COMPUTER SYSTEMS FACULTY

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Yuvraj Agarwal

George Amvrosiadis

David Andersen

Nathan Beckmann

Guy Blelloch

Randy Bryant

Christos Faloutsos

Greg Ganger

Philip Gibbons

Seth Goldstein

Mor Harchol-Balter

James C. Hoe

Zhihao Jia

Swarun Kumar

Brandon Lucia

Todd Mowry

Dave O'Hallaron

Bryan Parno

Andy Pavlo

Raj Rajkumar

Mahadev Satyanarayanan

Srinivasan Seshan

Justine Sherry

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Dimitrios Skarlatos

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Scalable Parallelism, Dynamic Parallelism, Self-adjusting Computation

Broadly construed, I research problems of scalability. Current foci include the design and development of abstractions, algorithms, languages, and systems for scalable parallel, dynamic, and interactive computation.

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Software Systems, Embedded Systems, Mobile Computing, Security/privacy, Energy Efficiency;

My primary research interests are in the broad area of systems – especially at the intersection of hardware and software systems. In recent years, I have worked on topics related to Energy Efficient Computing, Mobile Systems, Energy Efficient Buildings and the Internet of Things (IoT) with a significant cross cutting interest on security and privacy issues. In general, I like to design, build, deploy and evaluate systems at scale and I am actively looking for students to work with!

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Storage systems, distributed and operating systems, systems for machine learning

Current ongoing projects span distributed and cloud storage, new storage technologies, high performance computing, and systems for machine learning. In the (near) past I focused on building extremely scalable file systems, and finding workload assumptions that introduce biases in the design of distributed systems.

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Networks, distributed systems, overlay networks, peer-to-peer, availabilty, Internet measurement, wireless & ad-hoc networks.

I study the "systems" side of networks: How to improve the availability, performance, and usability of Internet-based and wireless and mobile systems. My research emphasizes building real systems and conducting real-world measurements to provide a better understanding of these networks.

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Computer systems & architecture, analytical modeling

My work spans computer systems, computer architecture, and analytical modeling. I'm interested in designing hardware-software systems that transparently adapt themselves to programs, letting general-purpose systems approach the performance of fully specialized architectures. I'm particularly excited about problems that require a combination of theory and practice to solve well.

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Parallelism, Data Structures and Algorithms, Cache Efficient Parallel Algorithms

My research has largely been in the interaction of Algorithms and Programming Languages, much of it in the area of parallel computing.

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Cloud computing and its application to large-scale, data-intensive computing problems; Formal verification of hardware and software

My recent research focus is in the use of large-scale, cluster-based computing facilities (often referred to as "clouds") for applications involving multiple terabytes of data. Specifically, I am interested in questions about what kind of programming models and algorithms will scale up and operate effectively in cloud computing environments.

I also have a longstanding interest in developing automated techniques to formally verify both hardware and software systems. This work spans many levels of the system, from transistor circuits up to high level protocols, and many levels of abstraction from individual bits up to abstract representations of data and memory structures.

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Databases, data mining

The major focus of my research is on data bases and data mining. There are three major research areas: Multimedia, sensor, and graph data mining. We use power laws, Singular Value Decomposition, to help us detect patterns and outliers, as well as concepts from fractals and self-similarity.

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Cloud computing, storage/file systems, operating systems, and distributed systems

My group and I explore new software systems approaches to address technology changes and enable new functionalities. We have ongoing projects in such areas as cloud computing systems, system support for machine learning (ML), resource scheduling, and distributed storage systems.

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Massive data sets, parallel computation, bridging theory and systems.

In my research I work on write-efficient algorithm design, for settings (such as emerging non-volatile memories) where writes are significantly more costly than reads. I also work with mapping out and exploring the space of large-scale machine learning from a systems' perspective.

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Compilers and Parallel Architectures, Technology and the Labor Market, Crypto-currencies, Programmable Matter, Reconfigurable Computing

My research is broadly about massively distributed systems (multicore processors, reconfigurable computing, molecular electronics, programmable matter, and Economics). The ULI project concerns new compiler techniques and architectures to support practical and efficient parallel programs on multicore processors. The BoLT project is researching distributed public ledgers (design, implementation, regulation) with a focus on increasing financial equity, universal basic income, identity management, and the interaction with real-world data.

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Stochastic modeling and analysis of computer systems; Resource allocation for distributed systems; Power management in data centers

I design new scheduling/resource allocation policies for many distributed computer systems, including multi-tiered data centers, web server farms, databases, and networks. My work involves analytical modeling of systems. I use queueing theory, probabilistic analysis, stochastic processes, optimization, and lots of math in general. I am always looking for students with exceptional analytical skills and math creativity.

James C. Hoe, Professor (ECE & CS);
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Computer architecture, high-level hardware description and synthesis

I am interested in many aspects of computer architecture and digital hardware design, including the specific areas of FPGA architecture for computing; digital signal processing hardware; and high-level hardware design and synthesis.

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Systems for machine learning, machine learning for systems, parallel and heterogeneous computation, distributed systems

My research interests lie in the intersection of computer systems and machine learning. In particular, my current research focuses on building efficient, scalable, and performant systems for ML applications, as well as leveraging ML techniques to optimize systems design.
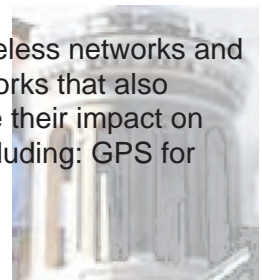
Swarun Kumar Assistant Professor (ECE & CS)
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Computer Networks, Wireless Networking, Distributed Systems, Mobile Computing

My research interests are in the area of computer networks with a special focus on wireless networks and mobile systems. I design and build systems that enable fast and reliable wireless networks that also provide new services. To do so, I study wireless signals at the physical layer to analyze their impact on data traffic and user applications. My research has targeted a range of applications including: GPS for indoors, robotic networks, wireless security and driverless cars, to name a few.

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Computer architecture, Programming and Software Systems, Intermittent Computing, Edge Computing, Space Computing Systems

I do research on the boundary between computer architecture, computer systems, and programming languages. I lead the abstract research group, and I am looking for graduate students who are excited about computer architecture, systems, and programming research on the hardware/software boundary.

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Computer architecture, compilers, operating systems, parallel processing, database performance, and robotics

My research interests focus on techniques for automatically transforming important applications (e.g., database management systems) to make them faster, more robust, and more energy-efficient.

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Scientific computing, Data-intensive computing, Cluster management, Cloud computing, and virtualization.

My students and I are developing a system called Autolab: an autograding service for the world's universities. Our research aims to understand the ideas and techniques needed to support a worldwide hosted service centered around the notion of autograding (i.e., programs evaluating other programs.) In particular we need to (1) create new abstractions for specifying labs, (2) formalize our notion of "tweaking" assignments" so that we can create "polymorphic labs" that change from semester to semester, and 3) develop new runtime techniques for evaluating the correctness and efficiency of programs, especially parallel programs.

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Security, Systems, Verification, Applied Cryptography

My research is primarily focused on investigating long-term, fundamental improvements in how to design and build secure systems. As a result, my work combines theory and practice to provide formal, rigorous security guarantees about concrete systems, with an emphasis on creating solid foundations for practical solutions. In the past, I have worked on topics such as network and system security, applied cryptography, usable security, and data privacy.

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Databases

I only care about databases.

Ragunathan (Raj) Rajkumar, Professor (ECE & CS)
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Distributed embedded, real-time and multimedia systems

My research interests are in all aspects of cyber-physical systems including connected and automated vehicles, real-time embedded systems and smart city technologies.

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*Edge computing, mobile computing, Internet of Things, distributed systems, operating systems*

My research focuses on the challenges of performance, scalabilty, availability and trust in information systems that reach from the cloud to the mobile edge of the internet. Most recently, I have been exploring the unique new opportunities enabled by cloudlet-based edge computing, especially wearable cognitive assistance applications that can be characterized as "Augmented Reality meets Artificial Intelligence".

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Network protocols/services/applications, distributed systems, mobile computing, and wireless networks

My research interests are broadly in the areas of network protocols, wireless networking, mobile systems and distributed systems. Most of my current research focuses on the following topics: 1) Using in-network and on-NIC processing effectively in data centers, 2) System and network support for streaming applications, especially low-latency applications such as AR, VR and gaming, 3) Congestion control protocol design and testing.
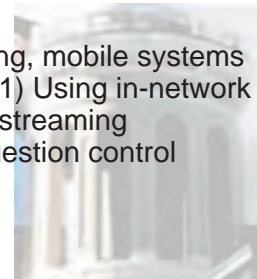
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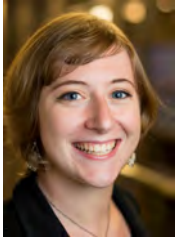
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Networked systems, Network functions virtualization, Congestion control, Computer system performance and fault-tolerance, Privacy and network security

My work focuses on computer networks. I've worked in the past on topics like network functions virtualization, network privacy and security, congestion control, datacenter networking, Internet measurement, and Internet architecture.   The bulk of my recent work has focused on network functions virtualization and network devices called middleboxes.

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Security, cryptography, distributed systems, and language-based security

I am broadly interested in security, cryptography, and distributed systems. I've worked on creating a scientific foundation for blockchains, and using programming language techniques to make cryptography easy to program.

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Computer Architecture, Operating Systems, Security

My research bridges computer architecture and operating systems focusing on performance and security. My work follows two central themes: (a) uncovering security vulnerabilities and building defenses at the boundary between hardware and OS, and (b) re-designing abstractions and interfaces between the two layers to improve performance and scalability.

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Networks, wireless networks, distributed computing

My current research focuses on future Internet architectures and wireless networking. The eXpressive Internet Architecture project is developing novel architecture that radically improves the trustworthiness, flexibility, and evolvability of the network. In the area of wireless, I have ongoing research to make various wireless deployments, such as residential and vehicular, self-managing and to leverage dynamic spectrum access opportunities.

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Computer and networked systems, Distributed data storage and caching,
Bridging theory and systems

My research interests lie in the broad area of computer and networked systems with a current focus on reliability, availability, scalability, and performance challenges that arise in data storage and caching systems, in systems for machine learning and in live video streaming. I emphasize on taking a principled approach to solving systems and networking problems. My group focuses on designing system solutions rooted in fundamental theory and in building systems that employ these solutions and insights to advance the state-of-the-art.
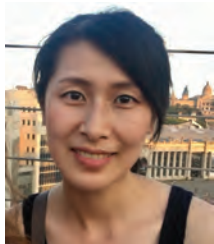
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System Security and Applied Cryptography

I am broadly interested in system security and applied cryptography. I take inspiration from the privacy and security challenges that people face today, and I like to solve such problems by building practical and secure systems via a co-design of systems and cryptography. One of my recent interests is in building systems that enable "sharing without showing": multiple organizations can jointly compute on their collective sensitive data while only learning their own input and the final result. Overall, my goal is to democratize advanced cryptography so that its capabilities are made accessible to everyone.