pages 340-348.
191. Ravi Sandhu and Sushil Jajodia, "Integrity Mechanisms in Database Management Systems." *Proc. 13th NIST-NCSC National Computer Security Conference*, Washington, D.C., October 1990, pages 526-540.
192. Ravi Sandhu, "Separation of Duties in Computerized Information Systems." *Proc. 4th IFIP WG11.3 Working Conference on Database Security*, Halifax, U.K., 18-21 September 1990, published as Database Security IV: Status and Prospects, (Jajodia, S. and Landwehr, C.E., editors), North-Holland 1991, pages 179-189.
193. Sushil Jajodia and Ravi Sandhu, "Polyinstantiation Integrity in Multilevel Relations Revisited." *Proc. 4th IFIP WG11.3 Working Conference on Database Security*, Halifax, U.K., 18-21 September 1990, published as Database Security IV: Status and Prospects, (Jajodia, S. and Landwehr, C.E., editors), North-Holland 1991, pages 297-307.
194. Ravi Sandhu, Sushil Jajodia and Teresa Lunt, "A New Polyinstantiation Integrity Constraint for Multilevel Relations." *Proc. IEEE Computer Security Foundations Workshop III*, Franconia, New Hampshire, June 1990, pages 159-165.
195. Sushil Jajodia and Ravi Sandhu, "A Formal Framework for Single Level Decomposition of Multilevel Relations." *Proc. IEEE Computer Security Foundations Workshop III*, Franconia, New Hampshire, June 1990, pages 152-158.
196. Sushil Jajodia and Ravi Sandhu, "Polyinstantiation Integrity in Multilevel Relations." *Proc. 11<sup>th</sup> IEEE Symposium on Research in Security and Privacy*, Oakland, California, May 1990, pages 104-115.
197. Ravi Sandhu, "Mandatory Controls for Database Integrity." *3rd IFIP WG11.3 Working Conference on Database Security*, Monterey, California, USA, 5-7 September 1989, published as Database Security III: Status and Prospects, (Spooner, D.L. and Landwehr, C.E., editors), North-Holland 1990, pages 143-150.

198. Ravi Sandhu, "Transformation of Access Rights." *Proc. 10<sup>th</sup> IEEE Symposium on Security and Privacy*, Oakland, California, May 1989, pages 259-268.
199. Ravi Sandhu, "Terminology, Criteria and System Architectures for Data Integrity." *Proc. of the Invitational Workshop on Data Integrity*, (Ruthberg, Z.G. and Polk, W.T., editors), National Institute of Standards and Technology, Special Publication 500-168, September 1989, section A.4, pages 1-14.
200. Ravi Sandhu, "Transaction Control Expressions for Separation of Duties." *Proc. Fourth Aerospace Computer Security Applications Conference*, Orlando, Florida, December 1988, pages 282-286.
201. Ravi Sandhu, "On Some Cryptographic Solutions for Access Control in a Tree Hierarchy." *Proc. Second ACM-IEEE Fall Joint Computer Conference*, Dallas, Texas, October 1987, pages 405-410.
202. Ravi Sandhu and Michael Share, "Some Owner-Based Schemes with Dynamic Groups in the Schematic Protection Model." *Proc. 7<sup>th</sup> IEEE Symposium on Security and Privacy, Oakland, California*, April 1986, pages 61-70.
203. Ravi Sandhu, "Analysis of Acyclic Attenuating Systems for the SSR Protection Model." *Proc. 6<sup>th</sup> IEEE Symposium on Security and Privacy, Oakland, California*, April 1985, pages 197-206.
204. Ravi Sandhu, "The SSR Model for Specification of Authorization Policies: A Case Study in Project Control." *Proc. Eighth IEEE Computer Software and Applications Conference*, Chicago, Illinois, November 1984, pages 482-491.

**END**