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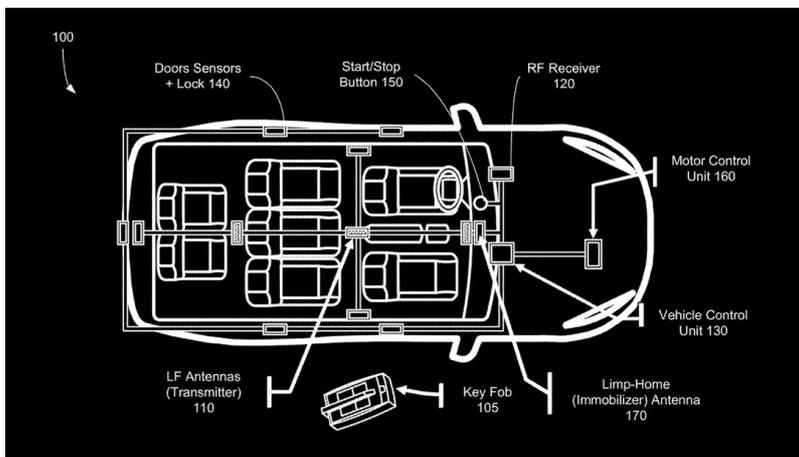
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# Apple built UWB into the iPhone 11. Here's what you need to know (FAQ)

Ultra wideband wireless technology will precisely pinpoint your location.

BY STEPHEN SHANKLAND | SEPTEMBER 14, 2019 5:00 AM PDT



Apple has patented the use of UWB, or ultra wideband, to recognize when you're approaching your car, unlock its doors and govern when you can turn it on.

Apple via US PTO; Stephen Shankland/CNET

This story is part of **Apple Event**, our full coverage of the latest news from Apple headquarters.

You've heard of [Wi-Fi](#), [Bluetooth](#) and [5G](#). Now it's time to learn another wireless communication term, because Apple has built it into its new [iPhone 11](#) and [11 Pro smartphones](#). The technology, ultra wideband, or UWB, lets you pinpoint the exact location of phones, key fobs and tracking tags, helping you find lost dogs or automatically unlock your car.

UWB calculates precise locations by measuring how long it takes super-short radio pulses to travel between devices. It's well suited to Apple's [rumored tracker tags](#). But UWB could also bring new smarts to your house, car and devices. Right now its use cases are limited, but UWB could lead to a world where just carrying your phone or wearing your

watch helps log you in to everything around you and log you out when you leave.

Apple's attention is good news for UWB fans who hope to see the technology catch on, says Tim Harrington, executive director of the [UWB Alliance](#), an industry group backing the technology. Unsurprisingly, Harrington is enthusiastic about Apple's embrace of the project.

"It's a game changer," Harrington said. "There's definitely more interest than there was three or four weeks ago."

Here's a look at UWB and its many uses.

### **What's UWB good for?**

Satellite-based GPS is useful for finding yourself on a map but struggles with anything much more precise and indoors. UWB doesn't have those handicaps.

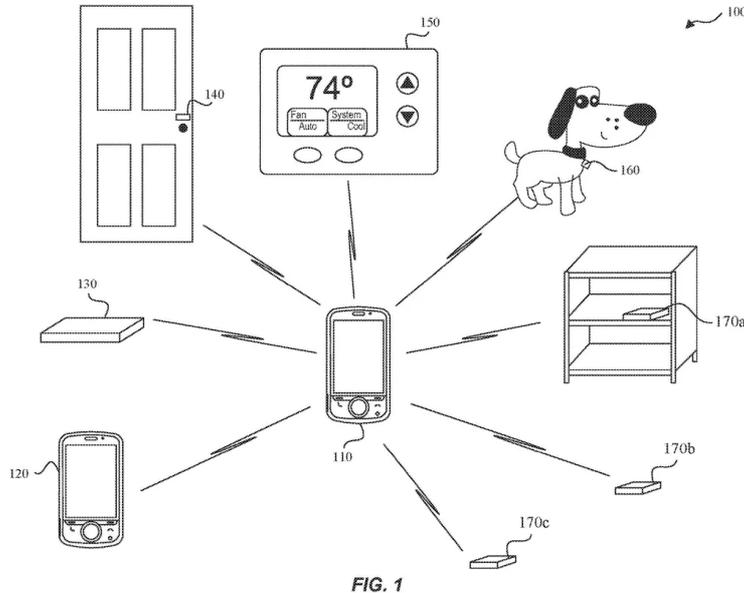
UWB could switch your TV from your child's Netflix profile to yours. Your smart speaker could give calendar alerts only for the people in the room. Your laptop could wake up when you enter the home office.

Imagine this scenario: You leave the office and as you near your car, receivers in its doors recognize your phone and unlock the vehicle for you. When you get out of the car at home, the receivers recognize you're no longer in the vehicle and lock the doors.

With UWB, your home could recognize that you're returning at night and illuminate your walkway. The technology could then automatically unlock your front door and turn on your home sound system, which follows you from room to room. "I'm walking in a sound and light cocoon in my house," said Lars Reger, chief technology officer of [NXP Semiconductors](#), whose chips are widely used in cars.

Bluetooth-based location sensing takes at least two seconds to get an accurate fix on your location, but UWB is a thousand times faster, Reger said.

UWB will add more than convenience, supporters say. Conventional key fobs have security problems in regard to remotely unlocking cars: criminals can use [relay attacks](#) that [mimic car and key communications](#) to steal a vehicle. UWB has cryptographic protections against that sort of problem.



Apple hopes UWB will help you find your dog, control your thermostat and unlock your front door.

Apple via US PTO

Of course, this same ability to track your movements has downsides, particularly if you don't like the idea of the government following your movements or coffee shops flooding your phone with coupons as you walk by. But with today's privacy push, it's likely phone makers won't let devices track your phone without your permission.

## How is Apple supporting UWB?

The iPhone 11 family has [Apple's new UWB chip, the U1](#). It joins a handful of other processors Apple has developed, including the [A series that powers iPhones and iPads](#), the M series for detecting phone motion and the [T series that handles Touch ID and other security duties](#) on Macs.

Apple didn't mention the U1 in its [iPhone 11 launch event](#) Tuesday, but it does on its website. "The new Apple-designed U1 chip uses ultra wideband technology for spatial awareness -- allowing iPhone 11 Pro to precisely locate other U1-equipped Apple devices. It's like adding another sense to iPhone," Apple says. "With U1 and iOS 13, you can point your iPhone toward someone else's, and AirDrop will prioritize that device so you can share files faster. And that's just the beginning."

Apple didn't respond to requests for comment about UWB and the U1.

Apple only promises UWB links between its own devices for now. But UWB standardization should open up a world of other connections, and software tweaks should let Apple adapt as UWB standards mature.

The effort is the culmination of years of work evident in several UWB patents. That includes patents for [shaping UWB pulses for more accuracy in distance measurements](#), using a [phone, watch or key fob location to enter and start a car](#), [calculating your path toward a car](#) so your car can send your phone a request for biometric authentication, and letting [Bluetooth and UWB cooperate](#) to grant you access to your car.

## Who else is interested in UWB?

Other companies involved with UWB include consumer electronics giants Samsung and Sony, chipmakers [Decawave](#) and NXP, carmakers Volkswagen, Hyundai, and Jaguar Land Rover, and car electronics powerhouse [Bosch](#).

Confusingly, those companies have banded together into two overlapping industry groups, the UWB Alliance [formed in December 2018](#) and the [FiRa Consortium](#) (short for "fine ranging") that [formed in August](#). Apple isn't listed as a member of either.



Apple marketing chief Phil Schiller touted the company's U1 chip for UWB in the iPhone 11.

Screenshot and illustration by Stephen Shankland/CNET

Each are working on standards to ensure UWB devices work together properly, but there are some differences. For example, the [UWB Alliance is trying to ensure UWB won't be harmed by a likely expansion of Wi-Fi into the 6GHz radio band](#) that UWB uses today. And the FiRa Consortium is the only one working on a program to certify that UWB devices work together, NXP said.

FiRa and the UWB Alliance are in discussions to align their work, Harrington says. "Both agree there needs to be only one standard," he said.

## How does UWB work?

The idea behind UWB has been around for decades -- indeed, the University of Southern California [established an ultra wideband laboratory called UItRa in 1996](#). Some of the concepts date back to radio pioneer Guglielmo Marconi, Harrington says.

UWB devices send lots of very short, low-power pulses of energy across an unusually wide spectrum of radio airwaves. UWB's frequency range spans at least 500MHz, compared with Wi-Fi channels about a tenth as wide. UWB's low-power signals cause little interference with other radio transmissions.

UWB sends up to 1 billion pulses per second -- that's 1 per nanosecond. By sending pulses in patterns, UWB encodes information. It takes between 32 and 128 pulses to encode a single bit of data, Harrington said, but given how fast the bits arrive, that enables data rates of 7 to 27 megabits per second.

The [IEEE](#) (Institute of Electrical and Electronic Engineers) developed a UWB standard called [802.15.4](#) more than 15 years ago, but it didn't catch on for its original intended use, sending data fast.

## But location sensing made UWB a hot topic again?

There's now a UWB renaissance for measuring location precisely. That 802.15.4 standard turns out to have been useful after all, because UWB's super-short radio pulses let computers calculate distances very precisely.

Radio waves travel about 30 cm (1 foot) in a billionth of a second, but with short pulses, devices can calculate distances very exactly by measuring the "time of flight" of a radio signal to another device that responds with its own signal. UWB players expect improvements with an [updated UWB standard called 802.15.4z](#) -- a standardization project Harrington leads.

UWB dovetails nicely with the [internet of things](#), the networking of doorbells, speakers, light bulbs and other devices.

It's already used today for location sensing. [NFL players have UWB transmitters in each shoulder pad](#), part of broadcast technology used for instant replay animations. A football's location is updated 2,000 times per second, according to Harrington.

[Boeing uses UWB tags](#) to track more than 10,000 tools, carts and other items on its vast factory floors.

UWB uses very little power. A sensor that sends a pulse once every second is expected to work for seven years off a single coin battery.

## Verizon has something called 5G Ultra Wideband. Is that the same thing?

No. [Verizon uses the same words](#), but it's branding.

"5G Ultra Wideband is our brand name for our 5G service," said spokesman Kevin King. "It's not a technology."

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