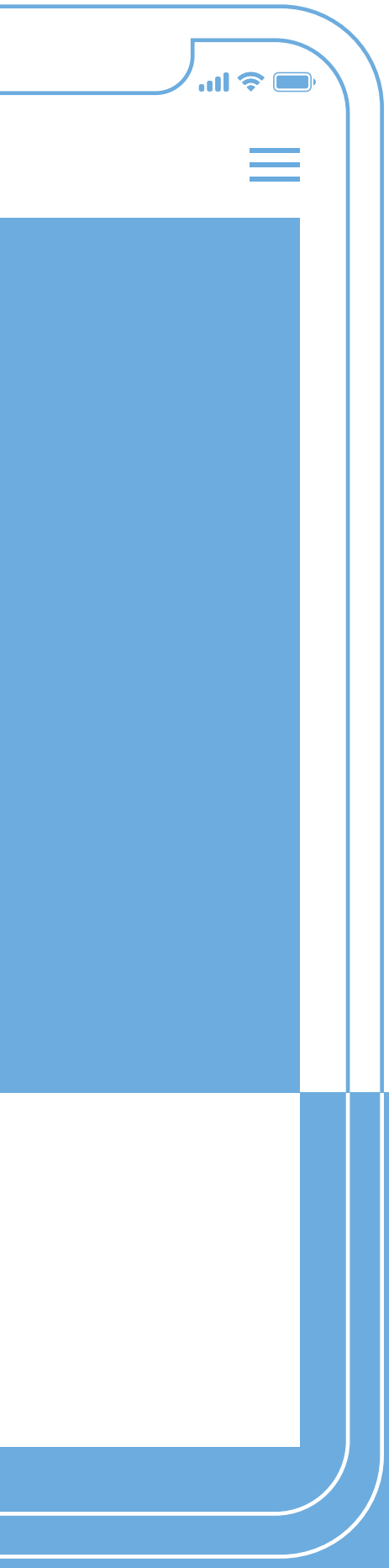


Cruise Mobile Apps

2024 Annual Report

sourcetoad OnDeck

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About Sourcetoad OnDeck

Sourcetoad OnDeck has specialized in innovative guest-facing software for the cruise and ferry industry since 2010. Our mission is to increase the value of both the guest's and the crew's time by building automation, communication, and self service systems.

We offer a number of custom and out-of-the-box solutions for cruise lines to increase operational efficiencies, improve guest experiences, free up crew schedules, and shorten technology ROI cycles. We offer the following products and services to our customers:

🏗️ Cruise Director Platform

- Shipboard and shoreside middleware and API management
- Ship-to-shore and shore-to-ship data synchronization and shipboard CDN system
- Onboard event analytics
- Infinite level permissioning and user management

📱 Mobile App-in-a-Box

Our guest mobile app works with the Cruise Director Platform to provide guests with everything from digital check-in to dinner reservations and folio management. Available for Otalio and MXP systems.

📦 Platform Modules

- Entertainment: music, TV, VOD, streaming, management, and iTV systems
- Intelligent Signage: Advanced onboard digital signage and interactive kiosks
- Captive Portal: iCafe systems, and guest/crew wifi access management
- Digital survey: Automated digital surveys for pre-cruise, post-cruise, spa, dining, and ShoreEx reviews for app and iTV
- Push notifications: A full push notification module for mobile apps and iTV
- ECS: Our workflow-based, onboard passenger notification system

👨‍💼 Professional Services

Sourcetoad OnDeck can help you develop the next groundbreaking solution in the Cruise industry. We provide:

- Shipboard and shoreside AI integration and development
- Custom software engineering for land and marine operations
- Documentation as a service
- 24/7/365 help and support desks

Introduction

The 2024 Cruise Mobile Apps Report provides a comprehensive overview of the current state, advancements, and future trajectory of mobile applications in the cruise industry. This year's report delves into how these digital tools are transforming the cruise experience for passengers, streamlining operations for crew and operators, and setting new benchmarks for innovation in maritime travel.

As the cruise industry continues to rebound and grow in the post-pandemic world, technology, particularly mobile apps, stands at the forefront of this resurgence. These applications are no longer mere conveniences but essential components of the cruise experience, offering functionalities that range from booking and itinerary management to onboard services, entertainment, and personalized guest experiences. This report highlights the pivotal role of mobile apps in enhancing guest satisfaction, operational efficiency, and ultimately, the financial performance of cruise lines.

In the context of an increasingly connected world, the report underscores the significance of digital transformation in the cruise sector. It examines the latest trends in mobile app development, including the integration of artificial intelligence, augmented reality, and IoT technologies, which are set to redefine the boundaries of what is possible on a cruise.

Furthermore, the report identifies key challenges and opportunities facing the industry: from improving internet connectivity at sea to addressing the accessibility challenges that many existing apps face. This report addresses how mobile apps can play a role in tackling these issues. Sourcetoad hopes to provide best practices and offer lessons learned for cruise lines looking to better use technology to enhance their offerings.

Predictions for the future of cruise apps highlight a landscape ripe with innovation. As cruise lines strive to offer more personalized, immersive, and seamless experiences, mobile apps are expected to become even more integral to the cruising experience. This report suggests that we will see advancements in personalization, enhanced connectivity and communication tools, and a greater emphasis on health, safety, and sustainability.

This report would not be complete without speculation around the hottest topic in every industry right now, AI and Large Language Models (LLMs), and how they might affect the mobile cruise app space in the very near future. Enjoy!

New A new addition to the 2024 report.

Updated A significantly updated section.

Methodology

Updated

The Lack of Inclusion of Onboard Web Applications and PWAs

It is important to note that some cruise lines (for example, Marella Cruises, P&O, and Cunard) have adopted an approach to mobile app technology by using Progressive Web Apps (PWAs) or onboard-only web applications. These are designed to perform many of the same tasks as a native, downloadable app. The inherent limitation of these apps only being accessible onboard means they fall outside the scope of our broader analysis, which focuses on apps available both on and off the ship.

Our Process

If you are interested in how we investigate each app, we have listed the highlights of our process below:

1. We start with our existing collection of cruise apps that we have downloaded over the years. Sourcetoad maintains a repository of Android APK files dating back to 2019 that we use for comparison.
2. The first work step is downloading all the applications onto a Samsung S13 Android device.
3. If the app is not available in the US region, we sideload the apps onto the device via ADB.
4. From there, we pull APK's English versions, along with ARM64 app and base, so that they will run natively on our device. This allows us to analyze them on an even playing field.
5. If the Android application is "split" (which is increasingly common), we merge in the splits with ApkEditor to unify the applications. We'll discuss the trend of splits later in the report.
6. We then disassemble the APK with Apktool using its standard tooling.
7. From there we run MobSF for a security report on the application.
8. For applications that are new to the report (meaning we don't have previous versions on file), we view the code in VS Code to investigate.
9. If we have a previous version, we run a diff against that previous version using Araxis Merge to see what has changed.

If you would like your app or a feature included in the next report, please contact us at **appreport@sourcetoad.com**.

Tools Used in Investigating the Apps New

Sourcetoad OnDeck used the following tools to manage the investigation of applications in this report:

Apktool

Apktool is a tool for reverse engineering Android APK files. It is supported by Sourcetoad and maintained by our Director of Engineering.

APKEditor

APKEditor is a tool that allows users to decompile resources of APK to human-readable json string or into XML source code (for un-obfuscated APKs). It also allows us to build back to APKs from decompiled json/XML files, and it merges multiple splitted APK files (directory, xapk, apkm, apks, etc.) back into standalone APKs.

MobSF

Mobile Security Framework (MobSF) is a tool for investigating the security of mobile apps on Android, iOS, and Windows Mobile. It checks for vulnerabilities, scans for malware, and assesses privacy risks in app code and during app operation. With features for both static (code analysis) and dynamic (runtime analysis) examination, MobSF is useful for developers who want to create secure mobile applications. It's user-friendly and integrates smoothly with automated development processes.

Araxis Merge

Araxis Merge is a tool for comparing and merging files, ideal for identifying changes between different versions of apps. It highlights differences in text files like source code, making it easy to spot new or removed features. With its ability to handle binary files and integrate with version control systems, Araxis Merge simplifies tracking modifications over time. By comparing app versions side-by-side, we can quickly work out what features have been added or deleted.

VS Code

Visual Studio Code, often called VS Code, is a popular, free software that helps developers write and organize text, especially useful for creating software. It's user-friendly and supports many programming languages. We use it as our generic code editor and viewer for investigating source code.

Mobile Applications

AIDA Cruises

New

AIDA Cruises was released in May 2012 and works across the full AIDA fleet.

Ambassador Cruise Line

New

Ambassador Cruise Line was recently released in September 2023. The app works on the full Ambassador fleet, with feature availability varying by ship.

Carnival Cruise Line

Carnival HUB was released in January 2015 and works across the cruise line's entire fleet.

Celebrity Cruises

Celebrity Cruises was released in November 2017. The app works on seventeen ships in Celebrity's fleet (*Apex*, *Ascent*, *Beyond*, *Constellation*, *Eclipse*, *Edge*, *Equinox*, *Infinity*, *Millennium*, *Reflection*, *Silhouette*, *Solstice*, *Summit*, and *Xcel*) with available features varying by ship. The app shares much of the same code base as the *Royal Caribbean International* app.

Compagnie du Ponant

New

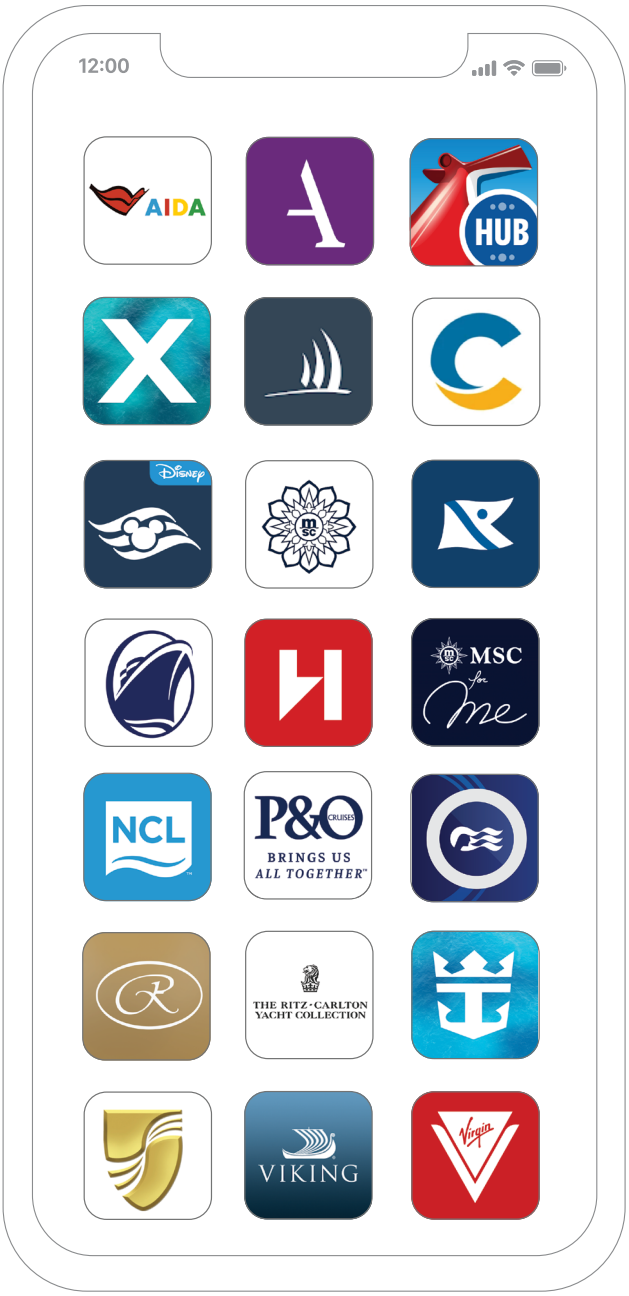
Released in January 2019, Ponant works across the cruise line's full fleet.

Costa Cruises

Costa App works across the full Costa Cruises fleet. It was released in January 2018.

Disney Cruise Line

Disney Cruise Line Navigator was originally released in June 2013, and had a major redesign in February 2018. The app works on the entire Disney fleet.



Explora Journeys

New

My Explora was recently released in June 2023. The app works onboard the Explora I.

Fred. Olsen Cruise Lines

Fred. Olsen Cruise Companion was released in July 2019. It works across all three ships in the cruise line's fleet.

Holland America

Holland America Line Navigator was released in February 2019 and works across the cruise line's entire fleet. The app shares a code base with Seabourn Cruise Line's app, *Seabourn Source*.

Hurtigruten

Hurtigruten's onboard app was released in June 2019. The app is supported on eight ships in the Hurtigruten fleet (*MS Fridtjof Nansen, MS Roald Amundsen, MS Maud, MS Otto Sverdrup, MS Fram, MS Spitsbergen, MS Nordlys*, and *MS Richard With*).

MSC Cruises

MSC for Me was released in May 2017. The app is available on all smart ships in the MSC fleet (*MSC Bellissima, MSC Divina, MSC Euribia, MSC Fantasia, MSC Grandiosa, MSC Magnifica, MSC Meraviglia, MSC Musica, MSC Poesia, MSC Seascape, MSC Seashore, MSC Seaside, MSC Seaview, MSC Splendida, MSC Virtuosa,* and *MSC World Europa*).

Norwegian Cruise Line

Cruise Norwegian was released in October 2017 and works onboard the full NCL fleet.

P&O Cruises Australia New

P&O Cruises Australia was released in April 2022. It works across all three ships in the P&O Cruises Australia fleet. This app shares part of its codebase with *Holland America Line Navigator*.

Princess Cruises

Princess Cruises released the *MedallionClass* app in August 2019. At the time of this report, the app works across the cruise line's entire fleet. In early 2024, Princess Cruises will be launching an entirely new app and phasing out *MedallionClass*.

Regent Seven Seas Cruises New

Regent Seven Seas Cruises was released in September 2022. The app works onboard the *Seven Seas Grandeur*. This is a departure from sharing a code base with other NCLH brands.

Ritz-Carlton Yacht Collection New

Yacht Journey was released in July 2022. The app works onboard the *Evrima*.

Royal Caribbean International

First released in November 2017, *Royal Caribbean International* is now available across the cruise line's full fleet. The app shares the same code base as the *Celebrity Cruises* app.

Seabourn Source

Seabourn Source was released in April 2020 and works across the cruise line's whole fleet. The app shares a code base with *Holland America Line Navigator*.

Viking Ocean Cruises

Viking Voyager was released in June 2017, and the app is now available on all active Viking Ocean, River, and Expedition ships.

Virgin Voyages

The *Sailor* app works on all three ships in the Virgin Voyages fleet. The app went live in February 2020.

Availability




NORWEGIAN CRUISE LINE
P&O BRINGS US ALL TOGETHER
PRINCESS CRUISES
Regent SEVEN SEAS CRUISES
AN UNRIVALED EXPERIENCE
THE RITZ-CARLTON YACHT COLLECTION
RoyalCaribbean INTERNATIONAL
SEABOURN
VIKING
VOYAGES
Supports mobile app onboard
Does not support mobile app onboard

Features

Since we first began analyzing cruise mobile apps in 2018, we've seen onboard features become more and more standardized across the industry. However, some apps still boast unique features and options. To help us see the big picture trends, we've categorized features into three groups: Common (a feature present in nearly every app), Less Common (present in a minimum of three but not in more than half of the applications), and Stand-out (unique to only one or two applications).

Common Features

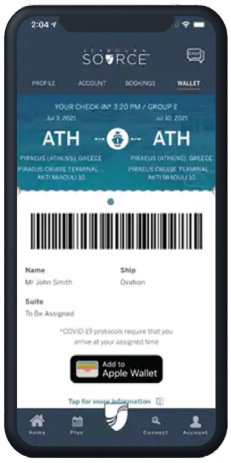
Updated

The following features are shared by a majority of onboard apps.



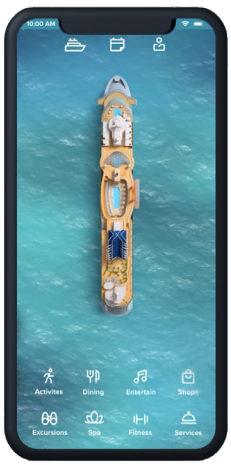
Chat

Chat has become a ubiquitous feature of onboard apps. However, user reviews reveal frustration with poor performance and unreliability of this feature across many apps we reviewed.



Check-in

Digital check-in remains a common feature, allowing passengers to upload travel documents, add proof of vaccination (where required), complete pre-boarding safety steps, view safety drills, and access digital boarding passes.



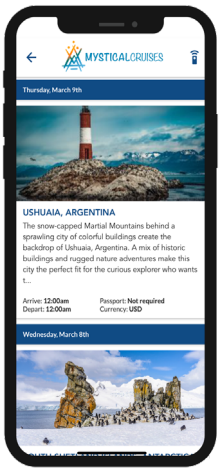
Deck Map

Ship maps and directories are another ubiquitous feature of onboard apps. The more robust deck maps are interactive and searchable, making it even easier for passengers to navigate the ships.



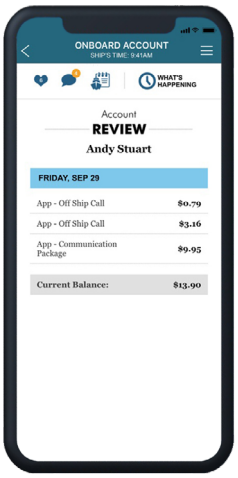
Dining

A majority of apps have information about dining options onboard the ship, including menus, hours, location, and dress code. Many apps also offer reservations, with some opening bookings prior to departure. One app offers a virtual queuing option.



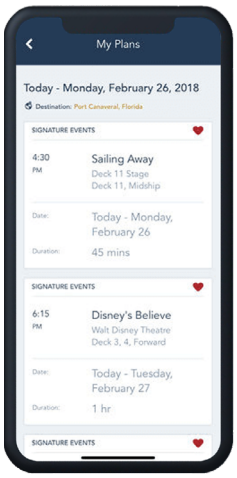
Destination Information

Most apps have now added port and destination information—including photos, activity suggestions, and cultural and historic information—allowing guests to learn about the ports of call along their cruise route.



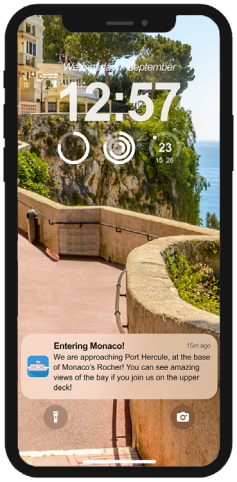
Folio

Nearly all onboard apps have a folio feature, which serves as a detailed billing record that refreshes as new charges are applied to a user's account. This feature enables passengers to see all the expenses billed to their account in real time.



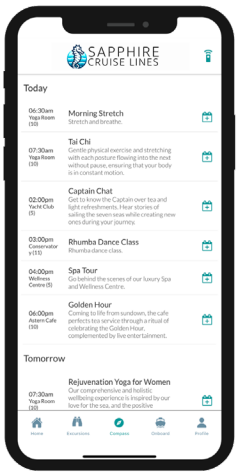
Itinerary

The itinerary is the passenger's personalized schedule. Activities that have been marked as favorites or confirmed with a booking appear on the guest's itinerary.



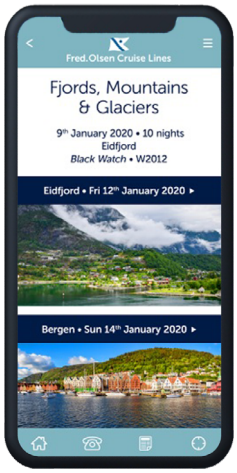
Notifications

Push notifications have become a standard feature in passenger-facing apps. Guests can receive notifications about their scheduled activities, updates to their billing folio, new chat messages, and more. As with onboard chat, user reviews reveal mixed success of this feature.



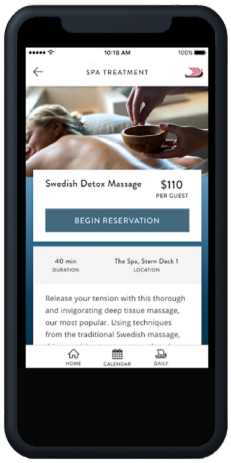
Schedule

The daily schedule is the hub for organizing daily activities. In most apps, events can be added, reserved, or highlighted before being copied to the guest's personal itinerary.



Shore Excursions

Excursion information has become a universal feature across onboard apps, with most apps allowing guests to view and book excursions, some prior to departure.

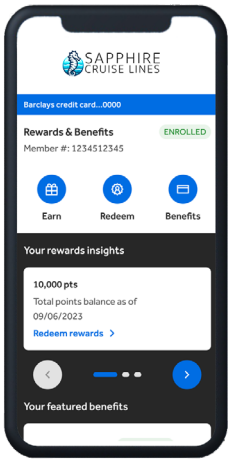


Spa Services

Most cruise lines offer some level of spa service. This feature allows guests to view offerings and make reservations. As with Shore Excursions, some apps allow guests to book these services shoreside as well.

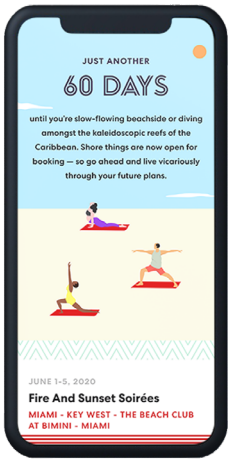
Less Common Features *Updated*

The following features are found in at least three, but no more than half of the apps we analyzed.



Credit Card Approvals *New*

A few apps have integrated the option to apply for instant approval of a cruise-line branded credit card. The card is then added to the guest's digital wallet, so they can begin spending and acquiring loyalty points immediately.



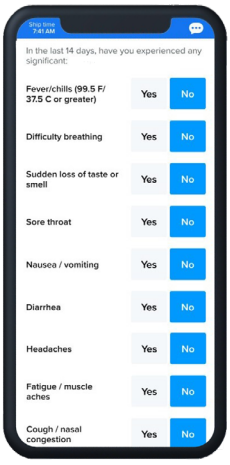
Cruise Countdown

Several apps include a pre-cruise countdown clock that can be viewed in the app and shared on social media. This feature encourages guests to download the app prior to the cruise, building anticipation for the upcoming voyage.



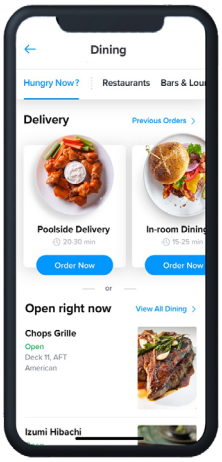
Digital Photo Archive *New*

Some apps offer guests the option to review, purchase, and share photos from the cruise.



Health Questionnaires

A few cruise lines have retained daily health surveys, but overall, health-related questionnaires are less common compared to prior years.



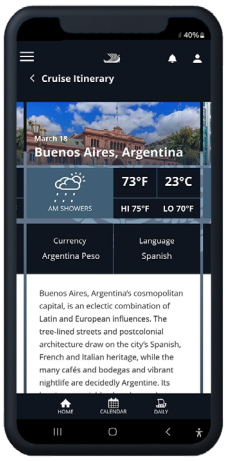
Mobile Ordering

Mobile ordering features can be found in several apps, offering guests the option to order food, beverages, or other services delivered to the guest's stateroom. A few apps offer delivery to the guest's location on the ship.



Ship Tracking *New*

Live ship tracking allows guests to see the ship's location in real time. Several apps now include this feature, along with the option to view the location of the cruise line's full fleet.

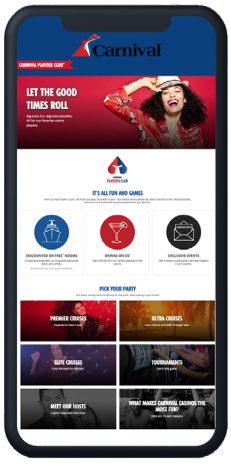


Weather *New*

Weather features have appeared in several of the apps we reviewed. This feature allows guests to view the forecast for each day of their cruise, helping them plan appropriately for shoreside excursions.

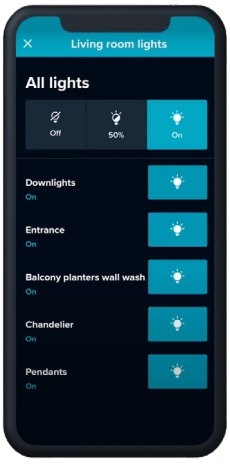
Stand-Out Features *Updated*

Below are some of the unique features that stood out to us.



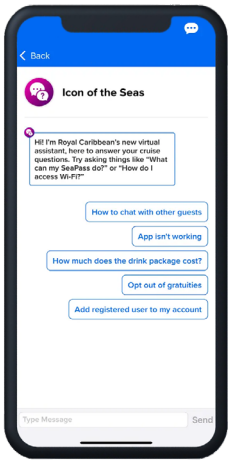
Casino Module *New*

Carnival Cruises has added a "Carnival Players Club" module to their app, which allows guests to earn, track, and redeem rewards points while playing at onboard casinos.



Digital Room Control

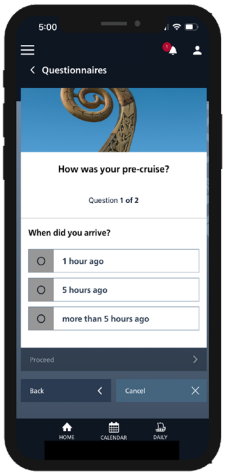
A few apps include room control features, giving guests the option to control the lighting, shades, temperature, and TV through their mobile devices.



Guest Services Chatbot

New

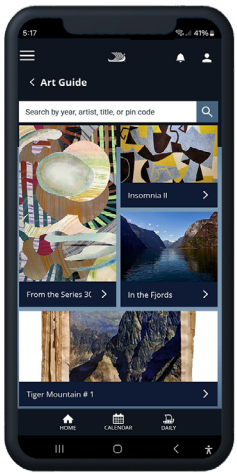
Royal Caribbean has introduced an AI-powered chatbot for guest services. The virtual assistant can respond to simple questions, provide information about the ship, or connect the guest with an actual agent.



Surveys

New

A few apps now include guest satisfaction surveys. This feature allows cruise lines to check in with passengers during the cruise and address any problems immediately, rather than waiting for feedback in an emailed survey after the cruise.



Virtual Art Guide

Two apps now include virtual art guides. These work in fairly different ways, but are interesting and unusual features none the less. Guests can listen along to audio clips to learn historical information about the works of art onboard.

Update Frequency

In 2023, cruise lines proved that they were serious about improving the passenger experience through a series of updates to their onboard apps. These updates spanned various aspects, including technology integrations, functionality enhancements, and health and safety measures.

Additionally, there was some emphasis on improving accessibility, guest engagement, and onboard services. Multiple apps introduced or expanded loyalty programs, dining options, or advanced digital services. Several cruise lines worked on improving accessibility and user experience by enhancing features such as camera functionality, filesystem access, and notifications.



Tools and Key Players

Artificial Intelligence Updated

Artificial Intelligence, and specifically Large Language Models (LLMs), is the undisputed number one topic in technology at the moment. We are fairly confident that most cruise companies are investigating the use of AI LLMs to automate more of their guest experiences and reduce the burden on front desk staff. AI, particularly Machine Learning (ML) is already extensively used in systems such as fuel management and marine equipment for optimization and maintenance predictability.

Implementation

The actual implementation of AI into guest facing apps has not happened overnight as it has on the mainstream internet. This is partly due to the fact that these technologies are so new that few hospitality companies have really had the time to investigate them fully.

The AI landscape is also moving so quickly that it is impossible to know who will be the winners and the losers in the market even over the next six months. Staying with the giants who will likely weather this storm, such as Microsoft, OpenAI, Google, etc. will reduce risk significantly, but their systems are not designed for a shipboard, offline environment.

Risks

The other potential reasons that AI has not shown up in every new release in cruise apps are the risks, which include:

- Hallucinations or incorrect information have extremely high impacts on the operation. A guest being told that there is a menu item that doesn't contain a particular allergen, or that their shore excursion leaves at the wrong time can all be costly mistakes.
- There is likely a general lack of good training data for these new models. Most cruise apps do not have a "speak to the front desk" style chat systems in place that are logging how actual humans respond to requests, and what these requests are. So the lack of data makes it difficult to fine tune these models.
- Hardware and power costs for on-premise AI applications can be extremely high. However, these costs are dropping rapidly every day with new dedicated hardware and more efficient, smaller models.

Although the implementation of AI systems has not skyrocketed in onboard apps, the below features are signs that it is starting to happen.

Google MLKit for barcode offline reading

The integration of Google MLKit for barcode offline reading in one cruise app represents an enhancement aimed at streamlining operations and improving the guest experience. Google MLKit is a mobile SDK that brings Google's machine learning expertise to Android and iOS apps, enabling them to utilize powerful ML features with ease. The offline barcode reading capability allows the app to quickly and accurately scan barcodes without needing an active internet connection. This tool could be used for excursion tickets, digital entry, or payment options.

Kore.ai

Kore.ai, a virtual AI assistant system, has now been seen bundled into applications, and at least three cruise lines are experimenting with virtual chat assistants. These bots are commonplace on the web and are growing in shipboard applications. This is mainly due to the lack of on-premise solutions and data infrastructure. Virtual assistants need to be trained and conversations built on top of readily available data sources and APIs. If the data required to answer questions about the weather tomorrow is in a different system from the one required to make dining reservation inquiries, the development of AI systems becomes prohibitively complex.

Virtual voice assistants like MSC's Zoe platform were bespoke builds. However, with the increasing sophistication of onboard middleware products, it will become easier and more cost-effective to integrate pre-built AI systems into existing mobile apps.

Technology Blends *Updated*

In the last 2 years, several cruise lines embraced a much wider range of newer technologies than the traditional native offerings (such as Kotlin/Java and Objective C/Swift), and broadened into mobile app frameworks including Capacitor, Flutter, React Native, and even Unity.

These platforms generally give developers a number of positives that make any trade off worth the effort:

- They offer the flexibility to develop one code base and deploy it to both Android and iOS. This can drastically reduce development time and costs.
- The technologies are generally more accessible and easier to understand for average developers than the native tooling.
- The popularity of frameworks like React Native has created huge ecosystems of support and libraries for developers to use when building in these tools. It makes it much easier to find something like a pre-built menu management system or passport scanner.

These strategies and technologies are not without their disadvantages:

- They can often be more complex than their native counterparts due to a large amount of logic utilized to communicate between the hybrid offering and the base native system.
- Logic is generally built to meet the common offering between platforms making it difficult to excel with platform specific enhancements.
- The ecosystems built around these frameworks often rely on individual contributors, and can require a fair amount of work in maintaining those packages, updates, and relationships.

Below we will look at some of the particular framework and tooling blends that have been spotted since 2022.

Increased Use of React Native in Cruise Apps

React Native is a popular framework for developing mobile apps using JavaScript and React. It allows for the creation of cross-platform applications that can run on both iOS and Android with a single codebase. The recent trend of more cruise apps adopting React Native signifies a shift towards more efficient,

cost-effective development practices. By using React Native, cruise lines can develop and maintain their mobile apps more easily, ensuring consistency across different platforms while reducing development time and costs. This approach enables quicker updates and feature rollouts, enhancing the user experience. It's particularly beneficial for cruise apps, which often require frequent updates to reflect changing schedules, destinations, and onboard activities. React Native's ability to deliver a native-like experience ensures that these apps are not only efficient but also offer a high-quality user interface and smooth performance.

React Native and Expo

A new app to the report this year is using a combination of React Native and Expo. Expo is a framework and platform for universal React applications. It works alongside React Native to simplify the process of developing and deploying mobile apps.

Expo is essentially a combination of two categories of tooling:

1. Templates, tools, scaffolding, etc. This category contains SDKs, assets, templates, and frameworks that make it easier and quicker for developers to build React Native apps. These components are updated frequently, and offload some of the time and cost of maintaining your own components as a dev team.
2. Workflow systems: Expo also offers a number of automated build, review, and deploy systems. These help developers test their applications more easily on devices. For example, developers can hit a button and reload the app on their device without rebuilding it. These tools also offer code review workflows for teams, along with cloud build systems (meaning that development teams don't need to worry about Apple and Android build servers, which need maintaining).

Expo is interesting depending on how you use it. It is mainly used to create apps that require little to no custom code. However, many of the core modules that React Native used to have solid community support for have fallen into disrepair in favor of Expo modules. The problem is that once you introduce Expo into your application, you are stuck with some of Expo's release cycles and quirks. So if you write your app with mostly custom code, but you also want to have the benefits of Expo's solid modules, then you have to juggle the two competing systems. This balancing act requires a lot of set up initially, but gets easier after it is implemented the first time.

React Native without Hermes

The observation that some apps are using React Native but have not yet upgraded to Hermes highlights a notable aspect of the development strategy and potential areas for optimization. Hermes is an open-source JavaScript engine optimized for running React Native applications on mobile devices. It aims to improve app performance, startup times, and reduce memory usage, which are crucial factors for enhancing the user experience on mobile devices.

Apps that haven't upgraded to Hermes might not be fully leveraging the performance improvements it offers. This could be due to various reasons, such as compatibility issues with existing code, the

complexity of migrating to a new JavaScript engine, or the development team's prioritization of other features and updates.

However, considering the benefits Hermes brings to React Native applications, especially in resource-constrained environments like mobile devices, upgrading to Hermes could significantly improve the overall efficiency and responsiveness of these cruise apps. It would enable faster app startup times and smoother operation, which is particularly valuable for enhancing user engagement and satisfaction onboard, where connectivity might be limited, and app performance is critical to the user experience.

Flutter

Two apps are now using Flutter. This is Google's UI toolkit, similar to React Native, and it allows for building natively-compiled applications for various platforms from a single codebase. This integration means the apps can now maintain a consistent look and feel across iOS and Android devices, while speeding up the development and update process. With its rich set of design widgets, Flutter helps create visually appealing and responsive interfaces. Additionally, as apps built with Flutter compile to native code, they often perform better, ensuring a smooth and engaging user experience for cruise guests. This toolkit will make the life of those development teams a lot easier, and spark more arguments in the industry on the React Native vs Flutter debate!

Unity combined with Flutter

One app has added both Unity and Flutter in a single app. This combination suggests a strategic approach to leveraging distinct strengths of each platform for different functionalities. Unity is known for its capabilities in game development and immersive experiences, and is likely being utilized for augmented reality (AR) or virtual reality (VR) features within the app. These features could include interactive tours, virtual onboard experiences, or gamification elements that enhance guest engagement.

Flutter, on the other hand, is used for its efficiency in creating responsive and visually appealing user interfaces for the app's standard features, such as booking, itinerary management, and customer service.

Xamarin

The addition of Xamarin native components in a cruise app is interesting, as Microsoft is ending Xamarin support on May 1, 2024. This might mean that the development team for one of the apps is contemplating a switch to .NET MAUI (Multi-platform App UI).

Xamarin has been a popular cross-platform development framework that allows developers to build apps for Android, iOS, and Windows using C# and the .NET framework. Xamarin native components enhance the app's performance and enable access to platform-specific functionalities.

Our speculation about migrating to .NET MAUI (Multi-platform App UI) stems from its relation to Xamarin; .NET MAUI is an evolution of Xamarin.Forms, and represents the next step in cross-platform app development under the .NET ecosystem. It allows

developers to create natively compiled apps for mobile and desktop from a single codebase, using modern patterns and practices.

New to 2024 New

ABTasty's Flagship

Two apps are now using Flagship by AB Tasty. Flagship is a feature flagging and experimentation platform that allows businesses to test, target, and personalize digital experiences in real-time. This is most likely being used for:

1. **A/B Testing and Experimentation**: The app may utilize Flagship to conduct A/B tests and experiments to optimize various features, layouts, and functionalities based on user feedback and behavior. This allows the cruise line to make informed decisions about which changes resonate best with passengers.
2. **Feature Flagging and Rollouts**: Flagship enables the app to implement feature flagging, allowing developers to control the release of new features or updates selectively. This ensures a smoother rollout process and reduces the risk of introducing bugs or disruptions to the app experience.
3. **Dynamic Content Personalization**: With Flagship, the cruise app can personalize content and offers based on user preferences, behavior, and demographics.
4. **Performance Monitoring and Optimization**: The platform provides insights into the performance of app features and experiments, allowing the cruise line to identify areas for improvement and optimize the app experience continuously.

Addition of Root Certs into Apps (Possible Pinning or Support for Older Devices)

The inclusion of root certificates within some cruise apps indicates a focus on enhancing security and compatibility. Root certificates are used in SSL/TLS, a standard security technology for establishing encrypted links between a web server and a browser. By embedding these certificates directly into the app, developers might be implementing certificate pinning, which enhances security by ensuring the app communicates only with the verified server. This method prevents man-in-the-middle attacks, where attackers impersonate a server to intercept data.

Alternatively, including root certificates can also be a strategy to support older devices that may not have up-to-date certificate stores, ensuring these devices maintain secure connections to the app's servers. In the context of cruise apps, which may be used by a wide range of guests with varying device models and ages, this addition is crucial for maintaining a secure and inclusive digital environment. It ensures all users, regardless of their device's age, can safely access app features like booking, check-ins, and onboard services.

Adyen

Adyen is a well-known global payment platform that offers a wide range of payment methods, from credit and debit cards to various local payment schemes. It appeared in two new cruise apps.

The inclusion of Adyen and other payment providers is most frequently used during the onboarding process to capture the credit or debit card that

will be billed for charges incurred onboard. This would be part of the digital check-in process, where the mobile app would ask for items such as the passenger's passport and credit card details.

Adyen's systems would tokenize the passenger's credit card securely over the internet, and then transport that token to the shipboard PMS or processing system through some type of proxy or middleware.

Airship

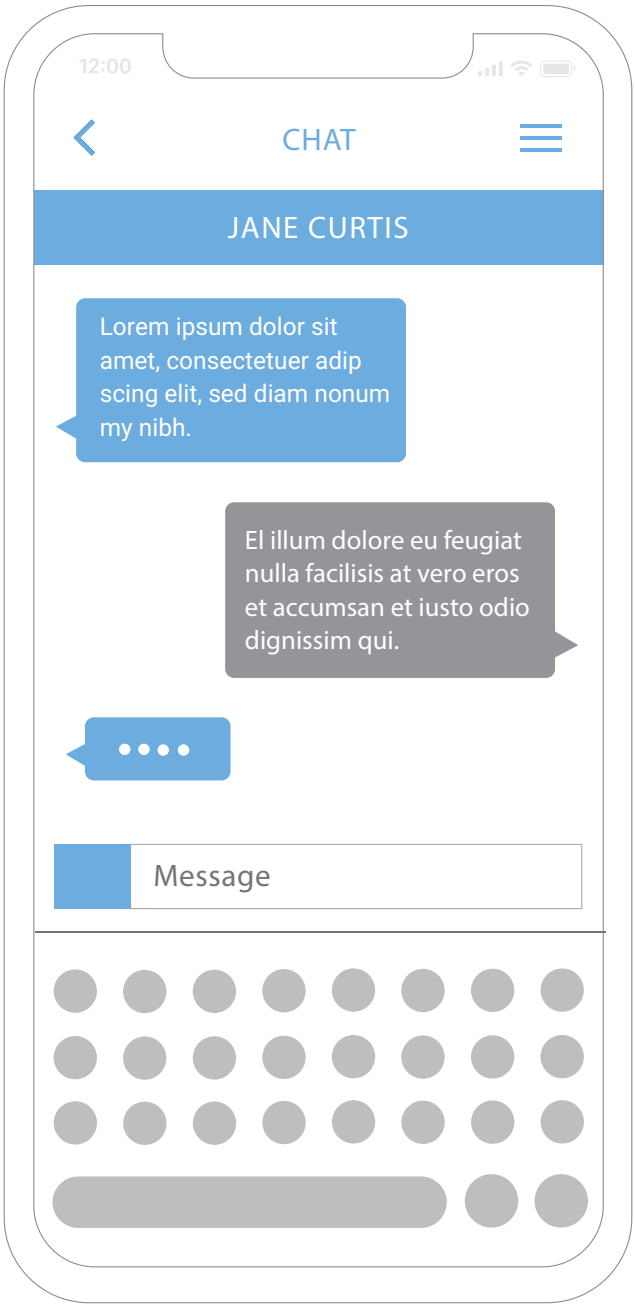
Airship is a customer engagement platform primarily used for mobile app messaging, including push notifications, in-app messages, and SMS. It allows for targeted, personalized communication with app users. In the context of a cruise app, Airship can enable cruise lines to send real-time notifications about onboard activities, itinerary changes, or special offers, enhancing the guest experience by keeping them informed and engaged throughout their cruise. It does require internet access so is most likely being used for shoreside marketing messaging.

App Bloating

We found that some cruise apps are growing in size unnecessarily, which is an opportunity to optimize app performance and enhance user experience, particularly for passengers downloading the app onboard. Inefficient practices, such as including unused language samples or excessive map tiles within the app itself, contribute to bloated app sizes, which can lead to longer download times and increased data usage for users.

For example, one app includes the ZXing plugin, which is used for barcode scanning, but also includes ZXing's sample data of 10 languages that are not used in the app. Another app includes a staggering 20,000 map tiles for a ship tracker, a resource-intensive feature that could easily be offloaded to a local server rather than being built into the app on the app store.

To address this issue, developers can adopt several



strategies:

1. **Remove Unused Components**: Eliminate unused features, language samples, or other unnecessary assets from the app to reduce its overall size without sacrificing functionality.
2. **Offload Data to Local Servers**: Rather than embedding large datasets, such as map tiles, directly into the app, offload them to local servers that can be accessed as needed. This reduces the initial download size of the app while still providing access to the required data when necessary.
3. **Dynamic Asset Loading**: Implement dynamic asset loading techniques to fetch resources from remote servers as needed, rather than bundling them into the initial app package. This approach can further reduce app size and improve performance by loading assets on-demand.

By implementing these optimization techniques, cruise app developers can significantly reduce app size, making it easier and more convenient for passengers to download and use the app, especially in situations where internet connectivity may be limited or expensive. This, in turn, enhances the overall user experience and ensures that passengers can quickly access the app's features and services while onboard.

AppLanga

The integration of AppLanga in two cruise apps represents a step towards enhancing the app's language and localization capabilities. AppLanga is a platform that simplifies the process of translating and localizing mobile apps into different languages. This tool allows for dynamic updates of app content in various languages without the need for new app releases.

In the context of cruise apps, adding AppLanga is particularly beneficial given the diverse, international clientele of cruise lines. It ensures that guests from different linguistic backgrounds can access the app in their preferred language, enhancing their overall user experience. This feature is vital for providing information like itineraries, services, and safety instructions in an accessible and understandable format. It not only improves guest satisfaction but also aids in effective communication, which is crucial in a travel and hospitality setting like a cruise.

There are other, less service-based ways of handling this, for example lang files, but AppLanga offers a large set of analytics tools to help the process.

Azure B2C

The addition of Azure B2C in a cruise app is an interesting move. Azure B2C (Business to Consumer) is a cloud-based identity management service from Microsoft that enables businesses to provide their customers with secure access to applications across various platforms. It does offer an on-premise solution as well, so it may be a key part in having a unified login for guests shoreside and shipboard.

This service could also be used for IT staff to log into the application using their corporate identity management tools, rather than using guest ID information.

Bandwidth Management Notifications

Some apps were found to have introduced various methods for notifying guests about their internet usage. One app included a guide for users on how to turn on Airplane Mode during their cruise, using only the onboard WiFi.

Another interesting feature was the inclusion of media upload monitoring from within the app. The guest is notified by the message: "You are using a cellular data connection. Your captured media is large and will drain up your package, it is recommended to use a WiFi connection." This is likely aimed at a feature where passengers can upload photos or videos of their trip that are collected inside the app. The warning is useful for guests who may have sticker shock on cellular overage fees, or see their international data package run out before their trip ends.

Blocking Reservations

One of the apps investigated had an interesting new feature: blocking a reservation if the guest has already attended that show/theater prior. The logic here is that if you've seen a show once before, then you should not be able to attend again to allow other guests to enjoy the performance on another day and time. We've seen this before based on cabin class, but not in a general, ship-wide manner.

Capacitor

Capacitor is a cross-platform app runtime that allows developers to build web applications that run natively on iOS, Android, and the web. It bridges the gap between web and native apps, enabling web technologies (HTML, CSS, JavaScript) to work seamlessly on mobile devices. Capacitor was built initially to replace Cordova by the team behind the Ionic framework.

In a cruise app, Capacitor can facilitate the creation of a single app that works across multiple platforms, ensuring consistent user experience. It's ideal for integrating web-based features like online bookings or interactive itineraries into native mobile apps.

Chucker

The integration of Chucker, an open-source tool, in one of the apps signifies a commitment to enhancing app development and debugging. Chucker allows developers to inspect network requests and responses directly in the app, making it easier to spot and fix issues related to API calls or data transfer.

In a cruise app, the use of Chucker can improve the reliability and performance of the app by enabling developers to quickly identify and address network-related problems. This ability is especially crucial in a cruise setting where internet connectivity might be variable. The use of Chucker is slightly strange to see, as Charles has been the predominant tool for this use case. This choice may have been made because development teams cannot VPN onto ships to use Charles, because onboard staff are being asked to handle more debugging themselves.

Credit Card Promos and Barclays Card Approval

Credit Card Promos have been spotted in two apps as a feature that allows guests to apply for or manage a cruise line-branded credit card, one in

partnership with Barclays Bank. This feature can streamline the process of applying for a credit card directly within the app, offering convenience and immediate access to credit for onboard or future bookings. It improves the guest experience by providing a quick and easy way to manage finances related to their cruise. It can also offer special benefits or rewards, like exclusive discounts or loyalty points, incentivizing guests to spend more onboard or book future cruises. There are also financial benefits to the cruise lines offering this feature.

ContentSquare

ContentSquare is an analytics platform that provides insights into user behavior and interaction patterns within digital applications. By integrating ContentSquare, the cruise app gains valuable capabilities for analyzing user interactions, understanding navigation paths, and identifying areas for improvement.

This addition allows the cruise line to gather comprehensive data on how passengers interact with the app, including their browsing habits, preferences, and pain points. With this information, the app developers can make data-driven decisions to optimize the user interface, streamline navigation flows, and personalize content to better meet passengers' needs and preferences.

COVID-19 Vaccine and Boosters Requirements

The implementation of a feature for COVID-19 booster proof in cruise apps reflects the ongoing adaptation of the cruise industry to the public health landscape. By requiring proof of COVID-19 booster vaccinations, these apps are playing a crucial role in enhancing passenger safety and compliance with health regulations.

This feature allows guests to conveniently upload and verify their vaccination status directly through the app, streamlining the boarding process and reducing paperwork. It's particularly important for ensuring a safe environment onboard, as cruises often involve close quarters and international travel.

Detection of Rooted Devices

We found one app that prohibits installation on Android rooted devices. This is a security measure aimed at protecting the integrity of the app and safeguarding user data. Rooting an Android device involves gaining privileged access to the operating system, which can potentially compromise the security of the device and the apps installed on it.

By restricting installation on rooted devices, the app developers are taking proactive steps to mitigate security risks associated with rooted devices. Rooted devices are more susceptible to malware and unauthorized access, posing a threat to the app's functionality and the privacy of its users. Additionally, rooting can enable users to bypass certain security measures implemented by the app, leading to potential vulnerabilities and exploitation.

Diagnostic Modules

Two apps were found to be using new Diagnostic Modules. These modules are likely designed to enable more efficient troubleshooting and debugging of issues that users may encounter while

using the app at sea, where traditional shoreside support mechanisms might be less effective.

By incorporating diagnostic capabilities directly into the app, the development team or onboard IT staff can gather real-time data on app performance, user interactions, and potential errors as they occur. This information can be useful for identifying and resolving issues that are difficult to replicate or diagnose from shoreside systems where test data and environments are notoriously difficult to simulate. It allows for quicker identification of problems, leading to faster fixes and updates, ultimately enhancing the user experience.

Digital Photo Archive

The Digital Photo Archive feature in some cruise apps is a modern approach to capturing and preserving memories made during a cruise. This feature allows guests to download their top twenty favorite photographs taken during various moments of their cruise journey, from the day of embarkation to formal events and other significant occasions. The photos are likely captured by an onboard photographer in some cases, and are tagged against passengers' passport photos on file. Other methods include purchasing photos from photographers where the guest gave the photographer their cabin number.

Feature Flags in Mobile App Builds

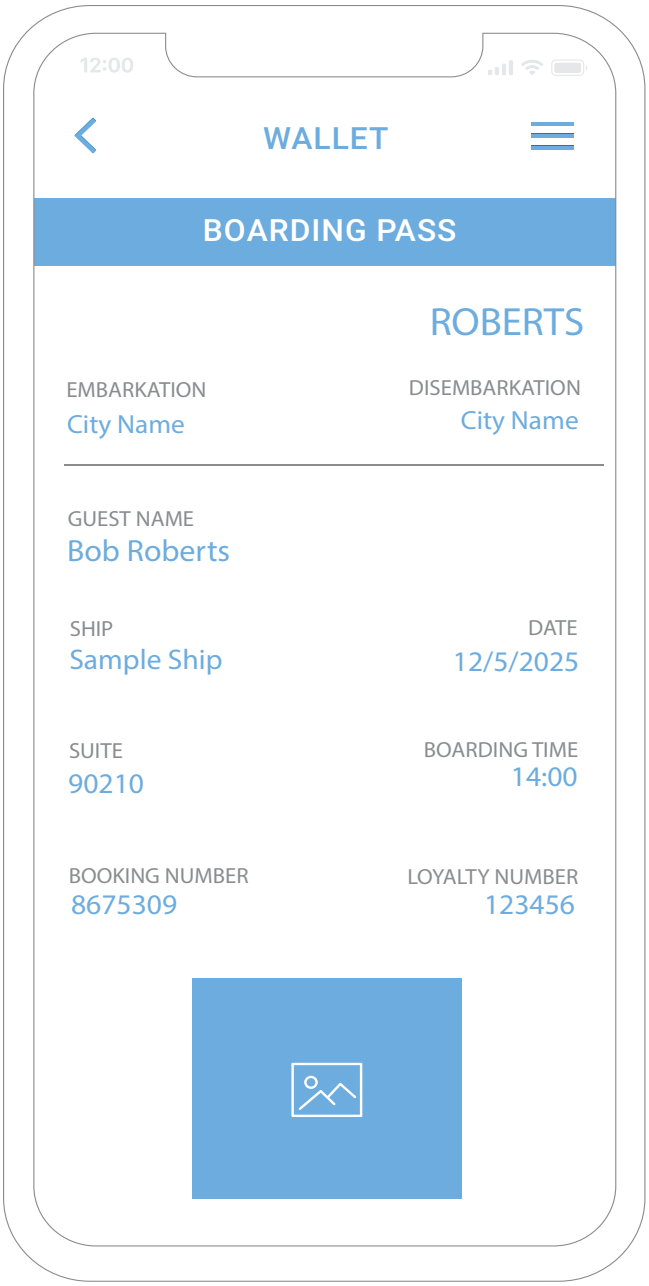
Feature Flags, also known as feature toggles, are a development technique that allows teams to turn features of a mobile app on or off without deploying new code. This approach enables more flexible and controlled feature release, testing, and rollback. In cruise apps, Feature Flags can be incredibly useful for managing and trialing new features like exclusive onboard services, digital itineraries, or personalized guest experiences. They allow the cruise line to selectively enable features for specific users or groups (like loyalty program members), test new functionalities in real-world scenarios, and quickly revert changes if needed, all without disrupting the overall app experience for all users. Feature Flags are especially useful for deploying a single app to ships that may have different features and experiences on offer.

Firebase

Firebase is a Google-backed platform that provides a suite of tools for building, improving, and growing mobile and web applications. It offers functionalities like databases, analytics, crash reporting, and user authentication. In cruise apps, Firebase can be used for tracking user behavior, managing user data, sending targeted notifications (like excursion updates or dining offers), and enhancing overall app performance and reliability.

Google Wallet

One app included the native Google Wallet functionality. This is most likely used to store digital boarding passes. There are a number of cross-platform systems for wallet management that are available, and cruise lines are mainly using them for boarding passes. However, it is possible that the integration could also allow for direct payments for onboard concessions (buying an expensive watch and not having it show up on your folio can be useful for some relationships).



Hard-coded Port Code Files

We found one app using a hard-coded port code file. This is likely due to the complexity of standardizing port codes and the necessity for accurate data integration between the Passenger Management System (PMS) and Content Management System (CMS). Port codes can pose challenges because they are often not standardized as airport codes, and there can frequently be differences in the codes between navigation systems, CMS, and PMS.

While the decision to hard-code port codes may ensure consistency and accuracy in data mapping between the PMS and CMS, it does present limitations, particularly in terms of flexibility and scalability. Hard-coded values are static and require manual updates whenever port codes change, which can be cumbersome and prone to errors, especially considering the dynamic nature of port information.

To address this issue more effectively, the app could implement a dynamic, onboard module that fetches and updates port code data from a central repository or API. This approach would allow for more agile and automated management of port code data, ensuring that the app remains up-to-date with the latest port information without requiring manual intervention.

Mapbox

Mapbox is a library for mapping, navigation, and location search services. It offers tools for creating custom maps with specific styles, data overlays, and interactive features. Mapbox is known for its customizations and its ability to work efficiently offline, which is a key advantage in environments with limited internet connectivity.

In the context of a cruise app, Mapbox is most likely being used for the ship tracking feature. This feature would allow passengers to view the current location of the ship, track the route it has traveled, and see upcoming ports of call. By hosting a tile server onboard, the cruise line can provide passengers

with continuous access to detailed maps without the need for external internet.

Mapbox's customization capabilities enable the creation of maps tailored to the cruise line's specific routes and destinations, as well as their branding. Maps can be customized to fit the look and feel of the cruise line's brand colors, quirks, and style.

Passengers could use these maps to explore the journey, learn about different stops, and plan activities for each port visit. This tool enhances the passenger experience by offering a visually engaging and informative way for them to connect with their voyage, making the cruise app a valuable tool for both navigation and personal trip planning.

MQTT Sockets Support for Local Notifications

MQTT (Message Queuing Telemetry Transport) is a lightweight messaging protocol, ideal for communication in networks with limited bandwidth. MQTT sockets support in an app allows efficient, real-time messaging between the app and a server. For local notifications in a cruise app, MQTT can be highly effective. It enables the app to receive timely updates and alerts from the cruise line's server, such as itinerary changes, event reminders, or safety alerts. This system ensures that passengers receive crucial information promptly, enhancing their overall experience and safety on the cruise.

Nearby Devices

One app asks permission for the guest's device to be able to access nearby devices. There are a few reasons for asking for this type of permission:

1. **Location-based Services**: The app might provide location-based services or information tailored to the user's surroundings, such as nearby attractions, events, or offers.
2. **Mesh Networking for Communications**: We know from a number of conversations in the industry that offline messaging might be helpful in emergencies, low connectivity areas, and on ships with older wifi infrastructure. This feature would allow devices to communicate directly with each other and spread data using a mesh network.

OneTrust

OneTrust is a privacy, security, and governance platform designed to help organizations comply with global regulations like GDPR and CCPA. It offers tools for consent management, data governance, and risk assessment. In a cruise app, OneTrust can be instrumental in managing guests' personal data responsibly. It ensures that the collection, storage, and usage of data, such as booking information or personal preferences, adhere to privacy laws. This not only builds trust with customers but also safeguards the cruise line from potential legal issues related to data privacy and security.

OpenCV

The Open Source Computer Vision Library (OpenCV) is a popular open-source library that provides tools and algorithms for real-time image processing, object detection, and computer vision tasks.

In the context of a cruise app, the integration of OpenCV suggests the potential for various advanced features and functionalities, such as:

- **Image Processing**: OpenCV can be used to enhance images captured by the app, improving clarity, contrast, and overall quality.
- **Object Detection**: The app may utilize OpenCV for object detection and recognition, enabling features like automatic tagging of landmarks, onboard facilities, or points of interest.
- **Augmented Reality (AR)**: OpenCV can power AR experiences within the app, allowing users to overlay digital information or virtual elements onto the real-world environment captured by the device's camera.
- **Security and Surveillance**: OpenCV's capabilities can also be employed for security and surveillance purposes onboard, such as monitoring crowd density, detecting anomalies, or identifying individuals. These are likely not built into a mobile app, but could be used in other devices such as cameras and other IoT devices onboard.

Prepaid Kids Credits

We discovered a new and interesting feature allowing for Prepaid Children Cruise credit cards in one app. This is a useful approach to catering to families and ensuring a smooth and enjoyable experience for younger passengers. These prepaid cards likely enable children to make purchases onboard within a controlled spending limit set by their parents or guardians.

This feature offers several benefits, such as fostering independence for children to make their purchases while onboard, teaching financial responsibility in a supervised environment, and providing parents with peace of mind by managing and monitoring their child's spending activity. The system also likely prohibits certain types of spending. It's probably fine for your little one to buy credits for the arcade, but you don't want them trying to purchase jewelry from a concessionaire.

Split APKs

Split APKs are a way of distributing Android apps where the app is split into multiple APKs based on device characteristics like screen size, CPU architecture, or language. This approach allows users to download only the parts of the app relevant to their specific device, reducing the app's size and improving download and install times. In the context of a cruise app, Split APKs can be particularly beneficial. They ensure that guests, regardless of their device type, download an optimized version of the app, leading to faster installation and less storage space used. This is especially useful for guests who may have limited internet access while boarding or during the cruise.

Timezone Alerts

The implementation of Timezone Detection in one app addresses a practical challenge faced by passengers on cruise ships: managing time zone changes. As cruises often traverse different time zones, keeping track of the correct local time can be confusing for passengers. This feature ensures that guests are always aware of the ship's time, which is crucial for attending activities and events onboard.

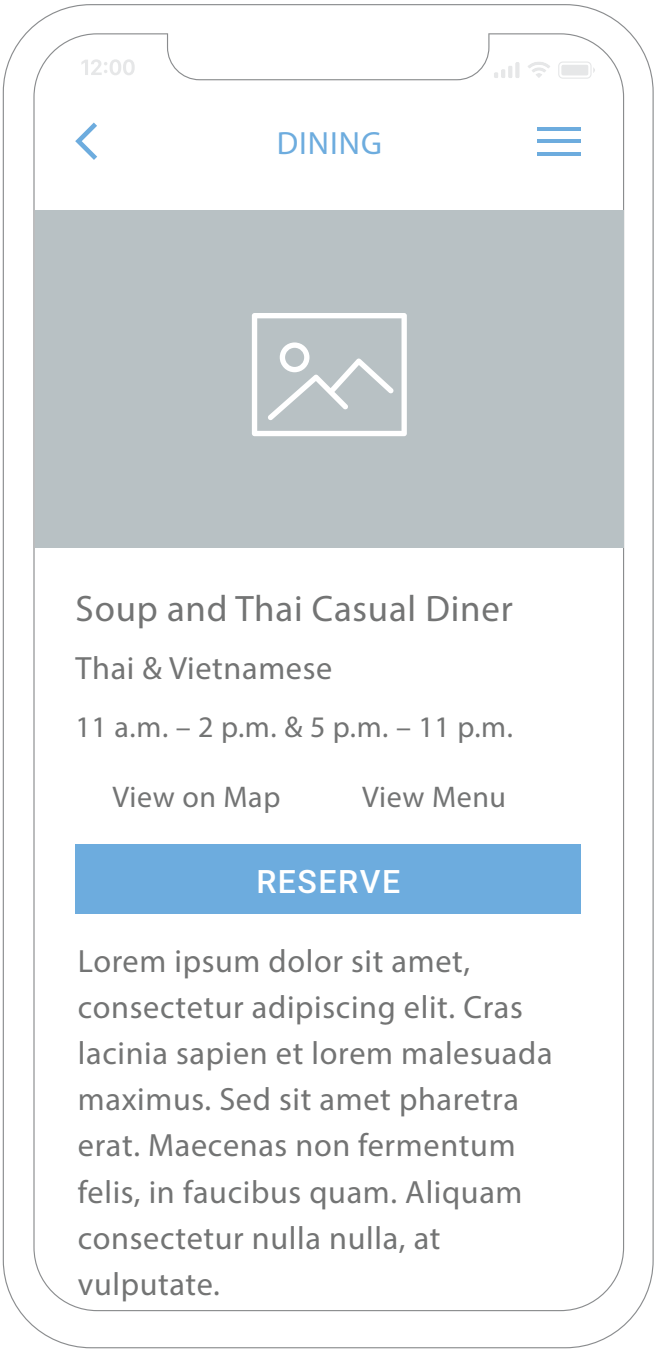
The Timezone Detection feature likely works by notifying users when their device's time does not

match the ship's time. It can prompt passengers to adjust their device settings to align with the ship's time zone, ensuring they are in sync with the onboard schedule. This can include alerts like "Alert, Ship time does not match with device time," providing a clear and direct reminder.

YubiKey Support

YubiKey is a hardware authentication device that provides an additional layer of security by requiring physical presence for authentication purposes.

By integrating YubiKey support, the cruise app enables users to enhance the security of their accounts by requiring the physical presence of the YubiKey device to authenticate access. This adds an extra level of protection against unauthorized access, particularly in scenarios where traditional password-based authentication may be vulnerable to phishing attacks or password breaches. This is likely to be used for onboard IT staff to access certain hidden areas of the app. It is unlikely that this is a guest-targeted feature.



Existing or Updated Tools and Key Players

Accenture

Based on our analysis, several apps likely include the multibillion-dollar consulting firm's participation in the programming. Accenture extensively publicized their involvement in the development of the Carnival Medallion project, and it appears to offer both full application development and the augmentation of in-house teams in the cruise space.

Adaptive Icons

Android Adaptive Icons first made their appearance in 2022 in some cruise apps. Adaptive Icons are a format for Android icons that attempts to standardize the look and feel of Android devices and their home screens.

Apple controls not only their software, but the hardware that it runs on as well. As a result, they can define the user experience across all devices. Google mainly controls the software aspect of Android (and even that statement is more complicated than the scope of this study). Due to the limited control over the interpretations that hardware manufacturers have allowed in the Android world, icons have been inconsistent in look and feel (to say the least).

Adaptive icons allow developers to upload their app icons in a number of layers. In the layers, components like the background are separated from the icon mark. This separation allows the operating system customizations each manufacturer has chosen to standardize their look and feel with a number of masks that are applied dynamically.

Alipay & WeChat Pay

The continued inclusion of libraries supporting both Alipay and WeChat Pay show the importance the industry is placing on the Chinese market.

Mobile wallets from Tencent (WeChat Pay) and Alibaba (Alipay) have become the norm in China. These systems largely dominate in China, accounting for 92% of market share and are rapidly turning the country into a cashless society. These integrations are presumably used for connecting credit cards or financial institutions to onboard folios as part of the check-in process, or to be linked to direct onboard purchasing and casino transactions.

ASSA ABLOY

ASSA ABLOY Global Solutions Marine is the leading provider of cabin door lock systems in the cruise industry. Mentions of their libraries have been spotted in a number of cruise apps in the past, but full implementation has seemed elusive. Two mobile apps include the full SDKs, although it is difficult to know the full level of integration. These SDKs would allow guests to use their phones to access the gangway and unlock their cabin doors.

Even though the technology to enable these convenient lock systems is available on many ships, it has yet to be widely rolled out. This may be due to several factors:

- The certifications required to work with the SDKs involve in-person ASSA ABLOY training, often in Northern Europe.
- Integration requires a fairly robust understanding

of security systems and may be more challenging than standard mobile app development.

- Gangway systems and door lock systems may be from different suppliers. This means that generating a soft key would enable a passenger to unlock their door, but not access the ship. Having a passenger carry a keycard and a phone defeats the purpose. Integration with two separate systems also dramatically increases development complexity.
- Card printing systems may be run through separate integrations with the PMS, creating issues for developers who would have to manage both access control and card printing at the same time (rather than simply rolling out a soft key option).

ASSA ABLOY's SDKs in Android binaries strongly suggest that this will soon change.

Augmented Reality *Updated*

Augmented Reality (AR) has been spotted in two cruise apps in the past. However, those libraries appear to have been removed, or are in the process of being removed. This points to the fact that AR functionality may have had limited passenger engagement, and little operational impact. There are still use cases out there that are intriguing, but for now the novelty of AR appears to have worn off.

Beacons & BLE

Bluetooth Low Energy (BLE) beacons allow a Bluetooth-enabled device (such as a smartphone) to detect small radio devices nearby. These devices send out an identifier that the detecting device can send back to a central server to learn more information. Up until 2020, the level of support for beacon functionality was increasing. The use of technologies such as the Android Beacon Library indicated that cruise lines were making significant investments in the infrastructure to enable this tech onboard.

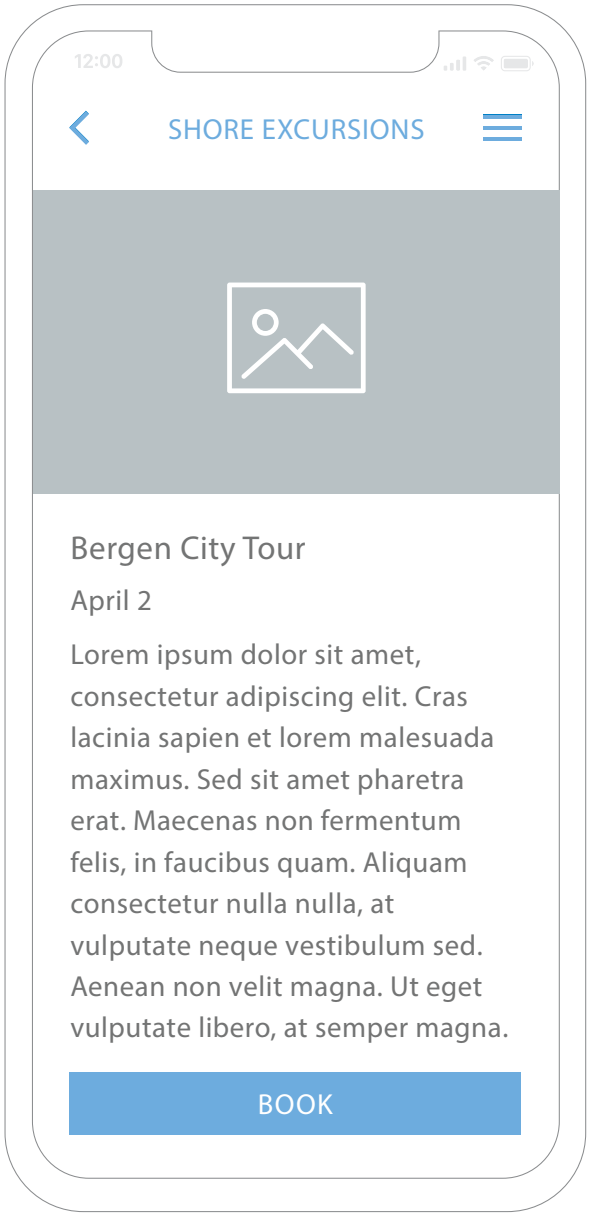
A few cruise lines have dropped support for BLE over the last two years. There are a number of possibilities to explain this:

- Analytics were showing that passengers were uncomfortable allowing their devices to hand over Bluetooth permissions to cruise lines. This may be due to bundling too many permission requests in a single ask and scaring the guests off from accepting anything. It also may have been a privacy concern for the users.
- BLE technology onboard ships has been difficult to implement. Signals do not pass well through steel bulkheads and fireproofed walls. Experiments where beacons were attached to tables to allow instant drink ordering were sometimes unsuccessful because passengers and crew moved tables around. BLE may not be as practical on a real ship as it is in a lab environment.

Braze *Updated*

The inclusion of Braze in two apps indicates a focus on enhancing customer engagement and personalized communication. Braze is a comprehensive customer engagement platform that provides tools for targeted marketing, user analytics, and personalized messaging, mostly for shoreside usage.

In the context of a cruise app, Braze can be used to send tailored notifications and messages to guests, based on their preferences and behaviors. Types of messages could include pre-cruise personalized recommendations for onboard activities, special dining offers, or reminders about upcoming events and excursions. Braze's analytics capabilities also allow the cruise line to gain insights into user interactions with the app, helping to refine marketing strategies and improve the overall guest experience.



Booking Cancellations

Booking Cancellations have appeared in cruise apps in the past, however they were removed in later iterations. As far as our research has found, the reason for this removal was operational and not technical. A number of PMS providers' systems have API calls that allow for booking and cancellations of restaurant and shore excursions. Spa bookings are less well-supported, but are improving.

At least one known issue in previous cancellation features was due to the business logic of the applications, which allowed passengers to cancel reservations outside of the cancellation policy of the cruise line. This issue was due to the fact that the PMS's business logic for policy control did not extend to the API. As a result, guests could cancel a shore excursion minutes before departure time, well after manifests for the tour guides and coach drivers had been printed. This logic has now been implemented on the app side.

Card Scanning

Card scanning applications and libraries are embedded into cruise apps to allow passengers to scan credit cards, driver's licenses, or passports to speed up the check-in process. Microblink seems to be the primary choice in embedded card-scanning SDKs. BlinkID and BlinkCard allow developers to capture ID documents and credit card information from device camera scans.

Charles

A common challenge while developing mobile applications for cruise lines is the debugging of issues discovered. No amount of logging and exception logging is the same as a developer being on the ship and experiencing the issue firsthand. Replicating the same issue locally might be difficult due to a variety of services not available in a test environment. Charles works by allowing a developer to proxy onto the ship to test the issue directly on a real device. We discovered a number of applications that contain a Charles SSL certificate, hinting towards multiple cruise lines using this type of debugging.

Cruise Director (Sourcetoad)

Sourcetoad's Cruise Director is a suite of onboard and shoreside software tools designed to manage various aspects of both guest-facing and crew-facing applications. Cruise Director contains out-of-the-box modules for entertainment (i.e., iTV and music), intelligent signage, captive portal, mobile app management, IoT device management, cabin access, and notifications. Custom modules are easily added to enable interfaces for new technologies, dashboards, and features.

The framework is built on shared API management, shoreside synchronization, content management, and analytics across the suite. This allows all modules to have a cohesive interface, which can be managed from a shoreside office, while sharing data with other modules and funneling data into a combined analytics system.

Developers

Analyzing the apps provided insight into the development teams behind the code. Package names and test account information were often clearly visible; however, it is problematic to make assumptions about developers unless it is quite obvious. Developer vendors can provide external libraries that cruise internal teams ingest into the in-house codebase to add an out-of-the-box feature. External development teams may also be augmenting in-house developers with outside vendors.

Exo Media Library

Exo Media Library is an Open Source Android media player add-on maintained by Google. Although it's not as efficient as the built-in Media Player, it can handle many more streaming standards. Typically, using the built-in operating system media player is good enough—or even better—than external libraries, but only for video content already on the device. Including an external media player in the app allows developers a number of benefits:

- The media player experience is typically much more customizable in the look, feel, and functionality.
- As new features become available, users need a simple app update, rather than updating their device's OS.
- The media playing experience will be the same,or at least much more similar, across devices.

The inclusion of this library points to at least one cruise line adding streaming video to their app. This

content might be movies, live TV, or events and performances.

Digital Rights Management for streaming studio-owned content to personal devices is still a challenge onboard—unless of course the cruise line is owned by a studio.

External Settings Files

Cruise applications have an uncommon constraint: they act differently based on the network you have joined. The problem requires a solution that works without the guest noticing anything, which can be achieved with external settings files. This solution works by requesting a file from a specific domain with configuration flags. Once connected to the onboard network, this file will return different flags than it would return when connected to a standard internet connection. This solution can be expanded greatly to include more than simple configuration flags. We noticed this pattern of development in many of the applications.

Flight Track Information

Multiple industry apps now support some level of flight tracking for guests. These features all focus on post-cruise flight information tracking. By combining guest PMS travel information with flight status data from third-party providers, passengers can anticipate their return travel plans. Flight delays can drastically change airport transport fees, wait times, and frustration levels, especially when internet access is limited. Having a centralized, app-provided pathway for these data can improve the guest experience significantly. Readily available flight information throughout a mobile app also reduces the number of calls and wait times on guests services on debarkation days when traffic is typically highest.

Image & Animation Libraries

Our research shows that libraries like Glide Transformations, React Native Animatable, and ViewAnimator are still being used to make apps a more fun, lighthearted experience for users.

Liferay

Liferay is an open-source enterprise CMS. We found that at least two cruise applications were using some part of Liferay DXP, the company's digital experience platform, most likely to deliver marketing content and images to the app. Liferay is also likely being used as an EFSS (enterprise file synchronization and sharing) tool to coordinate shoreside digital assets for synchronizing to onboard systems.

Medallia

Medallia is a platform technology that analyzes feedback from social media sources and review sites. They now also offer their own set of mobile feedback tools that can be embedded in applications, which is presumably how it is being used in at least one of the cruise apps we investigated.

netTALK *Updated*

netTALK Maritime provides a number of telephony, device tracking, and health-related SDKs for cruise mobile development. netTALK has traditionally provided telephony and chat services onboard, but the COVID-19 crisis saw them expand with a number

of innovative health and safety offerings.

Night Mode Support

A small, but interesting update for two applications was support for Night Mode. Night or Dark Mode is the ability for a device's applications to show darker backgrounds during low light conditions, which helps reduce eye strain at night. Cruise apps are typically heavily styled and branded when compared to a standard business application. As a result, more components are hand made, rather than using the standard operating system components.

Standard OS components make night mode integration easier for developers, as it generally comes standard with the module. It is possible that the addition of Night Mode in these applications was part of a framework upgrade where Night Mode was included, rather than a development priority, but it's an interesting feature to see in the industry either way.

Notifications *Updated*

Significant changes have been made in the notification landscape since our last app Oceans App Report in 2022. Two major cruise lines have moved to full **local push notifications systems**, reducing the size of their apps and their exposure to Apple's App Store complaints. That brings the total to three large brands using local push, and two newer entrants (both using the Cruise Director Platform).

Local push notifications were introduced in 2020 by both Google and Apple. This newer feature allows developers to build push notification servers on local networks (with some special permissioning). Essentially, these servers can mimic the functionality of the remote push systems. Local push means that a cruise director could theoretically write a small message inside of a web console to notify anyone who had opted-in that a pod of whales has been spotted off the port bow—in near real time.

The benefits to a true local push system are less on the app side and more on the infrastructure side. Having a local push system inside of a cruise's services might allow for much more intelligent messaging across devices and methods, as well as having deeper analytics and read responses.

A number of cruise lines now have **remote push notifications** permissions inside of their applications. When seen in combination with local push notifications, we can infer that remote push is being used to send messages about booked not departed messages, as well as post-cruise marketing content.

These types of notifications are familiar to most people as they have been around for a while. These are notifications triggered by a server on the internet creating an alert that is sent to a notification relay run by Google or Apple. To do this on Android, a request is made to Google Cloud Messaging (GCM) which then forwards the message to the device. Apple has Apple Push Notification service (APNs), which works in basically the same way.

Background push notifications are messages that a device can send its owner independently. These come in a few flavors:

- Polled messages, where the app makes a request to a server every now and again, and checks to see if there is a message waiting. This works on local servers but it's not instantaneous, and it can poll up to an hour at a time if the device's battery is low. Polled messages are great for tasks like reminding passengers what port is next, or that they have a spa reservation on Thursday.
- Local app notifications are when the app itself (not a server) sends a message to the user. This is often based on a timed event, such as "Your dining reservation is in one hour." In this case, the app has stored the time of the event, knows what time it is now, and sends the notification based on internal logic. The problem with this on a ship is that ship time and device time often differ. Messages are usually only off by an hour, but that's enough to confuse a guest, so messages must be more vague and less useful.

Notification Centers are also now in at least two applications. These are centralized messaging hubs inside of the mobile apps that show previously read messages. One variation of this was a digital survey system that allows passengers to see surveys they have already completed.



PDFium

PDFium is a Google-supported, open-source library for manipulating PDFs. It allows developers to view, print, search, and fill out PDF forms. Managing PDFs has largely been handled by server-side applications rather than on passengers' actual devices. We can assume that the inclusion of this library at the local level is to handle PDF documents (e.g., tickets, medical forms, etc.) in an offline environment.

ProGuard

ProGuard works like many obfuscation tools by optimizing the Java bytecode. This tool is joined by many on both Android and iOS for the purpose of optimization and security protections at the application level. ProGuard makes it more difficult

for prying eyes to glean information, making the application more secure.

SQL Cipher

SQLCipher is an open source extension to SQLite—the most common database engine built into smartphones and devices. It adds 256-bit AES encryption to a SQLite database, making them significantly more secure.

SQLite itself is not secure. If you store text in a SQLite database, you should assume anyone with access to the device has access to the text. So why would a cruise line want to encrypt their database on a user's device? Our top assumptions for doing this are:

- A general security improvement to the application brought on by regulations inside of large organizations.
- The application is now storing payment or credit card data, and there are regulations around how this data is stored at rest.
- Health and safety protocols require collecting personal health data which cannot be stored in un-encrypted databases.

Storing encrypted data on a mobile device is not a bad idea in general, and the drawbacks are limited to some very minor performance losses when writing data. As a result, the pros largely outweigh the cons. However, having personally identifiable information (PII), payment info, or health data on a device is still a security risk, and could be managed with tokenization and well-architected server access.

Virtual Queuing and Waitlists

Four cruise brands now show evidence of virtual queuing or waitlist systems. The virtual queuing systems work by asking guests to sign up for an event, a service, or even an overbooked excursion inside of the app. This is often prompted at the event location itself by a piece of signage and a QR code. The app then sends a notification to the guest when their turn has come.

Virtual queuing is available for activities such as rock walls and games, but also night clubs, restaurants, and even disembarkation. Online passenger forums, however, are often negative on this feature, with complaints mainly focusing on the inconsistency of the functionality. Some guests have commented that notifications have not been delivered, or they were "in queue" for over 24 hours. These types of issues are not unexpected in new features, but can be frustrating for passengers. However, once these bugs are worked out, virtual queuing will allow for a much safer, streamlined experience onboard.

WebP

WebP is a modern image format that provides superior lossless and lossy compression for images on the web. Using WebP, webmasters and web developers can create smaller, richer images that make the web faster.

WebP lossless images are 26% smaller in size compared to PNGs. WebP lossy images are 25-34% smaller than comparable JPEG images at equivalent SSIM quality index.

Security

Unfortunately, in many situations, app security within our industry appears to be an afterthought rather than a foundational component of app development. The cruise industry, with its unique operational challenges and reliance on interconnected systems, presents a lucrative target for cyber attackers. Recent incidents, including at least two breaches known to Sourcetoad, have highlighted the vulnerability of cruise apps. These breaches not only compromised user data but also allowed attackers to pivot from the app to sensitive onboard systems, endangering both privacy and physical security. This reality underscores the urgent need for development teams to prioritize security measures from the outset, integrating robust protections into the app's core design to safeguard against both current and emerging threats.

The following are a few examples of security practices that would not be up to the standards of most development teams.

Sourcemap inclusions

Three apps we investigated included the entire Sourcemap for the app. The inclusion of entire Sourcemaps in some cruise apps, presumably for aiding systems like Sentry in debugging, raises significant security concerns. Sourcemaps are designed to map minified or transpiled code back to its original source code for debugging purposes, allowing developers to identify and fix issues more easily. However, including entire Sourcemaps, which essentially contain the unminified and unobfuscated source code, poses a serious security risk. Exposing the source code in this manner makes it easier for malicious actors to reverse engineer the app, identify vulnerabilities, and potentially exploit them. Moreover, it violates best practices for code protection and confidentiality, as sensitive information or proprietary algorithms may be exposed. Instead, developers should carefully configure Sourcemaps to only include necessary information for debugging while ensuring that sensitive code remains protected. This approach strikes a balance between facilitating debugging processes and safeguarding the security of the app and its users.

Mixed Android API 31 to 33 Support

We found a number of apps are still using the Android API version 31. With API 31 now deprecated and API 33 being the current requirement, apps that have not updated to the latest API face significant implications. Primarily, these apps will be unable to receive updates or potentially be blocked from publishing in the Google Play Store until they comply with API 33 standards. This requirement ensures apps leverage the latest Android features, security enhancements, and performance improvements. For cruise apps, failing to update to API 33 could not only hinder the user experience by preventing access to new features and fixes, but also raise security concerns due to outdated protocols.

JavaScript not minified or uglified

We found that some apps have JavaScript (JS) files that are not minified or uglified. This raises some

concerns regarding performance optimization and code security. Minification and uglification are techniques used to reduce the size of JS files by removing unnecessary characters and renaming variables, which can significantly improve load times and overall app performance.

Unminified and non-uglified code is easier to read, and can often be read as plaintext that the original development team wrote. This makes it easier for an attacker to understand, making the application more susceptible to reverse engineering and unauthorized access.

To address this issue, developers should prioritize minifying and uglifying JS files as part of their deployment process. Automated build tools and plugins can streamline this process, ensuring that JS files are optimized for performance and security before being deployed to production environments.

Test Data/Shim

Many of the apps we researched included test, or "shim," data inside of them. This is basically a text file containing a fake passenger's details, calendar, folio, and any other items needed for testing. This shim data will also include items such as restaurant menus, available spa treatments, and shore excursion offerings. The reason the data is included in the actual app is so Apple (or other testers) can test the app without connecting to a PMS (property management system) or shoreside test databases. The risk with this data remaining in the application is that it could expose vectors of attack for hackers by providing insight into other onboard operations.

Test Logins

About half of the apps we investigated contained clear text usernames and easily visible passwords. This might sound more alarming than it actually is, but it is interesting to note. These credentials are for testing purposes, specifically for Apple's testing. Unlike the Google Play store, which relies solely on automated tests, Apple has real people testing the apps. Because most cruise apps are designed to only work shipboard, testers need a way to trigger "onboard mode" with fake credentials to log in. Of course, this leaves open the possibility that someone other than approved testers could log into the apps without having to pay for a ticket to board the ship.

Conclusion

The ramifications of such oversights are not hypothetical—they have manifested in real breaches that have allowed attackers to exploit vulnerabilities, jeopardizing sensitive onboard systems and, by extension, passenger safety. These incidents serve as a clarion call for a shift in how security is perceived and implemented in cruise app development. It is imperative for development teams to adopt a security-first approach, embedding security considerations into every phase of the app development lifecycle. This involves not only adhering to best practices like code obfuscation and minification, but also fostering a culture where security is everyone's responsibility.

Accessibility

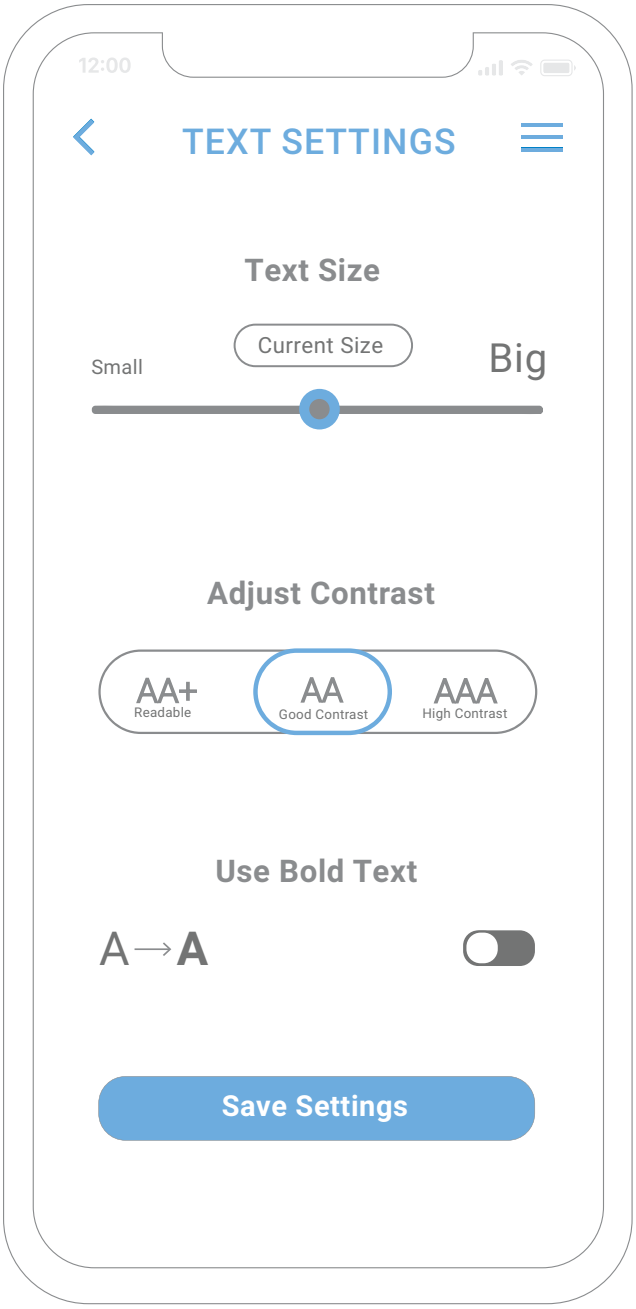
This year's report shows that cruise lines are making strides in incorporating accessibility features, such as text-to-speech functions, high contrast modes, and easy navigation options. These enhancements are crucial for users with visual impairments, mobility challenges, and other disabilities.

One app in particular stood out this year, with the introduction of accessibility enhancements for all videos, images, and animations. This accessibility enhancement is a significant step towards inclusivity and user-friendliness. This move also underscores the app's commitment to catering to a diverse range of guests, including those with disabilities or special needs.

Accessibility features can include options like subtitles or closed captions for videos, alt text descriptions for images, and the ability to control or disable animations for users with visual or motion sensitivities. By implementing these changes, the app becomes more accessible to individuals who may have impairments such as hearing loss, visual limitations, or cognitive disorders.

Another app in the study is using the Cordova Accessibility plugin. This tool allows developers to improve the app's compatibility with screen readers and other assistive technologies, ensuring that features such as navigation menus, booking systems, and daily schedules are accessible to users with visual impairments or other challenges. However, this plugin does have some known issues, and can be difficult to manage.

Despite recent progress, big accessibility gaps remain. Inconsistencies in screen reader compatibility and the lack of universal design



standards across apps pose significant hurdles. Accessibility cannot be an afterthought; it must be a core consideration from the inception of the app design, ensuring that all users can navigate and utilize the app with ease.

Embracing innovative technologies is key to advancing accessibility. Features such as voice recognition, customizable interface options, and adaptive text sizing can cater to a broader range of needs. Future advancements may include more sophisticated AI-driven aids that predict and adapt to individual user preferences, further removing barriers to accessibility.

Adhering to established web accessibility guidelines, such as the Web Content Accessibility Guidelines (WCAG), is essential for cruise apps. Audit services are available to review an app's adherence to accessibility, and regular testing with users who have disabilities is also vital to uncovering and addressing usability issues. Incorporating feedback into iterative designs ensures that the app evolves to meet diverse user needs effectively.

Beyond ethical considerations, legal compliance is a compelling reason for prioritizing accessibility. Lawsuits and legal actions have been rising, with organizations facing significant penalties for failing to provide accessible digital services. The Americans with Disabilities Act (ADA) in the U.S. and similar regulations globally mandate accessibility, making it not just a moral obligation but a legal requirement.

As technology evolves, so too will the landscape of accessibility in cruise apps. The commitment to accessibility will be ongoing and incremental based on the features that are being added to the apps. If your app team does not have an accessibility strategy, you need to get one fast.

Rating our Predictions from 2022

Much has changed since our last full analysis of onboard ocean apps. Below we summarize and score our predictions from 2022.

New Entries

In 2022, we noted the surprising number of major cruise lines missing from the app stores. We predicted that more cruise lines would adopt onboard apps, even cruise lines that primarily cater to older demographics. We anticipated that we would add at least two new apps to our next report. This year's report includes seven new apps, bringing the total to twenty-one. The new apps included this year are a mixture of new cruise lines entering the market, established cruise lines adopting new apps, and cruise lines adding onboard functionality to their existing apps. This growth proves our prediction right: more cruise lines have recognized the need for passenger-facing apps, and have invested in keeping pace with the rest of the industry.

Score: 10/10

Rewrites

We predicted that at least one or two apps from our report would be completely rewritten from the ground up. Since the number of mobile technologies is growing every day, investing in a complete app rebuild can often be easier than maintaining and updating old code bases. In our review of app updates in 2023, we found evidence that at least one app has been completely rebuilt since our last analysis.

Score: 8/10

Continuing Medical and Health Integrations

In 2022, we predicted that cruise lines would continue development of medical and health integrations in their apps. In our recent analysis, we found health-related features remain present in apps across the board. A majority of apps have added health features to their digital check-in process, such as the ability to upload proof of COVID-19 vaccination and boosters. A few cruise lines have retained daily health surveys in their apps, but daily questionnaires have decreased significantly compared to the peak years of the COVID-19 pandemic. Today, as regulations have eased, a majority of cruise lines no longer require negative COVID-19 tests or even proof of vaccination for passengers to sail (unless required by one of the destinations along their route). Overall, there is less new development in this area than we predicted; while cruise lines remain dedicated to keeping passengers safe, perhaps the industry is ready to move on from the pandemic.

Score: 6/10

Increased Shoreside Functionality

We doubled down on our prediction that more pre- and post-cruise features would be added to cruise apps, as both of these areas were largely unexplored at the time. This year, as predicted, we have seen pre-cruise features continue to grow across the board. A majority of apps boast at least some pre-cruise features, such as digital check-in, itinerary, ship information, and travel planning. Notably, more apps have added the ability to book activities and make dining reservations prior to the cruise. These

features help passengers spend less time waiting in guest services lines, freeing them up to enjoy their vacation. However, as in 2022, the post-cruise area remains mostly overlooked.

Score: 7/10

The Beginning of the End of Onboard Print Materials

In 2022, we predicted that printed onboard newsletters and schedules would continue to be phased out. Shifting printed items to digital delivery has benefits from not only a cost-saving perspective, but also a health and safety perspective. This year, more cruise lines have announced their commitments to going completely paperless, and digital daily newsletters and schedules have become a standard feature across a majority of cruise apps. Though it's difficult to say how many printed materials are still distributed without being on the ships themselves, the overall trend has definitely shifted to digital-first delivery.

Score: 8/10

Looking Ahead

Based on our findings in this year's report, it's evident that the cruise industry is poised for significant technological advancements aimed at enhancing guest experiences, streamlining operations, and offering personalized services. Here are several predictions for what will be added to cruise apps over the next two years, reflecting the trends and insights drawn from the report.

Enhanced Personalization

Cruise apps will likely integrate more advanced personalization features, using AI and machine learning to analyze user data and preferences. This could include personalized itinerary suggestions, dining recommendations, and activity booking options that align with the guest's interests and past behaviors.

Preparing for Chatbots

The AI hype train is not the same vehicle that blockchain was. Large Language Models are here and are useful today. There are some complexities in building interactive chat systems in the shipboard environment, but roadblocks to these technologies are falling daily with better connectivity and better on-prem models. We expect to see human-directed chat systems appearing rapidly (e.g. where passengers can message guest services directly) as a precursor to train the models that will replace the need for human intervention.

Augmented Reality (AR) and Spatial Computing Features

The integration of Spatial Computing into cruise apps can offer guests interactive experiences, such as virtual tours of the ship, AR navigation aids to help find their way around, and immersive previews of shore excursions or onboard activities.

Improved Connectivity and Communication Tools

As highlighted in the report, connectivity at sea is a challenge that the industry is keen to address. Expect to see enhancements in app functionalities that allow for better onboard communication, including messaging services, Wi-Fi calling, and internet access. This could extend to seamless integration with wearable devices for access and notifications.

Sustainability Tracking Features

With a growing emphasis on sustainability, cruise apps might include features that allow guests to track their own environmental footprint, offering insights into the sustainability of their activities and choices on board, such as carbon offset options, and sustainable excursion choices. This will be especially important for lines that use sustainability, or scientific and educational cruising as a competitive advantage.

Health and Safety Enhancements

In light of the ongoing emphasis on health and safety, cruise apps will likely expand their functionalities to include health screenings, virtual queues to reduce crowding, and real-time alerts for health and safety updates. This may also encompass touchless

technologies for boarding, payments, and accessing rooms or amenities.

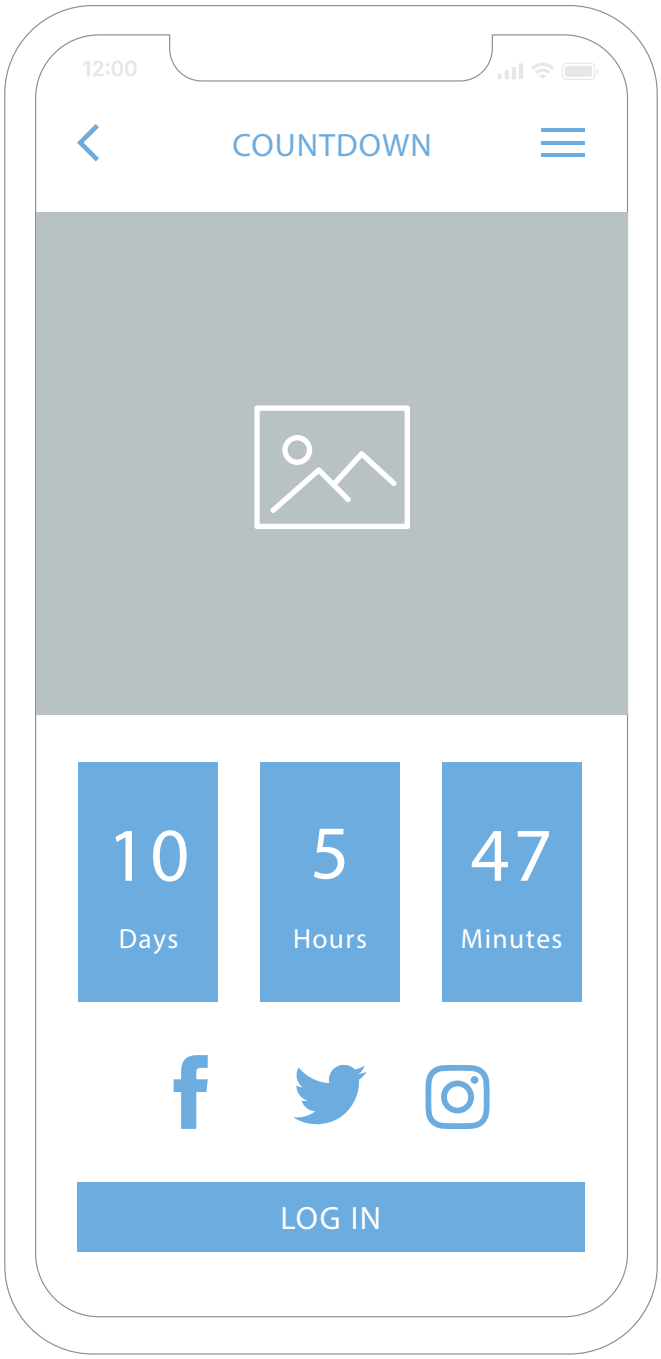
Enhanced Integration with Onshore Services

Expect to see cruise apps offering better integration with onshore services and experiences, providing seamless transitions between the ship and land for guests. This could include pre-booking of shore excursions, recommendations for onshore dining or shopping, and real-time updates on port schedules and activities.

Advanced Analytics for Personalized Marketing

The use of advanced analytics will become more prevalent in targeting guests with personalized marketing through the apps, offering promotions and deals that align with their preferences and past behaviors, potentially increasing onboard spending and enhancing guest satisfaction.

These predictions are based on the current trajectory of technological advancements, guest expectations, and the cruise industry's focus on innovation to enhance the cruising experience. As technology evolves, so too will the features and functionalities of cruise apps, reflecting the industry's commitment to offering a more connected, personalized, and seamless travel experience.



Conclusion

As we conclude the 2024 Cruise Mobile App Report, it's clear that the intersection of technology and cruising has never been more dynamic and essential. This year's insights reveal a sector that is rapidly evolving, driven by the pursuit of enhancing guest experiences, operational efficiencies, and industry standards through digital innovation. Mobile apps have emerged not just as tools of convenience, but as essential platforms for engaging with passengers, offering personalized experiences, and navigating the complexities of modern cruising.

Two years ago, our report focused on the intersection of Health & Safety, Guest Experience, and Operational Efficiency. This year, it's clear these pillars still guide where development dollars are spent. We also discussed how cruise mobile apps were converging on a standardized set of features, prompting us to predict that the future would bring more unique "surprise and delight" to entice and entertain guests. However, this has not been the case. A majority of cruise apps have instead continued to evolve in more predictable, logical directions. Features like onboard flight time information and prepayment options for guest bills have become logical extensions of the app functionalities, underscoring a trend towards continuous, incremental improvements that directly benefit guest experiences and operational performance.

The trend points to a more continuous, sustained, and incremental set of improvements that ultimately improve the guest experience and improve the operational efficiencies of the ships. Looking at this list, we understand that there are tons of improvements and features that could be added to almost every cruise app out there that would improve functionality in these areas. We would be surprised if we saw Augmented Reality making a comeback in place of a more efficient guest check out process, or allowing guests to cancel dinner reservations.

The more exciting future, as suggested by our findings, leans towards integrating advanced digital solutions, such as chatbots powered by large language models (LLMs) and workflow engines, to revolutionize app features. This shift from traditional app functionalities to AI-driven interactions holds the potential to dramatically reduce development demands on the ship crew while offering a more seamless and intuitive user experience. For instance, reporting maintenance issues through an app could transition from a multi-step process to a straightforward chat with an AI, capable of coordinating directly with maintenance systems. However, the transition towards AI features brings its own set of challenges, including the current limitations of chat interfaces and the potential for errors in task execution. Despite these hurdles, the push towards AI integration underscores a broader industry trend towards leveraging technology to enhance the cruise experience further.

In conclusion, our 2024 Cruise Mobile Apps Report paints a picture of an industry at the forefront of digital innovation, poised for further growth. The journey ahead is marked by opportunities for technological advancements that promise to redefine cruising. For cruise lines, the imperative is clear: embracing innovation, prioritizing security and accessibility, and continuously exploring new ways to elevate passenger engagement through mobile apps and emerging AI technologies will be critical in navigating the future of cruising.