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Education

Ph.D., Computer Science	1998	Georgia Institute of Technology
M.S., Computer Science	1993	Baylor University
B.S., Computer Science	1991	Baylor University

Experience

Jun. 1998 to Present — Baylor University
Professor of Computer Science

May. 2022 to Present — Central Texas Cyber Range
Central Texas Cyber Range (CTCR) Director of Research and Development

Jun. 2002 to Present — ICPC Headquarters
Deputy Executive Director of the ICPC
Executive Director of World Finals
Director of ICPC HQ Services

Sept. 1996 to Jun. 1998 — Georgia Institute of Technology
Graduate Research Assistant, Telecomm Group

Jun. 1996 to Sept. 1996 — Intel Architectures Lab
Intern

Peer Reviewed Publications

- Ernesto Quevedo Caballero, Michael J. Donahoo, and Tomas Cerny. Fairness Analysis of Deep Reinforcement Learning based Multi-Path QUIC Scheduling, SAC '23: Proceedings of the 38th ACM/SIGAPP Symposium on Applied Computing, Pages 1772–1781, March 2023.
- Rohit Singh, Shaun Hutton, Michael J. Donahoo, and Douglas Sicker. Toward Grading Cybersecurity & Resilience Posture for Cyber Physical Systems. SSRN. 2021.
- Tomas Cerny, Michael J Donahoo. Survey on Compromise-Defensive System Design. International Conference on Information Science and Applications, pgs. 513-521, 2019.
- Tomas Cerny, Filip Sedlisky, Michael J Donahoo. On Isolation-driven Automated Module Decomposition. Proceedings of the Conference on Research in Adaptive and Convergent Systems, pgs. 302-307, 2018.

- Safwan Malwood Hussein, Michael J Donahoo, Tomas Cerny. Security Challenges in Smart City Applications. International Conference on Security and Management. CSREA Press, pgs. 306-310, 2018.
- Tomas Cerny, Michael J Donahoo, Michal Trnka. Contextual Understanding of Microservice Architecture: Current and Future Directions. ACM SIGAPP Applied Computing Review, 17 (4), pgs. 29-45, 2018.
- Tomas Cerny, Michael J Donahoo. Second Screen Engagement of Event Spectators. Advances in Human-Computer Interaction, 2018.
- Tomas Cerny, Michael J. Donahoo, Jiri Pechanec. Disambiguation and Comparison of SOA, Microservices and Self-Contained Systems. Proceedings of the International Conference on Research in Adaptive and Convergent Systems, RACS 2017, Krakow, Poland, ISBN 978-1-4503-5027-3, pgs. 228-235, 2017.
- Tomas Cerny, Michael J Donahoo. On energy impact of web user interface approaches. Cluster Computing, Vol. 19, Issue 4, pgs. 1853-1863, 2016.
- Tomas Cerny, Michal Trnka, Michael J Donahoo. Towards Shared Security through Distributed Separation of Concerns. Proceedings of the International Conference on Research in Adaptive and Convergent Systems, pgs. 169-172, 2016.
- Tomas Cerny, Michael J Donahoo. Survey on Second Screen Systems. Proceedings of the 6th International Conference on IT Convergence and Security (ICITCS), 2016.
- Karel Cemus, Tomas Cerny, Lubos Matl, Michael J Donahoo. Aspect, Rich, and Anemic Domain Models in Enterprise Information Systems. In Proceedings of SOFSEM: Theory and Practice of Computer Science, 2016.
- Tomas Cerny, Michael J Donahoo. Survey on Concern Separation in Service Integration. In Proceedings of SOFSEM: Theory and Practice of Computer Science, 2016.
- Tomas Cerny, Michael J Donahoo. Impact of Remote User Interface Design and Delivery on Energy Demand. In Proceedings of the International Conference on Information Science and Security (ICISS), 2015.
- Karel Cemus, Tomas Cerny, Michael J Donahoo. Evaluation of Approaches to Business Rules Maintenance in Enterprise Information Systems. In Proceedings of the Conference on Research in Adaptive and Convergent Systems, 2015.
- Karel Cemus, Tomas Cerny, Lubos Matl, Michael J Donahoo. Enterprise Information Systems: Comparison of Aspect-driven and MVC-like Approaches. In Proceedings of the Conference on Research in Adaptive and Convergent Systems, 2015.
- Tomas Cerny, Michael J Donahoo. On Separation of Platform-independent Particles in User Interfaces. In Proceedings of Cluster Computing, 2015.
- Tomas Cerny, Miroslav Macik, Michael J Donahoo, Jan Janousek. On Distributed Concern Delivery in User Interface Design. In Computer Science and Information Systems, 2015.
- Lubos Matl, Tomas Cerny, Michael J. Donahoo. Effective Manycast Messaging for Kademlia Network. In Proceedings of 30th ACM/SIGAPP Symposium On Applied Computing, 2015.
- Karel Cemus, Tomas Cerny, Michael J. Donahoo. Automated Business Rules Transformation into a Persistence Layer. Procedia Computer Science Journal, Elsevier, 2015.
- Tomas Cerny, Michael J.Donahoo. Separating out Platform-independent Particles of User Interfaces. In Proceedings of International Conference on Information Science and Applications, LNEE, Springer, 2015.

- Tomas Cerny, Lubos Matl, Karel Cemus, Michael J. Donahoo. Evaluation of Separated Concerns in Web-based Delivery of User Interfaces. In Proceedings of International Conference on Information Science and Applications, LNEE, Springer, 2015.
- Tomas Cerny, Miroslav Macik, Michael J. Donahoo, Jan Janousek. Description and Cache Performance in Aspect-Oriented User Interface Design. In Proceedings of the 2014 Federated Conference on Computer Science and Information Systems, ACSIS, volume 2, pages 1667–1676. IEEE Computer Society Press and Polish Information Processing Society, 2014.
- Tomas Cerny, M. Macik, Michael J. Donahoo, and J. Janousek. Efficient Description and Cache Performance in Aspect-Oriented User Interface Design. In Federated Conference on Computer Science and Information Systems, 2014. P. 1697–1706
- Tomas Cerny, K. Cemus, Michael J. Donahoo, Song, E., Aspect-driven, Data-reflective and Context-aware User Interfaces Design. In: ACM SIGAPP Applied Computing Review. 2013, vol. 13, no. 4, p. 53-65. Internet: http://www.sigapp.org/acr/Issues/V13.4/ACR-13-4-2013.pdf. ISSN 1559-6915.
- Tomas Cerny, Michael J. Donahoo, Song, E. Towards Effective Adaptive User Interfaces Design. In: RACS '13 Proceedings of the 2013 Research in Adaptive and Convergent Systems. New York: ACM, 2013, p. 373-380. ISBN 978-1-4503-2348-2.
- Tomas Cerny, Chalupa V., Michael J. Donahoo. Towards Smart User Interface Design. In Information Science and Applications (ICISA), 2012 International Conference on [CD-ROM]. New York: IEEE, 2012, p. 1-6. ISBN 978-1-4673-1402-2.
- Tomas Cerny, Chalupa V., and Michael J. Donahoo. Impact of User Interface Generation on Maintenance. In Computer Science and Automation Engineering (CSAE). Beijing: IEEE, 2012, p. 621-625. ISBN 978-1-4673-0088-9.
- Tomas Cerny, P. Praus, S. Jaromerska, L. Matl, and Michael J. Donahoo. Towards a Smart, Self-scaling Cooperative Web Cache. In SOFSEM 2012: Theory and Practice of Computer Science. New York: Springer, 2012, vol. 7147, p. 443-455. ISBN 978-3-642-27659-0.
- Tomas Cerny and Michael J. Donahoo. MetaMorPic: Self-Contained Photo Archival and Presentation (Book chapter). Information Systems Development Information Systems Development. Berlin: Springer Science+Business Media , 2011, p. 157-166. ISBN 978-1-4419-9645-9.
- Tomas Cerny, P. Praus, S. Jaromerska, L. Matl, and Michael J. Donahoo. Cooperative Web Cache, Proceedings of 18th International Conference on Systems, Signals and Image Processing. Sarajevo: University of Sarajevo, 2011, p. 85-88. ISBN 978-9958-9966-1-0.
- Tomas Cerny and Michael J. Donahoo. How to Reduce Costs of Business Logic Maintenance. Proceedings of IEEE International Conference on Computer Science and Automation Engineering. Beijing: IEEE, 2011, p. 1-6. ISBN 978-1-4244-8728-8.
- Tomas Cerný and Michael J. Donahoo. FormBuilder: A novel approach to deal with view development and maintenance. SofSem 2011 Proceedings of Student Research Forum. Bratislava: OKAT, 2011, p. 16-34. ISBN 978-80-88720-17-1.
- Paul T. Edelman, Michael J. Donahoo, and David B. Sturgill. Secure Group Communications for Delay-Tolerant Networks, IEEE International Conference for Internet Technology and Secured Transactions, 2010.
- Tomas Cerny and Michael J. Donahoo. Evaluation and Optimization of Web Application Performance Under Varying Network Conditions. Proceedings of 44th Spring International Conference MOSIS'X, 2010, p. 41-48. ISBN 978-80-86840-51-2.

- Tomas Cerny and Michael J. Donahoo. MetaMorPic: Self-contained Photo Archival and Presentation. Information Systems Development, 2010. Heidelberg: Springer.
- Tomas Cerny and Michael J. Donahoo. Performance Optimization for Enterprise Web Applications Through Remote Client Simulation, Proceedings of the 7th EUROSIM Congress on Modeling and Simulation, 2010. Praha: Czech and Slovak Simulation Society.
- Tomas Cerny and Michael J. Donahoo. A Tool for Evaluation and Optimization of Web Application Performance. Proceedings of 44th Spring International Conference MOSIS'X. Ostrava, 2010, p. 49-54. ISBN 978-80-86840-51-2.
- Michael J. Donahoo and Daniel Hernandez. Scheduling for Receiver-driven Multicast Flow Control. In Proceedings of International Conference on Communications in Computing, June 2002.
- Wai Gen Yee, Michael J. Donahoo, Edward Omiecinski, and Shamkant B. Navathe. Scaling Replica Maintenance in Intermittently Synchronized Databases. In Proceedings of CIKM, November 2001.
- J. William Murdock, Ashok K. Goel, Michael J. Donahoo, and Shamkant Navathe. A Framework for Method-specific Knowledge Compilation from Databases. Journal of Intelligent Information Systems, 17(1): 5--21, November 2001.
- J. William Murdock, Ashok K. Goel, Michael J. Donahoo, and Shamkant Navathe. Data Mining for Design and Manufacturing: Methods and Applications, vol. 3 of Massive Computing Series, chapter Method-Specific Knowledge Compilation. Kluwer Academic Publishers, 2001. 1-4020-0034-0.
- Michael J. Donahoo and Sunila R. Ainapure. Scalable Multicast Representative Member Selection. In Proceedings of INFOCOM, pages 259--268. IEEE, March 2001.
- Wai Gen Yee, Michael J. Donahoo, and Shamkant B. Navathe. A Framework for Server Data Fragment Grouping to Improve Server Scalability in Intermittently Synchronized Databases. In Proceedings of CIKM, pages 54--61, November 2000.
- Michael J. Donahoo, Mostafa H. Ammar, and Ellen W. Zegura. Multiple-channel Multicast Scheduling for scalable bulk-data transport. In INFOCOM'99, pages 847--855, March 1999.
- Michael J. Donahoo, Gary N. Boone, and Tucker Balch. On the Directional Correlation of Axial Rotation in Inverted Felines and Planetary Spin: Coriolis Revisited. The Journal of Irreproducible Results, 44(5-6):37--39, 1999.
- Michael J. Donahoo. Application-based Enhancements to Network-Layer Multicast. Ph.D. disseratation, Georgia Institute of Technology, Atlanta, GA, September 1998.
- J. W. Murdock, A. K. Goel, M. J. Donahoo, and S. B. Navathe. Method Specific Knowledge Compilation: Towards Practical Design Support Systems. In Proceedings of the Fifth International Conference on Artificial Intelligence and Design (AID'98), pages 427--444, July 1998.
- Sameer Mahajan, Michael J. Donahoo, Shamkant B. Navathe, and Mostafa Ammar. Grouping Techniques for Update Propagation in Intermittently Connected Databases. In Fourteenth International Conference on Data Engineering, pages 46--53. IEEE, February 1998.
- Ellen W. Zegura, Kenneth L. Calvert, and Michael J. Donahoo. A Quantitative Comparison of Graph-based models for Internet Topology. Transactions on Networking, 5(6):770--783, December 1997.
- Michael J. Donahoo, Kenneth L. Calvert, and Ellen W. Zegura. Center Selection and Migration for Wide-area Multicast Routing. Journal of High-Speed Networking, 6(2):141--164, 1997.

- Michael J. Donahoo, J. William Murdock, Ashok K. Goel, Shamkant B. Navathe, and Edward Omiecinski. From Data to Knowledge: Method-specific Transformations. In Proceedings of the Tenth International Symposium on Methodologies for Intelligent Systems (ISMIS'97), pages 411--420, October 1997.
- Michael J. Donahoo and Ellen W. Zegura. Core Migration for Dynamic Multicast Routing. In Proceedings of the ICCCN '96, pages 92--98. IEEE, IEEE Computer Society Press, October 1996.
- Kenneth L. Calvert, Ellen W. Zegura, and Michael J. Donahoo. Core Selection Methods for Multicast Routing. In Proceedings of the ICCCN '95, pages 638--642. IEEE, IEEE Computer Society Press, September 1995.
- Shamkant B. Navathe and Michael J. Donahoo. Towards Intelligent Integration of Heterogeneous Information Sources. In Proceedings of the 6th International Workshop on Database Re-engineering and Interoperability, March 1995.
- Michael J. Donahoo. Integration of Information in Heterogeneous Library Information Systems. Master's thesis, Baylor University, May 1993.
- Gregory Speegle and Michael J. Donahoo. Using Statistical Sampling for Query Optimization in Heterogeneous Library Information Systems. In Proceedings of the 21st Annual Computer Sciences Conference, pages 475--482, February 1993.

Books

I proposed and developed the Practical Guide series with Morgan-Kaufmann. The series consists of books for students and professional programmers who need a focused and fast-paced tutorial on a specific programming topic. The goal of these books is to get readers up-to-speed on the principles of the technology with clear examples, sample code, and straight-forward instruction. These books explore example-driven approaches to programming topics in the areas of networking, databases, web programming, and general programming, in a wide variety of computer languages. Currently, the series contains twelve books, four of which I co-authored. See http://jeffdonahoo.com/practical for details.

- Kenneth L. Calvert and Michael J. Donahoo. TCP/IP Sockets in C: Practical Guide for Programmers, Second Edition. Morgan Kaufmann, 2009.
- Kenneth L. Calvert and Michael J. Donahoo. TCP/IP Sockets in Java: Practical Guide for Programmers, Second Edition. Morgan Kaufmann, 2008.
- Michael J. Donahoo and Gregory D. Speegle. SQL: Practical Guide for Developers. Practical Guide Series. Morgan-Kaufmann, 2005.
- David Makofske, Michael J. Donahoo, and Kenneth L. Calvert. TCP/IP Sockets in C#: Practical Guide for Programmers. Practical Guide Series. Morgan-Kaufmann, 2004.
- Michael J. Donahoo and Kenneth L. Calvert. TCP/IP Sockets in C: Practical Guide for Programmers. Practical Guide Series. Morgan Kaufmann, 2002. Originally published in 2000 as The Pocket Guide to TCP/IP Sockets: C Version.
- Kenneth L. Calvert and Michael J. Donahoo. TCP/IP Sockets in Java: Practical Guide for Programmers. Practical Guide Series. Morgan Kaufmann, 2001.

Patent

S. Mahajan, M. J. Donahoo, S. Navathe, M. Ammar, F. McGeough, S. Malik, "Database Synchronization and Organization System and Method'" U.S. Patent 6,226,650, Filed: September 1998, Awarded: May 2001.

Funding

- ICPCNews, Cisco, 2016-2017: $400,000.
- ICPC Funding, IBM, 2011-2017: Approximately $12,000,000 ($6,161,600 direct funding + in-kind support).
- Academic Contest Infrastructure Initiative Grant, IBM, 2011-2017: $2,240,000 + in-kind support.
- Academic CII Equipment, IBM, 2012-2017: Approximately $1,140,000 plus maintenance for 6 years.
- CLI Virtual Data Center, IBM, 2008: $615,600 plus maintenance for 5 years.
- ICPC Funding, IBM, 2003-2010: Approximately $8,000,000 ($4,097,100 direct funding + in-kind support).
- Academic Contest Infrastructure Initiative Grant, IBM, 2003-2010: $1,099,000 + in-kind support.
- Texas Infrastructure Fund Board Grant, 2002-2003: $18,000.
- Infocom Corporate Travel Grant, 2001: $1,000.
- A Flexible End-to-End Protocol Framework, NSF Subcontract from University of Kentucky, 2001: $12,000.
- Developing a Prototype Assessment Database Tool for Water Quality Management, Summer Sabbatical 2001.
- Performance Analysis of Data Aggregation Approaches for Update Propagation In Intermittently Connected Database Systems, Summer Sabbatical 1999.
- Scaling Update Propagation in Intermittently Connected Database Systems, University Research Committee Grant, 1999: $2,000.

Activities

Baylor Cybersecurity Program

I am currently co-developing a Cybersecurity Program at Baylor University in cooperation between computer science and business (MIS) with assistance from mathematics, political science, and psychology. First, we are developing a Cybersecurity Track in both the BSCS and undergraduate MIS programs. BSCS/MIS students will focus on deep technical/operational and management understanding. The BSCS students will take some MIS courses to insure an understanding of operations and management issues, and the final capstone course will feature teams of CS and MIS students. Second, I am developing and coaching teams for cybersecurity competition. During my first year (2017), the team advanced to the CCDC regionals, beating several top universities from the region. In support of this effort, I have recently volunteered to develop and teach a Competitive Cybersecurity class for both CS and MIS students (see Teaching section). Third, I have proposed the creation of a Cybersecurity Institute/Center at Baylor University. Fourth, to support these efforts, I have partnered with Baylor Development. Together, we hosted the first Baylor Cyber Day where we invited executives from Verizon (Senior Manager, Enterprise Identity and Access Management), Splunk (Director of Security Research), Forcepoint (VP of Data and Insider Threat Security), and IBM (Vice President of Global Security Sales). This group participated in a private, round-table discussion on our cyberprogram and a public student forum on cybersecurity. Baylor's president and vice provost participated in the event. Relationship development with these companies is underway. Fifth, I developed

and executed Baylor's first CyBear[1] Hackfest, which featured an informational track for non-technical students and a technical track where teams participated in a cyber offense/defense competition, which was all featured in local newspapers and television (see https://www.baylor.edu/its/CyberDay). We are in the process of developing a security-aware HackAThon for Baylor in Fall 2018. Finally, we are in the process of seeking NSA/DHS designation (i.e., inventory done and mentor assigned).

CyberSec Alliance

I am in the preliminary stages of co-developing a CyberSec Alliance (CSA). CSA provides a platform for workforce and economic development in the area of cybersecurity. CSA workforce focuses on introducing cybersecurity as a profession, from middle school and up. In middle and high school, we are collaborating with educators and administrators to develop/identify curriculum that can be applied from the simple (e.g., integrated into existing classroom) to advanced (e.g., cybersecurity path). We are also working with local schools to encourage/support participation in cybersecurity competitions such as CyberPatriot. We started this year with a single, test school district (Midway ISD) that introduced a cybersecurity course and fielded multiple CyberPatriot teams. We have provided training materials (in addition to the CyberPatriot materials) and hosted both rounds of competition on Baylor campus. We are in discussion with another school district (Temple ISD) at the superintendent level to develop a cybersecurity path (i.e., multiyear classroom instruction) and start CyberPatriot participation next year. The curriculum is being collaboratively designed to fit with Texas educational standards to insure courses count and receive maximum funding. The curriculum is also being designed to facilitate marketable certifications. We are working directly with Texas Education Service Centers to push out these services to other state districts. In addition to supporting these efforts, we are creating partnerships between districts and companies to provide advice, internships, coaching, etc. Beyond secondary education, we are developing partnerships with technical (e.g., TSTC) and community (e.g., MCC) colleges to provide courses for college credit in high school and post-secondary certification/degree programs for people from the recently-graduated to career-transition (e.g., former military). Basically, CSA Workforce attempts to draw potential workers into the pipeline as soon as possible and then provide them with a range of opportunities, from certifications to graduate/terminal degrees. CSA Economic focuses on local economic development based infrastructure and workforce. We are currently beginning work with local chambers of commerce and economic councils to develop plans for supporting the cybersecurity needs of local companies and attracting companies that provide and/or consume cybersecurity services and products.

Game Development Program

I co-developed the Game Development Program at Baylor University as a cooperation between Computer Science and Film & Digital Media (FDM). First, we created a Game Development Track for the BSCS, accredited by ABET, designed to educate game developers. The track draws on courses and expertise from FDM for production and graphic-design topics, i.e., level design, etc. Second, I created the Baylor Game Club, a multidisciplinary student organization for game development and critique, which is now part of Baylor's ACM student chapter. Third, I raised external funds with Baylor development to support a two-year, visiting professor to provide the initial offerings of early, special-topic courses in game development (e.g., Game Frameworks). I also recruited the visiting professor and lead the search for the two full-time professors hired specifically for the program. Fourth, I established relationships with industry and

[1] Bear puns are required by the handbook.

government (i.e., Texas Film Commission). This included recruiting a VP of a major game studio to teach our capstone course, which provide industry experience and contacts for students.

Computing for Compassion (C4C)

I co-created and co-direct a student organization called Computing for Compassion (C4C). C4C serves established, compassion-based ministries by identifying the barriers that most limit their efforts. We then develop computing solutions to address these problems, where appropriate. Such solutions seek to magnify ministry effectiveness. C4C enables students opportunity to apply their technical skills for the benefit of those in need. By communicating with clients, gathering requirements, designing, developing, testing and deploying solutions, students receive real-world experience that they cannot obtain in the classroom. One example C4C project is the STARS program. Research has shown that third grade children in the US who are reading significantly below their grade level risk many negative, life-long consequences. In fact, historically the number of prison beds needed in 20 years can be predicted by the number of such children today. Research has also demonstrated that a simple, mentor-based intervention can markedly improve the reading level in such children. The STARS program seeks to identify, vet, and deploy volunteer mentors from the community. The logistics of such a program are challenging (e.g., Schools cannot let just anybody work with elementary school children; background checks are required.) C4C has worked extensively with the STARS program to provide technical infrastructure for operating a large program. This work has allowed a great program to significantly expand its reach and impact.

ICPCNews

I created ICPCNews as a vehicle for globally promoting the message about the ICPC community. ICPCNews consists of professionals from around the world who volunteer to share the accomplishments and contributions of the ICPC community through story, photo, video, live coverage, and social media. The social media channel operates year-round with media impression of over 18 million during the World Finals. In addition, I designed MyICPC, a social engagement platform used at World Finals and several ICPC regional contests globally. Photographs from ICPCNews are featured in publications around the world in both web and print. Videos distributed over YouTube, etc. and in the ICPCLive broadcast are seen by tens of thousands around the globe.

Teaching

- Data Communication (CSI4321) – Undergraduate introduction to networking covering networking fundamentals, network security, and TCP/UDP socket programming. I developed this as a completely new course, and it is now part of the CS core curriculum.
- Advanced Data Communications (CSI5321) – Graduate course covering 1) a survey of seminal and current networking research, 2) core TCP/IP protocols in detail, and 3) advanced network programming. I developed this as a completely new course, and it is now a "systems" courses in the MSCS.
- Introduction to Operating Systems (CSI4337) – Operating system design and implementation. Topics include process control and synchronization, memory management, processor scheduling, file systems, and security.
- Introduction to Computer Science II (CSI1440) – Continuation of Introduction to Computer Science I. Introduction to basic aspects of arrays, pointers, classes, inheritance, polymorphism, virtual functions, linked lists, stacks, queues, and binary trees.
- Introduction to Cybersecurity (CSI4v96/5v96) – Concepts in cybersecurity, including cryptography, algebra (groups, rings, fields, etc.), authentication/access, intrusion, DoS, routing, firewall, malware, risk assessment/management, auditing, defensive programming, etc. Student teams develop a secure system using defensive programming techniques in a variety of languages. Team projects are deployed in a controlled environment, team source code is available to all teams, and teams are evaluated based on their ability to defend their solution while compromising other group solutions. An example project is a secure messaging system with relay server written in C++, client in Java, and user account management as a Python web application. Teams are evaluated on their ability to exfiltrate sensitive data (e.g., user accounts) and compromise the security constraints (e.g., inject a falsely-authenticated message) of other teams, while preventing the same for their own team. I developed this as a completely new course, counting as an advanced course for undergraduates and a "systems" course in the MSCS.
- Competitive Cybersecurity (CSI4v96) - Training course in Cybersecurity to provide experience in various areas in systems architecture and security. Each week system/security concepts are reviewed, and the student apply these to specific systems. Students should be able to demonstrate 1) general knowledge in all systems/services, 2) deep knowledge in targeted system and service, 3) teamwork, and 4) system defense/compromise.
- Discovering Series – As part of my classes, I developed a set of laboratory texts designed to ground course concepts. Thus far, I have not sought to publish these texts; they are provided as handouts to the students each semester.
  - Discovering TCP/IP – TCP/IP protocol description, packet analysis, and network systems with laboratory exercises designed to reinforce lecture. Includes 15 chapters covering packet analysis, Ethernet, IP, ARP, ICMP, UDP, TCP (reliability, flow/congestion control, etc.), DNS, DHCP, and HTTP. This is given to undergraduate Data Communications students.
  - Discovering Operating Systems – Multiple laboratory exercises demonstrating system administration, OS modification/recompilations, system fundamentals, and virtualization (machine, container, and serverless). This is given to undergraduate OS students.

- Discovering Security – Multiple laboratory exercises demonstrating system vulnerabilities and tools for discovery and exploitation. This is given to students in the Introduction to Cybersecurity class.

Awards

- 2018 Outstanding Teaching, Baylor University.
- 2016 Mark Measures Award, ICPC.
- 2014 University of Warsaw Medal, University of Warsaw.
- 2011 Joseph S. DeBlasi Outstanding Contribution Award, ICPC.
- 2008 Outstanding Teaching, Baylor University.

Research Interests

Networking

- Cryptocurrency – Fiat currencies create conflicting interests of issuers and holders as well as high transaction and exchange costs. Decentralized Virtual Currencies (DVC) remove governmental connections and providing efficient transfer. Unfortunately, most DVCs rely on a single currency with a fixed supply scheme, limiting growth as supply is arbitrary relative to economic needs. We explore adapting two forms of DVC, proof-of-work and distributed consensus based, to allow supply management relative to factors external to the currency system. Further we extend these DVC solutions to include multiple, competing currencies to disincentivize currency managers from manipulating money supply for personal gain and allowing specialized monetary policy to deal with localized issues or differing economic objectives. A graduate student working with me in this area is now the CISO of Baylor University.
- Peer-to-Peer Incentives – Maintenance of P2P infrastructure relies on peer contribution of resources such as bandwidth, computation, disk space, etc. Such peers are incentivized either through volunteerism, which encourages free loaders, or system-specific incentive, which is complex and narrowly applicable. We explore the creation of generalized incentive from a general, game-theoretic approach. We detail the P2P system context that incentive mechanisms must address, focusing on the main properties (e.g., the existence of cheap identities), types of transacted goods, common goals (e.g., maximize utilization, robustness to rational manipulations) and common problems of such systems; we define the design space for P2P incentive mechanisms through the first taxonomy for such mechanisms and examine the main classes; we analyze in-depth how known incentive mechanisms achieve their goals, from both a P2P systems and a game theory perspectives using BitTorrent and mechanism design models; and we bundle our prescriptions into a framework for designing P2P incentive mechanisms.
- DTN Secure Groups - Delay-Tolerant Networks (DTN) enable the use of mobile devices in high-latency, resource-constrained environments with ephemeral, clique connectivity that makes traditional, end-to-end security approaches unsuitable. We explore scalable, key-graph-based access control mechanisms in self-organizing overlays, focusing on minimizing overlay traffic. A graduate student working with me in this area now works on cybersecurity for the US Navy.
- Overlay Infrastructure Initiative - Overlays are quickly becoming part of the critical infrastructure for deployment of novel services for peer-to-peer networking. We explore issues involved in deployment and securing of overlay networks.

- Application-based Enhancement to Network-Layer Multicast - We consider the use of IP multicast to enhance the scalability of networked applications. IP multicast is a fairly rudimentary technology providing only best-effort delivery service. The appropriate mechanisms for adapting multicast depend on the semantics of the specific application. Our work bridges the gap between IP multicast and the applications.
- Center Placement Analysis - Center placement in core-based multicast routing plays a significant role in performance. We are studying the correlation between optimal core placement and application semantics/network topology. In addition, we are developing techniques of core placement given various levels of a priori knowledge.
- Dynamic Multicast Groups - Current multicast routing protocols do not address issues of group dynamics; consequently, routing performance and efficiency may suffer significantly when group membership changes. We are developing adaptations of current routing mechanisms to handle multicast group dynamics.
- Graph Topology - Many models of networks have been proposed and used in simulations; however, little consideration has been given to the effect a particular network topology has on performance. We are studying various network models in an effort to quantify their differences and qualify the effects of these differences on simulation performance.

Software Engineering

- Concern Separation/Weaving – One approach for the avoidance of replication in development and delivery systems involves concern separation. We study various approaches for weaver architectures to stitch concern elements in application integration. We apply this approach to restatement avoidance, UI generations, security, distributed computing, performance, etc.
- Adaptivity and Context-awareness – Modern enterprise application expectations include adaptation to user-specific preferences, such as skill levels, capabilities, locations, etc. A one-size-fits-all design fits nobody while multiple, custom designs are too difficult to develop and maintain. We explore techniques to easily generate adaptive designs that integrate new context-perspectives without unwieldy replication. Current approaches suffer conjoined concerns, limiting scale and increasing code volume.
- Generation – Entity classes determine the key information and constraints being maintained in CRUD applications. Unfortunately, in three-tiered architectures, attributes, attribute types and attributes constraints are often restated at each tier implementation. Entity-based automatic generation can be used to maintain the relationships, avoiding the side effects of replication. We apply this approach to UI development, business-rule maintenance, etc.
- Transformations – Domain-specific or GPL languages can enable derivation of join-points on which we may integrate new functionality or environment. For instance, we explore transforming knowledge from Java to JavaScript such that we preserve type-safety and/or single point definitions.

Database

- Large-Scale Integration - The extent to which integration of diverse and distributed information sources can scale depends on the level of automation available to integration process. Large-scale integration is impractical if it requires the intervention of an administrator who understands all the information to be integrated. We propose a technique in which each information source administrator submits an Augmented Export Schema describing the data at their site and its

relationship to a larger domain. We also proposed techniques for automatically integrating these individual schemas into a partially-integrated global schema.

- Iterative Query Processing with Incomplete Schemas - Large-scale, automated integration of remote data schemas results in a loosely coupled, partially integrated global schema. Traditional query processing may fail to locate all relevant information due to this imprecise schema. We have developed a query processing technique which allows the query processor to provide feedback to users to help them iteratively refine their query.
- Knowledge-Base Integration - Knowledge-base integration extends traditional information source integration to include integration of process. We proposed a unified architecture, based on previous work, to integrate both information and functionality of knowledge base systems.