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EDUCATION

BSEE Universidad de Puerto Rico, Mayaguez Campus, 1970

MSECE University of Massachusetts, Amherst, 1973

PH.D   Electrical & Computer Engineering, 1977.

E M P L O Y M E N T

Associate Research Professor & **2002 – Present**
Director WPI System Security Research Laboratory

Associate Research Professor. Primary research areas are: Security and security architectures, worm and zero-day worm modeling, efficiency of security protocols in wireless networks, and the design of Intrusion Detection and Countermeasure Systems. Major contributions over the last two years as a Research Professor include:

- **WPI System Security Research Laboratory:**

Founder and director of the WPI System Security Research LAB, see http://wssrl.wpi.edu/. . Currently the Lab includes 3 faculty members, 5 MS students, 2 Ph.D students, and several undergraduate students working on multiple security related projects. The Lab received total funding of approximately $ 100,000 from private corporations in CY 2004. Over the last two years the WSSRL lab has been involved in the following research efforts:

1. *SAFE,* is a distributed Intrusion Detection and Countermeasure System (IDCS) based on the principles of "the Wisdom of Crowds". That is, under the right set of circumstances groups are remarkably intelligent, and often more intelligent that the smartest member of the group. In this context, collective observations by multiple agents within SAFE, reach consensus around what nodes have been compromised or failed. Making use of Byzantine Agreement Protocols developed earlier by Lamport, BAP arrives at consensus. Once, a consensus has been reached, the offending nodes can be isolated and countermeasure actions initiated by the system. *SAFE version 1.1* will be released to the general academic community in the spring of 2004-2005 academic calendar.

2. *Worm and Zero-day Worm modeling.* Primary research in this area has been the creation of worm models that accurately reflect the propagation of computer viruses and worms in corporate environments. Specifically, understanding the impact of node diversity (Linux, MAC, VMS, IBM 360, UNIX variants, etc), bandwidth and topological constraints (not all nodes sit at the end of 1 Gbs link), and system countermeasures (removal and blocking of infected nodes) have on the overall propagation of the worm or virus. Major contributions of this efforts include: (a) the creation of a generalized behaviorally based worm model, and (b) the development of SSFNet *worm* simulator and simulation environment to be release in January 2004. *SSFNet-ZeroDayWorm, version 1.1, is* based on the SSFNet simulator developed by Michael Liljenstan at Dartmouth.

3. *Chimera, Swarms, and Swarm Attacks:* In order to study the effectiveness of current and future IDCS systems, the creation of new worms and malicious attacks is imperative.

Chimera is an effort at WSSRL designed to generate effective attacks and worms that have not been seen previously in the wild. The fundamental technologies behind Chimera are: (a) behavioral worm models, (b) Swarm Intelligence, and "Swarm Attacks".

4. *Efficiency of Wireless Security Protocols:* The use of wireless networks is increasing at an unparallel pace combined with the slow rate of performance improvement associated with battery life has force researchers to investigate the problem of energy dissipation associated with wireless protocols. This project attempts to remedy some of the limitations of previous efforts which by enlarge ignored the impact of security protocols such as 802.11x on battery life. Specific contributions of this work include empirical, as well as analytical, measurement and analysis of the most popular security wireless protocols today such as WEP, TKIP, and CCMP. In addition, a model enabling design tradeoffs between energy and security has been developed.

5. *Trust and Security in Peer Networks:* In a peer network environment, nodes collaborate to achieve some collective end. There is no hierarchy within the network, all nodes being given equal authority. No channel to nodes outside of the peer network is assumed to exist. In this untraditional environment, traditional security properties and assurance of fairness must be guaranteed. One solution that has been proposed is the formation of a Trusted Domain, and exclude perceived dishonest and unfair members. . However, such proposed solutions have been intolerant of masquerading, and have suffered from a lack of precise control over the allocation and exercise of privileges within the Trusted Domain. In this work, a new "Trust" model based on observations of social behavior and how trust is created and maintained by social groups has been developed. The model is robust in the sense that solves previous noted masquerading problems, does not depend on a central authority, and minimizes the potential of collusion amongst malicious nodes. A first implementation of the model called "Secure-Share" base on the Gnutella protocol is currently under development.

- **Master Thesis Supervised:**

  1. David Toth, *"The Byzantine Agreement Protocol Applied to Security"*, Expected Completion Date: December 2004.

  2. Frank S. Posluszny III, *"Overcoming the Limitations of Computer Worm Models",* Expected Completion date: January 2005.

  3. Kerry McKay: Tradeoffs Between Energy and Security in Wireless Networks, Expected completion date, March 2005.

  4. Justin Whitney, *"A Stratified Incentive Model for Trusted Domain Formation and Maintenance in Peer Networks",* May 2005.

- Departmental Contributions:

  1. Founder, primary driver behind the 1st WPI Faculty Research Retreat in Nantucket Island, June 2003

  2. Founder, primary driver behind the 1st WPI Student Research Retreat in Nantucket Island, June 2004

  3. Creator and Founder of WPI Milestones In Computer Science Distinguished Lecture Series, AY 2003-2004, AY 2004-2005.

- **Patents:**
  Application in progress: "Three New Algorithms for constructing pseudo-random binary sequences" with Andras with Sarkozy and Gabor Sarkozy.

President & CEO,   **1993 - 2001**
Acunet.net

Founder, President & CEO of Acunet.net, Inc. Acunet, until its sale in 2001, was a provider of eBusiness and eCommerce products and solutions World Wide. Dr. Colon Osorio was instrumental in the design and development of Acushop^{TM}, a 4th generation eCommerce platform.

Founder, President & CEO of the Acumen Consulting Group, Inc. Dr. Colon Osorio Started the company and grew the company to a 50-person firm before selling his controlling interest in 1998.

Senior Executive Vice President,   **1992**
Kendall Square Research

Responsible for the development of the KSR-1 and KSR-3 systems. Included the management of a multi-disciplinary engineering organization, as well as ongoing support of the KSR-1.

Corporate Consulting Engineer and   **1988 - 1992**
Senior Group Manager
Information Systems Business Unit, Digital Equipment Corporation

As one of 15 Corporate Consulting Engineer, served as member of the Strategic Task Force (STF). In this capacity, we were responsible for setting both the product and technology direction for the corporation. This included making recommendations to the office of the President on core physical technologies such as semiconductors & heads/media, system technologies such as Operating Systems and Networks, as well as System & Applications Software strategies. Specifically, a five-year technology and product development strategy will be developed and updated annually.

Senior Consulting Engineer and   **1976 - 1988**
Senior Engineering Manager
High Performance Systems, Digital Equipment Corporation

Led the development and market introduction of the Vax 8650, a 1.5X performance improvement over the VAX 8600.   One of the principal architects and project leader of the VAX 8600. Managed the VAX 8600 design validation, product debug, and introduction to manufacturing. Introduced software simulation models, and novel design verification techniques (such as I/O transactors) to reduce time to market.

From 1981 through 1982, as a Consulting Engineer and/or Engineering Manager led the development of multiple engineering and research projects. These include: (1) a 1.0u single chip VAX. This development later became the uVAXII chip set, Digital's most successful semiconductor development to date;

From 1976 through 1981:

- Principal architect of the PDP-11/60 FP11E, the floating point accelerator to the PDP-11/60. This implementation was the first in its class by introducing a Wallace tree for floating point multiplication, as well as using the Newton-Raphason approximation method to division.

- Principal architect of the 1st implementation of Digital Equipment Corporation CIS (Commercial Instruction Set) on a PDP-11, the PDP-11/44.
- Research & Development of several multiprocessor software and hardware development projects based on LSI-11 technology, including D^2FMP – a dedicated function multiprocessor implantation using LSI-11 processors.

ACADEMIA & PUBLIC SECTOR

Aside from his extensive industrial experience, Dr. Colon Osorio has been involved through the years with both academia and the public sector. Specifically, Dr. Colon Osorio held an Associate Professorship appointment at the University of Connecticut was Associate Editor of the IEEE Transaction on Computers from 1978 to 1982, published numerous articles in the computer field and a textbook on artificial intelligence entitled "Engineering Intelligent Systems". In the public sector, Dr. Colon Osorio has been a member of the Council for Economic Advisors on Technology to the Governor of Puerto Rico, and has been chairperson or board member of several public corporations.

HONOR & SOCIETIES

Member of the IEEE and ACM Societies. Received the Meritorious Service Award from the IEEE in 1982 for contributions to the IEEE Transactions In Computers.

PUBLICATIONS

TEXTBOOKS:

1. *"Engineering Intelligent Systems: Concepts, Theory, and Applications", with R.M. Glorioso, Digital Press, July 1980, Bedford, Massachusetts. Graduate Textbook in the field of artificial intelligence.*

Archival Journal:

1. *"CI Bus Arbitration Performance in a VAXCluster system", with Xi-Ren Cao, and Nii N. Quaynor, Digital Technical Journal, Number 5, September 1987.*

2. *"The VAX 8600 I Box, A Pipeline Implementation of the Vax Architecture", with Mario Troiani, S. Stephen Ching, Nii Quaynor, and John Bloem, Digital Technical Journal, Number 1, August 1985.*

Refereed Conferences:

1. *""Measuring Energy-Security Tradeoffs in Wireless Networks", Fernando C. Colon Osorio, Emmanuel Agu and Kerry McKay, accepted for publication IEEE 24th International Performance and Communications Conference, Phoenix, Arizona.*

2. *"Trust, the "Wisdom of Crowds, and Societal Norms: the Creation, Maintenance, and Reasoning about Trust in Peer Networks", with Justin Whitney, submitted for publication to TSPUC 2005. First International Workshop on Trust, Security and Privacy for Ubiquitous Computing, Taormina, Italy,*

3. *"Code Optimization for the Vax 8600", with S. Stephen Ching, et.al. 19th Hawaiian Conference on Systems Science, January 1986.*

4. *"A High End Vax – A Pipeline Implementation of the VAX Architecture", with R.M. Glorioso, Trigve Fossum, et.al. Proceedings of the 17th Annual Microprogramming Workshop, New Orleans, Louisiana, October 30 – November 2, 1984, pp. 258.*

5. *"Software Validation of a Complex Microarchitecture", by Fernando C. Colon Osorio, et.al. Proceedings of the 17th annual Microprogramming Workshop, New Orleans, Louisiana, October 30 – November 2, 1984, pp. 261.*

6. *"Tradeoffs in the Design of a System For High Level Interpretation", IEEE International Conference on Computer Design: VLSI Computers, ICCD '83, October 3 – November 3, 1983.*

7. *"RISC and CISC – Two Different Perspectives to An Identical Problem", Spring Computer Conference, COMPCOM '83, February 1983.*

8. *"Analysis of a Multiple Processor System: A Case Study of DFMP", with R.M. Glorioso and D.W. Li, Digest of Papers, September, 1976, COMPCON, Washington, D.C., IEEE Catalog Number 76CH1115-5C.*

9. *"Coupling Small Computers For Performance Enhancement", with R.M. Glorioso and Walter H. Kohler, Fifth Annual Conference on Modeling and Simulation, Volume 5, Number 2, pp. 819-824, April, 1974.*

10. *"A Unified Approach to Multiclass Classification and Clustering Problems", with R.M. Glorioso, Proceedings of the IEEE 1973 International Conference on Cybernetics and society.*

Technical Reports

1. *"Measuring the Tradeoffs Between Energy and Security in a Wireless Networks", WSSRL Technical Report, WSSRL-2004-06-09, July 2004.*

2. *"Tradeoffs Between Energy and Security in Wireless Networks". With Emmanuel Agu and Kerry McKay, WPI-CS-TR-04-11, April 2004.*

3. *"Applying Byzantine Agreement Protocols to the Intrusion Detection Problem in distributed systems", with Xiaoning Wang, WPI-CS-TR-03-01, Worcester Polytechnic Institute, January 2003.*

4. *"I/O Task Force Report – A look at Alpha Generation I/O Subsystems". With Barry Rubinson, Roger Wolfe, Jeff East, Dieter Gawlick, Stan Amway, David Thiel, Dileep Bhandarkar, Bob Willard, Catherine Van Ingen, Bob Bean, Richie Lary, Martin Czekalski, Charlie Cassidy, and Richard Sites, Internal Report prepared for the Office of the President, July 1990.*

5. *"Strategies for Improving VAXCluster Performance", by Fernando C. Colon Osorio 1988 Annual report, System Performance Group, HPS systems Research and Engineering pp. 1-1 to 1-20.*

6. *"Characterizing Computer Performance with Axioms", with Nii N. Quaynor, Xi-Ren Cao, and Dale Park, 1988 Annual Report, System Performance Group, HPS Systems Research and Engineering pp. 5-2 to 5-18.*

7. *"Final Report on the Vax Architecture Extensions Task Force, Fernando C. Colon Osorio, chair, with Doug Clark, DEC Internal Report, July 1986.*

8. *"Vax Architectural Extensions – VAX Vectors", final report, Fernando C. Colon Osorio. Chair with Dileep Bhandarkar, and Rich Grove, DEC Internal Report, April 1986.*

9. *"The Virtual Memory and Cache Unit of the Vax 8600", with William Bruckert, and Nii N. Quaynor, DEC Internal Report, October 1984.*

10. *"Evaluation of Stochastic Automata Models as Task Schedulers in Multiple Processor Systems", by Fernando C. Colon Osorio, DEC Technical Reports, TR-78-32, July 1978.*

R E F E R E N C E S

1. Dr. Yale N. Patt, Professor of Electrical and Computer Engineering and the Ernest Cockrell, Jr. Centennial Chair in Engineering at The University of Texas at Austin.

2. Prof. Dan Sieworek, Director Human Computer Interaction Institute, Professor Electrical and Computer Engineering at Carnegie Mellon University, and Buhl University Professor of Electrical and Computer Engineering.

3. Prof. Micha Hofri, Professor of Computer Science, Worcester Polytechnic Institute.

4. Mr. Robert Everett, Retired President of MITRE Corporation, and member of BOD at Digital Equipment Corporation.

5. Dr. Samuel Fuller, V.P. Research & Development and Corporate Officer Analog Devices Corporation

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