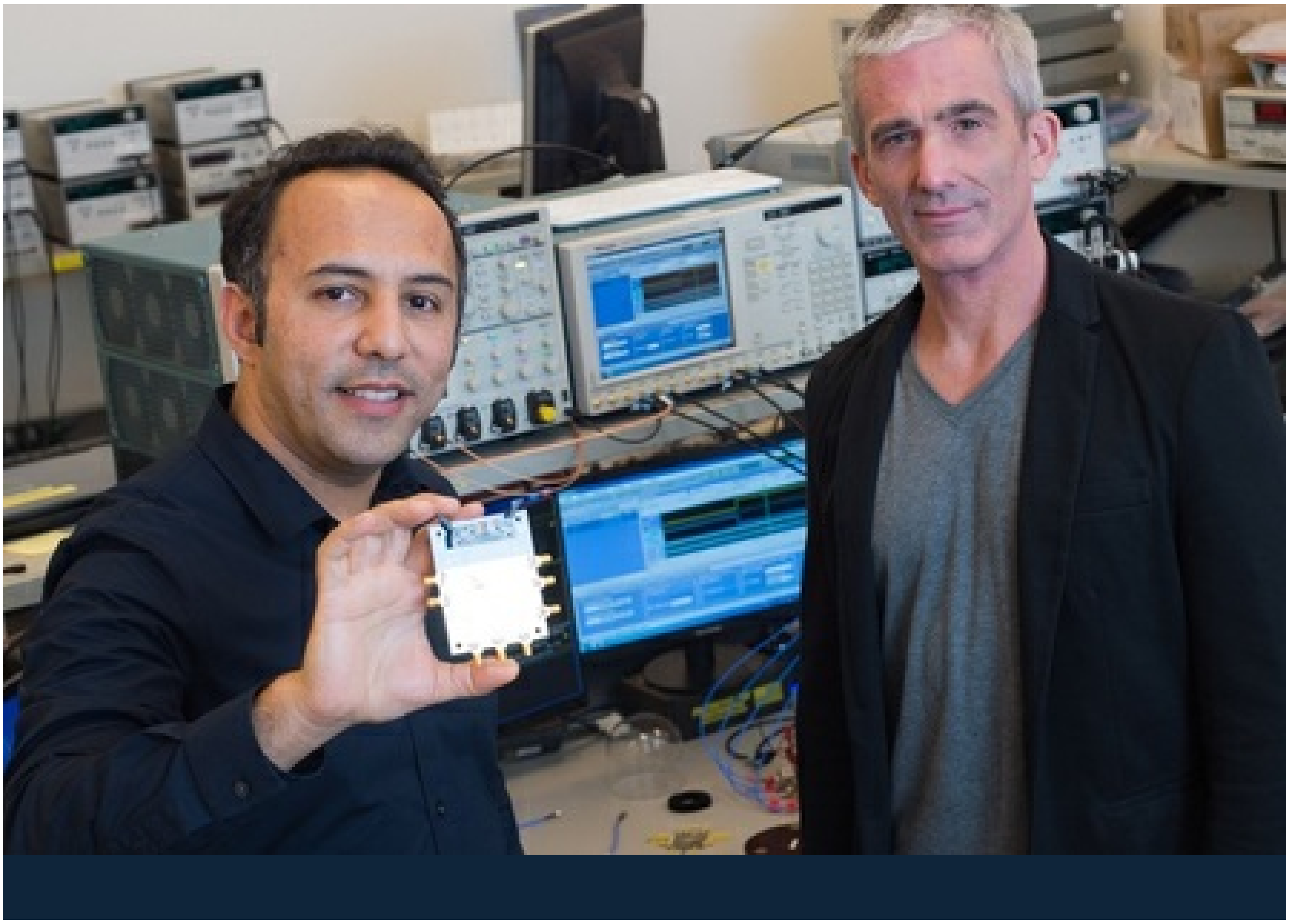
FierceWireless

Rice University researchers to use pulse-radio technology to deliver 1-terabit data

by Monica Alleven | Oct 13, 2016 11:22am



Inspired by none other than Italian radio inventor Guglielmo Marconi, researchers at Houston's Rice University in Texas are working on a laser-free wireless system capable of delivering 1 terabit of data per second.

For the uninitiated, 1 terabit of data could simultaneously stream about 200,000 high-definition movies. Put another way, 1 terabit would be about 20,000 times faster than today's 4G networks and about 20 times faster than the fastest home internet services in the U.S.

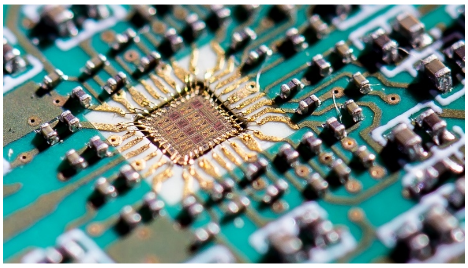
"Breaking the terabit-per-second barrier with radio will enable an entirely new set of wireless applications and communication paradigms," Edward Knightly, professor and chair of Rice's Department of Electrical and Computer Engineering, said in a press release. He's also principal investigator on a new $1.3 million, three-year grant from the National Science Foundation (NSF) to develop terabit wireless technology. That grant is part of a new $11 million round of investment announced by NSF this week.

Marconi first demonstrated pulse-based technology in the early 1900s using an antenna connected to a large capacitor. But instead of power going to a large antenna through an air gap, like Marconi's, the system developed at Rice goes to an on-chip antenna through a high-speed bipolar transistor, according to co-principal investigator Aydin Babakhani, an assistant professor of electrical and computer engineering at Rice.

"We're storing magnetic energy on the chip, and then using a simple digital trigger to release that," Babakhani said. "Once released, it radiates as a picosecond impulse. There is no oscillator: It's direct digital-to-impulse radiation. Unlike laser-based pulse systems, which can send even shorter pulses, ours can send many pulses very fast, which translates to a high pulse-rate frequency, something that's vital for achieving the data speeds we are targeting."

Babakhani said pulse-based technology is probably the only laser-free wireless technology that can support data rates in the 1-terabit-per-second range over a single channel, but his team must clear a number of hurdles to demonstrate that they can both send and receive 1 trillion high-frequency radio pulses per second.

Babakhani's lab set a world record earlier this year for transmitting the shortest radio pulse of 1.9 picoseconds. Plans call for developing and fabricating a dinner-plate-sized transmitter that can send even shorter pulses at high frequencies ranging from 100 gigahertz to several terahertz.



This chip converts a digital trigger to a 5-pico-second pulse of radiation with a frequency spectrum exceeding 1 terahertz. Image: Jeff Fitlow/Rice University

The transmitter will contain about 10,000 individual antennas – each of which is a separate microchip capable of sending out picosecond radio pulses. Babakhani said the number of antennas will boost the signal strength, making it possible to demonstrate the technology over distances up to a quarter mile. The antenna array also will allow the team to steer the signal with fine accuracy.

"Modulated, frequency-based communications technology has been perfect for the lower frequency radio waves that we have relied on over the past half-century, but everything changes at higher frequencies above 100 gigahertz," Knightly said in the release. "Instead of having signals that bounce off walls and are highly scattered throughout the environment, we're moving to a regime where we only effectively have line-of-sight. The benefit is we're going to blast all the bandwidth and all the information directly to a device with laser-sharp focus, and no one else will be able to intercept that signal because any receiver that's offline simply won't detect it. So, we're focusing like a laser but we're using radio. The challenge is to steer that beam to the right place at the right time and to follow users as they move."

For more:
- see the **release**
- see this *New Atlas* **article**

Related articles:
Rice University to study massive MU-MIMO thanks to $2.4M grant
Rice University claims multiuser MIMO breakthrough for TV white space
Rice University brings white-space network to Houston

Read More On

LTE **Rice University**

Crown Castle helps fund Texas 5G Alliance to smooth small cell deployments | FierceWireless

AT&T to lose hundreds of 5G millimeter wave spectrum licenses as part of FCC/FiberTower settlement | FierceWireless

Sprint to turn on Massive MIMO in 3 cities in April | FierceWireless

Sprint's CTO outlines network buildout plans, 5G preparations | FierceWireless

About the Author

Monica Alleven

Editor