



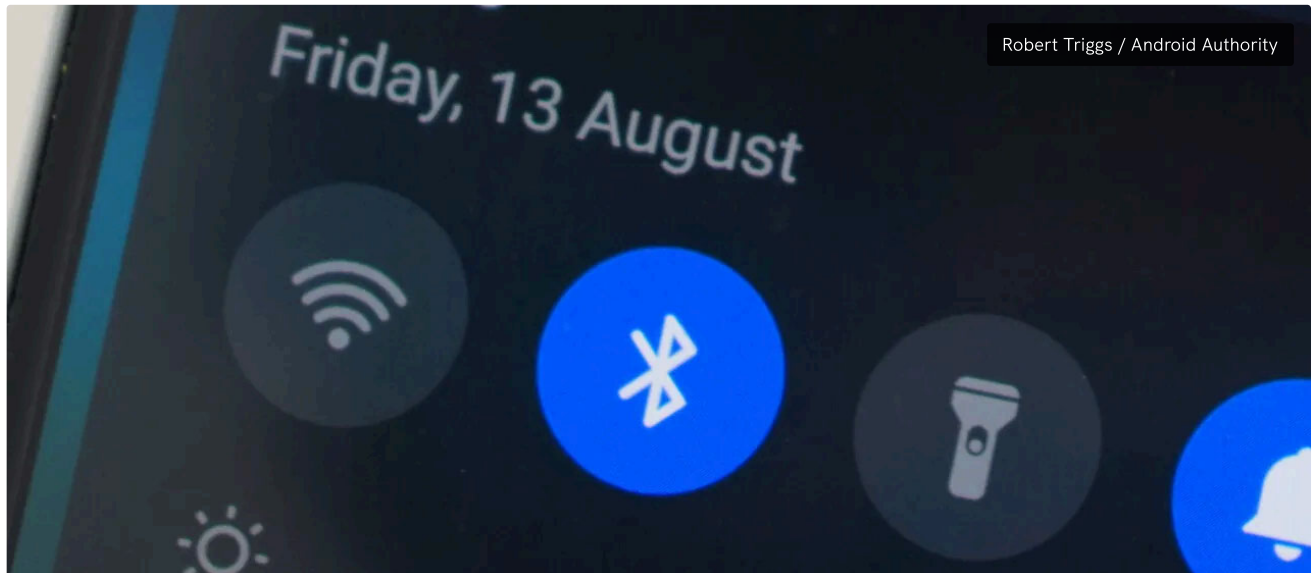
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A little history of Bluetooth

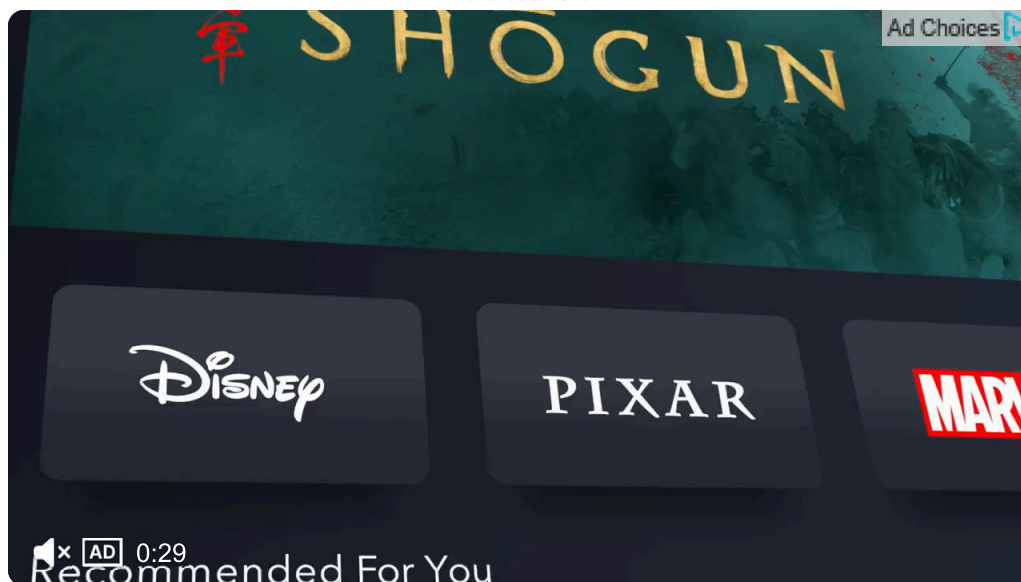
Bluetooth is a key technology in mobile, audio, and smart home industries. Here's how it evolved.

By Robert Triggs, Calvin Wankhede • September 1, 2023



It's almost certain that Bluetooth technology is a regular part of your mobile experience these days. It covers everything from audio for wireless headphones and speakers, pairing gaming controllers and keyboards, tethering internet connections, and even occasionally transferring files over the air. It's a feature that gets more useful every year, which is pretty remarkable considering how relatively limited its scope was when it was created over 20 years ago.

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The Bluetooth standard was originally conceived by Dr. Jaap Haartsen at Ericsson back in 1994. It was named for a renowned Viking and king who united Denmark and Norway in the 10th century. At the time, it was designed to replace RS-232 telecommunication cables, a much older standard conceived in 1960, by using short-range UHF radio waves between 2.4 and 2.485 GHz. Although this occupies very similar frequencies to Wi-Fi, Bluetooth has always been designed as a much shorter range and lower power alternative.

Timeline of Bluetooth technology

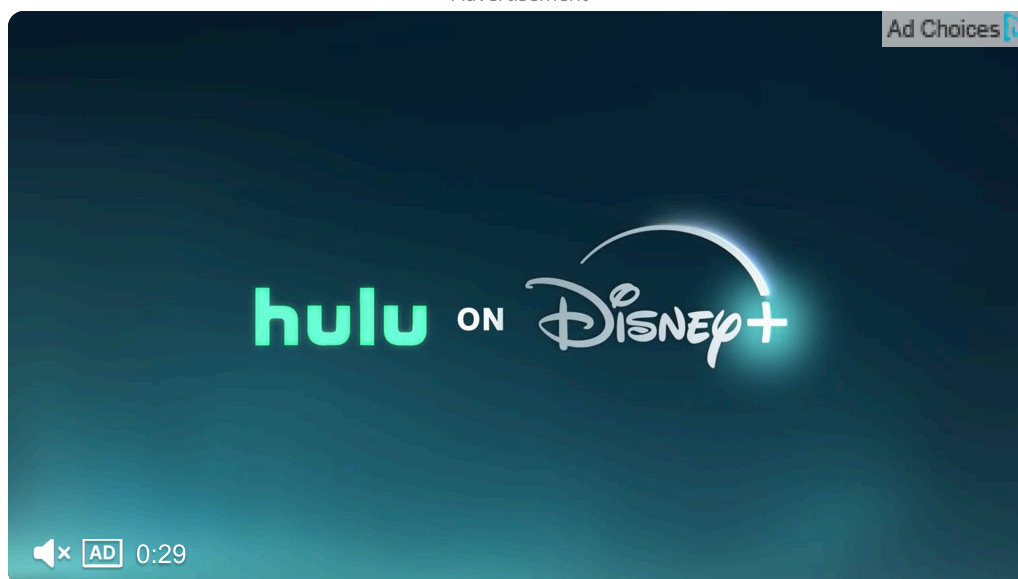
In 1998 the Bluetooth Special Interest Group (SIG) was formed, which to this day publishes and promotes the standard and its subsequent revisions. Bluetooth SIG initially only included Ericsson, IBM, Intel, Nokia, and Toshiba, but reached 4,000 members by the end of its first year. Shortly after the inception of the Bluetooth SIG, devices began making their way to markets. The group now contains over 30,000 member companies at various levels of influence.

Bluetooth was invented back in 1994, but the first Bluetooth phone didn't hit shelves until 2001.

Here's a timeline of important Bluetooth events, followed by some more detail on each era:

- **1999:** The first Bluetooth specification, named Bluetooth 1.0, was published in 1999.
- **2001:** The Sony Ericsson T36 became the first mobile phone to include Bluetooth.

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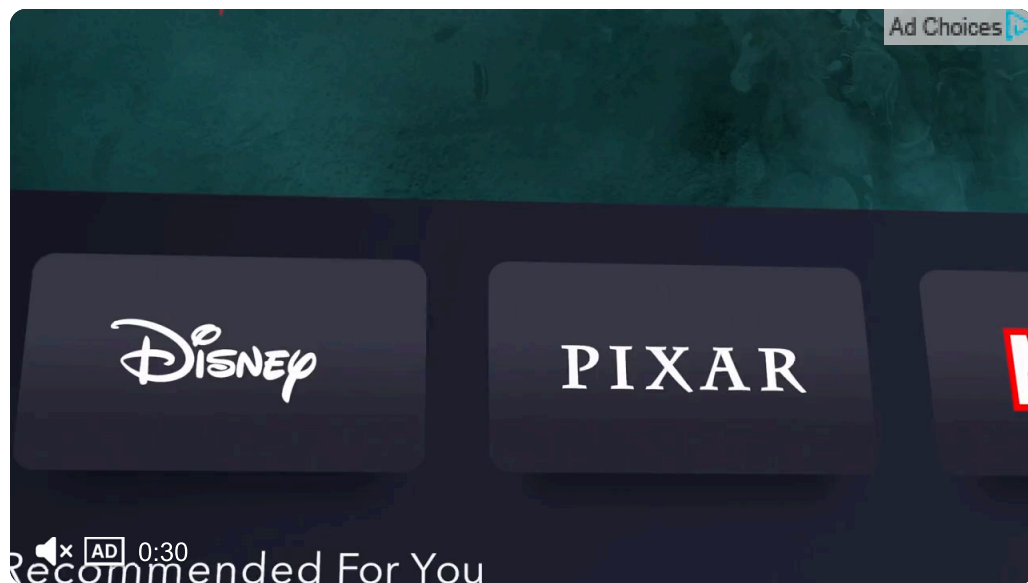
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- **2004:** Marked the release of Bluetooth 2.0 and Enhanced Data Rate (EDR), improving both range and bandwidth.
 - **2009:** Bluetooth 3.0 introduced High Speed transfers, which allowed devices to transfer files over Wi-Fi while still communicating over Bluetooth. This boosted transfer speeds to 23 Mbit/s, far beyond previous revisions.
 - **2013:** The Bluetooth SIG adopted Bluetooth 4.0 and introduced an optional Low Energy (LE) mode for portable devices running on battery power like wearables. The default, longer range implementation was split off into a *Classic* variant.
 - **2017:** Bluetooth 5 launch, continuing the tradition of improving range and transfer speeds for both Classic and Low Energy flavors.
 - **2022:** The Bluetooth SIG releases the complete suite of LE Audio specifications, paving the way for several quality-of-life improvements to audio devices.

The early standard: Bluetooth 1.0



The first consumer Bluetooth launched in 1999. It was a hands-free mobile headset that earned the technology the “Best of Show Technology Award” at COMDEX. The Bluetooth 1.0 specification also officially launched that year, leading to the release of the first Bluetooth-equipped chipsets, dongles, mice, wireless PC cards, and mobile phones in 2000.

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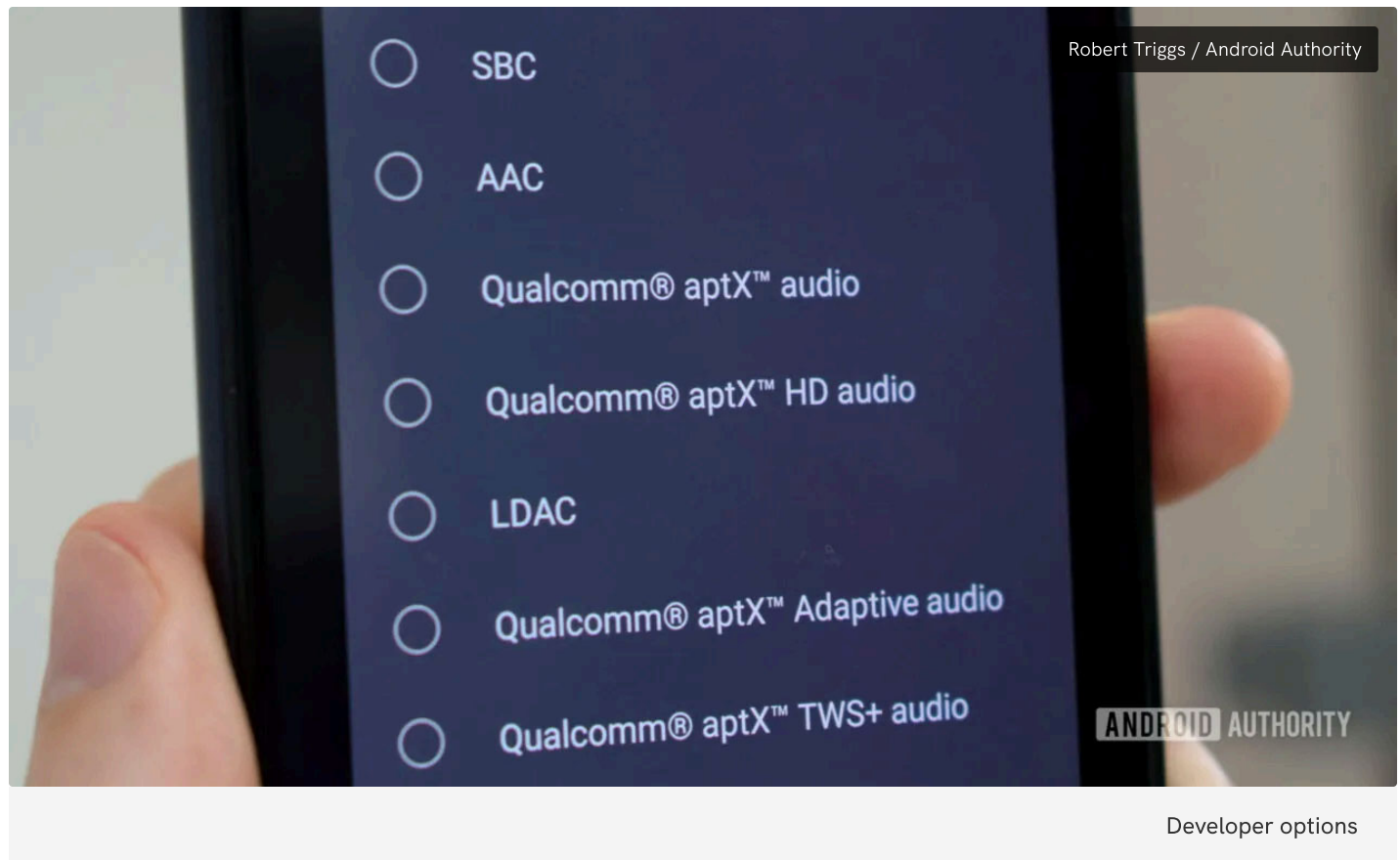


Right out of the gate, Bluetooth 1.0 was equipped for a wide variety of uses. The RS-232 standard was widely used as a computer serial port, catering to internet modems, printers, mice, data storage, and a host of other peripherals. As its proposed replacement, Bluetooth was designed as a flexible packet-based protocol with a wide selection of profiles to suit these applications and more. RS-232 was also rather power-hungry for a physical connection, so Bluetooth was built to require much less power.

This first version wasn't without problems. Anonymity was an issue due to compulsory address broadcasting. There were connection problems aplenty. The 1.0 specification offered peak data speeds of just 721 kbps and connections couldn't reach much farther than 10 meters. Once you factored in real-world performance, longer-range connection quality, and the rather hefty header packets, the actual data rate available to applications was notably slower. The standard originally offered profiles for wireless voice and headsets, dial-up networking, fax, and file transfers.

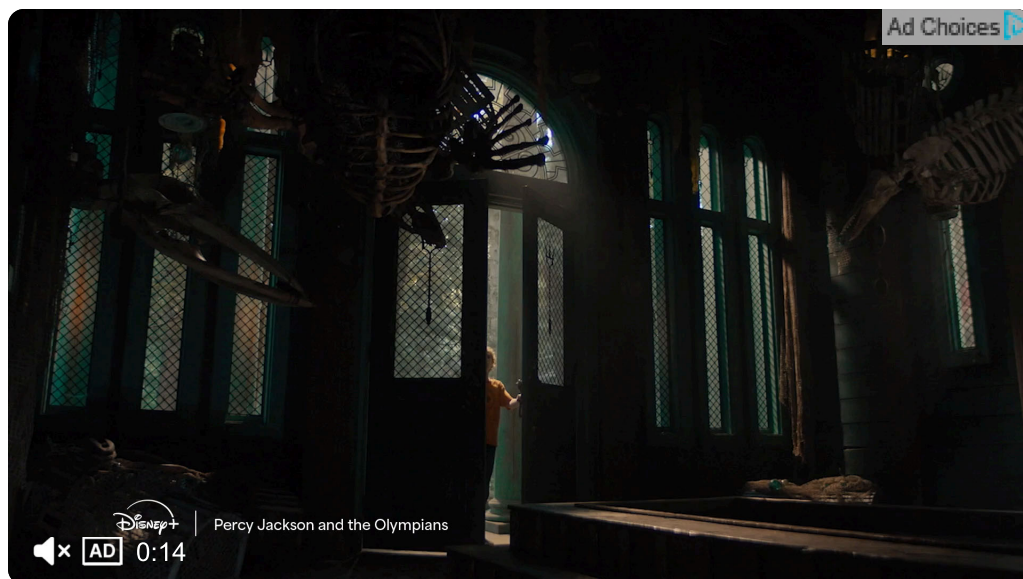
The first Bluetooth mobile phone was the Sony Ericsson T36, but it was the revised T39 model which actually made it to store shelves in 2001. It offered customers a 101 x 54 Monochrome LCD display, tri-band GSM connectivity, WAP internet, and enough memory to store up to 1,000 contacts. Fancy stuff.

Modern consumer use cases: Audio, IoT, and beyond



Bluetooth use cases have vastly expanded since those early days. It's the cornerstone of mobile and console gaming controllers, a key component in modern smart home equipment, fitness trackers, and mesh networks that are increasingly useful for industrial applications. To name just a few. Today, there is a wider range of supported profiles than ever before and the list keeps expanding.

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See also: [The best Bluetooth game controllers for Android, PC, and more!](#)

Probably the most common use for Bluetooth in modern products is audio. Yet, the original standard was never designed for anything close to full bandwidth music. 721 Kbps is enough for a good voice compression codec, even once you discount the header overheads and diminishing real-world speeds at longer distances. Still, such limited bandwidth couldn't hope to cater to anything close to Hi-Res audio today or even CD quality at the time.

Bluetooth was originally conceived with wireless voice calls in mind but not high-quality music streaming.

The introduction of the A2DP profile mandated the use of the SBC audio codec for Bluetooth audio. However, the standard earned a reputation for dubious sound quality. Third-party [Bluetooth audio codecs](#), such as Qualcomm's aptX and Sony's LDAC, stepped in to fill the audio quality gap. These used higher bitrates and better compression methods to improve audio quality.

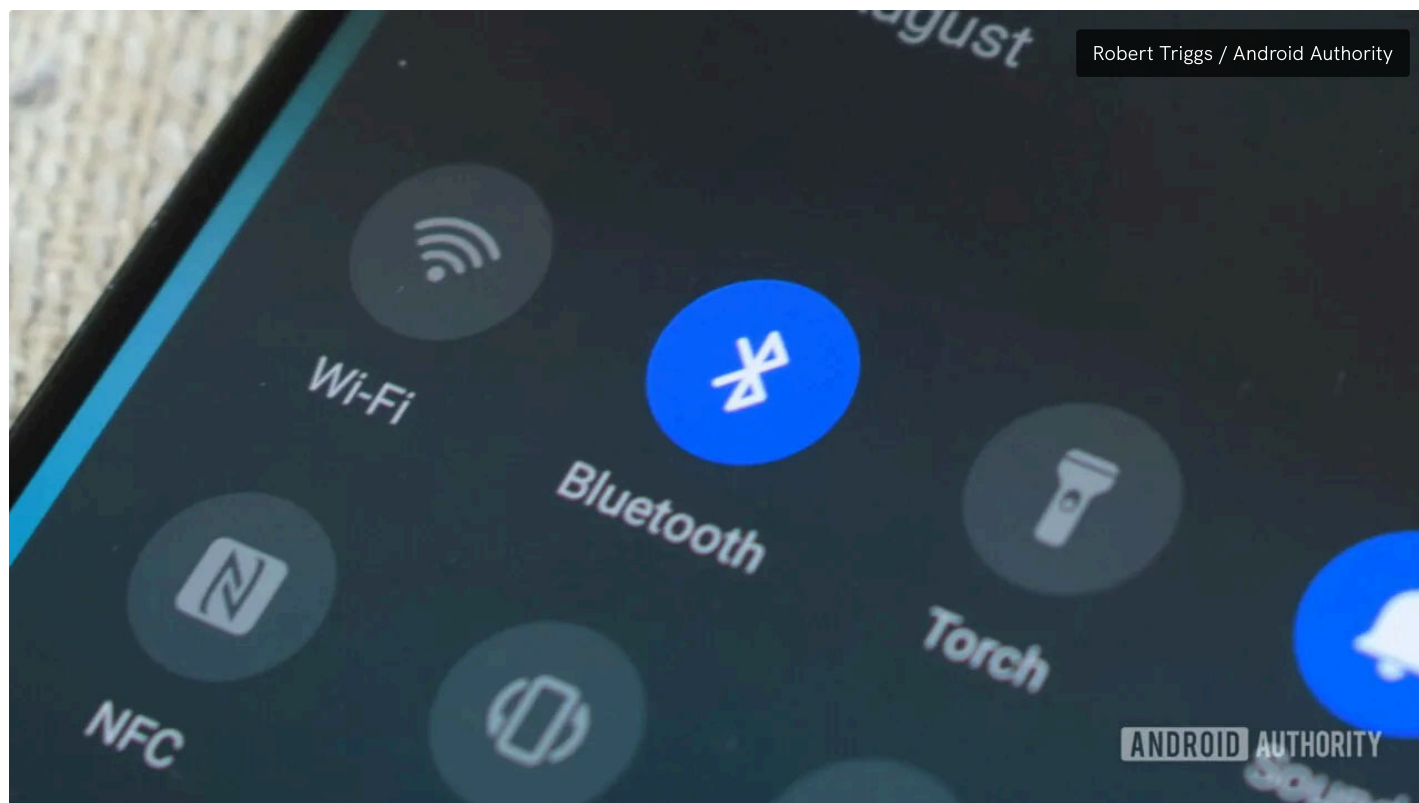
Bluetooth SIG eventually improved audio quality in the core specification in 2020 with the announcement of the LC3 codec and LE Audio protocol bundled into Bluetooth 5.2.

LE Audio also has implications for hearing aids, broadcast audio, and HD voice calling. That said, the verdict is still out on LC3 audio quality and adoption as we await compatible products to permeate the market.

Want to know more about Bluetooth audio codecs? Check out our deep dive series on the biggest standards in the game:

- [What is Bluetooth LE Audio? What you need to know about the LC3 codec](#)
- [Everything you need to know about Qualcomm's aptX](#)
- [aptX Adaptive takes Bluetooth audio up another level](#)
- [What you need to know about Sony's LDAC](#)

Bluetooth versions compared: Is Bluetooth 5 important?



The Bluetooth specification has undergone numerous revisions since 1999 to improve the standard's data speeds and connection quality, feature set, and to help accommodate all these new use cases and markets. Most recently, Bluetooth SIG has been focusing on audio, mesh networking, lower energy profiles, and a longer range for

IoT. In summary, the standard is faster and more secure, with more features than ever before.

Even so, Bluetooth's core capabilities have never been completely overhauled, to keep the platform as backward compatible as possible. Instead, each iteration adds new features, some optional, on top of existing ones.

The most notable optional additions to the specification include the Enhanced Data Rate for up to 3 Mbps since version 2.0, High-Speed transfers over Wi-Fi using Bluetooth pairing since version 3.0, and the introduction of Low Energy since version 4.0. Bluetooth 5.0 introduced Slot Available Masking to reduce interference with 4G LTE by scheduling data transmissions. The table below shows when these major features were introduced, and how typical use cases for speed and range have evolved over time.

	Data Transfer Speed	Typical Max Range	Key New Features
Bluetooth 1.0 (1999)	0.7 Mbps	~10m (33 ft)	
Bluetooth 2.0 (2004)	1 Mbps core 3 Mbps with EDR	~30m (100 ft)	Enhanced Data Rate (EDR) Secure Simple Pairing (BT 2.1)
Bluetooth 3.0 (2009)	3 Mbps with EDR (24 Mbps over HS 802.11 link)	~30m (100 ft)	High Speed (HS) L2CAP Enhanced Modes Enhanced Power Control
Bluetooth 4.0 (2013)	3 Mbps with EDR 1 Mbps Low Energy	~60m (200 ft)	Low Energy (BLE) Core Specification Addenda 1-4 (BT 4.1) IoT features (BT 4.2)
Bluetooth 5 (2017)	3 Mbps with EDR 2 Mbps Low Energy	~240m (800 ft)	Slot Available Masking (SAM) LE Long Range Core Specification Addenda 6

	Data Transfer Speed	Typical Max Range	Key New Features
			(BT 5.1) LE Audio (BT 5.2)

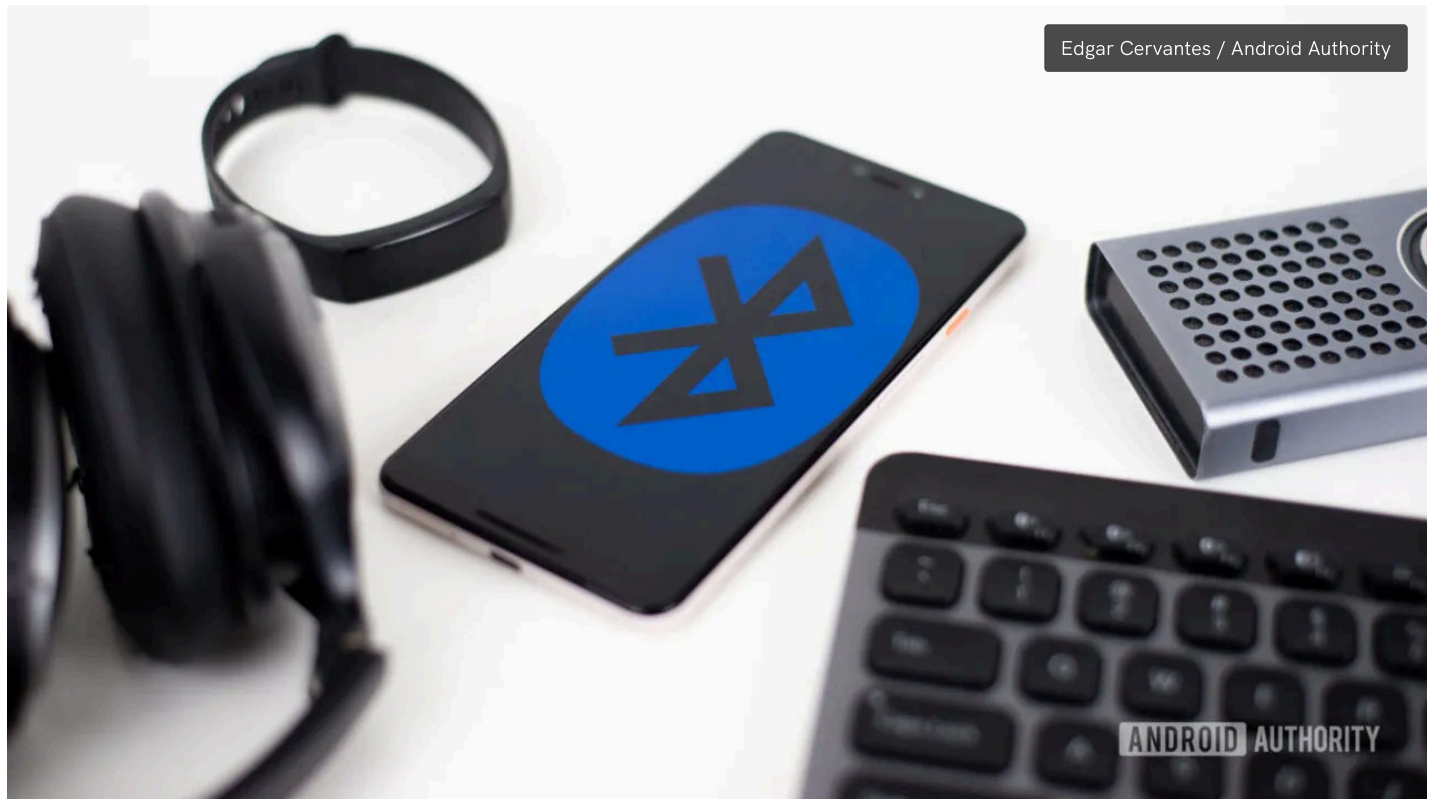
While important, these standards aren’t the best way to see Bluetooth’s modern capabilities and categories at a glance. Rather than evolving in a single path, the standard has split into Low Energy and Classic segments since version 4.0. Low Energy is tailored towards burst-like communication, like what’s used by fitness trackers and internet-of-things products. Classic continues to provide a higher data rate for products requiring a constant connection, such as your headphones.

The latest Bluetooth 5 revision continues down this path, splitting its improvements for Classic and Low Energy. This update places a heavy emphasis on boosting the range and data rate of its low energy and long-range options. There is also an equally wide selection of radio power options that offer ranges varying from very short to over 100 meters, and these aren’t locked to any particular standard. The table below is a better representation of how Bluetooth standards are formulated today.

	Low Energy (LE)	Classic Basic Rate & EDR
Channels	40 channels with 2 MHz spacing	79 channels with 1 MHz spacing
Data Rate	BLE 5: 2 Mbps BLE 4.2: 1 Mbps BLE 5 Long Range (S=2): 500 Mbps BLE 5 Long Range (S=8): 125 Mbps	EDR (8DPSK): 3 Mbps EDR ($\pi/4$ DQPSK): 2 Mbps Basic Data Rate: 1 Mbps
Power & Radio Profiles	Class 1: 100 mW (+20 dBm) Class 1.5: 10 mW (+10 dbm) Class 2: 2.5 mW (+4 dBm) Class 3: 1 mW (0 dBm)	Class 1: 100 mW (+20 dBm) Class 2: 2.5 mW (+4 dBm) Class 3: 1 mW (0 dBm)
Power Consumption	~0.01x to 0.5x of Classic	Based on radio class.

	Low Energy (LE)	Classic Basic Rate & EDR
Network Topologies	Point-to-Point (including piconet) Broadcast Mesh	Point-to-Point (including piconet)

Is Bluetooth still useful today?



Bluetooth has evolved from a wireless replacement for old RS-232 cables to a fully-fledged, far-reaching standard in its own right. It caters to everything from file sharing and device pairing to wireless music and industrial applications.

Today, the standard is perhaps facing its biggest fork yet, with a dual focus on retaining backward compatibility while also powering increasingly low-energy IoT devices and broad communication mesh networks. This definitely wasn't envisioned in the original specification. At the same time, technologies like NFC and UWB have encroached on some of Bluetooth's traditional use cases.

Despite its limitations, the flexibility of this particular wireless standard has been its greatest asset. One technology that covers so many use cases is invaluable compared to the alternatives of proprietary and broken standards. Bluetooth will stay a key driving factor not only in smartphones but across countless technology markets. Not bad for something created nearly thirty years ago.

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