CYBERSPACE RESEARCH WORKSHOP

Proceedings of the

Cyberspace Research Workshop

June 15, 2009

Shreveport, Louisiana

Editors

Vir V. Phoha
Louisiana Tech University

S.S. Iyengar
Louisiana State University

The Cyberspace Research Workshop is hosted by the Center for Secure Cyberspace (CSC), a collaboration between Louisiana Tech and Louisiana State Universities. Funding for the CSC is made possible by a grant from the Louisiana Board of Regents Support Fund LEQSF(2007-12)-ENH-PKSFI-PRS-03.

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CYBERSPACE RESEARCH WORKSHOP

The Center for Secure Cyberspace (CSC) would like to thank everyone who submitted their important works and joined us to discuss emerging technologies, to share ideas, and to create opportunities for researchers and practitioners in various areas of cyber security. The theme of this year's workshop is "Cyber Security in the 21st Century." A diverse set of topics fall within the cyber security realm. The purpose of this workshop is to share work related to a wide range of areas within this realm.

2nd Cyberspace Research Workshop

Welcome Keynote Speakers and Special Guests!

Colonel James A. (Tony) Buntyn
Dr. Raymond Paul
Dr. Chittoor V. Ramamoorthy
Mr. Brian Spink
Mr. Craig Spohn
Dr. Rayford B. Vaughn

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Schedule of Events

June 16 - 18, 2009
Shreveport Convention Center

Tuesday, 6.16 - Thursday, 6.18
Air Force Cyberspace Symposium

The 2009 AFCS will focus on "Collaboration in Cyberspace" by bringing together the entire cyber community. While this year's symposium has an AF and DoD focus, the agenda has been expanded to also explore how other governmental agencies (DHS, NSA, CIA, FBI, etc.) operate and approach cyber. By fostering "real" collaboration, attendees will gain a better understanding of the interdependencies created by cyber across government, industry and academia.
For more information, visit www.cyberinnovationcenter.org.

CYBERSPACE RESEARCH WORKSHOP

GENERAL CHAIR
Les Guice

CONFERENCE CHAIRS
Stan Napper
Asok Ray

PUBLICATION & PROCEEDINGS CHAIR
Jean Gourd

PUBLICITY CHAIR FOR ANNOUNCEMENT & WEB
Christian Duncan

LOCAL ARRANGEMENT CHAIR
Brenda S. Brooks

TECHNICAL PROGRAM COMMITTEE

V. Phoha, Chair	**S. S. Iyengar, Chair**
A. Ray	**J. Gourd**
C. Duncan	**R. Selmic**
K. Balagani	**E. Karim**
T. Kosar	**G. Allen**
J. Zhang	**P. Wahjudi**

D. Ali

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Monday, June 15, 2009	
0800 - 0830	**Registration**
0830 - 0845	**Opener/Welcome** **Dr. Vir Phoha, Louisiana Tech University**
0845 - 1000	**Invited Talk** **Speaker: Dr. C.V. Ramamoorthy, Professor Emeritus, UC Berkeley** **Chair: Dr. S.S. Iyengar, Louisiana State University**
1000 - 1015	**Break**
1015 - 1200	**Session 1: Research I** **Chair: Dr. Christian Duncan, Louisiana Tech University** **4 Papers, each 20 minutes in length with 5 minute Q&A**
1015 - 1040	"The Cyber Intelligence Mecca: Ten Rules for Achieving Cyber Situational Awareness" Lookingglass Whitepaper
1040 - 1105	"Integration of the Visual Authentication of Spatial Data with Spatial-Temporal Class Taxonomies for Advanced Spatial Authentication Modeling to Create *Pretty Good Security*" Greg Vert, Jean Gourd, and S.S. Iyengar
1105 - 1130	"Maturing Cybersecurity Using BioThreat Experience and Resources" Norman Lee Johnson and Tim Williams
1130 - 1155	"Adaptive Security for MANETs via Biology" Richard Ford, Marco Carvalho, William H. Allen, and Frederic Ham
1200 - 1330	**Lunch** **Invited Speaker: Dr. Raymond Paul, NII/DoD-CIO** **Chair: Dr. Les Guice, Louisiana Tech University**
1330 - 1515	**Session 2: Work in Progress** **Chair: Dr. Jian Zhang, Louisiana State University** **4 Papers, each 20 minutes in length, with 5 minute Q&A**
1330 - 1355	"Movement Speed and Camera Distance Measurement for Human Motion Detection Based on Interocular Distance" Khandaker Abir Rahman, Kiran S. Balagani, Vir V. Phoha, and Chuka Okoye
1355 - 1420	"Detecting (Approximate) Hole Coverage Areas in Wireless Sensor Networks" Christian A. Duncan, Jinko Kanno, and Rastko Selmic
1420 - 1445	"Detecting and Combating Compromised Platforms in a Mobile Agent Infrastructure" Jeremy Kackley and Paulus Wahiudi
1445 - 1510	"Integrating Fuzzy Logic with FPGA-Based Technology for Network Intrusion Detection" Marbin Pazos-Revilla and Ambareen Siraj
1515 - 1530	**Break**
1530 - 1715	**Session 3: Research II** **Chair: Norman Lee Johnson, Referentia Systems, Inc.** **3 Papers, each 20 minutes in length with 5 minute Q&A**
1530 - 1555	"Developing Systems for Cyber Situational Awareness" James S. Okolica, J. Todd McDonald, Gilbert L. Peterson, Robert F. Mills, and Michael W. Haas
1555 - 1620	"Protecting Reprogrammable Hardware with Polymorphic Circuit Variation" J. Todd McDonald, Yong C. Kim, and Michael R. Grimaila
1620 - 1645	"Using Automatic Signature Generation as a Sensor Backend" Daniel Wyschogrod and Jefffrey Dezso
1730 - 1900	**Dinner Banquet** **Invited Speaker: Dr. Rayford B. Vaughn, Distinguished Professor, Mississippi State University** **Chair: Dr. Vir V. Phoha** ***Awards Ceremony: Dr. Les Guice and Dr. Stan Napper, Louisiana Tech University**

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MESSAGE FROM THE GENERAL CHAIR

It is my privilege to welcome to Shreveport all the distinguished guests and participants for the Second Cyberspace Research Workshop (CRW). We appreciate the support of the organizers of the 2009 Air Force Cyberspace Symposium (AFCS) by including this workshop as part of the Symposium.

The AFCS is organized under the theme of "Collaboration in Cyberspace" reflecting the broad participation of speakers and attendees across the public and private sectors. Academia certainly recognizes the importance of collaboration in advancing a complex interdisciplinary field of science such as cyberspace, and it is most fitting that this research workshop be a part of the AFCS.

Cyberspace is rapidly emerging as an area of national priority as reflected by the numerous reports, policies and budgets that are shaping the direction of future investments. Research and education are essential components of these plans and it is important that academia provide effective leadership in advancing the agenda. This workshop provides the opportunity for academia to interact with government and private sector leaders, to share information on the latest research findings, and to develop plans for the future.

Our institutions take this opportunity to thank the Cyber Innovation Center (CIC) for all of its support in fostering collaboration, research, and technology development in the cyberspace industry. The CIC staff has worked tirelessly to bring together academic, government, military, and private sector leaders to provide innovative solutions to the nation's critical cyber security and defense needs.

We also thank the Louisiana Board of Regents for its funding that has brought together Louisiana's leading cyber researchers to establish the new Louisiana Tech-LSU Center for Secure Cyberspace to promote research excellence in cyber-centric sensor systems. The Center has initiated research in new areas of interest to both the military and the civil sector.

Perhaps the most important measure of the success of a research conference is the quality of original research and the discussions and ideas that are generated. We hope the CRW provides you with a sense of intellectual fulfillment. Most importantly, we hope that you get opportunities to meet other researchers and take back to your institutions many ideas and friendships that will seed new research and collaborations.

Les Guice, General Chair

MESSAGE FROM THE PROGRAM CHAIRS

Welcome to the Second Cyberspace Research Workshop.

The first decade of the 21st century has provided the basis for fascinating new technologies that are emerging in cyberspace. These technologies are changing the way we live, are bringing new challenges in security and privacy of information, and are changing the way the nation, states and individuals fight and defend. Of the many new transformative trends, we think that three major technologies—cloud computing, social networks, and integration of cyber and physical systems—will usher new online landscapes. The rapid changes in cyberspace have brought new challenges: how will these technologies shape the cyberspace landscape? What social changes will they affect? What security and protection problems will they spawn? And what will the solutions to these problems be?

The purpose of this workshop is to gather, at one place, researchers, practitioners, and users of emerging technologies to discuss not only the foundational research that forms the basis of building secure systems for these transformative technologies, but also to ponder where the cyberspace landscape is heading, and whether we can (or should) steer it into a safer, more guided environment. Or perhaps the dangers of manipulating a huge dynamic force—the cyberspace domain will prove to be too much to control. Will any effort result in catastrophe? Are we better off to let nature take its course? Whatever the emerging landscape becomes, it is imperative that we respond to it and develop technologies to make it more secure. We hope that this workshop will start a "thinking" towards answering these questions.

We have organized the workshop to present fundamental research—you will see 11 peer-reviewed papers that discuss foundational methods and a work-in-progress session where preliminary and ongoing work is presented. Integration of research with practice is very important for a field such as cyberspace, and that is why it is by design that we are holding this workshop in conjunction with the Air Force Cyberspace Symposium.

This conference has required the efforts of many people: the keynote speakers, the authors of the papers, the reviewers, the program committee, and others too numerous to list here. We thank them all.

Vir V. Phoha and S. S. Iyengar, Program Chairs

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Chittoor V. Ramamoorthy is Professor Emeritus of Computer Sciences and Electrical Engineering at the University of California, Berkeley, and a Professor in the Graduate School. He has earned 6 degrees, two from the University of Madras, India, two from the University of California, Berkeley and two from Harvard University. He has won numerous awards and recognitions. He was among the 3 engineers to develop the first transistorized computer—Honeywell—under the late Dr. Eachus. He has been a Professor of Electrical Engineering and Computer Sciences since 1967. His contributions have been in the areas of software engineering, distributed and parallel computation and computer architecture.

He is a Life Fellow of the IEEE and a Fellow of the Society of Design and Process Science. He served as the Founding Editor in Chief of the IEEE Transactions on the Knowledge and Data Engineering and served as the Editor in Chief of the IEEE Transactions on Software Engineering.

He was elected and served as the First Vice-President, the very first V.P. for Education, and Governing Board Member in the IEEE Computer Society. He served on several advisory committees of the U.S. Government and academia. He has published more than 200 papers and co-edited three books.

Editorships/Program Committees

- Editor in Chief, Int. J. Software Engineering and Artificial Intelligence
- Editor in Chief, IEEE Trans. Software Engineering, 1983-1987
- Founding Editor in Chief, IEEE Trans. Knowledge and Data Engineering
- Co-Editor in Chief, International Journal of Design and Process Sciences
- Co-Editor in Chief, International Journal of Systems Integration
- Member, Editorial Board, Int. J. Information and Computer Systems
- Member, Editorial Board, J. Programming Languages
- Member, Editorial Board, Computer J. IEEE Computer Society
- Member, First Vice President for Education and Governing Board IEEE Computer Society

- Founding Director, International Institute of Systems Integration (Brazil)
- Member, International Advisory Board (Singapore)
- Member, Advisory Boards: U.S. Army, Air Force and the Navy; Los Alamos National Labs, Lockheed Research, IBM and The University Systems of Florida, Texas, Missouri, California, Toronto, etc.

Awards/Lectureships

- IEEE Software Quality International Conference, 2007
- International Conference of the Society of Design and Process Sciences, 2007
- College of Engineering of Andhra University (India) International Transdisciplinary Workshop
- Herbert Simon Award, 2006
- Donald Fink Prize Paper Award, 2003
- R.T. Yeh Distinguished Achievement Award, 2002
- IEEE Computer Society's Hitachi-Kanai Award, 2001
- IEEE Computer Society's Group Award in Education for Curriculum Development
- IEEE's Centennial and Millennium Medal, 1984
- Distinguished Scholar Award, Society for Design & Process Science, 1995
- IEEE Richard E. Merwin Award, 1993
- IEEE Computer Society Meritorious Service Award, 1991
- Keynote Speaker, IEEE International Conference on Distributed Computing Systems, 1991
- IEEE Computer Society Taylor Booth Award, 1990
- Keynote Speaker, IEEE International Conference on Data Engineering, 1991
- Keynote Speaker, Silver Jubilee Anniversary Conference of the Computer Society of India, 1990
- Best Paper Award, 1987
- IEEE Computer Society, Outstanding Paper Award, 1987
- Keynote Speaker, International Computer Symposium, Taiwan, 1988 and 1990

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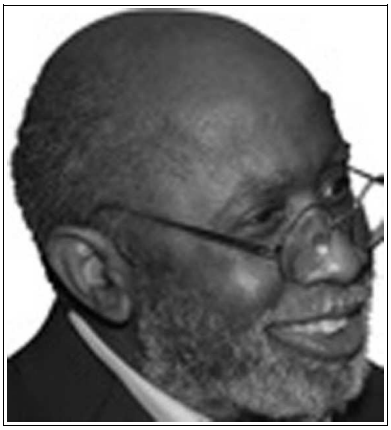

Raymond Paul has held many positions in the field of software engineering. Graduating from the University of Tokyo with a Doctorate in Software Engineering, Dr. Paul is an active member of the Institute of Electrical and Electronics and Engineers (IEEE) Computer Society. With the Department of the Navy, at Naval Sea Systems Command, Dr. Paul worked as a software engineer on AEGIS CG 47, Advanced Combat Direction System, and ADCAP MK 50. At the Army's Operational Test and Evaluation Agency, Dr. Paul developed the methodology for software test and evaluation for Army weapon systems. Currently, Dr. Paul serves in command and control (C2) Policy. In this position, Dr. Paul manages network enabled command and control systems engineering development for objective, quantitative and qualitative measurements. Dr. Paul's current research focus is on a dynamic integrated theoretic approach to C2 networks from multiple levels from dyadic to global. Understanding multiple concepts, theories at multiple levels along with attributes of nodes and the links may provide insight to better understand C2 organizational networks that are created, maintained, and reconstituted. Lastly, Dr. Paul is developing a methodology for dynamic environment decision making pertaining to real time data from sensors, software/systems and related processes and the risk identification and management framework that includes internal and external variabilities.

He has published chapters in 4 books and more than 74 articles on software engineering in various technical journals and symposia proceedings, primarily under Department of Defense (DoD) and IEEE sponsorship. He has authored chapters in 4 technical books concerning software engineering.

Awards/Lectureships

- Keynote Speaker, International Conference on Systems Integration Brasilia, Brazil
- Keynote Speaker, International Command and Control Technology Symposium
- Keynote Speaker, ACIS International Conference on Software Engineering Research and Applications
- Keynote Speaker, GSC Security Technology Summit
- Keynote Speaker, ICTAI: Evolutionary Computing and Genetic Algorithms
- Keynote Speaker, International Conference on Semantic Computing

Editorships/Program Committees

- Founding Board Member, Society for Design and Process Science
- Technology Advisory Board, Milwaukee Institute
- Technical Director, C2 Software Engineering; Command & Control Policy Directorate; Networks and Information Integration
- Co-Sponsor, Department of Information and Software Engineering
- Member, Institute of Electrical and Electronics Engineers Computer Society
- Member, ACM

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Rayford B. Vaughn is currently a William L. Giles Distinguished Professor and the Billy J. Ball Professor of Computer Science and Engineering at Mississippi State University (MSU). He teaches and conducts research in the areas of Software Engineering and Information Security. He also directs two research centers at MSU working in the areas of computer security and critical infrastructure protection. Prior to joining the University, he completed a twenty-six year career in the Army where he commanded the Army's largest software development organization and created the Pentagon agency that today centrally manages all Pentagon IT support. While on active duty with the Army, he served a three-year assignment with the National Security Agency's (NSA) National Computer Security Center where he authored national level computer security guidance and conducted computer security research.

Today, Dr. Vaughn has over 100 publications to his credit and is an active contributor to software engineering and information security conferences and journals. He is actively engaged in computer security research at Mississippi State University particularly in the area of control system security.

Awards/Lectureships

- Most Outstanding Faculty Member at MSU (awarded by the State Legislature), 2009
- William L. Giles Distinguished Professor
- Most Outstanding Academic Award by National Colloquium on Information Systems Security Education, 2005
- Mississippi State University Eminent Scholar, 2004
- Established Mississippi State University Center of Computer Security Research (2001) and the Critical Infrastructure Protection Center (2005)

Editorships/Program Committees

- Editorial Board, International Journal of Information Technology Decision Making (IT&DM), 2001-Present

- Member, Editorial Board, The International Journal of Computer and Internet Security (International Research Publication House), 2008-Present
- Principal Investigator, NSF Scholarship for Service (SFS) program and the DoD Information Assurance Scholarship Program
- Editorial Board, CrossTalk, Journal of Defense Software Engineering, 2005-2009

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Colonel James Anthony (Tony) Buntyn is a Systems Engineer for Raytheon/Network Centric Systems (NCS) Cyber Defense Solutions. He supports the efforts in Information Assurance and Information Operations. He is a Colonel in the United States Air Force (USAF) Reserve. Since 9/11 he has been activated three times. He just returned from spending two years at Barksdale Air Force Base where he was the Vice Commander of AFCYBER(P), under Major General Bill Lord. He worked closely with the Eighth (8th) Air Force (AF) since they were the force behind the initial effort to establish the Major Command.

He is very familiar with the USAF efforts to stand up the new twenty-fourth (24th) AF and all of the structure and capabilities that will move into the 24th AF. The twenty-fourth AF will stand up under AFSPACE. He was mostly responsible for establishing the organization and negotiation within the USAF to create what was to become AFCYBER. He worked with AFRL to direct relevant Cyber R&D and with the Electronic Systems Center (ESC) to create more responsive acquisition. He has spoken all over the country and in Europe on the USAF Cyberspace Command and Cyber Warfare. He worked for Lt. Gen. Robert Elder to help create the USAF Partnership with Industry with a goal of helping key Industrial Base partners secure sensitive weapon system data. In 2002-2004 he led the team that built the Combined Air Operations Center (CAOC) at Al Udeid AB, Qatar, and was the Deputy H6. In 2004-2005, he worked for Gen. Carlson at Barksdale to stand up the AF Network Operations and Security Center.

Awards/Credits/Lectureships

- Certified Information Systems Security Professional, (CISSP)
- Director, Global Cyberspace ACO at USAF 8AF
- AFCYBER(P) Command Vice Commander – USAF, 2007-2008
- Commander – 254th Combat Communications Group, 2000-2007
- Director, AFNOSC Program Management Office – USAF/8AF, 2004-2005
- Information Assurance Technical Lead at USSOCOM
- 26 Military Awards and Decorations
- 7 Promotions in Rank Structure

Editorships/Program Committees

- MEMBER – Air Force Scientific Advisory Board, Cyber Warfare Study Group

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Brian Spink has worked at the Air Force Research Laboratory (AFRL) for the last 29 years. He is a graduate of Clarkson University and Syracuse University in the field of Electrical Computer Engineering with a BS and MS, respectively. Mr. Spink currently is the AFRL Commander Representative to the 8th AF/AFCYBER(P) located at Barksdale Air Force Base (AFB), Louisiana.

Prior to this assignment, he was a Senior Electronic Engineer working in the Cyber Operations and Distributed Computing Branches of the Air Force Research Laboratory in Rome, New York.

Mr. Spink has a long history of Satellite, Terrestrial and Airborne Network Communications Research and Development. For the last 14 years he has been working in the area of Computer Network Security in both wired and wireless environments.

Awards/Credits/Lectureships

- 2006 & 2008 AFRL Special Act Service Award
- 2004 AFRL Cyber Team Award
- AFRL Small Business Innovative Research Program, 2008 University of Houston Cyber Conference
- Acting Branch Chief – Distributed Computing Branch
- Acting Technical Advisor – Computer Network Defense Branch

Program Committees

- Liaison, CIC Science & Technology Advisory Council
- Past Chairman of the Mohawk Valley IEEE Section
- Co-Chairman, IEEE Communication Society, Mohawk Valley Section
- Chairman, AOC Education Awards Panel and AOC Board Member

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Craig Spohn has twenty years of business experience in the Information Technology field, working in international, commercial and federal government markets. Currently, Craig is the Executive Director of the Cyber Innovation Center (CIC). The CIC is part of a public/private initiative whose mission is to support research, educational and technological advancement for the cyber mission and to foster collaborative and strategic alliances between governmental agencies, private industry and academic institutions.

Before serving as the Executive Director of the CIC, Craig was the Director of an Information Technology Consulting Group for a Shreveport-based technology company. Prior to returning to Shreveport-Bossier, Craig was with Science Applications International Corporation (SAIC), a large defense contractor. At SAIC, Craig served as Vice President for Middles East Business and coordinated SAIC's Saudi Arabian business activities as General Manager of the Saudi Joint Venture.

Craig and his wife, Stacy, have a son, Sam, and two daughters, Caroline and Sarah-Catherine.

Editorships/Program Committees/Memberships

- AFCEA
- Rotary of Shreveport
- Military Affairs Council
- Louisiana Committee of 100
- Bossier Chamber of Commerce Board
- LSU-S Science and Technology Council
- Biomedical Research Foundation of NW LA
- Louisiana Committee for Economic Development
- Consortium for Education, Research and Technology
- Louisiana Tech Computer Science Industrial Advisory Board
- Vice Chairman of Governor Jindal's Transition Team for Higher Education

Works Presented

[1] C.A. Duncan, J. Kanno, and R. Selmic. Detecting (approximate) hole coverage areas in wireless sensor networks. In *Proceedings of the 2nd Cyberspace Research Workshop*, Shreveport, LA, June 2009.

[2] R. Ford, M. Carvalho, W.H. Allen, and F. Ham. Adaptive security for manets via biology. In *Proceedings of the 2nd Cyberspace Research Workshop*, Shreveport, LA, June 2009.

[3] N.L. Johnson and T Williams. Maturing cybersecurity using biothreat experience and resources. In *Proceedings of the 2nd Cyberspace Research Workshop*, Shreveport, LA, June 2009.

[4] J. Kackley and P. Wahjudi. Detecting and combating compromised platforms in a mobile agent infrastructure. In *Proceedings of the 2nd Cyberspace Research Workshop*, Shreveport, LA, June 2009.

[5] J.T. McDonald, Y.C. Kim, and M.R. Grimaila. Protecting reprogrammable hardware with polymorphic circuit variation. In *Proceedings of the 2nd Cyberspace Research Workshop*, Shreveport, LA, June 2009.

[6] J.S. Okolica, J.T. McDonald, G.L. Peterson, R.F. Mills, and M.W. Haas. Developing systems for cyber situational awareness. In *Proceedings of the 2nd Cyberspace Research Workshop*, Shreveport, LA, June 2009.

[7] M. Pazos-Revilla and A. Siraj. Integrating fuzzy logic with fpga-based technology for network intrusion detection. In *Proceedings of the 2nd Cyberspace Research Workshop*, Shreveport, LA, June 2009.

[8] K.A. Rahman, K.S. Balagani, V.V. Phoha, and C. Okoye. Movement speed and camera distance measurement for human motion detection based on interocular distance. In *Proceedings of the 2nd Cyberspace Research Workshop*, Shreveport, LA, June 2009.

[9] G. Vert, J. Gourd, and S.S. Iyengar. Integration of the visual authentication of spatial data with spatial-temporal class taxonomies for advanced spatial authentication modeling to create pretty good security. In *Proceedings of the 2nd Cyberspace Research Workshop*, Shreveport, LA, June 2009.

[10] Lookingglass Whitepaper. The cyber intelligence mecca: Ten rules for achieving cyber situational awareness. In *Proceedings of the 2nd Cyberspace Research Workshop*, Shreveport, LA, June 2009.

[11] D. Wyschogrod and J. Dezso. Using automatic signature generation as a sensor backend. In *Proceedings of the 2nd Cyberspace Research Workshop*, Shreveport, LA, June 2009.