embrace

The State of Mobile Experience

Top challenges facing app users and mobile engineers

20
23

Contents

Introduction

Mobile technology has become one of the most important parts of our daily lives.

Think of how many things you rely on your mobile phone for every day: to check in with your family members, to video chat your friends, to update your coworkers that you'll be late, to get directions, to order food, to watch your favorite show... the list goes on and on.

Chances are, you've got at least a few apps on your phone that help you do all of these many, many things.

At Embrace, we're in the business of making apps, like the ones you love and rely on every day, *better*. That means empowering our community of engineers to build incredible mobile experiences for their end users. It means focusing ruthlessly on things like performance, speed, design, and issue resolution. Because we've seen, first hand, that customers who have a bad experience on an app are the ones that are likely to churn – and that costs your business.

But what exactly does "bad experience" mean? Does it mean the same thing for app users vs. the engineers who build the products they're consuming? What are the real implications of a bad experience, and how can those be avoided? How will future technologies enable us to surprise and delight our end users even more?

To answer these questions, we embarked upon a 3-part research study. First, we surveyed over 900 app users in the U.S. to understand their frustrations. Next, we turned to our own expert community. We polled almost 80 developers, engineers, and managers who work on mobile apps to get their perspectives on the good, the bad, and the future of their industry. Looking at where users and engineers aligned – and where they didn't – proved really insightful.

Lastly, we turned to our own data. Embrace works with customers across a spectrum of industries, from mobile gaming, to e-commerce, to IoT. We analyzed the performance data of all of our customers in aggregate, and started to benchmark this performance across key stability and experience indicators by industry. This let us see how actual results align with opinions and intentions.

The ultimate goal of this data is to arm mobile engineers with insight so they can keep building amazing apps. Because all of us, as end mobile users, benefit from that knowledge. We hope you find it as informative as we have.

ERIC FUTORAN
CEO & Founder

ANDREW TUNALL
Head of Product

Key insights

01 Performance issues are common

Despite ever-increasing expectations for speed and performance (1 in 5 app users expect key app flows to be done in under 5s), nearly half of people still experience issues daily. App users are very willing to delete an app off their phone entirely due to repeated poor experiences.

02 Priorities differ between builders and users

Users' and engineers' priorities around aspects of poor experience don't always align. For more critical issues like crashes, both agree that these are the most frustrating and critical-to-address problems. Slow startup, on the other hand, is less frustrating for users vs. unresponsive buttons or forms. However, slow startup is higher priority for engineers, while unresponsive buttons or frozen screens are relatively lower. Bridging this disconnect might better serve end users.

03 Android vs. iOS users have different experiences

Based on Embrace's aggregated analysis of apps using our tool, Android apps encounter more performance issues vs. iOS. App users differ in how they experience iOS vs. Android, as well, with Android users complaining more about slow startup times, and iOS users reporting slower loading images and video media. Each OS has its own performance challenges, and a nuanced approach is warranted.

Key
insights

04   Performance benchmarks are lowest for gaming apps

Across industry categories, gaming apps tend to suffer the most from performance issues – including crashes, ANRs for Android, user terminations for iOS, and high memory consumption. IoT, navigation, education, and social media apps also tend to encounter more performance issues than average.

05   Monitoring performance is a top concern, now and in the future

Monitoring performance is one of the top challenges for mobile engineers, both now and in the near future. Loss of brand reputation is named as one of the biggest threats of allowing poor performance to persist, highlighting the far-reaching and long-lasting implications of investing in your app.

06   AI is predicted to change the industry more than any other tech

When it comes to looking toward the future of mobile, engineers see AI/ML as by far the thing that will change the industry the most. When it comes to new challenges, building for complex IT infrastructure and maintaining app security are expected to be significantly bigger challenges in the future vs. today.

embrace

Perspectives
from app users

1

Fast & frictionless

What comes to mind when you think about a good mobile user experience? For most, one of the first answers is speed.

In a world of instant gratification and ever-improving technology, everyday users are trained to expect a response from their devices more and more quickly.

So how fast is fast enough? For users, it often depends on the task or operation they're waiting on. A 2018 study found that 71% of app users expect a mobile app to load within 3 seconds or less, and over 60% would abandon an app that didn't load after 5 seconds.

Today, that 3 second benchmark has been shaved further down.

Best practice standards from most performance tools suggest that quick functions like startup time should complete in 2s or less for optimal user experience.

In our study of over 900 app users in the U.S., we asked people how long they would wait for more complex app flows - such as logging in to an account, checking out a purchase, or playing multimedia. On average, the majority of users won't wait more than 30s for these types of flows to complete. A sizable number – about 1 in 5 – won't even wait more than 5 seconds, revealing how critical speed really is when it comes to overall experience.

Q: How long would you wait for an app if it's being slow while you're trying to... ?

UNDER 30 SECONDS

UNDER 5 SECONDS

	Under 5 seconds	Under 30 seconds
Log into your account	19%	40%
Checking-out / buying an item	13%	33%
Play an audio / video clip	19%	37%

0%   20%   40%   60%
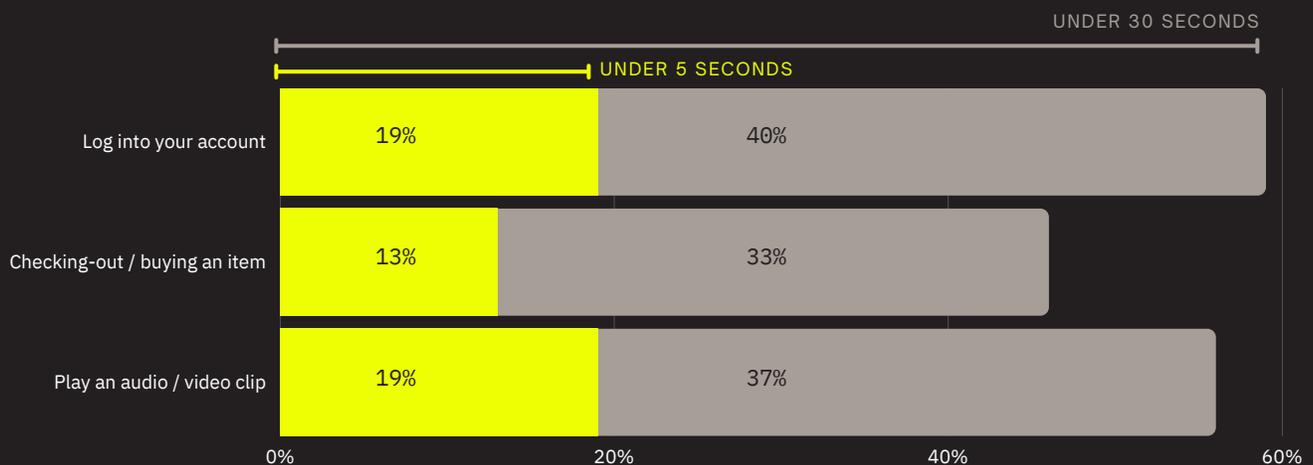
Performance issues

Nearly half of people encounter performance issues on a daily basis

Studies show that reliable performance is one of the most important traits of a mobile app for users (66%), second only to security (70%). And speed, as we've seen, is clearly one of the critical performance factors that can make or break a user's experience. But it's not the only one.

Other performance issues we polled app users on included app crashes, frozen screens, slow-loading photo or video content, and unresponsive forms.

According to our research, two-thirds of app users encounter at least one of these types of issues weekly across any of their apps. Nearly half of users encounter problems at least once a day. This means that, despite ever-increasing performance expectations, most app users are still struggling with poor aspects of experience, at least somewhat regularly.

66%
Experience any performance issue at least once a week

48%
Experience any performance issue at least once a day

Q: Which of these do you experience at least once a week / once a day on any of the apps you use?

At least once a week

Slow startup	28%
Slow images	26%
App is frozen	25%
Slow video	25%
Crashes	25%
Unresponsive buttons/links	19%
Unresponsive forms	9%

At least once a day*

Slow startup	53%
Slow images	49%
App is frozen	44%
Slow video	50%
Crashes	45%
Unresponsive buttons/links	39%
Unresponsive forms	40%

*Of those who experience the issue at least once a week

Frustration ratings

For app users, nothing is more frustrating than when their app crashes suddenly.

Q: How frustrated do you feel when the following things happen when you're trying to use an app?

Legend: ■ Not at all frustrated (1) ■ 2 ■ 3 ■ 4 ■ Extremely frustrated (5)

Category	1	2	3	4	5
App crashes suddenly	6%	8%	22%	25%	39%
App is frozen	6%	8%	28%	25%	33%
Can't fill a form	8%	10%	27%	25%	30%
Buttons / links unresponsive	6%	10%	26%	31%	27%
A video takes a while to load	6%	14%	37%	26%	17%
App is slow to start up	7%	15%	36%	27%	15%
An image takes a while to load	7%	14%	37%	27%	15%
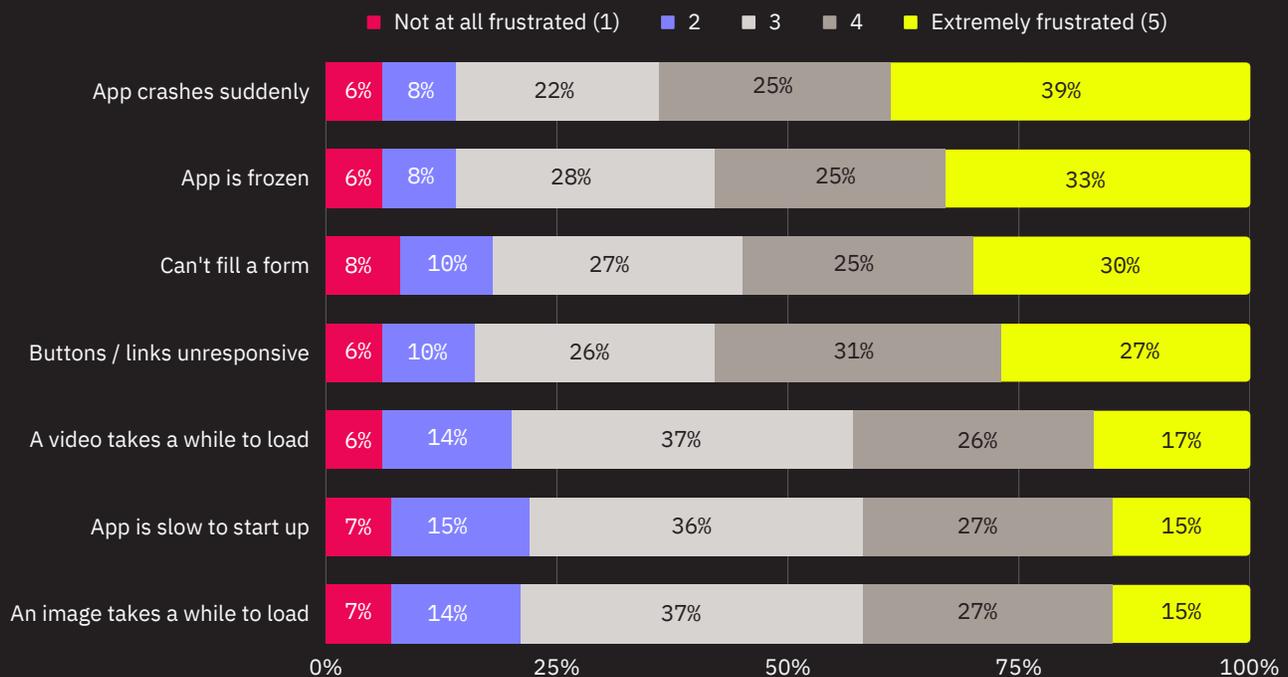
Nearly 40% of users consider crashes "extremely frustrating", while one-third say the same when an app is frozen. We see a drop-off in the strength of negative feelings when users answer about slow app startup, as well as slow video/audio loading.

There seems to be an understanding that some lag time might happen when it comes to "content" loading, whether that's the initial app home page or a buffering video. Issues that cause a disruption in the user's navigation and flow, however, are widely intolerable.

Likelihood to delete app

60% of app users would uninstall an app that has crashed a few times

Q: How likely are you to delete an app from your phone entirely if the following things happen a few times?

Legend: ■ Not at all likely (1) ■ 2 ■ 3 ■ 4 ■ Extremely likely (5)

	Not at all likely (1)	2	3	4	Extremely likely (5)
App crashes suddenly	6%	10%	24%	28%	32%
Buttons / links unresponsive	7%	13%	29%	29%	22%
App is frozen	6%	14%	29%	23%	28%
Can't fill a form	7%	14%	28%	25%	26%
App is slow to start up	10%	21%	35%	20%	14%
A video takes a while to load	11%	21%	36%	19%	13%
An image takes a while to load	11%	23%	36%	17%	13%
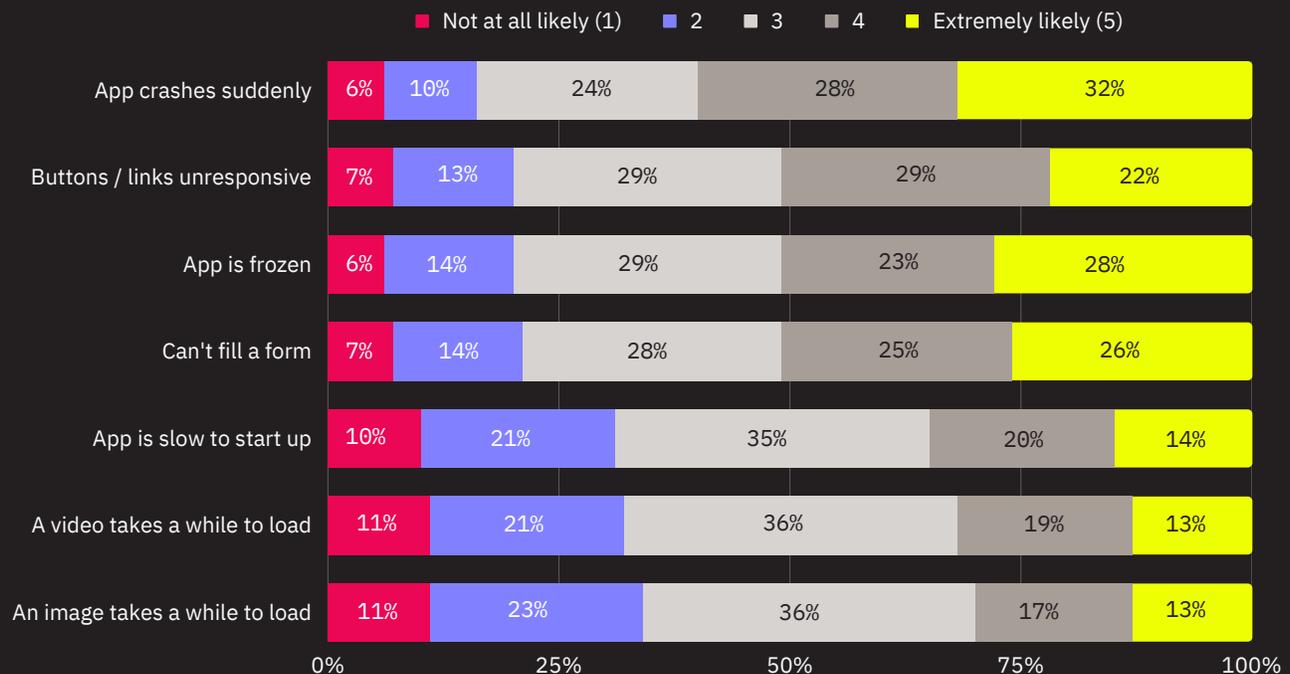
Issues with performance, if recurrent, can lead app users to uninstall the app from their phone completely. This is a worst-case scenario for engineers and brands, especially considering mobile's rise as an important channel for doing business with customers.

As with user frustration, tendency to uninstall can be linked to a few key performance culprits: crashes, unresponsive app elements, and freezes.

Spotlight on Digital Natives

83% of **Digital Natives*** experience app performance issues at least weekly

vs. **66%** of average app users

61%
Experience performance issues daily or more frequently
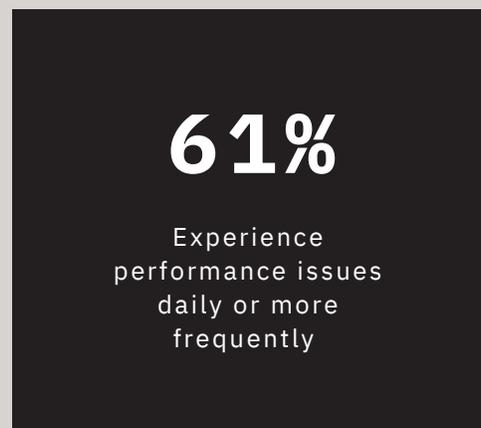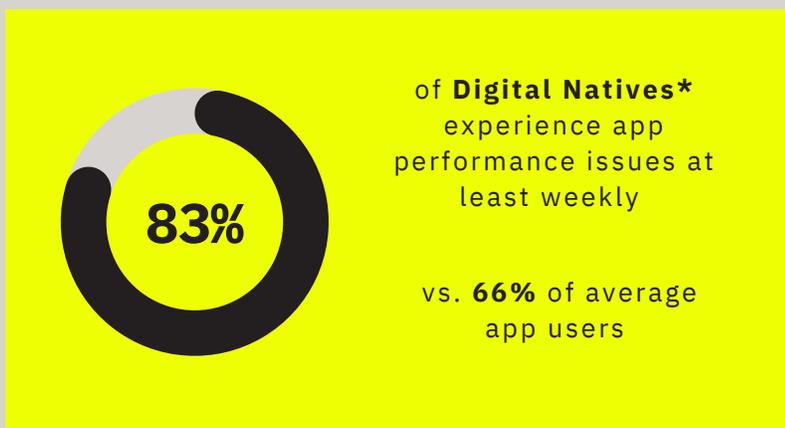
Most frustrating performance issue for **Digital Natives**:

65%	Crashes
59%	Unresponsive buttons/links
57%	App is frozen

Their most important apps for **daily life**:

Messaging

Social media

Music

Maps
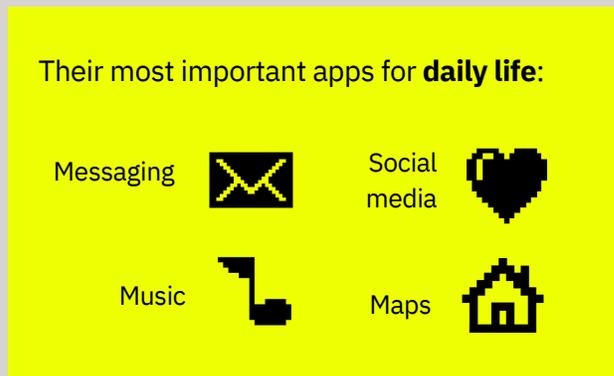
Digital Natives are more likely than average to get frustrated and delete an app with **slow loading video**

*Digital Natives defined as app users aged 35 or younger

embrace

Perspectives from mobile engineers

2

Top engineering challenges

Monitoring app performance is the top reported challenge among mobile engineers.

When asked about the key challenges they're facing in app development today, monitoring app performance topped the list, in line with keeping up with frequent changes in the space. This was the case for both iOS and Android, and it suggests that engineers are aligned with their end users when it comes to building and maintaining great experiences.

Q: What are the biggest challenges facing you/your team in developing mobile apps today?

Challenge	Percentage
Monitoring app performance	50%
Keeping up with frequent changes	44%
Building for multiple device and OS compatibility	31%
Supporting older versions / devices	29%
Maintaining data privacy / compliance	17%
Building for complex IT infrastructure	15%
Security & authentication	14%
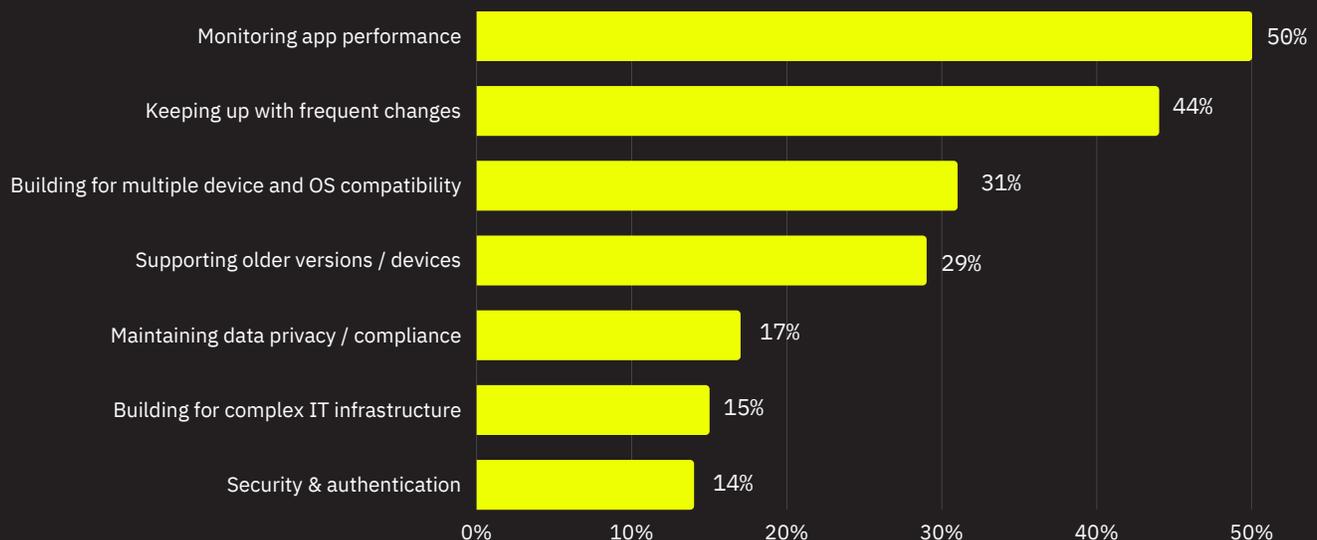
Performance concerns

But mobile teams' performance concerns don't always align with users' frustrations.

When asked what they're most concerned about when it comes to their app's performance, the number one issue that came through was crashes. Crashes were also the most frustrating issue for app users, as well as the issue most likely to prompt app uninstalls.

But user vs. industry perspectives differed on other elements of performance.

The second-most critical issue that engineers named was a slow app startup. For users, however, this was among the least frustrating problems. There's also some misalignment on frozen screens and unresponsive elements, which frustrate users greatly but rank fairly low in terms of engineers' priorities to address.

Q: Which issues are you most concerned about reducing when it comes to your mobile app's performance?

Issue	%
Crashes	83%
Slow app startup	65%
Memory issues	50%
ANRs (if applicable)	49%
Frozen screens	41%
Transactions that can't be completed	34%
Unresponsive buttons / links	30%
Transactions that take too long to complete	30%
Slow loading video	15%
Slow loading imagery	13%
Unresponsive forms	11%
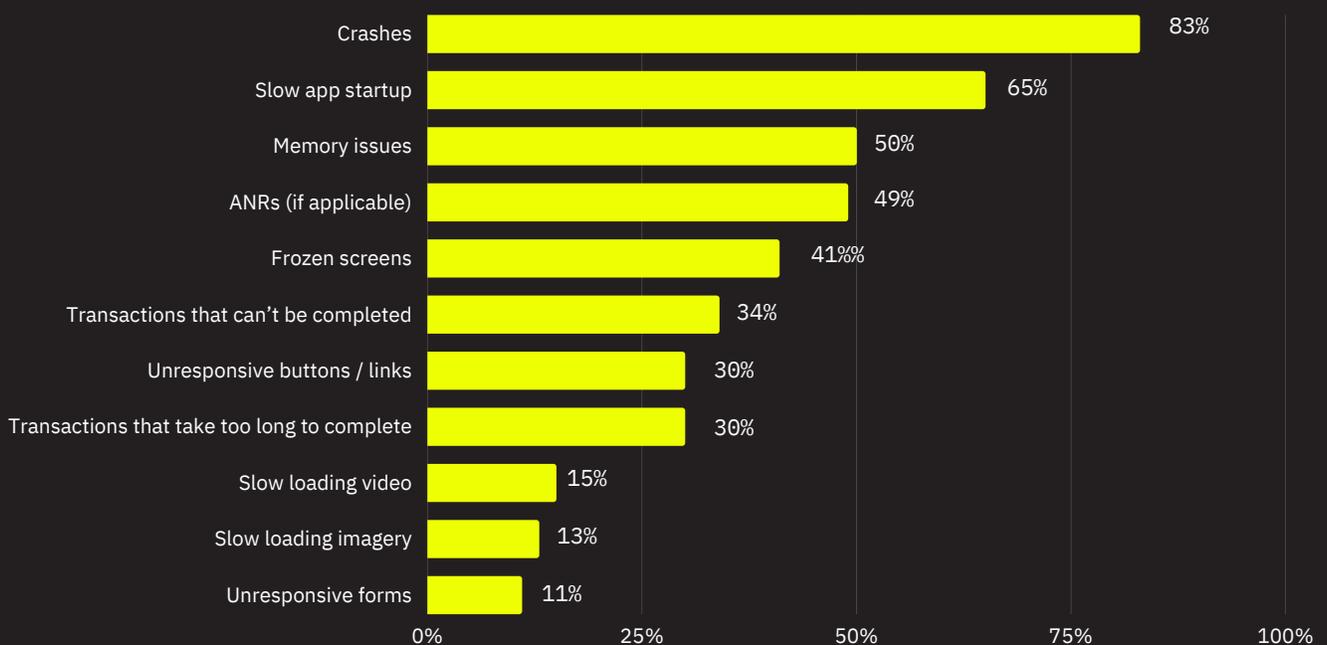
Differing priorities

Where priorities around performance issues align and diverge:

Higher priority for app users

- ●● Frozen screens
- ●● Unresponsive buttons, links, and forms

Higher priority for engineers

- ●● Slow app startup

App users and engineers aligned on priority

- ●● Crashes
- ●● Slow imagery
- ●● Slow video

Mobile engineering challenges

#1

Monitoring app performance is the top challenge reported by mobile engineers

Top performance issues reported by engineers:

83%	Crashes
64%	Slow startup
50%	Memory issues

Top high-level concerns related to poor app performance:

Complaints / bad user reviews

Loss of brand trust / reputation

Customers deleting the app

embrace
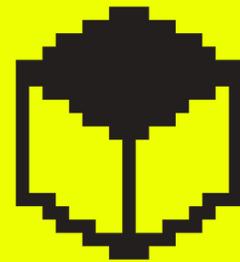
Android
vs. iOS comparisons

3

Performance issues

Reported performance issues by app users differ by OS

Mobile engineers know how difficult it is to create consistent, nearly identical experiences for both Android and iOS versions of their app. This is influenced not only by the structure and nuances of each operating system, but also by how many versions of each OS and how many different devices supporting each OS exist out in the wild. This issue, often called OS or device "fragmentation," tends to affect Android users and engineers more severely because of the sheer diversity of devices in the ecosystem. Often, this leads to tricky performance issues that make it harder to optimize the Android experience. Our research among users is consistent with this industry observation.

App users who own an Android device are considerably more likely to say they struggle with slow startup times vs. those with iPhones, both on a weekly and daily basis or more. Additionally, among Android users who report experiencing an issue at least weekly, they tend to be more likely than their iOS counterparts to say they experience those issues daily or more. Among iPhone users, the most consistent issue they report at higher rates vs. Android owners is slow-loading video. Crashes – the worst of the worst when it comes to user frustration – seem to impact different OS users at generally equal rates.

Q: Which of these do you experience at least once a week / once a day on any of the apps you use?

At least once a week	Android	iOS
Slow startup	33%	25%
Crashes	25%	25%
Slow images	25%	27%
App is frozen	24%	27%
Slow video	23%	27%
Unresponsive buttons / links	20%	19%
Unresponsive forms	10%	8%

At least once a day*	Android	iOS
Slow startup	54%	52%
Crashes	40%	47%
Slow images	52%	46%
App is frozen	48%	41%
Slow video	45%	54%
Unresponsive buttons / links	48%	32%
Unresponsive forms	38%	40%

*Of those who experience the issue at least once a week

Performance priorities

Where priorities around performance issues align and diverge by OS / framework adoption:

Higher priority for iOS engineers

- ●● Slow imagery
- ●● Unresponsive buttons, links, and forms
- ●● Slow transactions

Higher priority for Android engineers

- ●● Slow app startup
- ●● ANRs

Higher priority for cross-platform engineers

- ●● Memory issues
- ●● Slow imagery
- ●● Slow video

Performance issues reported by users align well to known problems that specialized OS engineers recognize and focus on. For example, we saw that iPhone users reported issues with imagery more frequently vs. Android owners; among iOS engineers, this emerged as a slightly higher priority to address vs. their counterparts in other systems. A similar pattern occurs with Android and slow startup times, being named by users and engineers alike as a priority.

When it comes to engineers who work with cross-platform frameworks, such as React Native, Flutter, and Unity, memory issues tend to plague them the most. This is unsurprising considering apps build on these types of frameworks have a larger device footprint vs. native due to factors like having their own rendering engine, utilizing memory-intensive UI elements, and having a lot of added libraries.

The bigger impact

Among mobile teams, the consequences of poor app performance are far-reaching

These vary from bad reviews, to customers deleting an app, to lost revenue.

Interestingly, mobile engineers whose teams primarily build for iOS are more concerned about the potential loss of brand trust / brand reputation vs. those who build for primarily for Android.

Q: What are your biggest concerns when it comes to your customers/end users having a poor experience on your app?

Legend: ■ iOS ■ Android

Concern	iOS	Android
Loss of brand trust/reputation	74%	68%
Complaints/bad reviews (i.e. on Google Play Store)	71%	76%
Customers deleting app	61%	65%
Revenue lost from incomplete transactions	42%	41%
Customers using a competitor app/service	34%	38%
Revenue lost from advertisers/sponsors	8%	6%

20
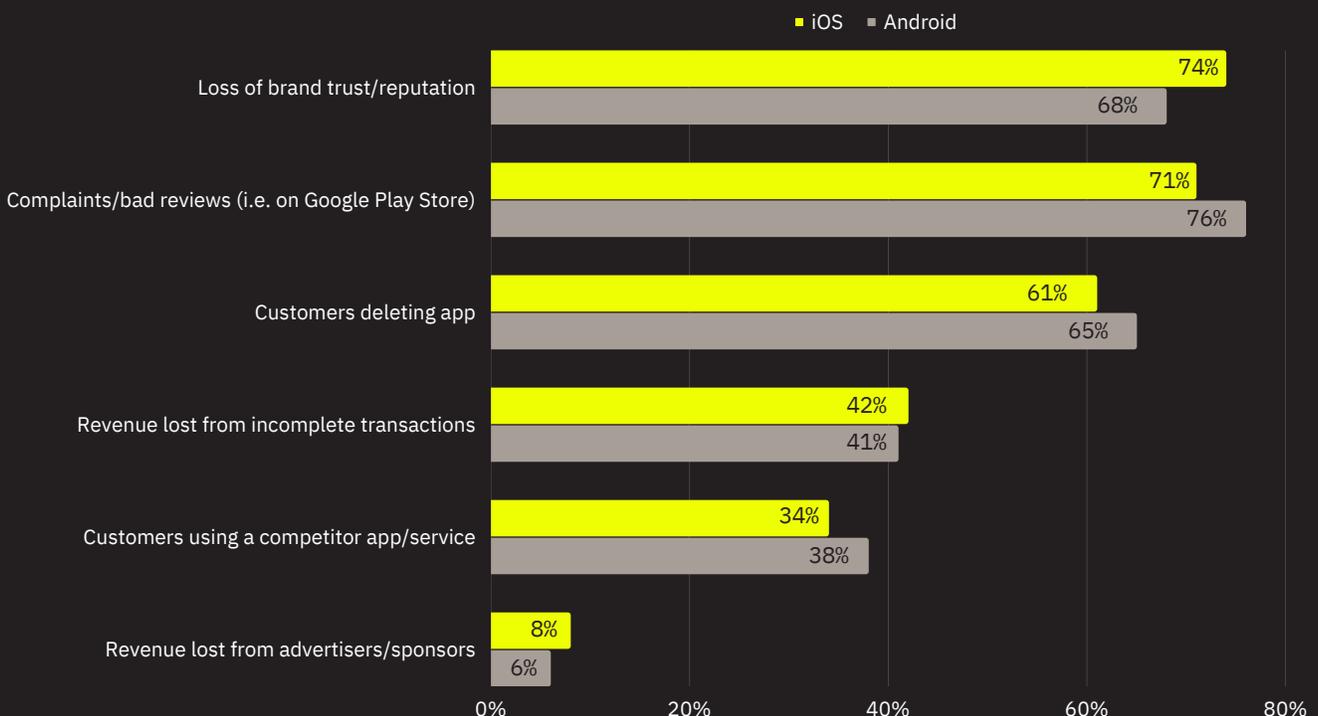
embrace

Benchmarking industry performance

4

Database breakdown

Embrace tracks performance and user experience metrics for apps across the following categories:

Perceptions among app users and the engineers who create the mobile experiences they're consuming are both critical in evaluating the state of mobile today.

A third part of the picture is looking at actual app performance, and seeing how that varies across different industries and among the dominant operating systems.

In this case, Embrace's app data provides some insight.

We've analyzed all of our customer apps in aggregate to benchmark mobile app performance across common industries. The apps used in this analysis all fall into one of the key industry categories, as shown on the right. Industry scores for all of these categories are calculated based the median metric of all apps in the category.

Only apps where Embrace has enough data for analysis are included in this reporting. This is evaluated based on a combination of session volume sent to Embrace and the daily active user numbers of the app more generally. Industry categories with less than 5 apps (such as heavy industry) are excluded from the rankings, as you'll see in the next few pages.

E-commerce	Delivery	Heavy Industry
Real Estate	IoT	Education
Media	Social	Point of Sale
Finance	Games	Health
Navigation	Hospitality	Security

Cross-platform metrics

iOS apps show greater stability vs. Android apps across industries.

% of crash-free sessions	Android	iOS
Overall	99.81%	99.93%
Hospitality	99.88%	99.99%
Social	99.85%	99.98%
Delivery	99.94%	99.98%
Media	99.91%	99.97%
Navigation	99.22%	99.97%
Finance	99.89%	99.96%
Real Estate	99.77%	99.94%
E-commerce	99.86%	99.92%
Health	99.80%	99.90%
Education	99.65%	99.89%
IoT	99.64%	99.88%
Games	99.68%	99.87%

% of sessions with low-memory warnings	Android	iOS
Overall	12.94%	5.49%
Games	26.02%	18.79%
Education	12.74%	13.31%
Real Estate	10.70%	5.49%
E-commerce	13.03%	5.25%
Hospitality	11.66%	5.05%
Navigation	10.20%	4.73%
Delivery	9.99%	4.05%
Social	13.99%	3.50%
Health	15.36%	3.48%
Media	12.67%	3.43%
Finance	11.13%	3.29%
IoT	10.07%	2.94%

Platform-specific metrics

Across iOS and Android-specific measures of good user experience, gaming apps rank the lowest.

% of user-termination free sessions	iOS
Overall	90.55%
Education	94.73%
Real Estate	93.95%
Navigation	93.58%
Health	92.11%
Delivery	91.91%
Media	91.46%
Hospitality	90.86%
E-commerce	89.87%
IoT	89.06%
Finance	88.48%
Social	87.82%
Games	87.76%

% of ANR exit-free sessions	Android
Overall	99.37%
Hospitality	99.89%
Delivery	99.84%
IoT	99.79%
Health	99.61%
Media	99.59%
E-commerce	99.41%
Finance	99.41%
Real Estate	99.28%
Education	99.23%
Social	99.19%
Navigation	98.92%
Games	98.03%

Rankings at a glance

Best crash-free rates:

iOS	Android
●● Hospitality	●● Delivery
●● Social	●● Media
●● Delivery	●● Finance

Best UT-free rates:

iOS
●● Education
●● Real Estate
●● Navigation

Least low-memory warnings:

iOS	Android
●● IoT	●● Delivery
●● Finance	●● IoT
●● Media	●● Navigation

Best ANR-free rates:

Android
●● Hospitality
●● Delivery
●● IoT

embrace

The future of mobile development

5
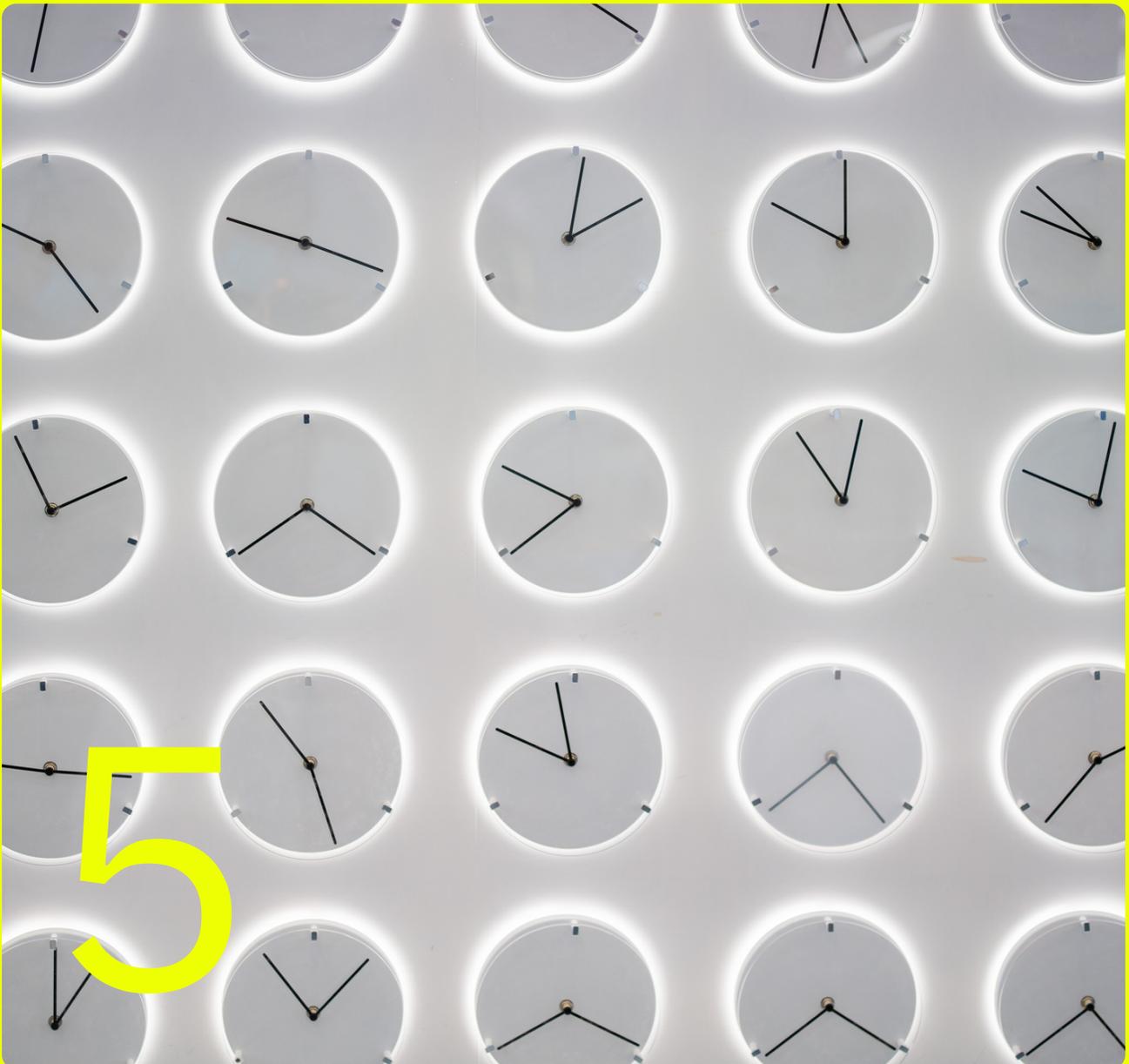
Today vs. tomorrow

Monitoring app performance was named as the top challenge, both facing mobile teams today and as anticipated for the future.

Aside from this particular concern, professionals don't see the challenges of mobile development tomorrow being the same as they are today.

Building for complex IT infrastructure, in particular, is anticipated to be one of the top challenges in mobile development in the next five years. This is understandable considering the rising complexity of building and maintaining software, mobile and otherwise, as the microservices model becomes standard.

For several of these challenges, perceptions differ between Android and iOS mobile engineers. iOS engineers are actually more likely to see building for complex IT infrastructure as a key challenge (31% vs. 19%), while Android engineers are more likely to say monitoring app performance will continue to be a challenge (42% vs 31% for iOS engineers).

Q: What are the biggest challenges facing you/your team in developing mobile apps today? / What will be the biggest challenges in the next 5 years?

Today   Next 5 years

Challenge	Today	Next 5 years
Monitoring app performance	50%	35%
Supporting older versions / devices	29%	29%
Building for multiple device and OS compatibility	31%	24%
Maintaining data privacy / compliance (e.g. GDPR, CCPA)	17%	23%
Building for complex IT infrastructure	15%	28%
Security & authentication	14%	23%
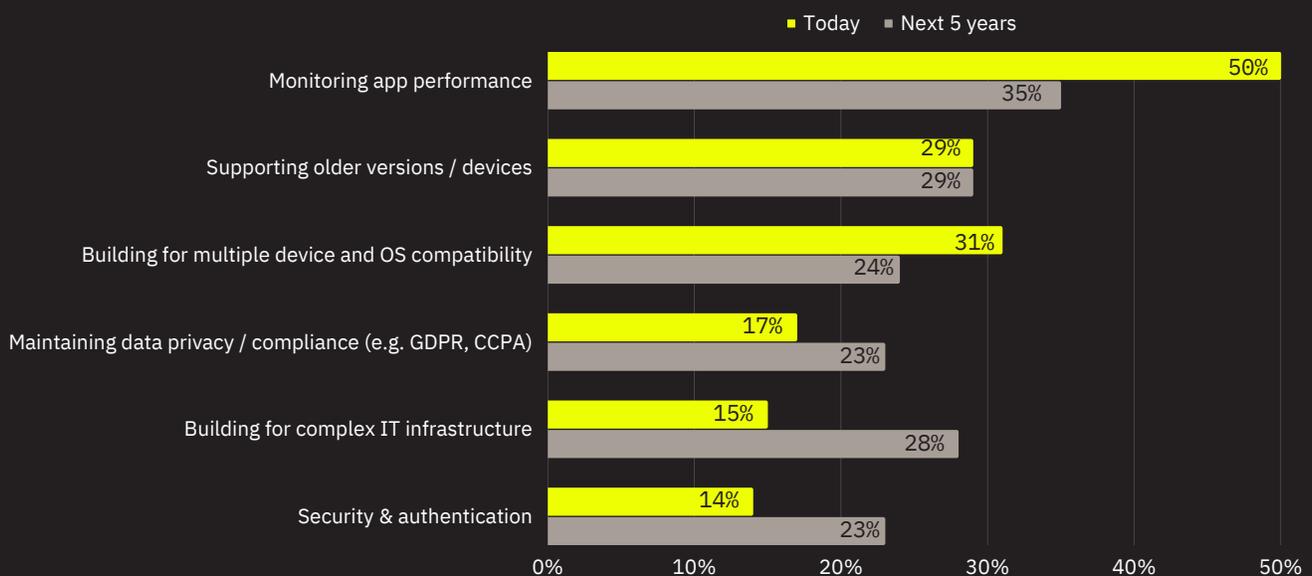
Game-changing tech

A.I. is predicted to most dramatically impact mobile development in the near future.

Q: Which of the following, if any, emerging technologies do you think will dramatically change mobile app development in the next 5 years?

Technology	Percentage
AI & machine learning	79%
Low / no-code development	25%
AR / VR	25%
Cloud computing	20%
IoT integration	20%
Blockchain	12%
Metaverse integration	12%
Edge computing	8%
Beacon technology	3%
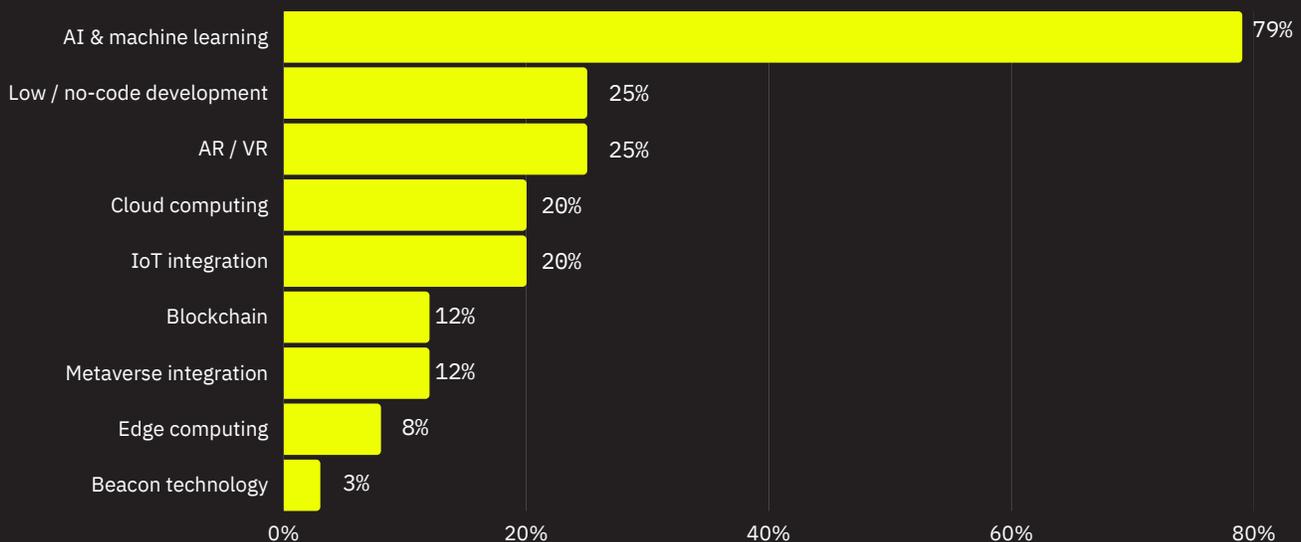
When asked which emerging technologies they thought would most dramatically change mobile development in the next five years, engineers overwhelmingly named artificial intelligence and machine learning. Other factors had a more lukewarm response.

AI is already transforming how we build and use software. A 2022 study by IBM found that 35% of companies reported using AI in their business, and 42% are exploring it. Companies are actively using ChatGPT and other generative AI tools for customer support,

copywriting, and even helping healthcare professionals diagnose routine illnesses.

While the AI space is rapidly developing, most organizations aren't yet equipped to make use of its potential. Lack of skill and expertise were called out as the main barriers for business adoption of AI, according to the same IBM study. For mobile engineers, this spells out a huge opportunity to develop specialized, in-demand skills for now and in the future.

Languages & frameworks

UI frameworks, and more modern languages that work well with them, are trending quickly.

97%
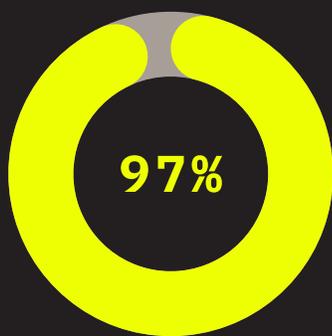
Of iOS engineers plan on using Swift over Objective-C in the future

83%
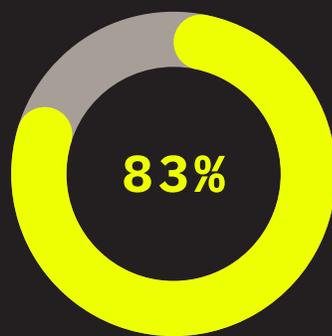
Of Android engineers are using or plan to use Jetpack Compose

Reasons for Jetpack Compose*

Make UI easier to manage and maintain	82%
Speed up dev time	71%
Make UI components easier to reuse	71%

Among both iOS and Android engineers we surveyed, there's a clear trend toward embracing more modern languages and utilizing UI frameworks. Nearly all iOS engineers we surveyed plan on adopting Swift over Objective-C.

Becoming familiar with Swift puts engineers in a strong position to use SwiftUI, Apple's latest UI framework, and one which they're promoting as a method to build beautiful apps with less and less code. Similarly, most Android engineers are either currently using, or plan to use, Jetpack Compose, a modern toolkit for building native UI for Android.

When probed why, they mentioned time-savings and easier maintenance of UI elements as influencing factors.

More generally, engineers from our survey see low-code/no code development as the second most likely technology to change mobile development in the near future, behind AI. The world of user interface and user design looks to be the first major manifestation of this trend.

*Of those who use or plan to use Jetpack Compose

Final takeaways

Researching both engineers and end users has shed light on key challenges, trends, and opportunities within the mobile space. Perhaps the biggest of these is that mobile experiences are not meeting user expectations. The majority of people continue to struggle with crashes, slow loading screens, and unstable interfaces. Alongside these user complaints is a demand for better-than-ever performance, and mobile engineers understand this dichotomy. They called out monitoring performance as a primary challenge for app development, both now and as anticipated in the future. The picture further muddies when we take into account the nuances between Android and iOS, the range in performance standards across different industries, and the tide of breakthrough tech that makes this space ever-changing. Having learned all of this about the state of mobile experiences today, what should organizations take away from this research to propel their development forward?
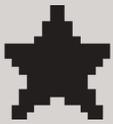
01   Organizations can benefit from looking more critically at concerns that users express vs. focusing purely on industry standards of performance

Our research found conflicting priorities between the types of issues that users find intolerable vs. the issues that engineers are most concerned about. Startup time is a key example where the industry standard, 2 seconds or less for app startup, is likely influencing how much engineers prioritize it. App users, however, area actually more frustrated by unresponsive interfaces vs. a slow startup.

02   Poor user experience can have lasting, negative consequences for a business

Engineers recognize the brand impact that comes into play when optimizing – or neglecting – mobile experiences. One of their biggest concerns when asked about end users having a frustrating app experience was the loss of brand trust and reputation. This is a very difficult thing to rebuild, much more so than adjusting for temporary customer churn or negative reviews.

03   The right tooling can help both engineers and their organization address other critical needs, build better apps, and stay competitive

Findings from this study suggest that mobile engineers are spending a lot of time monitoring app performance. The right mobile-focused tooling can ease that load for engineers, and let them focus on the other key challenges they named, such as keeping up to date with frequent changes made by operating system providers. It can also empower both engineers and their organizations to build more engaging experiences for their end users, explore cutting-edge technology with confidence, and iterate rapidly to stay competitive.

Methodology

The data in this report comes from three unique pieces of research: a survey of mobile app users, a survey of mobile development professionals, and a rank analysis of apps currently using Embrace. Where relevant, all charts and figures include references to the data source and sample size throughout this report.

App users survey

Embrace conducted a 10-minute online survey of 901 mobile app users in the U.S. Mobile app users are defined as people who report owning a mobile smartphone and regularly using at least one app on their phone. Fieldwork was conducted in December 2022. The survey was built and distributed by SurveyMonkey. Respondents were recruited through SurveyMonkey's panel of respondents, and were sampled to be generally representative of the U.S. population in terms of age, gender, and geography.

Mobile development professional survey

Embrace conducted a 10-minute online survey of 78 mobile development professionals in the U.S. Respondents were sourced from Embrace's community of users, and had titles such as "mobile engineer," "product manager," "engineering manager," etc. Fieldwork was conducted in March 2023. The survey was built via Qualtrics and distributed through Embrace.

Embrace app ranking analysis

Embrace analyzed data across 259 apps using our platform in aggregate. These consisted of 133 iOS apps and 126 Android apps, and ranged across industry categories. Individual apps were categorized based on industry, and benchmarks on key metrics were calculated for each industry. Industry benchmarks represent the median score of all apps in the category. This means that small apps have the same weight as large apps. Only apps with greater than 1,000 sessions per day were included in this analysis. For data integrity, any category with less than 5 apps was not included in this report.

embrace

Embrace is a data-driven toolset to help engineers manage the complexity of mobile. Using automated data collection and a unified digital platform, Embrace reduces the toil of mining for insight across disparate tools. Engineers can identify, prioritize, and resolve problems in their apps, while also surfacing opportunities to perfect app performance and delight their end users. Get in touch with us to learn more.

Contact

📍 8569 Higuera St, Culver City, CA 90232

📞 (424)-326-9004

✉️ contact@embrace.io

▸ embrace.io