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Immediate Release

Three NYU Tandon teams win $2.5 million from an NSF partnership to ensure resiliency is part of next-G wireless telecommunications

BROOKLYN, New York, May 11, 2022 – Lightning-fast, low-latency wireless, from 5G to 6G and beyond, will enable such services as virtual and augmented reality streaming, near zero latency vehicle-to-cloud communications to help self-driving cars navigate in real time, remote surgery, coordination of automated systems in factories and other facilities, and a plethora of futuristic consumer apps. But it will also open a Pandora's box of security vulnerabilities in the hardware serving as its backbone and software driving its networks.

A new National Science Foundation (NSF) initiative has awarded three teams of researchers at the NYU Tandon School of Engineering a combined $2.5 million to confront these challenges head on. Participating in the projects, which are supported by NSF's Resilient and Intelligent Next Generation Systems (RINGS) partnership, are Elza Erkip, Siddharth Garg, Zhong-Ping Jiang, Farshad Khorrami, Ramesh Karri, Yong Liu, Pei Liu, Shiv Panwar, and Sundeep Rangan. All are professors of electrical and computer engineering, with affiliations at NYU WIRELESS, NYU Center for Cybersecurity, and the Center for Advanced Technology in Telecommunications (CATT).

Together, the projects will focus on making current and future wireless infrastructure, software and hardware systems more resilient to flaws, accidents, subterfuge and hacks. Of the RINGS partnership grants awarded to 37 institutions, NYU Tandon was one of only three to receive a trio of them.

"Broadly speaking, to 'harden' next-generation telecommunications, we are seeking to understand and rethink the design of wireless networks from the physical layer — the foundational hardware of telecommunications networks — up to the application level," said Rangan. "Advanced wireless systems and protocols are increasingly critical to the national economy, and resilience and resistance to attack are key to protecting vital investments already made and that are continuing to be made."

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One of the three projects focuses on building next generation resilient wireless systems from unsecure hardware. It will look into ways of flagging so-called hardware Trojans. These are malicious additions to hardware components supplied by a third party in order to launch an attack from within a network node, such as a cellular base station. Once triggered, these attacks can degrade or disable service, transmit signals to disrupt other nodes, or snoop or leak sensitive data.

Among the research team's objectives are estimating the capacity of undetected hardware attacks and optimizing the power and computation devoted to hardware verification. They will apply these methods to networks, making it easier to detect jamming and multi-user attacks. The researchers are also developing a novel and powerful evaluation platform to experiment with hardware security methods at different regions of the radio spectrum.

According to Karri, Co-Chair of NYU Center for Cybersecurity, the project will explore attackers' and defenders' use of analog side channels unique to 5G, including radio frequencies in the millimeter-wave spectrum, side-by-side computer system timing information, power consumption and digital side channels. The defenses will be evaluated on a 5G software-defined radio, through the use of crowdsourcing as part of NYU Tandon's 2022 CSAW Embedded Security Challenge.

Added Panwar, Director of CATT – which is sponsored by the New York State's Empire State Development's Division of Science, Technology and Innovation: "There is growing interest in the resilience and security of 5G, so NYU Tandon, home to the Center for Cybersecurity and NYU WIRELESS, is in a great position to work at this intersection of security and wireless to secure the current and next generation of telecommunications."

Another of the projects aims to advance data modeling with the goal of enabling resilient edge networks with data-driven model-based learning. Computational wireless systems enable secure, robust, and high-performance applications in education, business, transportation, healthcare, entertainment and more. Edge networks, where computation and data storage capabilities are as close as possible to the source of a request, are key to their success.

The investigators will address vulnerabilities that could affect the availability, reliability, and resiliency of edge networks. These include both expected resource and demand variations, such as diurnal application traffic patterns, user mobility, and random link/node failures; and unexpected shifts of operating conditions, such as traffic flash-crowds triggered by emerging events, and major infrastructure failures after coordinated malicious attacks and natural disasters.

Erkip is also a co-principal investigator with Andreas Molisch of the University of Southern California on a project to enable resilient delivery of real-time interactive services over NextG computer-dense mobile networks. The research takes a hard look at real-time interactive services (RTIs), a technology at the intersection of sensing, computation, and communications. Traditionally, these systems are not optimized to work with each other, particularly not in real-time, constraining the type of services that they can enable.

RTIs require real-time aggregation of distributed data streams onto edge/cloud computer servers that can process data as soon as it is generated. To make this possible, the investigators will develop a mathematical framework and algorithms to provide such RTI services with guaranteed latencies.

“The results will benefit the U.S. economy by enabling more efficient, more reliable, and more resilient automation schemes, for example for smart factories and farms, as well as improved augmented/virtual reality,” said Erkip.

As part of the projects, all three of the teams will engage local citizen scientists to create educational opportunities around the research, and will disseminate the results and data to the wider community through workshops. In addition, the PIs teach security and wireless classes at NYU and will integrate the research and experiments in their classes and class projects.

“Our project, for example, will include a robust plan for outreach to students from underrepresented groups,” Erkip added. “The interdisciplinary nature of the research will benefit participating students.”

RINGS, a public-private partnership focused on accelerating research to increase the competitiveness of the U.S. in networking and computing technologies and ensure the security and resilience of NextG technologies and infrastructure. The partnership includes **Apple**, **Ericsson**, **Google**, **IBM**, **Intel**, **Microsoft**, **Nokia**, **Qualcomm**, and **VMware**. Government partners include the U.S. Department of Defense's Office of the Under Secretary of Defense for Research and Engineering and the National Institute of Standards and Technology.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

About the New York University Tandon School of Engineering

The NYU Tandon School of Engineering dates to 1854, the founding date for both the New York University School of Civil Engineering and Architecture and the Brooklyn Collegiate and Polytechnic Institute. A January 2014 merger created a comprehensive school of education and research in engineering and applied sciences as part of a global university, with close connections to engineering programs at NYU Abu Dhabi and NYU Shanghai. NYU Tandon is rooted in a vibrant tradition of entrepreneurship, intellectual curiosity, and innovative solutions to humanity’s most pressing global challenges. Research at Tandon focuses on vital intersections between communications/IT, cybersecurity, and data science/AI/robotics systems and tools and critical areas of society that they influence, including emerging media, health, sustainability, and urban living. We believe diversity is integral to excellence, and are creating a vibrant, inclusive, and equitable environment for all of our students, faculty and staff. For more information, visit engineering.nyu.edu.

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