

SRIVATSAN VARADARAJAN

Technology Fellow | Safe Autonomy and Certifiable ML/AI Scientist | Innovator | Engineering Leader

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EXECUTIVE PROFILE

- Research scientist with an enduring passion for engineering large, complex, safety & security critical cyber-physical systems and a technologist at heart that derives great satisfaction from maturing relevant solutions from concept to prototype and eventually transitioning them to fielded products with practical constraints, real-world deployment situations and operational considerations.
- Over 20 years research and technology development experience that include securing \$MM grants in external R&D contracts, developing breakthrough technologies in internal R&D projects for Aerospace, Defense, Space and Industrial products, effectively demonstrating technologies during flights tests and in operational environments, providing engineering leadership roles on successful execution of large-scale projects as principal investigator or program manager and building global teams, fostering collaboration amongst them while also mentoring junior scientists and engineers in the process.
- Technical Engineering Fellow associated with Safe Autonomous Systems group within Advanced Technology (AT) which supports Unmanned Aerial Systems (UAS) and Urban Air Mobility (UAM) side of Honeywell's Aerospace business. Research areas include certifiable design of innovative technologies like Artificial Intelligence (AI) and Machine Learning (ML) for autonomous systems while leveraging formal methods (e.g., model checkers, theorem provers) and automated testing for their verification. Extensive expertise in the development of distributed, fault-tolerant networks, wireless communications and dependable, embedded hardware and software platforms.
- As an Engineering Fellow, part of various strategy initiatives within Honeywell to help drive product features anticipating marketplace/customer needs, develop technology roadmaps, participate in regulatory compliance/industry standardization efforts, manage Intellectual Property portfolio in strategic thrust areas, as well as oversee specific research and technology development projects in the core areas of certifiable platforms and assurance technologies for autonomous avionics systems.
- Pursue research interests by initiating and securing funding through government agencies like DARPA/NASA/AFRL/DHS/ARL/ONR and subsequently leading multi-institutional research efforts with university collaborators and industrial partners. Frequently interact with broader research community through publications, serving as track/session chairs or on program committees, participating in working groups, attending workshop/conference, acting as referees for various workshops/conferences/journals, and other professional affiliations.

EDUCATION

- Computer Science and Engineering, University of Minnesota. 1996 - 2004.**
Ph.D. Dissertation: *On End-to-End Quality of Service (QoS) Support and Resource Management for Continuous Media Delivery over Distributed Networks.*
- Mathematics, University of Minnesota. 2002 – 2003.**
M.S. Specialization: *Combinatorics, Stochastics and Measure Theory.*
- Computer Science and Engineering, University of Minnesota. 1996 – 1999.**
M.S. Thesis: *Error Spreading Protocol: A Perception-Driven Approach to Error Handling in Continuous Media Streaming.*
- Birla Institute of Technology and Science (BITS), Pilani, India. 1990 - 1994.**
M.M.S. Master of Management Studies (with specialization in Information Systems).

PROFESSIONAL EXPERIENCE

Oct 2019 - Present **Safe Autonomous Systems, Advanced Technology, Honeywell Aerospace**
Engineering Fellow (current)

- **Certifiable ML/AI for Assurable Autonomous Avionics:** Leading an Internal R&D project to develop an eco-system of certification aiding technologies including a scalable formal methods based verification approach for camera based automatic landing assists, explainable/interpretable methodologies for increasing trust/confidence of inference engine's correctness and leveraging verifiable runtime monitors for safety case of contingency handling of nominal/off-nominal situations during (semi) autonomous operations for UAM and UAS Cargo. Generate compliance evidence artifacts for ARP 4754/DO-178C/DO-254 & ARP 4761 (safety).
- **Certifiable Hardware and Platform Software for Next Generation Avionics:** Spearheaded Certifiable Multicore Deos platform technology from concept to technology readiness level (TRL) 6 and subsequently successfully transitioned it into NextGen products in strategic thrust areas for Honeywell. This was accomplished as part of an ongoing RDE project over 8 years. This hybrid ARINC 653/RMA solution results in lower size, weight and power (SWaP), lower certification costs and higher throughout performance, and therefore is a critical enabler for expanded offerings as well a scalable products & functions integration on a single platform. We are currently exploring time-space partitioned approach for GPUs and hardware assists that will enable AI/ML inferencing engines (e.g., perception) for autonomy applications to coexist with traditional avionics (e.g., displays).
- **DARPA Automated Rapid Certification of Software (ARCOS):** Leading the ongoing program effort as PI/PM for novel tool assisted frameworks for design of systems and software, their verification automation and finally enabling incremental certification e.g. satisfying DO-178C and Overarching Properties (OAP) objectives of design enhancements/software refinements. We are developing certified software components for Advanced Failsafe (AFS) function that monitor and handles contingencies for a copter/rotorcraft in Ardupilot platform for an autonomous surveillance mission. ARCOS tools are being transitioned into internal RDE projects to speedup certification of autonomy solutions. Boeing, as part of ARCOS, generated compliance evidence artifacts using our tools for AH-64 APACHE Navigation sub-

system and validated their scalability to handle complex software. This is joint work with SRI and University of Washington, Seattle. We are also developing a property based, outcome driven approach to certification leveraging safety and security assurance cases using Claims-Arguments-Evidence (CAE) notation for compliance. The automated analysis for defeaters, synthesis and semantic analysis is based on s(CASP)/Prolog engine uses sophisticated mechanisms such as abductive reasoning, counterfactual reasoning, constraint-based reasoning, and co-inductive reasoning. Joint work with Adelard, SRI and University of Texas, Dallas.

Aug 2016 – Oct 2019 – **Crew Interface and Platform Systems, Advanced Technology, Honeywell Aerospace**
Staff Research Scientist

- *DARPA Building Resource Adaptive Software Systems (BRASS)*: Lead PI/PM for Honeywell on a project related to Assurance of Autonomous Systems for the DARPA Building Resource Adaptive Software Systems (BRASS) program. This was joint work with SRI, University of California, Berkeley and Boston University. In the project we demonstrated adaptable software on a ROS/RADL platform for F1/10 autonomous car and a Segway robot equipped with LIDAR, IMU, GPS and Camera sensors. We developed Extended Kalman Filters (EKF) based navigation software that was robust to sensor failures, an adaptable sensor processing algorithm for a vision-based feature extraction under extreme weather and poor lighting conditions and finally a vehicle guidance and path planner for dynamic mission objectives.
- *NASA Safe Autonomous Systems Operations (SASO)*: Lead Investigator for the project as part of the Airspace Operations and Safety Program (AOSP). Collaborating with MIT, we developed a rigorous mathematical framework, based on Category Theory and Sheaf Theory, for analysis and safety assessment of complex distributed airspace systems-of-systems (SoS) like National Airspace (NAS) for Next Generation Air Transportation System (NextGen) technologies.
- *NASA Aviation Safety Program's System-Wide Safety Assurance Technologies (SSAT)*: PM/PI for Honeywell's joint collaboration with Galois on the program with the objective of Assuring Onboard Flight Critical Integrated Distributed Systems. As part of the project, we developed a Domain Specific Language (DSL) for system specifications from which actual flight software code can be synthesized that is both type safe and secure (w.r.t. memory safety, thread safety etc.) and also generate formal models (e.g. SAL, AADL) on which you can model-check safety/security properties to guarantee the generated implementation code inherits those properties.
- *NASA Orion C3I Network Router*: NASA Constellation project involving Lockheed Martin and Honeywell. Led the systems development team for Orion C3I Network Router for the NASA Constellation project which was essentially a Router in the sky for all constellation elements with an IP-based network capability to support command & data-handling, telemetry, other real-time traffic like audio/voice and video traffic. Honeywell developed the FPGA functions and hardware assists while Lockheed Martin provided the software functions. Design included Differentiated QoS with Token Bucket rate control with Deficit Weighted Round Robin (DWRR) Scheduling, Primary and Dissimilar Voice (PV-DV) Synchronization of audio between ground system and CEV. The technical focus at the different OSI layers of the network stack were: Application: Audio CODEC (G.729 to/from PCM), C&DH, FTP, Telemetry; Transport: RTP/UDP for Audio/Video; Network: QoS, IPv4/v6; Link: Spacewire, Ethernet, 802.11g MAC, TT-GbE; PHY: WAN I/F, 802.11g I/F, TT-GbE I/F, I/F to antennae, PCI, CPBus; Security: IPSec

Oct 2011 – Aug 2016 **Crew Interface and Platform Systems, Advanced Technology, Honeywell Aerospace**
Principal Research Scientist

- *NASA CEV TTGbE Network*: Part of the design team for the joint technology development between Honeywell and TTEch of Fault-Tolerant Time Triggered Ethernet (TTE), a next generation avionics networking Ethernet solution that supports mission critical on-board communication architecture for the Orion Crew Entry Vehicle (CEV) manned space program. TTE has been standardized in 2016 as SAE AS6802. The network connects all on-board avionics and controls on the crew exploration vehicle (CEV) and includes multi-priority traffic classes with different degrees of fault-tolerance and safety criticality levels. We developed a hybrid synchronous-asynchronous fault-tolerant protocol, design and verification of high-integrity and standard-integrity end-systems (HNIC, SNIC) and switches for this network.
- *Network Scheduling Tool (NST)*: Designed and Prototyped the Network Scheduling Tool (in Python) that schedules the Time-Triggered (TT) data flows on the TTGbE network. The tool uses a fast bin packing algorithm to do hybrid mixed mode scheduling whereby TT, Rate Constrained (RC) and Best Effort (BE) dataflows can coexist cooperatively on the network with appropriate guarantees on end-to-end bandwidth, latencies & jitter. NST has been made compatible with ESCAPE-VBN to also satisfy commercial network tooling requirements in addition to the NASA ORION program.
- *Multiple Level Security (MLS) Project*: Led an internal RDE project to evolve CDS5 display platform on OH-58 (Kiowa Warrior) toward MLS compliance and certification. Goal is to reduce Customer's risk of security failure and associated costs and for Increased Security Capabilities and Enclave Protections in existing platforms and better integrated safe and secure information flow management.
- *Cyber Reasoning Tool and Anomaly Detection Project*: Led an internal RDE multi-year project for developing an Adaptive Cyber Security Onboard Control Systems for Air Transport for detecting and responding to cyber threats in real-time. As part of the project, we designed, developed and matured a Bayesian Cyber Intrusion Detection and Protection System.

June 2004 – Oct 2011 **Crew Interface and Platform Systems, Advanced Technology, Honeywell Aerospace**
Senior Research Scientist

- *ITA Network Theory and Sensor Networks*: Lead principal investigator for US-UK International Technology Alliance, funded by the UK Ministry of Defence (MoD) and U.S. Army Research Lab (ARL), representing Honeywell as part of the IBM led industry and academic consortium, aimed at fundamental research in network sciences for developing inter-domain routing for MANETs and theoretical bounding of Quality of Information (QoI) in sensor networks for Kalman-filter based tracking applications.
- *DARPA META II*: Led the HON team along with SRI for the META II program which was part of DARPA's Adaptive Vehicle Make (AVM) portfolio of programs aimed at developing a new approach to design, verification, and manufacturing of complex defense systems and vehicles. We focused our project towards developing formal specification, modeling and analysis tools capability for different fault-tolerant network architectures, platform hardware design and software replication strategies.
- *Wireless Upload of Navigation Databases into the Aircraft*: Took on the Project Manager from being one of the key technical contributors for this ongoing project. We used 3G/4G/LTE

wireless service to upload database from a Wireless server Unit on the ground and accessible via the Internet into the DLMU or DL1000 LRUs on the aircraft. The key challenges are to manage the load time under stringent constraints: (i) supported data rates are not high (ii) frequent interruptions/disruption possible and (iii) to do so only during takeoff and landing because the aircraft will be powered on only during those times. Another challenge was to develop security approaches for confidentiality due to commercial needs versus authentication (source integrity) needed from safety perspective. Also built software prototypes for the RSA 2048 based signature-verification scheme that uses SHA-256 digest.

- *Next Generation IMA Networks*: Developed designs for Switches and End System/NICs (called SNITCHES) for the next generation network architectures in commercial avionics, including developing modeling, analysis and simulation capability. The goal is to reduce size, weight and power (SWaP) by connecting them in a BRAIN Fault-tolerant network architecture and building a high integrity host platform on top of such a network. The earlier evolution of the design included building similar technologies for Ethernet based switched avionics network including ARINC 664 Part 7 (AFDX) and Time Triggered Ethernet (TTE). Further developed algorithms for virtual link optimization and configurations under latency, jitter and loss constraints. Also conducted failure mode and effects analysis (FMEA) to categorize and study fault behavior on 644 networks.
- *Networked Radar*: Feasibility and related Technology development of Networking Aircraft Weather Radars. The goal is to extend aircraft surveillance range by sharing hazard information through an air-to-air network that uses each aircraft's weather radar as a communications device without hardware or RF modifications. The key challenge and contributions were in designing the multi-function waveform and a protocol with low-overhead networking which does hazard data information distribution through peer-to-peer streaming.
- *MANET Learning*: Automatic Learning-based Cross-Layer Parameter Configuration for a MANET. Our approach to network configuration uses distributed control that relies on automatically learning the relationships among configuration parameters and maintains near-optimal configurations adaptively, even during highly dynamic scenarios and under limiting resource conditions. This intelligent tuning of protocol stack parameters to automatically configure each node in the MANET uses a technique called ORACLE, the Optimizing Rapidly Adaptive Configuration Learning Engine, which is a unique hybrid approach to network configuration control, combining Machine Learning and network modeling.

Nov 2001 – June 2004 **Honeywell Technology Center, University of Minnesota**
Research Associate

ONR DYNAMIC Adaptation in Mobile Inter-networked QoS-aware Uninhabited Environments (DYNAMIQUE): The goal of this project was to be able to provide fine-grained QoS control for critical applications in a mobile ad-hoc network. We formulated the Admission Control and QoS Adaptation problems, simulated our proposed mechanisms in QUALNET in each case over routing protocols like AODV, DSR and validated its performance through analytical studies.

Sep 1996 - June 2004 **University of Minnesota**

Guidant PhD Dissertation Fellowship.
Graduate Teaching Instructor; Research Assistant; Teaching Assistant

June 1998 IBM Almaden Research Center
– Sep 1998 Summer Intern.

Developed a Performance Monitoring and Fault Injection Tool, to aid testing for fault tolerance in the Distributed Shared RAID cluster. The code was developed in C, C++ on the NT platform with varying software layers: Application (Tcl plugins and scripts), NT Driver routines and Firmware (embedded software on the Copperhead Adapter).

May 1996 - Bell Labs, Lucent Technologies
Aug 1996 Summer Intern.

Developed a capacity management tool for their switching software, especially determining load on their 5ESS switches. This was an analyzer of CPU load, Network load (Socket Ports used up) and variety of metrics calculated of data from their switching software.

Aug 1994 – Fujitsu, ICIM (Indian Subsidiary of Fujitsu, Japan):
July 1995 Software Engineer, International Software Division.

- System Software: Part of the team, which developed a Code Analysis Tool for Fujitsu, Japan. Development was on Sun Solaris using C and front end on X-MOTIF.
- Application Software: Part of the team, which developed software for ICL Council Houses, UK and Waikato Hospital, New Zealand. Development was on INGRES V6.4 and front-end being Gupta SQL.

PATENTS, AWARDS and HONORS

1. Filed U.S. patent (pending), August 5, 2021, entitled "*Inference engine scheduling for time-space partitioned safety-critical avionics systems*", The new edge-computing platforms with specialized HW inference engine (e.g., GPU or FPGA) which are expected to co-host traditional graphics and new, mostly AI/ML compute applications like DNNs, Pavel Zaykov, Larry Miller, Srivatsan Varadarajan.
2. Awarded U.S. Patent No. 10917355, February 9, 2021, entitled "*Methods, systems and apparatuses for optimizing time-triggered ethernet (TTE) network scheduling by using a directional search for bin selection*", Benjamin F. DeLay, Srivatsan Varadarajan, Theodore J. Bonk, William T. Smithgall, Brent A. Morin.
3. Awarded U.S. Patent No. 10908955, February 2, 2021, entitled "*Systems and methods for variable rate limiting of shared resource access*", Srivatsan Varadarajan, Larry James Miller, Chittaranjan Kashiwar, Pavel Zaykov.
4. Awarded U.S. Patent No. 10887244, January 5, 2021, entitled "*Methods, systems and apparatuses for optimizing time-triggered ethernet (TTE) network scheduling by bin allocation, demand prediction and machine learning*", Benjamin F. DeLay, Srivatsan Varadarajan.
5. Awarded U.S. Patent No. 16420849, November 26, 2020, entitled "*System and methods for contingency budgeting for time-partitioned systems*", Pavel Zaykov, Larry James Miller, Srivatsan Varadarajan, Chittaranjan Kashiwar.
6. Awarded U.S. Patent No. 10768984, September 8, 2020, entitled "*Systems and methods for scheduling tasks using sliding time windows*", Srivatsan Varadarajan, Larry James Miller, Arthur Kirk McCready, Aaron R. Larson, Richard Frost, Ryan Lawrence Roffelsen.

7. Filed U.S. patent (pending), August 28, 2019, entitled "*Methods, systems and apparatuses for optimizing the bin selection of a network scheduling and configuration tool (nst) by bin allocation, demand prediction and machine learning*", Benjamin F. DeLay, Srivatsan Varadarajan.
8. Filed U.S. patent (pending), May 30, 2019, entitled "*Systems and Methods for Image Aided Navigation*", Benjamin Johnson, Vibhor Bageshwar, Srivatsan Varadarajan.
9. Filed U.S. patent (pending), February 2, 2019, entitled "*Systems and methods for simulating worst-case contention to determine worst-case execution time of applications executed on a processor*", Pavel Zaykov, Larry James Miller, Srivatsan Varadarajan.
10. Awarded U.S. Patent No. 9769082, September 19, 2017, entitled "*System and method for network bandwidth, buffers and timing management using hybrid scheduling of traffic with different priorities and guarantees*", Srivatsan Varadarajan, Brendan Hall, William Todd Smithgall, Ted Bonk, Benjamin F. DeLay.
11. Awarded U.S. Patent No. 9769075, September 19, 2017, entitled "*Interference cognizant network scheduling*", Srivatsan Varadarajan, Brendan Hall, William Todd Smithgall, Ted Bonk, Benjamin F. DeLay.
12. Awarded U.S. Patent No. 9762501, September 12, 2017, entitled "*Systematic hybrid network scheduling for multiple traffic classes with host timing and phase constraints*", Srivatsan Varadarajan, Brendan Hall, William Todd Smithgall, Ted Bonk, Benjamin F. DeLay.
13. Awarded U.S. Patent No. 9612868, April 4, 2017, entitled "*Systems and methods generating inter-group and intra-group execution schedules for instruction entity allocation and scheduling on multi-processors*", Arvind Easwaran, Srivatsan Varadarajan.
14. Filed U.S. patent (pending), January 5, 2017, entitled "*Methods and systems for adaptive cyber reasoning*", Raj Mohan Bharadwaj, Srivatsan Varadarajan, Darryl Busch, Jun Ho Huh, Daniel P. Johnson.
15. Filed U.S. patent (pending), August 25, 2016, entitled "*Method and system for optimizing wireless networks through feedback and adaptation*", Kartik B. Ariyur, Srivatsan Varadarajan, Yunjung Yi.
16. Awarded U.S. Patent No. 9306766, April 5, 2016, entitled "*Versatile source port enforcement for data networks*", Brendan Hall, Srivatsan Varadarajan, Guenther Bauer, Wilfried Steiner.
17. Awarded U.S. Patent No. 8976790, March 10, 2015, entitled "*Disjoint data path routing for integrity and availability augmentation*", Brendan Hall, Kevin R. Driscoll, Srivatsan Varadarajan.
18. Awarded U.S. Patent No. 8908675, December 9, 2014, entitled "*Virtual pairing for consistent data broadcast*", Brendan Hall, Srivatsan Varadarajan, Kevin R. Driscoll.
19. Awarded U.S. Patent No. 8665884, March 4, 2014, entitled "*Embedded end-to-end delay information for data networks*", Brendan Hall, Srivatsan Varadarajan, Wilfried Steiner, Guenther Bauer.
20. Awarded U.S. Patent No. 8634305, January 21, 2014, entitled "*Time triggered ethernet system testing means and method*", William Todd Smithgall, Brendan Hall, Srivatsan Varadarajan.
21. Awarded U.S. Patent No. 13073269, October 4, 2012, entitled "*Centralized traffic shaping for data networks*", Brendan Hall, Srivatsan Varadarajan, Wilfried Steiner, Guenther Bauer.
22. Awarded U.S. Patent No. 8193969, June 5, 2012, entitled "*Method and system for maintaining spatio-temporal data*", Srivatsan Varadarajan, Vicraj T. Thomas, James A. Freebersyser.
23. Awarded U.S. Patent No. 8107387, January 31, 2012, entitled "*Method to operate a wireless network having a predictable and stable performance*", Kartik B. Ariyur, Yunjung Yi, Srivatsan Varadarajan.
24. Awarded U.S. Patent No. 7486221, February 3, 2009, entitled "*Methods and systems for using pulsed radar for communications transparent to radar function*", David W. Meyers, James A. Freebersyser, Harold Vincent Poor, Srivatsan Varadarajan.
25. Awarded U.S. Patent No. 7460549, December 2, 2008, entitled "*Resource management for ad hoc wireless networks with cluster organizations*", Ionut E. Cardei, Allalaghata Pavan, Srivatsan Varadarajan, Lee B. Graba.

2012 NASA Johnson Space Center Group Achievement Award. Performing the Exploration Flight Test 1 (EFT-1) end-to-end between MCC at Johnson Space Center and the Lockheed Martin Integrated Test Lab in Denver

2012 Honeywell Aerospace Outstanding Engineer Award. This was a peer reviewed award and selected based on demonstration of excellence in design, problem solving, problem avoidance, technical advancement, customer satisfaction, creation of new business opportunities and/or significant cost reduction efforts.

2011 Honeywell Technical Achievement award. Cited for work on “Orion Command, Control, Communications and Intelligence Router Card and Network Scheduler”. These prestigious awards, which are given to less than one percent of the total Engineering population (7 winners in 2011 for Honeywell Aerospace wide), for their outstanding technical innovations, creativity and contributions to Honeywell Aerospace’s growth and success.

Corporate Research and Innovation awards. Multiple awards from Honeywell for outstanding technical contributions and excellence.

Guidant Fellowship for outstanding achievement, one fellowship was awarded by the department of Computer Science and Engineering, University of Minnesota, 2002-2003. The Guidant Foundation established a fund in the Institute of Technology to provide fellowships in the departments of Computer Science and Engineering, Electrical and Computer Engineering, and Mechanical Engineering for students of academic merit.

Research Fellowship by Honeywell, through University Affiliate Program, 2001-2004.

Secured awards with merit scholarships in National Science Talent Search Exams, Physics Talent Society of India.

PROFESSIONAL AFFILIATIONS and ACTIVITIES

Involved with many full proposals as co-PI for external sponsors like NASA, DARPA, ONR, AFRL, ARL and NSF.

Participated in TTGbE standardization, AADL workshop and would potentially in the future in the AVSI standards body, contingent on budget availability.

Full Professional Member of ACM and IEEE.

Refereed for professional conferences and journals: IEEE INFOCOM, NOSSDAV, IEEE ICDCS, IEEE Symposium on Reliable Distributed Systems, ACM SIGMETRICS, IEEE/ACM Transactions on Networking, IEEE Journal on Selected Areas in Communications and IEEE Transactions on Parallel and Distributed Systems. Also was on the program committee and a referee for IEEE International Symposium on Object/Component/Service-oriented Real-time Distributed Computing (ISORC).

Program committee and track chair for AI/ML in Integrated Communications, Navigation, and Surveillance (ICNS) conference. ICNS the premier international aviation conference addressing technology and policy advances in communications, navigation, and surveillance (CNS) and air traffic management (ATM). The ICNS Conference provides a forum for leaders and technical experts from government, industry, and academia around the world to address important policy issues and set the future direction of CNS and ATM.

PUBLICATIONS

Journals

1. **Language for Unified Verification and Implementation for Distributed Avionics**, with Benjamin F. Jones, Lee Pike, and Brendan Hall; Journal of Aerospace Information Systems, American Institute of Aeronautics and Astronautics, October 2018.
2. **Resource Management for Ad-hoc Wireless Networks with Cluster Organization** with I. Cardei, P. Allalaghata, L. Graba, M. Cardei and M. Min; special issue on cluster computing in the Internet: Journal of Networks, Software Tools and Applications, Kluwer Academic Publishers, Volume 7, Issue 1, Jan 2004.
3. **On Localized Control in Quality-of-Service Routing** with S. Nelakuditi and Z-L. Zhang; IEEE Transactions on Automatic Control (ToAC), Special Issue on Systems and Control Methods for Communication Networks, August 2002.
4. **Error Spreading: A Perception-Driven Approach Orthogonal to Error Handling in Continuous Media Streaming** with H. Ngo and J. Srivastava; IEEE/ACM Transactions on Networking (ToN), Feb 2002.

Conferences and Workshops

5. **Requirements-Driven Model Checking and Test Generation for Comprehensive Verification**, with Devesh Bhatt, Hao Ren, Anitha Murugesan, Jason Biatek and Natarajan Shankar, to appear in NASA Formal Methods Symposium (NFM), Organized by Jet Propulsion Laboratory (JPL), May 2022.
6. **IP Core for Cache and Memory Thrashing**, with Michal Dobes, Pavel Zaykov, Larry Miller, and Pavel Badin, submitted to 28th IEEE International Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA), 2022.
7. **DesCert - Design for Certification**, with Devesh Bhatt, Natarajan Shankar, Michael Ernst, et al. DARPA Automated Rapid Certification Of Software (ARCOS), Phase 1 Technical Report, October 2021, also on arXiv - March 2022.
8. **Abstraction, Composition and Contracts: A Sheaf Theoretic Approach**, with Alberto Speranzon, and David Spivak, Logic in Computer Science, arXiv preprint, February 2018.
9. **Operadic Analysis of Distributed Systems**, with Alberto Speranzon, David Spivak, and Patrick Schultz, NASA Technical Report; Contract Number: NNL14AA05C, NASA Aviation Safety program SSAT, November 2017.
10. **Enhanced Security of Building Automation Systems Through Microkernel-Based Controller Platforms**, with Xiaolong Wang, Richard Habeeb, Xinming Ou, Siddharth Amaravadi, John Hatcliff, Masaaki Mizuno, Mitchell Neilsen, and S. Raj Rajagopalan, 2017 IEEE 37th International Conference on Distributed Computing Systems Workshops (ICDCSW), June 2017.
11. **A Sheaf Theoretic Modeling and Composition Framework for Complex Systems of Systems**, with Alberto Speranzon, and David Spivak, 20th ACM International Conference on Hybrid Systems: Computation and Control conference (HSCC); *Winner of the Best Poster at HSCC 2017*, April 2017.
12. **Maximizing Fault Tolerance in a Low-SWaP Data Network**, with Kevin Driscoll, Brendan Hall, 31st Digital Avionics Systems Conference (DASC), October 2012. Nominated for *Best of Conference Award* and won the *Best Paper in Session Award*.
13. **Quantitative Fault Propagation Analysis for Networked Cyber-Physical Systems**, with Linda Briesemeister, Grit Denker, Daniel Elenius, Ian A. Mason, Devesh Bhatt, Brendan Hall, Gabor Madl Wilfried Steiner, Second Analytic Virtual Integration of Cyber-Physical Systems (AVICPS) Workshop, November 2011.

14. **META 2f: Probabilistic, Compositional, Multi-dimension Model-Based Verification (PROMISE)**, with Linda Briesemeister, Grit Denker, Daniel Elenius, Ian A. Mason, Devesh Bhatt, Brendan Hall, Gabor Madl Wilfried Steiner, Defense Technical Information Center (DTIC); DARPA META Program Final Report, October 2011.
15. **TT Ethernet Dataflow Concept**, with Wilfried Steiner, Gunther Bauer, Brendan Hall and Michael Paulitsch, The 8th IEEE International Symposium on Network Computing and Applications (IEEE NCA09), May 2009.
16. **Topology-aware Inter-domain Routing for Heterogeneous MANETs**, with Starsky H.Y. Wong , Seung-Hoon Lee, Chi-Kin Chau, Jon Crowcroft, Mario Gerla, Kang-won Lee, Annual Conference of ITA (ACITA) 2009.
17. **Inter-Domain Routing for Heterogeneous MANETs** with Seung-Hoon Lee, Starsky H.Y. Wong, Chi-Kin Chau, Kang-won Lee, Jon Crowcroft, Mario Gerla, Demonstration and short paper at ACM Hotmobile 2009.
18. **Multi-Sensor Centralized Tracking System; A study of QoI of H_∞ filter-based trackers with synchronization and localization errors artifacts on the sensor networks**, with Vibhor Bageshwar. Technical report ITA system (ITACS), December 02, 2008.
19. **Analytic Framework and QoS Adaptive Mechanisms for Achieving Transport Capacity Bounds in Multi-hop Statically Routed IEEE 802.11b Networks** with Yunjung Yi and Kartik Ariyur, First Annual Conference of ITA (ACITA) 2007.
20. **Automatic Learning-based MANET Cross-Layer Parameter Configuration** with K. Haigh, C.Y. Tang, IEEE International Conference on Distributed Computing Systems (ICDCS 2006) workshop on Wireless Ad hoc and Sensor Networks (WWASN2006), Lisbon, Portugal.
21. **Coverage-aware proxy placement for dynamic content management over the Internet** with R. Harinath, J. Srivastava and Z. L. Zhang; IEEE International Conference on Distributed Computing Systems (ICDCS) workshop "International Workshop on New Advances of Web Server and Proxy Technologies", May 2003.
22. **An Adaptive, Perception-Driven Error Spreading Scheme in Continuous Media Streaming** with H. Ngo and J. Srivastava; Proceedings of the 20th International Conference on Distributed Computing Systems (ICDCS 2000), cosponsored by IEEE Computer Society, April 2000.
23. **Adaptive Layer Discard Schemes for Video Delivery over Wireless Networks** with S. Nelakuditi, R. Harinath and Z. L. Zhang; LANMAN'99, the 10th IEEE Workshop on Local and Metropolitan Area Networks.
24. **Error Spreading: Reducing Bursty Errors in Continuous Media Streaming** with H. Ngo et.al Proceedings of the IEEE International Conference on Multimedia Computing and Systems (ICMCS), June, 1999.
25. **Performance Evaluation of Media Losses in Continuous Media Toolkit** with D. Wijesekara, S. Parikh and J. Srivastava; in the proceedings of the International Workshop on Multimedia Software Engineering, MSE, 1998.
26. **Providing Cost-effective Multimedia Services in a Concurrent Engineering Environment** with J. Srivastava et.al; in the proceedings of the Concurrent Engineering Symposium 1998, Detroit Michigan.

SELECTED TRAININGS and CERTIFICATIONS

Six Sigma Green Belt Certified 2005.

Honeywell Leadership Skills workshop, 2008.

Honeywell Strategic Marketing Workshop Training, 2012.

CITIZENSHIP and STATUS

US Citizen

REFERENCES

Provided on request