AT&T Business

Lightning-fast tech sparks leading-edge research

- **Business needs** - An environment to enable research in fields from agriculture to telemedicine.

- **Networking solution** - 5G+ connectivity and AT&T Multi-Access Edge Computing (MEC) deliver better connectivity with very low latency.

- **Business value** - High-speed technologies support leading-edge investigations that will benefit Tennessee and beyond.

- **Industry focus** - Education and research

- **Size** - The university has a $1.7 billion annual impact on the Tennessee economy.

About the University of Tennessee, Knoxville

The University of Tennessee, Knoxville (UT), is a public land-grant research university in Knoxville, Tennessee. Founded in 1794 (two years before Tennessee achieved statehood), UT Knoxville is the flagship campus of the University of Tennessee system, with 13 colleges. UT Knoxville is classified as producing very high research activity by the Carnegie Classification of Institutions of Higher Education (Doctoral Universities R1 category).

The situation

Research is a priority at UT, where faculty, students, and partners work to solve difficult challenges in education, agriculture, telemedicine, transportation, and many other fields. The university needed an environment that could deliver high-speed technologies with meaningful uses to Tennesseans and the world.

Solution

UT agreed to work with AT&T Business on research projects using the AT&T 5G+ millimeter wave spectrum network and AT&T Multi-Access Edge Computing (MEC) in a lab environment. UT is one of only six U.S. universities chosen to advance research initiatives with AT&T Business, enabling faculty and students to tackle real-world issues.

Unlocking complex challenges

The University of Tennessee, Knoxville, is home to nearly 34,000 students and 1,600 full-time instructors. It offers more than 900 study programs and 300 study abroad programs. It is working on more than $1 billion in projects.

UT is the state's flagship land-grant institution and premier public research university. The 910-acre urban campus has 294 buildings. It has thousands of world-class faculty, staff, students, and partners conducting research, scholarship, and creative work at the forefront of knowledge, unlocking solutions to complex challenges, and serving the people of Tennessee and communities far beyond.

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Collaborative, interdisciplinary research initiatives harness the creativity and ingenuity of faculty, staff, and students in each of UT's 13 colleges, the Institute for Agriculture, and the Space Institute. The university's 283 extension agents in all 95 counties across the state are a tremendous resource for state residents.

Working to improve lives

"UT is committed to investing in big ideas that match the state's most pressing challenges and aligning with stakeholders committed to innovating our economy for the future," said Marc Gibson, associate vice chancellor for research and director of the division of partnerships and economic

development. "Our students and faculty are solving complex challenges that help Tennessee companies remain competitive in a global market. Through industry partnerships and alliances with Oak Ridge National Laboratory, the Tennessee Valley Authority (TVA), and others, UT is leading cutting-edge research that helps us address economic growth."

University research expenditures were well over $320 million in 2022, and UT has already surpassed where it was at this time last year. "We're proud of that and looking at very large multidisciplinary proposals, working with alliances across the state with other institutions and industry partners," Gibson said.

The university teamed up two decades ago with Battelle Memorial Institute to manage and operate Oak Ridge National Laboratory to advance science in the service of humanity. "We're always looking for ways that our students, faculty members, and researchers can align with the state's needs," Gibson said. "We take very seriously our land-grant mission to serve all residents and communities—aiming to make life and lives better for all Tennesseans, and our relationship with AT&T is an example of the university working toward that goal."

New support for education and research

The university and AT&T Business created the AT&T 5G Lab on the Knoxville campus to support their shared commitment to bringing high-speed technologies with meaningful uses to Tennesseans. AT&T 5G+ networks support UT education and research with faster speeds and lower latency, allowing students and faculty to work with minimal interruption.

AT&T 5G+ uses the millimeter wave spectrum to deliver super-fast speeds and unprecedented performances in high-traffic areas. The higher bandwidth supports better quality video. The university also uses AT&T Multi-Access Edge Computing (MEC), a private cellular solution that delivers the coverage, speed, low-latency, security, and privacy that UT requires.

Better network connections create easier access to resources. The networks also enable virtual reality, giving students a more personal and collaborative online experience. Augmented reality applications help students better visualize projects.

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Aly Fathy, Ph.D.
Professor of Electrical Engineering
UT Tickle College of Engineering

Enormous opportunities

Özlem Kilic, UT Interim Vice Provost for Academic Affairs and Dean of the College of Emerging and Collaborative Studies, is enthusiastic about the possibilities for using AT&T Business technology. "It was such an enabler for us to have access to cutting-edge technology, for not only research but also from the education perspective," she said. "This technology is accelerating everything to converge."

The university was making progress before the AT&T 5G lab was introduced, she said, but the enhanced bandwidth enables the use of technology like artificial intelligence for real-time applications. "5G has opened up a great opportunity to pull things together a lot faster," Kilic said.

She appreciates working with AT&T Business technology and looks forward to offering students unique and exciting learning opportunities. "We are delighted that the AT&T Lab will enable us to use technology such as augmented and virtual reality to educate our students on concepts that may be either too risky, too dangerous, or impossible to have otherwise," she said.

For instance, she envisions the technology being used to support immersive virtual experiences such as with nuclear reactors or deep space exploration. "It is going to create enormous opportunities for us, and I want to recognize Deborah Crawford, our Vice Chancellor for Research, for her amazing support," Kilic said. Since joining the university, Vice Chancellor Crawford has led an ambitious new strategy to expand the university's research enterprise and impact.

A game changer for researchers

Aly Fathy, Professor of Electrical Engineering in the UT Tickle College of Engineering, has seen growing emphasis on new technologies and multidisciplinary studies during his 20 years at the university. "A good example is jumping to the 5G arena to do the latest research. We know this will be a game changer for areas like mobility, telemedicine, transportation, artificial intelligence, and other areas," he said.

Fathy is site director for a National Science Foundation Industry-University Collaborative Research Center. "One of our dreams was to collaborate with industry on high frequency millimeter wave communication," he said. Gibson took the lead to connect Fathy with AT&T Business. "We were talking with other communication companies as well, but AT&T is really

dominating with help and support to education," Fathy said. "I'm so happy that AT&T has established its centers to achieve that goal."

"With AT&T's generous donation to UT, we were able to fulfill our mission to interact with companies. Our AT&T account representative is very supportive and helpful, and we appreciate his encouragement and patience with us," Fathy said. "From the UT side, Deb Crawford and Marc Gibson helped quite a lot to get us to the second phase."

Interdisciplinary collaborations

Precision agriculture is an application for Kilic's dissertation, so she is enthusiastic about using 5G technology to remotely monitor crop health. "It's a whole new way of doing agriculture," she said. "There are exciting applications now since 5G is shrinking the technology, making it portable, and providing the bandwidth to do real-time computations. It's a big enabler in terms of monitoring vegetation and crops."

Fathy's interests include communications and security, so he has been working to address Tennessee's digital divide. He and his students are exploring ways to use 5G to augment the security of private networks and bring advanced antenna technologies to rural areas.

"There's also lots of interest in telemedicine, fast computation, and composite material manufacturing at UT using AI as well," he said. "And we've been working with Dean Kilic on the university's new College for Emerging and Collaborative Studies." AT&T Business presented a virtual reality demonstration that showed ways to use AI in different courses from mechanical engineering to library science for the new college.

Gibson welcomes the interest that UT's interdisciplinary collaborations have attracted. "This has brought tremendous momentum. The interest level with some of our industrial partners is at an all-time high, and the announcement of the AT&T test lab has really brought a lot of that to bear," he said.

"Every single application I can think of is highly sensitive, and a millisecond delay can be tremendously disastrous. Those are very important aspects that AT&T brings to the picture."

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Security and reliability

Network security and reliability are vital to university researchers. "We will be handling sensitive data ranging from human health to crop health to how we navigate autonomous cars in traffic," Kilic said. "Every single application I can think of is highly sensitive, and a millisecond delay can be tremendously disastrous. Those are very important aspects that AT&T brings to the picture."

"We will be handling health data, and it will have to be reliable," she added. "We can't drop any portion of an image that we are scanning for cancer, for example, so it's very important that our network is functional and reliable 100 percent of the time."

Gibson said the international automotive manufacturers working with UT expect dependable connectivity as well. "The work that they want to do with autonomous vehicles requires a reliable network. And some of our faculty members want to start researching smart manufacturing and what that means for factories and manufacturing facilities, so having a reliable network is critical to performing that type of research," he said.

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Fathy says the AT&T network has served him and his students well. "I'm getting better and better service and the system is working all the time with no problem at all. This is good. Very reliable."

Technical and workforce support

Fathy recently received a National Science Foundation (NSF) grant to train Tennessee community college faculty and students in the AT&T 5G lab. "We need technical and workforce support to increase the use of this technology in Knoxville and beyond," he said.

AT&T Business helped the university submit the proposal. "Our account representative put me in touch with the group at AT&T and one of them was actually working at the NSF. She helped me along the way to zoom in on certain areas," Fathy said. "AT&T appreciates the education and research aspect of our work and they want to help us along the way. This is a spirit you can't find in many industry places."

Kilic says the 5G lab presents new opportunities for industry partnerships. "Often the conversation has been ongoing for decades, but it has been limited to smaller scopes and the relationship is not sustained long term, so it doesn't grow to a bigger scale," she

said. "I think the 5G lab is a great example of how working together with industry can lead to bigger things. I'm excited about that new model."

Enhanced research with 5G technology

The future is promising for the leading-edge research being conducted at UT. "Emerging technology is rapidly changing how we do anything in our lives or businesses and 5G is an accelerator," Kilic said. "The investment from our university seed funds on 5G and the relationship with AT&T will be a game changer for us."

The university will be introducing new courses to enable students in many majors to explore how 5G will enable their lives and careers. "We want to encourage all our students, not just engineering or other STEM fields, in the conversations that AT&T and the 5G presence have enabled," she said. "Many new courses will be inspired by this technology."

UT engineers and scientists have been envisioning the possibilities of enhancing their research capabilities with 5G technology. "It has been in the back of our minds but having it on campus and looking with fresh eyes to the education prism, we realize that the stars are aligning. This technology is touching every discipline and changing future careers. And AT&T's presence was definitely a great trigger and enabler," Kilic said.

Gibson noted that the AT&T Business services will greatly enhance UT's work in artificial intelligence.

"That's one of the areas that the university is leading in, so this relationship and the work that we're doing with AT&T are critical for the forward-looking work we want to do to lead in that space."

The 5G technology will also make it easier for the university to support communities by providing improved connectivity and broadband access that makes it easier for students in rural areas to access online educational programs.

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