

Professor Ravi Sandhu

**Executive Director and Chief Scientist, Institute for Cyber-Security Research (ICSR) & Lutchter Brown Endowed Chair of Cyber-Security, University of Texas at San Antonio.
Also Chief Scientist and Co-Founder, TriCipher Inc.**

Contact

Ravi Sandhu,

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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

Career Focus and Goals

My career has focused on high impact research and practice 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

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 information and system security, notably access control models and systems, and professional leadership in research journals and conferences.”

Highly Cited Papers

The most cited paper in Access Control with 2000+ Google Scholar citations.

1. Role-Based Access Control Models, IEEE Computer, 29(2):38-47, Feb. 1996.

The second-most cited paper in Access Control with 500+ Google Scholar citations.

2. Proposed NIST Standard for RBAC. ACM TISSEC, 4(3):224-274, Aug. 2001.

Paper with 300+ Google Scholar citations.

3. The ARBAC97 Model for Role-Based Admin. of Roles. ACM TISSEC, 2(1):105-135, Feb. 1999.

Papers with 200+ Google Scholar citations.

4. The NIST Model for Role-Based Access Control. 5th ACM RBAC:47-63, July 2000.
5. Configuring RBAC to Enforce MAC and DAC. ACM TISSEC, 3(2):85-106, May 2000.
6. Access Control: Principles and Practice. IEEE Communications, 32(9): 40-48, Sept. 1994.
7. Lattice-Based Access Control Models. IEEE Computer, 26(11): 9-19, Nov. 1993.

Papers with 100+ Google Scholar citations.

8. Role-Based Access Control on the Web. ACM TISSEC, 4(1):37-71, Feb. 2001.
9. Framework for Role-Based Delegation Models. 16th ACSAC:168-176, Dec. 2000.
10. Role-Based Authorization Constraints Specification. ACM TISSEC, 3(4):207-226, Nov. 2000.
11. Role-Based Access Control. Adv. in Computers, 46:237-286, Academic Press 1998.
12. Task-based Authorization Controls. 11th IFIP Data and Application Security:262-275, Aug. 1997.
13. The Typed Access Matrix Model. 13th IEEE Security and Privacy (Oakland):122-136, May 1992.

Research Highlights

- **Statistics:** 170+ papers (with 50+ co-authors), 9 USA patents, 12 PhD graduates, 30+ research grants.
- **Research sponsors include**
 - Govt.: NSF, NSA, NRO, NRL, NIST, DARPA, ARDA, AFOSR, Sandia, DOE, IRS, RADC, FAA.
 - Industry: Intel Corporation, Northrop Grumman, Lockheed Martin, ITT.

- **Recent research initiatives include**
 - The PEI (policy, enforcement, implementation) layered models methodology for synthesizing secure systems (since 2006, although the roots of PEI trace back to the OM-AM paper of 2000).
 - Using PEI for innovative applications of modern trusted computing including secure information sharing, secure knowledge management and collaboration systems (since 2004).
 - Development and applications of the UCON usage control model (since 2002).
 - Continued development of administrative models for RBAC (since 1997).
 - Security for the semantic web (since 2007).
- **Role-Based Access Control (RBAC).** 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.
- **Earlier research.** My research on multilevel secure databases and on safety in access control remains state-of-the art even today. Other significant contributions include influential papers on lattice-based access control, access control hierarchies, separation of duties and task-based access control.

Professional Leadership Includes

- Founding Series Editor, Synthesis Lectures on Info. Security, Privacy & Trust, Morgan-Claypool, 2006-.
- 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 Computer and Communications Security Conference (CCS) in 1993.
- Conference Founder, ACM Symposium on Access Control Models and Technologies (SACMAT) in 1995 (known as ACM Workshop on Role-Based Access Control prior to name change in 2001).
- Conference Steering Committee Chairman: ACM SACMAT.
- Conference Steering Committee Member: ACM CCS, IEEE CSFW.
- Past Program Chairman: CCS, SACMAT, CSFW, ACSAC, IFIP WG 11.3.
- Past General Chairman: CCS, SACMAT, CSFW.

Academic Career

- **Univ. of Texas at San Antonio, 2007-: Founding Executive Director and Chief Scientist, Institute for Cyber-Security Research (ICSR) and Lutchter Brown Endowed Chair of Cyber-Security**
Tenured Full Professor in the Department of Computer Science, College of Science.
ICSR spans multiple Colleges including the Colleges of Science, Engineering and Business.
- **George Mason University, 1995 onwards: Full Professor, 1989-1995: Associate Professor**
Department of Information and Software Engineering, George Mason University, Fairfax, Virginia
Director and founder of the Laboratory for Information Security Technology, 1995 onwards
- **Ohio State University, 1983-1989: Assistant Professor, 1982-1983: Instructor**
Department of Computer and Information Science, Ohio State University, Columbus, Ohio

Entrepreneurial and Consulting Career

- TriCipher Inc., 2000 onwards, Chief Scientist and Co-Founder
- 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

- My teaching is focused on Cyber-Security courses at the graduate level.
- I have been a leader in curriculum development throughout my career, notably at the MS & PhD level.
- I have presented short courses, tutorials and invited lectures all over the world including Asia, Australia, Europe, North America and South America.

Sponsored Research Grants

1. Information Operations Across Infospheres
Principal Investigator: Ravi Sandhu
Sponsor: *Air Force Office of Scientific Research*, 2006-2009
2. Secure Knowledge Management: Models and Mechanisms
Principal Investigator: Ravi Sandhu
Sponsor: *National Science Foundation*, 2005-2008
3. Deploying Secure Distributed Systems using LaGrande Technology: Models, Architectures and Protocols
Principal Investigator: Ravi Sandhu
Sponsor: *Intel Research Council*, 2004-2007
4. Usage Control Models, Architectures and Mechanisms Based on Integrating Authorizations, Obligations and Conditions
Principal Investigator: Ravi Sandhu
Sponsor: *National Science Foundation*, 2003-2006
5. Next Generation Authentication and Access Control for the FAA
Principal Investigator: Ravi Sandhu
Sponsor: *Federal Aviation Administration*, 2004-2005
6. 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*, 2003-05
7. Scalable Authorization in Distributed Systems
Principal Investigator: Ravi Sandhu
Sponsor: *National Science Foundation*, 1999-2002
8. Sonora: Secure Metadata Models and Architectures
Principal Investigator: Ravi Sandhu
Co-Investigator: Larry Kerschberg
Sponsor: *Northrop Grumman*, 2001-2002
9. Secure Objects
Principal Investigator: Ravi Sandhu
Co-Investigators: Larry Kerschberg and Edgar Sibley
Sponsor: *National Reconnaissance Office and National Security Agency*, 2000-2001
10. Security and Containment Policy for the Attack Sensing, Warning and Response Laboratory
Principal Investigator: Ravi Sandhu
Sponsor: *National Security Agency*, 1999-2000
11. Secure Role-Based Workflow Systems
Principal Investigator: Ravi Sandhu
Sponsor: *Naval Research Laboratory*, 1999
12. Control and Tracking of Information Dissemination
Principal Investigator: Ravi Sandhu
Sponsor: *Lockheed Martin*, 1999
13. Distributed Role-Based Access Control Models and Architectures

- Principal Investigator: Ravi Sandhu
Sponsor: *Sandia National Laboratories*, 1999
14. Role-Based Access Control on the Web
Principal Investigator: Ravi Sandhu
Sponsor: *National Security Agency*, 1998-99
 15. Secure Remote Access
Principal Investigator: Ravi Sandhu
Sponsor: *National Security Agency*, 1998
 16. Agent-Based Systems
Principal Investigators: Ravi Sandhu, Prasanta Bose, Elizabeth White
Sponsor: *National Security Agency*, 1998
 17. Multi-Layered Countermeasures to Vulnerabilities in Networked Systems
Principal Investigator: Ravi Sandhu
Sponsor: *National Security Agency*, 1996-97
 18. 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
 19. 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
 20. A Pragmatic Approach to the Design and Analysis of Composite Secure Systems
Principal Investigator: Ravi Sandhu
Sponsor: *National Security Agency*, 1994-97
 21. Design of Multilevel Secure Relational Databases
Principal Investigator: Ravi Sandhu
Sponsor: *National Security Agency*, 1994-96
 22. 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
 23. Architectures for Type-Based Distributed Access Control
Principal Investigator: Ravi Sandhu
Sponsor: *National Security Agency*, 1993-96
 24. Privacy Models and Policies
Principal Investigator: Andrew Sage, George Mason University
Investigators: Sushil Jajodia, Paul Lehner, Ravi Sandhu
Sponsor: *Internal Revenue Service*, Tax Systems Modernization Institute, 1995
 25. Derivation, Modeling, and Analysis of Access Control Systems
Joint Principal Investigators: Ravi Sandhu and Paul Ammann
Sponsor: *National Science Foundation*, 1992-95
 26. Unified Security Models for Confidentiality and Integrity

Principal Investigator: Ravi Sandhu
Sponsor: *National Security Agency*, 1992-94

27. Foundations of Multilevel Secure Object-Oriented Databases

Principal Investigator: Ravi Sandhu
Sponsor: *National Security Agency*, 1992-94

28. Polyinstantiation in Multilevel Relations

Principal Investigator: Sushil Jajodia
Co-Principal Investigator: Ravi Sandhu
Sponsor: *Rome Air Development Center*, Department of Defense, 1992

29. Models, Mechanisms and Methods for Integrity Policies

Principal Investigator: Ravi Sandhu
Sponsor: *National Security Agency*, 1989-92

30. 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. Xinwen Zhang, *Formal Model and Analysis of Usage Control*, GMU, Summer 2006. (Co-advisor: Francesco Parisi-Presicce.)
2. Mohammad Abdullah Al-Kahtani, *A Family of Models for Rule-Based User-Role Assignment*, GMU, Spring 2004.
3. Jaehong Park, *Usage Control: A Unified Framework for Next Generation Access Control*, GMU, Summer 2003.
4. Ezedin Barka, *Framework for Role-Based Delegation Models*, GMU, Summer 2002.
5. Pete Epstein, *Engineering of Role/Permission Assignments*, GMU, Spring 2002.
6. Qamar Munawer, *Administrative Models for Role-Based Access Control*, GMU, Spring 2000.
7. Gail-Joon Ahn, *The RCL 2000 Language for Role-Based Authorization Constraints*, GMU, Fall 1999.
8. Joon Park, *Secure Attribute Services on the Web*, GMU, Summer 1999.
9. Phillip Hyland, *Concentric Supervision of Security Applications: An Assurance Methodology*, GMU, Spring 1999.
10. Tarik Himdi, *A Scalable Extended DGSA Scheme for Confidential Data Sharing in Multi-Domain Organizations*, GMU, Spring 1998.
11. Srinivas Ganta, *Expressive Power of Access Control Models Based on Propagation of Rights*, GMU, Summer 1996.
12. Roshan Thomas, *Supporting Secure and Efficient Write-Up in High-Assurance Multilevel Object-Based Computing*, GMU, Summer 1994.

USA Patents

1. *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.
2. *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.
3. *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.
4. *One Time Password Entry to Access Multiple Network Sites.* Ravi Sandhu, Colin deSa and Karuna Ganesan. USA Patent 7,055,032. May 30, 2006.
5. *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.
6. *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.
7. *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.
8. *High Security Cryptosystem.* Ravi Sandhu, Colin deSa and Karuna Ganesan. USA Patent 6,940,980. September 6, 2005.
9. *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. 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.
2. 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.
3. 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).
4. 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.
5. 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.
6. 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.
7. Jaehong Park and Ravi Sandhu. "The UCON_{ABC} Usage Control Model." *ACM Transactions on Information and System Security*, Volume 7, Number 1, February 2004, pages 128-174.
8. 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.
9. 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.
10. 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.
11. 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.
12. Joon Park and Ravi Sandhu, "Secure Cookies on the Web." *IEEE Internet Computing*, Volume 4, Number 4, July 2000, pages 36-45.
13. 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.
14. 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.

15. 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.
16. 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.
17. 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.
18. 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.
19. 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.
20. 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.
21. Ravi Sandhu and Pierangela Samarati, "Access Control: Principles and Practice." *IEEE Communications*, Volume 32, Number 9, September 1994, pages 40-48.
22. Ravi Sandhu, "Lattice-Based Access Control Models." *IEEE Computer*, Volume 26, Number 11, November 1993, pages 9-19. **Cover Article.**
23. 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.
24. 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.
25. Paul Ammann and Ravi Sandhu, "The Extended Schematic Protection Model." *Journal of Computer Security*, Volume 1, Number 4, 1992, pages 335-383.
26. Ravi Sandhu, "Lattice-Based Enforcement of Chinese Walls." *Computers & Security*, Volume 11, Number 8, December 1992, pages 753-763.
27. Ravi Sandhu and Sushil Jajodia, "Eliminating Polyinstantiation Securely." *Computers & Security*, Volume 11, Number 6, October 1992, pages 547-562.
28. 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.
29. Ravi Sandhu, "Expressive Power of the Schematic Protection Model." *Journal of Computer Security*, Volume 1, Number 1, 1992, pages 59-98.
30. Ravi Sandhu and Sushil Jajodia, "Integrity Principles and Mechanisms in Database Management Systems." *Computers & Security*, Volume 10, Number 5, August 1991, pages 413-427.
31. 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.
32. Ravi Sandhu, "The Demand Operation in the Schematic Protection Model." *Information Processing Letters*, Volume 32, Number 4, September 1989, pages 213-219.

33. Ravi Sandhu, "The Reflected Tree Hierarchy for Protection and Sharing." *Information Processing Letters*, Volume 30, Number 1, January 1989, pages 21-26.
34. Ravi Sandhu, "Nested Categories for Access Control." *Computers & Security*, Volume 7, Number 6, December 1988, pages 599-605.
35. 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.
36. 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.
37. 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

38. Ravi Sandhu, "Role-Based Access Control." *Advances in Computers*, Volume 46, (M. Zelkowitz editor), Academic Press, pages 237-286, 1998.
39. Ravi Sandhu and Pierangela Samarati, "Authentication, Access Control and Intrusion Detection." In *The Computer Science and Engineering Handbook*, CRC Press, 1997, pages 1929-1948.
40. Sushil Jajodia, Boris Kogan and Ravi Sandhu, "A Multilevel-Secure Object-Oriented Data Model." In *Readings in Object-Oriented Systems and Applications*, (Rine, D. editor), IEEE Computer Society Press, 1995, pages 206-215.
41. 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.
42. 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.
43. 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.
44. 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.
45. 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.
46. 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

47. Xinwen Zhang, Michael J. Covington, Songqing Chen and Ravi Sandhu, "SecureBus: Towards Application-Transparent Trusted Computing with Mandatory Access Control." *Proc. 2nd ACM Symposium on Information, Computer and Communications Security (AsiaCCS)*, Singapore, March 20-22, 2007, pages 117-126.
48. Xinwen Zhang, Masayuki Nakae, Michael J. Covington and Ravi Sandhu, "A Usage-Based Authorization Framework for Collaborative Computing Systems." *Proc. 11th ACM Symposium on Access Control Models and Technologies (SACMAT)*, Lake Tahoe, CA, June 7-9, 2006, pages 180-189.
49. Ravi Sandhu, Kumar Ranganathan and Xinwen Zhang, "Secure Information Sharing Enabled by Trusted Computing and PEI Models." *Proc. 1st ACM Symposium on Information, Computer, and Communication Security (AsiaCCS)*, Taipei, Taiwan, March 21-24, 2006, pages 2-12. **Keynote Lecture**
50. Xinwen Zhang, Ravi Sandhu, and Francesco Parisi-Presicce, "Safety Analysis of Usage Control Authorization Models." *Proc. ACM Symposium on Information, Computer, and Communication Security (AsiaCCS)*, Taipei, Taiwan, March 21-24, 2006, pages 243-354.
51. Masayuki Nakae, Xinwen Zhang and Ravi Sandhu, "A General Design towards Secure Ad-hoc Collaboration." *Proc. 1st ACM Symposium on Information, Computer, and Communication Security (AsiaCCS)*, Taipei, Taiwan, March 21-24 2006, page 358.
52. Ravi Sandhu and Xinwen Zhang, "Peer-to-Peer Access Control Architecture Using Trusted Computing Technology." *Proc. 10th ACM Symposium on Access Control Models and Technologies (SACMAT)*, Stockholm, June 1-3, 2005, pages 147-158.
53. Ezedin Barka and Ravi Sandhu, "Role-Based Delegation Model/ Hierarchical Roles (RBDM1)." *Proc. 20th Annual Computer Security Applications Conference*, Tucson, Arizona, December 6-10, 2004, pages 396-404.
54. Mohammad Al-Kahtani and Ravi Sandhu, "Rule-Based RBAC with Negative Authorization." *Proc. 20th Annual Computer Security Applications Conference*, Tucson, Arizona, December 6-10, 2004, pages 405-415.
55. Ravi Sandhu, "A Perspective on Graphs and Access Control Models." *Proc. 2nd International Conference on Graph Transformation(ICGT)*, Roma (Italy), September 28 - October 2, 2004, Springer-Verlag LNCS Vol. 3256, pages 2-12. **Keynote Lecture.**
56. 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.
57. Roshan Thomas and Ravi Sandhu, "Towards a Multi-Dimensional Characterization of Dissemination Control." *Proc. 5th IEEE International Workshop on Policies for Distributed Systems and Networks*, Yorktown Heights, June 7-9, 2004, pages 197-200.
58. Xinwen Zhang, Jaehong Park, Francesco Parisi-Presicce and Ravi Sandhu, "A Logical Specification for Usage Control." *Proc. 9th ACM Symposium on Access Control Models and Technologies (SACMAT)*, New York, June 2-4, 2004, pages 1-10.

59. 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.
60. 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.
61. 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, Springer-Verlag Lecture Notes in Computer Science 2776, pages 17-31. **Keynote Lecture.**
62. 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.
63. Mohammad Al-Kahtani and Ravi Sandhu. "Induced Role Hierarchies with Attribute-Based RBAC." *Proc. 8th ACM Symposium on Access Control Models and Technologies*, Como, Italy, June 2-3, 2003.
64. Sejong Oh, Ravi Sandhu and Xinwen Zhang. "PBDM: A Flexible Delegation Model in RBAC." *Proc. 8th ACM Symposium on Access Control Models and Technologies*, Como, Italy, June 2-3, 2003.
65. 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, Springer-Verlag Lecture Notes in Computer Science, Volume 2612, pages 355-372.
66. Mohammad Al-Kahtani and Ravi Sandhu, "A Model for Attribute-Based User-Role Assignment." *Proc. 17th Annual Computer Security Applications Conference*, Las Vegas, Nevada, December 9-13, 2002, pages 353-362.
67. Jaehong Park and Ravi Sandhu, "Originator Control in Usage Control." *Proc. 3rd IEEE International Workshop on Policies for Distributed Systems and Networks*, Monterey, California, June 5-7, 2002, pages 60-66.
68. Sejong Oh and Ravi Sandhu, "A Model for Role Administration Using Organization Structure." *Proc. 7th ACM Symposium on Access Control Models and Technologies*, Monterey, California, June 2-4, 2002, pages 155-162.
69. Jaehong Park and Ravi Sandhu, "Towards Usage Control Models: Beyond Traditional Access Control." *Proc. 7th ACM Symposium on Access Control Models and Technologies*, Monterey, California, June 2-4, 2002, pages 57-64.
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