

CIHAN TUNC

CONTACT INFO

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RESEARCH INTERESTS

• Cybersecurity • Cyber-resiliency • Intrusion detection/prevention • Cyber-threat analysis in social media • Autonomic computing • Cloud computing • Internet of Things (IoT)

EDUCATION

The University of Arizona, Tucson, AZ

Aug 2011 – Jan 2015

Ph.D. in Computer Engineering (Electrical and Computer Engineering)

Dissertation: “*Autonomic Cloud Resource Management*”

Research: Autonomic Power, Performance, and Security Management for Cloud Systems

Advisors: *Salim Hariri and Ali Akoglu*

Northeastern University, Boston, MA

Sep 2008 – May 2010

M.Sc. in Computer Engineering (Electrical and Computer Engineering)

Thesis: “*Variation and Defect Tolerance for Nano Crossbars*”

Advisor: *Mehdi B. Tahoori*

Bahcesehir University, Istanbul, Turkey

Sep 2003 – Jun 2008

B.Sc. in Electrical & Electronics Engineering

Graduation Project: “*Carry Save Tree Generation*”

Advisor: *H. Fatih Ugurdag*

RESEARCH FUNDING AND GRANTS

Current Funding

- **AF Office of Scientific Research**, “*Resilient DDDAS-based Cloud Services (rDaaS) for Cyber Battle Management Systems*,” S. Hariri (PI), **C. Tunc (Co-PI)**, Budget: \$453,404 (Perc: 50%), Period: 06/15/2018 - 06/14/2021
- **National Science Foundation**, “*FCTaaS: Federated Cybersecurity Testbed as a Service*,” S. Hariri (PI), **C. Tunc (Co-PI)**, Budget: \$300,000 (Perc: 11%), Award Period: 10/01/2018 - 09/30/2020
- **National Institute of Standards and Technology**, *Resilient Application as a Service (RAaaS)*,” S. Hariri (PI), **C. Tunc (Co-PI)**, Budget: \$150,000 (Perc: 50%), Award Period: 06/01/2018 - 05/31/2020
- **Department of Energy, National Nuclear Security Administration (NNSA)**, “*Partnership for Proactive Cybersecurity Research and Training (PACT)*,” S. Hariri (PI), T. Bose (Co-PI), G. Ditzer (Co-PI), D. Rawat (Co-PI), F. Stomp (Co-PI), **C. Tunc (Senior Personnel)**, DOE/NNSA National Lab Collaborator: Dr. Charlie Catlett (Argonne National Laboratory), Budget: \$3,000,000, Award Period: 10/1/2019 - 10/1/2022
- Multiple **SBIR/STTR** proposals together with Avirtek (received Phase I and II awards); e.g., “*RMS - Resilient Middleware Services for Cyber Physical Systems*”, “*Multi-Layer Mapping of Cyberspace*”, “*Autonomic Monitoring, Analysis, and Protection (AMAP)*”, “*Tactical Immune System (TIS)*” (~\$3,800,000 budgeted, I have been serving as a Senior Personnel)

Past Funding

- **National Institute of Standards and Technology (NIST)**, “*Resilient Cloud Services (RCS): Design, Analysis, and Deployment*,” S. Hariri (PI), **C. Tunc (Co-PI, 20%)**, Budget: \$50,000 (Perc: 20%), Period: 05/01/2016 - 04/30/2017

Pending Funding

- **National Science Foundation**, “*CNS Core: Large: On-Demand Composable High Performance Data Centers*,” S. Hariri (PI), A. Akoglu (Co-PI), I. Djordjevic (Co-PI), Y. Takashima (Co-PI), **C. Tunc (Co-PI)**, Budget: \$3,000,000 (Perc: 20%)

PUBLICATIONS

Thesis & Dissertation

- [TD1] C. Tunc, “Autonomic Cloud Resource Management,” **PhD Dissertation**, Jan 2015.
[TD2] C. Tunc, “Variation and Defect Tolerance for Nano Crossbars,” **MS Thesis**, May 2010.

Text Book

- [TB1] S. Hariri and C. Tunc, “High Performance Distributed Computing Systems: Architecture, Networking, and Programming,” Sentia Publishing, ISBN: 978-0-9990053-2-3, 2017.

Book Chapters

- [BC1] J. Pacheco, C. Tunc, and S. Hariri, “Resilient Communications and Command and Control of Cyber-Physical Systems,” in “Enhancing Cyber Resilience of Communications, Command and Control of Large-Scale Systems with Moving Target Defense”, (to appear).
[BC2] J. Pacheco, C. Tunc, and S. Hariri, “Smart Cities,” in “Cyber Resilience of Systems and Networks,” Springer, ISBN: 978-3-319-77491-6, 2019.
[BC3] C. Tunc, S. Hariri, and A. Battou, “A Design Methodology for Developing Resilient Cloud Services (RCS),” in “Handbook of System Safety and Security: Cyber Risk and Management, Cyber Security, Threat Analysis, Functional Safety, Software Systems, and Cyber Physical Systems,” edited by Edward Griffor, Elsevier Inc., ISBN: 978-0-12-803773-7, 2016.

Journals and Magazines

- [J1] C. Tunc, E. Blasch, Y. Badr, and S. Hariri, “Service-Oriented Infrastructure for Resilient DDDAS-based Cyber Battle Management,” submitted to *Future Generation Computer Systems - Special Issue on Self-Protecting Systems*, 2019.
[J2] S. Shao, C. Tunc, A. Al-Shawi, S. Hariri, “Feature Engineering for Machine Learning-Based Author Identification in Internet Relay Chat,” submitted to *IEEE Transactions on Information Forensics and Security*, 2019
[J3] J. Bernard, S. Shao, C. Tunc, H. Kheddouci, and S. Hariri, “Cyber-Threat Detection in Internet Relay Chat Channels through Quasi-cliques based Analysis,” submitted to *Social Network Analysis and Mining*, Springer, 2019
[J4] C. Tunc, D. Machovec, N. Kumbhare, A. Akoglu, S. Hariri, and H.J. Siegel, “Value of Service Based Resource Management for Large-Scale Computing Systems,” *Springer Cluster Computing*, vol. 20, no. 3, pp. 2013-2030, Sep. 2017.
[J5] J. Pacheco, C. Tunc, P. Satam, and S. Hariri, “Secure and Resilient Cloud Services for Enhanced Living Environments,” *IEEE Transactions on Cloud Computing*, Special Issue on Enhanced Living Environments: Algorithms, Architectures and Platforms (Cloud4ELE), vol. 3, no. 6, pp. 44-52, Nov. 2016.
[J6] D. Machoveca, B. Khemkaa, N. Kumbhare, S. Pasrichaa, A.A. Maciejewska, H.J. Siegel, A. Akoglu, G.A. Koenig, S. Hariri, C. Tunc, M. Wright, M. Hilton, R. Rambharos, C. Blandin, F. Fargo, A. Louri, and N. Imam, “Utility-Based Resource Management in an Oversubscribed Energy-Constrained Heterogeneous Environment Executing Parallel Applications,” *Elsevier Parallel Computing (ParCo)*, Nov. 2016.
[J7] S. Hariri, J. Pacheco, C. Tunc, and Y. Al-Nashif, “A Methodology for Designing Resilient and Smart Critical Infrastructures,” *Electrical and Computer Engineering Department Heads Association*, 2015.
[J8] C. Tunc and S. Hariri, “CLaaS: Cybersecurity Lab as a Service,” *Journal of Internet Services and Information Security (JISIS)*, vol. 5, no. 4, pp. 41-59, Nov. 2015.

Conferences and Workshops

- [C1] S. Shao, C. Tunc, A. Al-Shawi, and S. Hariri, “Automated Twitter Author Clustering with Unsupervised Learning for Social Media Forensics,” 16th ACS/IEEE International Conference on Computer Systems and Applications (AICCSA 2019), Abu Dhabi, UAE, Nov. 2019.
[C2] S. Shao, C. Tunc, A. Al-Shawi, and S. Hariri, “One-class Classification with Deep Autoencoder Neural Networks for Author Verification in Internet Relay Chat,” 16th ACS/IEEE International Conference on Computer Systems and Applications (AICCSA 2019), Abu Dhabi, UAE, Nov. 2019.
[C3] J. H. Pacheco Ramirez, V. Benitez, C. Tunc, and C. Grijalva Lugo, “Anomaly Behavior Analysis for Fog Nodes Availability Assurance in IoT Applications,” Workshop on Automation of Cloud Configuration and Operations (ACCO 2019), co-located with AICCSA 2019, Abu Dhabi, UAE, Nov., 2018.
[C4] F. Fargo, O. Franza, C. Tunc, and S. Hariri, “Autonomic Resource Management for Power, Performance, and Security in Cloud Environment,” Workshop on Automation of Cloud Configuration and Operations (ACCO 2019), co-located with AICCSA 2019, Abu Dhabi, UAE, Nov., 2018.

- [C5] M. Merzouki, C. Mahmoudi, R. Bohn, **C. Tunc**, “*Security Automation for Cloud-Based IoT Platforms*,” The 2019 IEEE International Conference on Internet of Things, Atlanta, USA, Jul. 2019.
- [C6] J. Bernard, S. Shao, **C. Tunc**, H. Kheddouci, and S. Hariri, “*Quasi-Cliques Analysis for IRC Channel Thread Detection*,” Complex Networks 2018, UK, Dec. 2018.
- [C7] S. Shao, **C. Tunc**, and S. Hariri, “*Autonomic Author Identification in Internet Relay Chat (IRC)*,” 15th ACS/IEEE International Conference on Computer Systems and Applications (AICCSA 2018), Aqaba, Jordan, Nov. 2018.
- [C8] J. Pacheco, **C. Tunc**, and S. Hariri, “*Security Framework for IoT Cloud Services*,” Workshop on Automation of Cloud Configuration and Operations (ACCO 2018), Jordan, Oct.-Nov., 2018.
- [C9] M. Yang, I.B. Djordjevic, **C. Tunc**, S. Hariri, and A. Akoglu, “*An Optical Interconnect Network Design for Dynamically Composable Data Centers*,” 19th IEEE International Conference on High Performance Computing and Communications (HPCC 2017), Bangkok, Thailand, Dec. 2017,
- [C10] N. Kumbhare, **C. Tunc**, D. Machovec, A. Akoglu, S. Hariri, and H.J. Siegel, “*Value-Based Scheduling for Oversubscribed Power-Constrained Homogeneous HPC Systems*,” IEEE International Conference on Cloud and Autonomic Computing (ICCAC 2017), Tucson, Arizona, USA, Sep. 2017.
- [C11] **C. Tunc**, S. Hariri, and Y. Badr, “*Resilient Dynamic Data Driven Application Systems as a Service (rDaaS): A Design Overview*,” Workshop on InfoSymbiotics: DDDAS Dynamic Data Driven Applications Systems (InfoSymbiotic:DDDAS17) in IEEE International Conference on Cloud and Autonomic Computing (ICCAC 2017), Tucson, Arizona, USA, Sep. 2017.
- [C12] S. Shao, **C. Tunc**, P. Satam, and S. Hariri, “*Real-time IRC Threat Detection Framework*,” The 1st International Workshop on Autonomics and Cloud Security (ACS) in IEEE International Conference on Cloud and Autonomic Computing (ICCAC 2017), Tucson, Arizona, USA, Sep. 2017.
- [C13] **C. Tunc**, S. Hariri, M. Merzouki, C. Mahmoudi, F.J. de Vault, J. Chbili, R. Bohn, and A. Battou, “*Cloud Computing Security Automation Framework*,” The 1st International Workshop on Autonomics and Cloud Security (ACS) in IEEE Intn’l Conference on Cloud and Autonomic Computing (ICCAC 2017), Tucson, Arizona, USA, Sep. 2017.
- [C14] **C. Tunc**, F. Fargo, Y. Al-Nashif, and S. Hariri, “*Autonomic Cross-Layer Management of Cloud Resources Framework*,” The IEEE Workshop on Automation of Cloud Configuration and Operations (ACCO 2017) in IEEE International Conference on Cloud and Autonomic Computing (ICCAC 2017), Tucson, Arizona, USA, Sep. 2017.
- [C15] A.T. Ozdemir, **C. Tunc**, and S. Hariri, “*Autonomic Fall Detection System*,” The IEEE Workshop on Automation of Cloud Configuration and Operations (ACCO 2017) in IEEE International Conference on Cloud and Autonomic Computing (ICCAC 2017), Tucson, Arizona, USA, Sep. 2017.
- [C16] N. Kumbhare, **C. Tunc**, S. Hariri, I. Djordjevic, A. Akoglu, and H.J. Siegel, “*Just In Time Architecture (JITA) for Dynamically Composable Data Centers*,” 13th ACS/IEEE International Conference on Computer Systems and Applications (AICCSA 2016), Agadir, Morocco, Nov. 2016,
- [C17] **C. Tunc**, N. Kumbhare, A. Akoglu, S. Hariri, D. Machovec, and H.J. Siegel, “*Value of Service Based Task Scheduling for Cloud Computing Systems*,” IEEE International Conference on Cloud and Autonomic Computing (ICCAC 2016), Augsburg, Germany, Sep. 2016.
- [C18] J. Yu, **C. Tunc**, and S. Hariri, “*Automated Framework for Scalable Collection and Intelligent Analytics of Hacker IRC Information*,” IEEE International Conference on Cloud and Autonomic Computing (ICCAC 2016), Augsburg, Germany, Sep. 2016.
- [C19] S. Gu, L. Yao, **C. Tunc**, A. Akoglu, S. Hariri, and E. Ritchie, “*An Autonomic Workflow Performance Manager for Weather Research and Forecast Workflows*,” IEEE International Conference on Cloud and Autonomic Computing (ICCAC 2016), Augsburg, Germany, Sep. 2016.
- [C20] J. Pacheco, **C. Tunc**, and S. Hariri, “*Design and Evaluation of Resilient Infrastructures Systems for Smart Cities*,” IEEE International Smart Cities Conference (ISC2), Trento, Italy, Sep. 2016.
- [C21] D. Machovec, **C. Tunc**, N. Kumbhare, B. Khemka, A. Akoglu, S. Hariri, and H.J. Siegel, “*Value-Based Resource Management in High-Performance Computing Systems*,” 7th ACM Workshop on Scientific Cloud Computing (ScienceCloud’16), Kyoto, Japan, Jun. 2016.
- [C22] S. Hariri, **C. Tunc**, P. Satam, F. Al-Moualem, and E. Blasch, “*DDDAS-Based Resilient Cyber Battle Management Services (D-RCBMS)*,” IEEE 22nd International Conference on High Performance Computing Workshops (HiPCW), Bangalore, India, Dec. 2015.
- [C23] J.H. Pacheco Ramirez, B. AlBaalbaki, **C. Tunc**, S. Hariri, and Y. Al-Nashif, “*Anomaly Behavior Analysis System for ZigBee in Smart Buildings*,” 12th ACS/IEEE International Conference on Computer Systems and Applications (AICCSA 2015), Marrakech, Morocco, Nov. 2015.
- [C24] **C. Tunc**, S. Hariri, F. Montero, F. Fargo, and P. Satam, “*CLaaS: Cybersecurity Lab as a Service -- Design, Analysis, and Evaluation*,” IEEE International Conference on Cloud and Autonomic Computing (ICCAC 2015), Boston, MA, USA, Sep. 2015.

- [C25] **C. Tunc**, S. Hariri, Y. Al-Nashif, F. Montero, F. Fargo, and P. Satam, “*Teaching and Training Cybersecurity as a Cloud Service*,” IEEE International Workshop on Autonomic Cloud Cybersecurity (ACC 2015) in 2015 International Conference on Cloud and Autonomic Computing (ICCAC 2015), Boston, MA, USA, Sep. 2015.
- [C26] B. Khemka, D. Machovec, C. Blandin, H.J. Siegel, S. Hariri, A. Louri, **C. Tunc**, F. Fargo, and A.A. Maciejewski. “*Resource Management in Heterogeneous Parallel Computing Environments with Soft and Hard Deadlines*,” The XI Metaheuristics International Conference (MIC 2015), Agadir, Morocco, Jun. 2015.
- [C27] **C. Tunc**, F. Fargo, Y. Al-Nashif, S. Hariri, and J. Hughes, “*Autonomic Resilient Cloud Management (ARCM): Design and Evaluation*,” 2014 International Conference on Cloud and Autonomic Computing (CAC 2014), London, United Kingdom, Sep. 2014.
- [C28] F. Fargo, **C. Tunc**, Y. Al-Nashif, A. Akoglu, and S. Hariri, “*Autonomic Workload and Resources Management of Cloud Computing Services*,” 2014 International Conference on Cloud and Autonomic Computing (CAC 2014), London, United Kingdom, Sep. 2014.
- [C29] F. Fargo, **C. Tunc**, Y. Al-Nashif, and S. Hariri, “*Autonomic Performance-per-Watt Management (APM) of Cloud Resources and Services*,” ACM Cloud and Autonomic Computing Conference, Miami, Florida, USA, Aug. 2013.
- [C30] B. Yuce, S. Korkmaz, V.B. Esen, F. Temizkan, **C. Tunc**, G. Guner, I.F. Baskaya, I. Agi, G. Dunder, and H.F. Ugurdag, “*Synthesis of Clock Trees for Sampled-Data Analog IC Blocks*,” East-West Design & Test Symposium, Rostov-on-Don, Russia, Sep. 2013.
- [C31] F. Ugurdag, O. Keskin, **C. Tunc**, F. Temizkan, G. Fici, and S. Dedeoglu, “*RoCoCo: Row and Column Compression for High-Performance Multiplication on FPGAs*,” East-West Design & Test Symposium, Sevastopol, Ukraine, Sep. 2011 (*outstanding paper award*).
- [C32] **C. Tunc** and M.B. Tahoori, “*On-the-fly Variation Tolerant Mapping in Crossbar Nano-Architectures*,” IEEE VLSI Test Symposium (VTS), Santa Cruz, California, USA, Apr. 2010.
- [C33] **C. Tunc** and M.B. Tahoori, “*Variation Tolerant Logic Mapping for Crossbar Array Nano Architectures*,” IEEE Asia and South Pacific Design Automation Conference (ASP-DAC), Taipei, Taiwan, Jan. 2010.

Ongoing/Future Works

- [J9] **C. Tunc**, M. Merzouki, C. Mahmoudi, R. Bohn, S. Hariri, and A. Battou, “*A Security Automation Framework for IaaS in Multi-Cloud*”
- [J10] **C. Tunc**, F. Fargo, Y. Al-Nashif, S. Hariri, “*Autonomic Resilient Cloud Services*”
- [J11] **C. Tunc**, F. Fargo, Y. Al-Nashif, A. Akoglu, and S. Hariri, “*Autonomic Cloud Resources Management*”

WORK EXPERIENCE

The University of Arizona, Tucson, Arizona

Research Assistant Professor

May 2015 – Present

Research Experiences:

- Autonomic computing, cloud resiliency, cybersecurity, cyber-threat analysis and prevention systems, Cybersecurity Lab as a Service (CLaaS), Internet of Things (IoT), power and performance management for large-scale systems. (For more information, please refer to the Projects section)
- Development of research projects and assisting in and writing technical proposals.
- Coordination of various international conferences, workshops, meetings.
- Management and maintenance of the platforms and infrastructures at the Autonomic Computing Lab (ACL).
- Assist in developing cybersecurity, cloud, IoT based testbeds for research and experimentation.

Teaching Experiences:

- Instructor for “ECE 509 – Cybersecurity: Concept, Theory, and Practice” during Fall 2019 – this is a completely *online class* with 19 grad-level students. I have prepared lecture notes, homework, quiz, midterm, final, projects, etc. and graded them.
- Co-instructing (teaching, lecturing, and advising) students (together with Prof. Salim Hariri) through the following grad-level courses (with both in-class and online students):
 - ECE 524 – Fundamentals of Cloud Security: Created syllabus, prepared lecture notes, homework, and quiz questions from scratch, advised students on projects, and gave classes during Spring 2018.
 - ECE 677 – Distributed Computing System: During Fall 2015, 2016, and 2017, prepared and gave some of the lectures, prepared homework and quizzes, and advised student projects.
 - ECE 509 – Cybersecurity: Concept, Theory, and Practice: Prepared homework and quizzes, advised students through their projects, and coordinated the lab sessions during Spring 2015, 2016, 2017, and 2018.

- Supervision/mentoring graduate- (both PhD and MS) and undergraduate-level students (more info below)

National Institute of Standards and Technology (NIST), Gaithersburg, Maryland

Guest Researcher

Sep 2016 – Present

- Research and development on the cloud computing system management and security automation.
- Data collection from all the entities in a cyber-environment for the analysis and security.

Avirtek, Inc., Tucson, Arizona

Research Scientist Consultant

May 2015 – May 2017

- Avirtek AIM (Automated & Integrated Management) system development and integration.
- Automation of the system installation and configuration.
- Development of new technologies for Avirtek systems
 - Securing commercial AIM products that operate under a licensed environment only.
 - Building autonomic computing-based management modules.
 - Collection of the cyber-environment data including network, computers, and users.
- Guiding/mentoring software engineers.
- Assisting in the preparation of the proposals between Avirtek and The University of Arizona.

The University of Arizona, Tucson, Arizona

Graduate Research Assistant

Aug 2011 – Jan 2015

- Research on autonomic power and performance management for cloud computing systems.
- Development of AskCyPert – Cybersecurity as a Service (CLaaS) backend.
- Research and development of acceleration of hypothetical LDPC decoders using FPGAs.
- Responsible for the platforms and infrastructures of the ACL lab at The University of Arizona.

Graduate Teaching Assistant

Aug 2013 – Dec 2014

- Teaching MPI and OpenMP for “ECE677 – Distributed Computing System” (Fall 2013 and Fall 2014). Responsibilities included setup, configuration, and maintenance of the systems required during the class, as well as grading homework, term papers, and projects.
- Grading homework and projects for “ECE506 – Reconfigurable Computing” (Spring 2014).

Samsung Research America, Dallas, Texas

R&D Engineering Intern

May 2013 – Aug 2013

- Design and optimization of a MIMO detector architecture based on K-Best algorithm for Xilinx Virtex-6 (XCVLX550T) to be used in next-generation WiFi systems.
- Implementation of the required blocks using Verilog and Xilinx CoreGen to achieve very high throughput.
- Optimization of the algorithm and implementation for the high-performance requirements.

Ozyegin University, Istanbul, Turkey

Research Assistant

Sep 2010 – Aug 2011

- Research on computer arithmetic, specifically on row and column compressors, to accelerate the summation and multiplication operations.

Instructor/Teaching Assistant

Jan 2011 – Jul 2011

- Teaching 23 high-school students on making a line-following robot (its designing, electronics components, and programming) in two weeks from scratch during RoboKamp at 2011.
- Grading and assisting Java based “CS 101 – Computer Programming”.
- Assisting “EE 564 – Computer Architecture & Performance”.

Vestel Corporation, Manisa, Turkey

Lab Instructor

Sep 2010 – Dec 2010

- Instruction of lab session of the “Embedded Systems Design” course, which included Computer Architecture, PIC programming, and Embedded System Design using FriendlyARM boards.

Northeastern University, Boston, MA

Research Assistant

Sep 2008 – May 2010

- Research on “Variation and Defect Tolerance for Nano Crossbars”, *(Please refer to the Projects section)*

Teaching Assistant

Sep 2008 – May 2010

- Instruction “EECE 2413 – Electronics Lab” (Fall 2009 and Spring 2010).
- Grading “EECE 3324 – Computer Architecture and Organization” (Spring 2009).
- Grading “EECE 2312 – Digital Logic Design” (Fall 2008).

Bahcesehir University, Istanbul, Turkey

Undergraduate Lab Assistant

Feb 2007 – Jun 2007

- Research on FPGA design and design automation.
- Helping students in the FPGA-based “Digital System Design Lab” (Fall 2007).

RELATED RESEARCH PROJECTS

Autonomic Monitoring, Analysis, and Protection (AMAP) based Operations Center

Oct 2019 – Present

- Continuously monitoring cyber resources and services to perform anomaly behavior analysis especially on different filetypes such as pdf, jpg, html, xml, rtf.
- Collaborating on the creation of the required modules such as continuous threat modeling, cyber situation awareness, anomaly behavior analysis, and intelligent cyber security assistant.
- Deploying at dynamic large-scale environments requires continuous threat modeling through high-performance computing paradigm, which I manage to be built using GPU systems when needed.

FCTaaS: Federated Cybersecurity Testbed as a Service

Aug 2018 – Present

- Seamless composition of several heterogeneous testbeds to be ubiquitously accessed as a cloud service
- Developing integration of the distributed testbeds using Kafka, NTP, and a web interface
- Design and development of the required scheduling algorithms for cybersecurity experiments on distributed testbeds that are managed and controlled by different organizations
- Keeping the privacy and security of the users and distributed testbeds

Multi-Layer Anomaly Behavior Analysis (MLABA)

Jun 2018 – Present

- Design and development of innovative data structures for cyberspace referred as Cyber-Persona footprint, Logical Resource Footprint, and Physical Resource Footprint
- Design and development of the footprint monitoring tool storing data using MongoDB
- Collaborated on the anomaly behavior analysis framework to create models using individual footprints and fusing them as needed. Currently mentoring a PhD student on the development of the logical and physical models.

Cyber Threat Detection via Social Media Analysis

Aug 2015 – Present

- Analysis and detection of activities and users in social media platforms (e.g., Internet Relay Chat (IRC) and Twitter).
- Guided and collaborated with graduate students in the development and research of the architecture that includes autonomic bot services, activity analysis, user identification and detection, sentimental analysis.
- Autonomic bot services monitor the IRC channels and Twitter accounts continuously and Stanford CoreNLP sentiment analysis was used for user intent, IBM Watson for personality analysis, etc.
- We were able to predict the WannaCry ransomware issue almost one month in advance as there was a high traffic regarding to the EternalBlue exploitation.
- Different machine learning algorithms are combined to create user identification and analysis.
- Collaborated on the development of graph theory algorithms that are used to create the hidden connections between the active users.

Resilient Cloud Services

Jan 2014 – Present

- Developed a framework using Moving Target Defense (MTD) and software obfuscation for resilient cloud services.
- Built the approach using OpenStack on a private cloud environment as well as on AWS.
- For verification and evaluation, multiple MapReduce implementations (e.g., Hadoop and MRS-MapReduce), benchmarks, data mining tools have been developed.
- Implemented multiple attack scenarios applying DoS/DDoS attacks including fork bombing, TCP/UDP flood, etc.
- The systems operate with negligible overhead under heavy attacks, which cause failure for non-resilient systems.

Security Automation of Cloud Computing System

Sep 2016 – Sep 2017

- Together with NIST colleagues, research and development of the cloud computing system security automation based on NIST SP 800-53 (revision 4) security controls.
- Built a private cloud system using OpenStack and automated the management of the virtual machines (VMs).
- Automated the monitoring of the security control checks for the built cloud environment.
- Next phases of the project are aimed at creating a standard for the security of the cloud computing systems.

Autonomic Power & Performance Management for Cloud Resources

Aug 2012 – Aug 2018

- Reducing power/energy consumption of cloud systems without sacrificing high-performance requirements.
- VM resources are provisioned on runtime using AppFlow case-based reasoning and data mining.
- A private cloud environment was built using Xen on an IBM HS-22 blade server (and allocated 10 blades).
- Developed the monitoring tool to capture the VM resources utilization, the processes' resource usage, hypervisor's utilization, and the physical host system utilization.
- A performance-per-Watt-based autonomic resource management tool is developed.
- The system reduces power consumption up to 80% compared to static resources and up to 30% compared to other dynamic methods.

Value of Service Based Task Scheduling for Cloud Computing Systems

Feb 2015 – Dec 2018

- Task scheduling approaches to reduce total energy consumption while maintaining task performance.
- A power model has been created to predict the total energy consumption of the tasks running on the VMs.
- Value of Service concept that depends on the performance and energy values has been developed.
- Obtained an increase of the value gained by tasks' performance up to 50% and energy 40% compared to simple heuristics.

AskCyPert – Cybersecurity as a Service (CLaaS)

Jan 2014 – May 2017

- Aims to provide a virtual cybersecurity lab for the users around the globe with multiple experiment options.
- I built the CLaaS backend where VMs, vSwitches, vNetworks, etc. are created and configured for each experiment/testbed automatically using Perl SDK for VMware and VIX.
- In later stages, I have moved the environment to Amazon cloud systems (Amazon AWS Python SDK has been used) to provide high scalability.
- Developed network sniffing, TCP/IP attack, DNS attack, buffer overflow, and cross-site scripting attack labs.
- More than 400 students (worldwide) have used the environment for multiple experiments.
- More information can be found on <http://askcypert.org/>

Acceleration of Hypothetical LDPC Decoders using FPGAs

Jan 2012 – Sep 2013

- Developed a tool to evaluate hypothetical LDPC decoders on any FPGA without user involvement by generating Verilog for any code-rate and code-length LDPC decoder.
- The tool synthesizes the generated Verilog codes using Xilinx ISE shell, uploads the bitstream to the FPGA for simulations, and extracts the Floor Error Rate and the codes that result in errors after the simulations.
- Fully serial architecture is included in the pre-defined architecture list.

Row and Column Compressors for FPGAs and ASICs

Sep 2010 – Aug 2011

- Built a framework for benchmarking various summation and multiplication methods.
- The framework generates Verilog RTLs and then tests the designs with testbenches. If the designs pass the testbench, they are synthesized using Xilinx ISE and/or Synopsys DC.

Variation and Defect Tolerance for Nano Crossbars

Sep 2008 – May 2010

- Developed variation- and defect-tolerant logic mapping algorithms for nano crossbars (e.g., simulated-annealing-based framework).
- Developed a characteristic testing approach for the fast-creating delay-based modeling for the nano crossbars.
- Enabled mapping a design on nano crossbars even under high defect and variation conditions (as high as 10%).

POSTERS, PRESENTATIONS, TALKS

- **C. Tunc**, “Welcome to Cybersecurity”, Navajo Technical University, Crownpoint, New Mexico, Dec. 2019 (talk)
- **C. Tunc**, “Cloud Computing Infrastructure and Security”, American University of Malta, Malta, Nov. 2019 (talk)
- **C. Tunc**, “IRC User Identification for Threat Detection”, Franco-American Workshop, Lyon, France, Jul. 2018 (presentation)
- **C. Tunc**, “Cloud Security Automation”, Franco-American Workshop, Lyon, France, Dec. 2017 (presentation)
- **C. Tunc**, “IRC Chat Analysis for Hacker Behavior”, Franco-American Workshop, Lyon, France, Dec. 2017 (presentation)
- **C. Tunc**, S. Hariri, “Autonomic Security Compliance Framework”, NSF CAC Semiannual Meeting, Lubbock, Texas, Oct. 2017 (poster and presentation)
- **C. Tunc**, S. Hariri, and F. Montero, “Autonomic Security Compliance Engine (ASCE),” Semi-annual NSF Cloud and Autonomic Computing Center Meeting, Tucson, Arizona, Apr. 2017 (poster and presentation)
- **C. Tunc**, “Parallel Distributed Computing,” Simposio Internacional de Ingeniería, Sistemas y Tecnología, Hermosillo, Mexico, Feb. 2014 (presentation and lecture)
- **C. Tunc**, “Cloud Computing Resiliency Through Dynamic Redundancy,” Simposio Internacional de Ingeniería, Sistemas y Tecnología, Hermosillo, Mexico, Feb. 2014 (presentation)
- F. Fargo, **C. Tunc**, Y. Al-Nashif, S. Hariri, and A. Akoglu, “Autonomic Cloud Management System,” Franco-American Workshop, Tucson, Arizona, USA, 2014 (poster)
- Z. Li, F. Fargo, **C. Tunc**, Y. Al-Nashif, S. Hariri, and A. Akoglu, “Cloud Autonomic Manager (CAM),” NSF CAC Semiannual Meeting, Tucson, AZ, 2011 (poster and presentation)
- **C. Tunc**, “Autonomic Management and Cybersecurity” during CAT Vehicle research experience for undergraduate program seminar talk, 2014, 2015, and 2017, PI: Jonathan Sprinkle (talk)
- **C. Tunc**, “Autonomic Computing Lab,” during Arizona GenCyber Cybersecurity Camp, The University of Arizona, 2014 and 2015 (talk)

PROFESSIONAL ACTIVITIES

Journal Associate Editor

- Associate Editor for Springer Cluster Computing

Journal Reviewer

- Springer Cluster Computing
- IEEE Transactions on Cloud Computing
- IEEE Pervasive Computing
- ACM Transactions on Management Information Systems
- Elsevier Computer Standards & Interfaces
- Elsevier Future Generation Computer Systems
- Elsevier Computers and Electrical Engineering
- Elsevier Computers & Security
- IEEE Transactions on Sustainable Computing

Conference Program Chair & Co-Chair

- Program Co-Chair, *The IEEE Workshop on Automation of Cloud Configuration and Operations (ACCO 2019, co-located with AICCSA 2019)*, Abu Dhabi, AUE, 2019
- Program Co-Chair, *The IEEE Workshop on Automation of Cloud Configuration and Operations (ACCO 2018, co-located with AICCSA 2018)*, Aqaba, Jordan, 2018
- Program Co-Chair, *The IEEE Workshop on Automation of Cloud Configuration and Operations (ACCO 2017, co-located with ICCAC 2017)*, Tucson, AZ, USA, 2017
- Program Co-Chair, *IEEE International Workshop on Big Data Analytics for Cybersecurity Computing (BDAC 2016, co-located with Intelligence and Security Informatics (ISI 2016))*, Tucson, AZ, USA, 2016

Conference Chair

- Publicity Chair, The IEEE International Conference on Autonomic Computing and Self-Organizing Systems (ACSOS), Washington DC, 2020

- Registration, Finance, and Publication Chair, *16th ACS/IEEE International Conference on Computer Systems and Applications (AICCSA 2019)*, Abu Dhabi, UAE, 2019
- Proceedings Chair, *The International Conference on Big Data & Cybersecurity Intelligence (BDCSIntell'2018)*, Beirut, Lebanon, 2018
- Registration, Finance, and Publication Chair, *15th ACS/IEEE International Conference on Computer Systems and Applications (AICCSA 2018)*, Aqaba, Jordan, 2018
- Registration, Finance, and Publication Chair, *14th ACS/IEEE International Conference on Computer Systems and Applications (AICCSA 2017)*, Hammamet, Tunisia, 2017
- Registration, Finance, and Publication Chair, *IEEE International Conference on Cloud and Autonomic Computing (ICCAC 2017)*, Tucson, AZ, USA, 2017
- Registration, Finance, and Publication Chair, *13th ACS/IEEE International Conference on Computer Systems and Applications (AICCSA 2016)*, Agadir, Morocco, 2016
- Publication Chair, *IEEE International Conference on Cloud and Autonomic Computing (ICCAC 2016)*, Augsburg, Germany, 2016
- Registration and Finance Chair, *12th ACS/IEEE International Conference on Computer Systems and Applications (AICCSA 2015)*, Marrakech, Morocco, 2015
- Registration and Publication Chair, *IEEE International Conference on Cloud and Autonomic Computing (ICCAC 2015)*, Boston, MA, USA, 2015

Conference Technical Program Committee member

- The 11th IEEE International Conference on Cloud Computing Technology and Science (CloudCom'19), Sydney, Australia, 2019
- 2018 Artificial Intelligence and Cloud Computing Conference (AICCC 2018), Tokyo, Japan, 2018
- IEEE Global Communications Conference 2018, UAE, 2018
- Foundation and Applications of Self* Systems (FAS* 2018) Posters and Demos Session, Trento, Italy, 2018
- 6th International Conference on Control Engineering & Information Technology (CEI'18), Istanbul, Turkey, 2018
- International Workshop on Architectures for Future Mobile Computing and Internet of Things (FMCIoT'2018), Tangier, Morocco, 2018
- 10th IEEE International Conference on Cloud Computing Technology and Science (CloudCom'18), Cyprus, 2018
- 9th IEEE International Conference on Cloud Computing Technology and Science (CloudCom'17), Hong Kong, 2017
- IEEE International Conference on Cloud and Autonomic Computing (ICCAC 2017), Tucson, AZ, USA, 2017
- IEEE International Workshop on Autonomic Cloud Cybersecurity (ACC 2015, co-located with ICCAC 2015), Boston, MA, USA, 2015

Additional Duties

- Subreviewer for various conferences, such as IEEE Global Communications Conference (GlobCom 2018), International World Wide Web Conference (WWW 2016), The International Conference on Information and Communication Systems (ICICS 2014 and 2015), International Conference on Very Large Scale Integration (VLSI-SoC 2013, 2014, and 2015), NASA/ESA Conference on Adaptive Hardware and Systems (AHS 2013 and 2007)
- PhD forum mentor for the students attending AICCSA 2019 and AICCSA 2018

CO-SUPERVISED STUDENTS

PhD Students:

- Clarisa Grijalva, "*IoT security Framework for Smart Cyber Infrastructures*," University of Arizona, 2018 – Present
- Sicong Shao, "*Understanding Cyber Attackers and Attacks via Social Media Analysis*," University of Arizona, 2016 – Present
- Likai Yao, "*Autonomic Workflow for Weather Research and Forecast Workflows*," University of Arizona, 2015 – Present
- Zhiwen Pan, "*A Context Aware Anomaly Behavior Analysis Methodology for Building Automation Systems*," University of Arizona, 2015 – 2017
- Jesus Pacheco, "*An Anomaly Behavior Analysis Methodology for the Internet of Things: Design, Analysis, and Evaluation*," University of Arizona, 2014 – 2017

MSc Students:

- Birkan Kolcu, “Seniors’ Virtual Assistant via Artificial Emotional Intelligence,” University of Arizona, 2018 – Present
- Firas AlMoualem, “SDR - Based Resilient Wireless Communications,” University of Arizona, 2015 – 2017
- Shuqing Gu, “An Autonomic Workflow Performance Manager for Weather Forecast and Research Modeling Workflows,” University of Arizona, 2015 – 2017
- Bilal Al Baalbaki, “Anomaly Behavior Analysis System for ZigBee in Smart Buildings,” University of Arizona, 2013 – 2015

BSc Students:

- Birkan Kolcu, “LIDAR Security and Resiliency for Smart Cars,” Ozyegin University, 2017 – 2018

TEACHING INTERESTS

• Fundamentals of Cloud Security • Cybersecurity - Concept, Theory, Practice • Distributed Computing • Reconfigurable Computing • Algorithms, Graphs, and Networks • Computer Architecture & Performance • Fundamentals of Computer Engineering • Analysis of Algorithms • Microprocessors • Digital System Design

AWARDS

- *Best poster award* in CAC 2014 – F. Fargo, C. Tunc, Y. Al-Nashif, A. Akoglu, and S. Hariri, “Autonomic Management of Cloud Resources and Services Framework,” IEEE International Conference on Cloud and Autonomic Computing (CAC 2014), London, UK., Sep. 2014
- *Graduate Research Assistantship* in the Department of Electrical and Computer Engineering of the University of Arizona (Fall 2011 – Fall 2014)
- *Graduate Research/Teaching Assistantship* in the Department of Electrical and Computer Engineering at Northeastern University (Fall 2008 – Spring 2010)
- *Outstanding paper award* (F. Ugurdag, O. Keskin, C. Tunc, F. Temizkan, G. Fici, and S. Dedeoglu, “RoCoCo: Row and Column Compression for High-Performance Multiplication on FPGAs,” East-West Design & Test Symposium, Sevastopol, Ukraine, Sep. 2011)

MEMBERSHIP

- IEEE Member (2006 – Present)
- Turkish Student Association at the University of Arizona (Academic Advisor, Spring 2017 – Fall 2018)
- Turkish Student Association at the University of Arizona (President, Spring 2012 – Fall 2014)
- IEEE Student Branch at Bahcesehir University (President, Fall 2007 – Spring 2008)
- IEEE Student Branch at Bahcesehir University (Member, Fall 2006 – Fall 2007)

REFERENCES

- Prof. Salim Hariri, The University of Arizona, Tucson, Arizona hariri@email.arizona.edu
- Prof. Ali Akoglu, The University of Arizona, Tucson, Arizona akoglu@email.arizona.edu
- Prof. H.J. Siegel, Colorado State University, Fort Collins, Colorado hj@colostate.edu
- Prof. Hamamache Kheddouci, Lyon 1 University, Lyon, France hamamache.kheddouci@univ-lyon1.fr
- Prof. Youssif Al-Nashif, Florida Polytechnic University, Lakeland, Florida yalnashif@floridapoly.edu

More references are available upon request.