efigence

# Mobile Technology Trends 2024

Navigating Through the Future of Mobile Development.

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# Introduction

In 2023, there are over 6.7 billion smartphone mobile network subscriptions worldwide. The estimations are that in 2028, this number will exceed 7.7 billion. The mobile landscape is growing and changing rapidly, and technologies that exist within it are becoming more and more advanced.
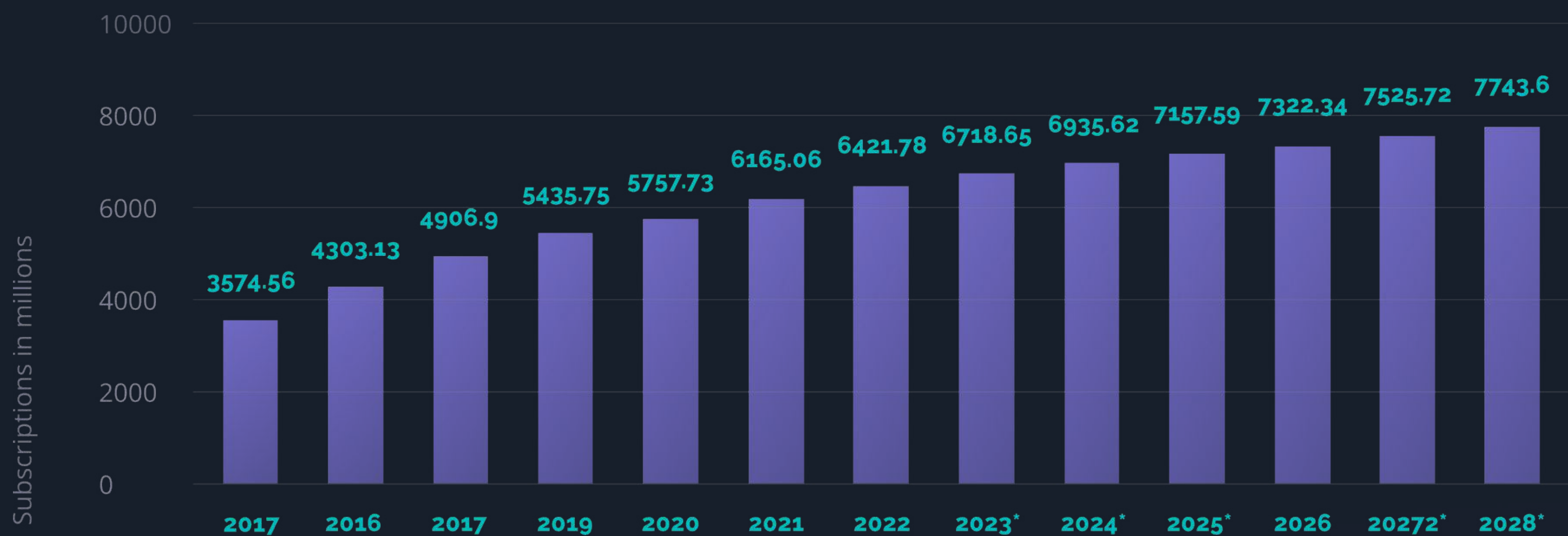


In this publication, we take a closer look at what mobile technology trends will look like in 2024 and beyond. We examine 12+ major trends and two mobile development approaches. We hope this publication will help you understand the mobile landscape and its potential even better.

Undoubtedly, we can expect many fascinating applications of diverse mobile technologies and perhaps the advent of some brand-new ones.

The future surely is bright, but it's also fast, mobile, and user-centered. Let's have a look at it together.

**Efigence Team**

# 5G Technology

## Cellular networks are constantly evolving.

In 2019 5G started replacing the older wireless standard that was 4G (even though 5G deployments started in 2018 in the USA, they really got underway in 2019).

Generally speaking, G stands for a global technological standard for wireless devices. For instance, 1G enabled voice calls, and 2G introduced text messages. With 3G, users get the opportunity to browse the internet (at really slow speeds). 4G was introduced in 2010, and it enabled achievable download speeds at 10-20 Mbps.

And now, we are living in the times of 5G – a technology that allows for a maximum download speed of 10 Gigabytes.

The truth is that 5G has a huge impact on the vast majority of mobile technologies. With increased download speeds, mobile apps can operate much faster and provide more features such as:

- Real-time interactions
- 4K and more video streaming
- IoT and wearables
- AR and VR
- Location-based services

What's more, with 5G, new types of mobile apps are possible, including connected driver-less vehicles, the use of IoT in global logistics, smart homes, and even smart venues like smart stadiums where spectators have real-time access to game statistics.

**1980**
**1G** Mobile voice calls

**1990**
**2G** Mobile voice calls and SMS

**2000**
**3G** Mobile web browsing

**2010**
**4G** Mobile video consumption and higher data speed

**2020**
**5G** Technology to enhance experiences and drive digitalizations of indutries

# Driver-less cars

## Waymo is a US-based company that's working

on the world's first autonomous ride-hailing service and autonomous trucking and local delivery solutions. Waymo works on an autonomous driving system that's capable of replacing the human driver altogether. Such a system could be applied both in passenger cars and trucks, thus supp. Waymo based their solution on a network of radars, lidars, and cameras, and 5G is a huge accelerator when it comes to their operations.



Interestingly, simultaneously, O2 is working on a similar 5G-powered project in the UK. They want to use their 5G network to test driverless vehicles and smart transport systems on the streets of London.

# Smart stadiums

## Some time ago, Verizon started offering its [Ultra 5G network](#) capabilities on selected stadiums.

This technology can be used not just to provide spectators with great UX coming from the fast internet but also to improve security (e.g., facial recognition) and crowd analytics. In the near future, we will most likely see stadiums using augmented reality showing all the crucial data insights in real time, e.g., how fast a player is sprinting or what's his accuracy level.



Source: https://www.archdaily.com/941030/how-ar-and-vr-will-enhance-the-future-of-the-sports-arena-experience
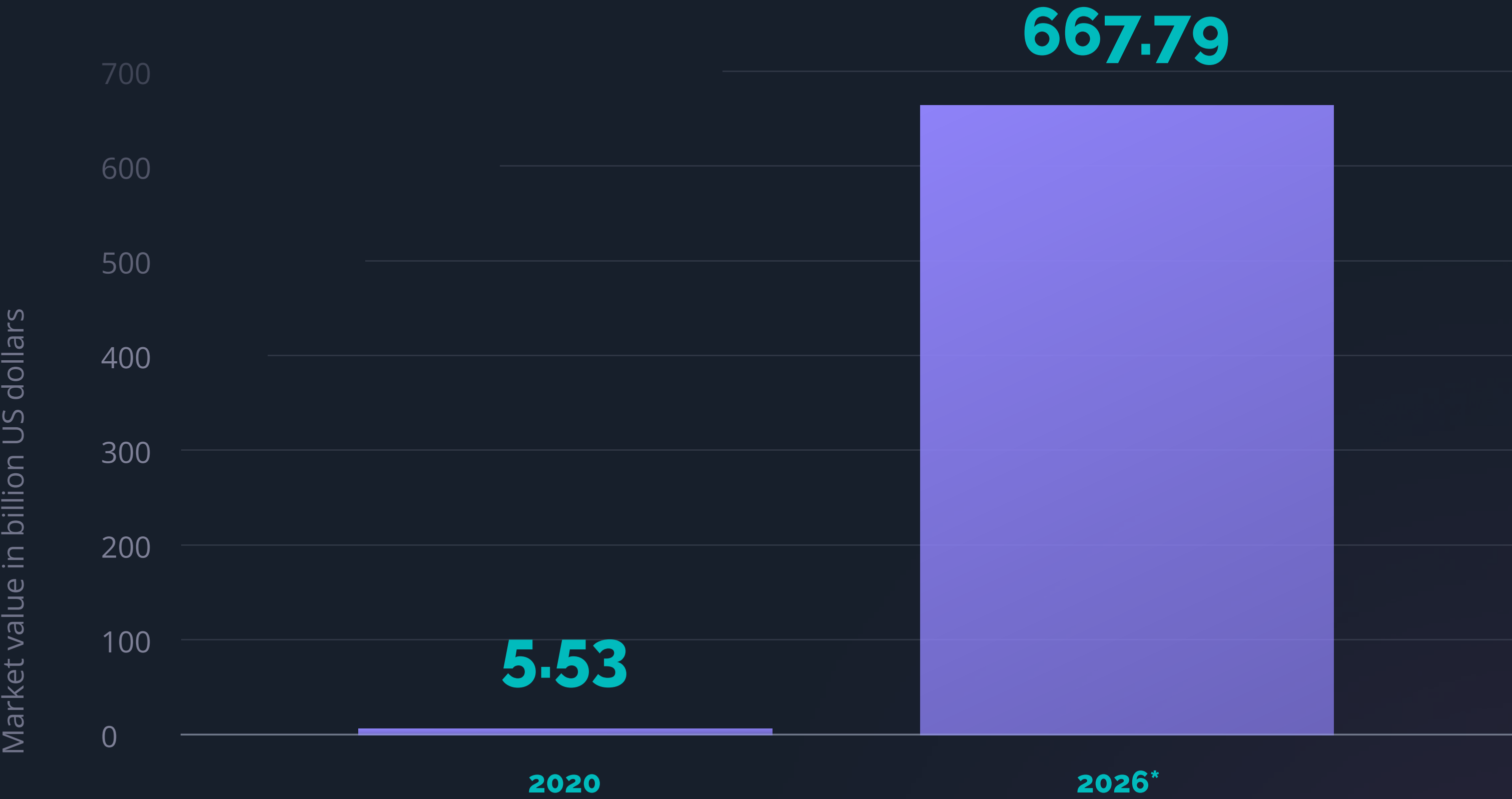
What's more, with 5G, new types of mobile apps are possible, including connected driver-less vehicles, the use of IoT in global logistics, smart homes, and even smart venues like smart stadiums where spectators have real-time access to game statistics.

# What will be possible in the future?

## As 5G networks become more widespread,

we can expect to witness a surge in innovative apps and solutions that leverage augmented reality, virtual reality, and real-time data streaming to deliver high-quality user experiences and enable more streamlined business operations.

The 5G tech market is predicted to grow rapidly. Currently, the forecast for 5G is to reach a value of 667.79 billion USD by 2026:

**667.79**

700

600

500

Market value in billion US dollars

400

300

200

100

**5.53**

0

2020                    2026*

Source: https://www.statista.com/statistics/1256269/worldwide-5g-technology-market-revenues/

We can surely expect to see more intelligent mobility systems, including car-sharing services, public transport, and logistics services. The same is true concerning smart cities, smart venues, and smart homes. Healthcare is also an area with huge potential for improvement. Telemedicine and remote patient monitoring will become more reliable and accessible, enabling real-time consultations with doctors and better management of our health conditions.

# Internet of Things (IoT)

Internet of Things refers to a system of interconnected objects (things) that are connected to the internet and can collect and transmit data over a wireless network without human involvement. These devices range from common household items like fridges and robot vacuums to specialized industrial devices. In 2023, IoT solutions are everywhere and both ordinary consumers and companies use them in everyday life and daily operations.

IoT is more and more often also a part of mobile applications. That's because a mobile app acts like a bridge between an IoT device and a mobile phone, thus enabling users to effectively manage their smart devices.

## iRobot

Roomba is one of the most advanced robot vacuum cleaners in the market. The latest models use both IoT and Wi-Fi to capture mapping and navigation information. Roomba constantly collects and processes data, e.g., how long it was cleaning, how far it went, did it encounter any error codes, is it functioning correctly, etc. There is also a mapping feature so that the vacuum can find itself in a given space and calculate the covered area. Moreover, all that information can be sent to the Cloud so it can be shown on the customer's mobile device.



Knows your kitchen
from your living room

Source: https://superiorvacuums.ca/products/irobot-roomba-i7-robot-vacuum-with-wi-fi-connectivity

# Opportunities for the future

In 2023, there are slightly over 15 billion devices that are connected to the internet. The estimations are this number will almost double by 2030:
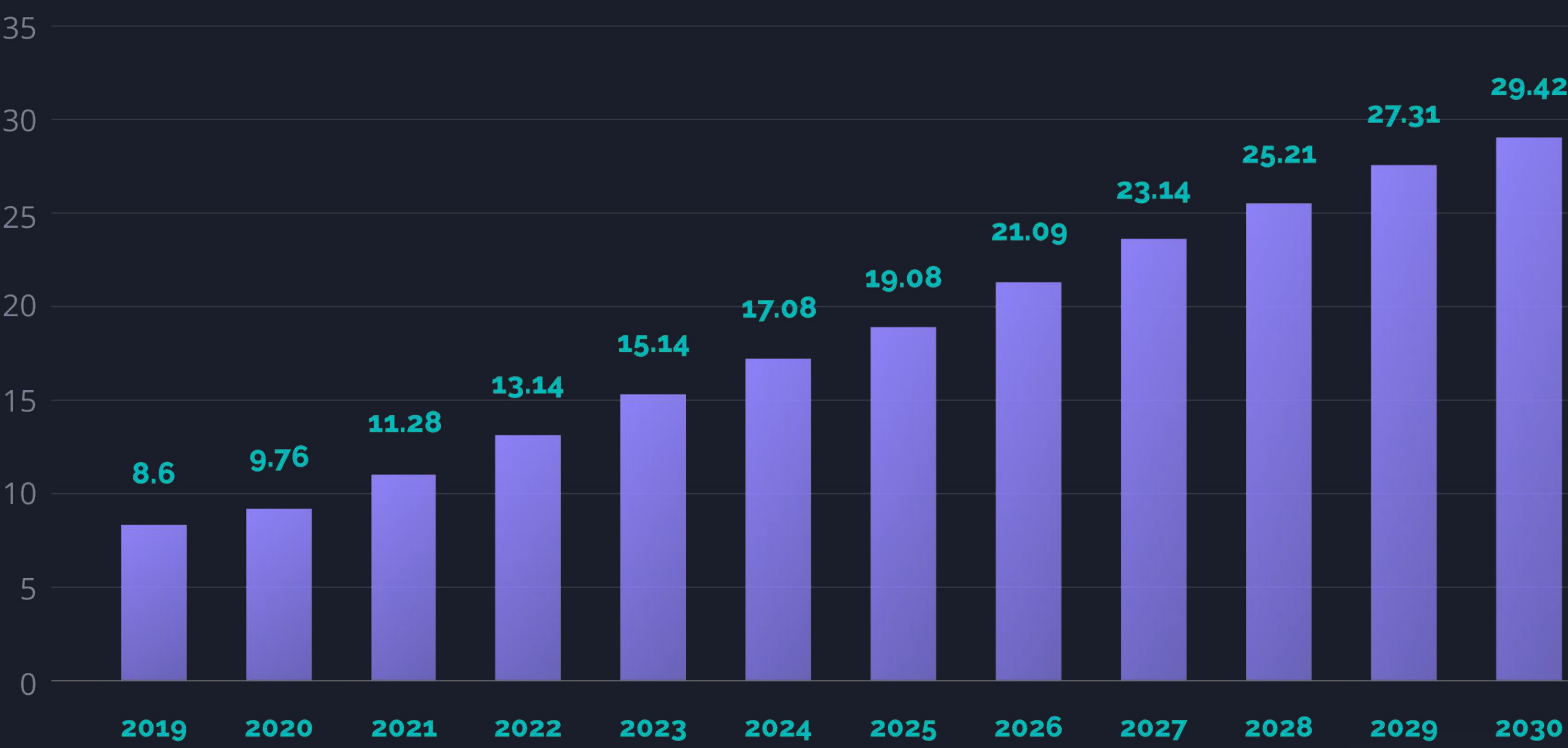
With more and more devices connected to the internet, we will be able to collect and analyze data more effectively. In the near future, IoT will move towards edge computing, meaning more data will be processed in the device itself (and not sent to the cloud). This will make IoT devices more effective and secure.

*According to Gartner, by 2025, 75% of the enterprise-generated data will be created and processed outside centralized data centers or in the cloud. IoT will surely play a big part in this transition.*

Secondly, IoT will be more and more often supplemented by AI and ML to streamline data analysis. This will help businesses and professionals make informed decisions in a shorter period of time, as they will be provided with accurate and pre-analyzed data. Imagine a doctor receiving a report from an IoT device

on a patient's condition along with a shortlist of possible treatments and medicines that should be administered. Obviously, the doctor will still have to make the decision, but this initial analysis conducted by AI (integrated with the latest and most comprehensive medical data sources) can help HCPs make good decisions much faster.

# Challenges

This technology is growing really fast, so it is obvious there are some challenges lying ahead. The first challenge we want to mention is standards compliance. Connected objects must be able to communicate with each other to transfer data and share what they collect. Devices operating in different standards will have major difficulties when it comes to communicating and sharing data.

Secondly, there are many privacy issues that have not yet been resolved. Technology has developed much faster than the legal environment, so the further development of the Internet of Things poses specific security challenges, e.g., open-source code vulnerabilities and the lack of full visibility of the IoT devices inventory.

# AR/VR

Augmented and virtual realities find applications in a number of sectors, including gaming, healthcare, and education. These solutions make user experiences more immersive and engaging.

## AR and VR in gaming

When it comes to AR in gaming, Pokemon GO is by far the best example. This game was first released in 2016 and quickly got traffic that exceeded the one Twitter and Facebook have! The game is engaging, quite realistic, and, above all, it brings back memories for today's 30-year-olds.

Virtual reality is even more immersive – you need special goggles and hand-held devices so that you can move and look in different directions in your VR world. PlayStation VR alone has over 600 games!

What can we expect in the future? Primarily, better quality – AR and VR images are still quite raw, and they are no match for normal games. Thanks to modern technologies (like the aforementioned 5G), this will shortly change – AR and VR games will be nicer to look at and more natural in use.
This will naturally result in higher market value. According to Statista, the global VR market size is projected to increase from less than 12 billion U.S. dollars in 2022 to more than 22 billion U.S. dollars by 2025.

# AR and VR in healthcare
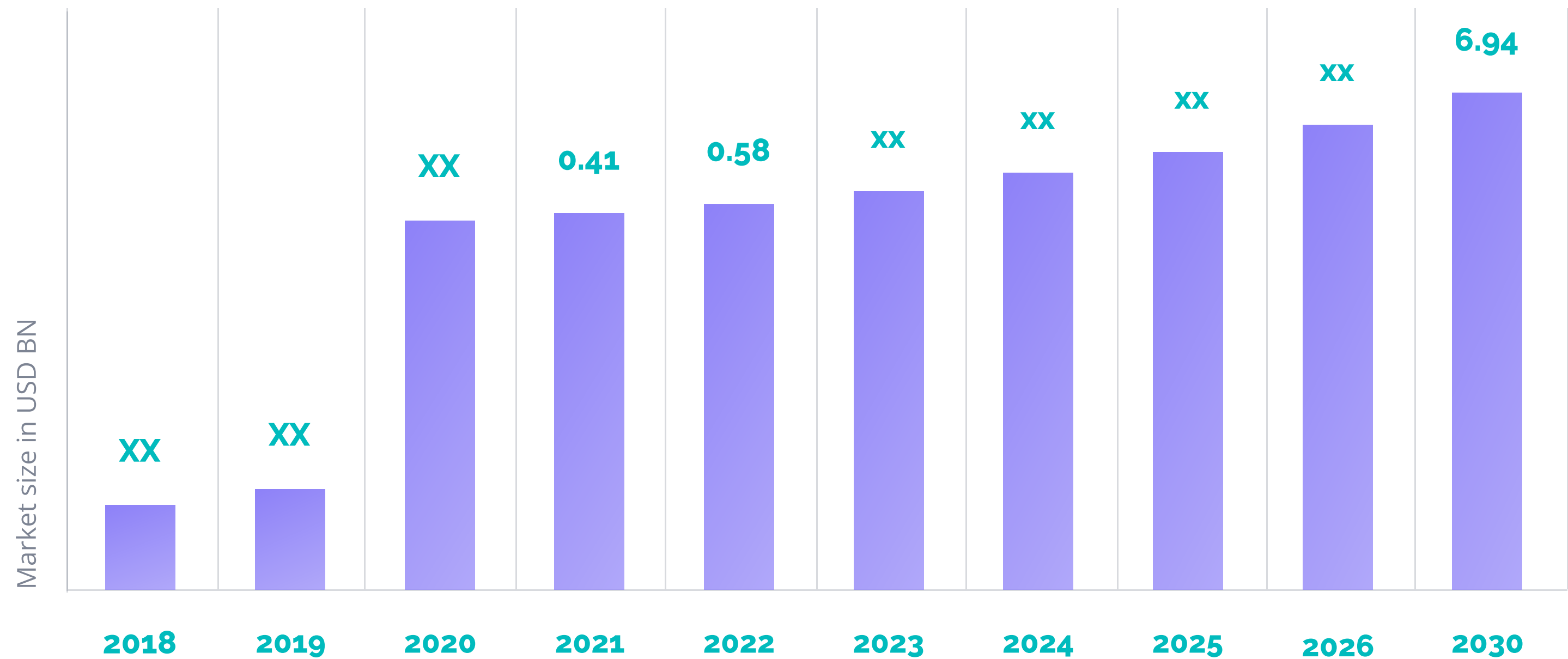
In this sector, both technologies are incredibly useful when it comes to medical training, diagnosis, and treatment. Imagine student surgeons learning their craft in advanced VR applications. Or an AR app showing cancer outbreaks directly on the patient's body. We're not quite there yet, but with rapid tech advancements, we can predict that in the near future, all of this will be possible,

No wonder it's predicted for this market to get close to $7bn in 2030:

**AR and VR in healthcare market**



Market size in USD BN

| 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2030 |

XX 2018, XX 2019, XX 2020, 0.41 2021, 0.58 2022, XX 2023, XX 2024, XX 2025, XX 2026, 6.94 2030

# AR and VR in education

Is it difficult to imagine a mobile app for students that extends and visualizes everything they can read about in their books? Not at all! 3D lectures and even virtual class trips on the moon – it's all possible thanks to AR and VR. These technologies can revolutionize the way we learn and obtain new information. And thanks to the fact that VR engages more than one sense, it will be much easier to remember what we learn for longer.

This is something that's happening already! For example, Froggipedia is an Apple AR app that helps students explore and discover the unique life cycle and intricate anatomical details of a frog, making learning for students fun and engaging.
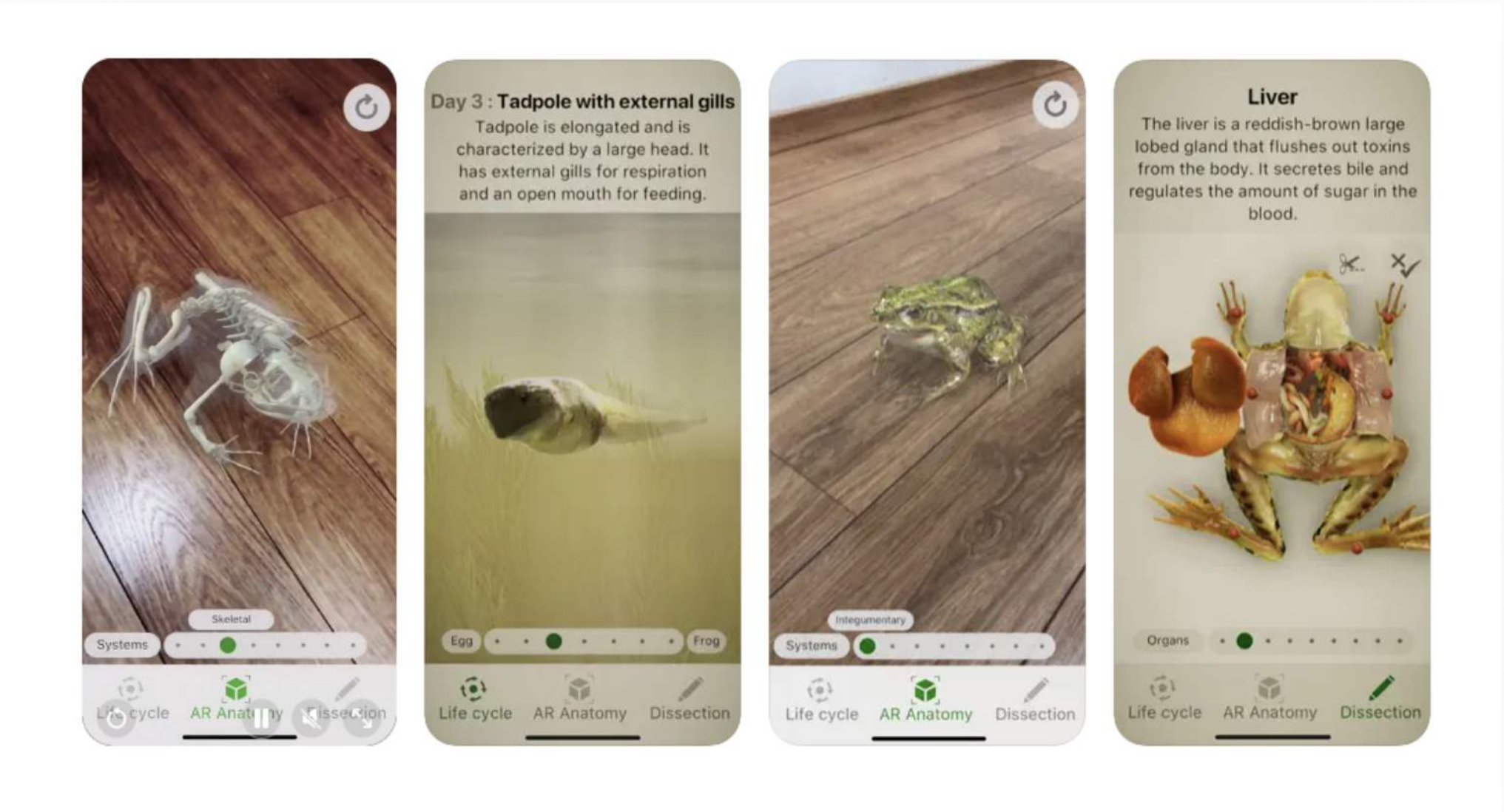
# Mixed reality in everyday use

About a decade ago, one of the very first mixed reality products, Google Glass, appeared. The fact is, this device was not a huge success, but it opened the door for the concept of extending the real world with digital elements. Today, the first mature mixed reality devices (such as Apple Vision Pro, which we discuss in the wearables section) started to appear. In the near future, they will allow you to transfer to virtual reality but also expand the real one.

With Apple interested in this technology, we can be sure that soon, such devices will become a must-have accessory. Perhaps they will even replace home computers in the long run.



Meta Quest 3; source: https://www.meta.com/ca/quest/quest-3/

# AR and VR in education

In the near future, thanks to advancements in hardware, such as faster processors, higher-resolution displays, and more comfortable and compact headsets, users will enjoy more immersive experiences. Enhanced eye-tracking and gesture-recognition systems will make interactions more intuitive and responsive. Lastly, something we've already talked about is that faster 5G networks will reduce latency, enabling real-time, high-quality streaming of AR and VR content.

# AI and ML

These two fascinating technologies are already changing the way we work and lead our lives. AI has conquered almost every part of our lives, from work to entertainment. When it comes to mobile apps, we want to focus on two major elements:

- User personalization
- Predictive analytics

Both these applications are possible thanks to the fact that AI can efficiently analyze user behavior and tailor experiences to its findings. **Netflix** is a great example. This streaming platform is also available in the form of a mobile app, and it uses machine learning to analyze what different users are watching and tailor recommendations to them.



Source: https://www.cnbc.com/2021/11/02/netflix-launches-its-first-mobile-games.html

*"Machine learning powers our recommendation algorithms. We're also using machine learning to help shape our catalog of movies and TV shows by learning characteristics that make content successful."*

Netflix Research

But user personalization is just one side of the coin. Predictive analytics also has tremendous potential to improve the way we use mobile apps. This advanced data analysis technique uses historical and current data to forecast future outcomes or trends. It leverages statistical algorithms and machine learning models to make predictions about user needs or behavior.

In the near future, given the fact that machine learning becomes more and more advanced as it gets more data to learn from, both personalization and predictive analytics will achieve a whole new level. Soon, mobile applications will understand individual user preferences, anticipate their needs, and proactively provide relevant content or services, ultimately delivering a seamless and intuitive user journey that adapts in real time to maximize user satisfaction and engagement.

We can see the first signs of this revolution even today.

# AI and ML in mobile apps

Nowadays, mobile devices can even support ML calculations directly in their hardware. That's why Apple recently introduced its Neural Engine (ANE). Starting with this year's smartwatches and iPhones, Siri is capable of generating responses directly on the device, not Apple servers. AI/ML is probably the most important technology now, and it's becoming a must-have feature in both mobile and web apps.

Thanks to solutions such as ANE, mobile device owners can benefit from:

| | |
|---|---|
| Improved search result matching | Real-time data analysis |
| Personalization | Smart virtual assistants (boosted by ChatGPT) |
| Real-time translation | Argument reasoning |
| Image recognition | Object detection |
| Data generation | Photorealistic effects in video games |

# Google Assistant

It's one of the most advanced personal assistants out there. With Google Assistant, you can search for stores, make phone calls, check and update your schedule, check news, translate content, and even hear a joke. Such assistants will only get more advanced, and the scope of their possibilities will continue to grow.

Imagine waking up and having Google Assistant immediately remind you about all the important meetings scheduled for that day. Next, it shows you the best way of getting to your meeting while automatically texting the other party that you might be a few minutes late due to a car accident on the way. All of that is garnished with human-like conversation skills.

*The Intelligent Virtual Assistant (IVA) Market size is expected to grow from USD 11.13 billion in 2023 to USD 45.83 billion by 2028, at a CAGR of 32.72%.*

Netflix Research

# AI tools supporting developers

AI is now a big thing when it comes to web and mobile developers' work. Tools like GitHub Copilot and Adobe App Builder can support the code development process and deal with some of the mundane tasks. They can also streamline the work for coders and developers with disabilities.

For example, GitHub Copilot uses OpenAI Codex, real-time code suggestions, and all functions directly within the editor. As per GitHub research findings, developers leveraging Copilot experience a boost in coding speed of up to 55%, and report increased confidence throughout the coding process.
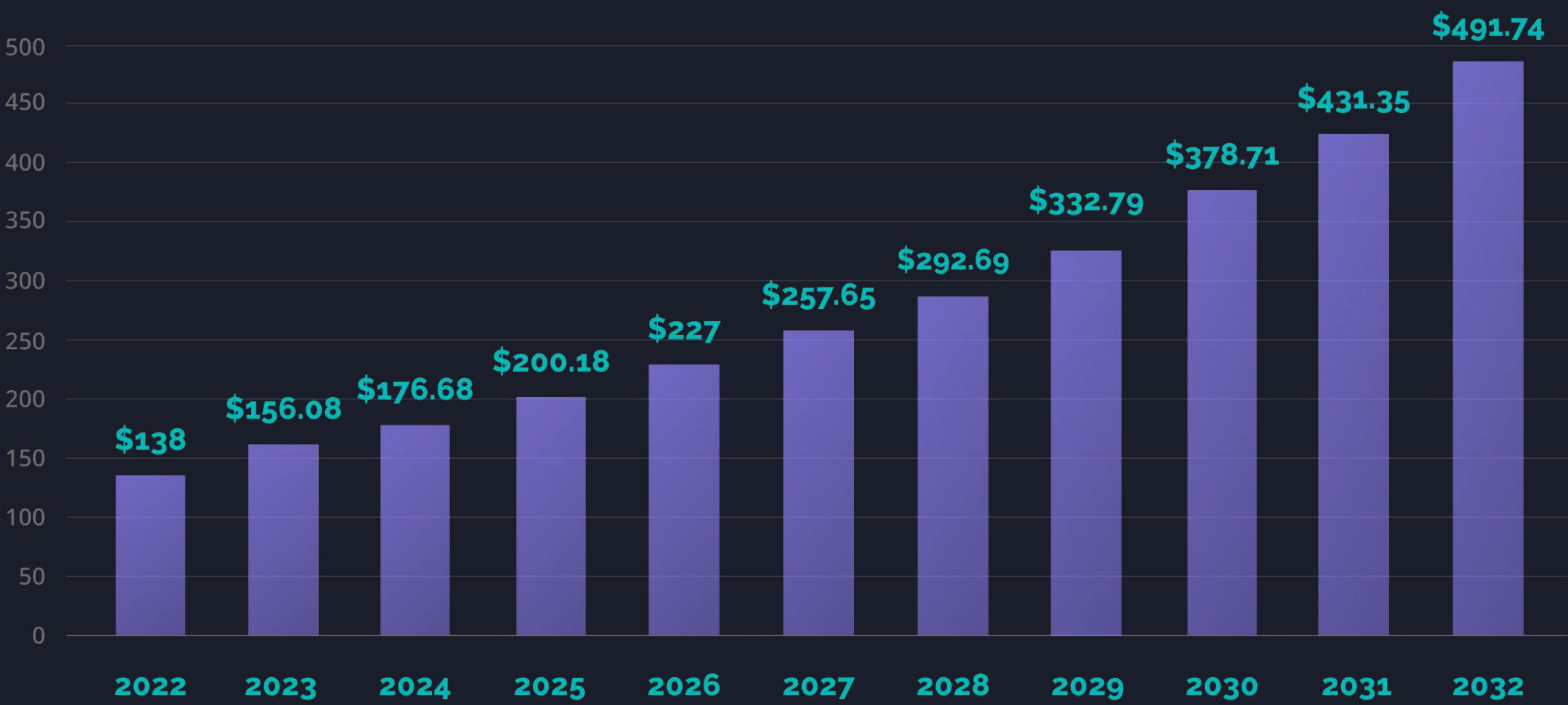
# Wearables

Activity trackers, smartwatches, smart glasses, and many more devices are now connected to the internet and benefit from artificial intelligence. This market is dynamically growing, primarily because of the versatility of this technology.

Wearables can help you:

- Track your physical activity
- Monitor your health
- Make phone calls and send text messages
- Monitor external conditions around you
  (e.g., for hazardous working conditions)
- Help you locate the right place or item
  (e.g., in a warehouse)
- Get more engaging experiences
  (e.g., in gaming)

And much more. No wonder this market sector is rapidly growing. According to the latest forecasts, the global wearable technology market is expected to grow at a CAGR of 13.60% all the way to 2032. At this time, this market is expected to surpass $490bn.

**Wearable technology market size 2022 to 2032 (USD Billion)**

| Year | Market Size |
| --- | --- |
| 2022 | $138 |
| 2023 | $156.08 |
| 2024 | $176.68 |
| 2025 | $200.18 |
| 2026 | $227 |
| 2027 | $257.65 |
| 2028 | $292.69 |
| 2029 | $332.79 |
| 2030 | $378.71 |
| 2031 | $431.35 |
| 2032 | $491.74 |

Source: www.precedenceresearch.com

The same is true concerning smartwatches. They started as simple timekeeping accessories with basic features like notifications. Today, thanks to technologies mentioned in this publication and the fact that they use fully-fledged operating systems, smartwatches enable you to track your health, use different entertainment and productivity apps, and even browse the internet.

The number of smartwatch users is continually growing, with prediction to surpass the 230 million users mark in 2030:
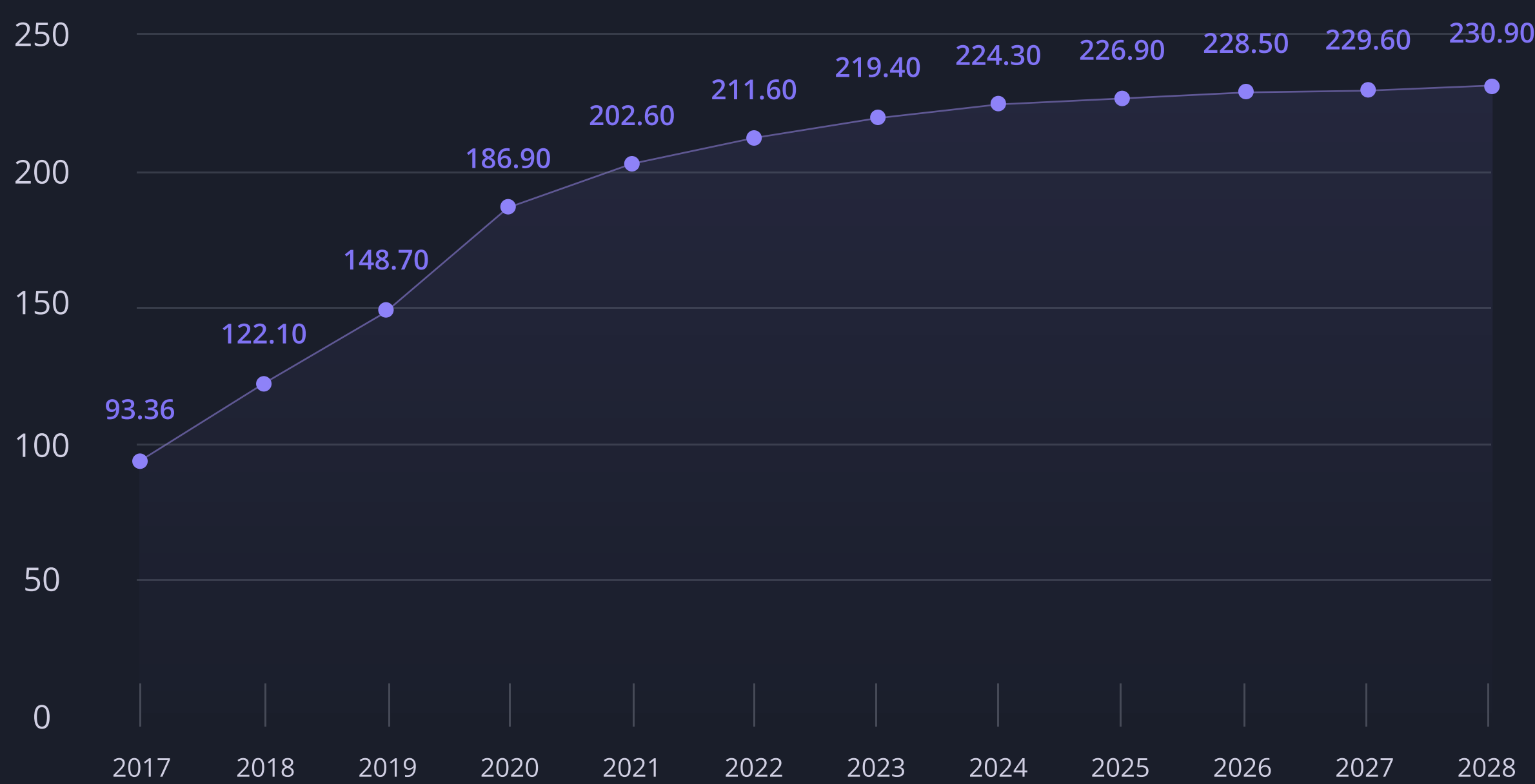
# What can we expect in the future?

First off, we can expect further integration of artificial intelligence and wearables. This will enable the production of smarter and more context-aware devices that will be able to provide more personalized recommendations, assist with daily tasks, and improve the user experience.

The role of wearables will also grow in the healthcare sector. They will continue to play an important role in monitoring patients' conditions 24/7, both in the hospitals and outside of them. HCPs will be using them to monitor not just basic vitals but also potentially dangerous irregularities, e.g., in heart rate.

Lastly, concerning IoT, wearables will be more useful when it comes to managing other devices, including smart homes and vehicles (imagine your fridge sending you a notification to your smartwatch that you're out of milk or a car letting you know that someone has just parked very close to you and there is a risk of damaging your car).

# Apple Vision Pro

It's a super-advanced mixed-reality headset developed by Apple. With Vision Pro, you can turn the world around you into your computer or private Theater. Apple calls this technology spatial computing – you can steer and view anything using just your voice, eyes, and gestures. With Vision Pro, you can open the same apps you can open on your computer or on your TV, and they are projected, e.g., on your desk or in your living room.



Source: https://www.apple.com/apple-vision-pro/

Apple Vision Pro is not yet available on the market; it is projected to be released in 2024 for an initially set price of $3,499. But even today, we can say that it will be a big revolution in the way we work, consume content, and communicate with others. It's safe to call Apple Vision Pro one of the most advanced wearables ever made.

# Gaming

## Many of the technologies we mentioned so far, including 5G, IoT, AI, and wearables, can truly change the way we play online and mobile games.

With these new technological advancements, games will be even more immersive and realistic. Take Apple Vision Pro as an example – can you imagine super-realistic games that interact with all your senses via this headset? We sure can!

The mobile gaming market is experiencing huge growth right now, mostly because smartphones and tablets are now so fast and engaging. Image and video quality is staggering even today; just imagine what will be possible not just next year but five years from now and beyond. Undoubtedly, mobile games will be using more AR and VR functions as smart headsets gain popularity.

The first AAA games are now appearing on smartphones, proving how much computing power we carry in our pockets. Gaming is also becoming a very important market in the mobile world. This can be seen in Apple's policy – this company is now trying to come back after many years as a brand associated with games.

# Predicted market growth

According to Precedence Research, in 2022, the mobile gaming market was worth slightly over $184 billion. By 2023, it is expected to surpass $775 billion at an impressive CAGR of 15.5%.



Source: https://www.precedenceresearch.com/mobile-gaming-market
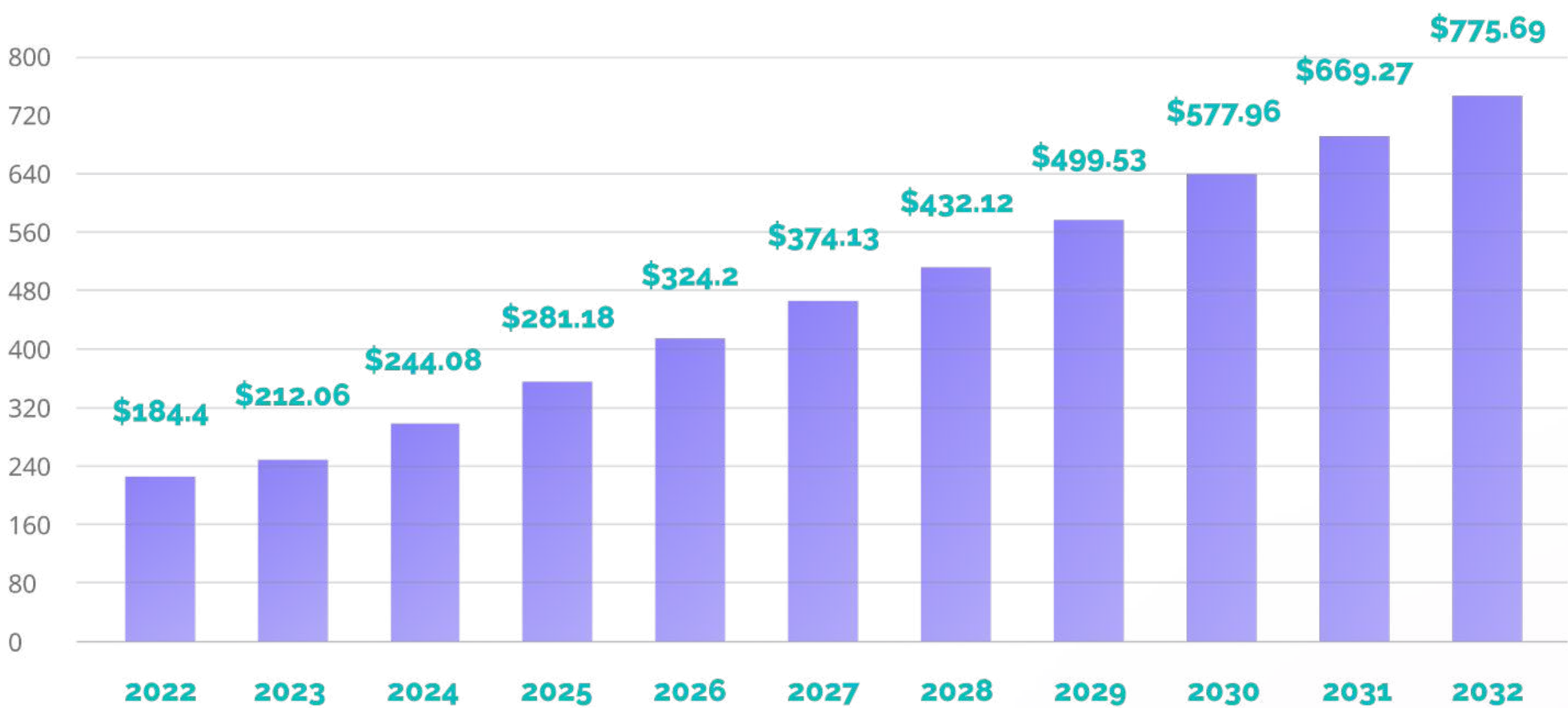
# Profiling successful gaming apps

As mobile technologies continue to grow, game developers need to up their game and come up with strategies and approaches that will help them achieve success with their new apps and games.

One key aspect of successful gaming apps is their ability to offer engaging gameplay experiences that captivate and retain players. Here's what's going to be crucial in the coming months and years:

- Intuitive user interfaces
- Regular updates
- Top-notch visual experiences
- Personalization of gameplay experiences to different players
- Good monetization strategy

## According to **BusinessOfApps.com,** Subway Surfers is currently the most popular mobile game, with over 300 million downloads.

What contributed to the success of this game? Here's what Mathias Gredal Nørvig, SYBO Games CEO, said about the success of their game:

*"Our success can be attributed to many factors: simplistic yet super appealing gameplay, engaging and familiar characters, combined with high quality, state-of-the-art animation, graphics, and moves that amplify the play experience. We have been adapting and evolving Subway Surfers while keeping the nostalgic feel that makes this game one-of-a-kind."*

Consider this a ready-made recipe for the successful mobile games of the future.

# Security

**While passwords are the go-to solution for many companies when it comes to mobile security, the truth is that there are other, more secure and flexible solutions. In the near future, we can expect to see a decreased role of traditional passwords compared to other authentication options, e.g., passkeys and biometry.**

# Apple Passkey

You can think of this technology as passwords 2.0. Apple enables iOS users to replace standard passwords with their passkeys. What's the difference? Passkeys are more secure than standard passwords, primarily because your own device uniquely generates them for every account. As a result, they are less vulnerable to phishing.

Additionally, there are more safety measures – if you want to use Apple Passkey, your iCloud Keychain and two-factor authentication must be on. Once that's done, Apple Passkey uses biometric authentication (Face ID) to make this solution more secure.
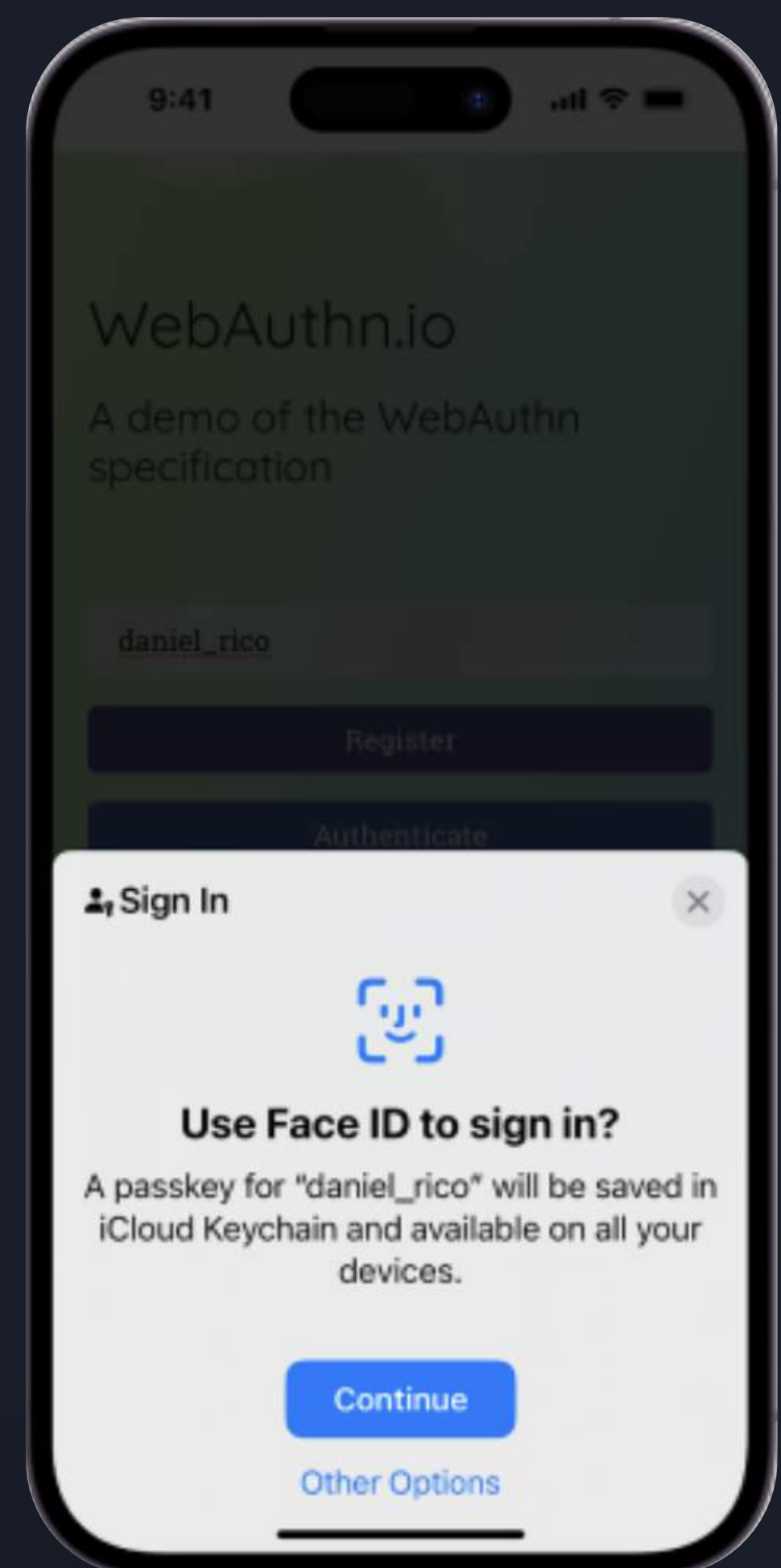
# Biometric authentication

Even today, users can log into online services and even pay for them using biometric authentication. Typical solutions include scanning user's

- Face
- Retina/iris
- Fingerprint

When it comes to biometric authentication, by 2026, the global authentication and identification market is forecast to reach nearly $8.8bn. The biggest growths are predicted for the following market sectors:

- Government bodies
- Defense bodies
- Banking and financial institutions
- Commercial organizations

Source: https://www.statista.com/statistics/1299001/biometric-authentication-and-identification-market-by-end-user/
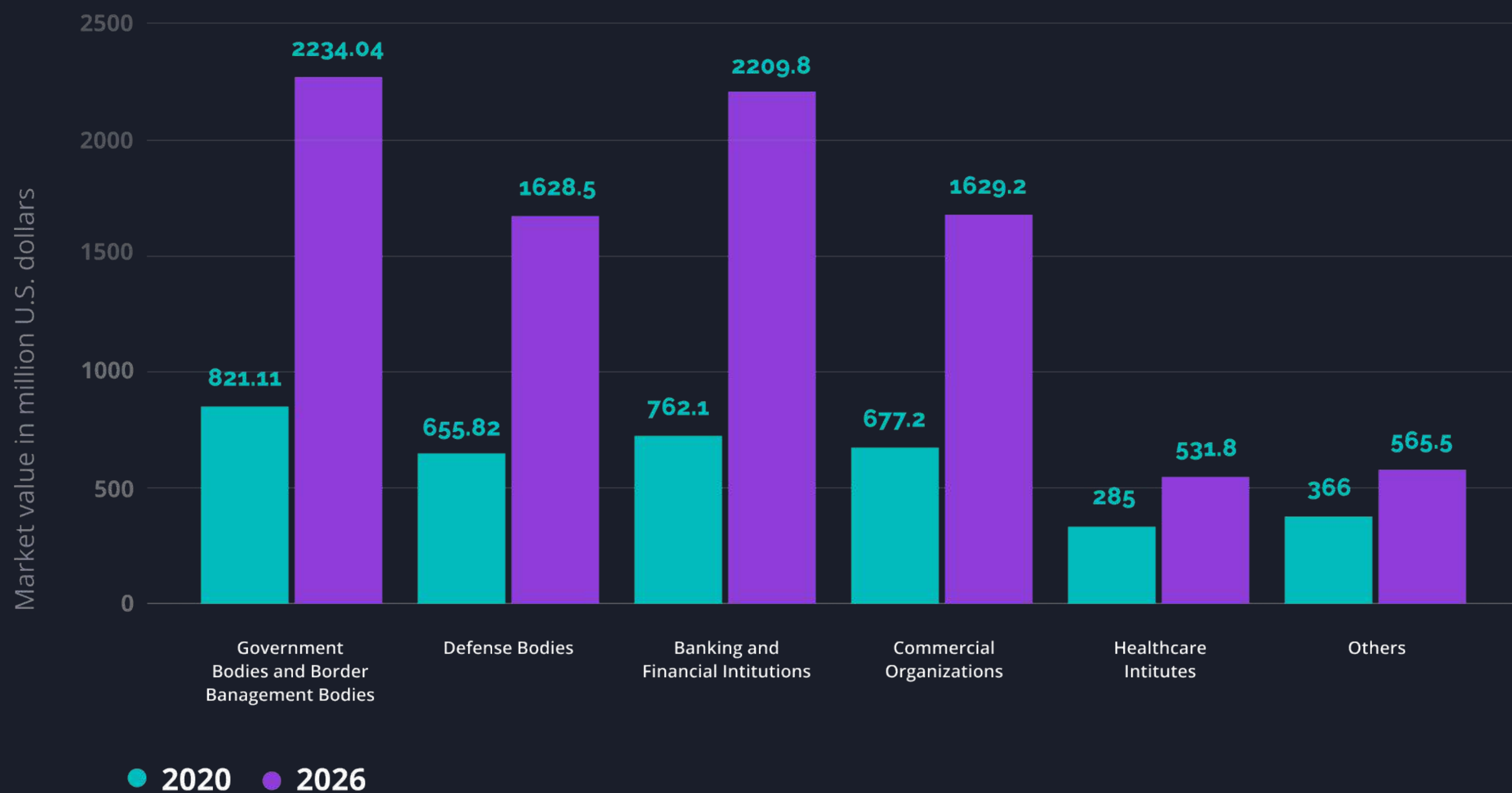
Two other important solutions that will still play a crucial role in mobile security are:

- MFA (Multi-Factor Authentication):

  This solution uses more than one security measure to enable users to log into an app or pay for their order. MFA can include biometry combined with a password or a security question. In the future, apps may require users to provide two different authentication methods, e.g., a face scan and a fingerprint scan. In 2022, the global MFA was estimated at nearly $13bn, and should double its value by 2027.

- Blockchain-based authentication:

  Blockchain technology can also be used to create a decentralized and secure identity verification system that eliminates the need for centralized password databases and reduces the risk of data breaches. We will discuss blockchain more in one of the next sections.

- FIDO:

  This acronym stands for Fast Identity Online. FIDO Alliance is an organization supported i.a. by supported by Mastercard, Apple, Microsoft, and Samsung. It's dedicated to developing open, interoperable authentication standards to reduce reliance on passwords and enhance online security. In 2022, FIDO authentication had a market value of 1.2bn, with the forecast to exceed $12bn by 2032.

# Super-apps

If you've never heard this term, here's a short explanation. Super-apps provide various different services and constitute stand-alone commerce and/or communication platforms that help users with many different aspects of their lives. In other words, super apps constitute marketplaces of services and offerings enabling users to do many things within one app.

## Alipay

That's probably the best example of a super-app. Alipay is made of over 100,000 mini-apps (shops, outlets, and restaurants), and it comprises many different features for finance management, shopping, and ordering diverse services online. With Alipay, you can order food from your favorite restaurant, shop online, collect and use discounts, and share product/ service recommendations with your friends. As of 2023, Alipay is the leading payment platform in China, and it has around 1.3 billion users around the world.



Source: https://www.smartshanghai.com/articles/smsh/yes-foreigners-can-use-alipay-this-is-how
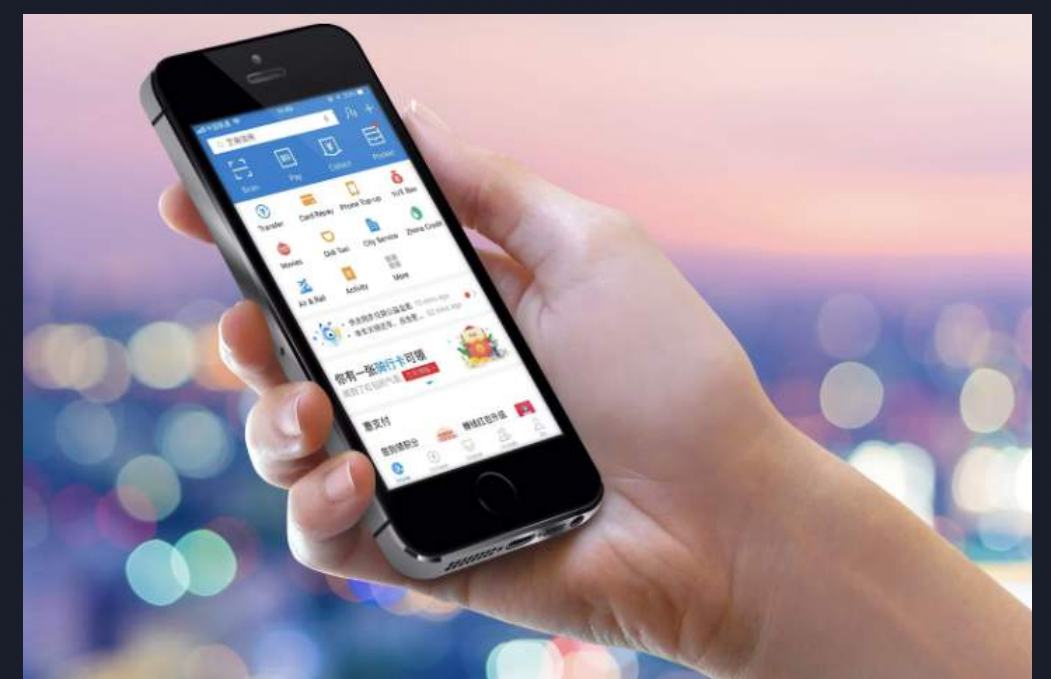
## AirAsia

That's another fascinating example of a super-app. AirAsia works as an OTA (online travel agency), enabling users to book flights, hotels, and transportation. Moreover, with AirAsia, you can book restaurants, ride serves, and even shop for products (both duty-free and regular merchandise). Of course, users can collect points for every purchase and sign up for the BigPay card. Lastly, AirAsia users can interact with travelers with similar interests in the community section. And with RedGames, they can enjoy a wide variety of free mobile games.



Source: https://www.airasia.com/aa/appdownload/
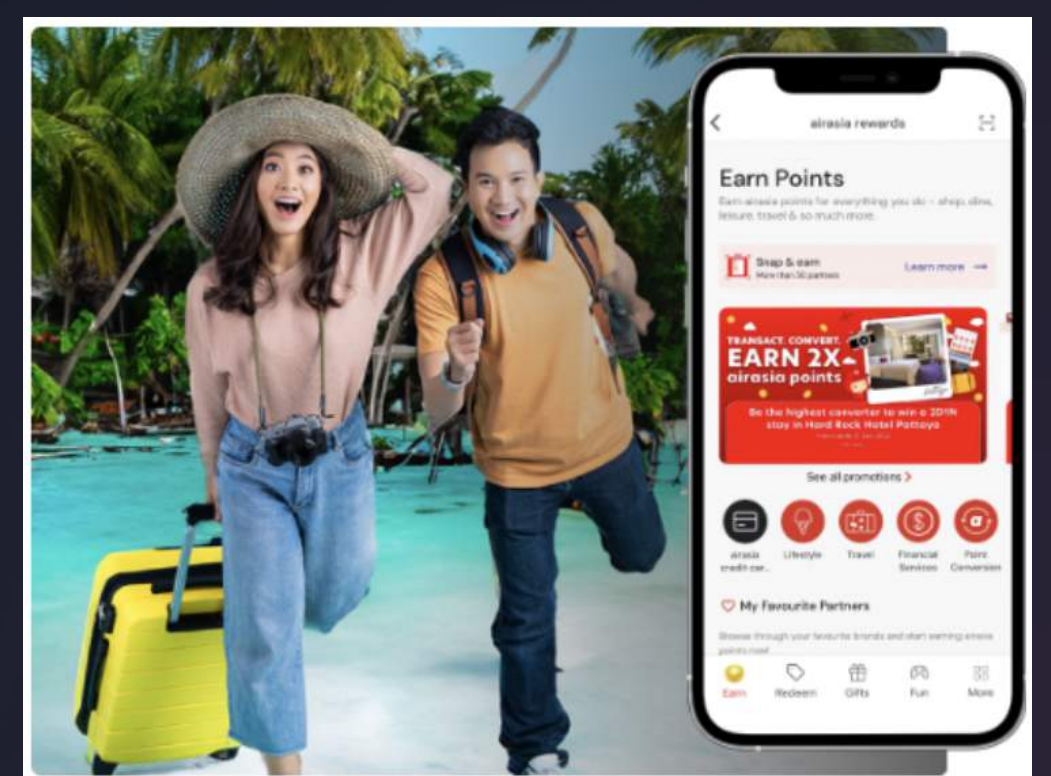
# What can we expect in the future?

The shift from single-purpose apps to super-apps is already happening, and it constitutes a significant evolution in the way we engage with mobile apps. Although now super-apps are popular mostly in the Asian countries, we will surely see them in the US and Europe as well. They will shortly start to displace standard one-purpose apps primarily because they offer more convenient and efficient all-in-one experiences.

**The super-apps market size was at $61.35bn in 2023 and is projected to exceed $714bn by 2032:**



Source: https://www.visionresearchreports.com/super-apps-market/40077
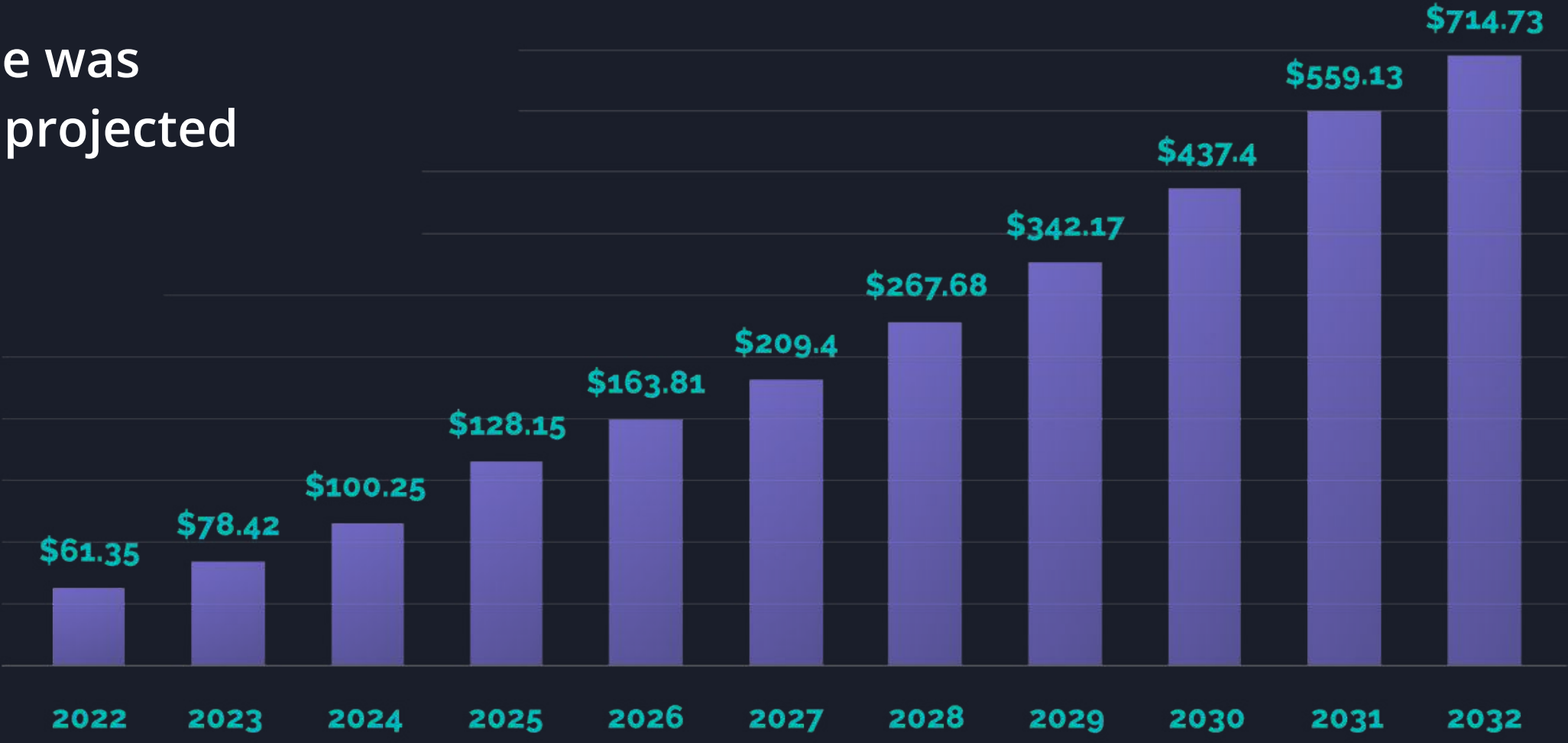
As The Wall Street Journal predicts, in the Western world, super-apps will likely be popular, especially due to a streamlined user experience, e.g., the ability to manage fewer accounts, transact faster, and save money through loyalty and rewards. B2B super-apps will also constitute a big trend in this sector. B2B super-apps will likely focus on driving value through data-driven insights, automated advice, and seamless integration of business platforms into a single dashboard.

# Blockchain

Although many people associate this technology with cryptocurrencies, blockchain comes in handy concerning mobile apps and their security. Here, we'd like to turn your attention to three crucial aspects:

- Cryptocurrency wallets:

You can create mobile apps that serve as cryptocurrency wallets. Users can securely store, send, and receive cryptocurrencies using these wallets. Some examples of mobile apps-slash-cryptocurrency wallets are Coinbase, TrustWallet, and even Revolut.

- Secure user authentication:

   Blockchain can be used to enhance user authentication in mobile apps. Instead of traditional login credentials, users can log in using their blockchain-based identity, making it more secure. Here, SelfKey is a good example. SelfKey is a blockchain-based self-sovereign identity system that provides a mobile app for managing and verifying identity documents and personal information.

- Decentralized applications:

   Develop decentralized applications that run on blockchain platforms like Ethereum, Binance Smart Chain, or others. These apps often rely on smart contracts for secure and transparent transactions. Users can interact with these DApps through mobile interfaces. Uniswap is a good example of such a DApp. It's a decentralized exchange platform that allows users to swap various cryptocurrencies without the need for a centralized intermediary.

These three solutions enable secure data storage and transactions, but there are also mobile payment apps that use blockchain technology for secure and instant cross-border payments using standard payment methods.

# Ripple

This app uses its native digital asset (XRP), which serves as a "bridge currency" in this app. When companies or individuals need to transfer money between two different currencies, they can use XRP as an intermediary. This eliminates the need for the involvement of multiple correspondent banks, thus minimizing the cost and the time needed to finish the transaction. So, for instance, if a company in the US wants to send money to a company in Germany, they can simply convert USD into XRP and then send the XRP to the German recipient, which will convert it to EUR. The whole process happens much faster compared to standard cross-border payments.

Source: https://ripple.com/solutions/cross-border-payments/

# Coinbase

This app is frequently listed as one of the best cryptocurrency apps out there. Its popularity is not surprising; users value Coinbase for its user-friendly interface, secure storage of various cryptocurrencies, ease of buying and selling various digital assets, educational resources, and options like recurring purchases and debit card and instant payment integration (for example, lately Coinbase introduced integration with Interac – the Canadian instant payment system).
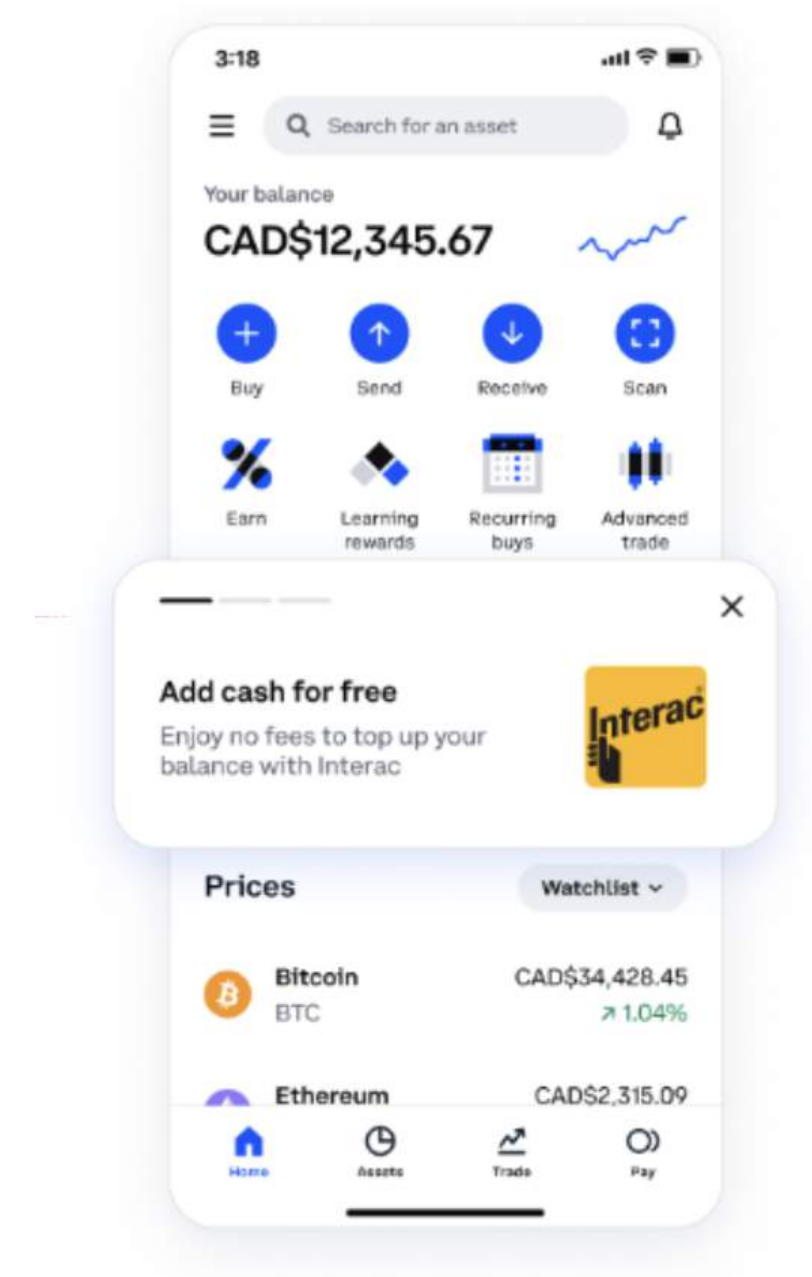


# What's the future of blockchain?

Like all other technologies mentioned in this ebook, blockchain's future is bright. This technology will find numerous applications in:

• Supply chain management
• Identity verification
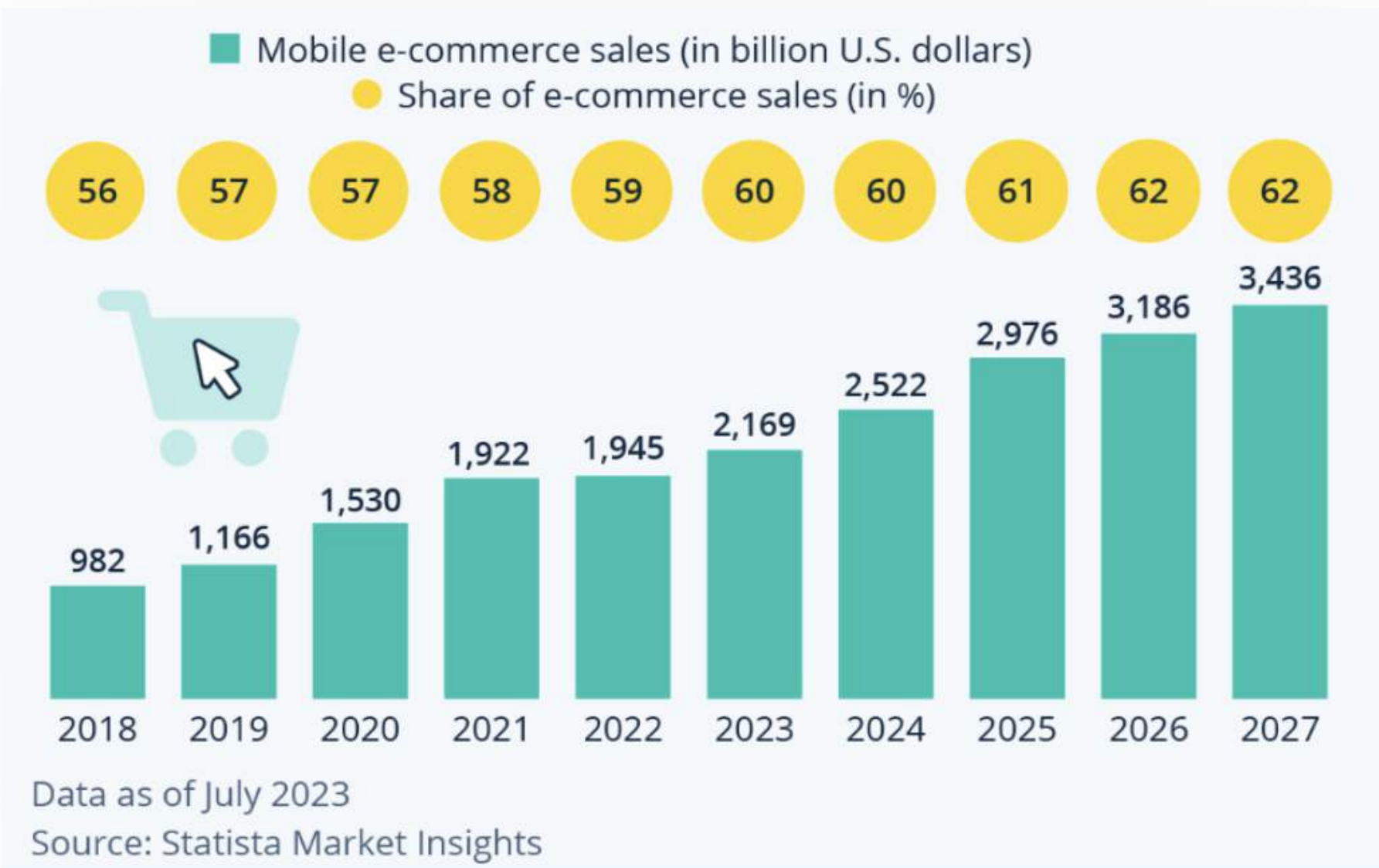• Mobile payments
• And data security

In the near future, we can anticipate a greater emphasis on the security, efficiency, and transparency of this technology. Blockchain is likely to become more integrated into everyday life. The possible applications of blockchain reach beyond cryptocurrencies into territories such as supply chain management, digital identity, and decentralized finance. What's also very important is that blockchain has the potential to offer solutions that give people greater control over their personal data.

Available market data clearly shows that blockchain will continue to grow. Estimations show this technology should reach almost $40bn global value in 2025 (compared to slightly over $23 in 2023).

# Mobile commerce and delivery apps

When you take a look at available market data, you will see that mobile commerce is now a major trend in online trade. According to Oberlo.com, the share of mobile e-commerce sales in total e-commerce sales has increased to 60% in 2023 and is predicted to reach 62% in 2027:



Mobile e-commerce sales (in billion U.S. dollars)
Share of e-commerce sales (in %)

| 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|------|------|------|------|------|------|------|------|------|------|
| 56 | 57 | 57 | 58 | 59 | 60 | 60 | 61 | 62 | 62 |
| 982 | 1,166 | 1,530 | 1,922 | 1,945 | 2,169 | 2,522 | 2,976 | 3,186 | 3,436 |

Data as of July 2023
Source: Statista Market Insights

Source: https://www.statista.com/chart/13139/estimated-worldwide-mobile-e-commerce-sales/

The reasons for this revolution are apparent. Mobile commerce provides unmatched convenience and speed. Nowadays, all users have to do is open a mobile app, select a product, pay for it, and schedule the best delivery option. Everything can happen in a matter of a minute!

# What can we expect in the future?

More and more online stores will decide to develop a mobile application, and thanks to SaaS solutions, they will be much cheaper to get. Mobile development companies will start offering ready-made mobile apps that only need to be tailored to a given company (when it comes to branding and inventory), making this technology available even to mid-sized stores.

Delivery apps will also thrive. Even today, this market is quite saturated (just to mention SkipTheDishes, DoorDash, and Uber Eats). In the near future, delivery apps will go beyond food delivery, encompassing a wider range of products and services, including groceries, medications, electronics, and more. We will probably also see a growth in autonomous vehicle delivery integrated with such apps. Here, we think primarily about autonomous delivery bots and drones. This solution will significantly reduce delivery times and costs.

Even today, Amazon is working on its automated delivery system (Amazon Scout) in some communities in the US. In the near future, autonomous robots, drones, and vehicles will be delivering our orders right to our doorsteps, and delivery within 24 hours will become a standard, at least in developed countries.



Source: https://www.aboutamazon.com/news/transportation/meet-scout

The reasons for this revolution are apparent. Mobile commerce provides unmatched convenience and speed. Nowadays, all users have to do is open a mobile app, select a product, pay for it, and schedule the best delivery option. Everything can happen in a matter of a minute!

# Amazon Shopping

It's one of the most popular mobile commerce apps out there (over 500 million users). Amazon Shopping offers some app-only benefits to make mobile shopping on Amazon faster and easier. Amazon Shopping enables users to browse the entire marketplace, view product details, read reviews, and purchase millions of products. Plus, the app integrates many Prime perks, including access to exclusive deals.
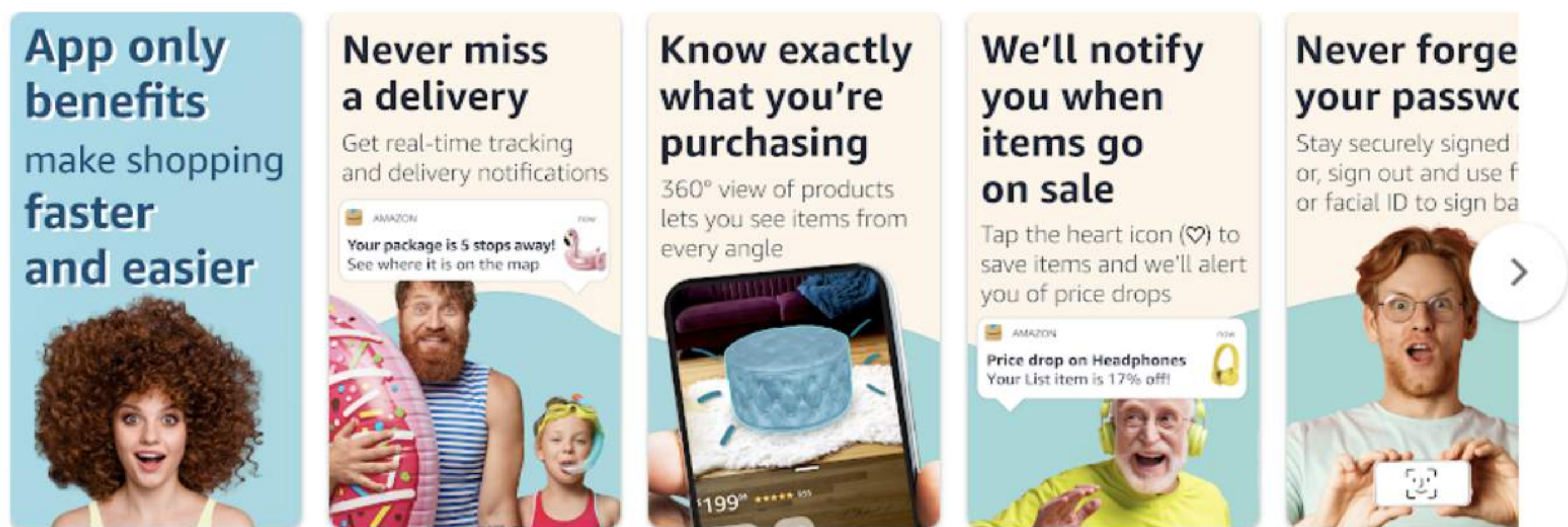


Source: https://play.google.com/store/apps/details?id=com.amazon.mShop.android.shopping&hl=en_CA&gl=US

# Uber Eats

Uber Eats is a food delivery platform that allows users to order a wide range of meals and food items from local restaurants, cafes, and eateries. Users can customize their orders and schedule delivery with just a few taps. On a global scale, Uber Eats is the most popular food delivery service, with over 88 million users, availability in over 10,000 cities, and over $55 billion in gross bookings in 2022.
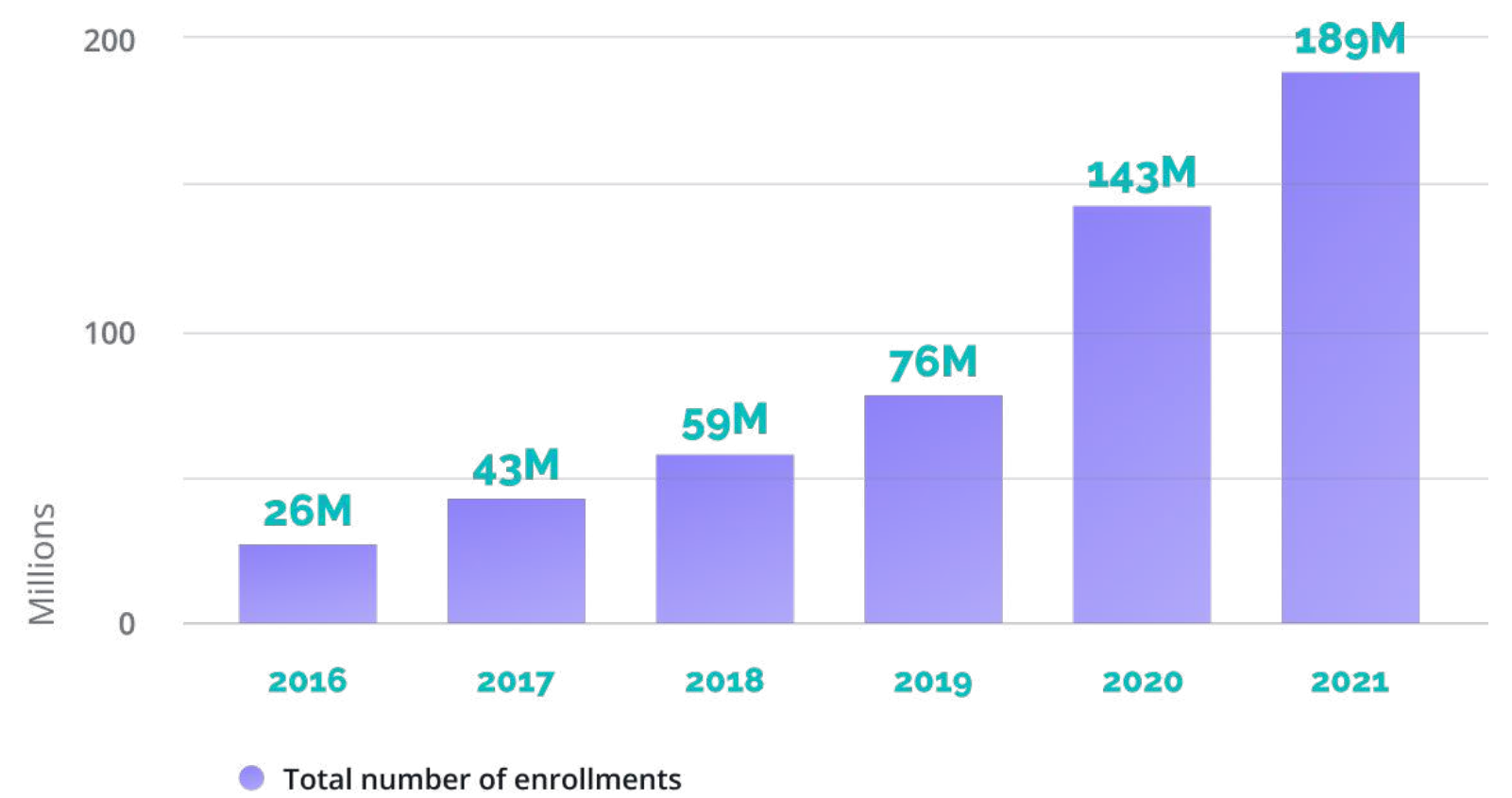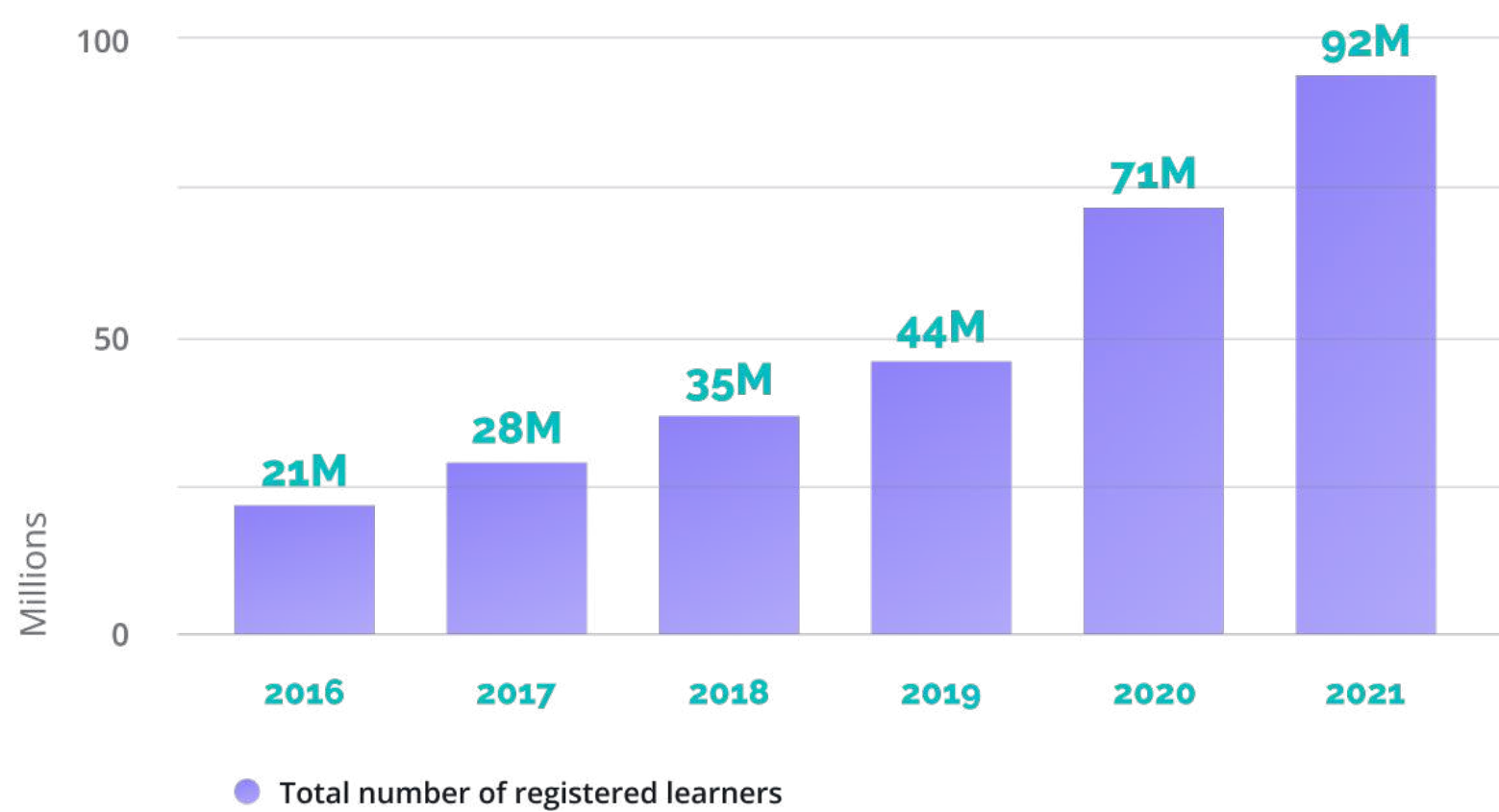


Source: https://www.uber.com/newsroom/arriving-now-the-new-uber-eats/
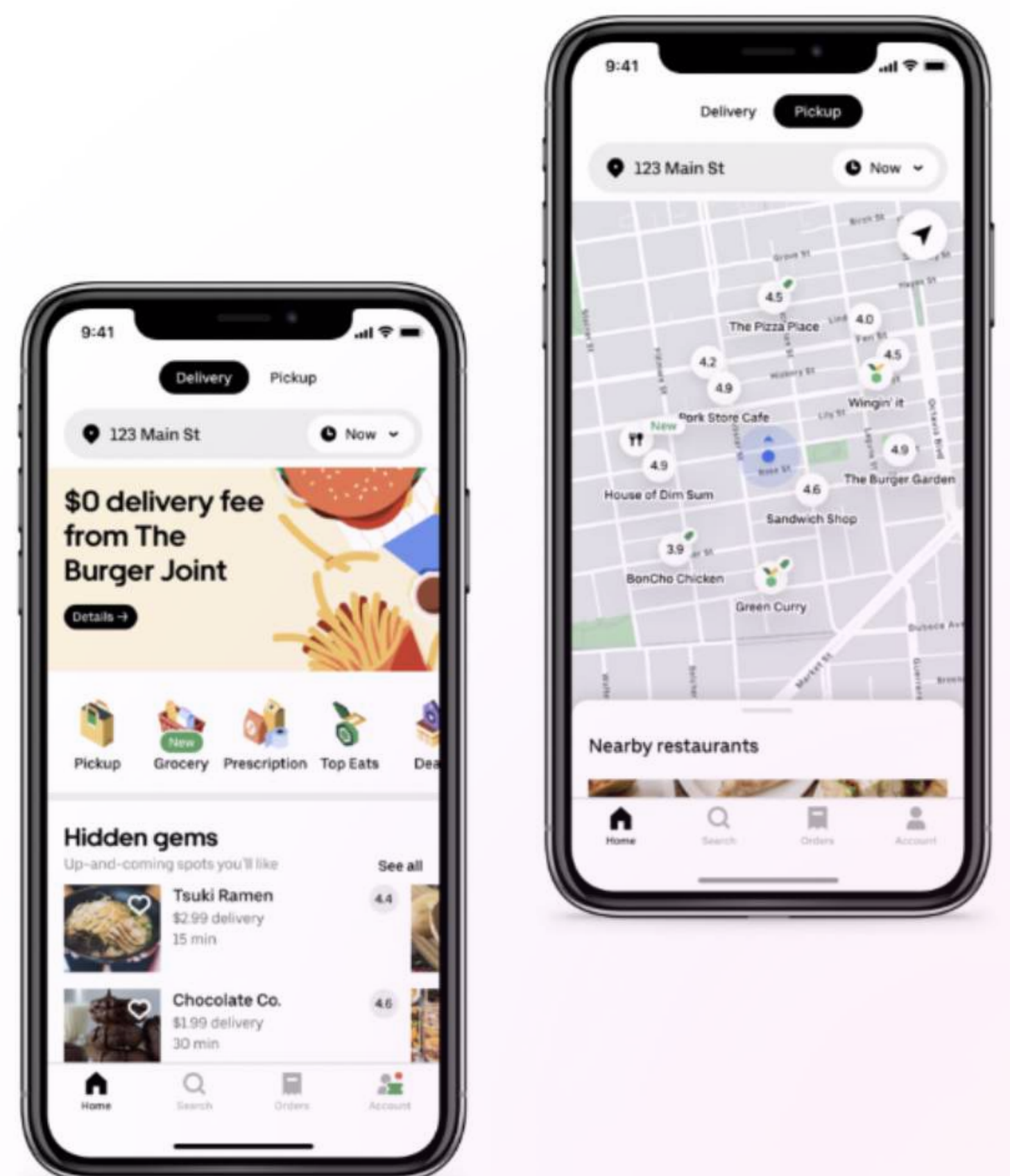
# Mobile Learning

This trend was boosted especially in 2020, primarily because of the COVID-19 pandemic. These two charts below show that post-pandemic growth levels are much higher compared to pre-pandemic levels:

**The demand for online learning on Coursera continues to outpace pre-pandemic levels**



Chart 1 — Millions (Total number of registered learners):
- 2016: 21M
- 2017: 28M
- 2018: 35M
- 2019: 44M
- 2020: 71M
- 2021: 92M

Chart 2 — Millions (Total number of enrollments):
- 2016: 26M
- 2017: 43M
- 2018: 59M
- 2019: 76M
- 2020: 143M
- 2021: 189M

Source: https://www.weforum.org/agenda/2022/01/online-learning-courses-reskill-skills-gap/

If there was anything positive related to the last global pandemic, it was this – the surge in remote education (and work). Online and mobile learning offers many significant advantages for students:

- Access to global education (you can live in Poland and get a certificate from the University of Toronto without leaving your house)
- Full flexibility (students learn at their own pace, whenever possible)
- Possibility to do several courses simultaneously (if you want, you can enroll in three or more courses at the same time, thus making your learning more effective)
- Possibility to learn from your mobile device (you don't even have to be at home to benefit from mobile/remote learning – all you need is a mobile device with access to the internet)

Nowadays, mobile education apps are engaging and simply nice to use. Such elements as gamification, scoreboards, badges, and certificates make your learning far more immersive. The results of such learning stay with you for longer, too!

# Duolingo

This app is synonymous with mobile learning. Duolingo enables users to learn foreign languages (yes, you can learn several languages simultaneously) in a fun and engaging way. The app is divided into different real-life subjects, and you learn with several different characters (e.g., a bear, an older lady, a young kid, and a professional coach). To encourage users to learn every day, Duolingo keeps your track record and gives you awards for achieved milestones and the length of your learning. Such an approach is extremely effective – Duolingo has over 500 million registered users.



Source: https://elizanedwards.medium.com/a-more-immersive-duolingo-3571002d0134
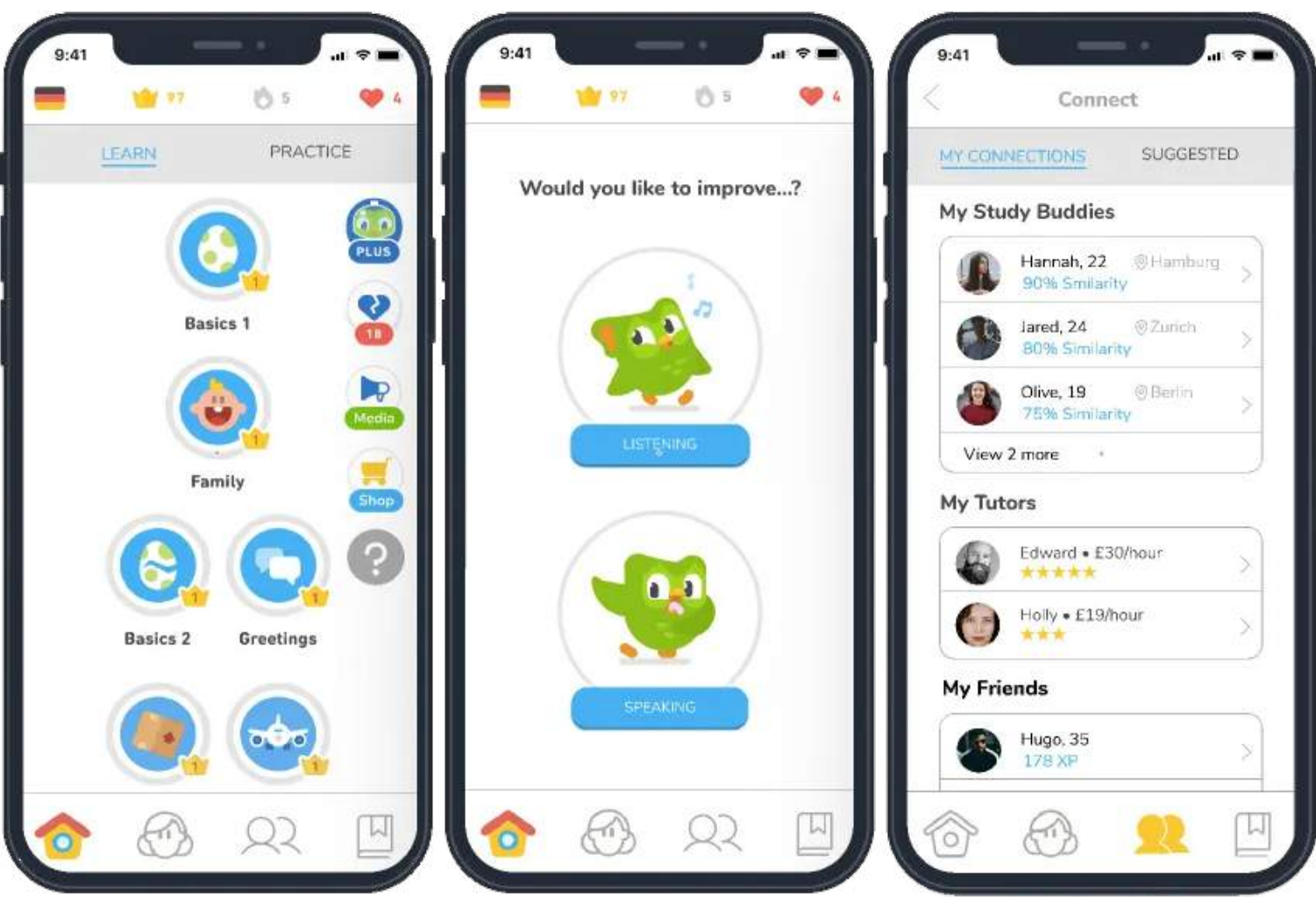
# Thinkific

It's a mobile learning platform for course creators and community managers. It provides tools and features for course creation, hosting, and management. Creators can use Thinkific to design and deliver a wide range of courses, from educational and training programs to coaching and consulting services. Users value this platform for its simplicity, branded content (anyone can have their own mobile app within this platform), and accessibility (students can learn from their mobile phones, wherever they are).
By theend of 2020, Thinkfic has seen more than 100 million course enrollments taken via this platform.

Source: https://apps.apple.com/us/app/thinkific/id1557573471
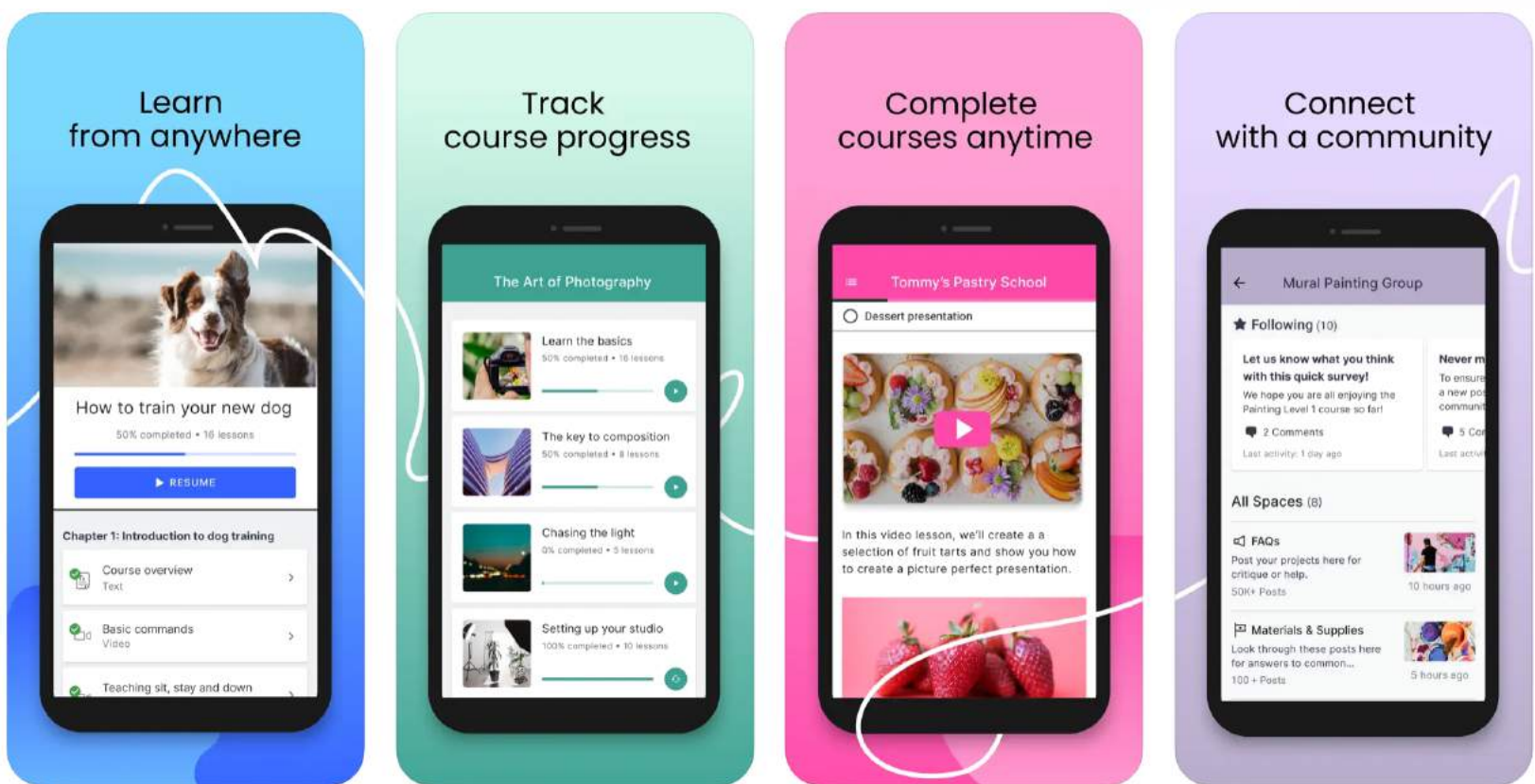
# The future of mobile learning

In 2022, the global mobile learning market was valued at $46bn. Predictions show this market will grow at a CAGR of 15% all the way to 2032 when it should reach $55bn. What can we expect in the near future when it comes to mobile learning?

We will see mobile learning implementations across various sectors, including education, corporate training, and professional development. As mobile technologies advance, mobile learning apps and platforms are likely to become more sophisticated, incorporating features such as augmented reality and virtual reality, making learning experiences even more immersive and engaging.
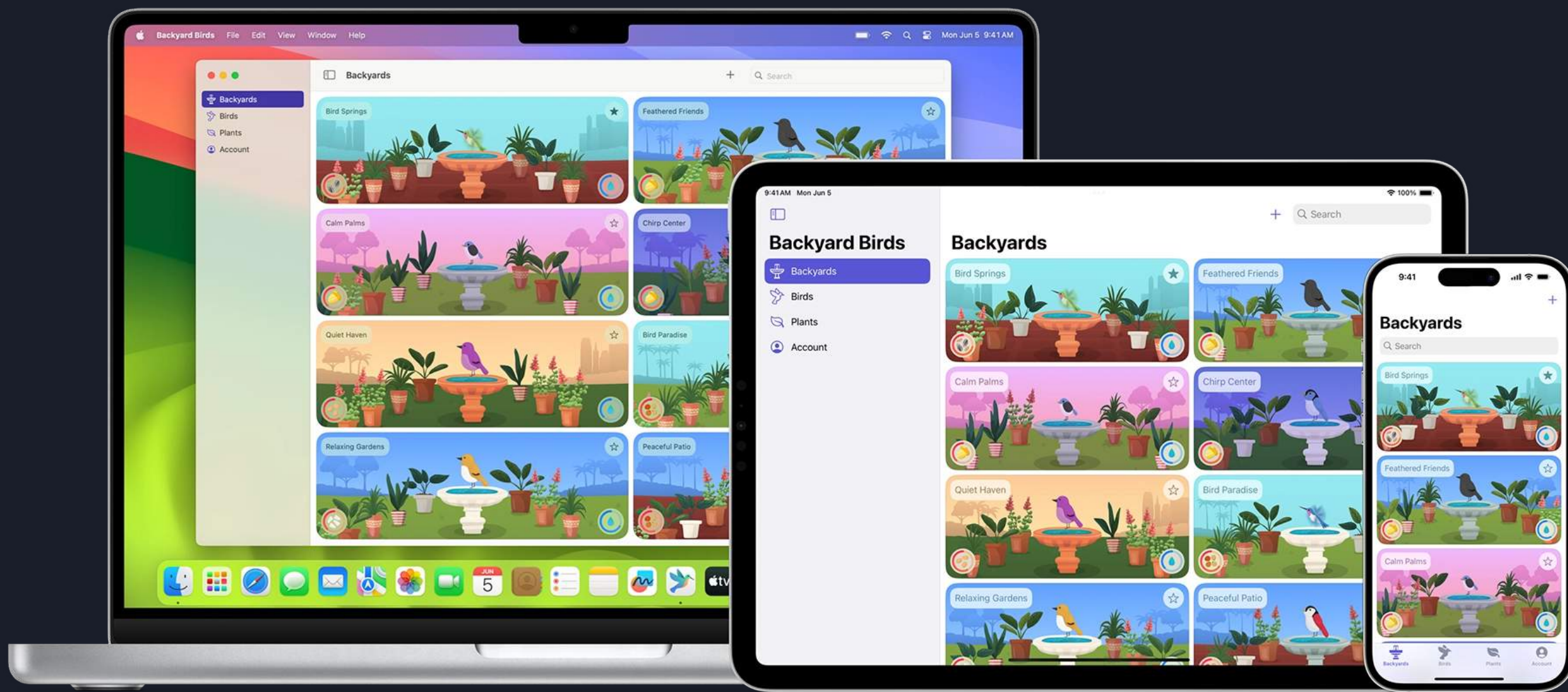
# Declarative programming

If you've never heard this term, here's a short explanation: Declarative programming is all about expressing what a given piece of software should accomplish instead of specifying how it should achieve the result.

In other words, this programming approach focuses on describing the desired outcome or the problem to be solved, leaving the details of the implementation to the programming language, chatbot, or framework. When it comes to mobile programming, there are two major declarative programming tools: SwiftUI for iOS and Jetpack Compose for Android.

## SwiftUI

It's probably the best example of declarative programming in action. SwiftUI was developed by Apple, and it enables the development of apps for all Apple platforms with just a little coding. SwiftUI uses a declarative syntax, so you can simply state what your user interface should do. As a result, the code is simpler and easier to read than ever before, saving developers both time and maintenance work. What's also important is that Swift UI provides a real-time preview feature that allows developers to see how their user interface looks and behaves as they write code.

Source: https://developer.apple.com/xcode/swiftui/

# What can we expect in the future?

Declarative programming makes coding easier and faster; there's less code too, making this technology perfect for light mobile apps. As artificial intelligence and automation technologies advance, declarative programming is likely to see increased integration with these innovations. Developers will soon use mostly AI-driven tools to generate declarative code. Additionally, declarative programming's abstract nature makes it perfect for cross-platform development, thus reducing the need for platform-specific code. In the future, we may see declarative languages and frameworks that can be used for multiple platforms with a single codebase, making development much easier and faster.

# Mobile development technologies

Mobile development is constantly evolving. Currently, there are three major approaches to designing mobile apps and platforms:

1. Native development
2. Cross-platform development
3. Multiplatform development

How will they evolve? What will change in the future? Let's have a look.

# Native development

Native apps are made with a specific operating system (OS) in mind and written in a language that only that system supports and accepts. iOS accepts Swift/SwiftUI and Objective-C, while Android works with Java and Kotlin.

In general, native development offers many significant advantages. For starters, native mobile apps offer full compatibility with a given OS. As a result, those apps offer a full range of features and unmatched performance combined with seamless interface interactions. Additionally, native applications use all functions of devices with a given system (e.g., camera, GPS, or microphone), support push notifications, and can work offline.

# What's the future of native development?

Market forecasts show that in 2030, the mobile application market will be worth $567.19 billion (compared to $229bn in 2022). What will change over that period? First, we can expect increased emphasis on cross-platform development technologies, primarily because it makes it easier for developers to write code that works on both iOS and Android. Secondly, in the near future, there will be more powerful and user-friendly development tools, and alongside AI-driven app personalization, they will streamline the development process. Lastly, we'll witness a growing emphasis on security and privacy, with stricter regulations and a heightened focus on protecting user data.

# Cross-platform development

Cross-platform mobile development is a good solution for companies that want to develop apps for both operating systems but they don't have the resources or time to develop two separate apps. With cross-platform development, you start with one codebase and use it for both operating systems, which significantly shortens and streamlines the development process; fewer people are involved, too.

Of course, cross-platform development is not perfect; there are still some downsides, with the major one being that your app won't have full access to all the features and functions within the user's phone. You can think of cross-platform development as some sort of a compromise – you get one codebase and quick development, but you need to "sacrifice" some of the functions. That said, cross-platform development is ideal for relatively simple apps that don't need access to all the device's options.

When you take a look at the chart below, you will see that there are two cross-platform technologies that are especially popular:



Share of respondents

State managements

● 2019  ● 2020  ● 2021  ● 2022
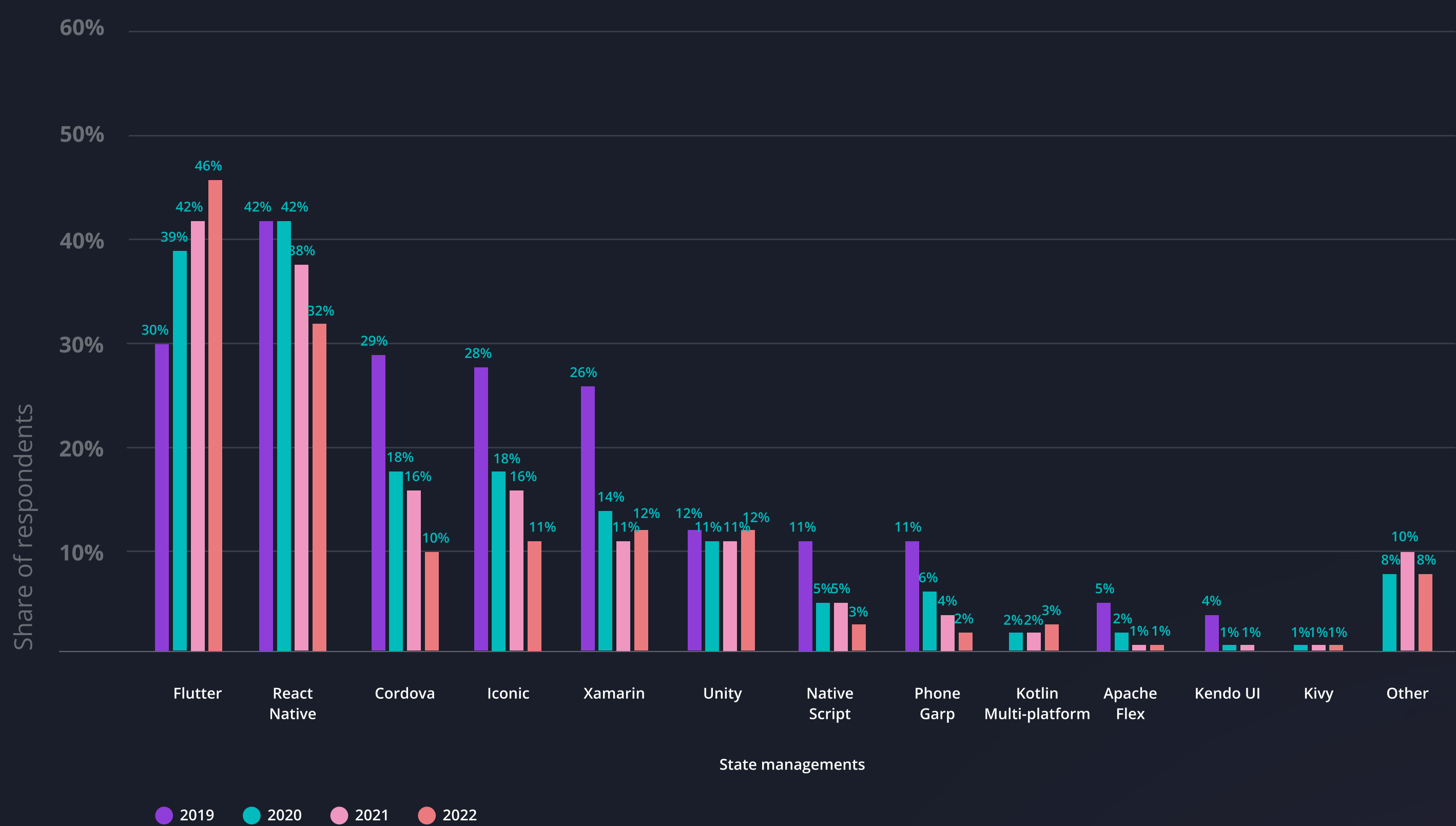
Interestingly, only one of them – Flutter – has significantly increased the number of developers' working hours, meaning the popularity of this framework will likely go up in the near future. However, below, we are discussing four technologies worth your attention when it comes to cross-platform development.

# Kotlin

Kotlin is a versatile programming language widely used in cross-platform mobile development, offering expressive syntax that enhances developer productivity. It's a good choice primarily due to its interoperability with Java and a rich ecosystem of libraries and tools.

| Pros of Kotlin | Cons of Kotlin |
|---|---|
| Kotlin seamlessly works with existing Java codebases, making it easier for developers to use the entire Android ecosystem. | Kotlin compilation can be slower than Java, potentially affecting development speed. |
| Kotlin's syntax reduces the amount of code, resulting in more readable code and easy-to-maintain apps. | Continually decompiles to Java. |
| It offers enhanced type-safety and null-safety, reducing the risk of errors. | Requires at least basic Java knowledge. |
| Kotlin enables developers to write code more quickly and efficiently. | You can still get a better-performing app with Java |

# Coroutines

When it comes to Kotlin, it's also vital to mention Coroutines. Put shortly, these are concurrency design patterns that can be used within Kotlin to simplify the code that's executed asynchronously. Thanks to Coroutines, developers can write asynchronous code in a more readable way.

# Kotlin Multiplatform

This technology is still in its beta phase, but some mobile dev projects have already been developed using it. Kotlin Multiplatform simplifies the development of cross-platform projects, and it goes beyond mobile devices – apps developed with Multiplatform can work on iOS, Android, Windows, Linux, and macOS. The biggest advantage of this technology is that it reduces the time spent on writing and maintaining the code for different platforms while offering the flexibility and many other benefits of native mobile development.

Netflix uses Kotlin Multiplatform to write platform-agnostic business logic in Kotlin and compile it to a Kotlin library for Android and a native Universal Framework for iOS via Kotlin/Native. They use this technology to develop a mobile app called Prodicle that enables innovation in the physical production of TV shows and movies. This is how their app logic created with Kotlin Multiplatform looks:



Source: https://netflixtechblog.com/netflix-android-and-ios-studio-apps-kotlin-multiplatform-d6d4d8d25d23
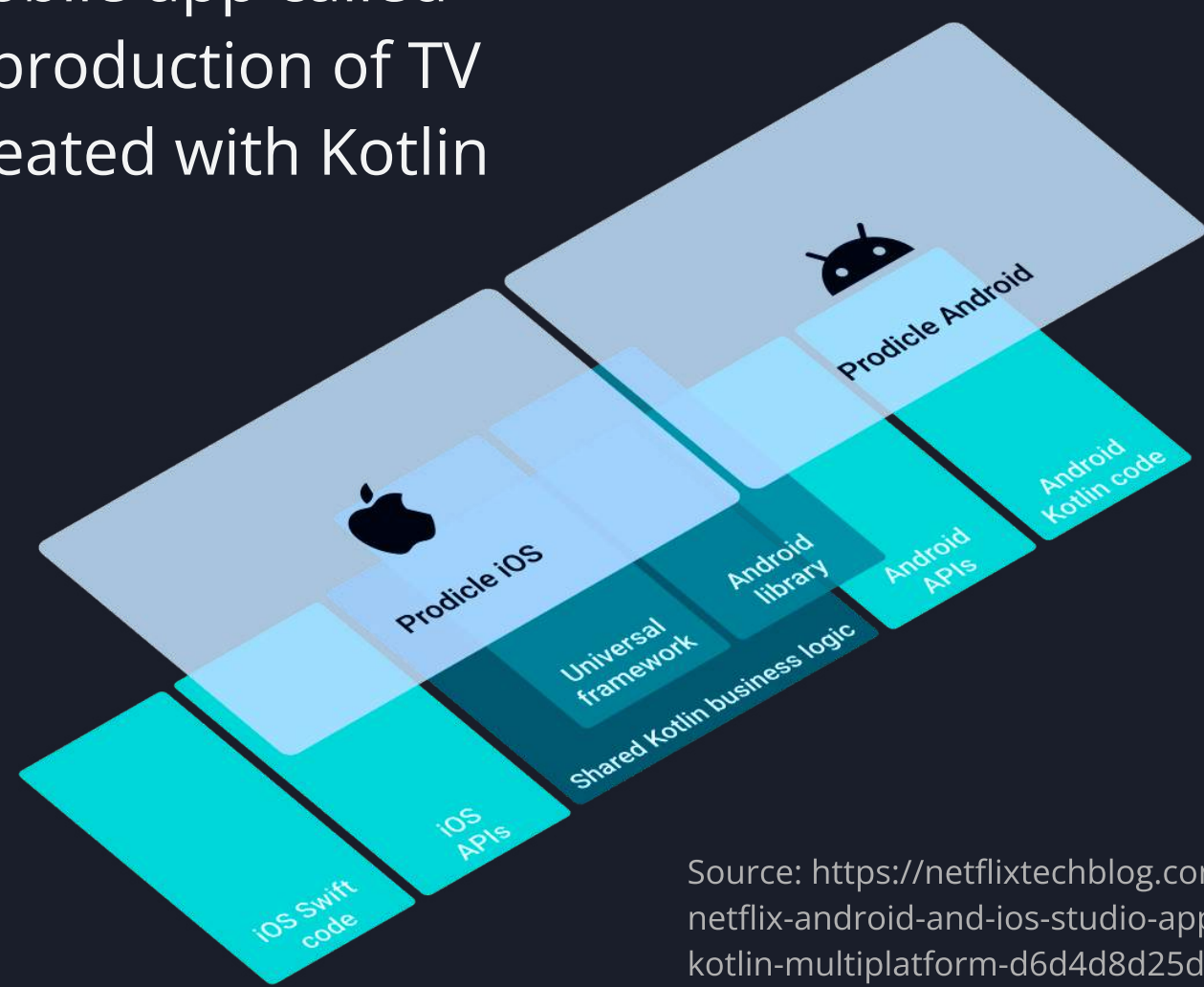
| Pros of Kotlin Multiplatform | Cons of Kotlin Multiplatform |
| --- | --- |
| KMM allows developers to share common logic across platforms while maintaining native UIs, reducing code duplication and development time. | The ecosystem, though growing, is not as mature as native or other established cross-platform solutions, potentially leading to the need for custom solutions. |
| Since UI is developed using native tools, apps maintain a high performance and offer a native look and feel for each platform. | For developers not familiar with Kotlin or the multiplatform approach, there's a learning curve involved in mastering KMM. |
| Kotlin is a modern, concise, and safe programming language, known for reducing boilerplate code and improving developer productivity. | Debugging support on iOS is not as advanced as on native platforms, which can slow down development. |
| KMM seamlessly integrates with existing iOS and Android codebases, allowing gradual adoption in existing projects. | Setting up a KMM project, especially for iOS, can be more complex compared to native development. |
| Backed by JetBrains, KMM benefits from strong support and a growing community, which aids in resolving issues and improving the framework. | While the community is growing, it's still smaller compared to more established frameworks, which might affect the availability of resources and solutions. |
| Integration with IntelliJ IDEA and Android Studio offers excellent tooling support, enhancing the development experience. | Ensuring consistency across platforms can be challenging and might introduce platform-specific bugs. |
| Regular updates and improvements are being made to the framework, indicating a commitment to its long-term viability. | The development and direction of KMM heavily depend on JetBrains, which could impact its evolution based on the company's priorities. |

As you can see on the chart above, Flutter is by far the number one cross-platform technology in the current mobile dev landscape. Flutter is a good choice if you can accept a slightly less responsive/ functional app or when your budget is limited. On the other hand, Flutter wins when it comes to responsiveness.

| Pros of Flutter | Cons of Flutter |
| --- | --- |
| Allows developers to use one codebase for multiple platforms (iOS, Android, web, desktop), saving time and resources. | Flutter apps tend to be larger than native apps, which might be a concern for users with limited device storage. |
| Enhances the development process by allowing instant viewing of changes in the code without the need for a full restart. | While growing, the ecosystem of third-party libraries and packages is not as extensive as native development, which might require building custom solutions. |
| Flutter provides a comprehensive set of pre-designed widgets that help in creating complex UIs with a native feel. | Developers new to Dart and Flutter might face a steep learning curve, especially if they are accustomed to native development languages. |
| Offers high performance as it uses the Dart language, which compiles into native code, reducing the need for a bridge to communicate with native components. | Certain platform-specific advanced features may not be directly supported or may require additional work to implement. |
| Backed by Google, Flutter has a growing community and extensive documentation, making it easier to find solutions and support. | Flutter might lag in updating its framework to accommodate the latest platform features introduced by iOS or Android. |
| Offers a high level of customization for UI components, allowing for unique and creative designs. | Ensuring that the app behaves consistently across different platforms can be challenging. |
| Seamless integration with Firebase provides a suite of tools for backend, analytics, and more. | |

# React Native

The last cross-platform technology we want to talk about is React Native (RN). It's a mobile application development framework created by Facebook back in 2015. RN allows developers to build cross-platform mobile apps using JavaScript and React. React Native offers multiple of pre-built components, a fast development cycle, and a strong developer community, making it a popular choice for efficient and cost-effective mobile app development.

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| Pros of React Native | Cons of React Native |
|---|---|
| Enables writing one codebase for both iOS and Android platforms, significantly reducing development time and cost. | For highly demanding graphical tasks or heavy computations, React Native might not match the performance of native apps. |
| Allows developers to see the results of the latest changes immediately without rebuilding the entire app, enhancing developer productivity. | For complex applications, a good understanding of native development (iOS and Android) is still required. |
| Utilizes JavaScript and React, which are widely known and used, making it easier for web developers to transition to mobile app development. | Debugging in React Native can sometimes be more complex compared to native development, particularly when native components are involved. |
| Offers a hot-reload feature, increasing developer productivity. | Initialization time can be slow, even on high-end devices. |

# What's the future of cross-platform development?

As you can see, cross-platform technologies still struggle with some issues and limitations. However, we can predict the majority of those issues will be eliminated sooner or later. Cross-platform development is too convenient and effective for companies and organizations developing them stop working on those problems.

Possibly, in the near future, some of them will be eliminated, and cross-platform apps will behave almost like native apps. Secondly, cross-platform applications will be cheaper and faster to develop, primarily thanks to AI-powered solutions providing developers with support in writing new lines of code (this is already possible!).

# Summary

We hope this publication showed you how fascinating the world of mobile technologies is. AI, AR, IoT, blockchain, 5G, and smart devices make our lives easier and more efficient. They help us do our jobs more effectively, take care of our health, and enjoy immersive and engaging experiences (just imagine what Apple Vision Pro will make possible!).

Shortly, all those technologies will become even more advanced, secure, and user-centered. One thing is certain – whichever technology you think about, it will most likely grow in the coming years and grow significantly – in the mobile world, a CAGR of over 20% is nothing unusual!

Now, it's time for you to join this revolution. If you're thinking about adopting one or more mobile technologies to your company's strategy, now's the time to act. As those technologies are getting more advancing and maturing, starting from scratch will only get harder and more expensive.

If you'd like to find out more, feel free to reach out to our team. We will gladly become your guides in the mobile technology world and help you make the most of what's possible.

Start here for free!

# Sources

https://datareportal.com/reports/digital-2023-global-overview-report

https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/

https://5gobservatory.eu/about/what-is-5g/

https://waymo.com/

https://www.statista.com/statistics/1183457/iot-connected-devices-worldwide/

https://www.gartner.com/smarterwithgartner/what-edge-computing-means-for-infrastructure-and-operations-leaders

https://www.linkedin.com/pulse/future-iot-emerging-trends-applications-hireotter/

https://www.balbix.com/insights/addressing-iot-security-challenges/

https://en.wikipedia.org/wiki/List_of_PlayStation_VR_games

https://www.precedenceresearch.com/wearable-technology-market

https://www.macrumors.com/roundup/apple-vision-pro/

https://www.gamesindustry.biz/subway-surfers-lessons-from-the-worlds-most-downloaded-game

https://support.apple.com/en-ca/guide/iphone/iphf538ea8d0/ios

https://www.statista.com/statistics/1342107/global-multi-factor-authentication-market-size/

https://www.statista.com/statistics/1372921/fido-authentication-market-size/

https://www.enterpriseappstoday.com/stats/alipay-statistics.html

https://technode.global/2023/04/27/airasia-superapp-average-monthly-active-users-up-12-percent-q-o-q-in-first-quarter/

https://www.linkedin.com/pulse/ripple-coin-xrp-revolutionizing-cross-border-payments-beyond/

https://www.oberlo.com/statistics/mobile-commerce-sales

https://www.businessofapps.com/data/uber-eats-statistics/

https://www.weforum.org/agenda/2022/01/online-learning-courses-reskill-skills-gap/

https://www.gminsights.com/industry-analysis/mobile-learning-market

https://developer.apple.com/xcode/swiftui/

https://www.demandsage.com/whatsapp-statistics/

https://techcrunch.com/2023/08/29/whatsapp-launches-its-native-macos-app/

https://play.google.com/store/apps/details?id=com.waze&hl=en&gl=US

https://www.grandviewresearch.com/industry-analysis/mobile-application-market

https://pangea.ai/blog/tech-stack/top-kotlin-pros-and-cons-you-need-to-know-about

https://www.statista.com/statistics/869224/worldwide-software-developer-working-hours/

https://www.altexsoft.com/blog/engineering/pros-and-cons-of-flutter-app-development/

https://pagepro.co/blog/react-native-pros-and-cons/

https://kotlinlang.org/lp/multiplatform/

https://homesupport.irobot.com/s/article/964

https://resources.github.com/copilot-for-business/

https://www.makeuseof.com/what-is-a-neural-engine-how-does-it-work/