

#WWDC19

Designing for Privacy

Mark Xue, Privacy Engineer

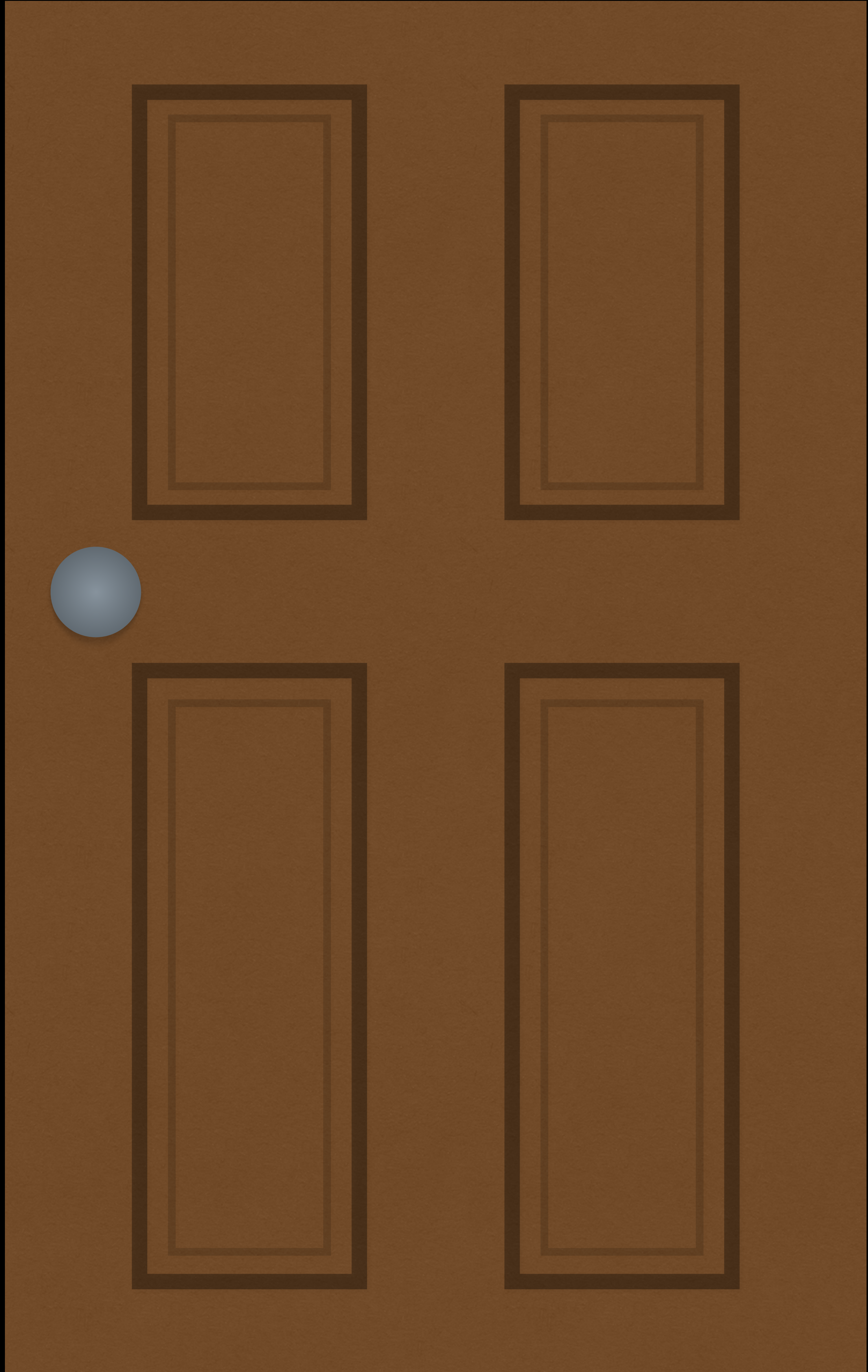
Julien Freudiger, Privacy Engineer

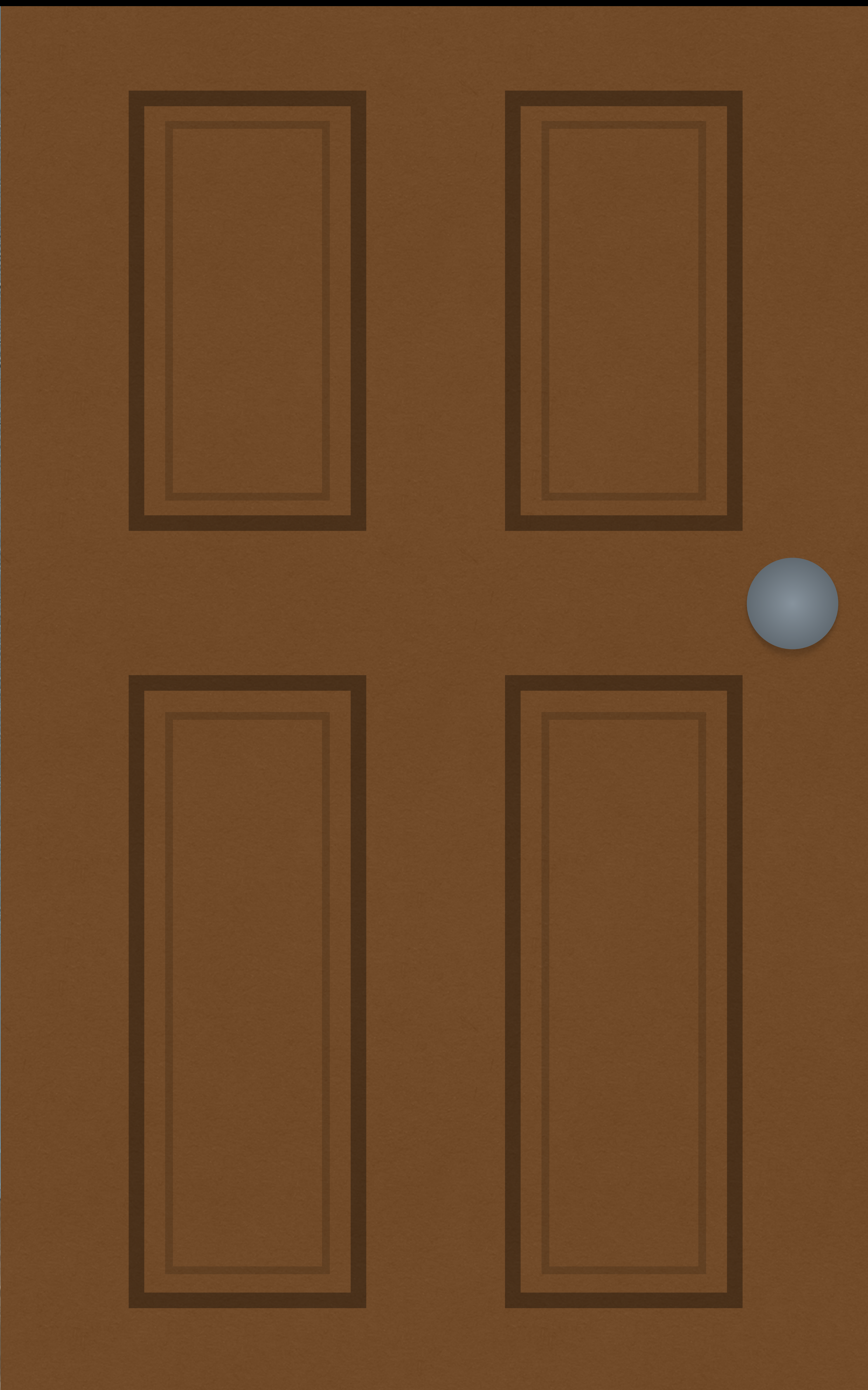
#WWDC19

Designing for Privacy

Mark Xue, Privacy Engineer

Julien Freudiger, Privacy Engineer













“We at Apple can — and do — provide the very best to our users while treating their most personal data like the precious cargo that it is.”

Tim Cook
IDPPC Keynote, 2018

“And if we can do it, then everyone can do it.”

Tim Cook
IDPPC Keynote, 2018

Data Minimization

On Device Intelligence

Transparency and Control

Apple's Privacy Principles

Security

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Security

Privacy and user experience

What's new in frameworks

Privacy updates

Solving privacy challenges

Privacy and user experience

What's new in frameworks

Privacy updates

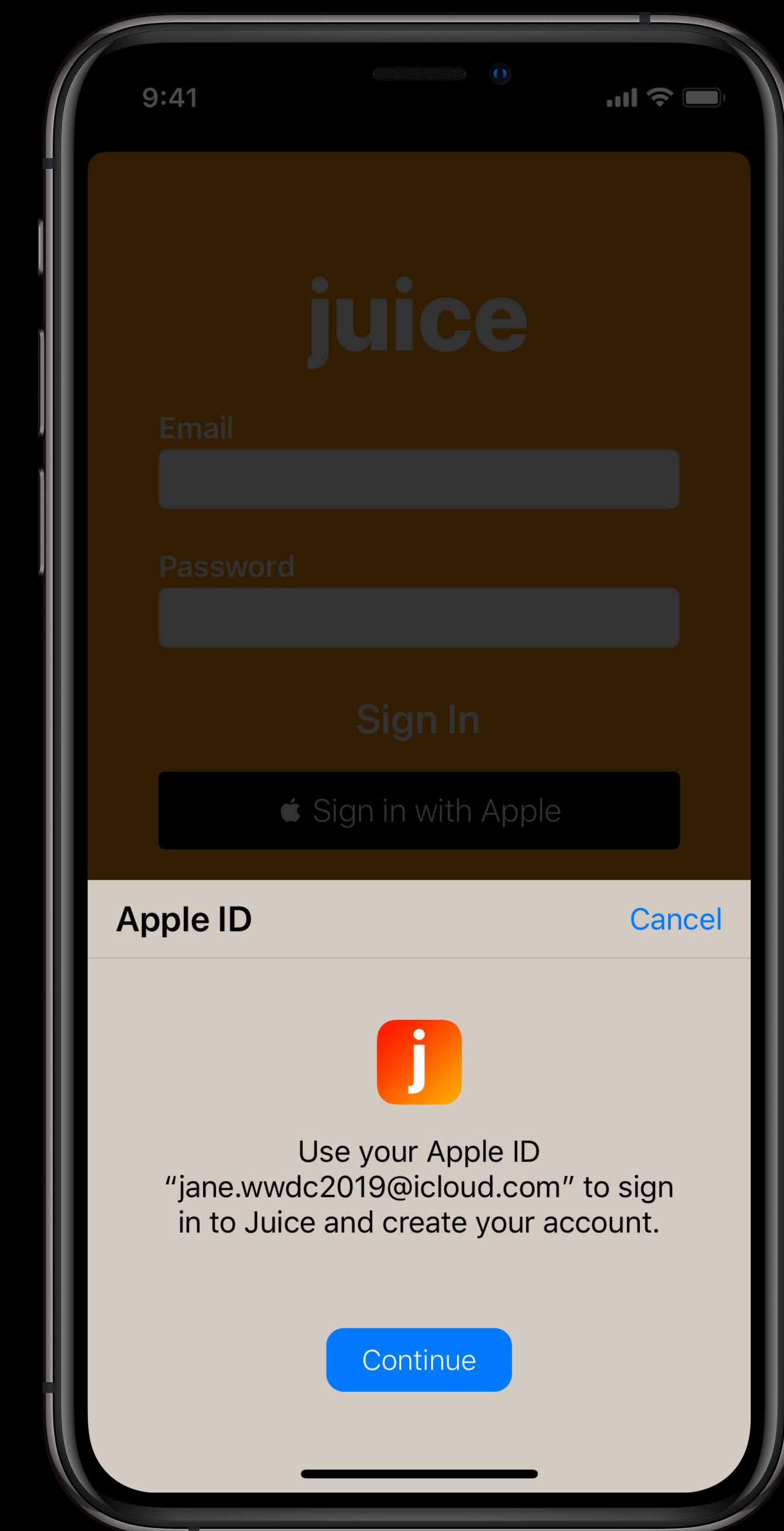
Solving privacy challenges

Sign In with Apple

Sign In with Apple

Apple doesn't track usage of your app

Only ask for name and email if you need it



dany-4ever@outlook.com

spamvortex@yahoo.com

drogonthegreat1@gmail.com

snowdontknow@yahoo.com

ghostrulez13@gmail.com

jane.appleseed@icloud.com

Sign In with Apple

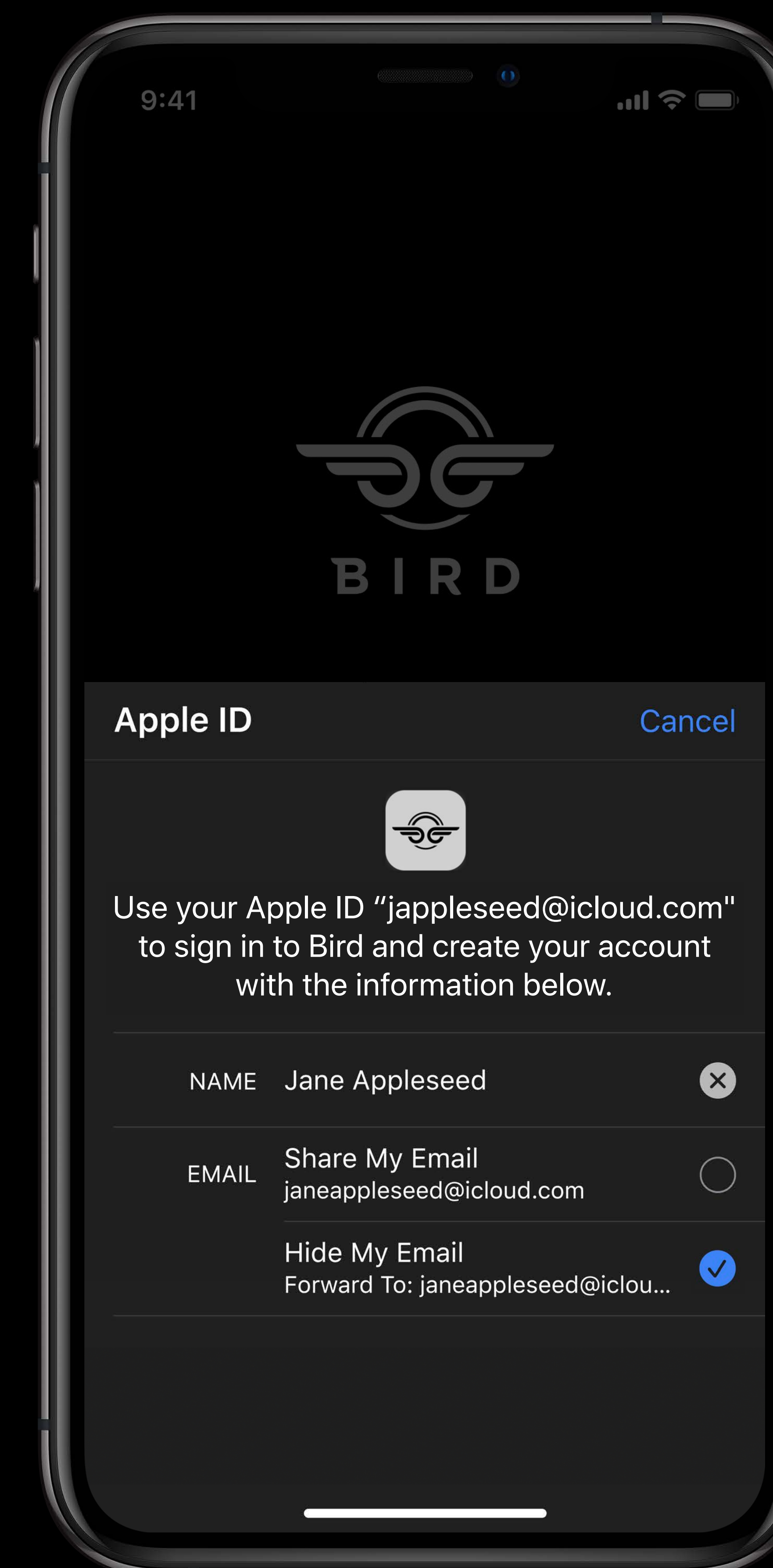
Hide my email

Contact the user at an email associated with their AppleID

Apple doesn't retain emails after delivery

Team ID scoped email address

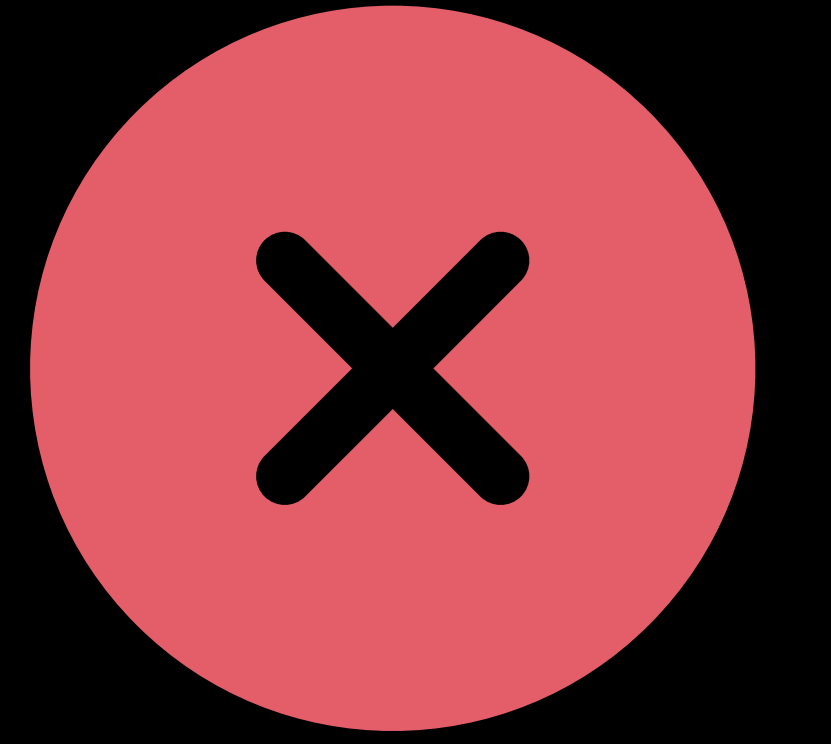
Whitelist of incoming domains or addresses



Fraud Detection



Fraud Detection



People Results

Name
Jane Appleseed

DOB
April 1, 1976

Contact
johnny@apple.com

Relatives
Steve Jobs, Craig Federighi

[View More](#)

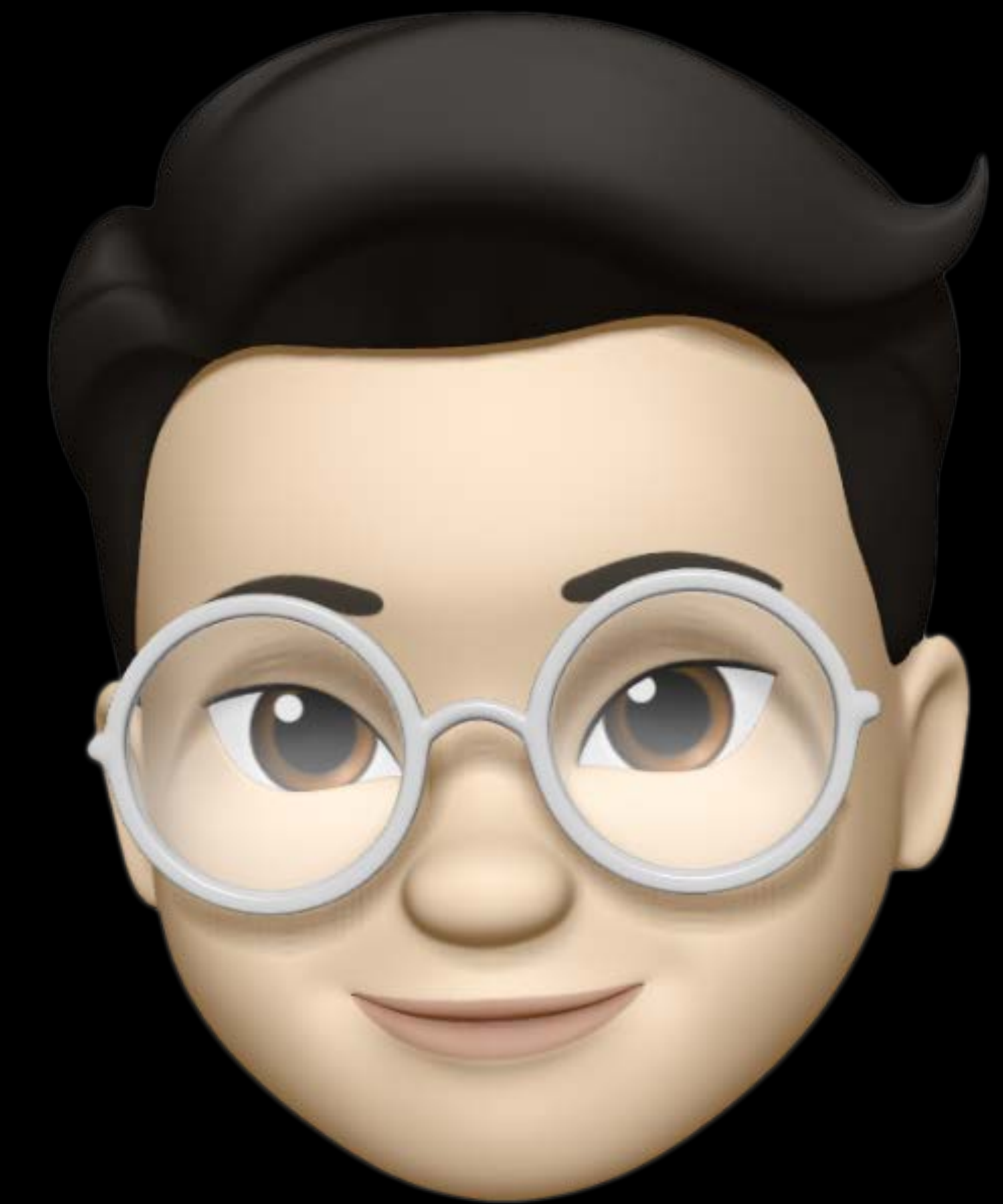
Sign In with Apple

Real user detection

NEW

Uses on-device intelligence

Supported on iOS at account creation



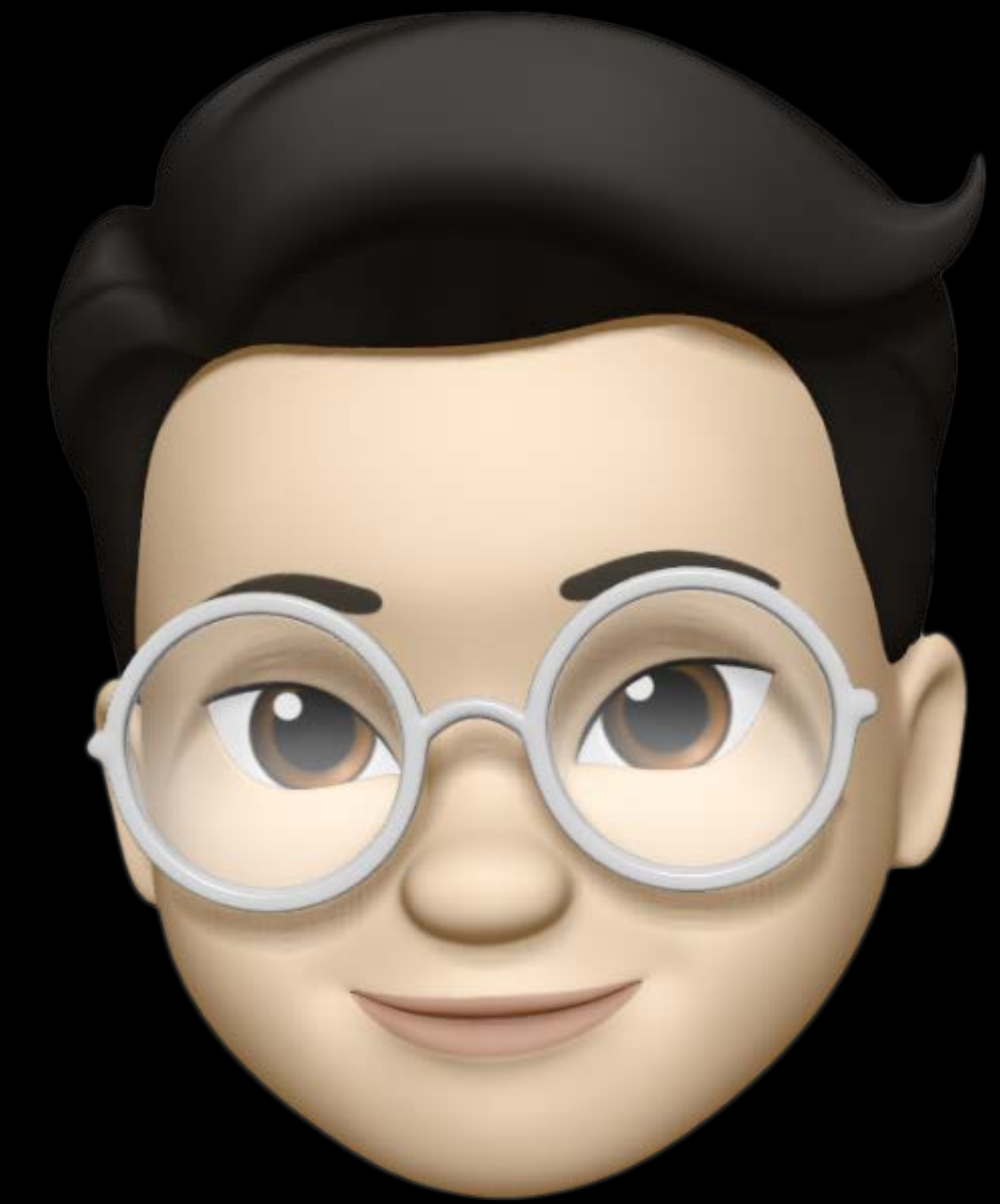
Sign In with Apple

Real user detection

NEW

Uses on-device intelligence

Supported on iOS at account creation



Sign In with Apple

Real user detection

NEW

```
func authorizationController(controller _:ASAAuthorizationController,  
                             didCompleteWithAuthorization authorization:ASAAuthorization){  
    if let credential = authorization.credential as? ASAAuthorizationAppleIDCredential {  
        let realUserStatus = credential.realUserStatus  
        switch realUserStatus {  
        case .unsupported:  
            ...  
        case .unknown:  
            ...  
        case .likelyReal:  
            ...  
        }  
    }  
}
```

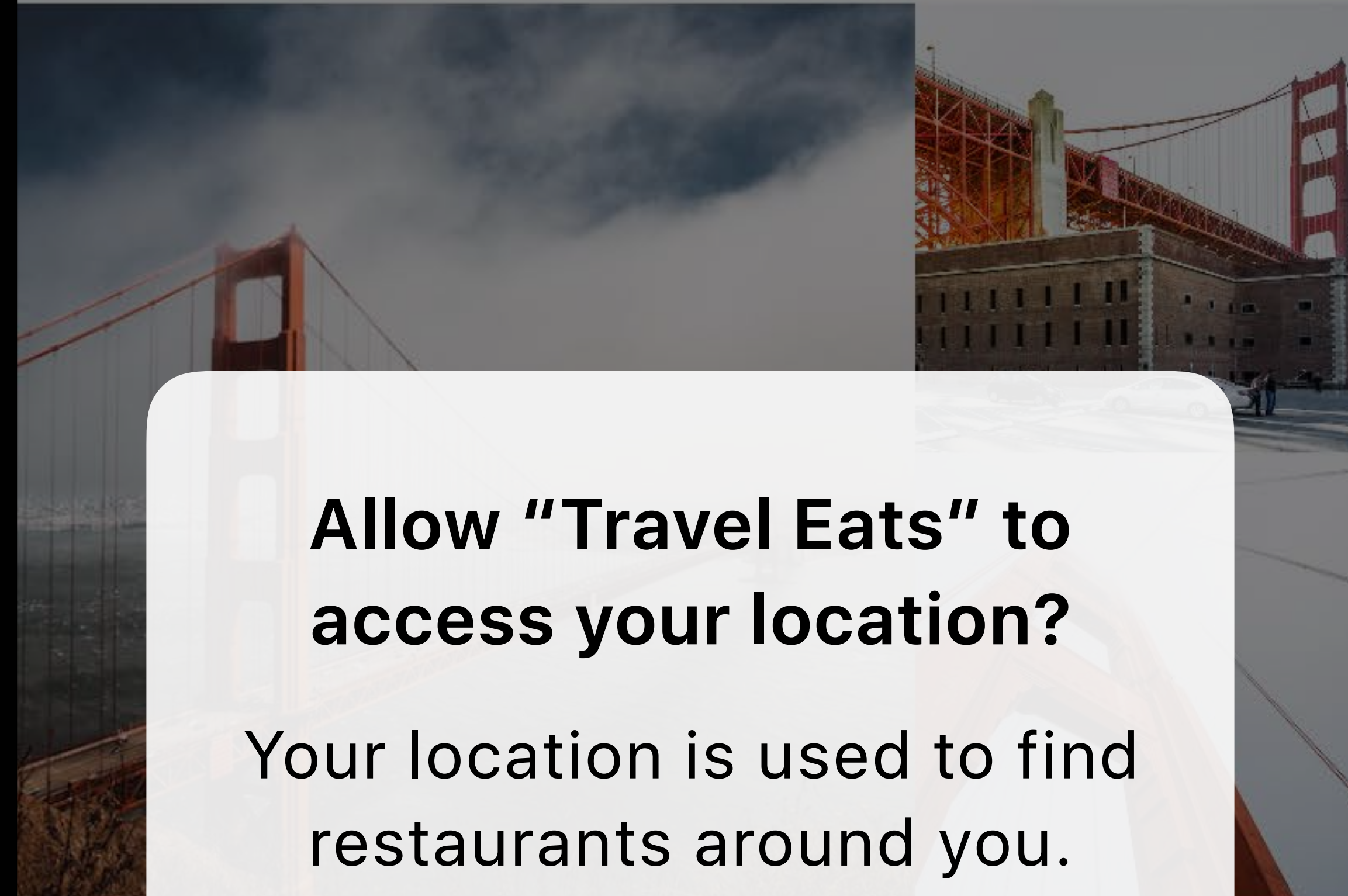


Location

9:41



Golden Gate Bridge



Allow "Travel Eats" to access your location?

Your location is used to find restaurants around you.

Only While Using the App

Always Allow

Don't Allow

The Golden Gate Bridge is a suspension bridge that spans the Golden Gate strait.

Hours
Every Day Open 24 hours

Golden Gate Bridge

Golden Gate

Lincoln Blvd

Mason St

Graham St

Presidio of San Francisco

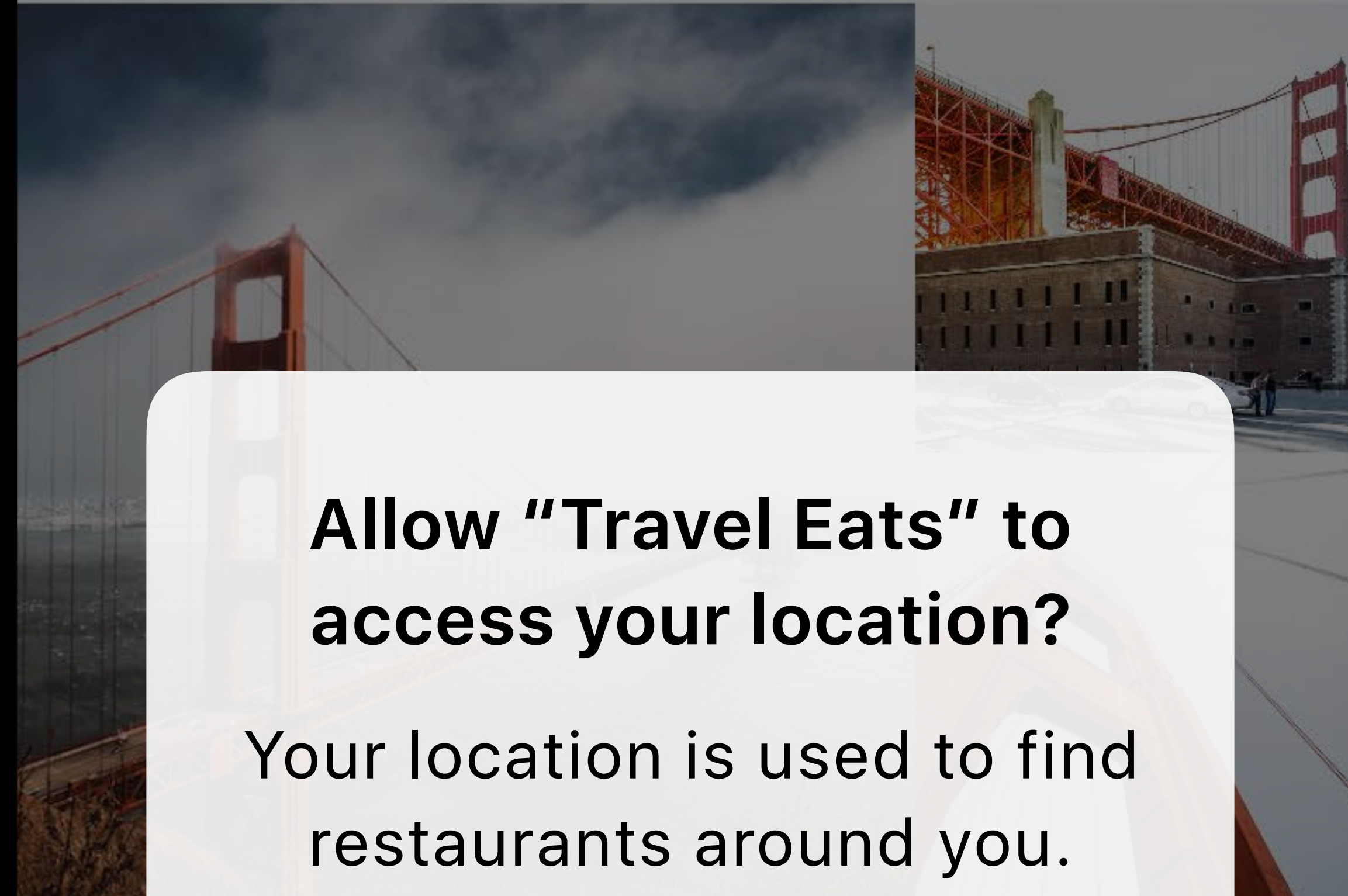
Legal

FINE

9:41



Golden Gate Bridge



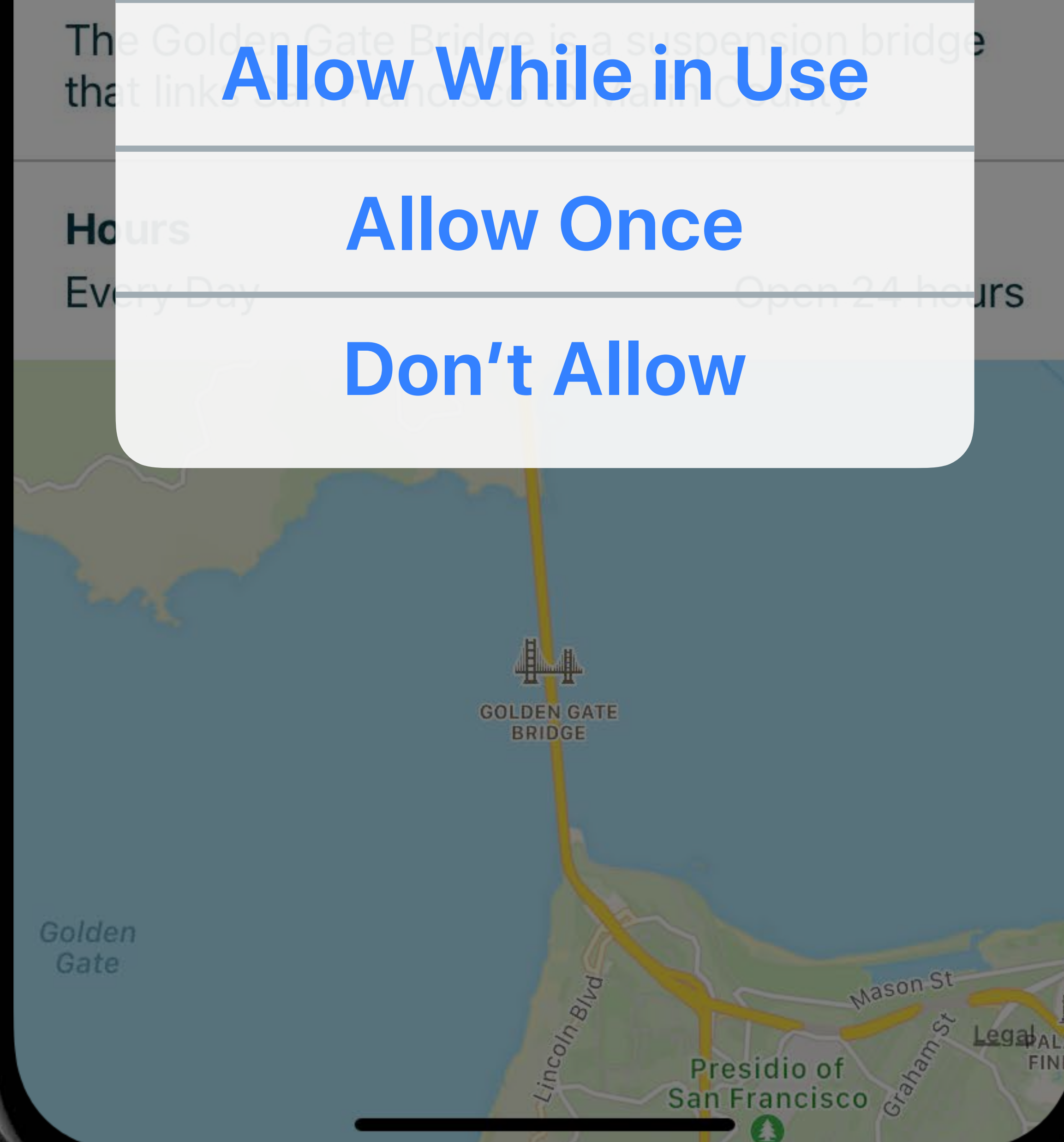
**Allow "Travel Eats" to
access your location?**

Your location is used to find
restaurants around you.

Allow While in Use

Allow Once

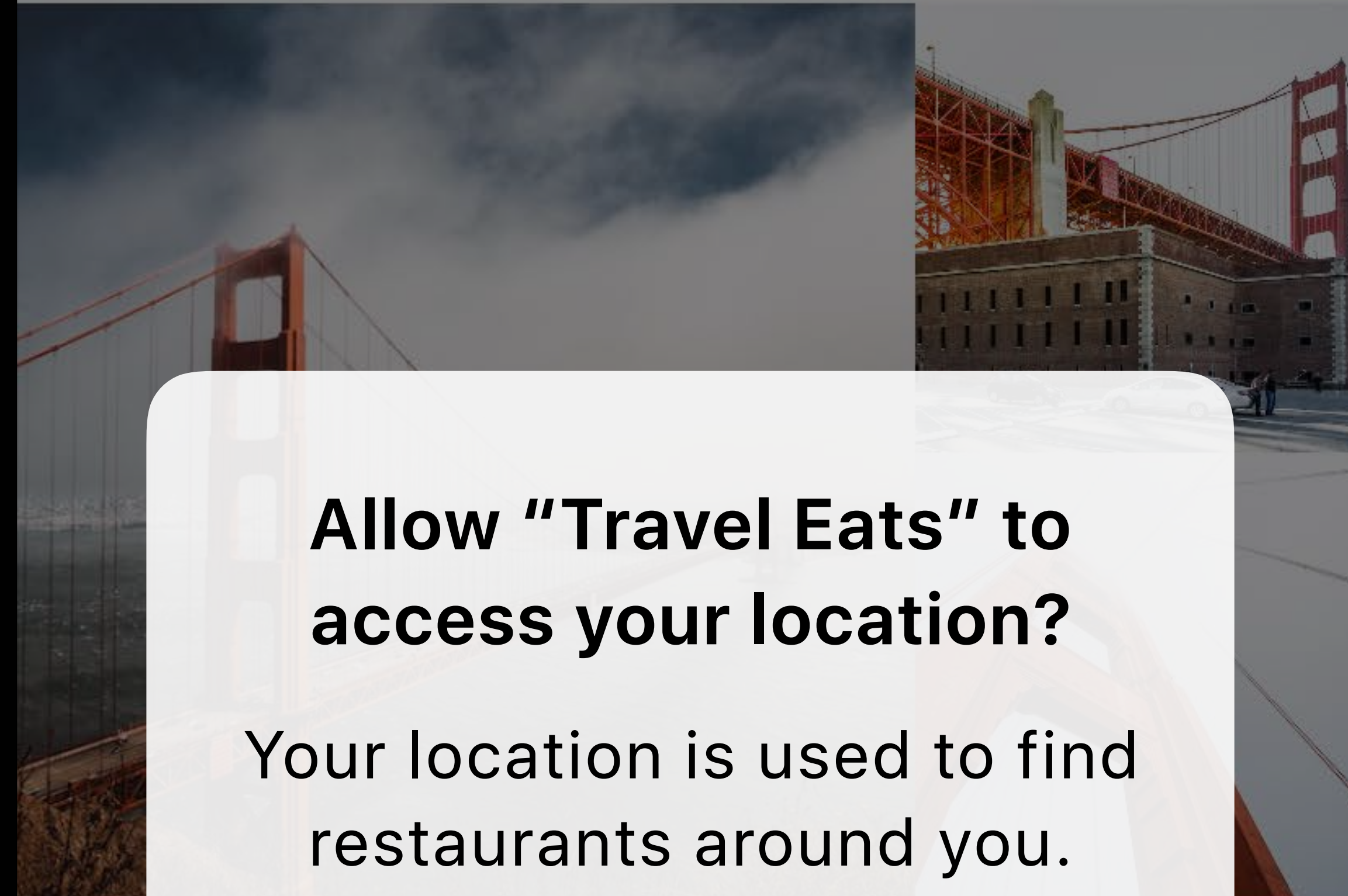
Don't Allow



9:41



Golden Gate Bridge



**Allow "Travel Eats" to
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Your location is used to find
restaurants around you.

Allow While in Use

Allow Once

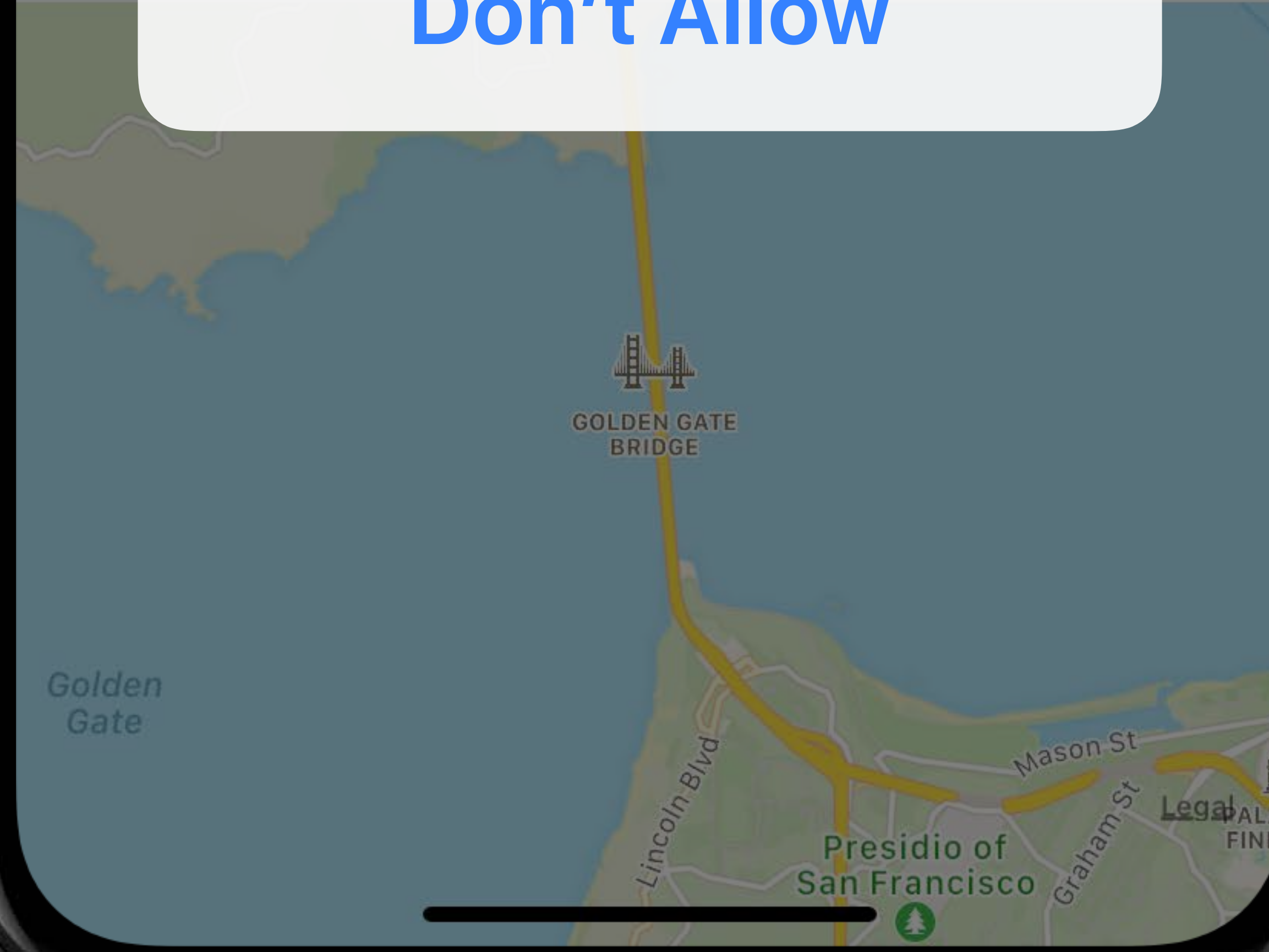
Don't Allow

The Golden Gate Bridge is a suspension bridge
that links the city of San Francisco, California, to the

Hours

Every Day

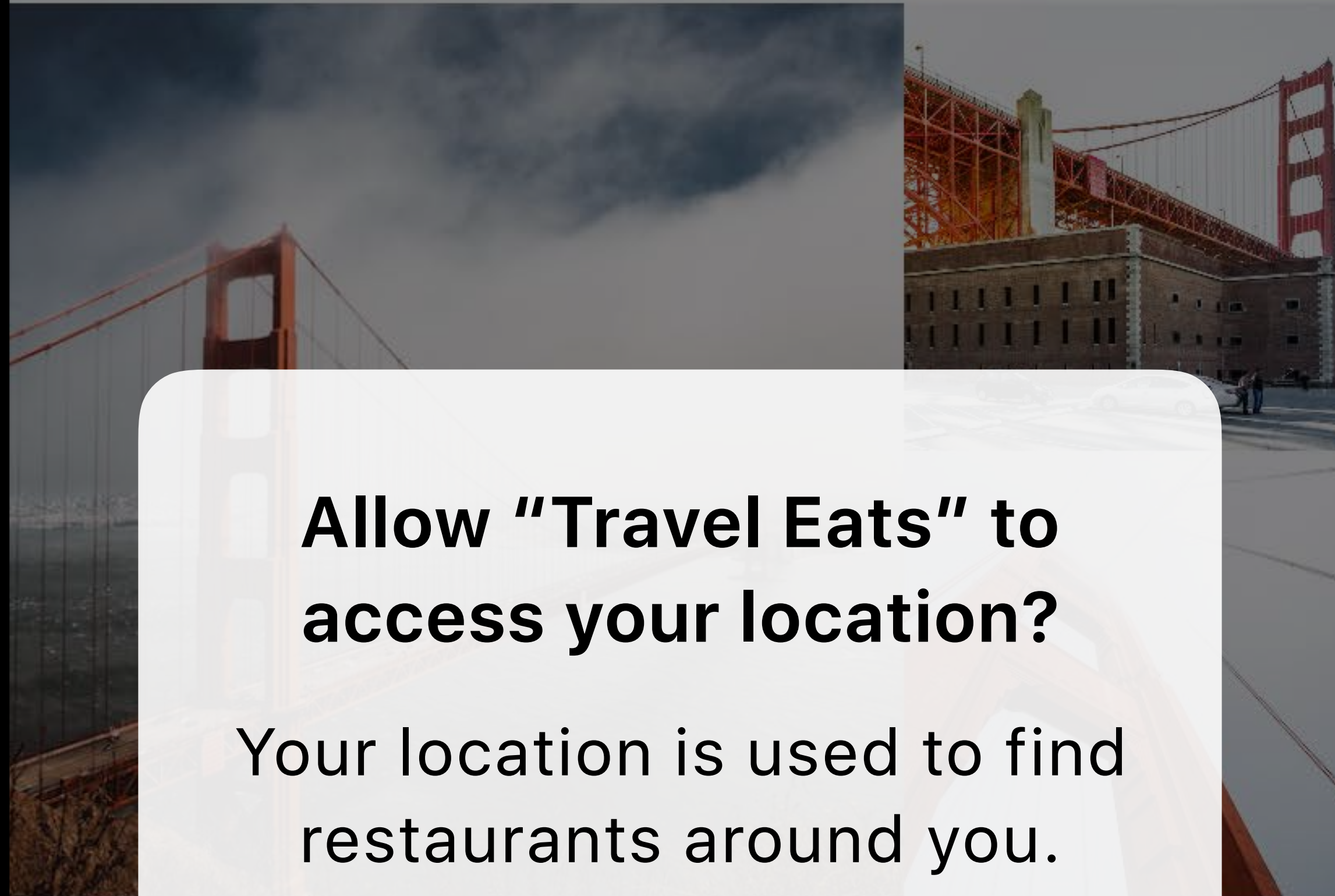
Open 24 hours



9:41



Golden Gate Bridge



**Allow "Travel Eats" to
access your location?**

Your location is used to find
restaurants around you.

Allow While in Use

Allow Once

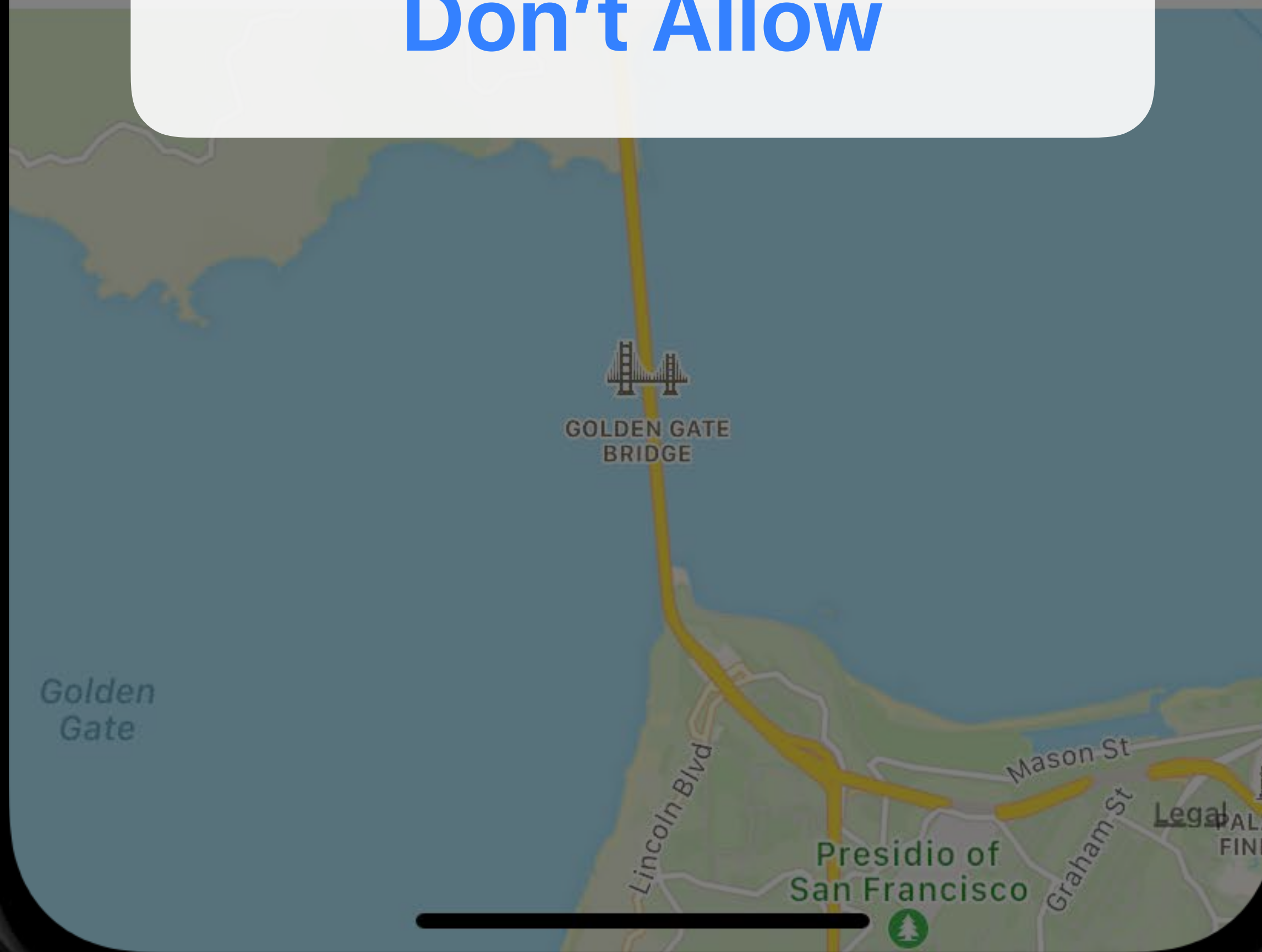
Don't Allow

The Golden Gate Bridge is a suspension bridge
that links the San Francisco Peninsula to the

Hours

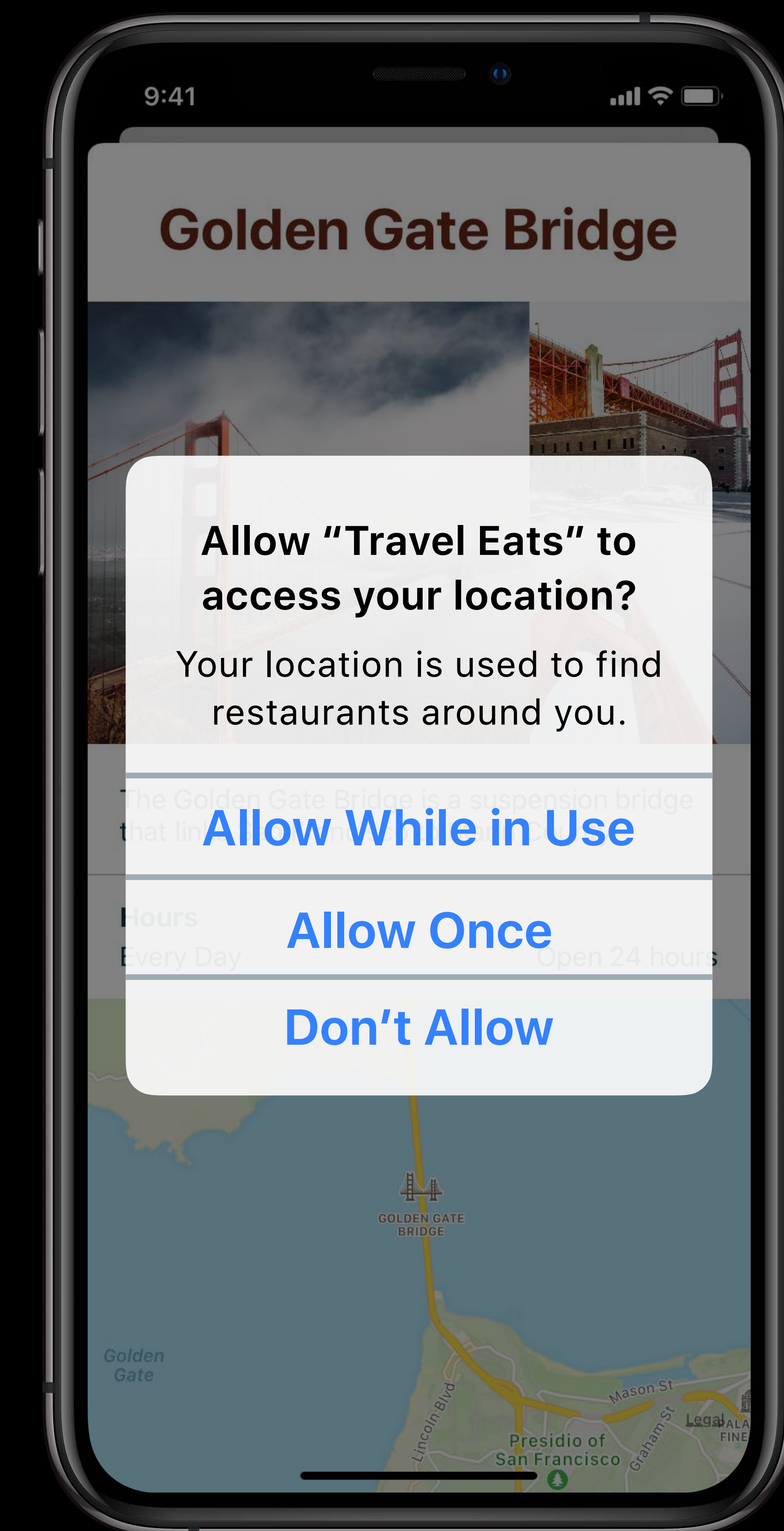
Every Day

Open 24 hours



Location Permissions

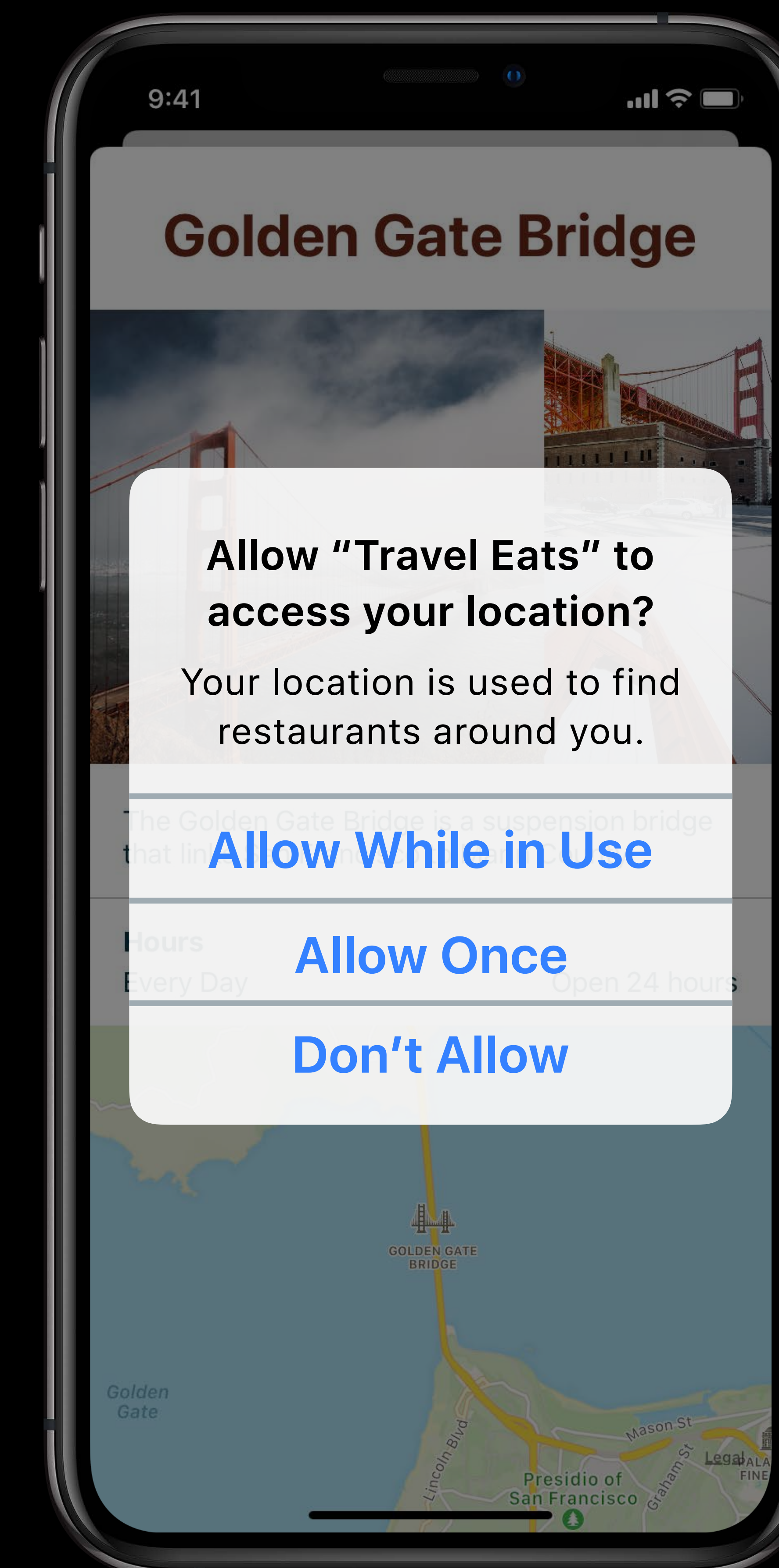
Deferred Always



Location Permissions

Deferred Always

In-app prompt for "Allow Once" or "While in Use"

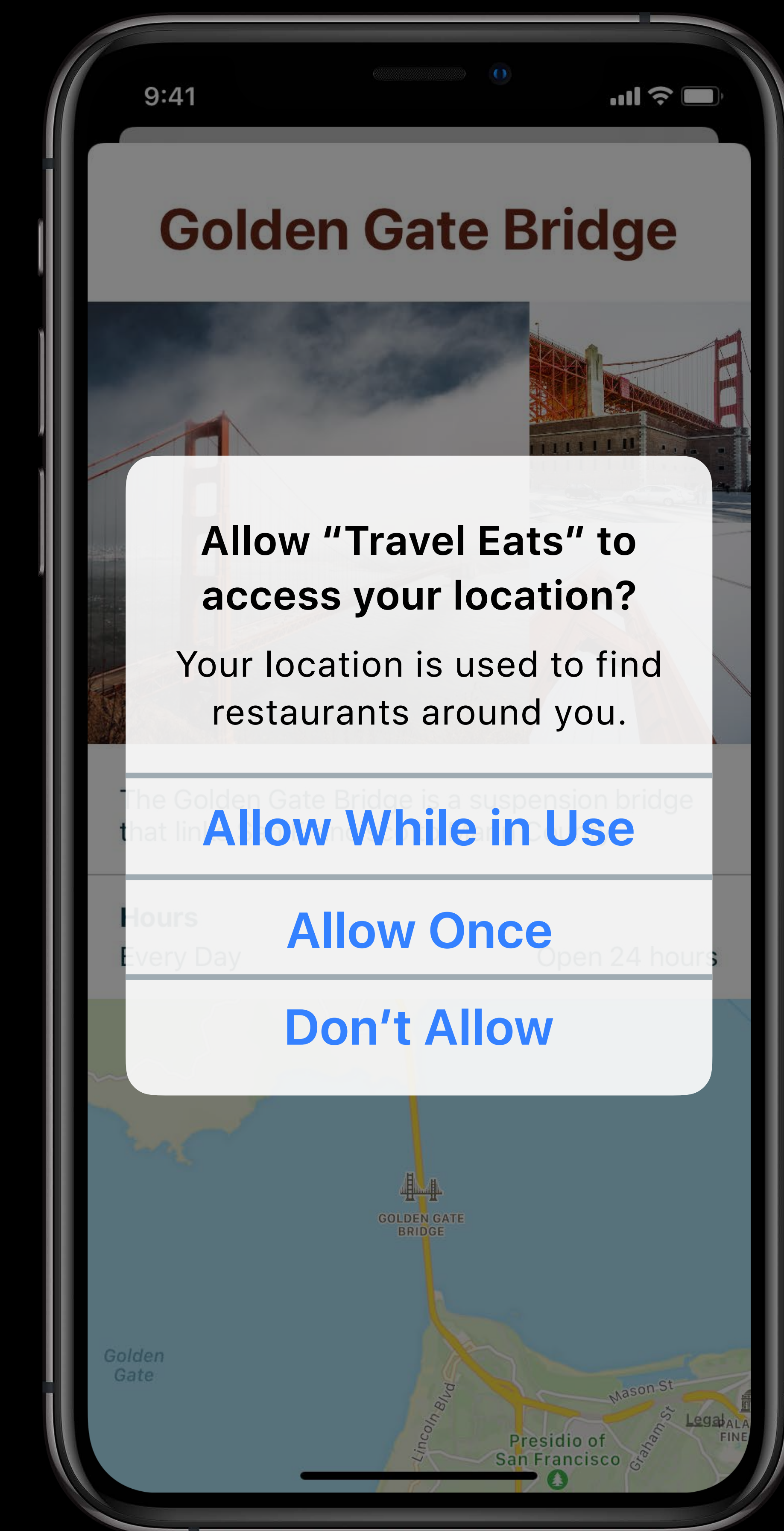


Location Permissions

Deferred Always

In-app prompt for "Allow Once" or "While in Use"

iOS generates "Always" events for your app



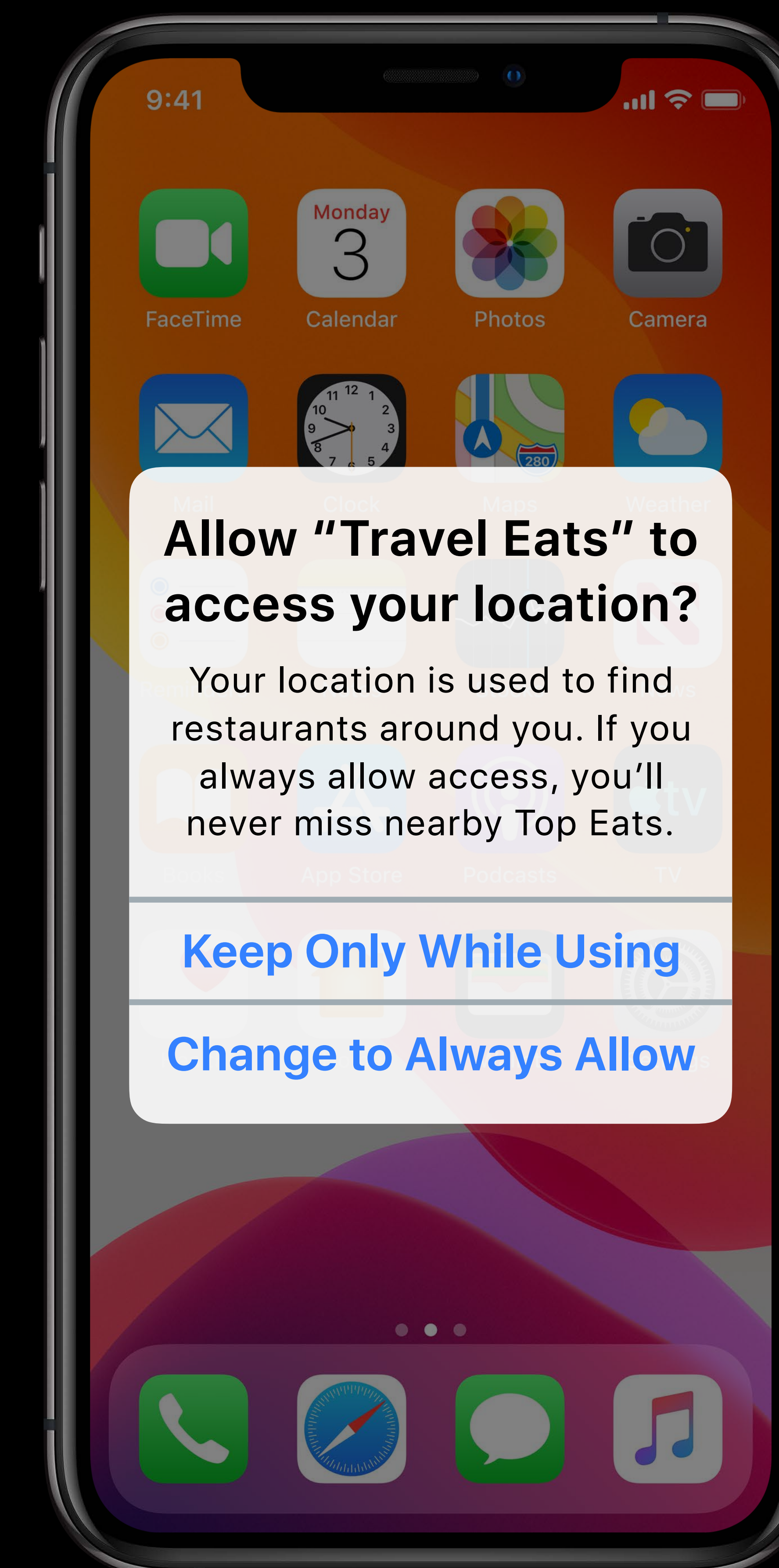
Location Permissions

Deferred Always

In-app prompt for "Allow Once" or "While in Use"

iOS generates "Always" events for your app

"Always" prompt deferred until delivery of first "Always" event

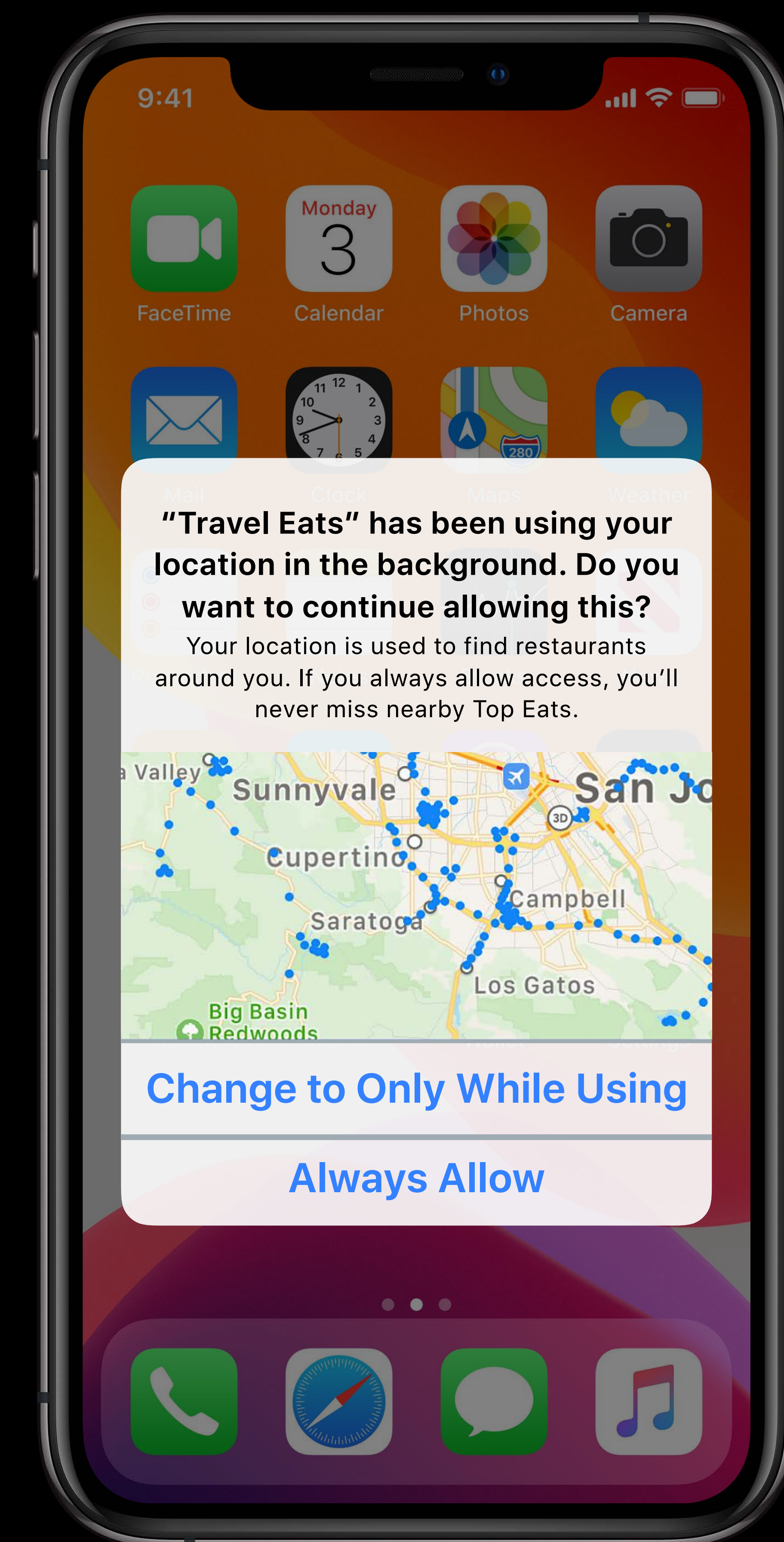


Location Permissions

Always Reminder

Periodic reminders

Once on upgrade to iOS 13



Location Permissions

No compatibility breaking API changes

Test for “Allow Once” and “Always” behaviors

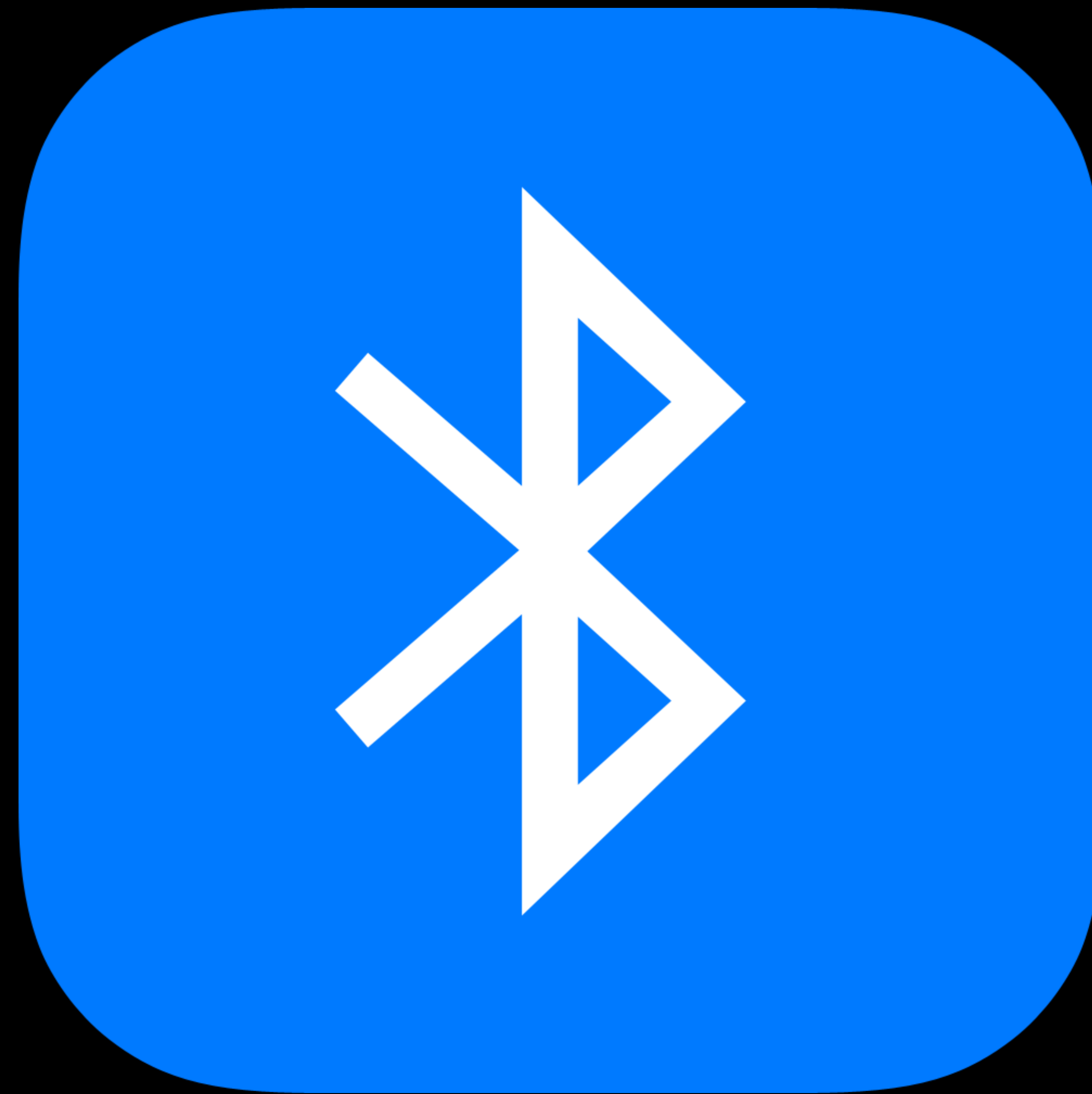
Ensure your use of “Always” provides clear user value

What’s New in Core Location

WWDC App

Core Location Lab

Friday, 1:00



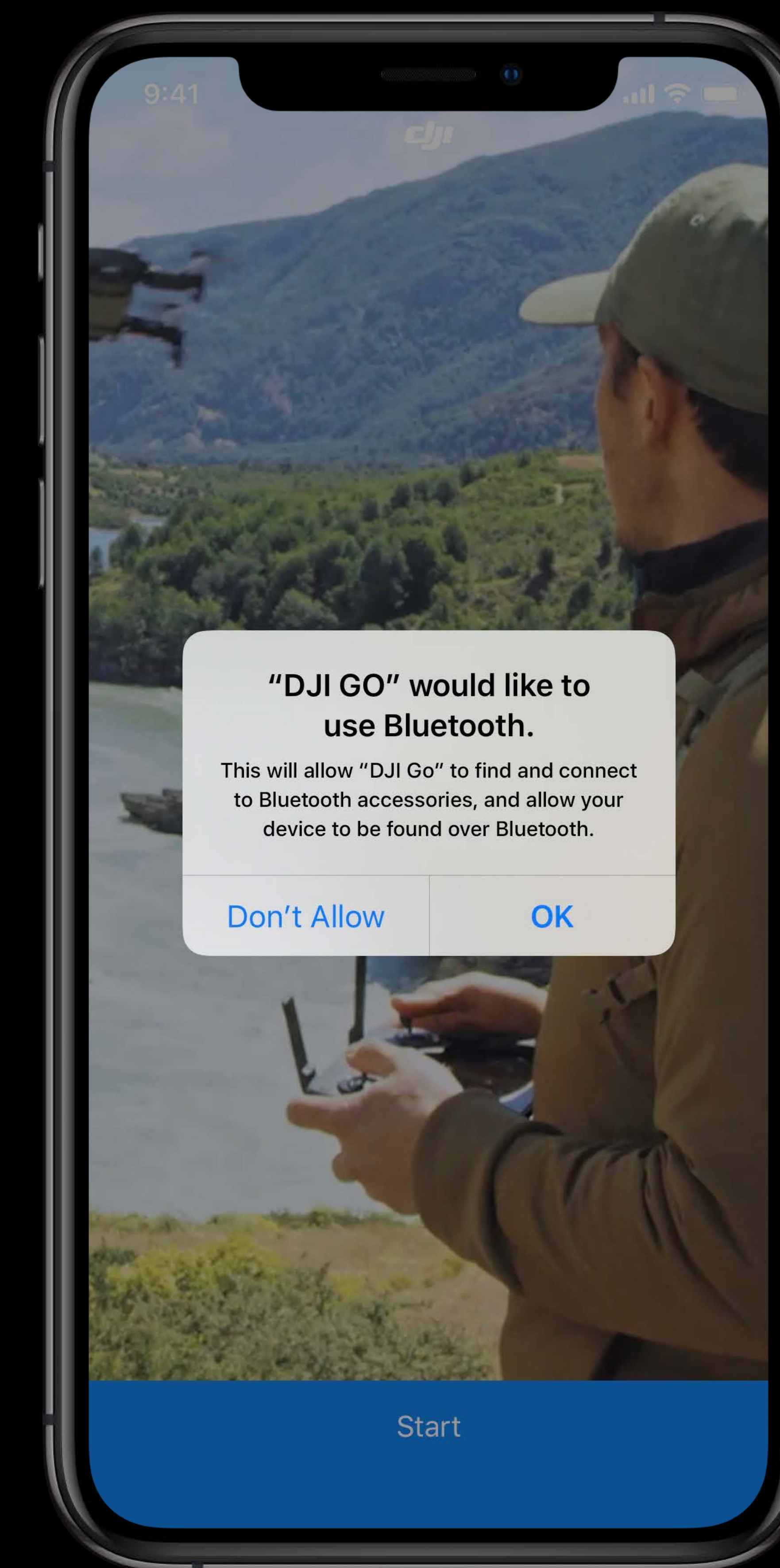
Bluetooth

Changes to Bluetooth Permissions

User consent required for all CoreBluetooth API's

Applies to apps linked with any SDK

`NSBluetoothAlwaysUsageDescription`
in Info.Plist



```
// Changes to Bluetooth Permissions

import CoreBluetooth
let centralManager = CBCentralManager(delegate: self, options:nil)
//iOS will now prompt the user for access to bluetooth
...
func centralManagerDidUpdateState(_ central: CBCentralManager) {
    let authorizationStatus = central.authorization
    switch authorizationStatus {
        case .notDetermined:
            ...
        case .restricted:
            ...
        case .denied:
            ...
        case .allowedAlways:
            ...
    }
}
```

```
// Changes to Bluetooth Permissions
```

```
import CoreBluetooth
```

```
let centralManager = CBCentralManager(delegate: self, options:nil)
```

```
//iOS will now prompt the user for access to bluetooth
```

```
...  
func centralManagerDidUpdateState(_ central: CBCentralManager) {  
    let authorizationStatus = central.authorization  
    switch authorizationStatus {  
        case .notDetermined:  
            ...  
        case .restricted:  
            ...  
        case .denied:  
            ...  
        case .allowedAlways:  
            ...  
    }  
}
```

```
// Changes to Bluetooth Permissions

import CoreBluetooth
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func centralManagerDidUpdateState(_ central: CBCentralManager) {
    let authorizationStatus = central.authorization
    switch authorizationStatus {
        case .notDetermined:
            ...
        case .restricted:
            ...
        case .denied:
            ...
        case .allowedAlways:
            ...
    }
}
```

macOS Permissions

Access to data

Contacts

Calendars

Reminders

Photos

Full Disk Access

macOS Permissions

Access to data

Contacts

Calendars

Reminders

Photos

Full Disk Access

Desktop

Documents

Downloads

iCloud Drive

Third-party cloud storage

Network volumes

Removable volumes

macOS Permissions

Access to user activity

Camera

Microphone

macOS Permissions

Access to user activity

Camera

Microphone

Screen recording

Keyboard Input Monitoring

macOS Permissions

Automation

Synthetic Input Events

AppleEvents

Advances in macOS Security

WWDC App

Security Lab

Thursday, 2:00

Privacy and user experience

What's new in frameworks

Privacy updates

Solving privacy challenges

Intelligent Tracking Prevention

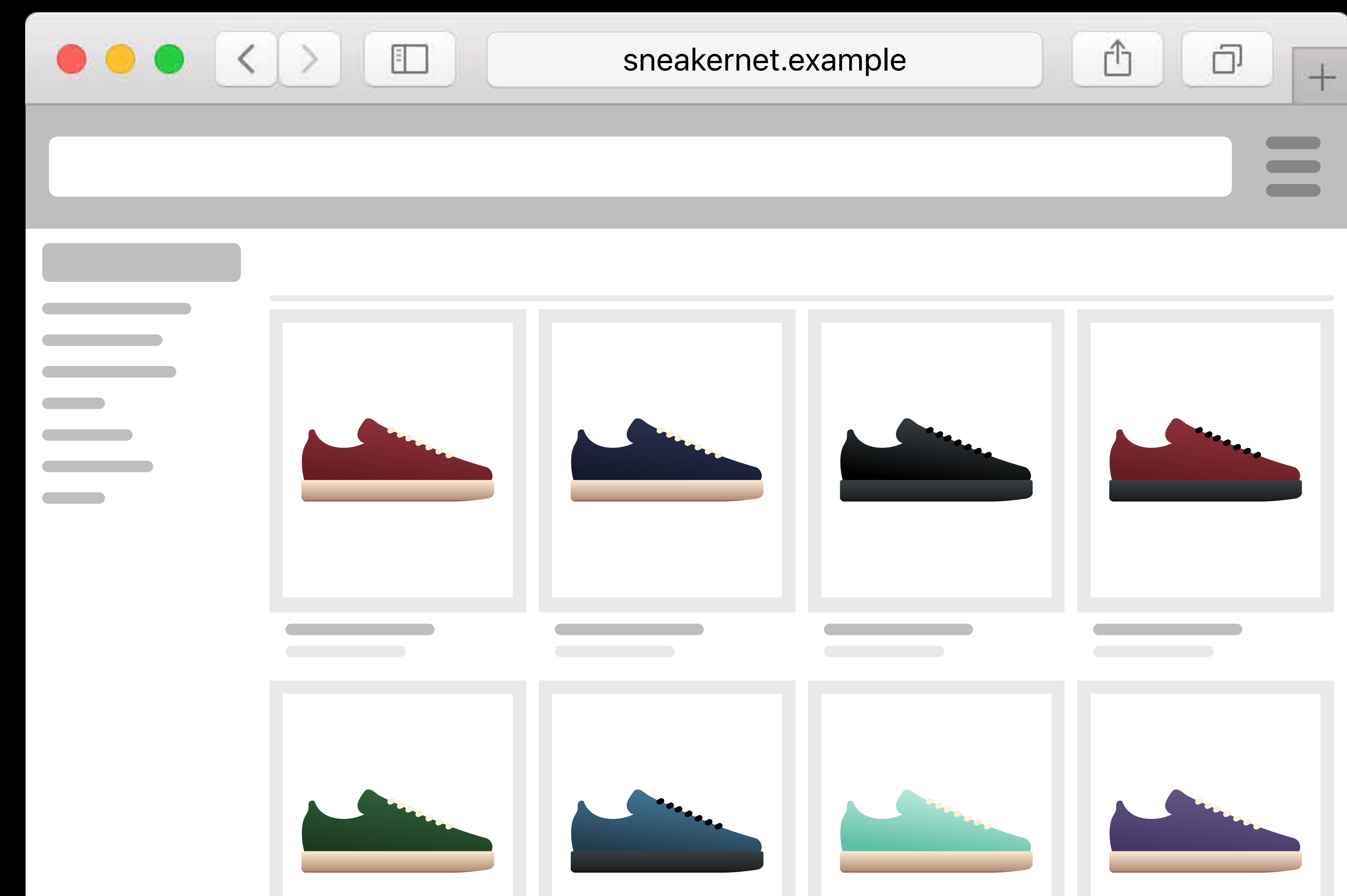
Privacy Preserving Ad Click Attribution

Measure ad campaign conversions

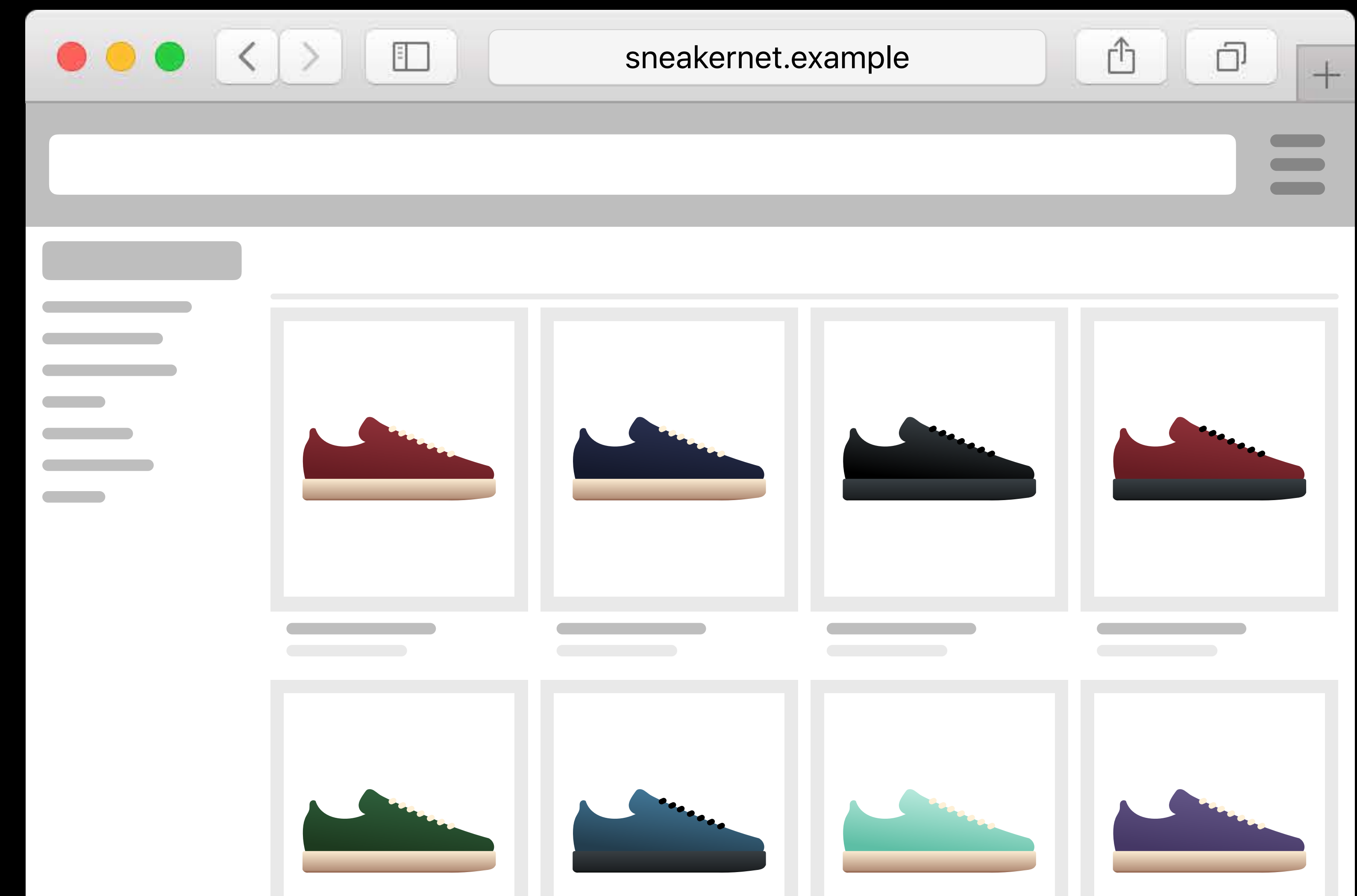
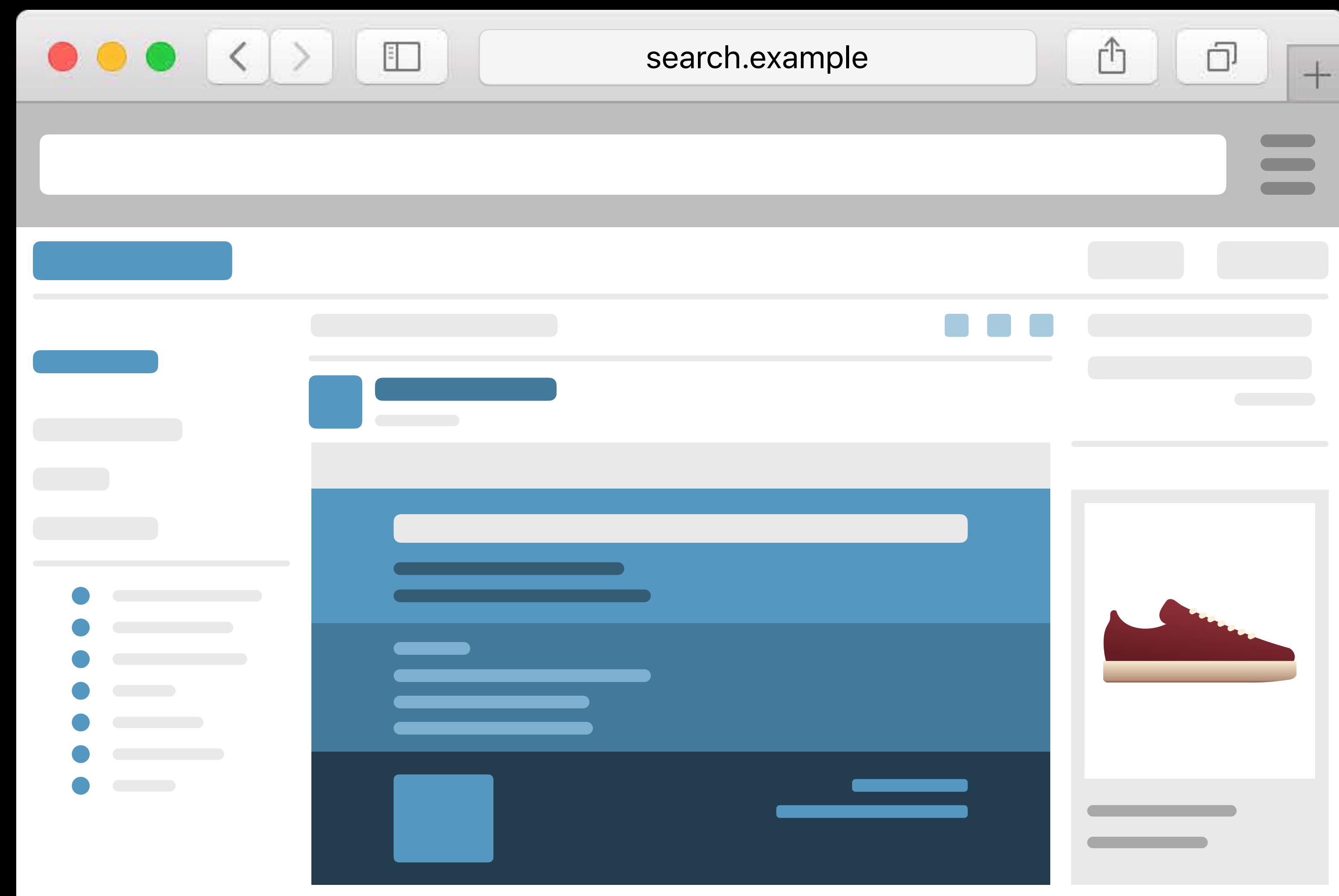
Without tracking individual users

Privacy Preserving Ad Click Attribution

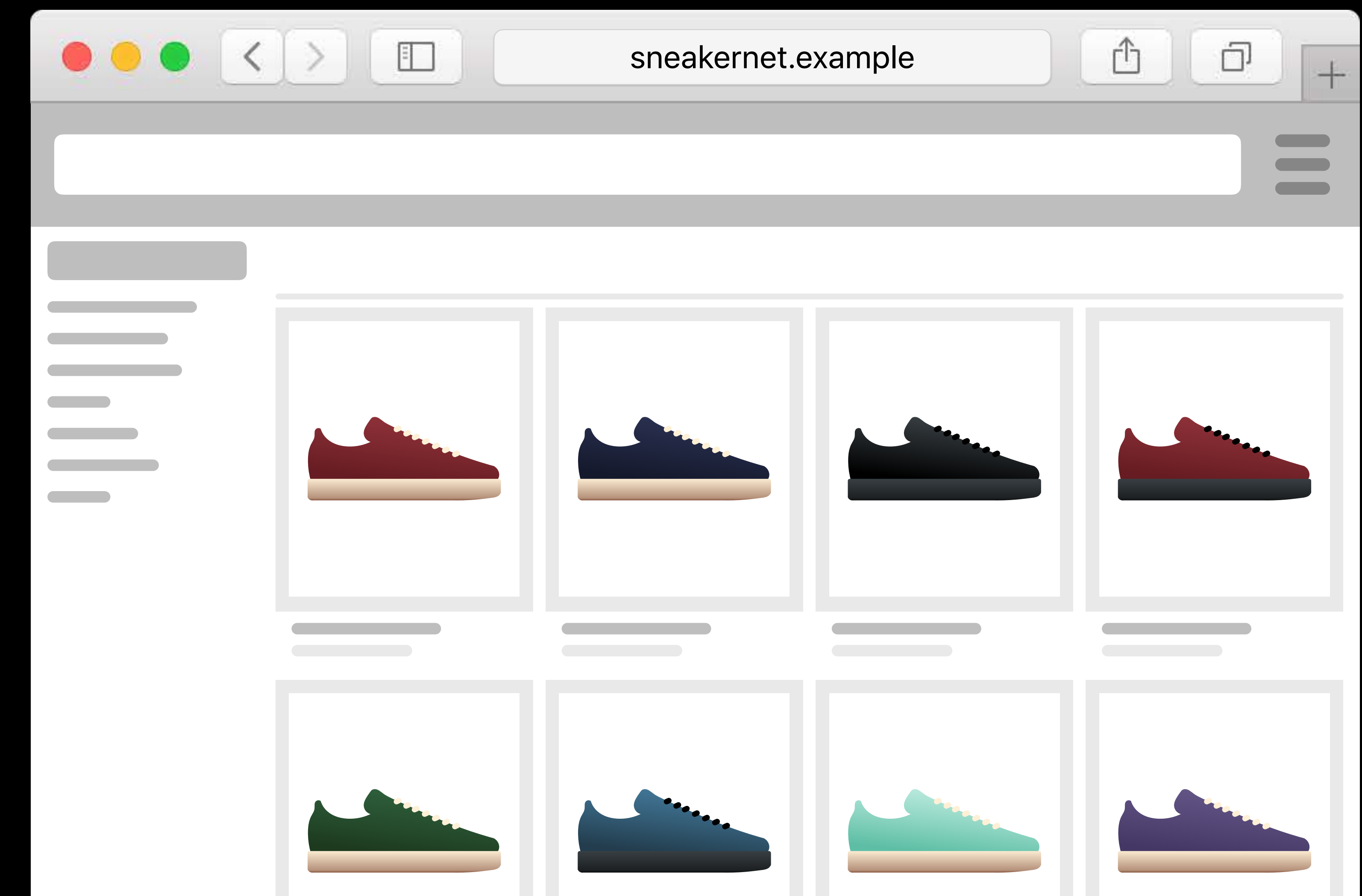
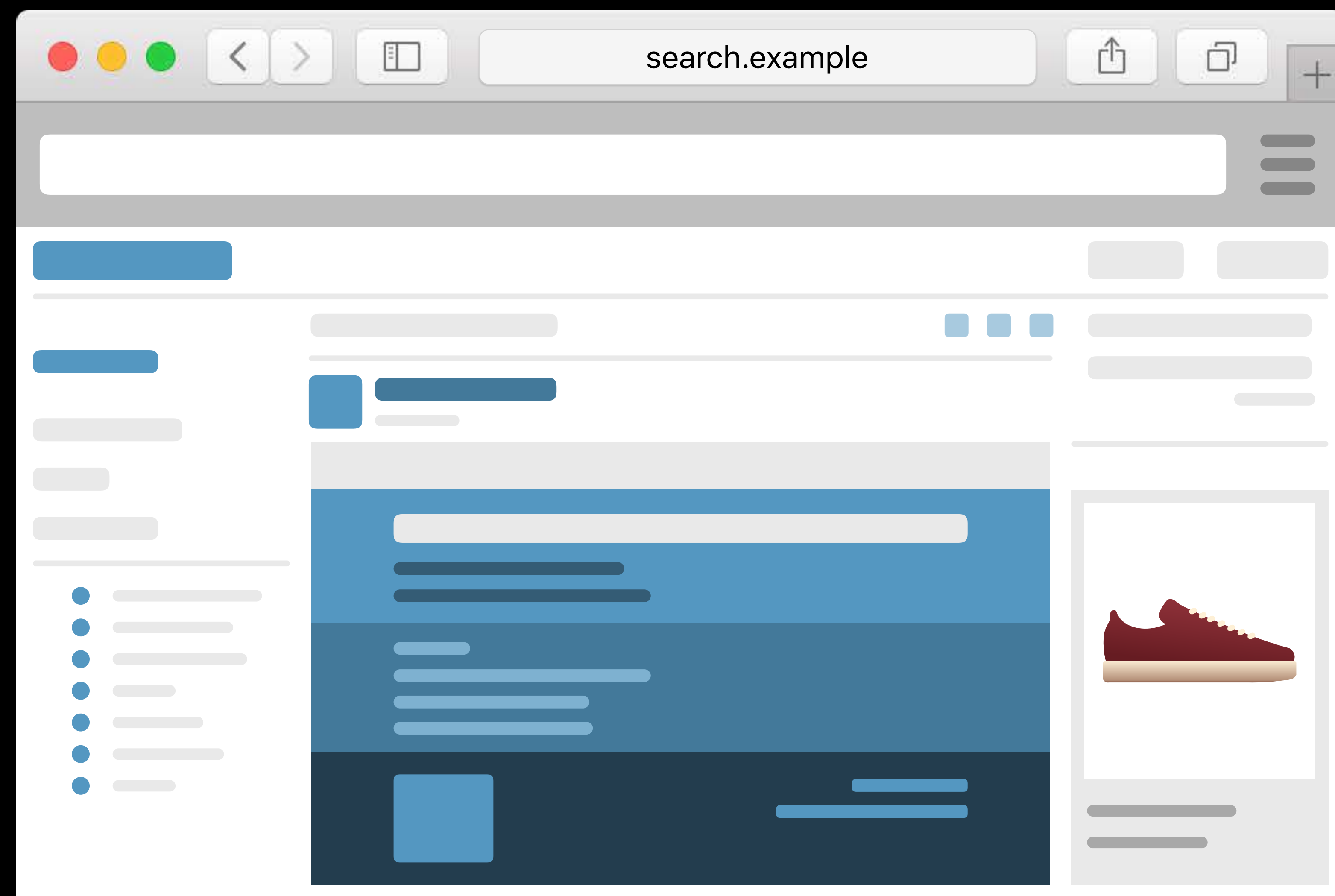
Privacy Preserving Ad Click Attribution



Privacy Preserving Ad Click Attribution

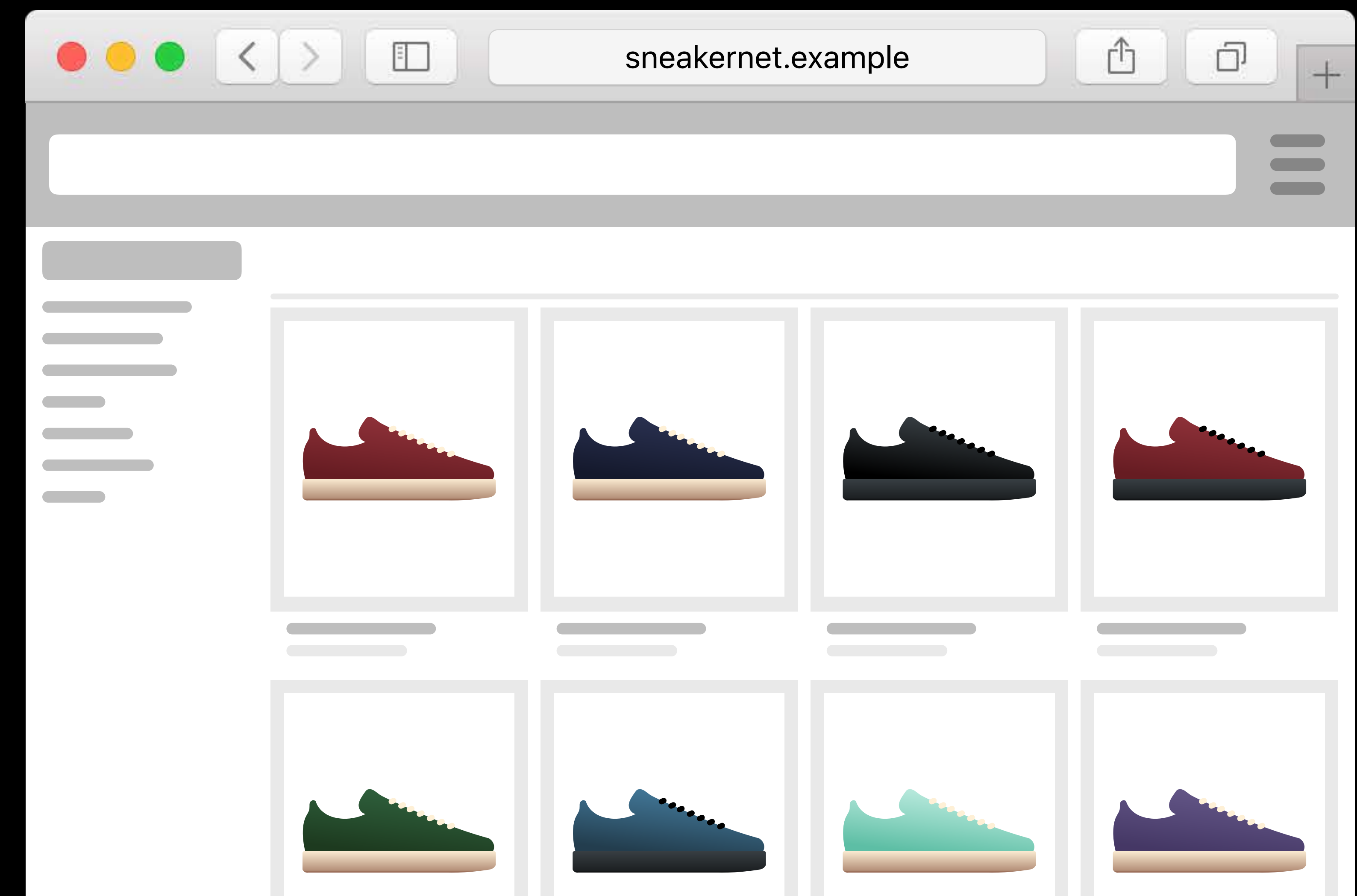
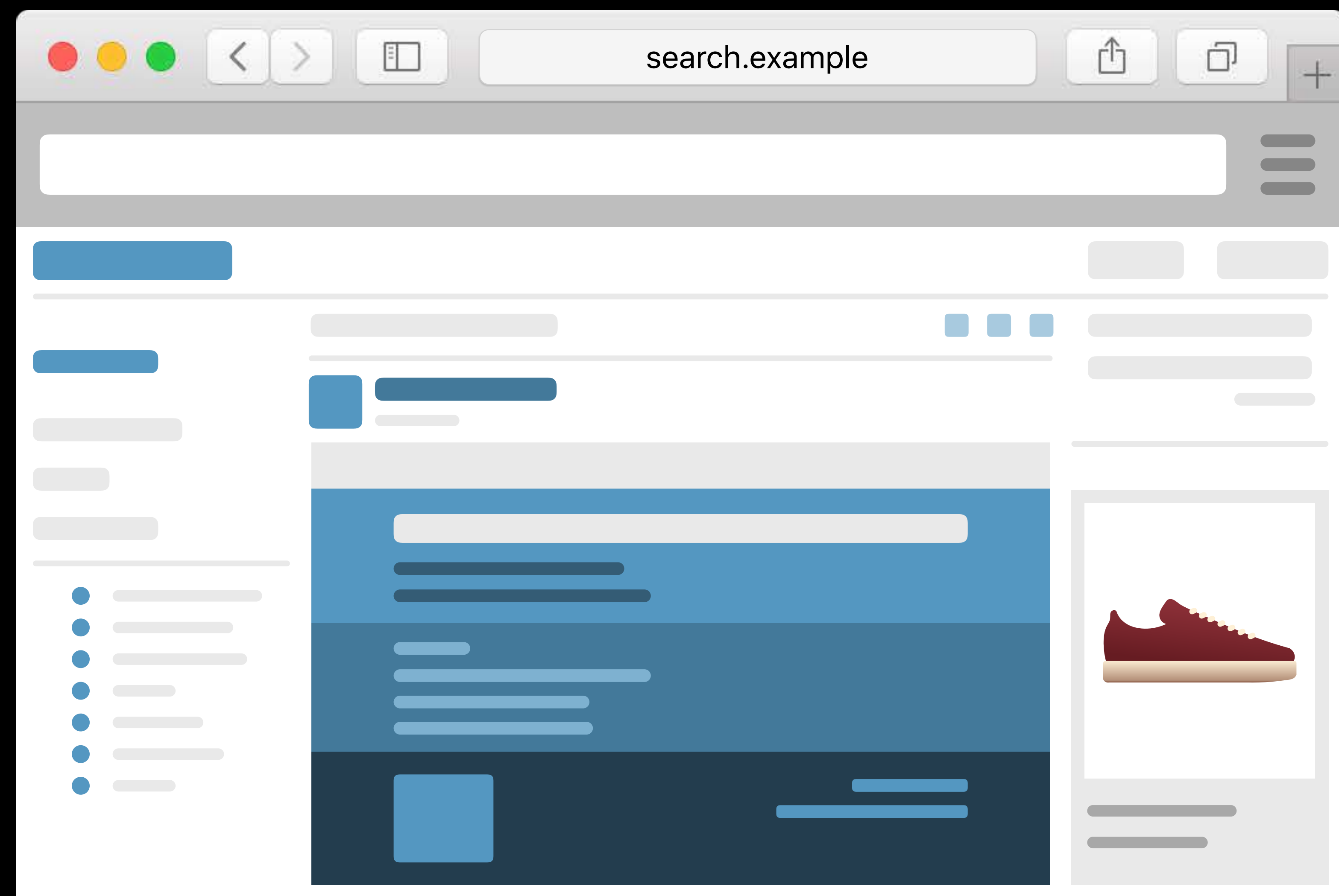


Privacy Preserving Ad Click Attribution



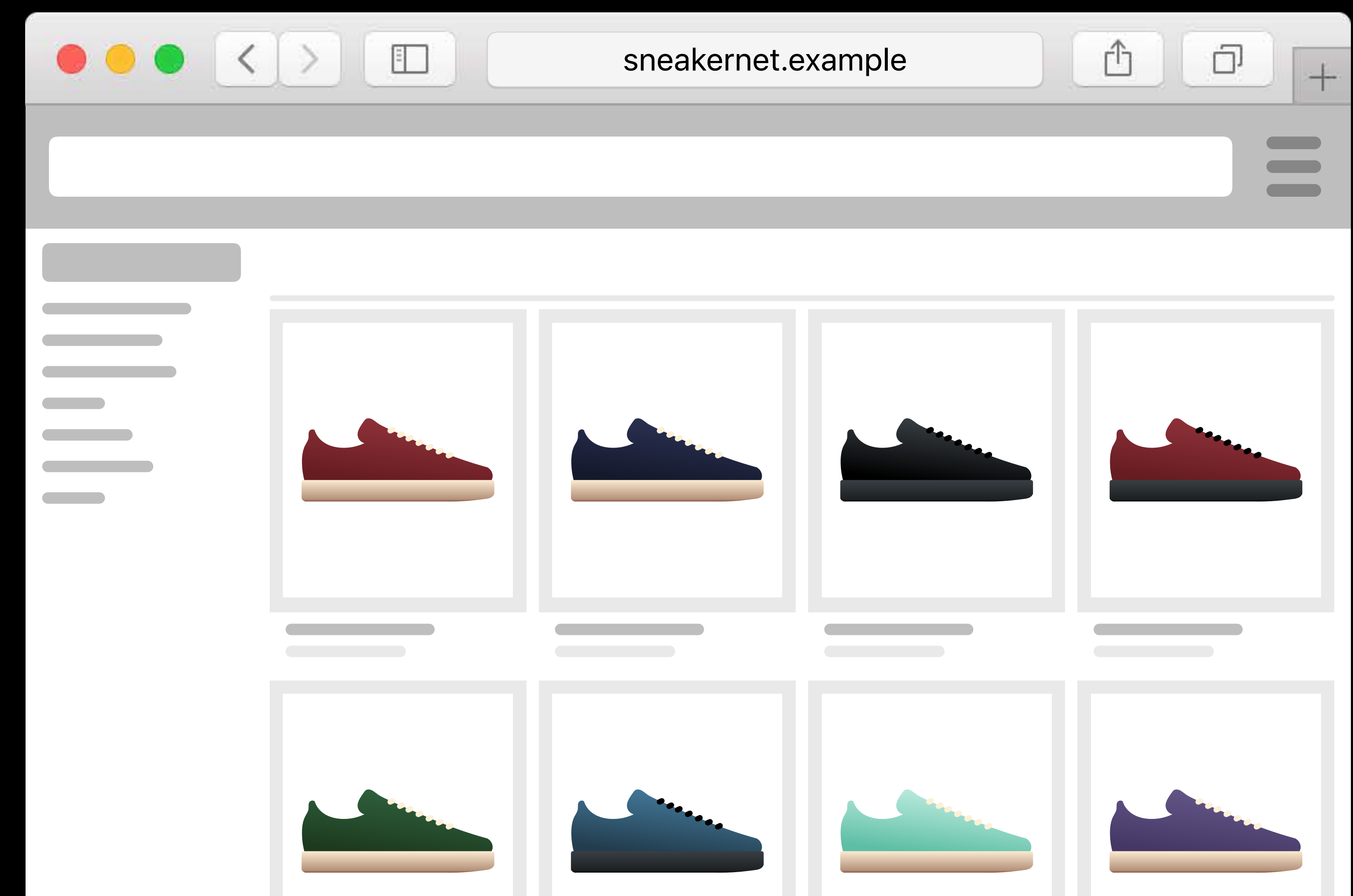
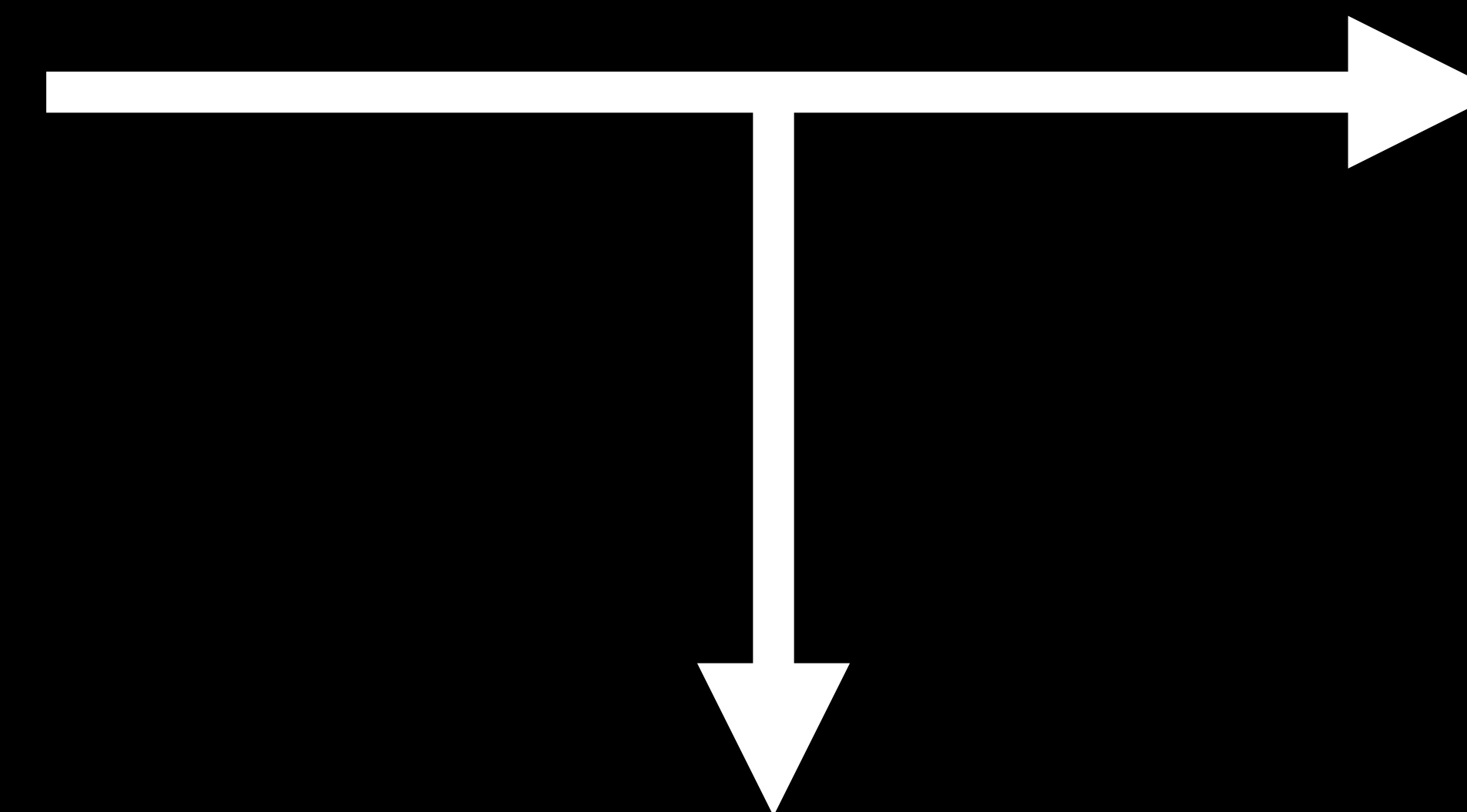
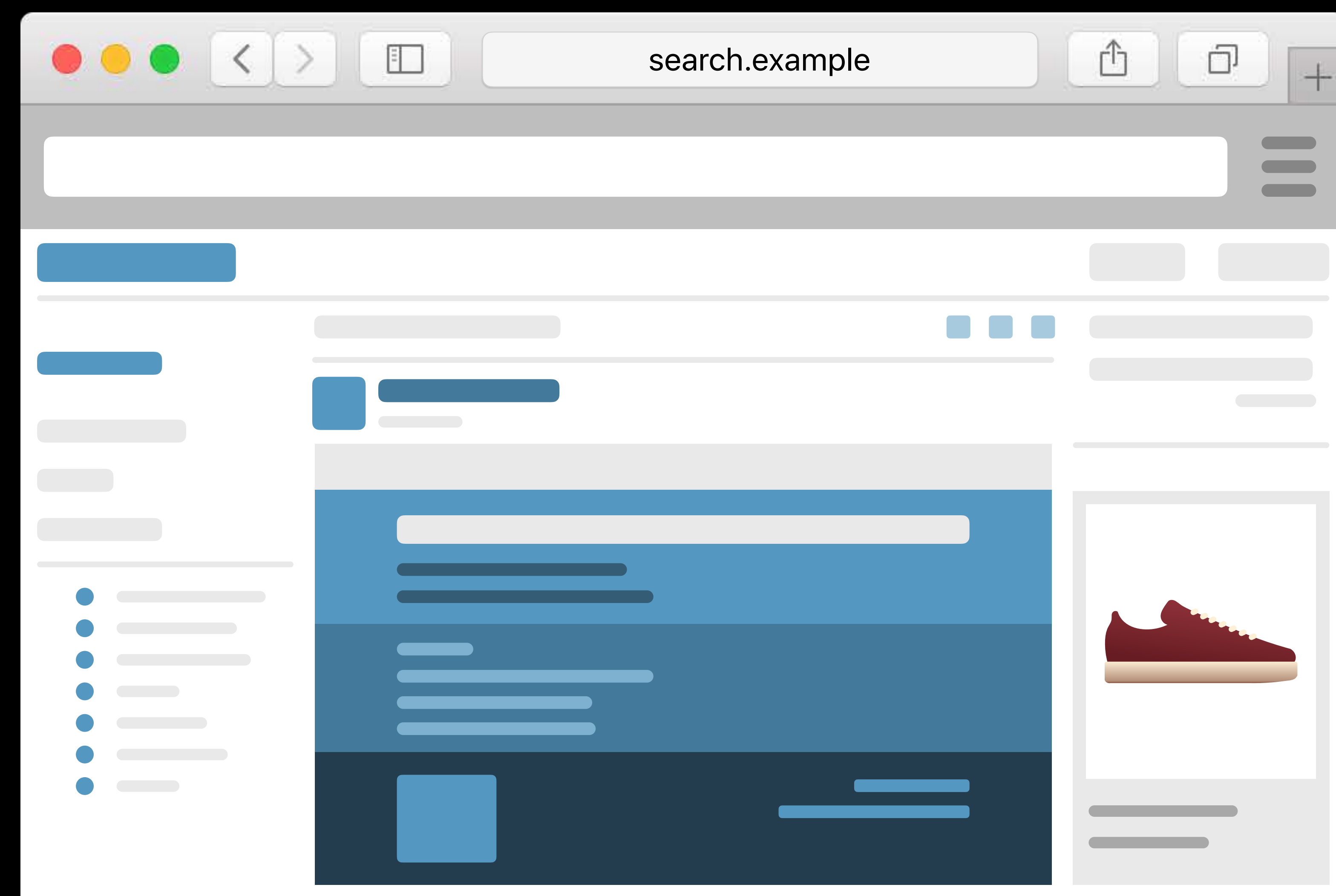
Privacy Preserving Ad Click Attribution

NEW



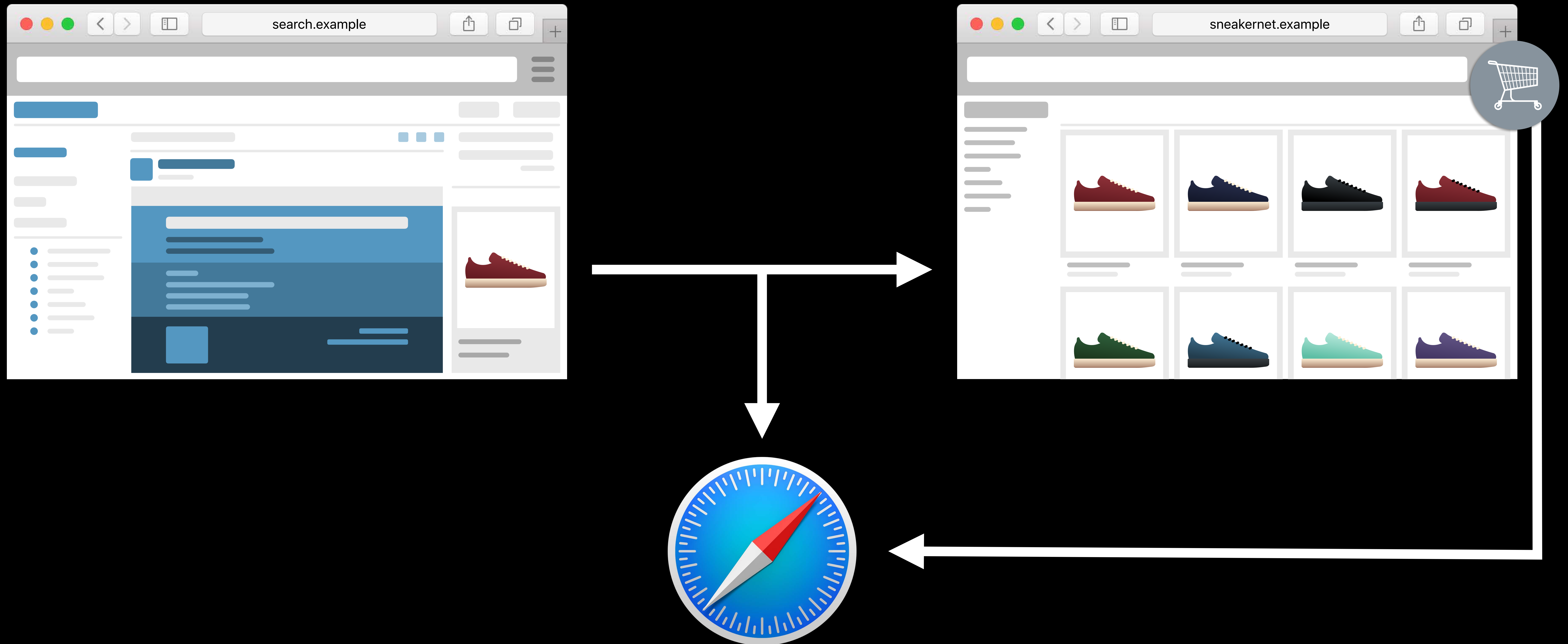
Privacy Preserving Ad Click Attribution

NEW



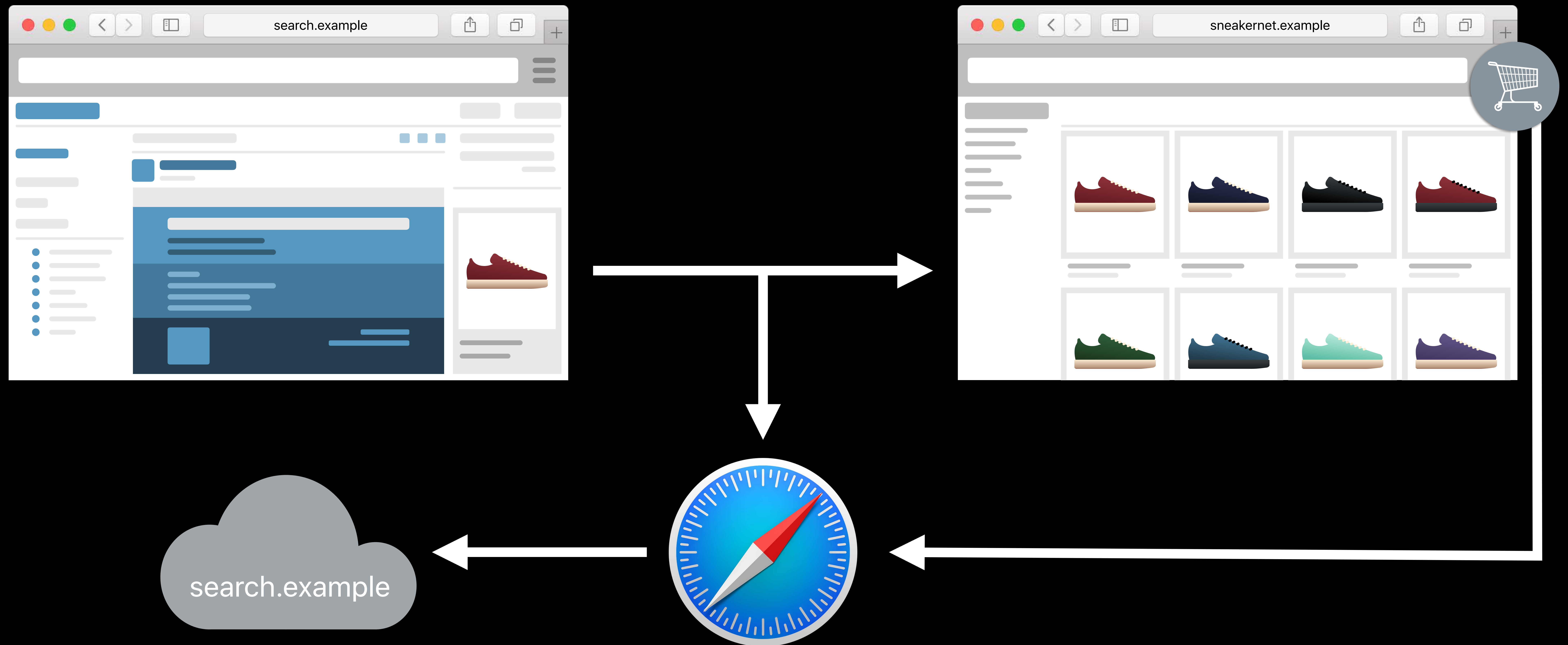
Privacy Preserving Ad Click Attribution

NEW



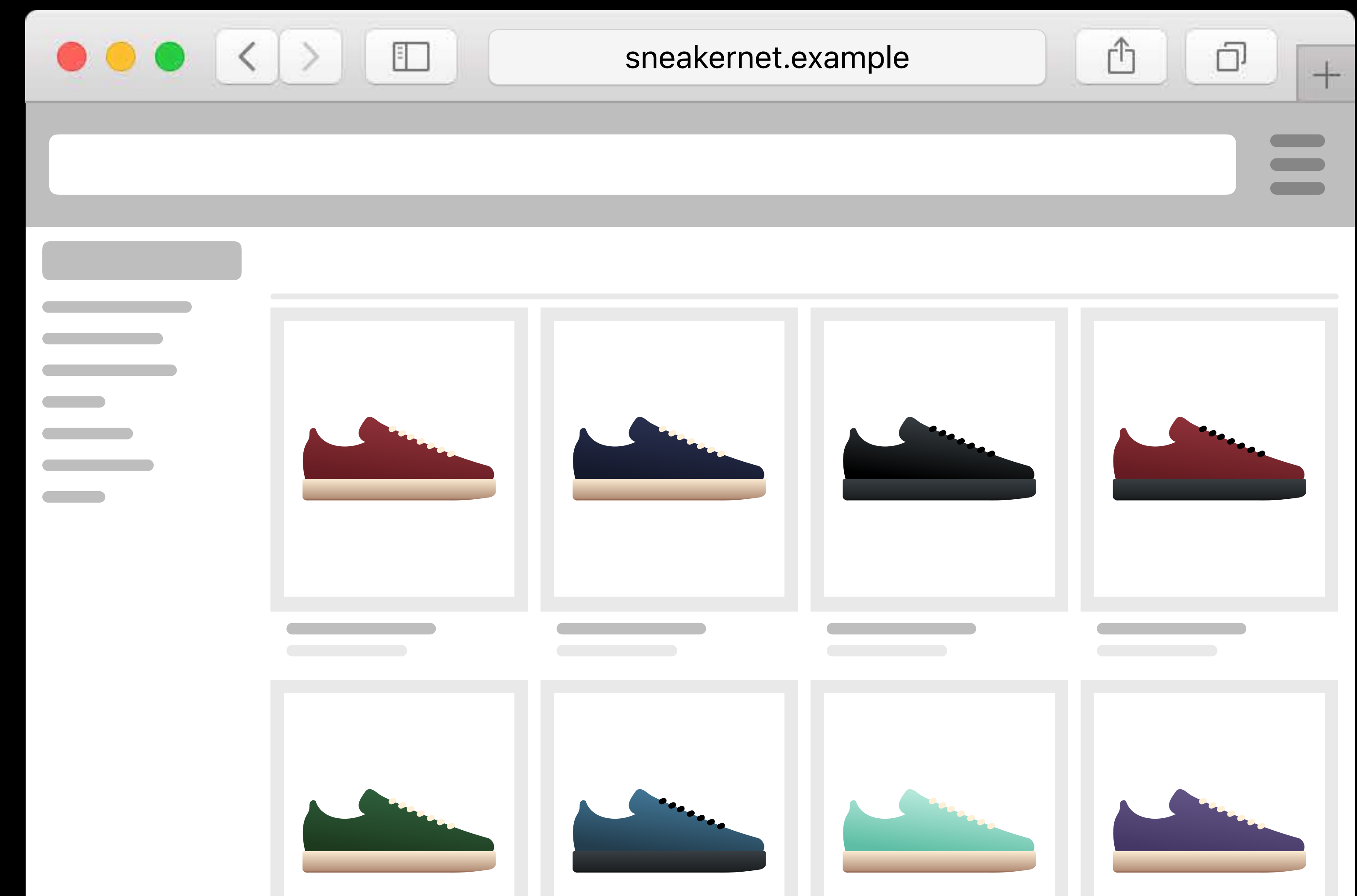
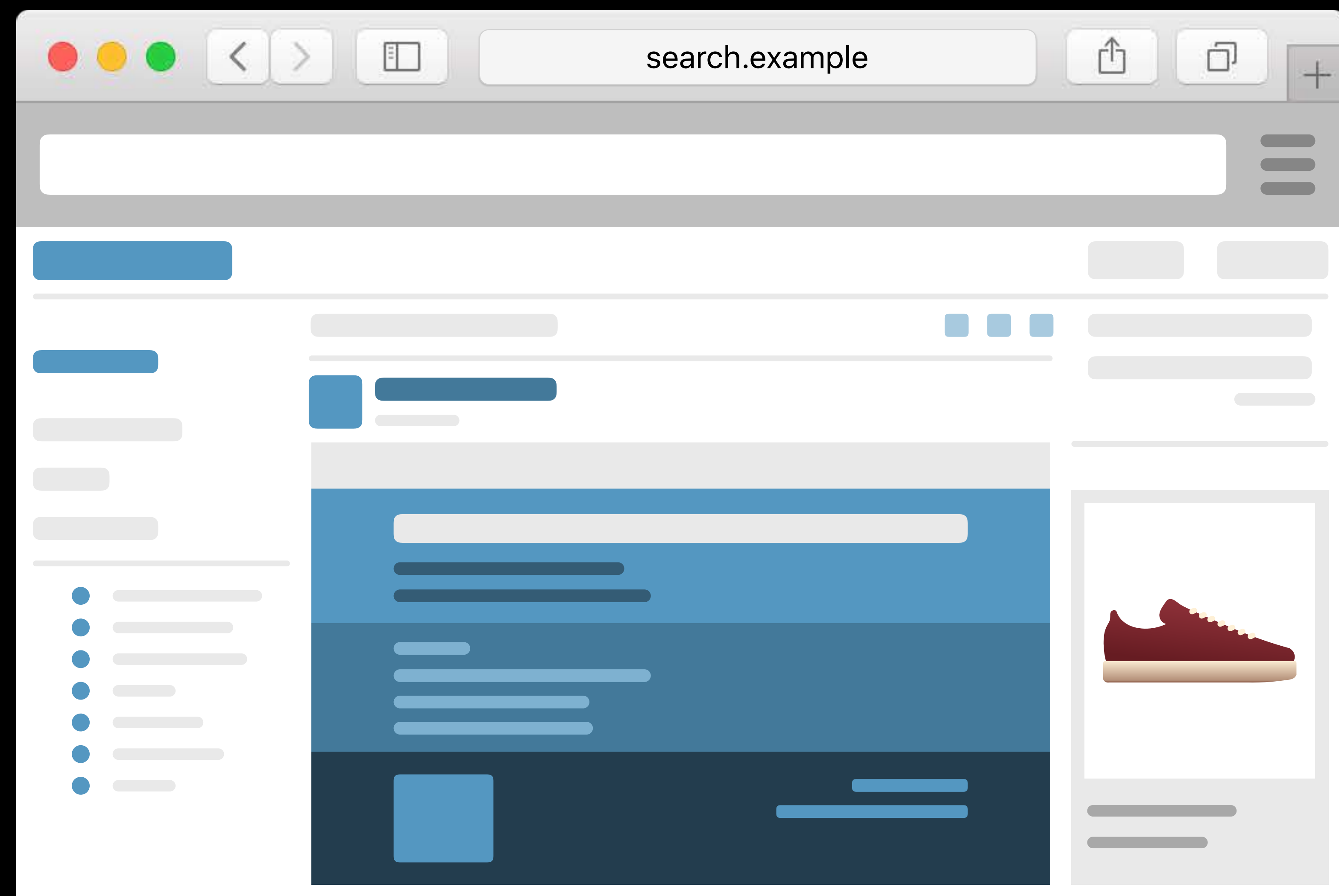
Privacy Preserving Ad Click Attribution

NEW



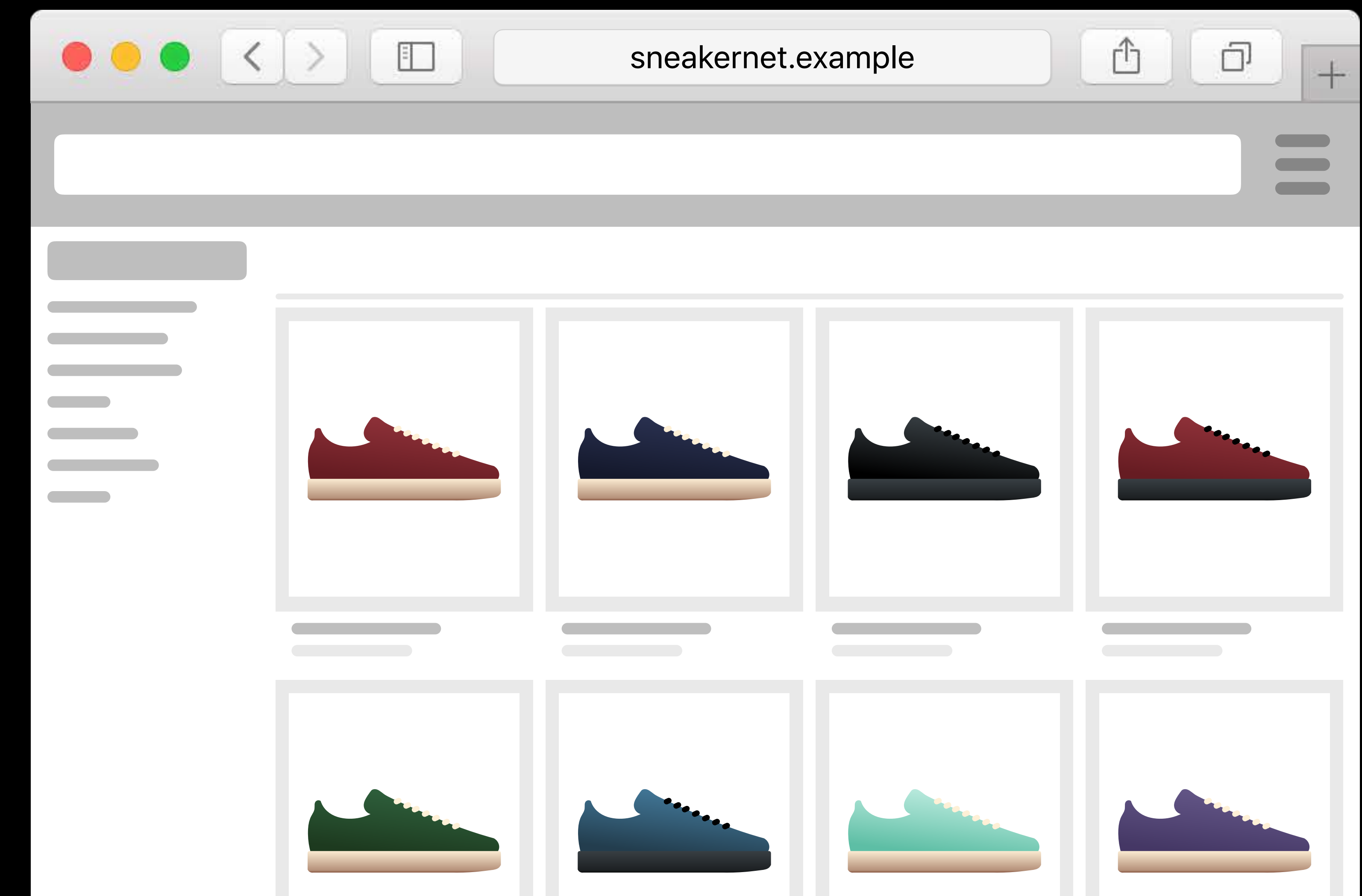
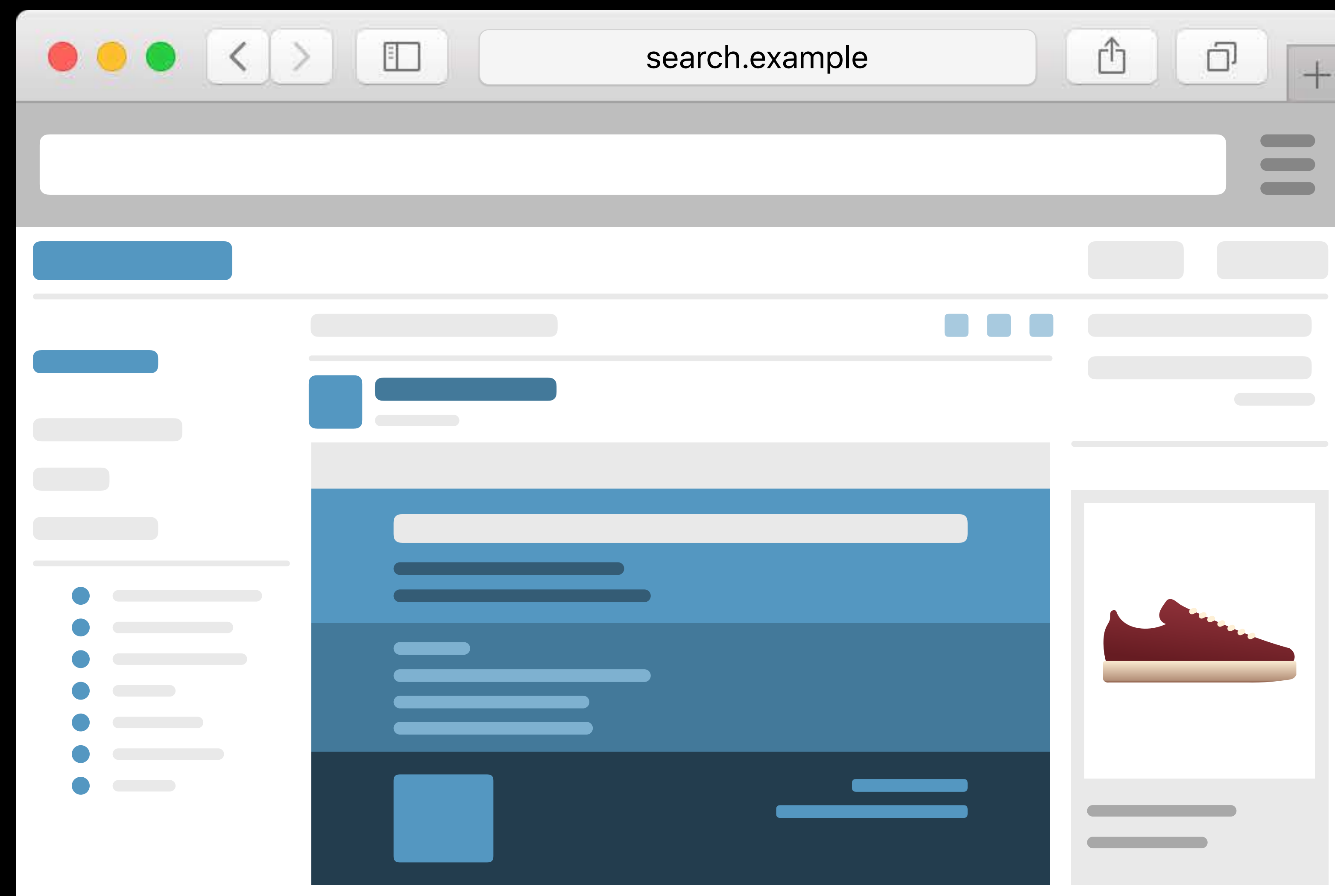
Privacy Preserving Ad Click Attribution

NEW



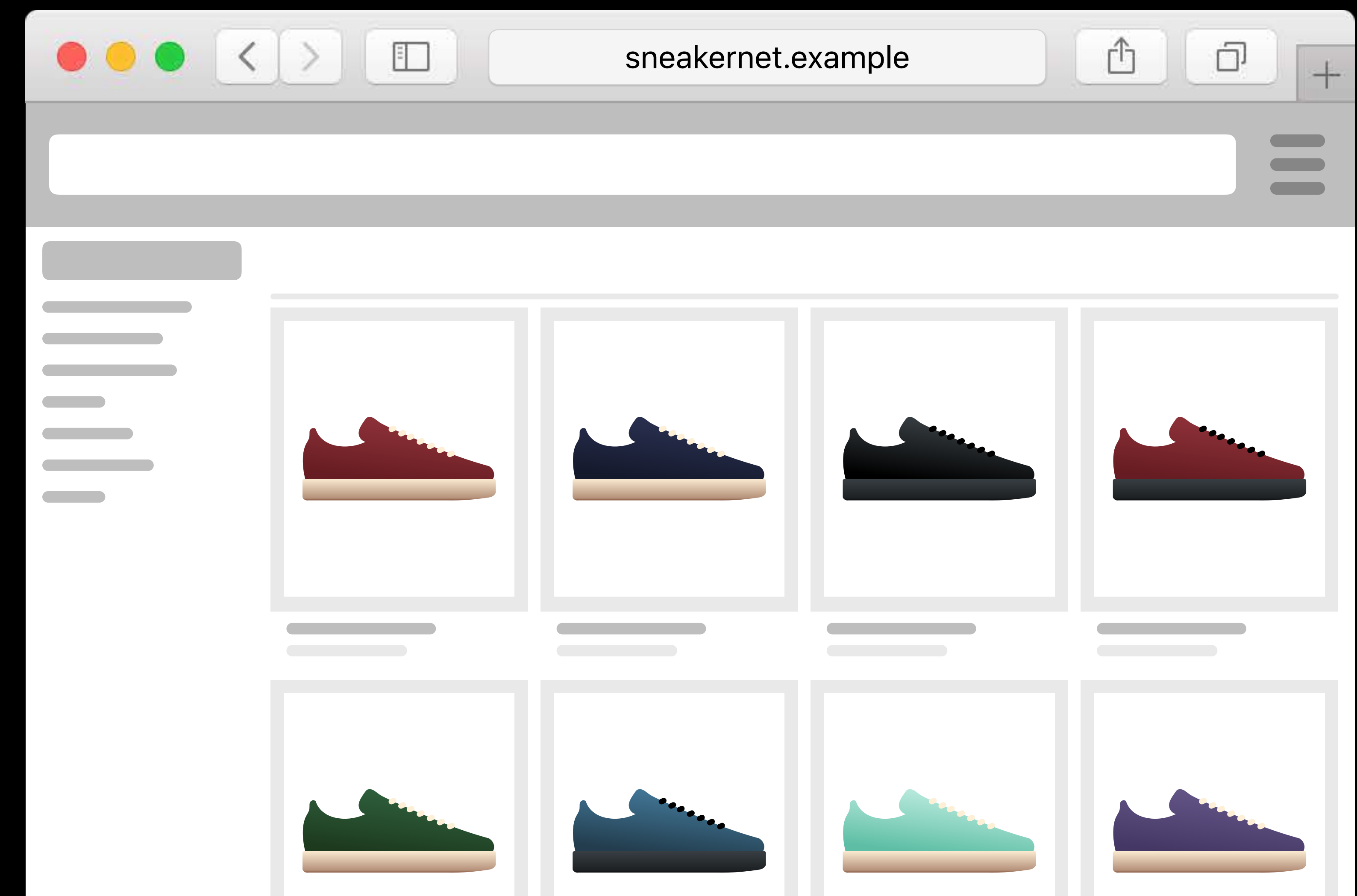
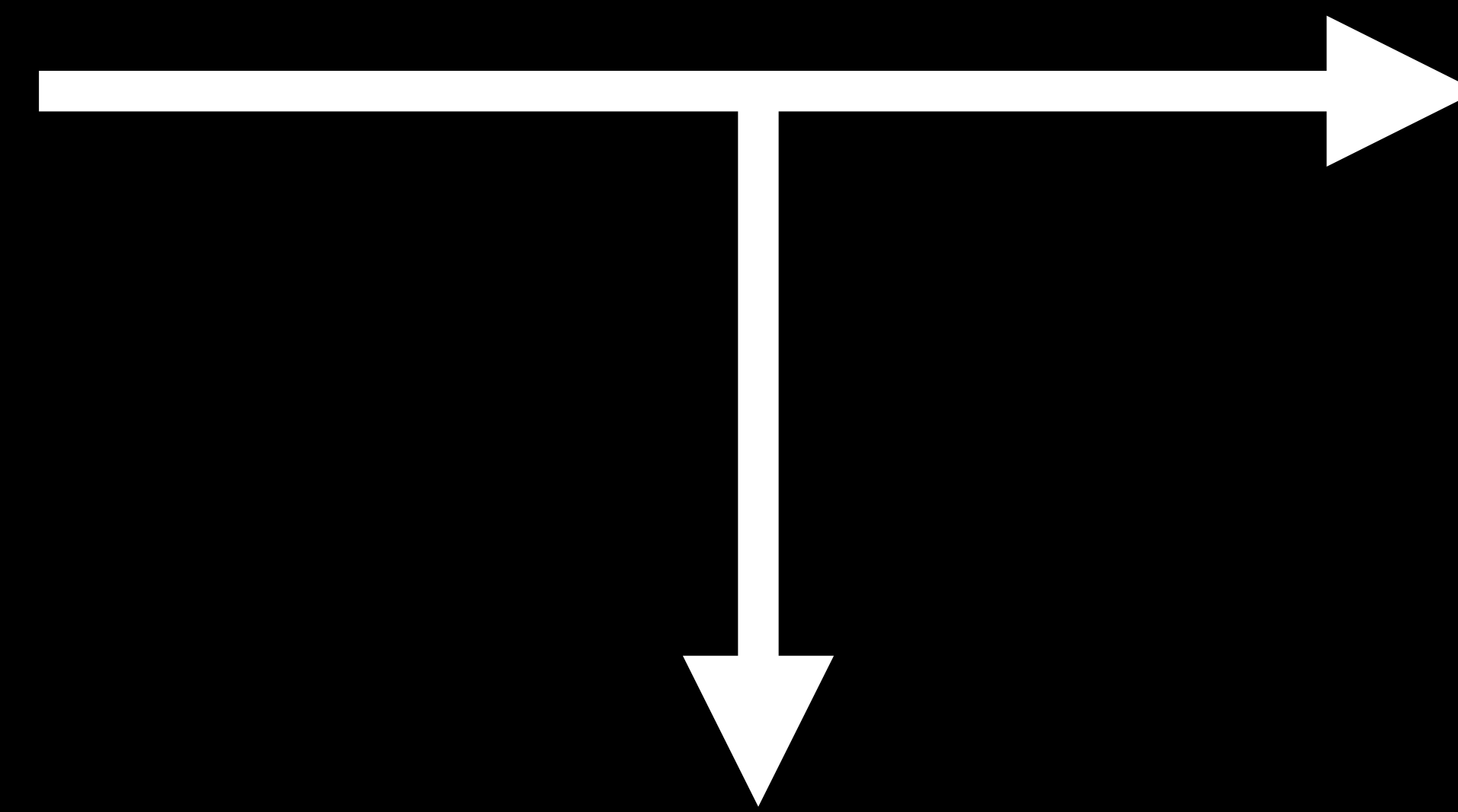
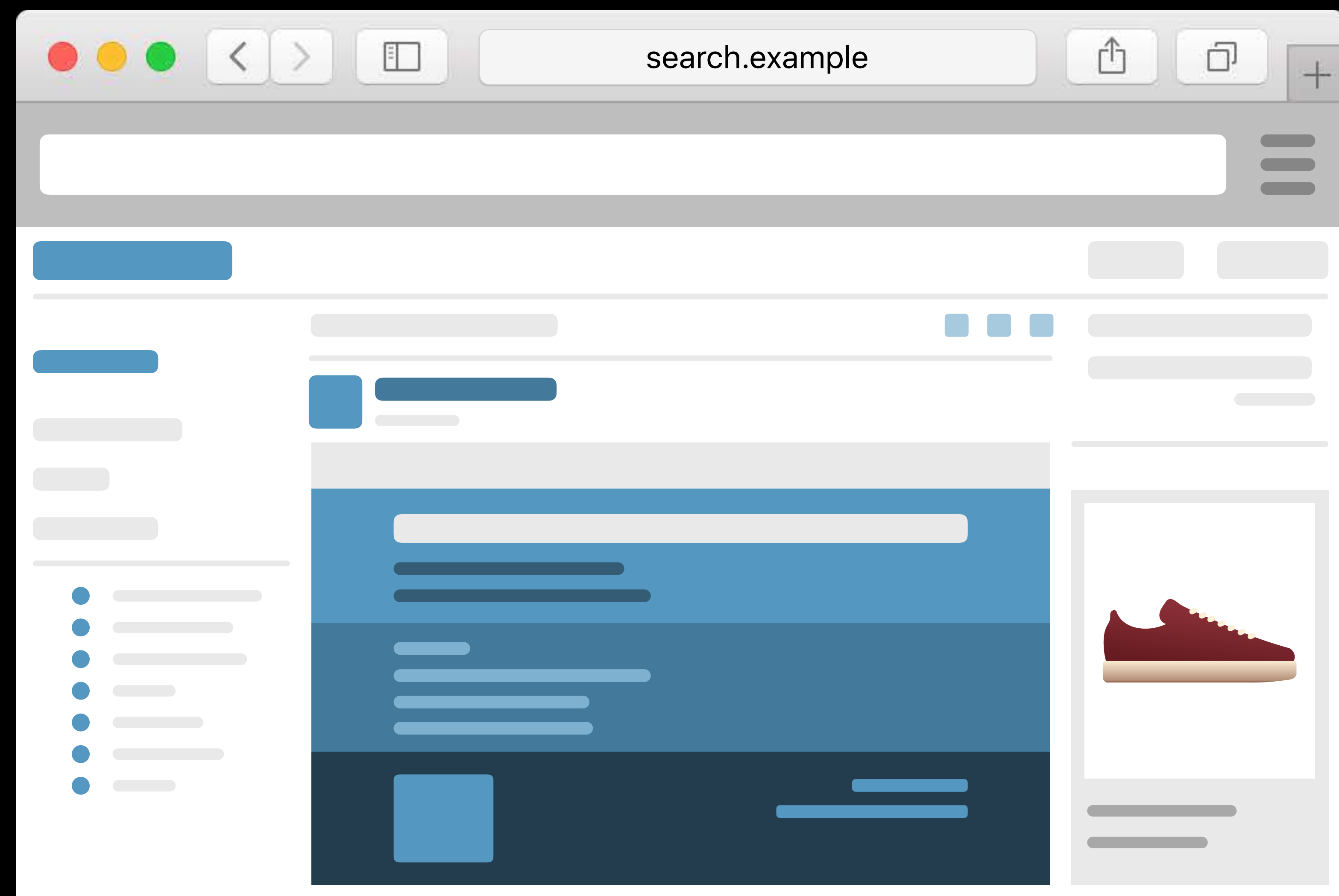
Privacy Preserving Ad Click Attribution

NEW



Privacy Preserving Ad Click Attribution

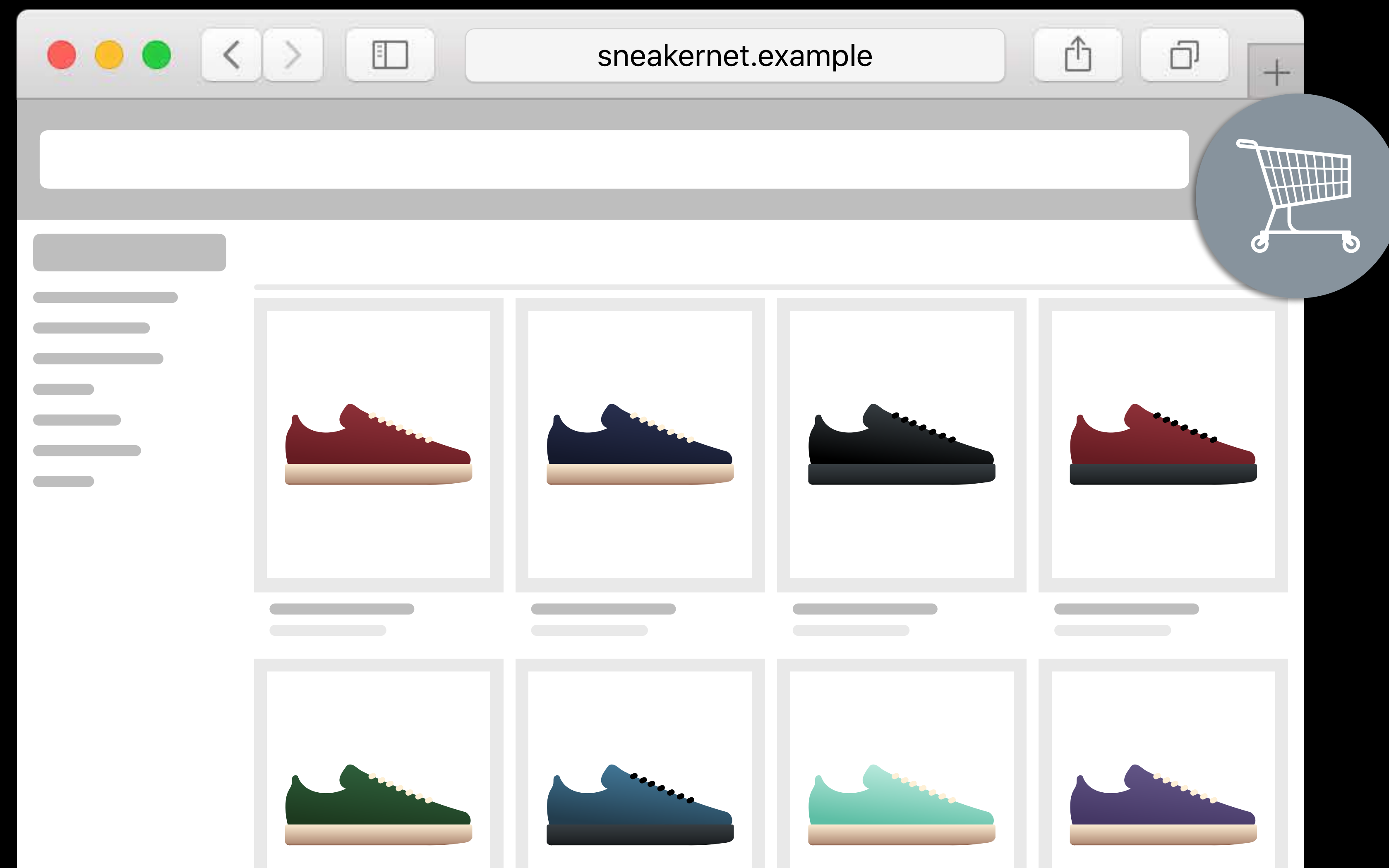
NEW



Clicked on search.example
ad for SneakerNet

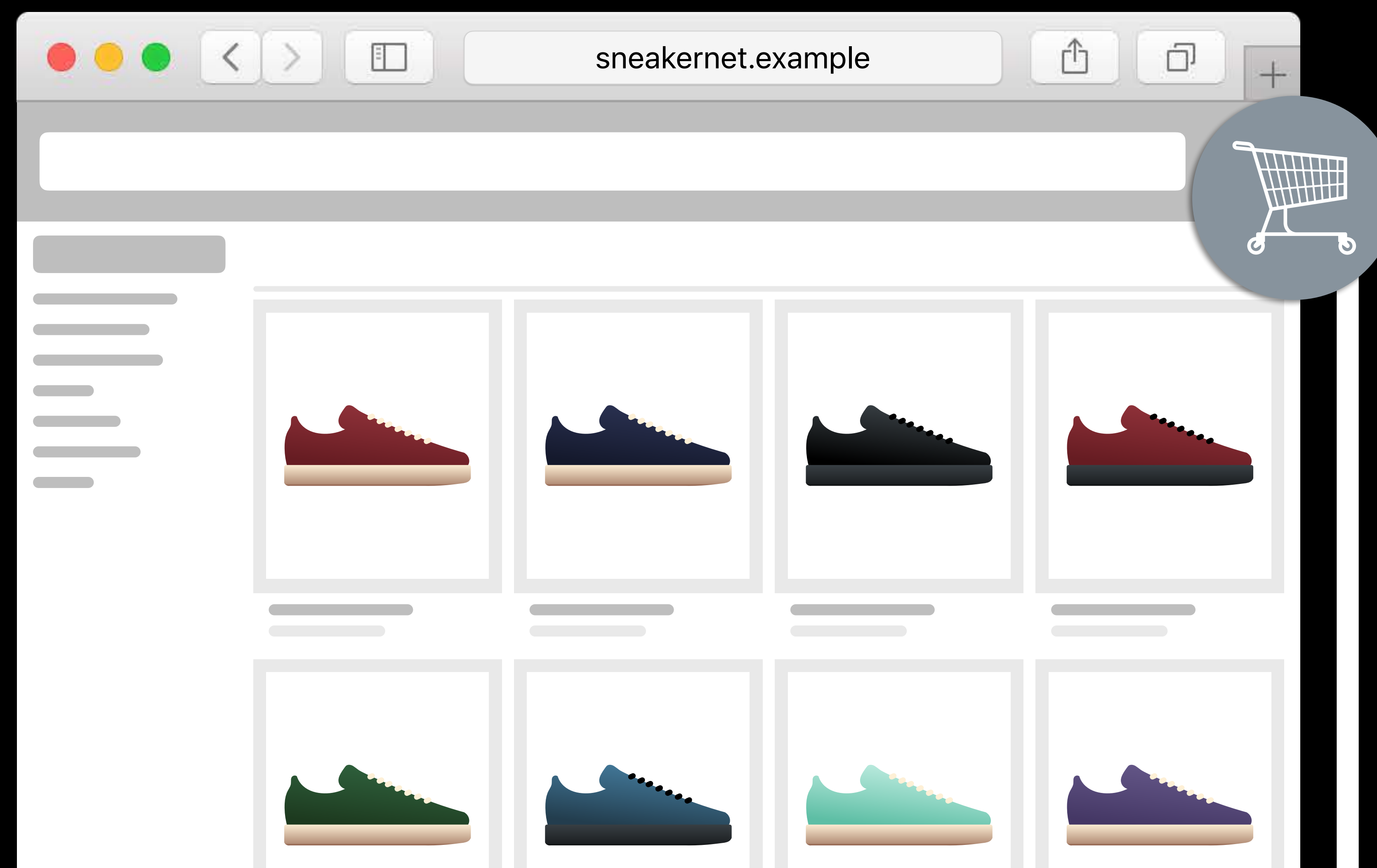
Privacy Preserving Ad Click Attribution

NEW



Privacy Preserving Ad Click Attribution

NEW

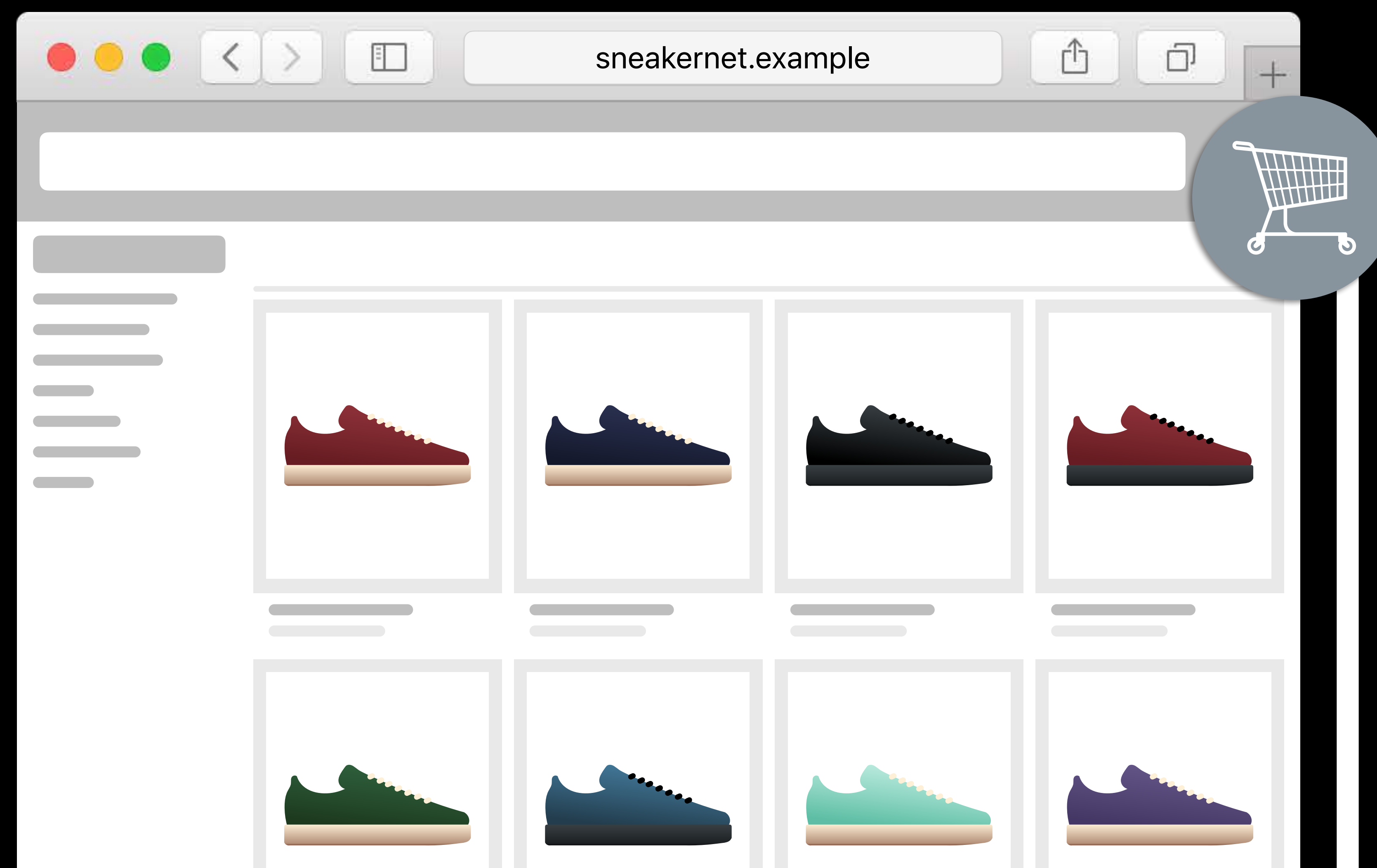


Made a purchase on SneakerNet



Privacy Preserving Ad Click Attribution

NEW



Conversion from search.example
to SneakerNet



Privacy Preserving Ad Click Attribution



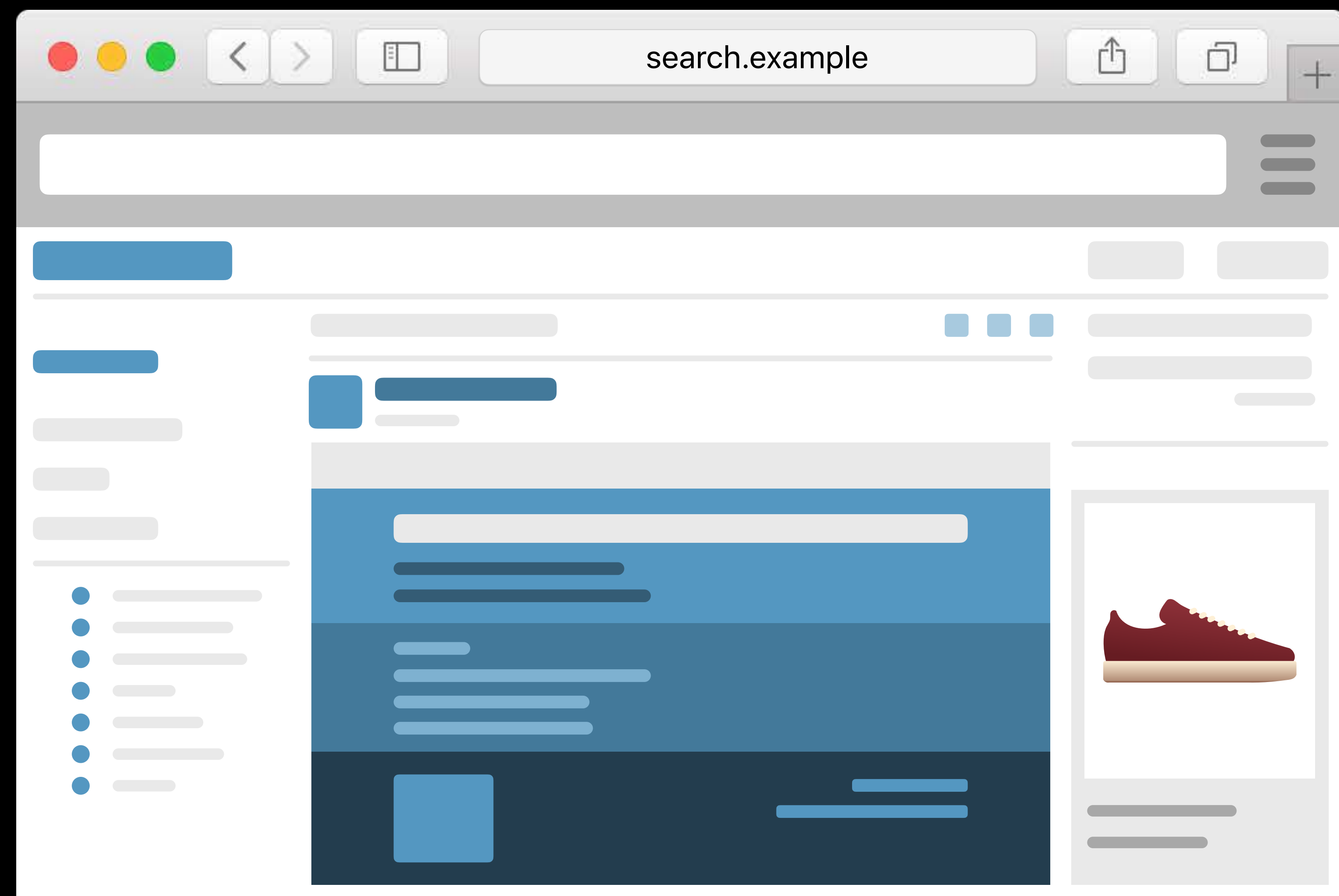
Conversion from search.example to SneakerNet

Privacy Preserving Ad Click Attribution



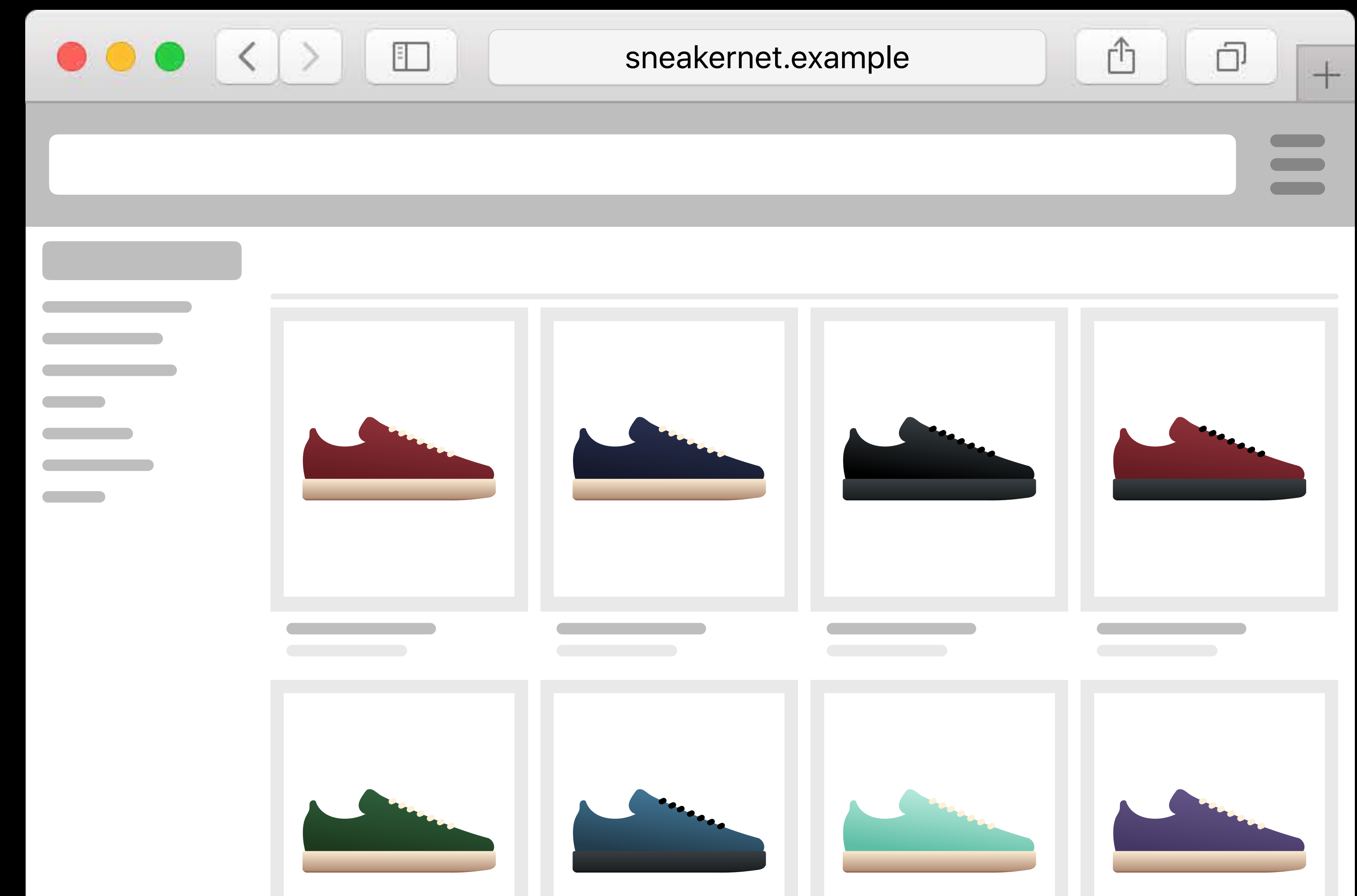
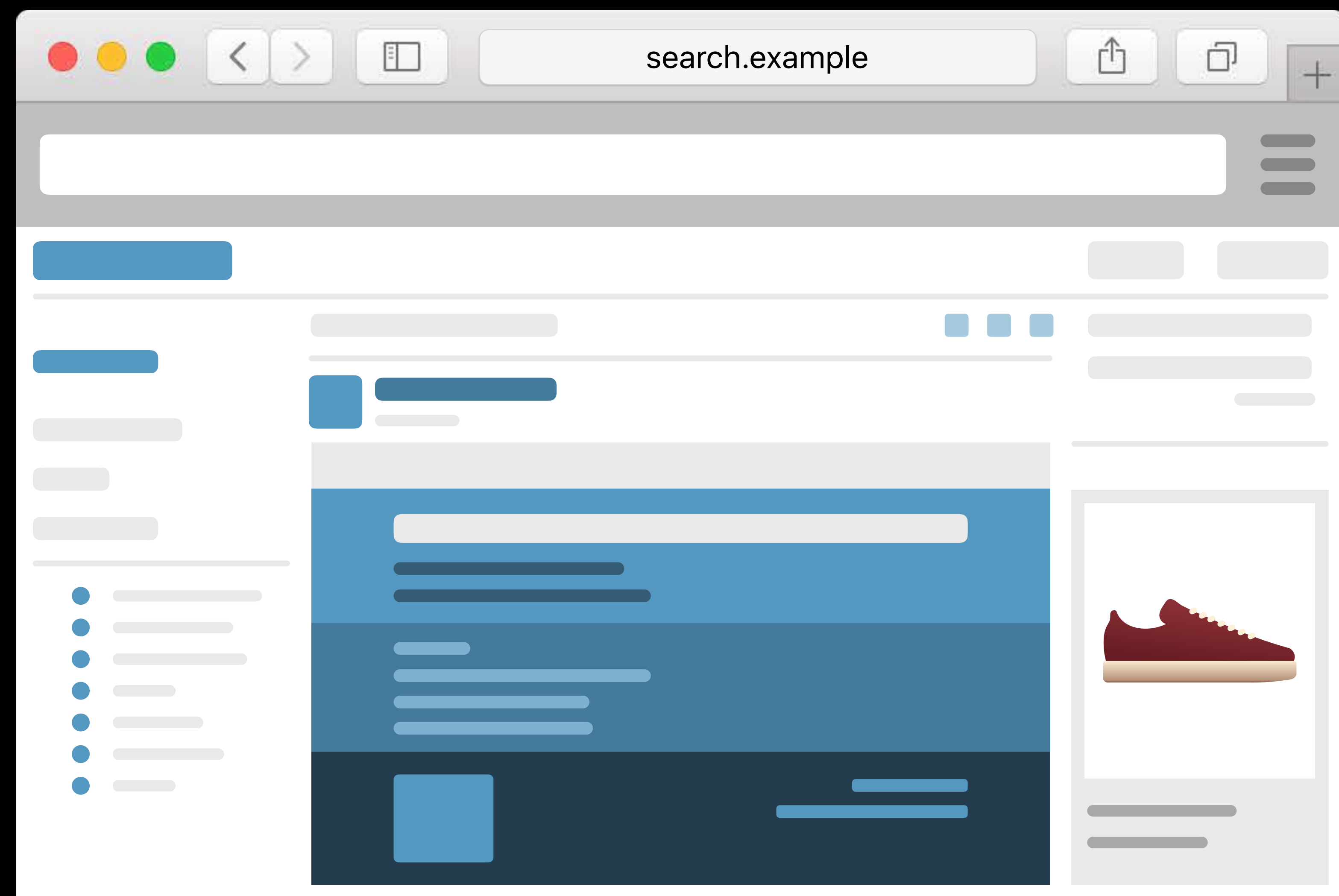
Conversion from search.example to SneakerNet

Privacy Preserving Ad Click Attribution



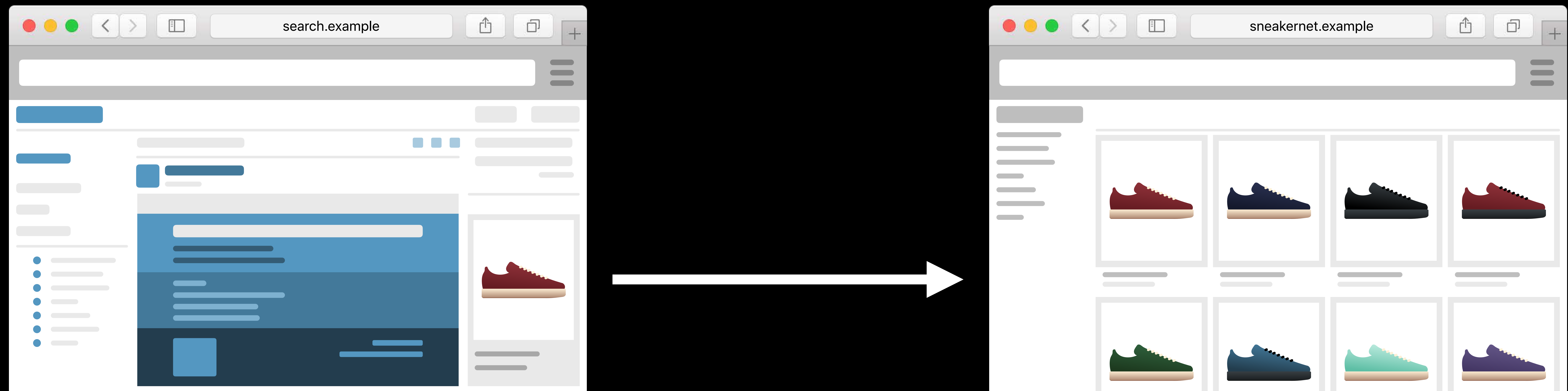
```
<a adDestination="SneakerNet.example" adCampaignID="55"... >
```

Privacy Preserving Ad Click Attribution



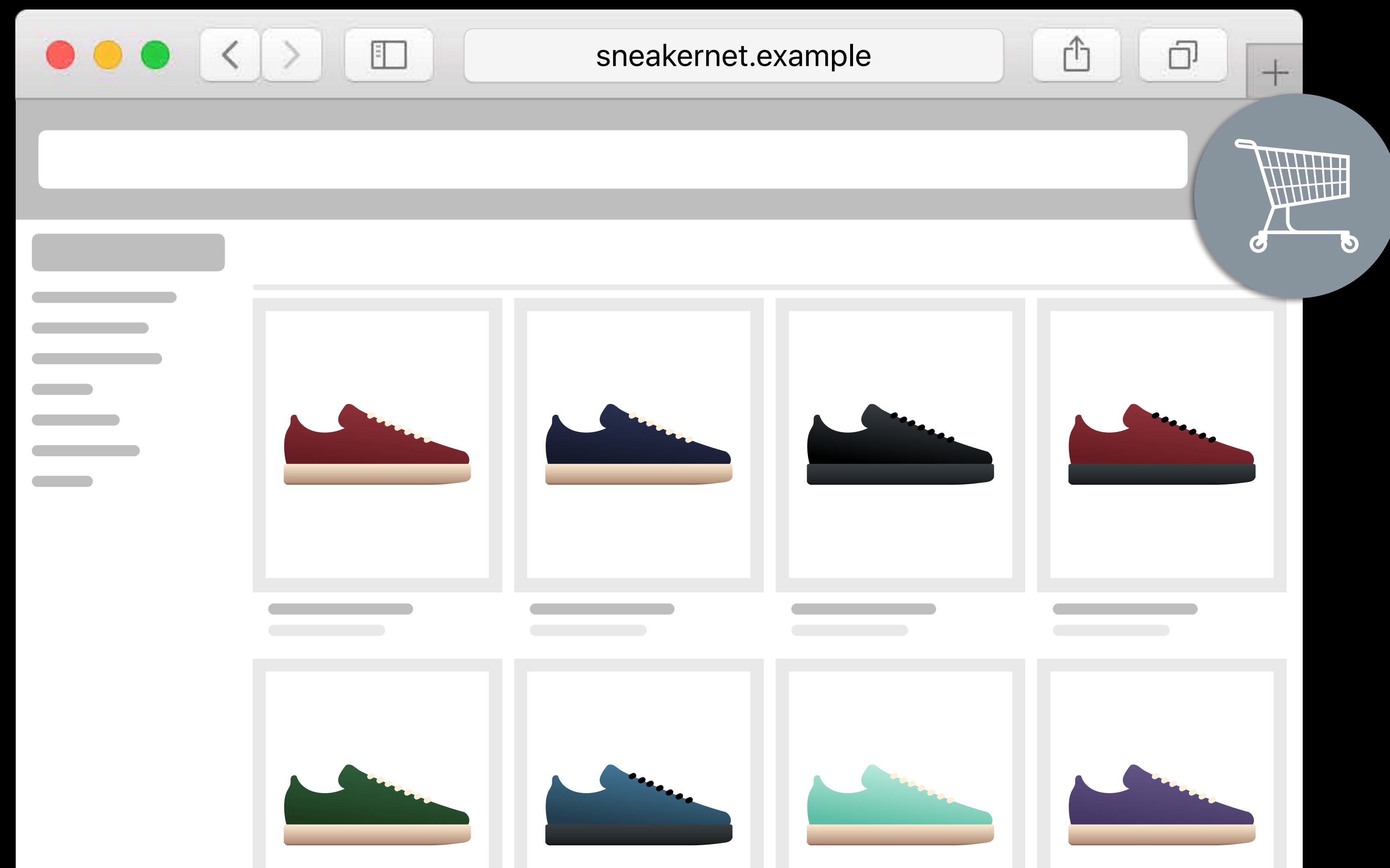
```
<a adDestination="SneakerNet.example" adCampaignID="55"... >
```


Privacy Preserving Ad Click Attribution

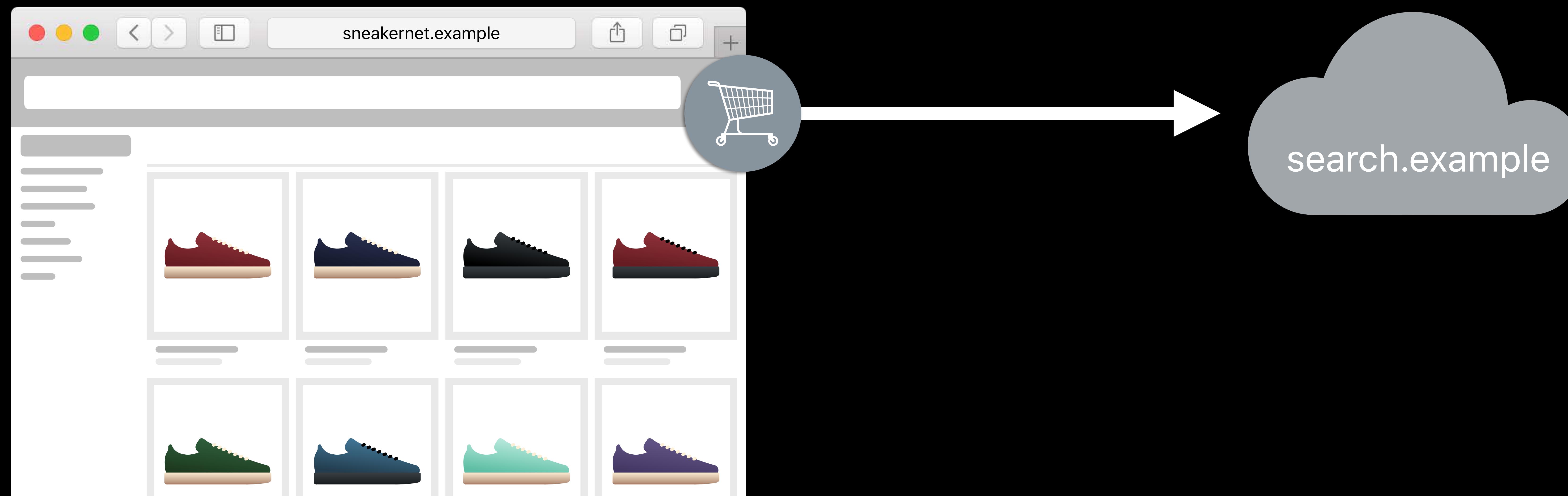


```
<a adDestination="SneakerNet.example" adCampaignID="55"... >
```

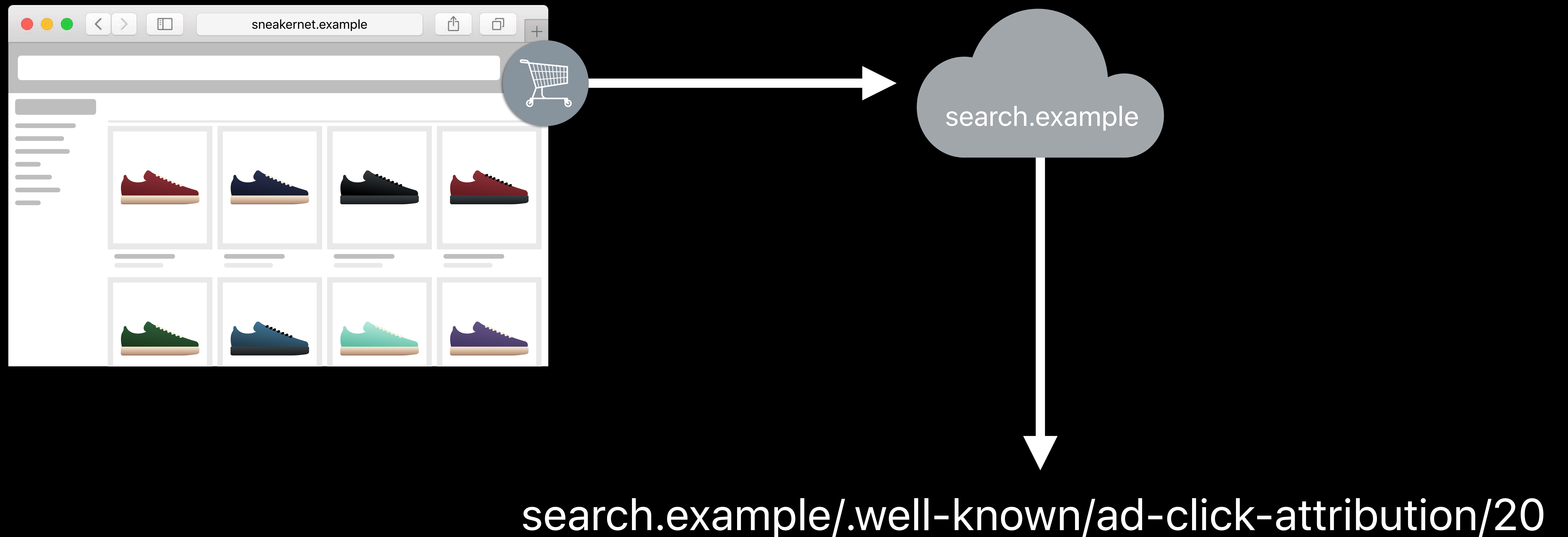
Privacy Preserving Ad Click Attribution



Privacy Preserving Ad Click Attribution



Privacy Preserving Ad Click Attribution



Privacy Preserving Ad Click Attribution

CampaignID and ConversionID each limited to 64 possible values

Attribution delayed 24-48 hours to prevent correlation

Attribution sent in ephemeral browsing session

Clicks and Conversions in private browsing are not recorded

Privacy Preserving Ad Click Attribution

Safari Technology Preview 83

iOS 13 and macOS Catalina

Submitted to W3C

webkit.org/blog

Speech Recognition

```
// Offline Transcription

import Speech
let recognizer = SFSpeechRecognizer()
if recognizer.isAvailableForLocalRecognition(){
    let request = SFSpeechRecognitionRequest(requiresLocalRecognition: true)
}
```



```
// Offline Transcription

import Speech
let recognizer = SFSpeechRecognizer()
if recognizer.isAvailableForLocalRecognition(){
    let request = SFSpeechRecognitionRequest(requiresLocalRecognition: true)
}
```

```
// Offline Transcription
```

```
import Speech
```

```
let recognizer = SFSpeechRecognizer()
```

```
if recognizer.isAvailableForLocalRecognition(){
```

```
    let request = SFSpeechRecognitionRequest(requiresLocalRecognition: true)
```

```
}
```

TestFlight Feedback

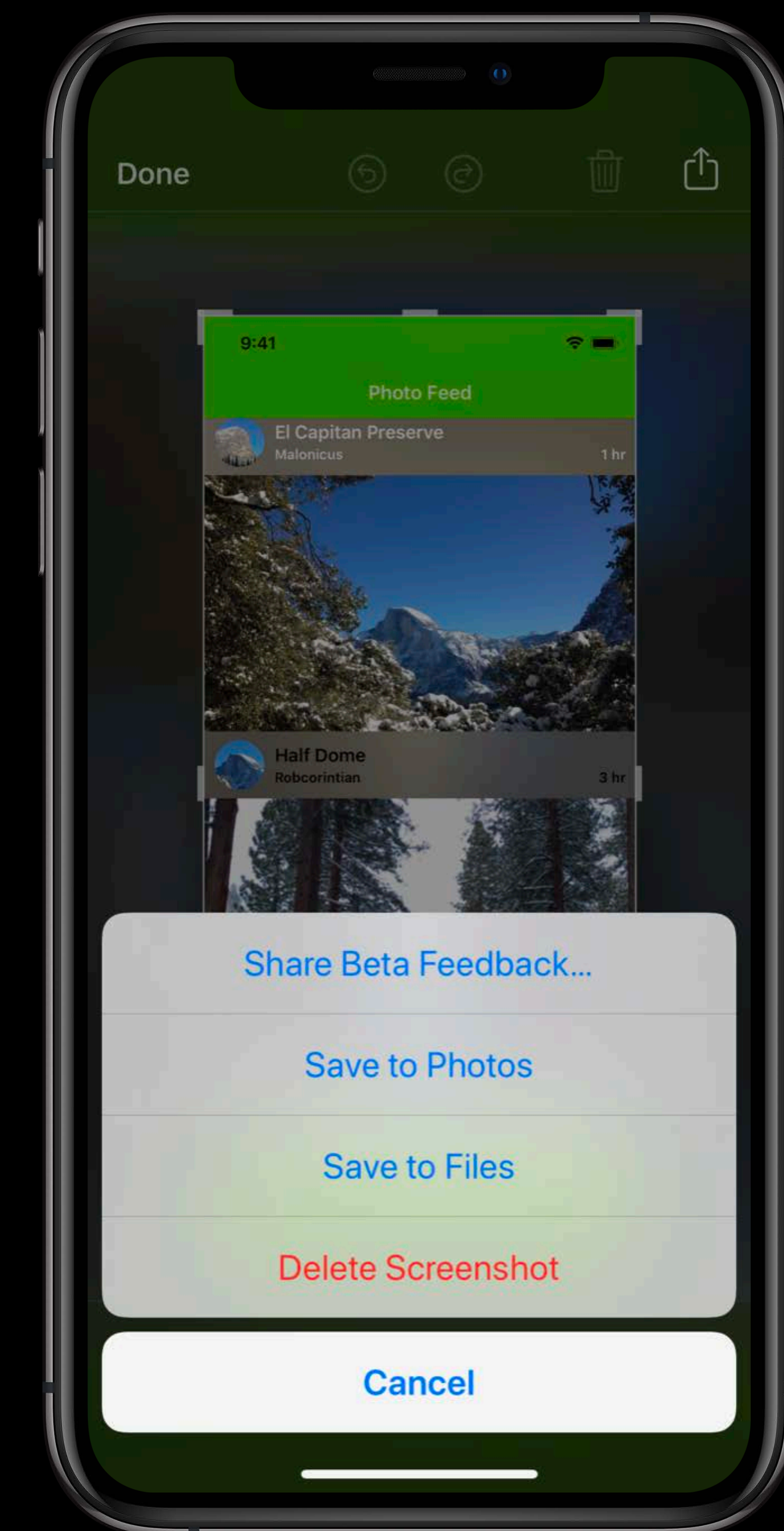
Improved TestFlight Feedback

Submit feedback directly from Screenshot UI

Can submit feedback along with crashes

User in control of sharing feedback

Available on iOS 13 with TestFlight 2.3



Privacy and user experience

What's new in frameworks

Privacy updates

Solving privacy challenges

CNCopyCurrentNetworkInfo

Only for apps that declare `com.apple.developer.networking.wifi-info` entitlement

And

- Configured a Virtual Private Network
- Configured a Wi-Fi Network using `NEHotspotConfiguration`
- Obtained location permission

Advances in Networking, Part 1

Thursday, 11:00

Advances in Networking, Part 2

Thursday, 5:00

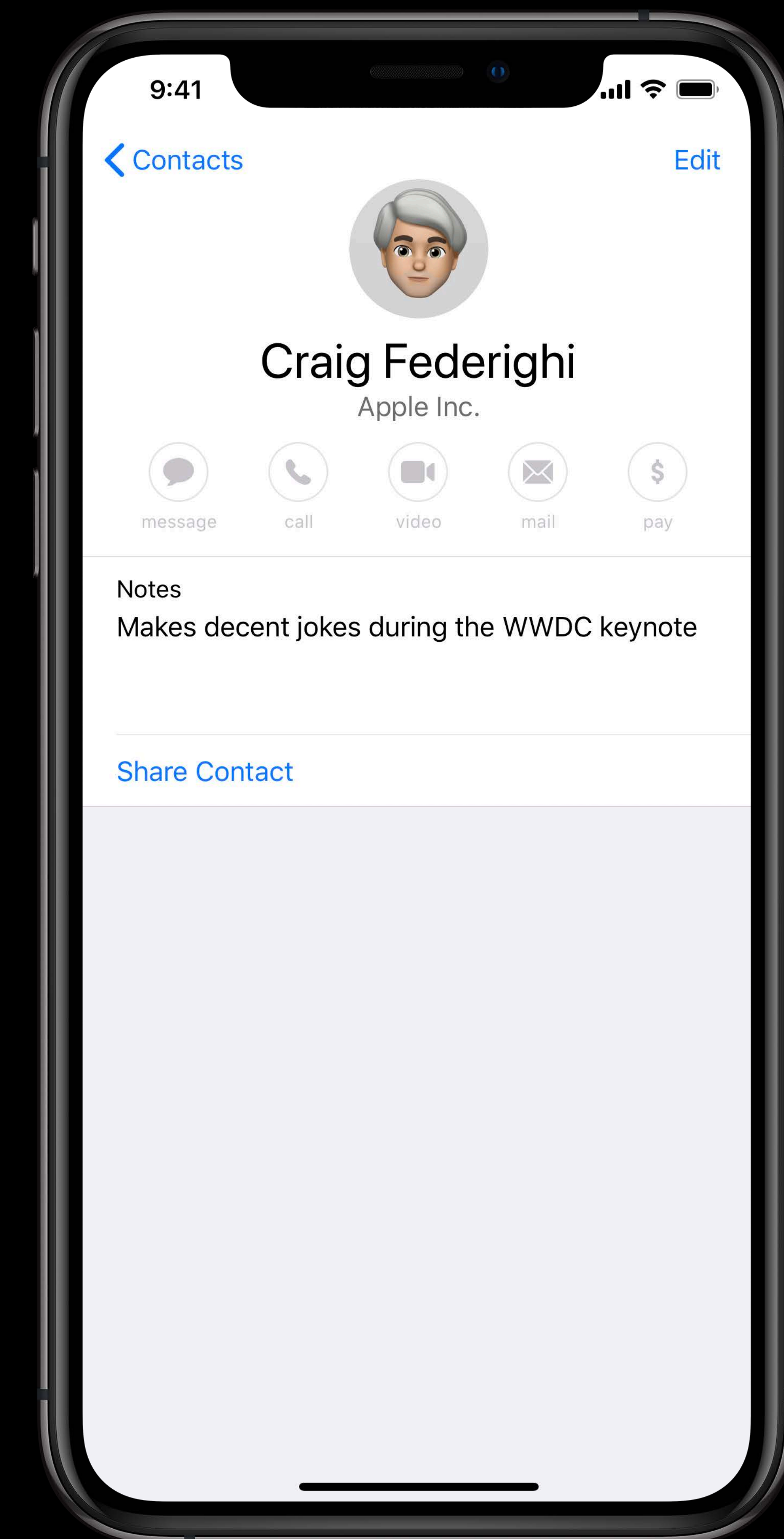
Notes Field in Contacts

Access to notes field requires entitlement

- `com.apple.developer.contacts.notes`

File a Contacts entitlement request at

developer.apple.com/contact/request/contact-note-field/



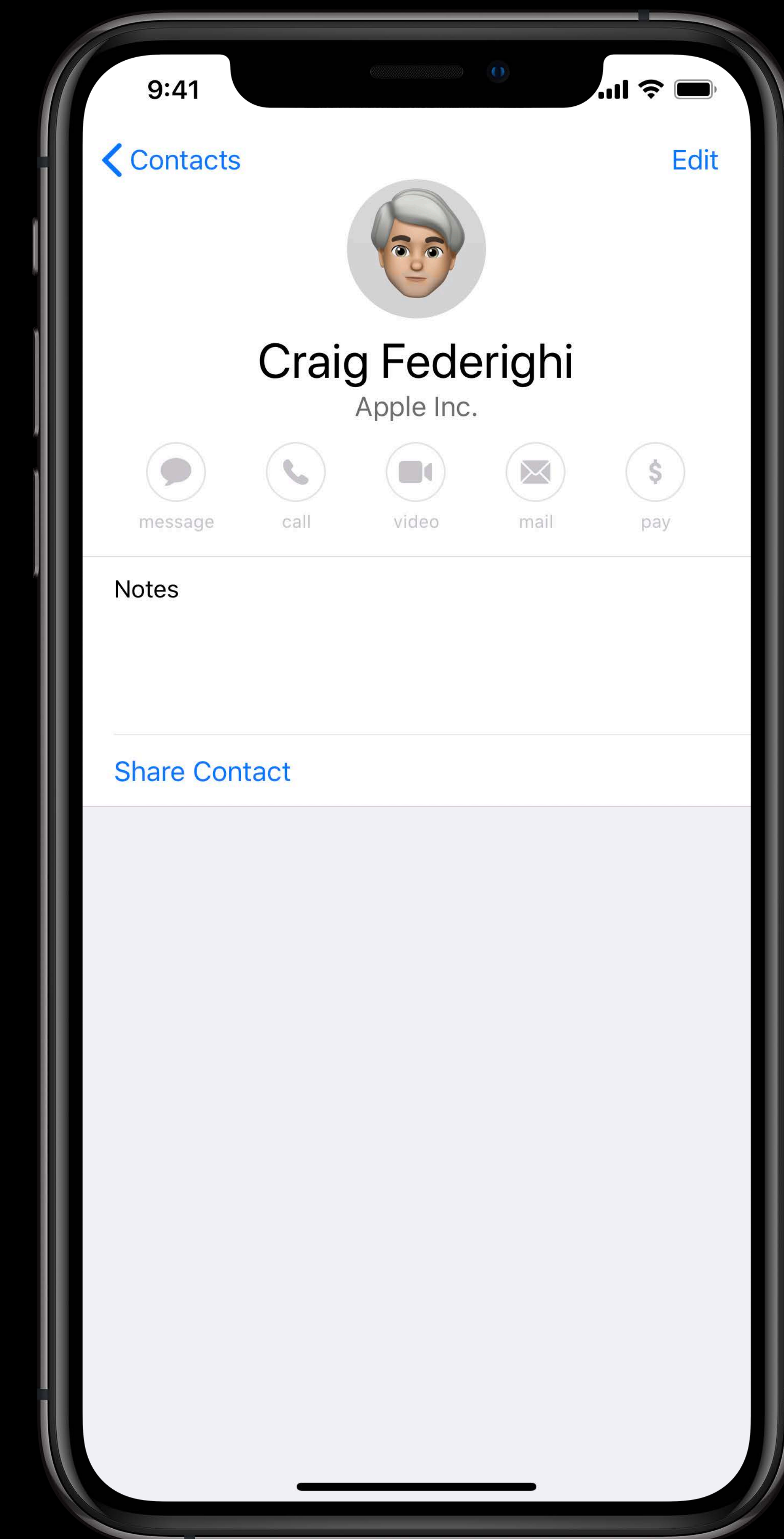
Notes Field in Contacts

Access to notes field requires entitlement

- `com.apple.developer.contacts.notes`

File a Contacts entitlement request at

developer.apple.com/contact/request/contact-note-field/



Custom URL Schemes

Source Application only if from the same developer

```
import UIKit

func application(_ app: UIApplication,
                 openurl: URL,
                 options: [UIApplication.OpenURLOptionsKey : Any] = [:]) -> Bool
{
    let sourceApplication = options[.sourceApplication]
    ...
}
```

Custom URL Schemes

Source Application only if from the same developer

```
import UIKit

func application(_ app: UIApplication,
                 openurl: URL,
                 options: [UIApplication.OpenURLOptionsKey : Any] = [:]) -> Bool
{
    let sourceApplication = options[.sourceApplication]
    ...
}
```

Game Center Player Identifiers

Two new scoped identifiers

- `teamPlayerID` team-scoped player identifier
- `gamePlayerID` game-scoped player identifier

Existing `playerID` is deprecated



Contextual Information

Provide entry points into your apps

- NSUserActivity
- SiriKit INInteraction

Your App



Contextual Information

NEW

Provide entry points into your apps

- NSUserActivity
- SiriKit INInteraction

Your App



Data Stewardship

```
delete(with:completion:)
```

```
deleteAll(completion:)
```

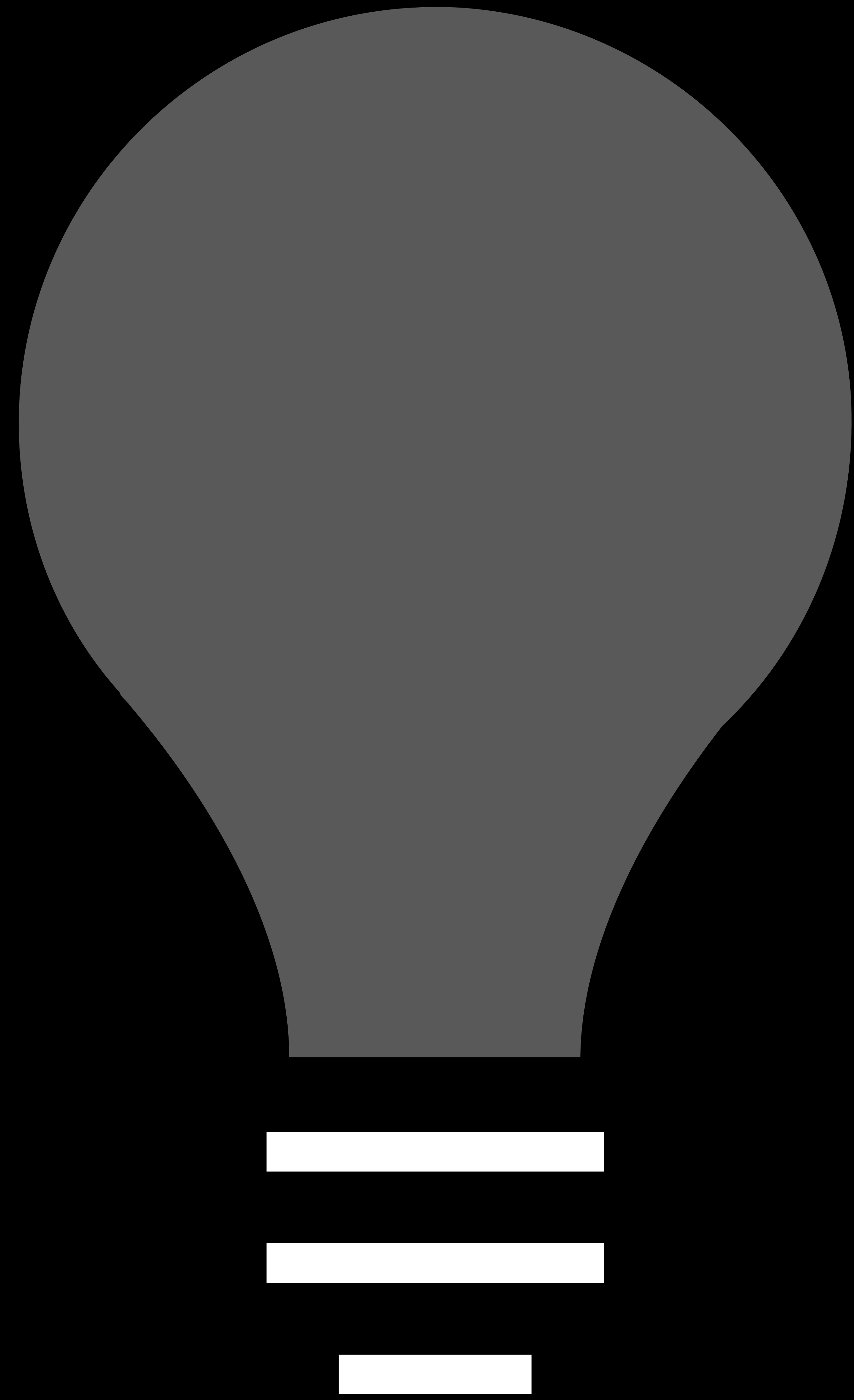


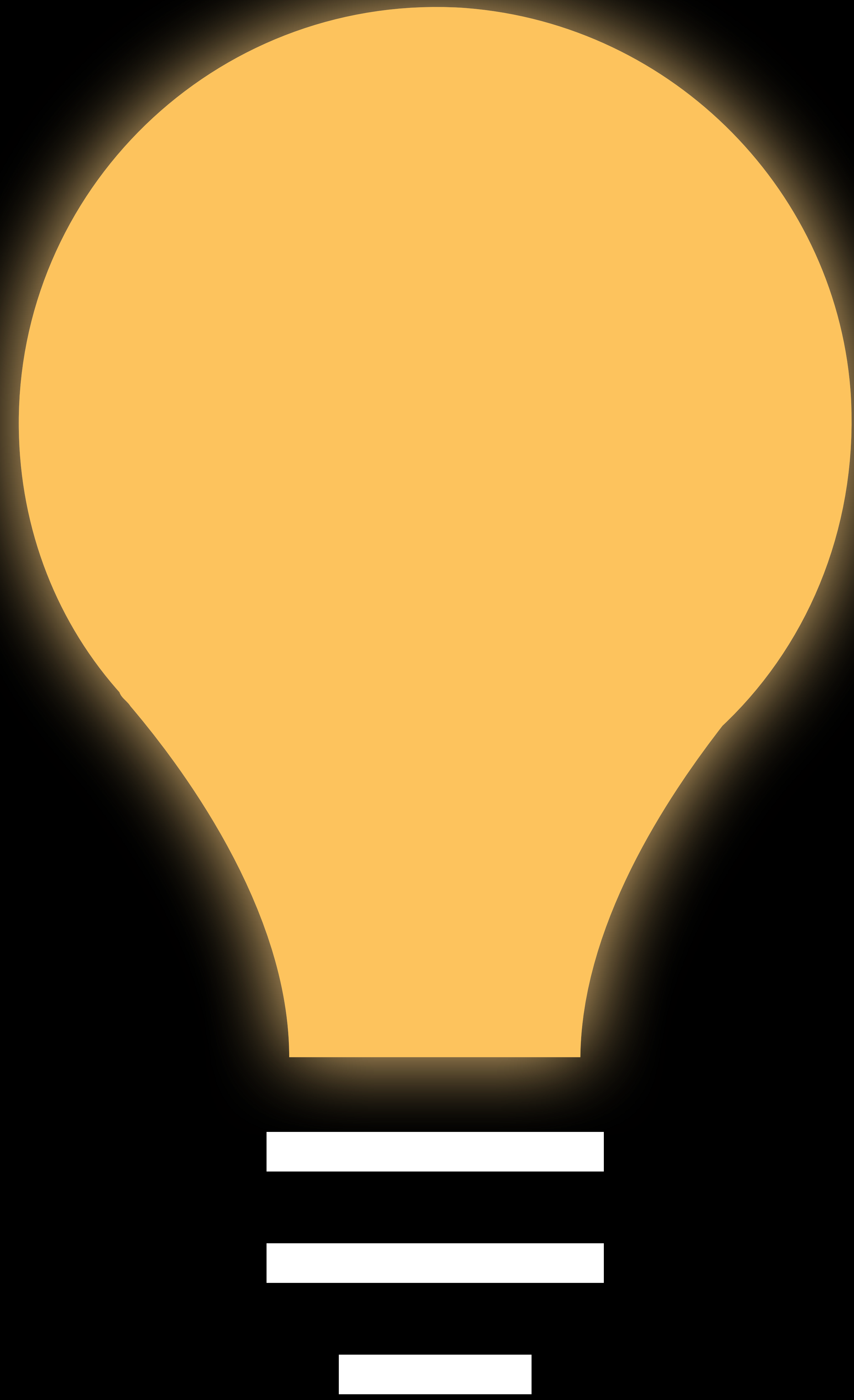
Privacy and user experience

What's new in frameworks

Privacy updates

Solving privacy challenges







Machine Learning



Find My



Home



Machine Learning

Machine Learning

Train a machine learning model

- Without collecting sensitive user data
- While personalizing the model to the user
- While improving the user experience

Data

Data Data Data Data Data Data Data Data Data Data

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Data Data Data Data Data Data Data Data Data Data

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Data Data Data Data Data Data Data Data Data Data

Data

Data Collection

Data Collection



User Data

Random identifiers

Round

Sample

Data Collection



User Data

Random identifiers

Round
Sample



User studies

Diverse set of participants

Ongoing studies

Data Collection



User Data

Random identifiers

Round
Sample



User studies

Diverse set of participants

Ongoing studies

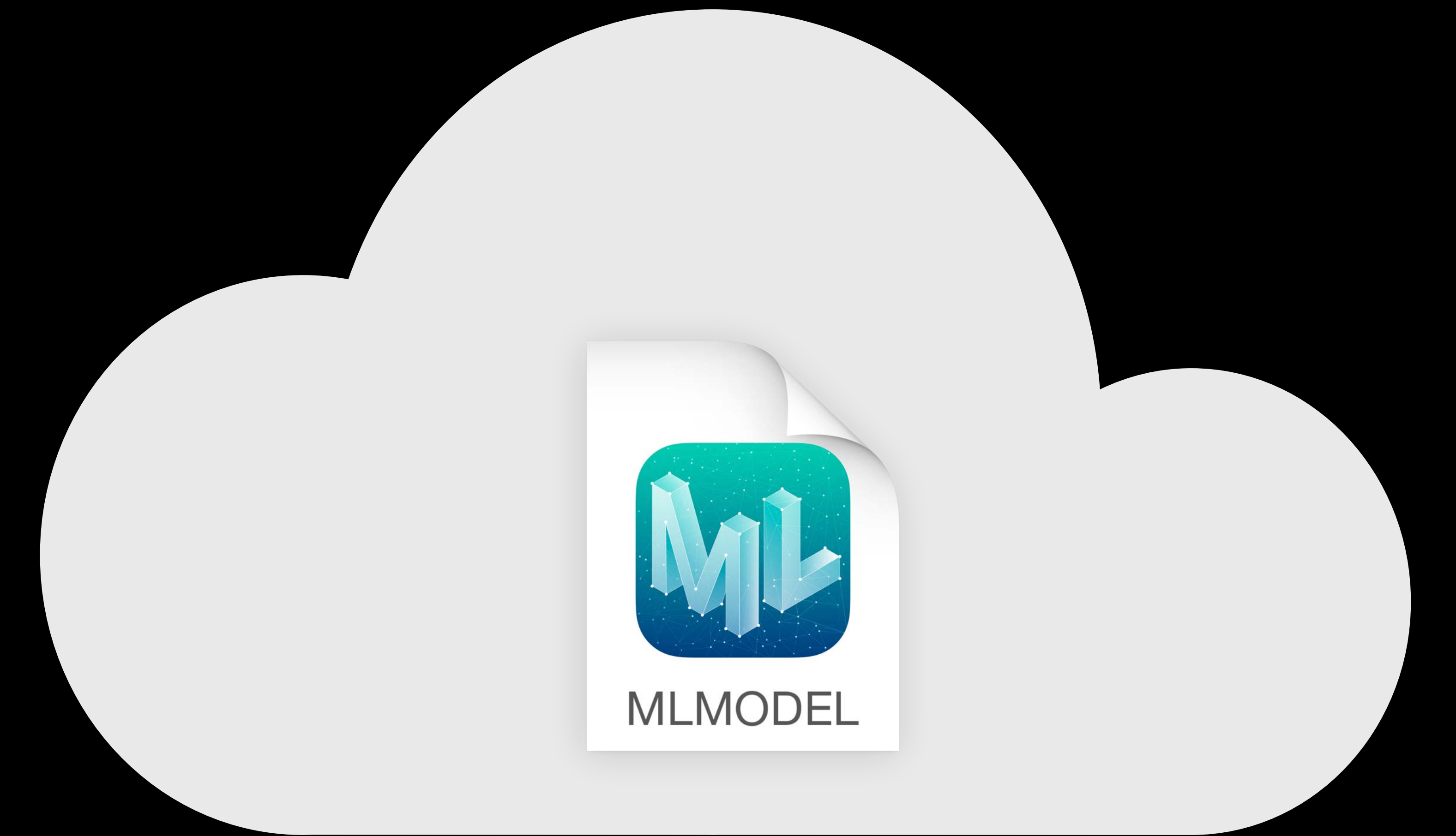
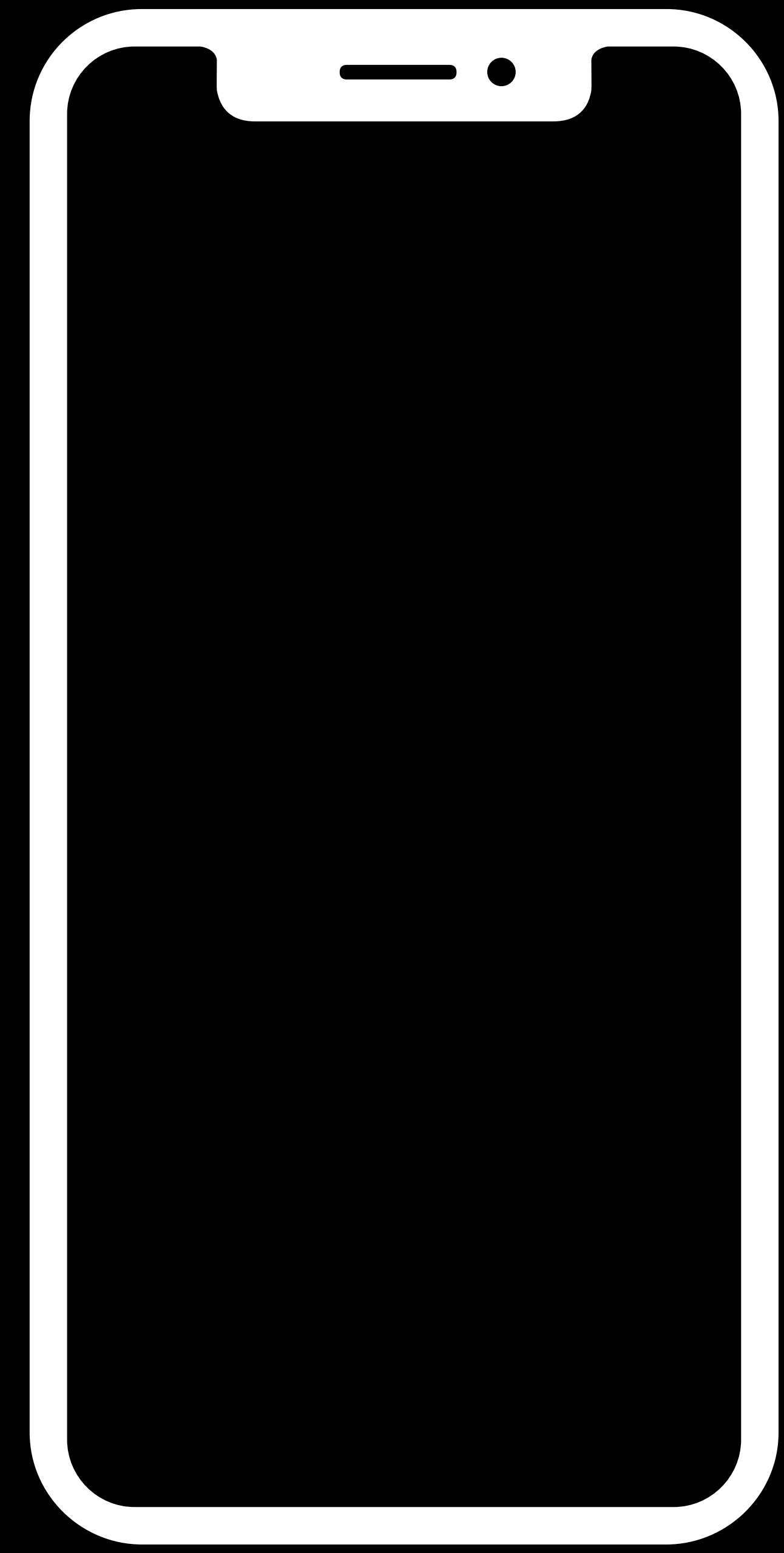


External datasets

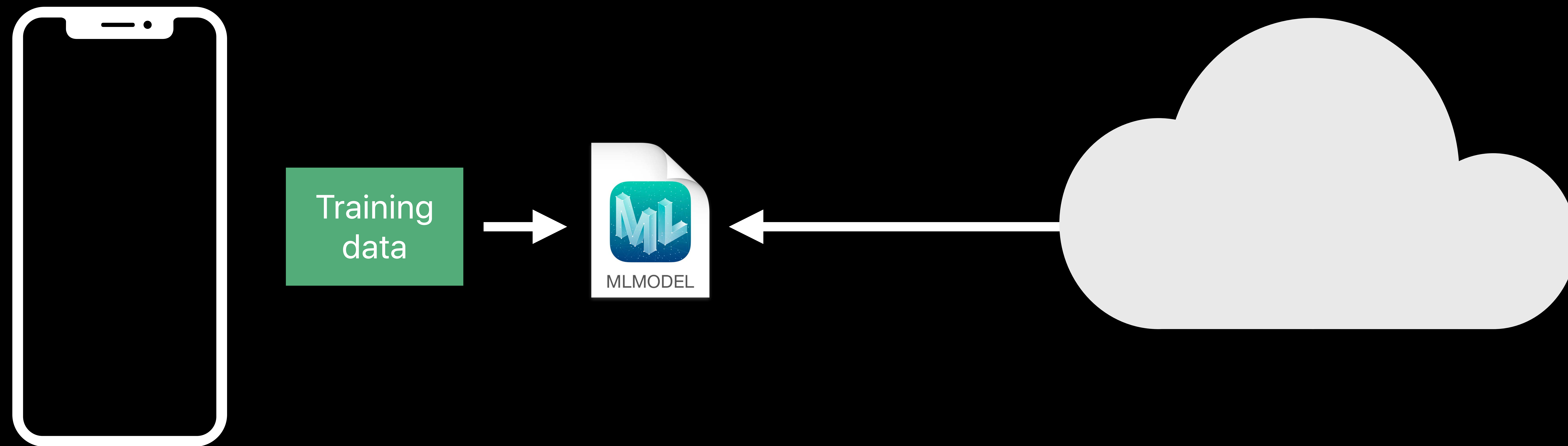
Public data sets

Partnerships

On-Device Training

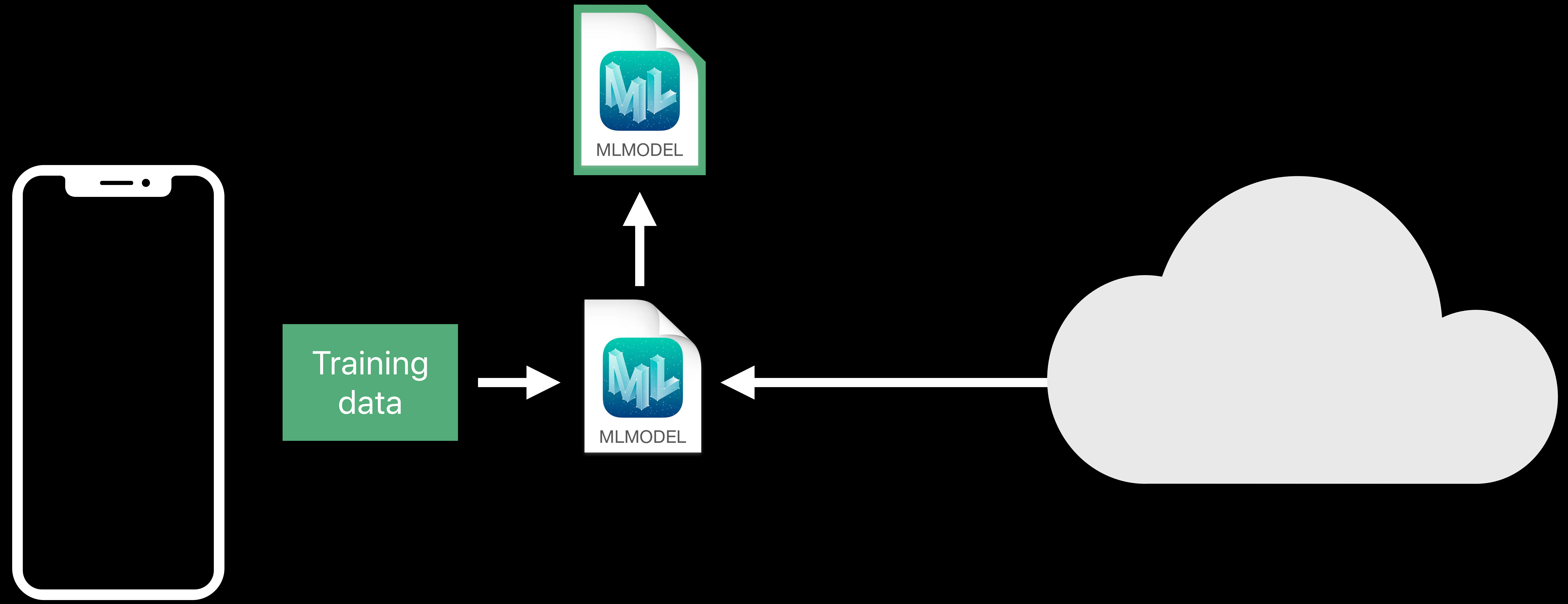


On-Device Training



On-Device Training

NEW



Background Tasks API

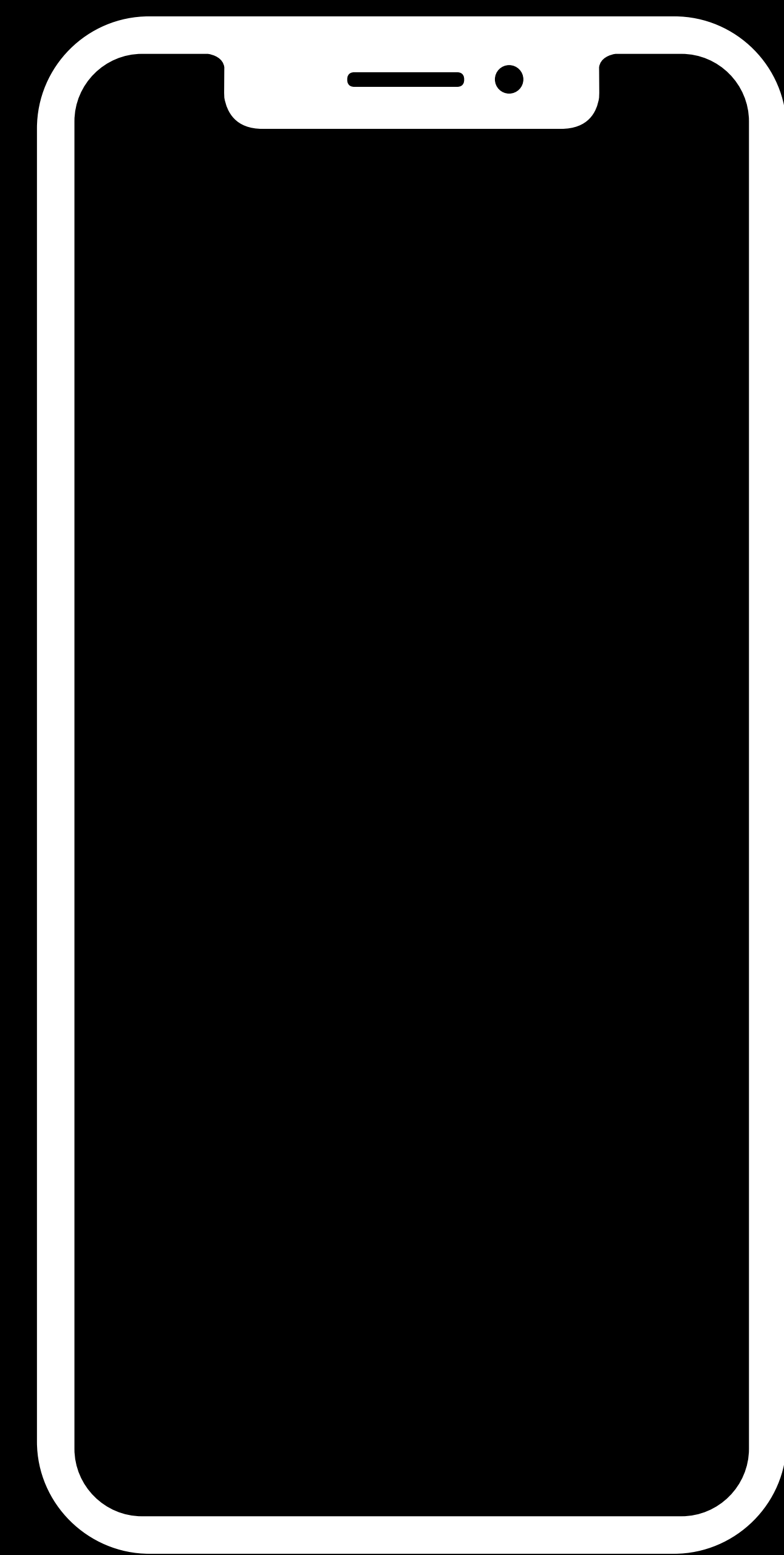
BackgroundTasks Framework

- `BGProcessingTaskRequest`
- `BGTaskScheduler`

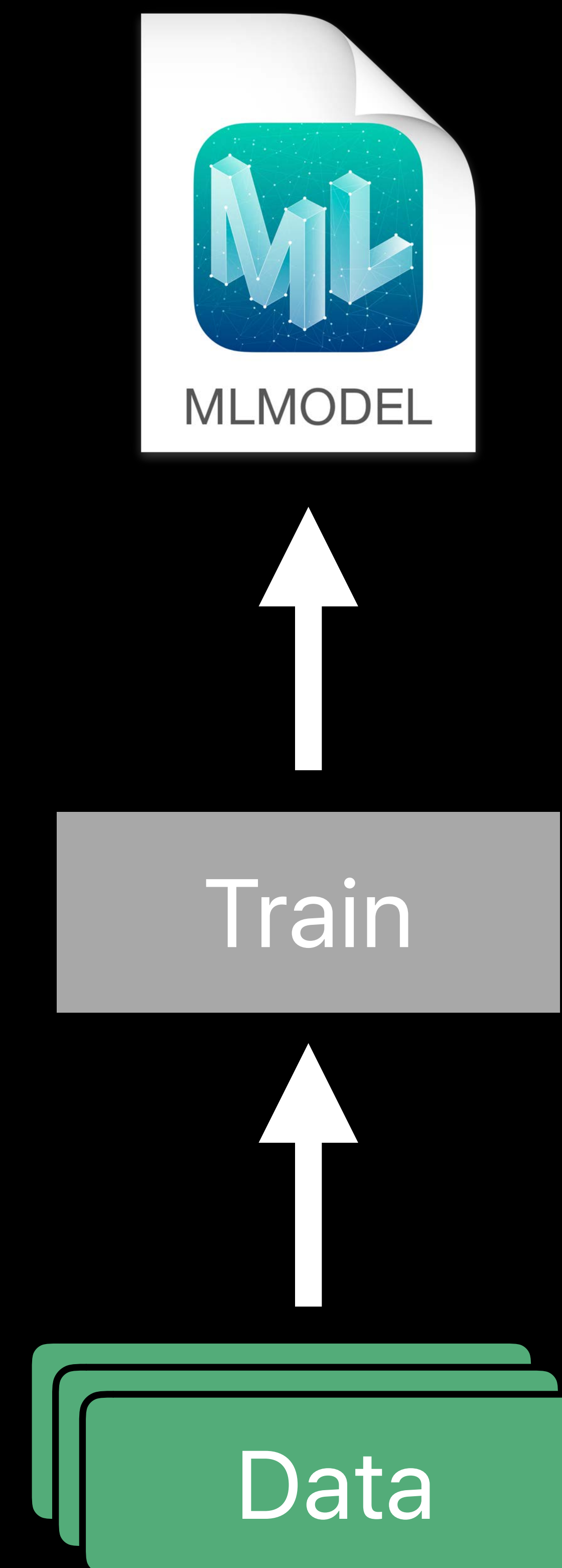
Your Background tasks run as long as your app is regularly used

Private Federated Learning

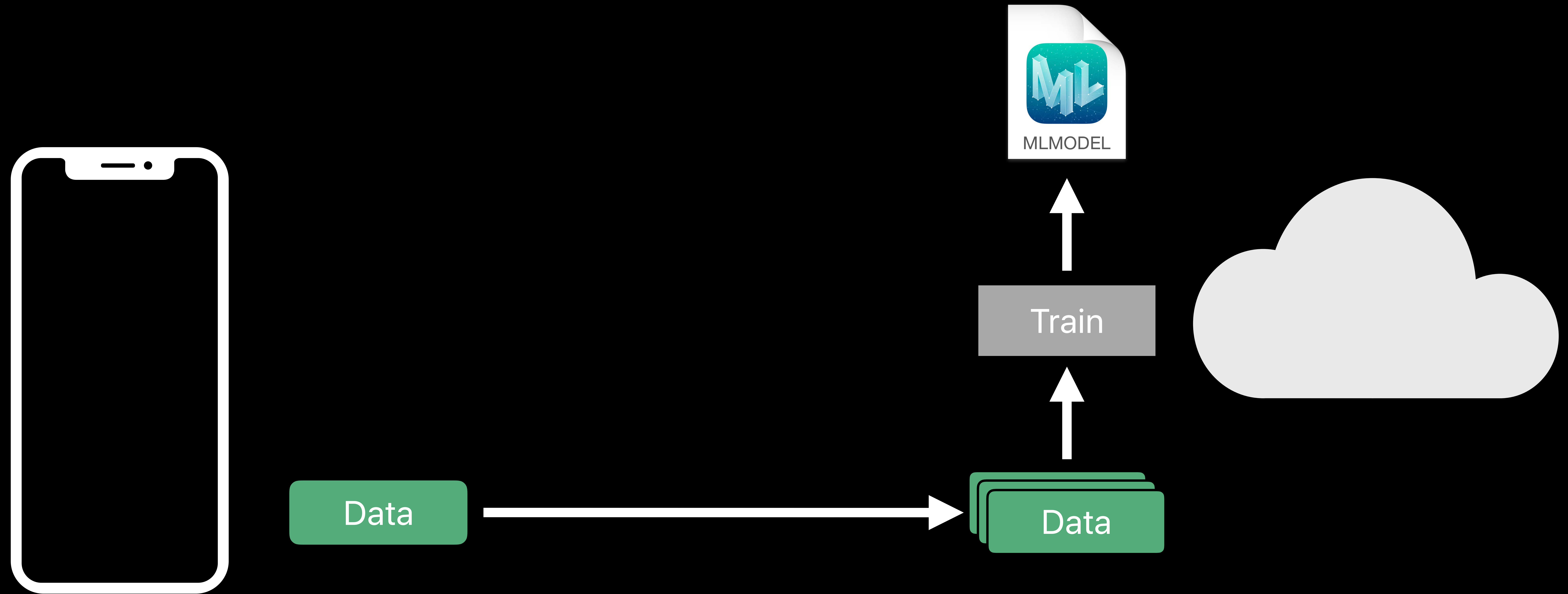
Private Federated Learning



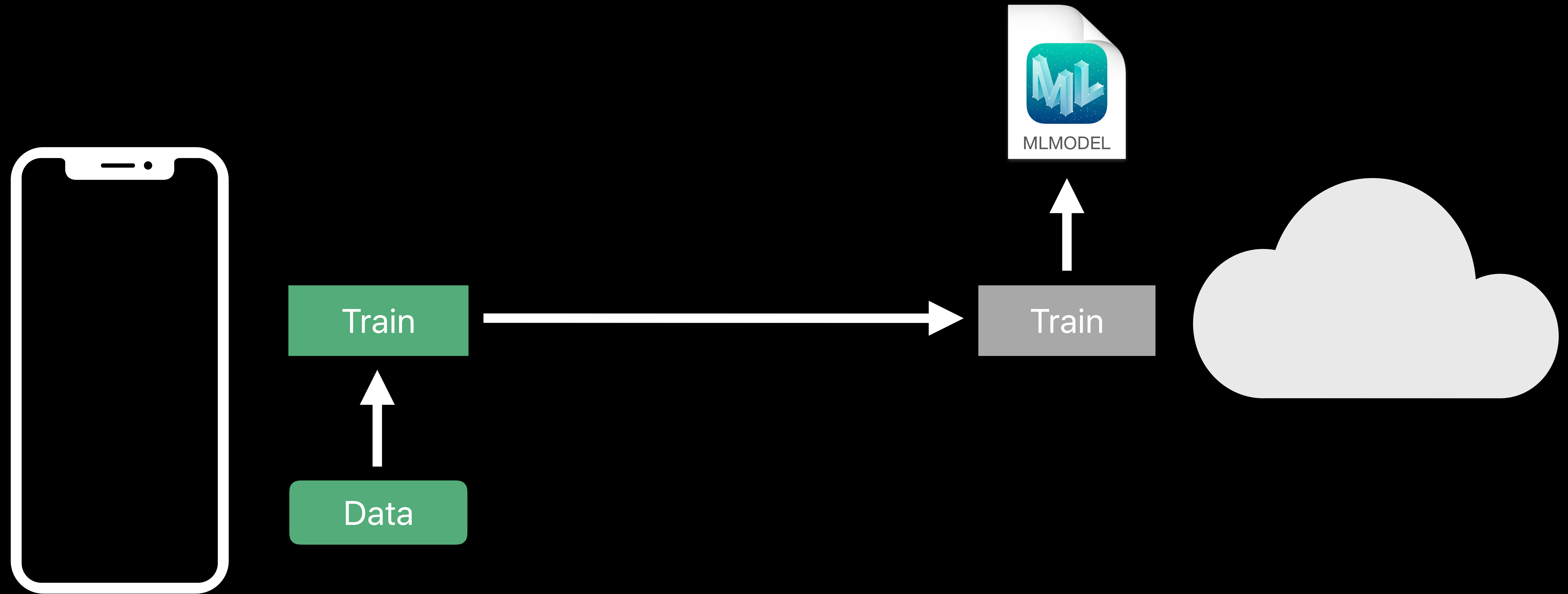
Data



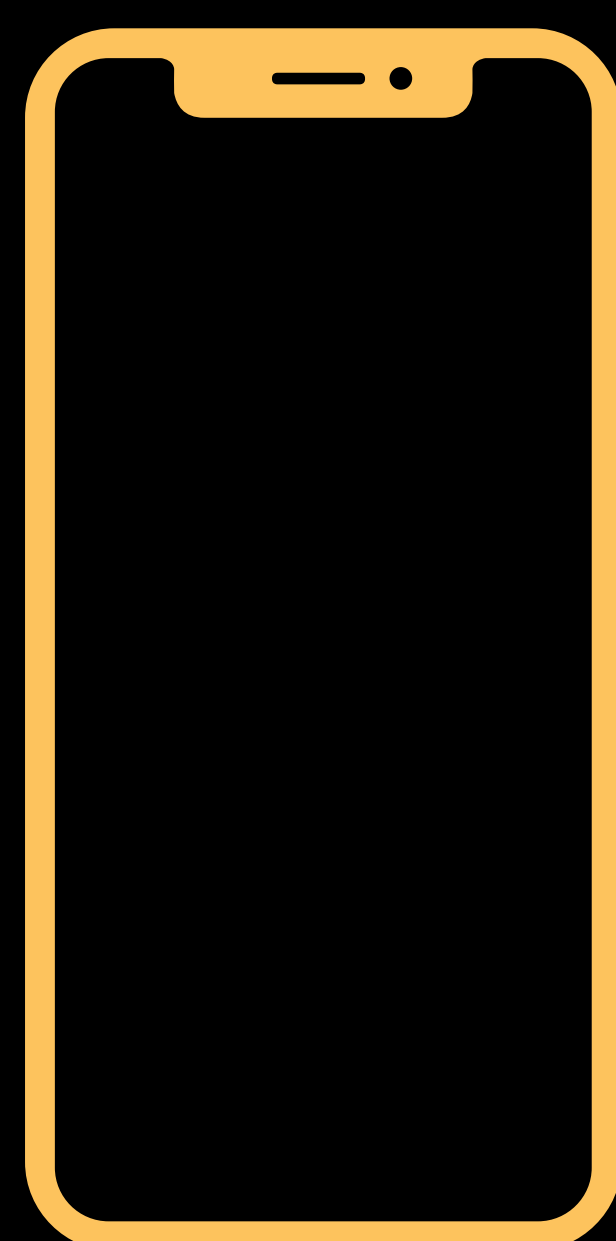
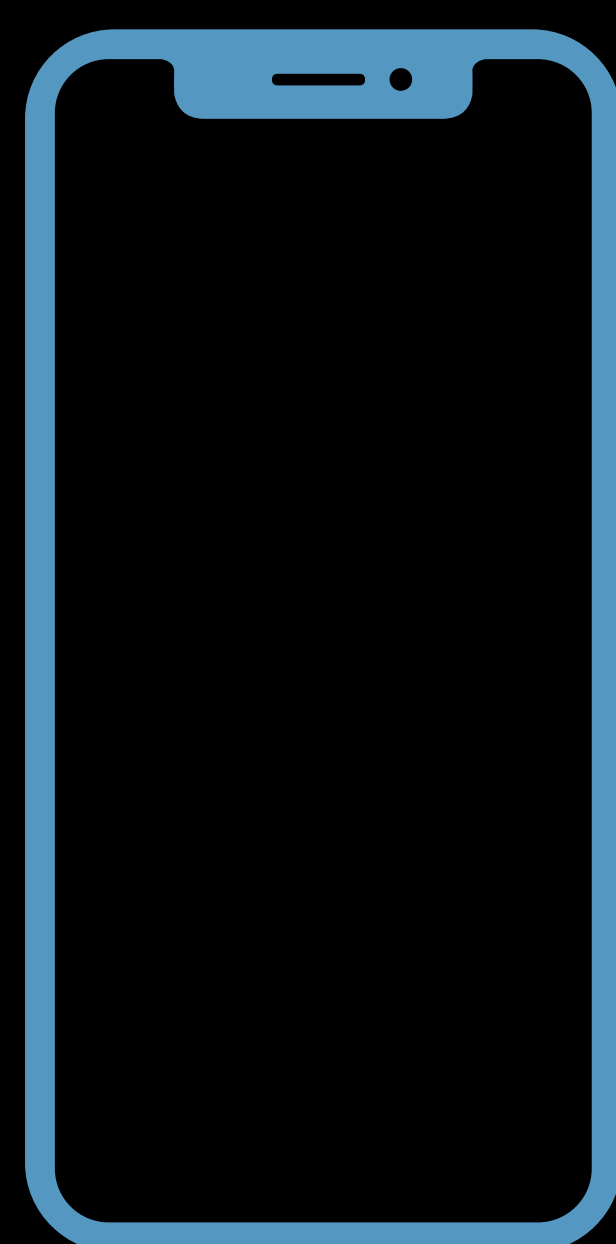
Private Federated Learning



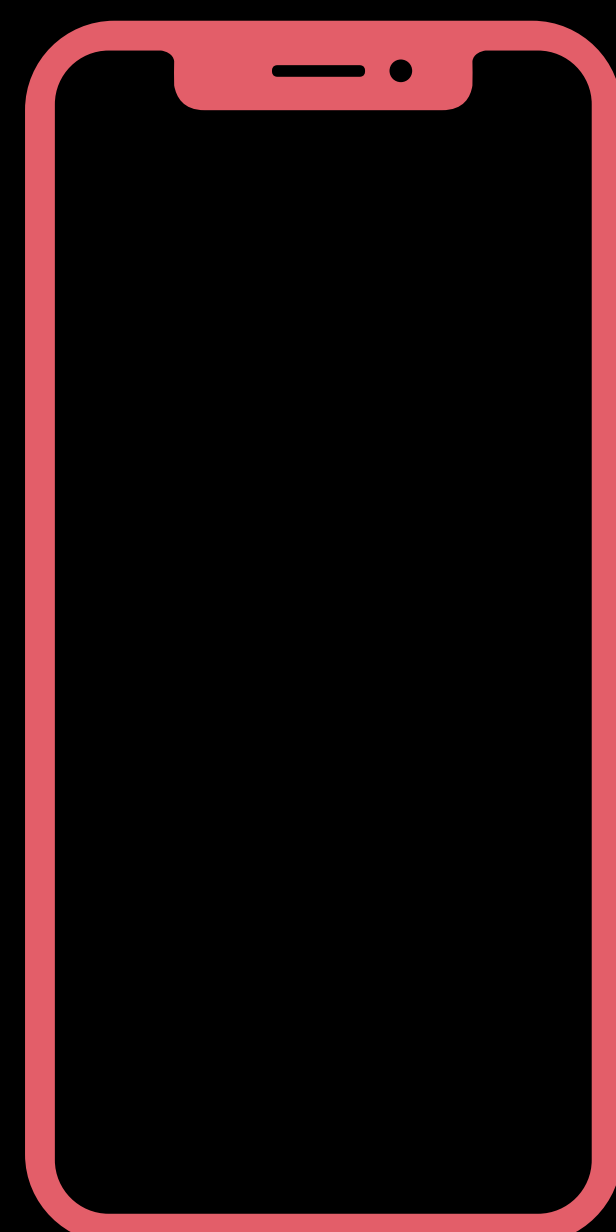
Private Federated Learning



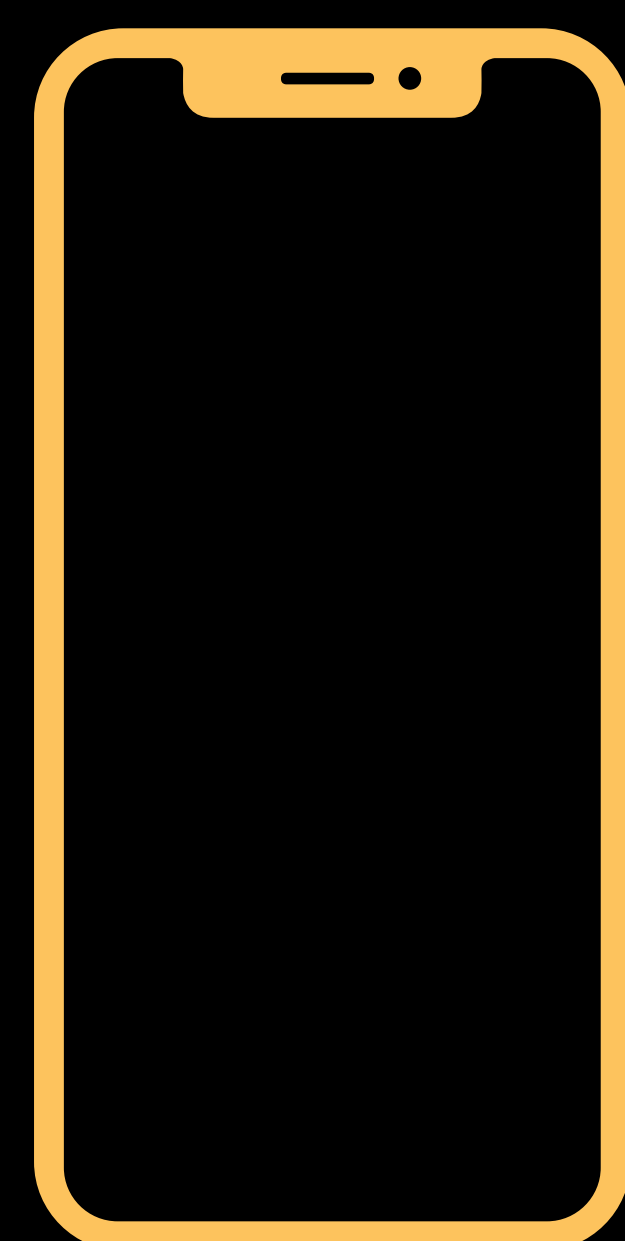
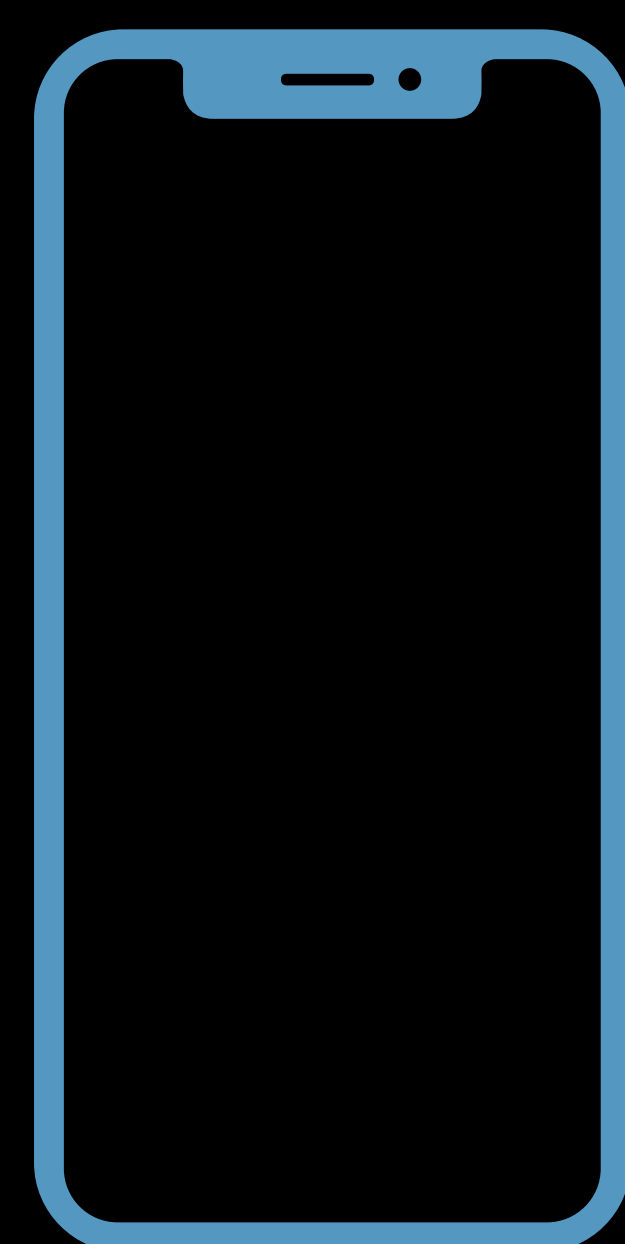
Private Federated Learning



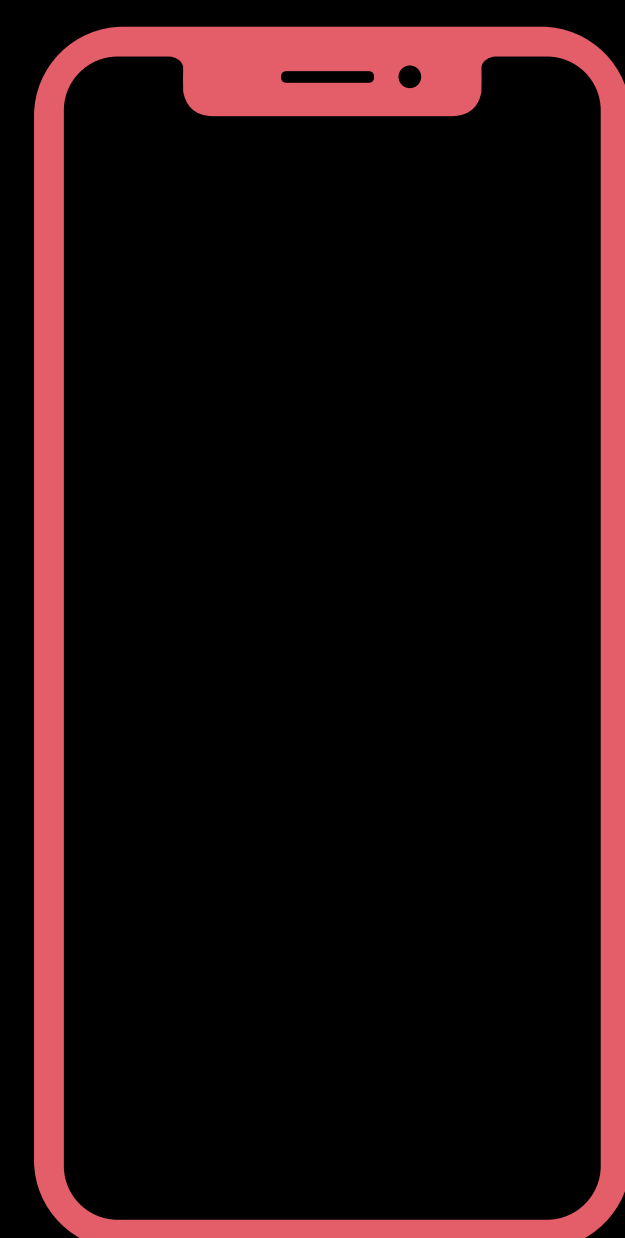
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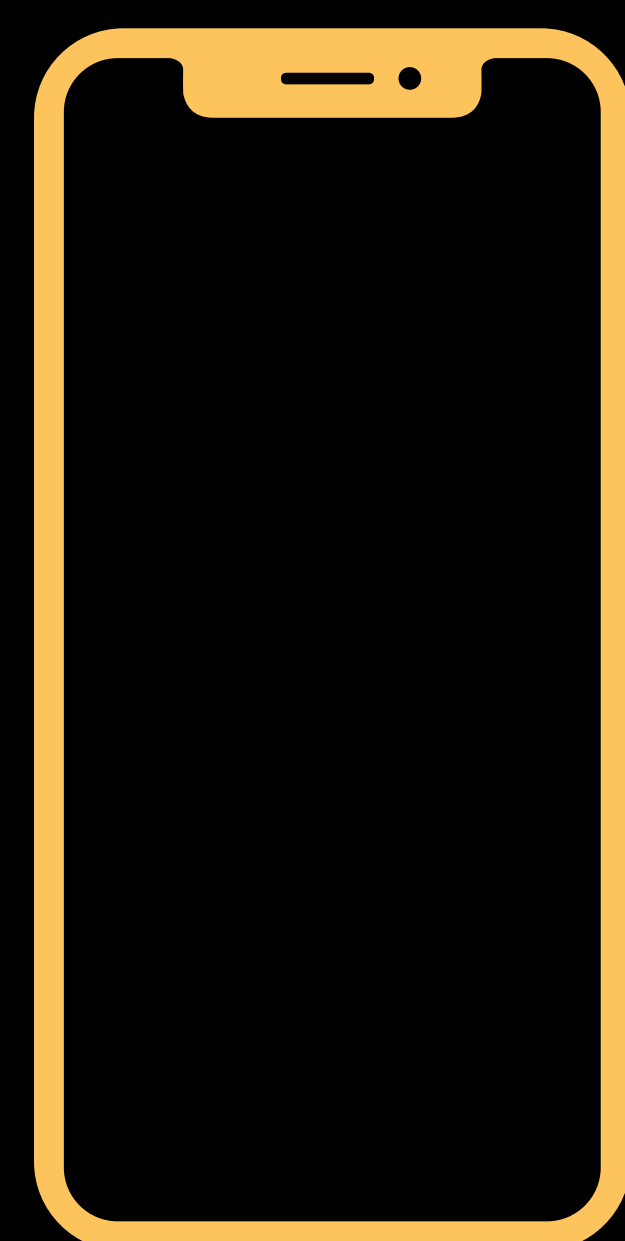
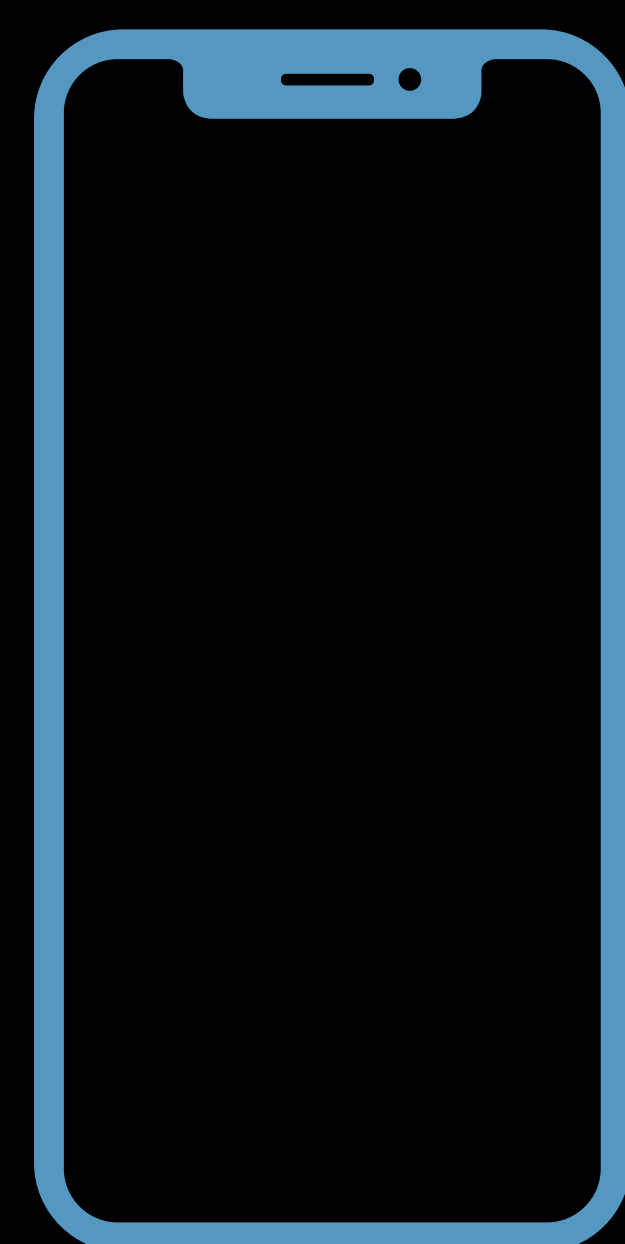
Private Federated Learning



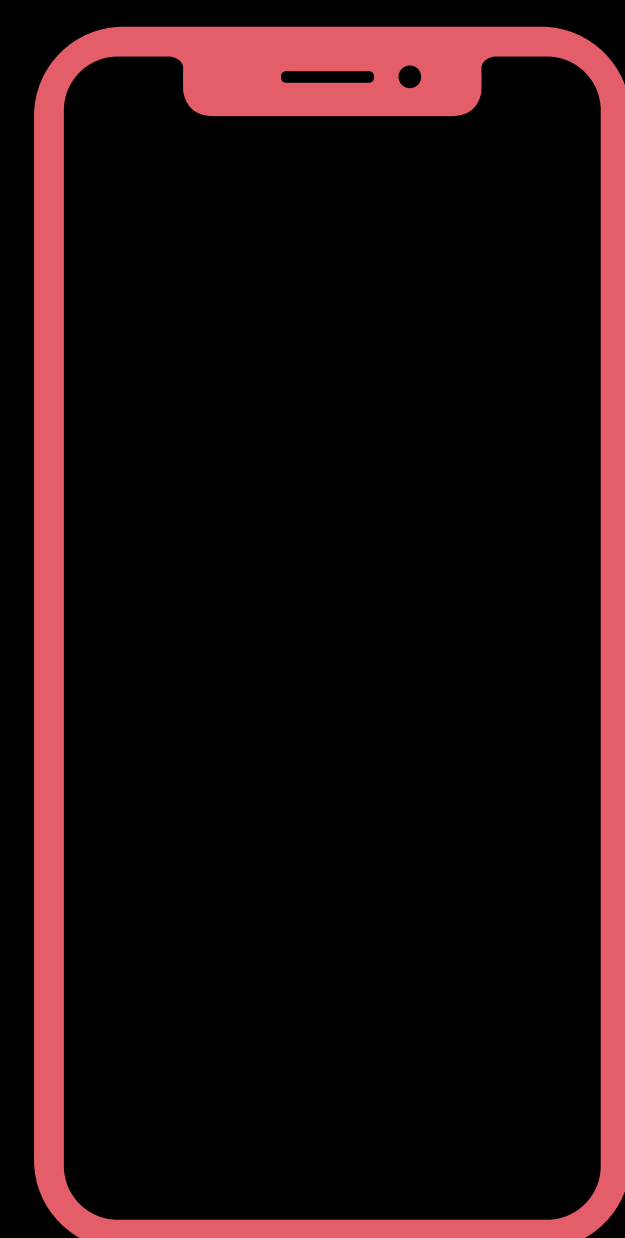
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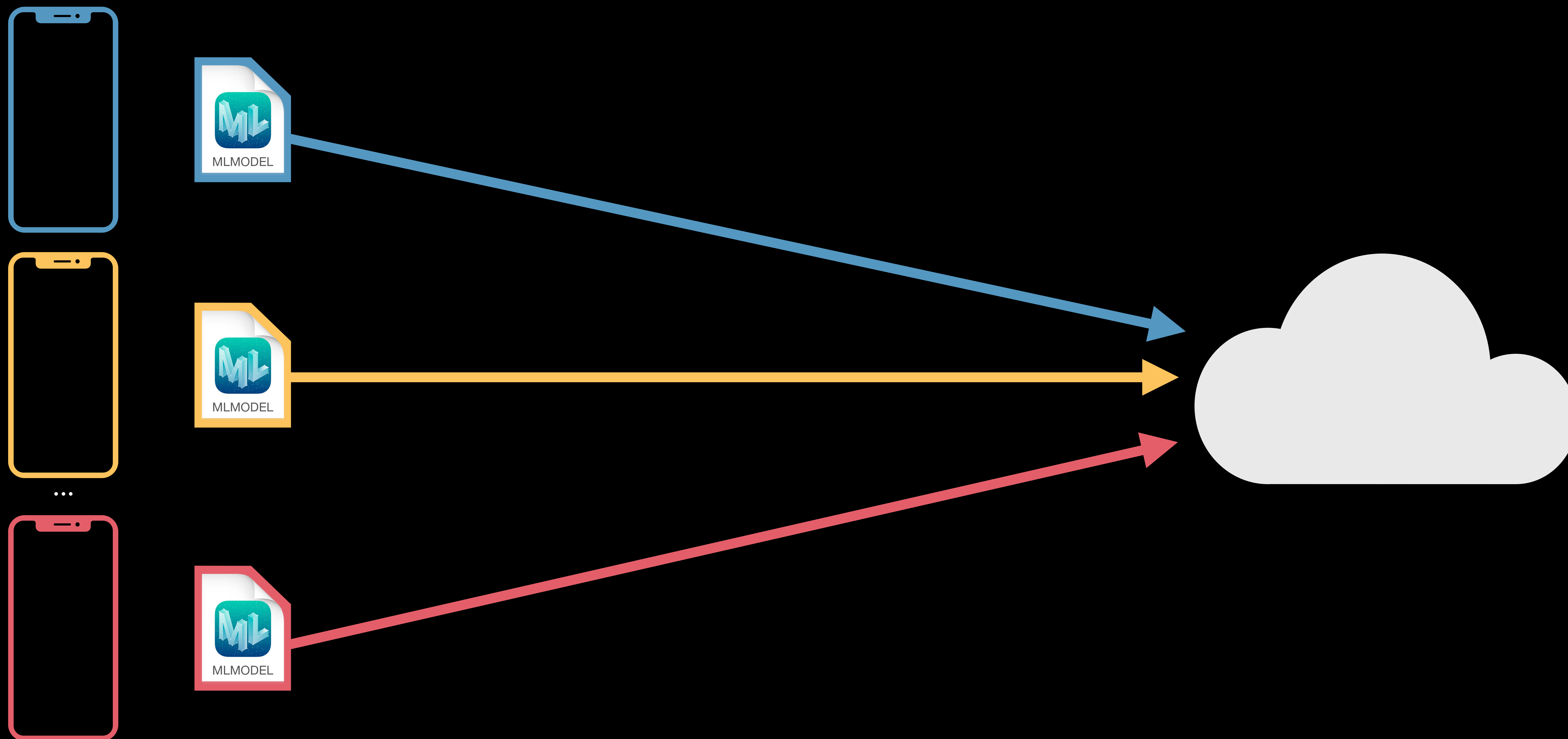
Private Federated Learning



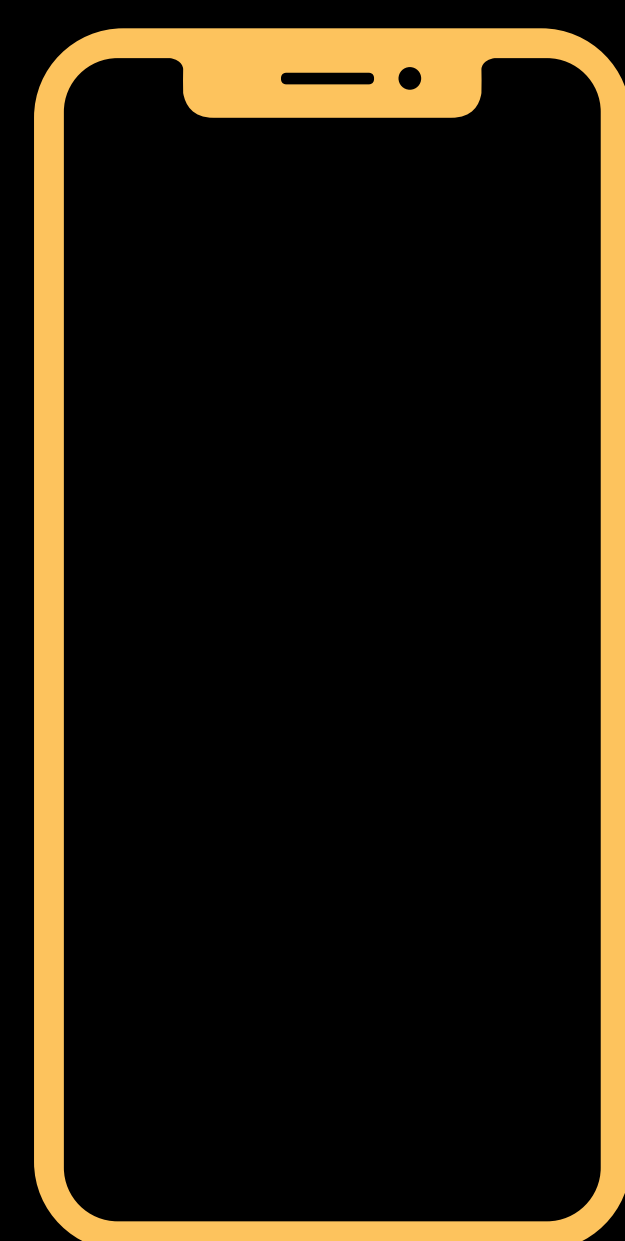
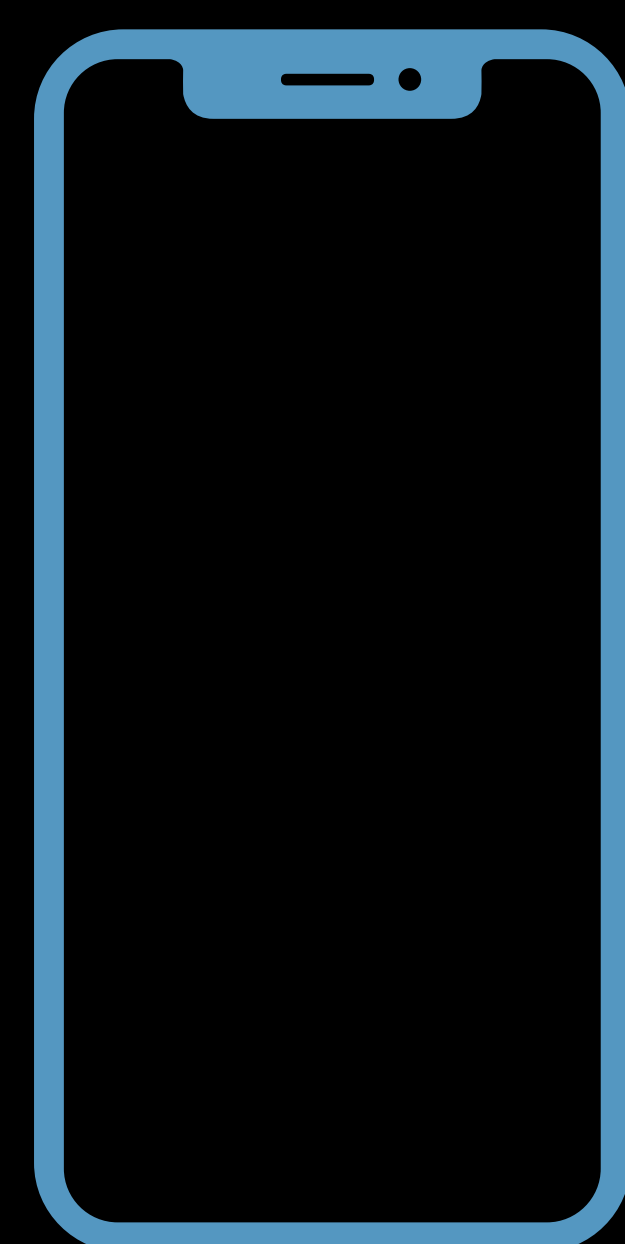
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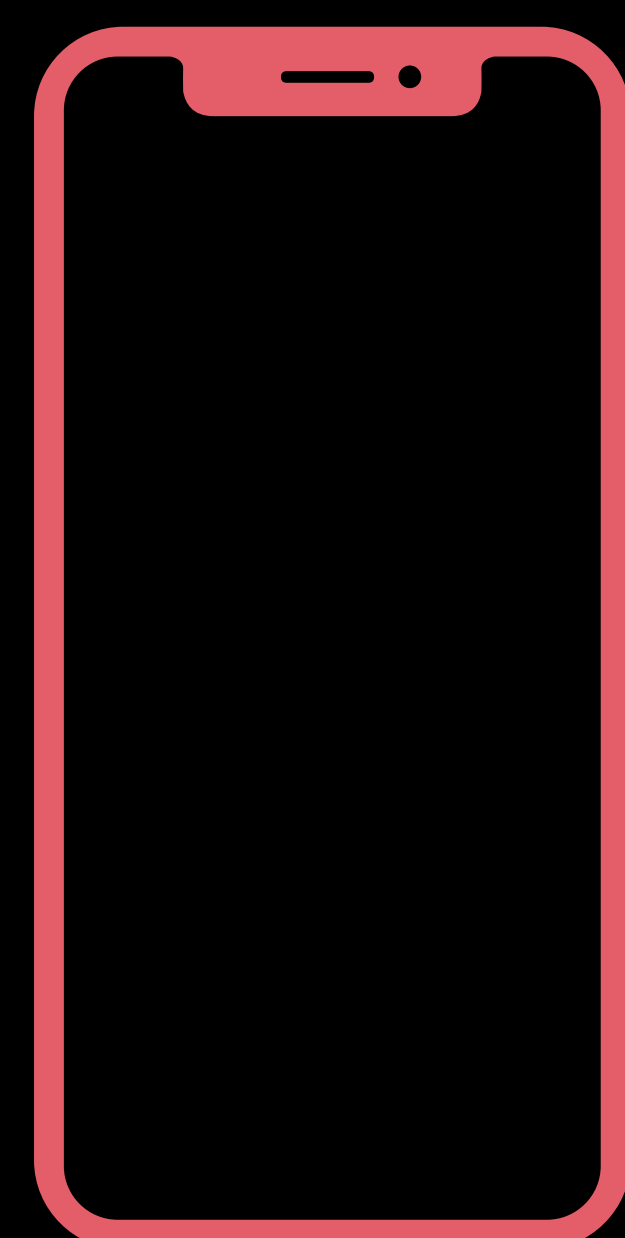
Private Federated Learning



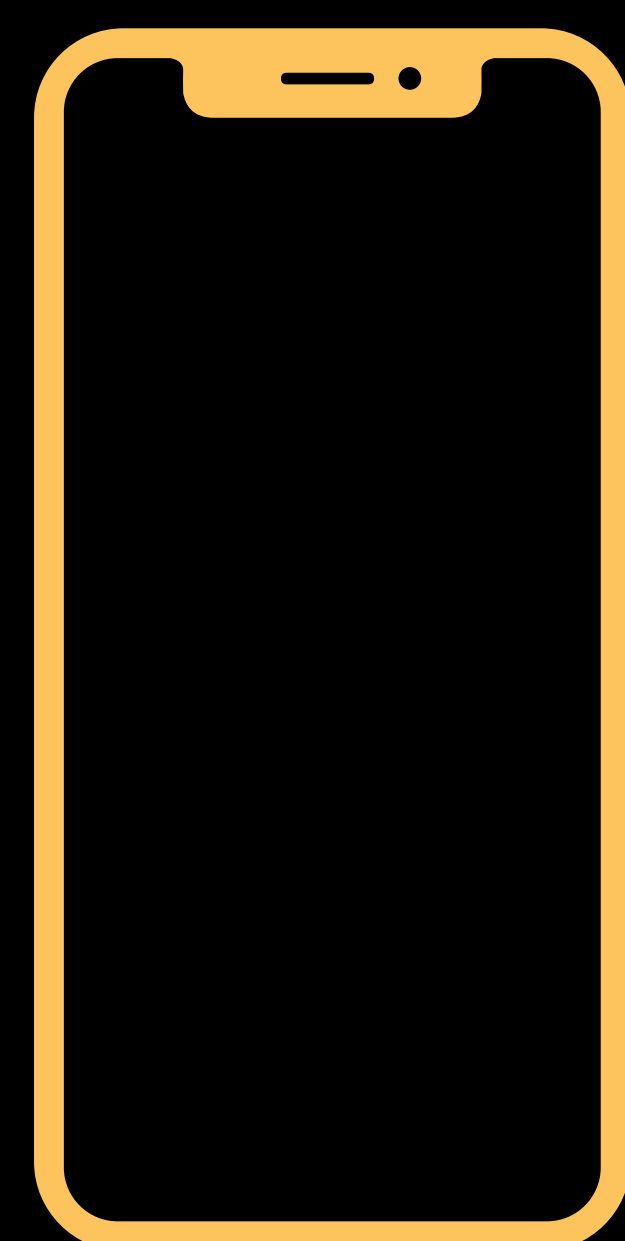
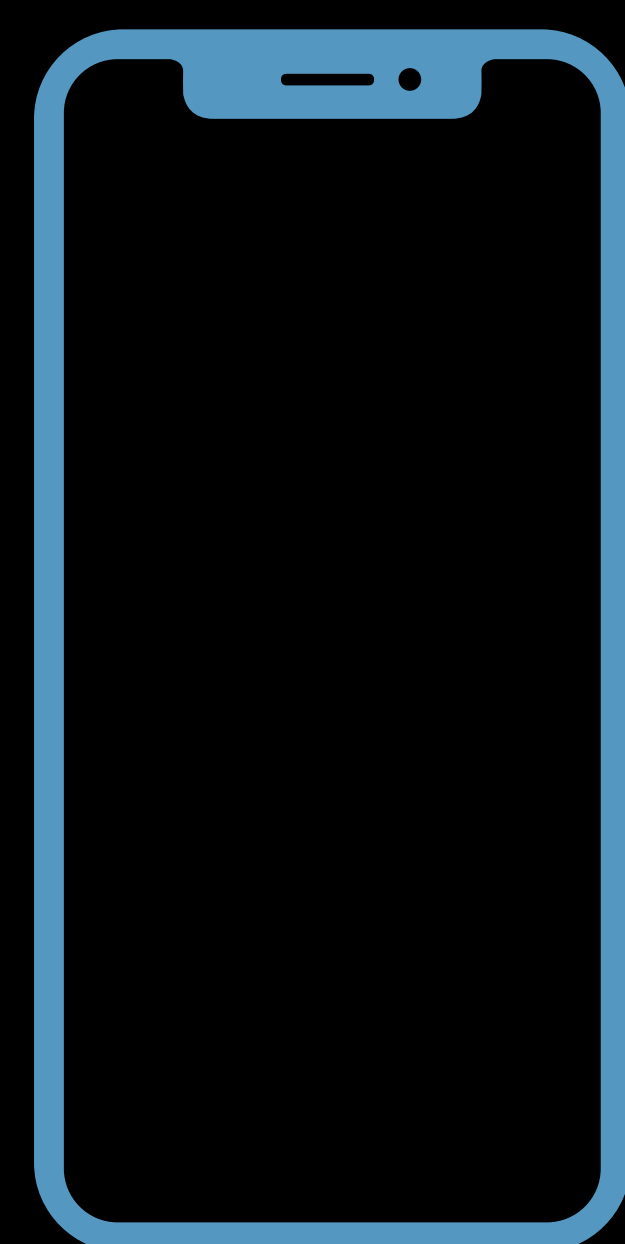
Private Federated Learning



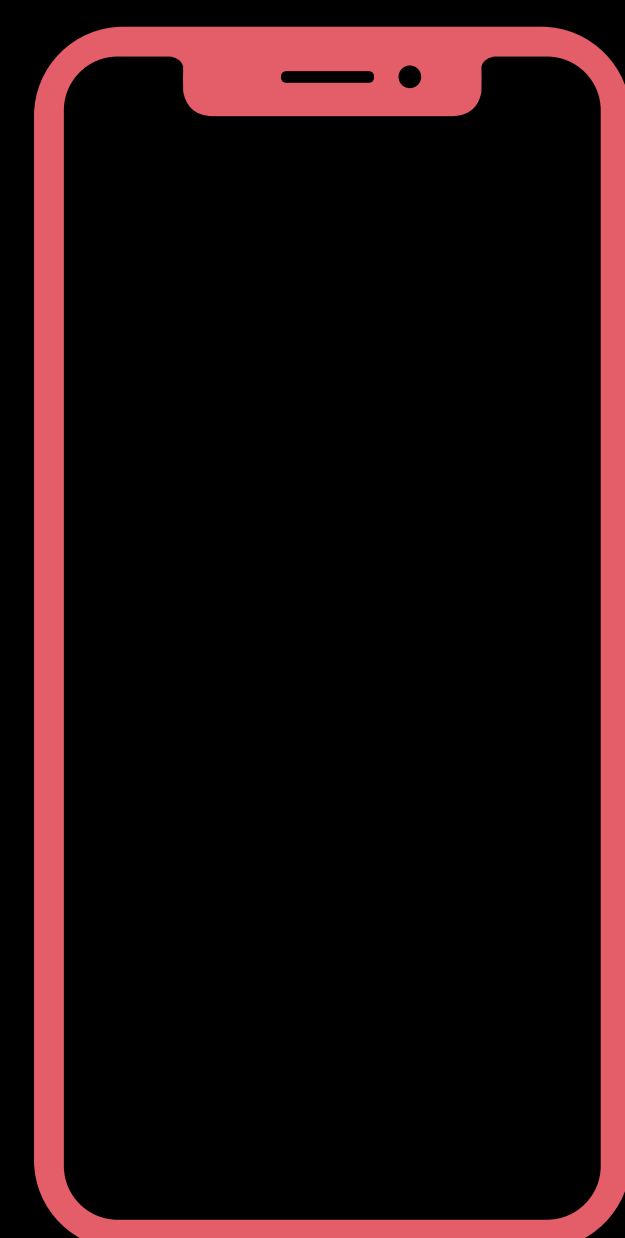
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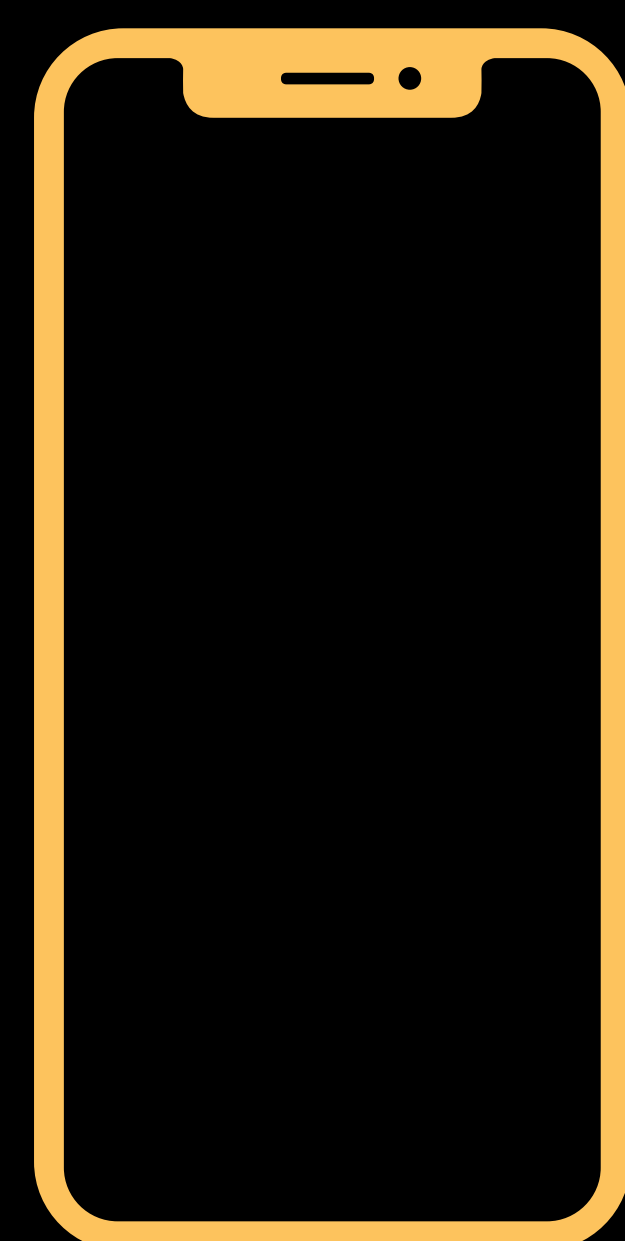
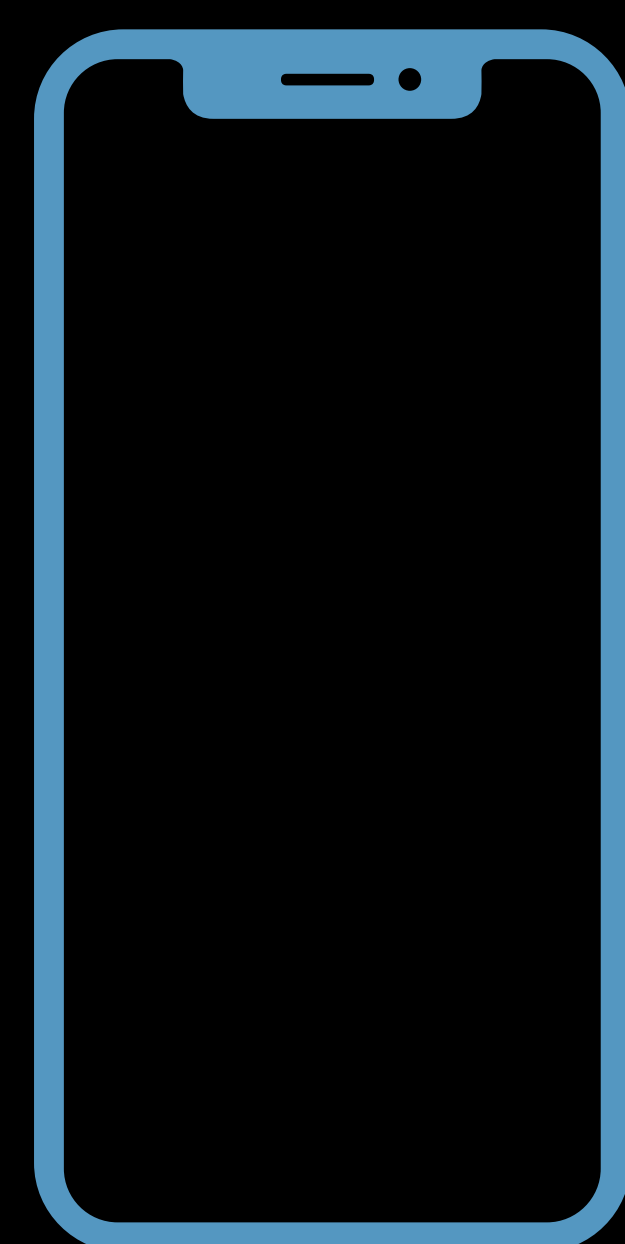
Private Federated Learning



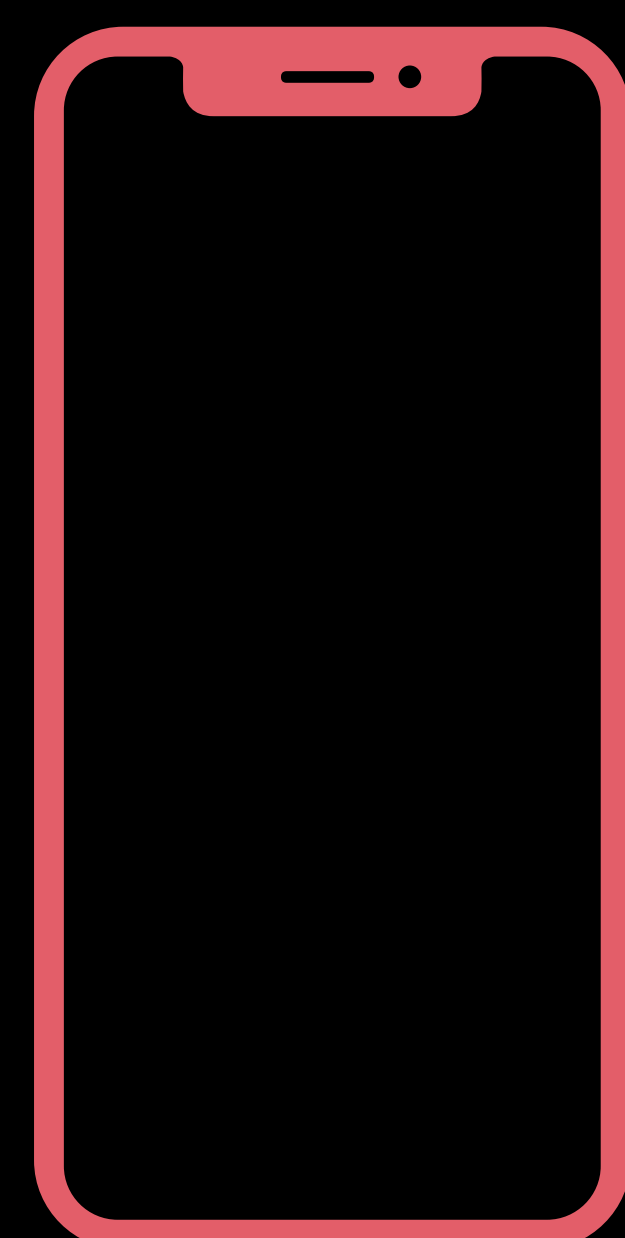
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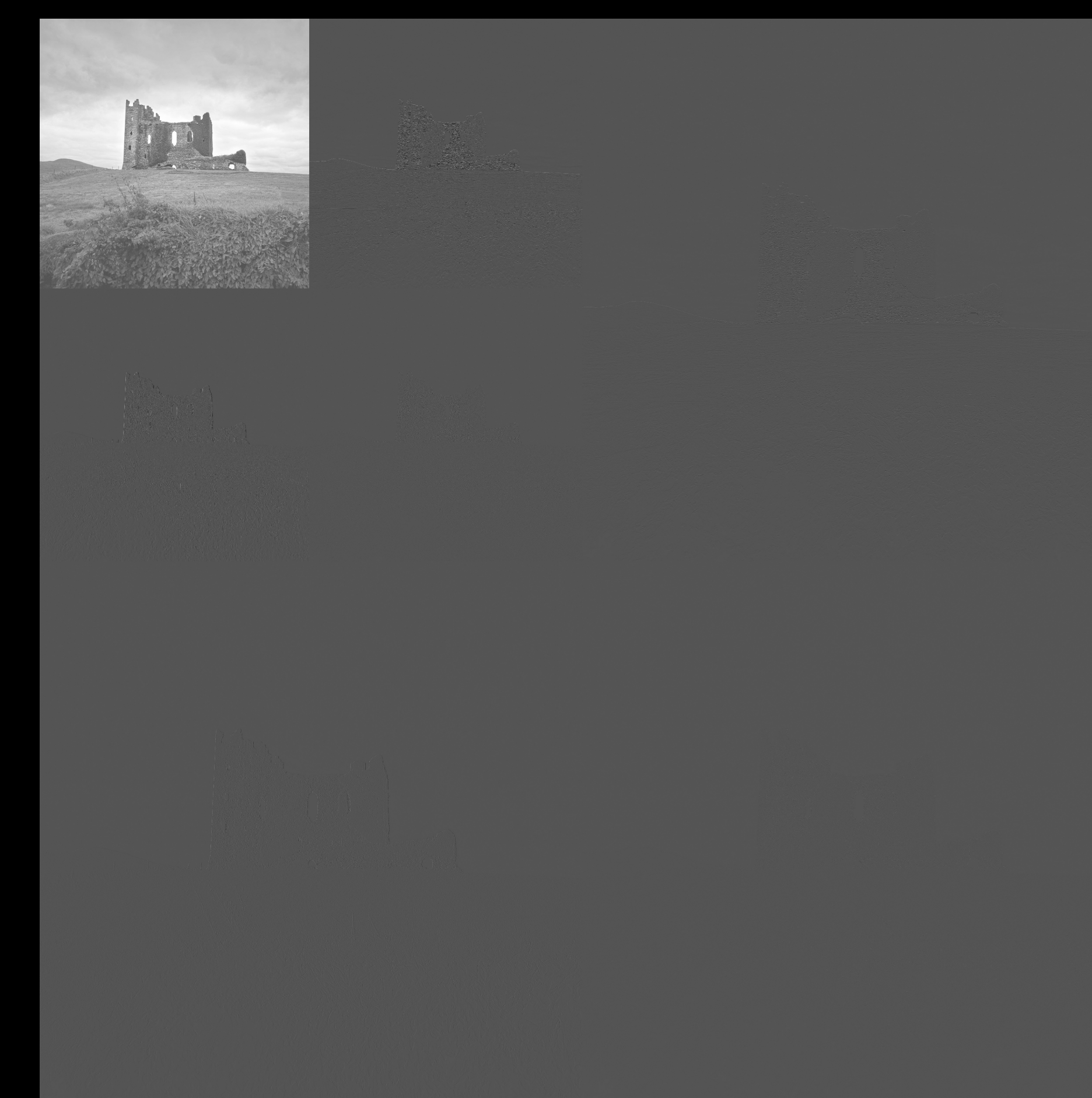
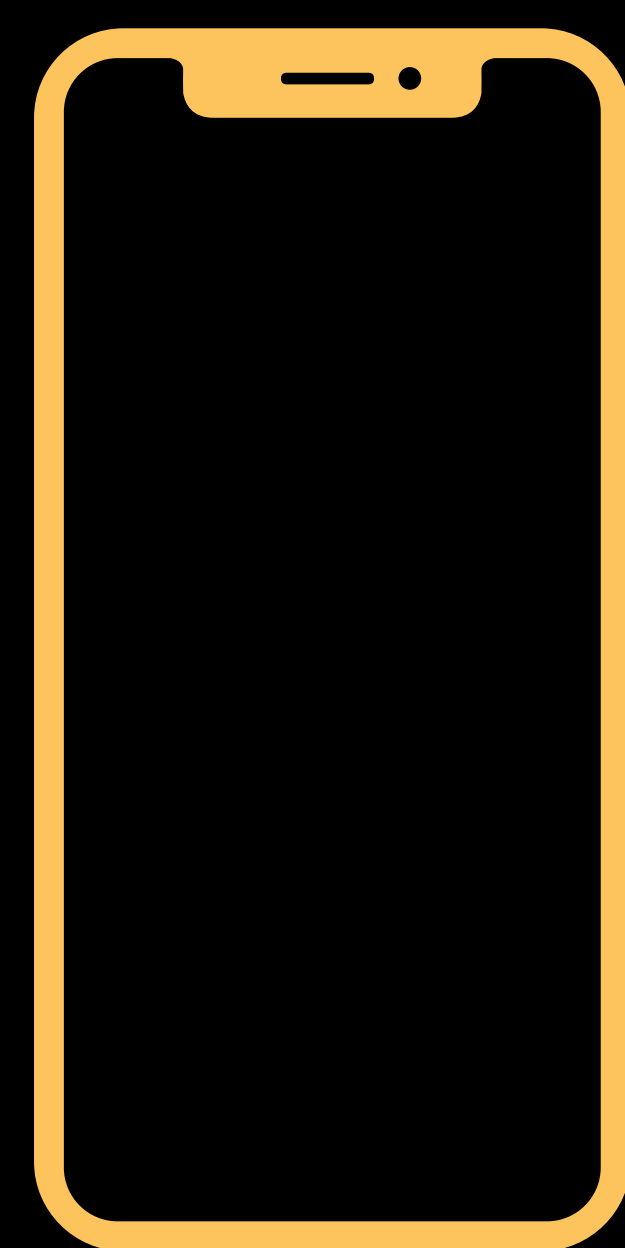
Private Federated Learning



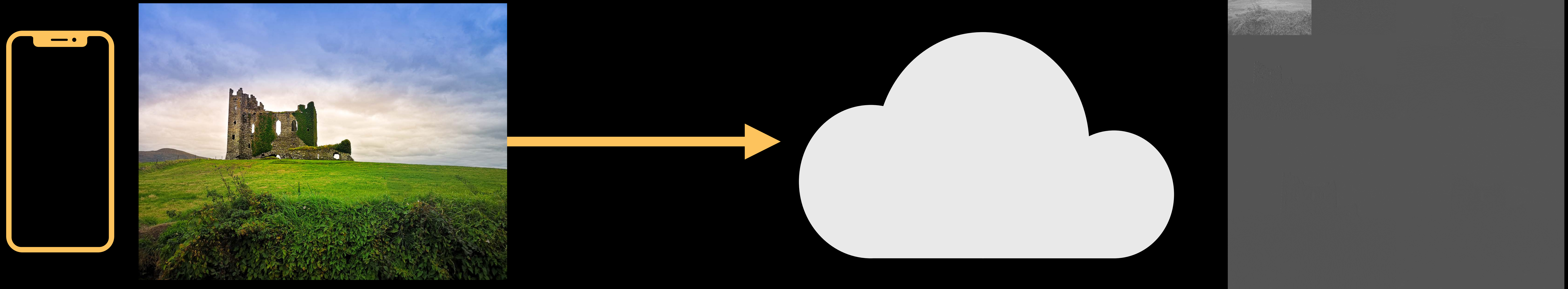
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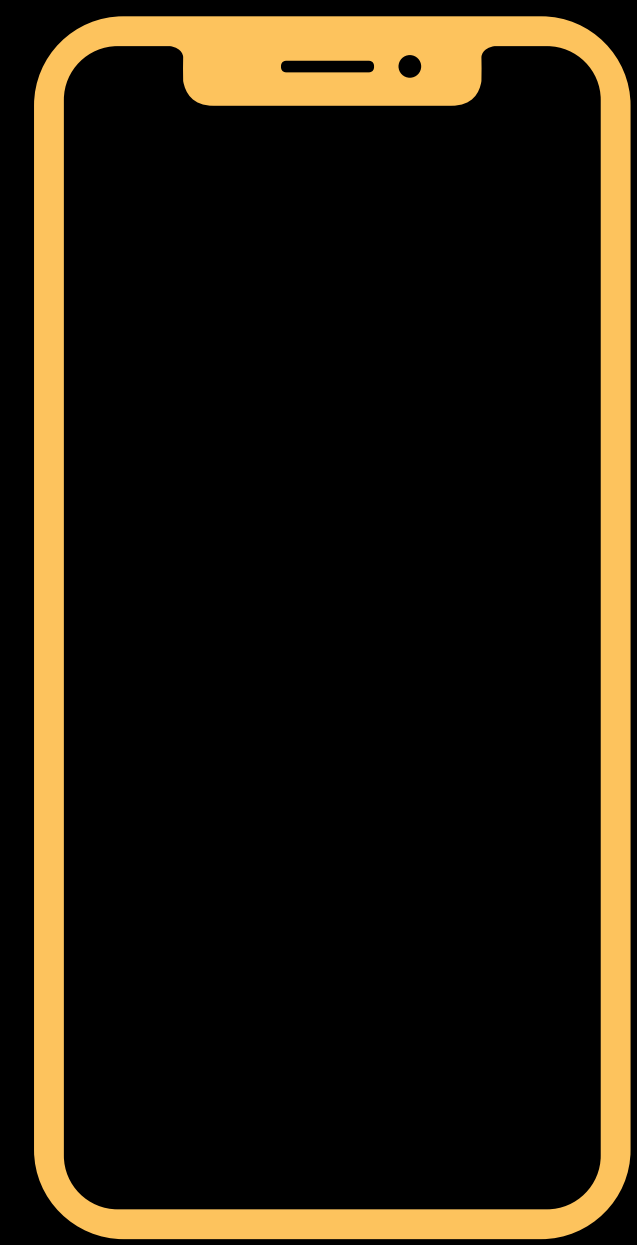
Updates Can Be Sensitive



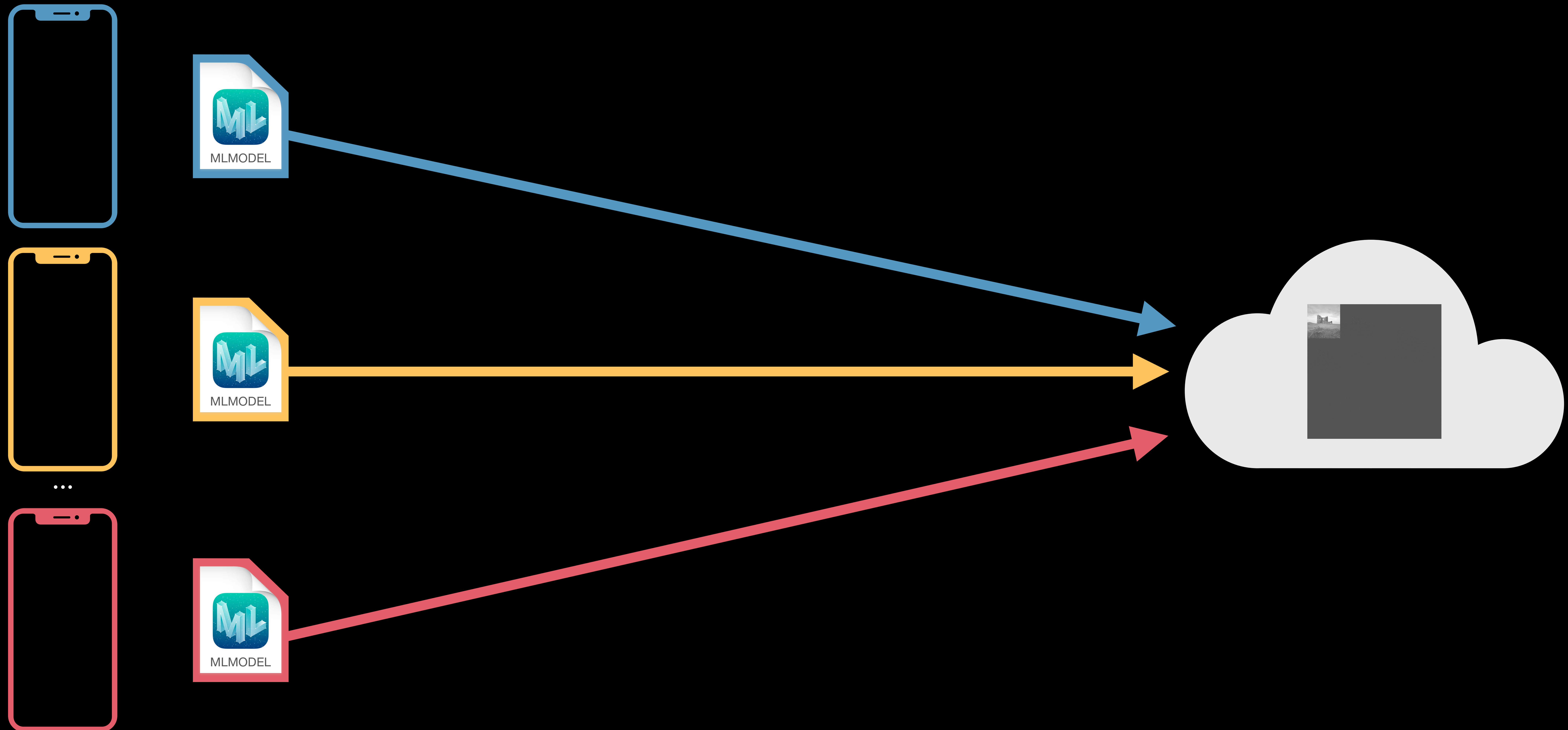
Updates Can Be Sensitive



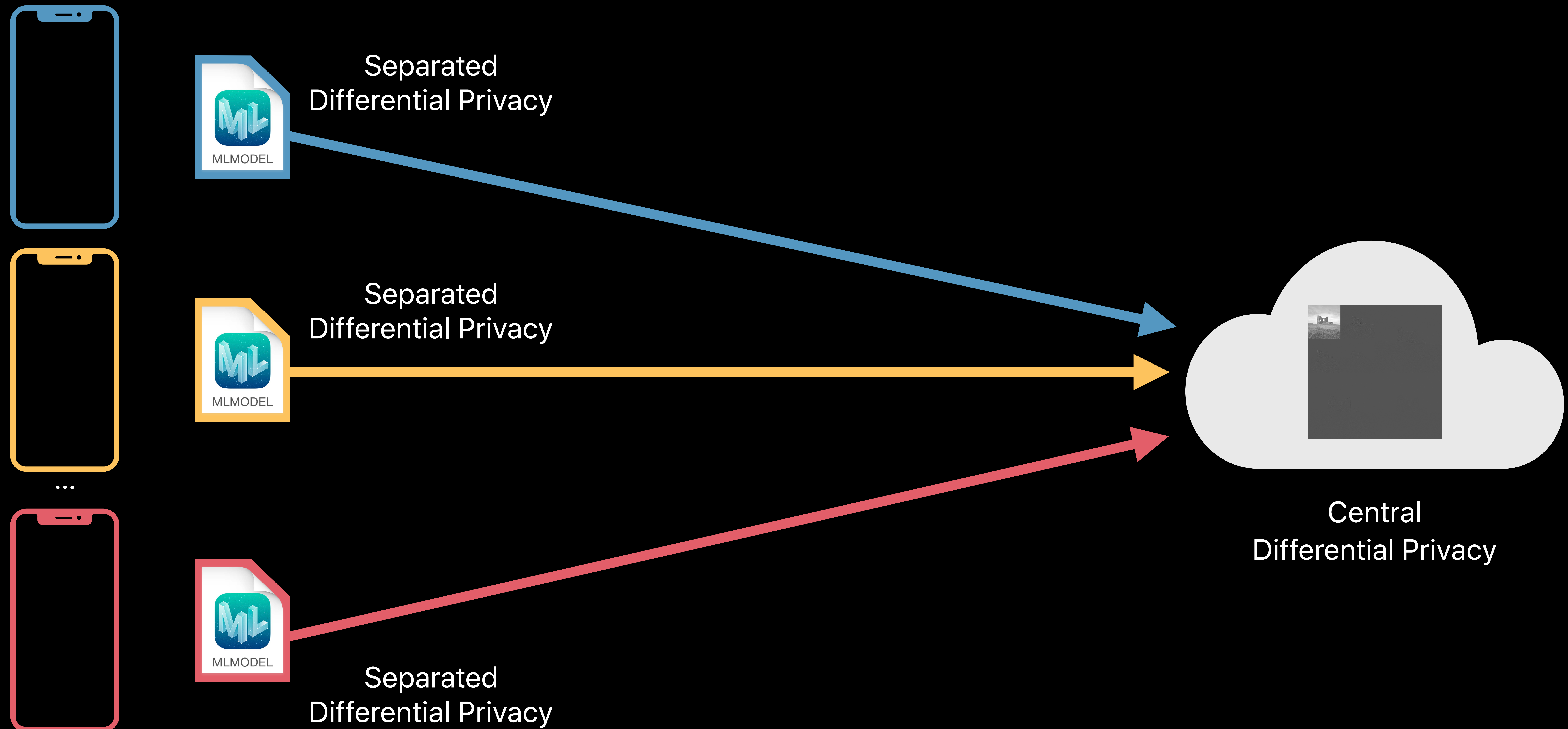
Updates Can Be Sensitive



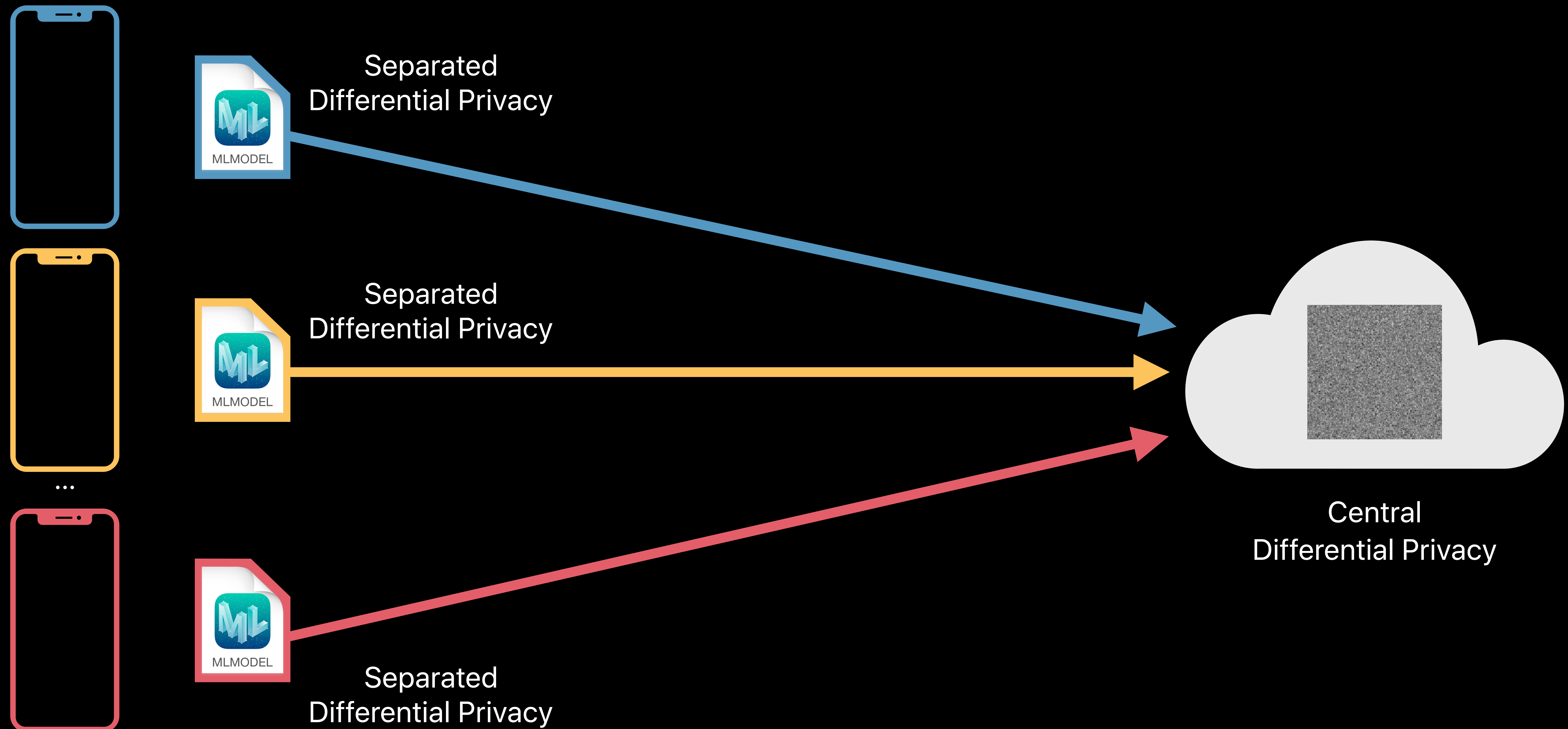
Private Federated Learning



Private Federated Learning



Private Federated Learning



Use Cases

QuickType keyboard

Vocal Classifier for personalized Hey Siri

And more

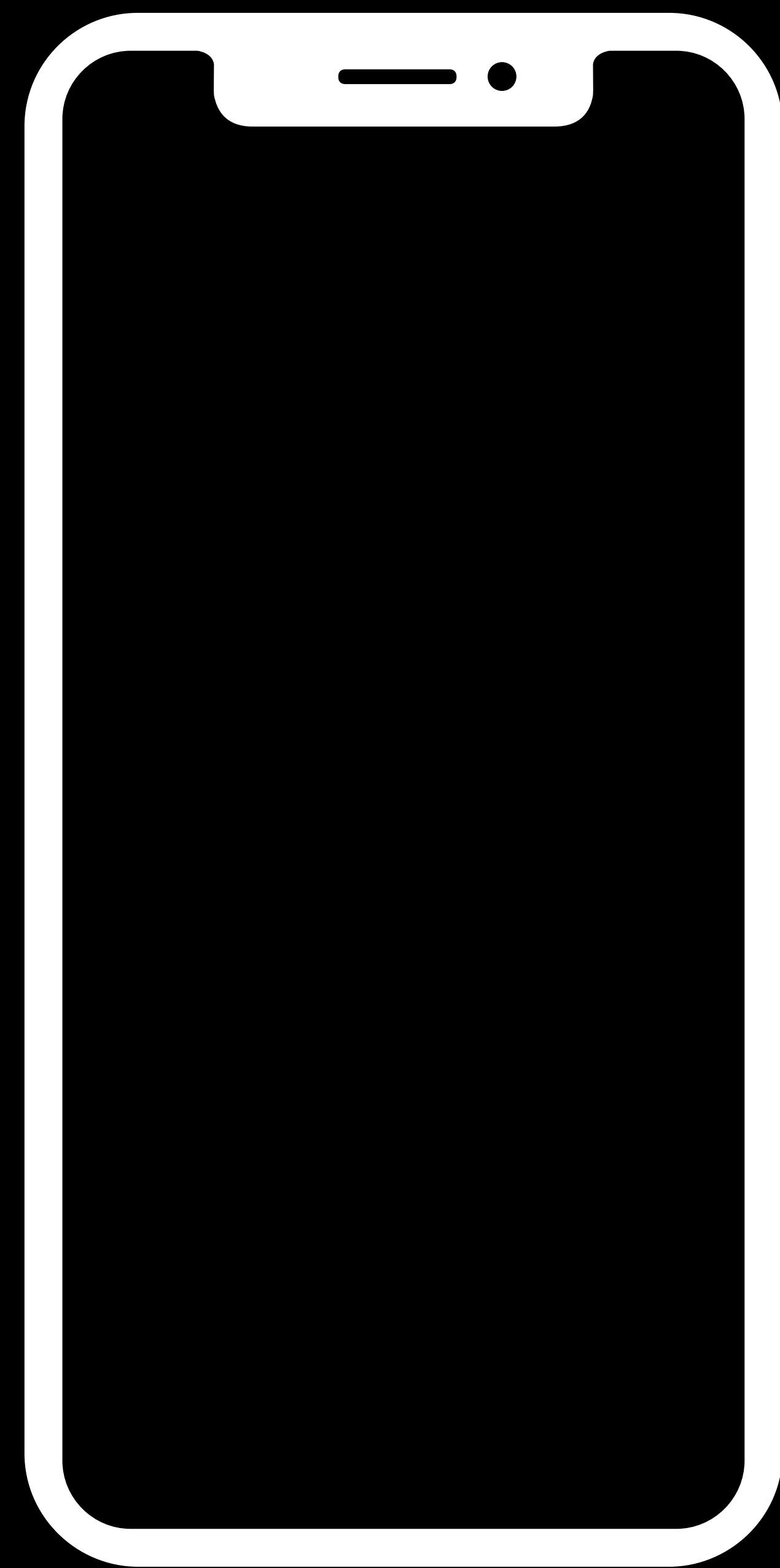


Machine Learning

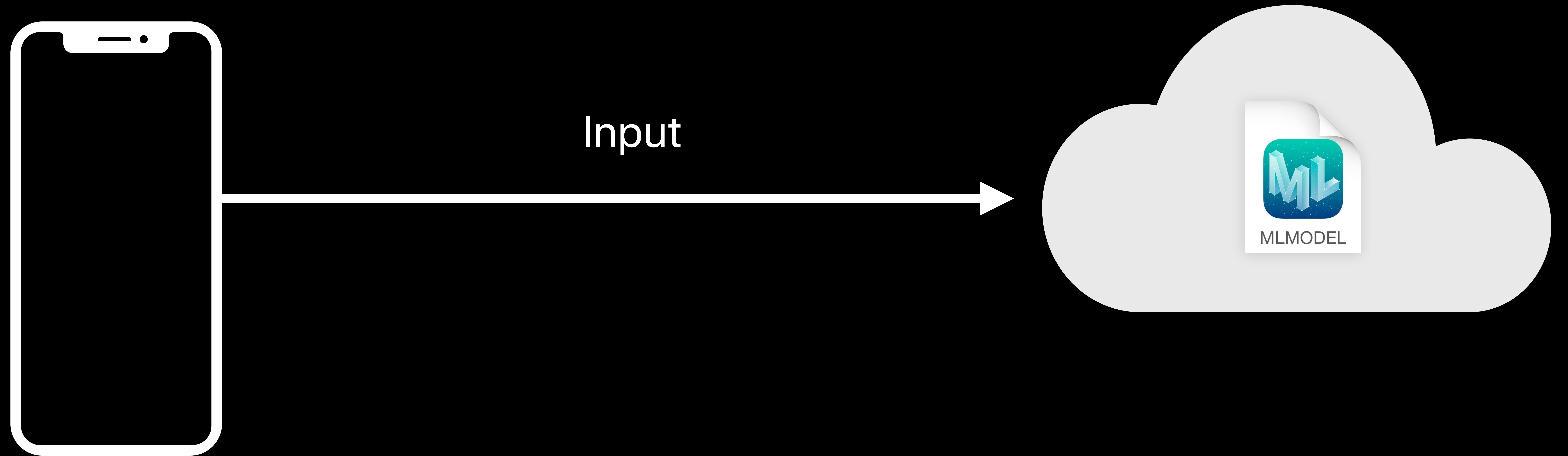
Evaluate a machine learning model

- Without collecting user data
- With fast inferences
- Without Internet connection latency

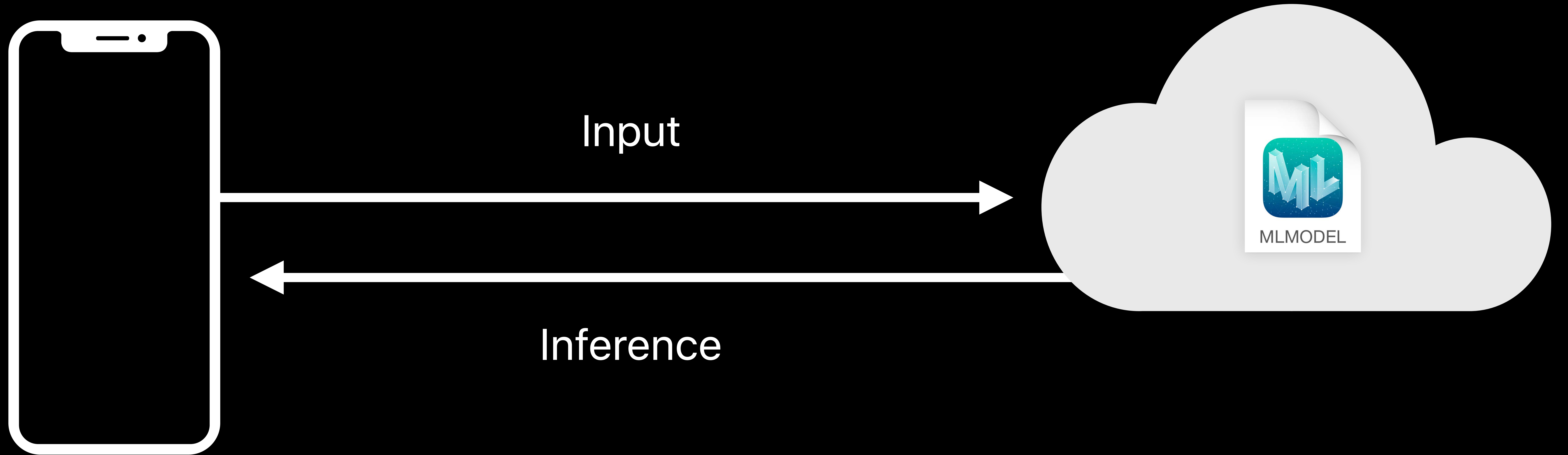
Inference



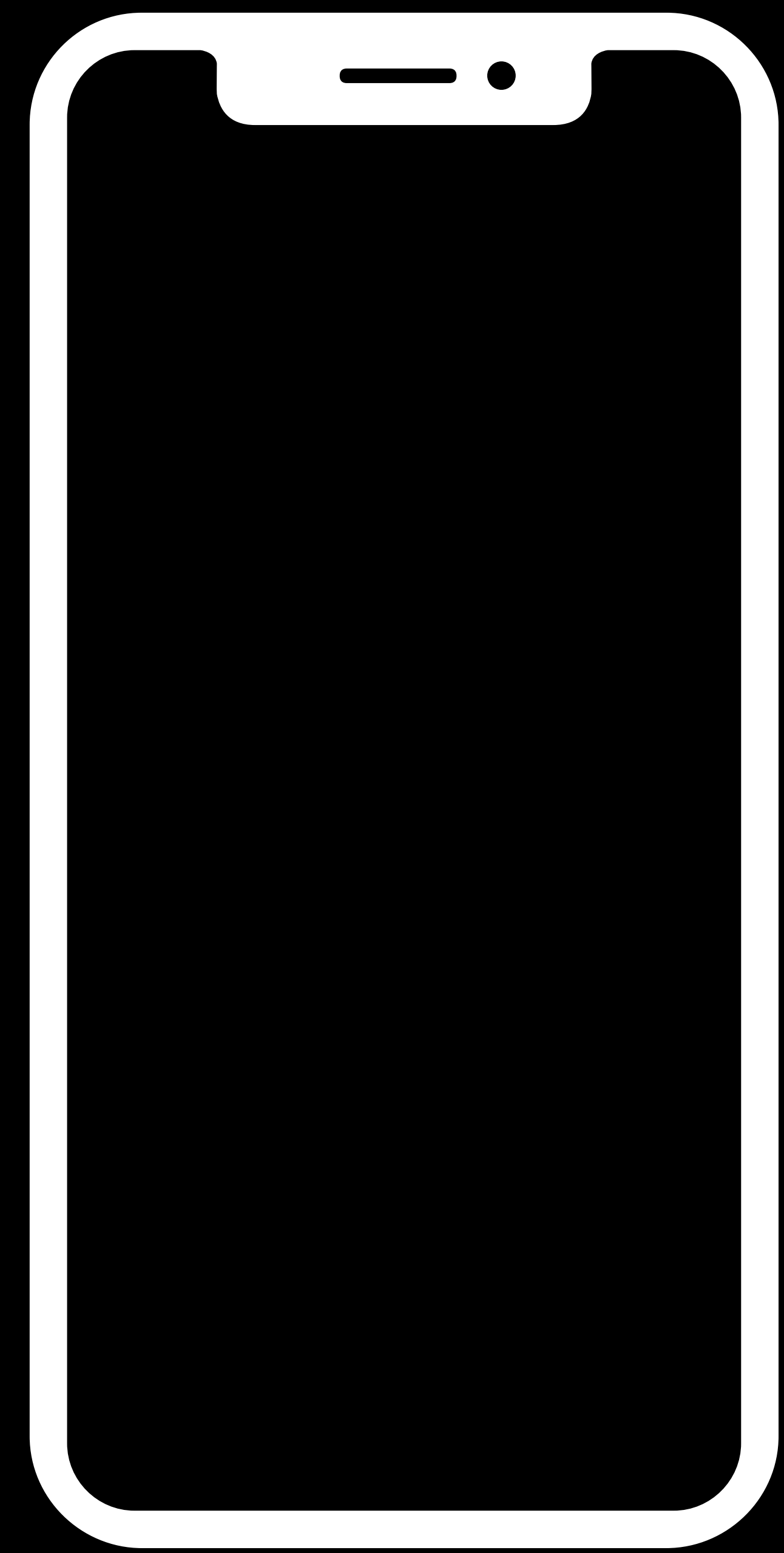
Inference



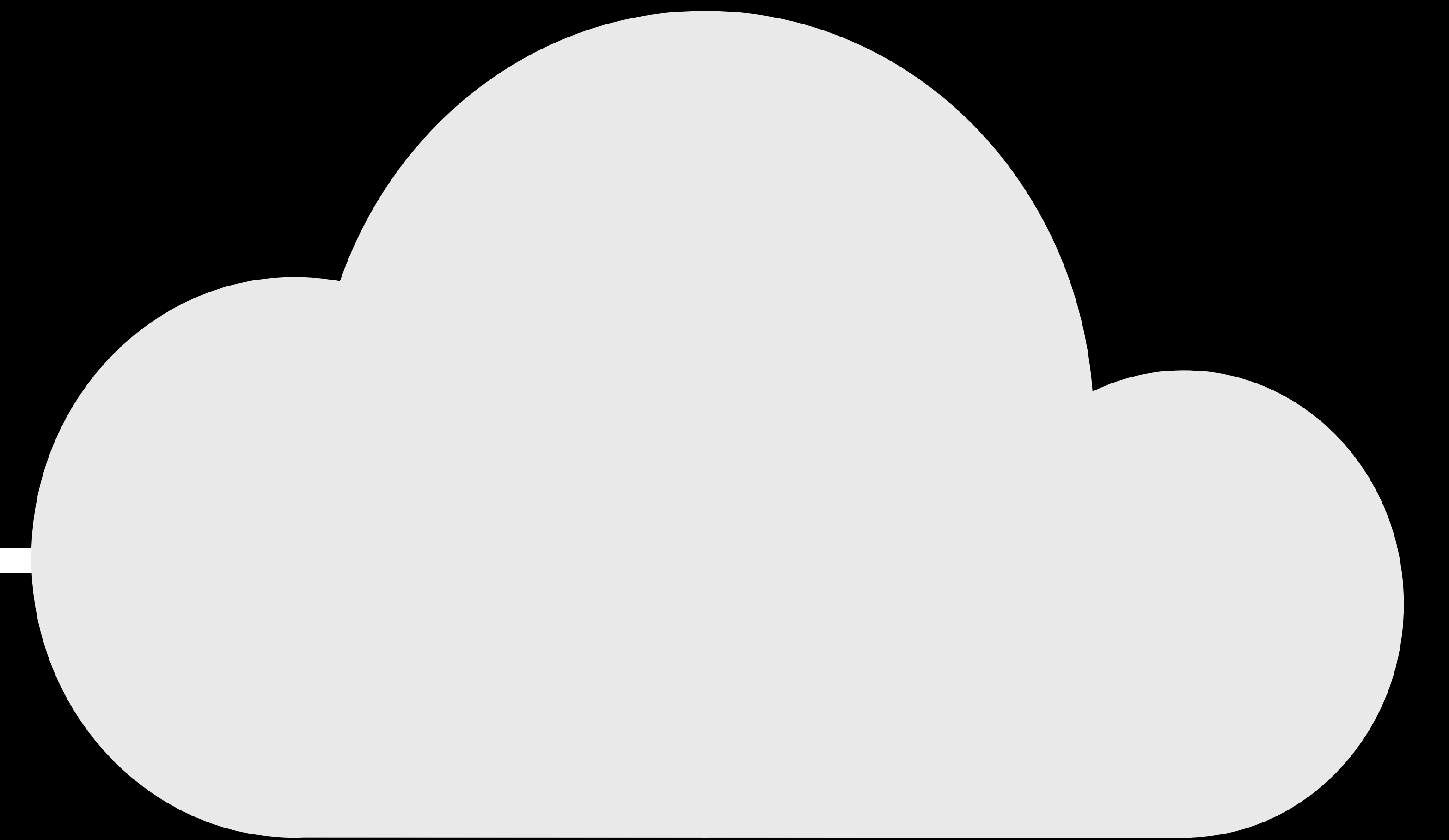
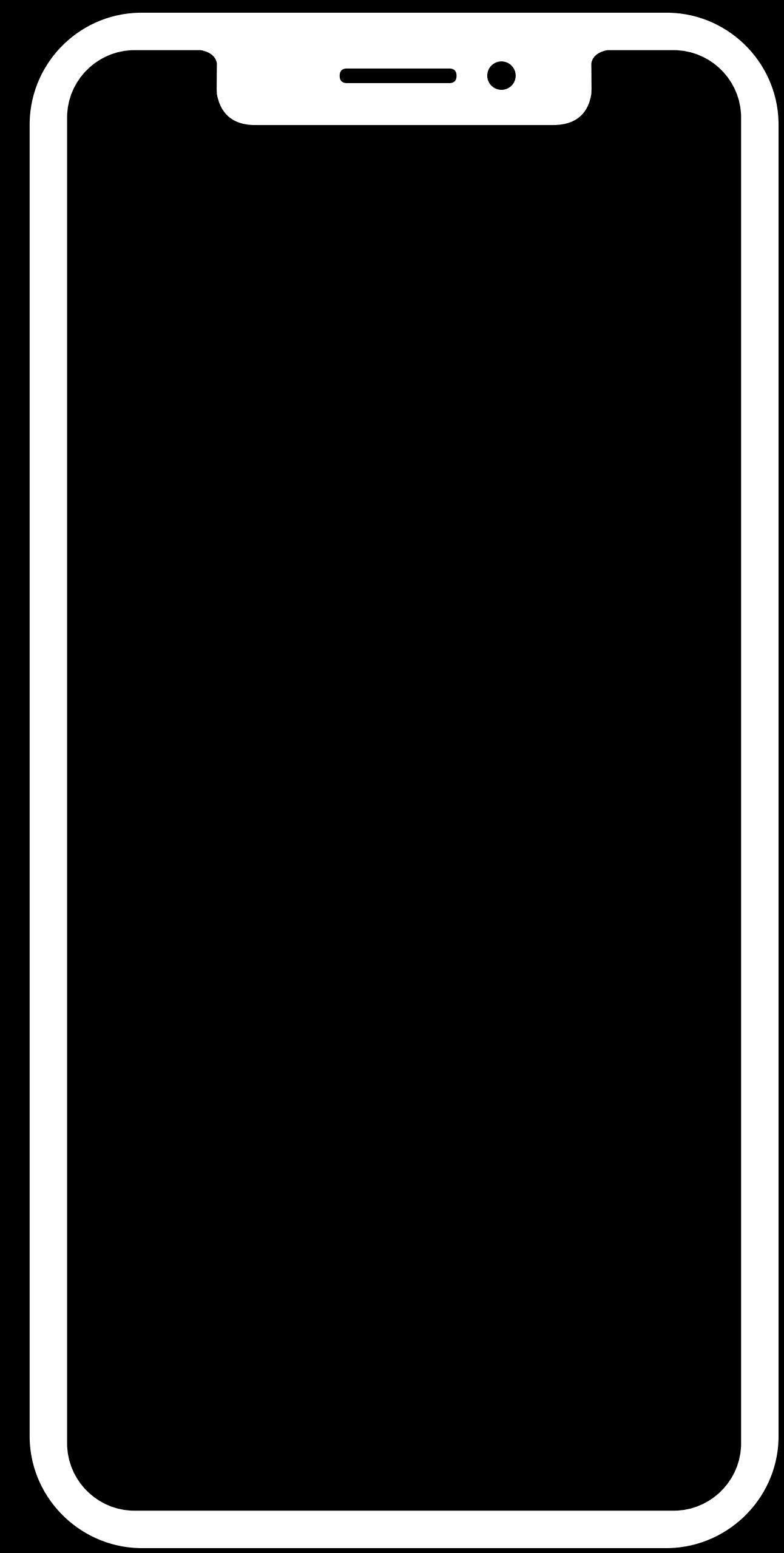
Inference



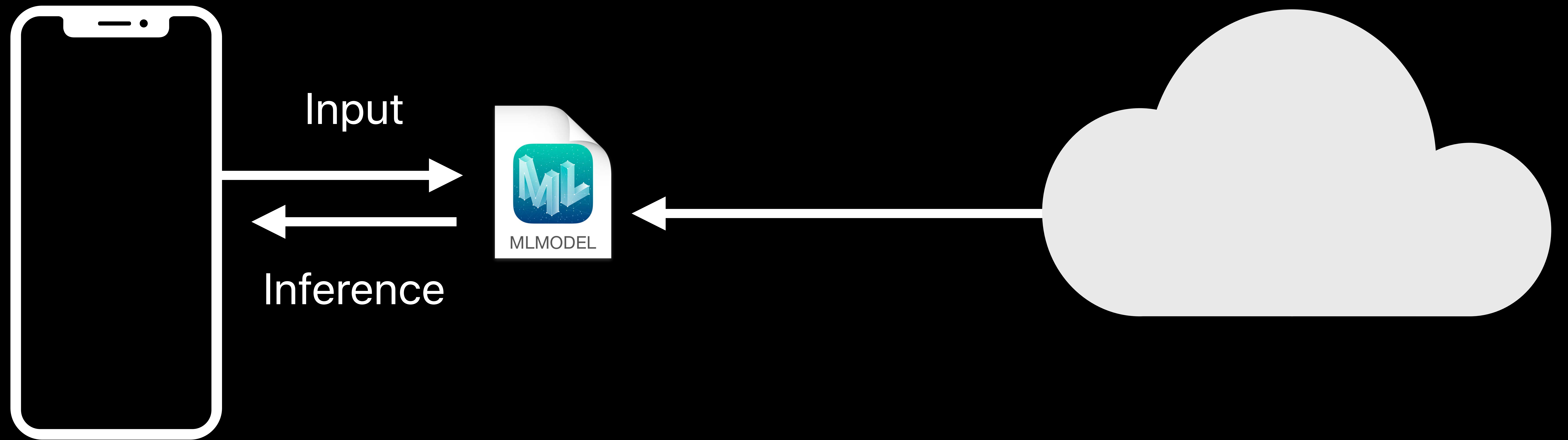
On-Device Inference



On-Device Inference



On-Device Inference



CoreML

Optimized for Apple Neural Engine

Easily convert existing models to CoreML

Expanded coverage of model architectures





Face ID data never leaves the device.



Machine Learning



Find My

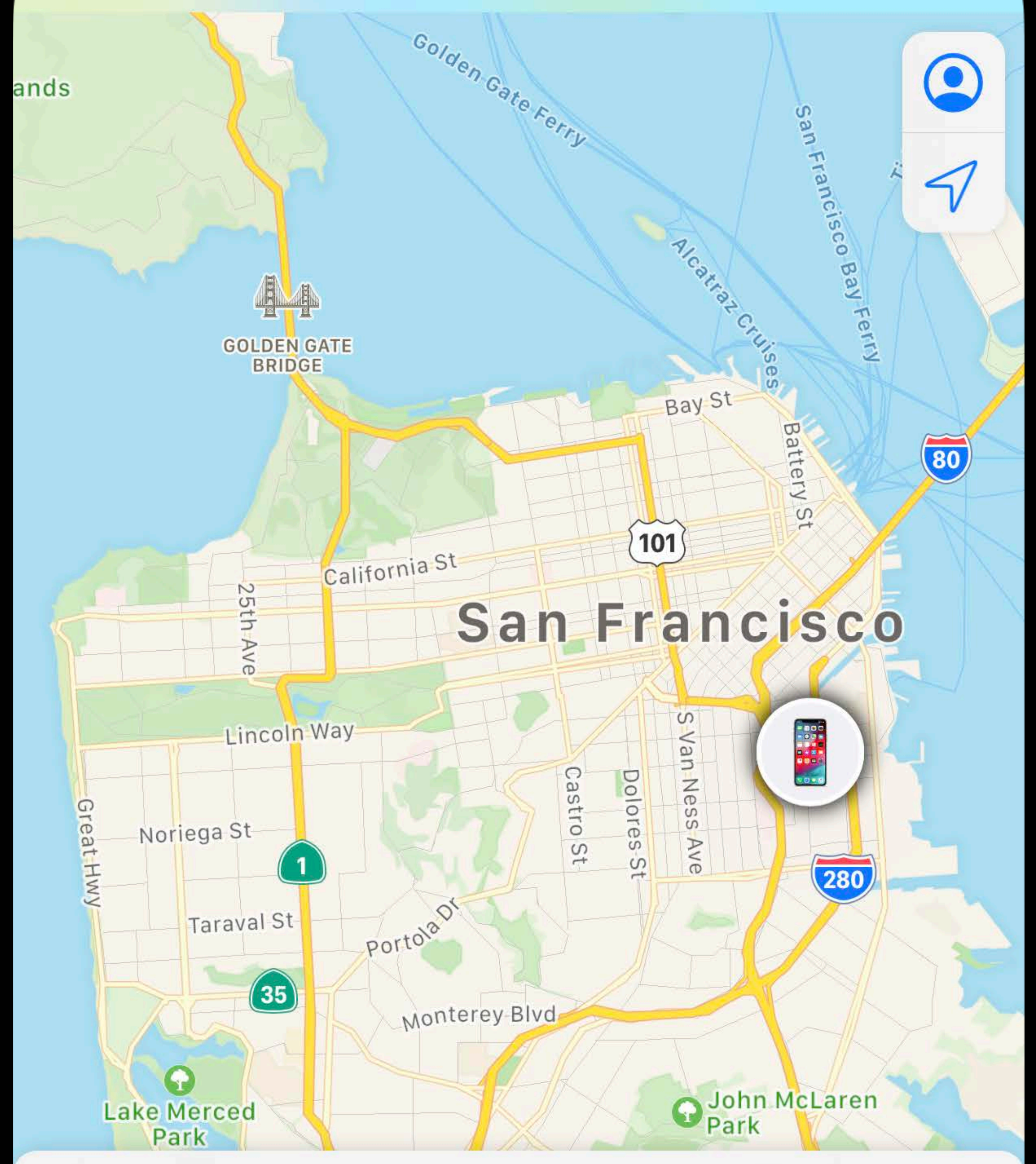


Home



Find My

9:41



Devices

-  **Julien's iPhone** 0 mi
San Francisco, CA • Now
-  **Julien's MacBook Pro 13** 0 mi
San Francisco, CA • Now
-  **Julien's MacBook Pro 15** 0 mi
San Francisco, CA • Now
-  **Julien's Apple Watch** 0 mi
San Francisco, CA • Now



People



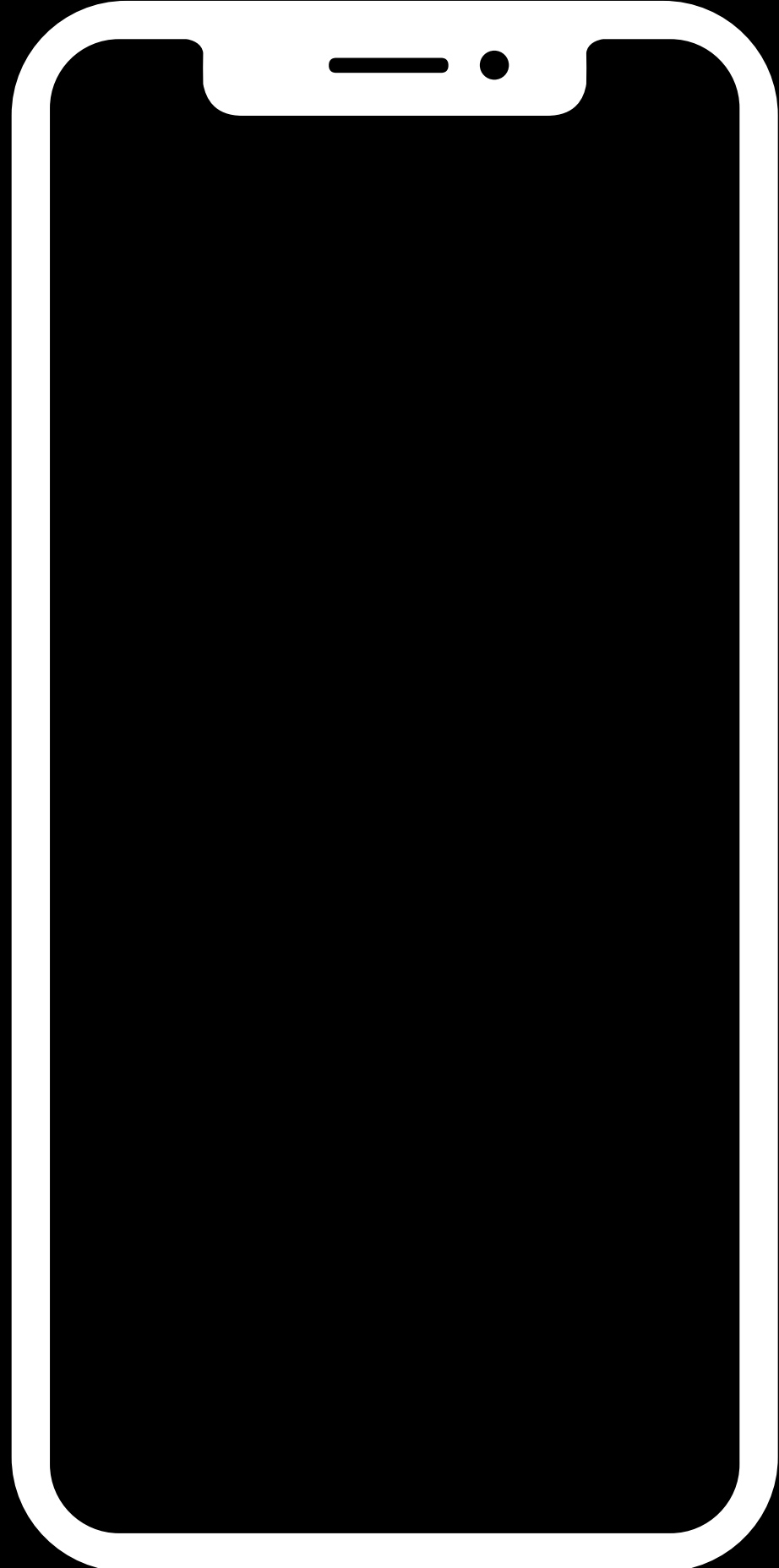
Devices



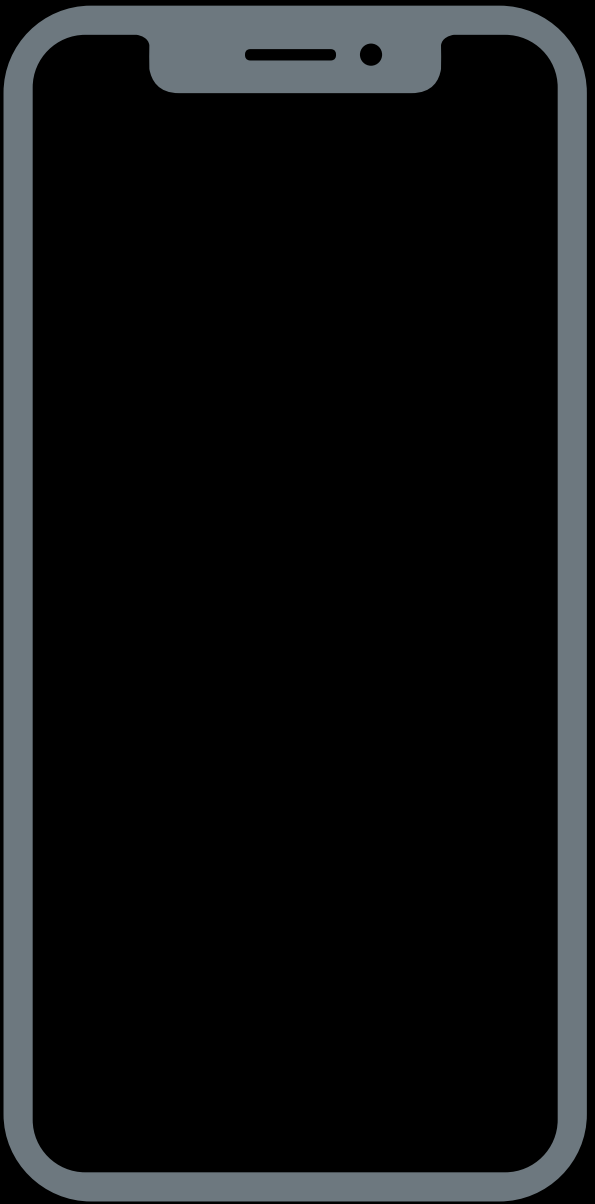
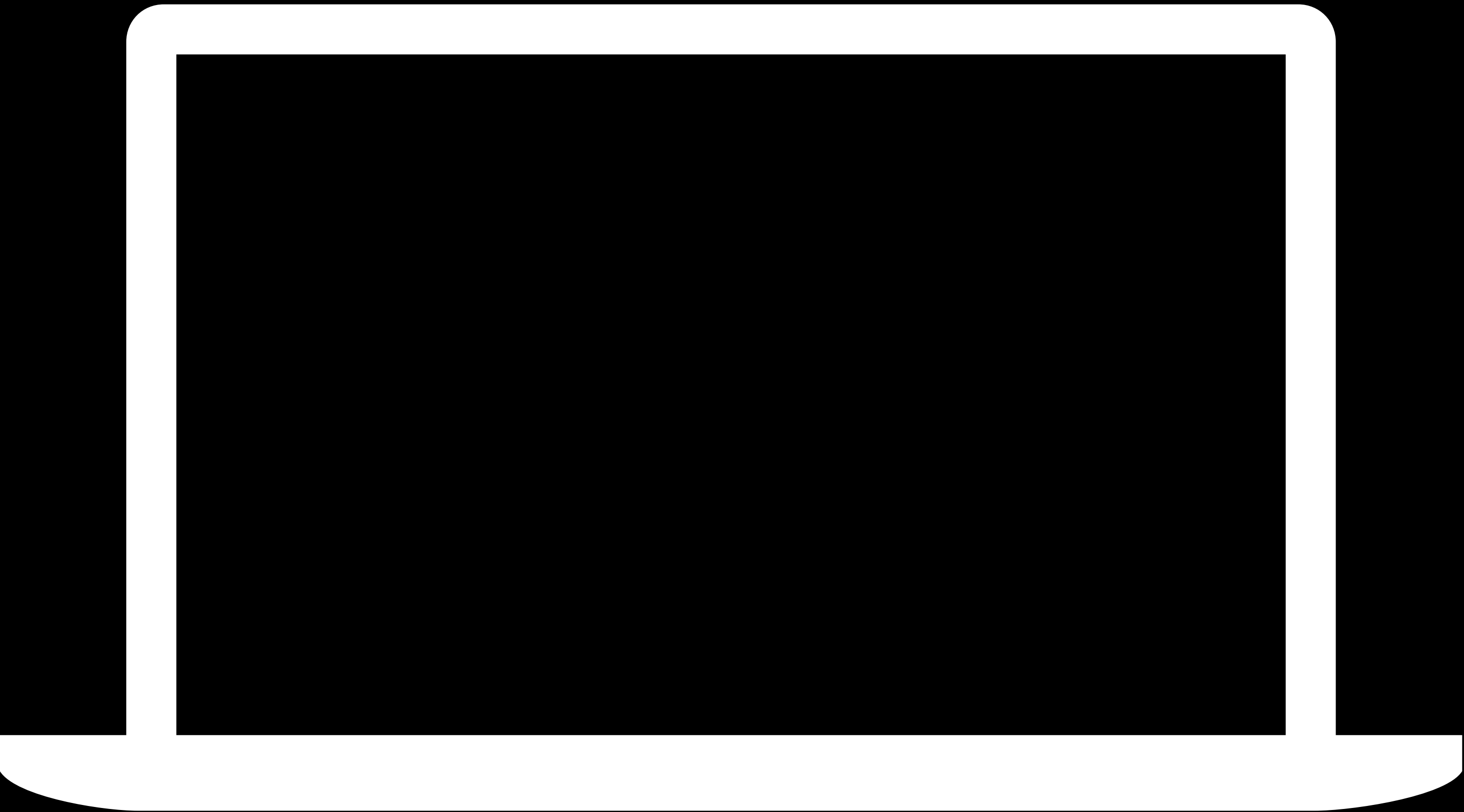
Find My

Find devices when they are offline

- While making sure lost devices cannot be tracked
- Without revealing identity of finders to Apple
- Without allowing Apple to know the location of lost devices
- Without compromising all day battery life



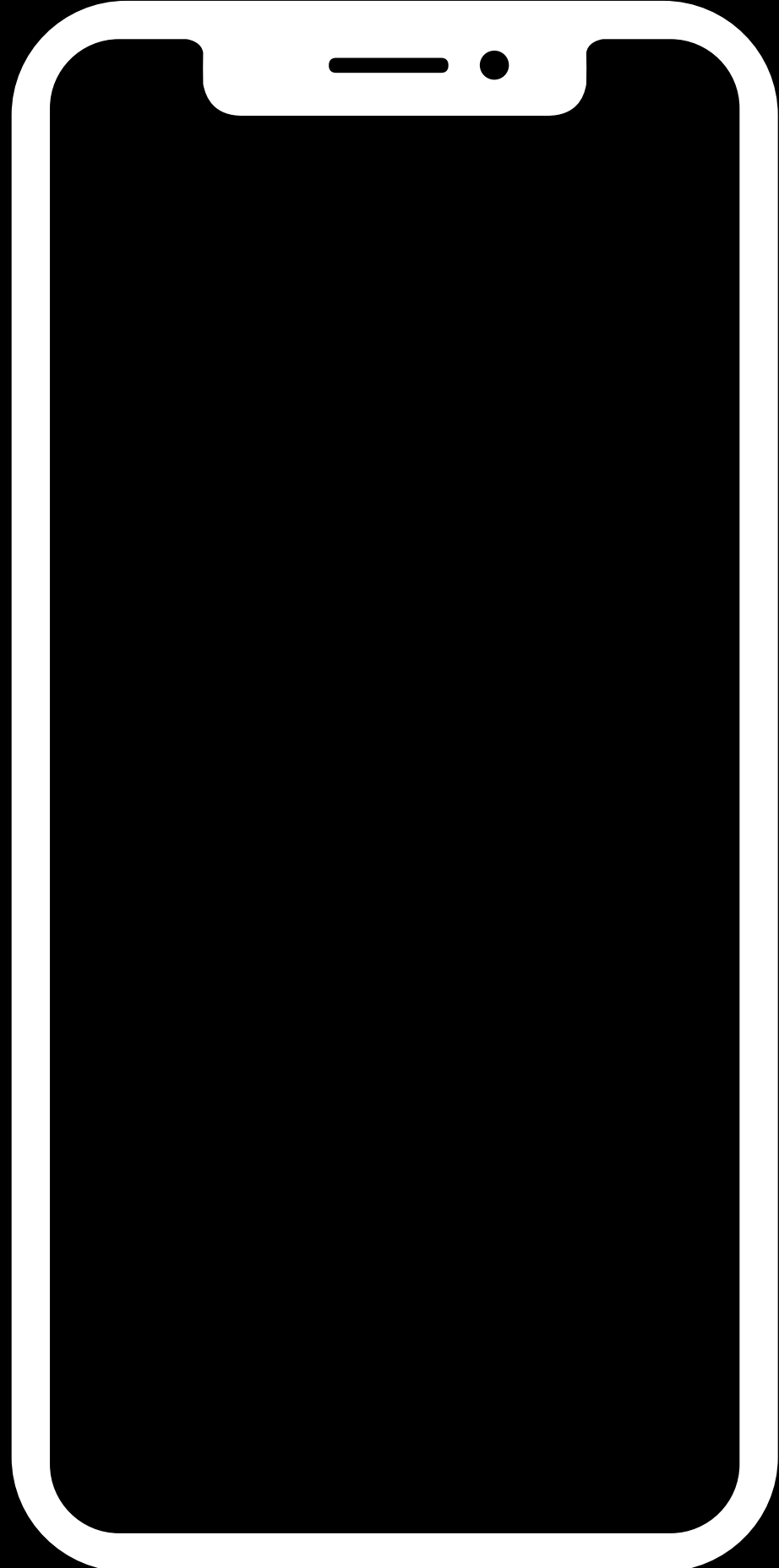
Owner



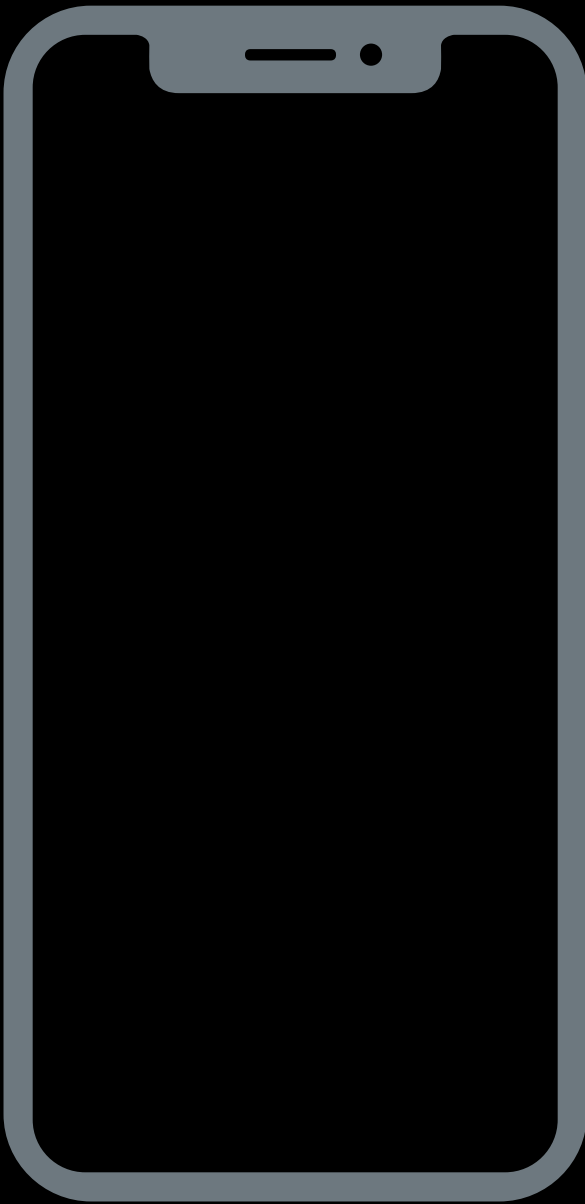
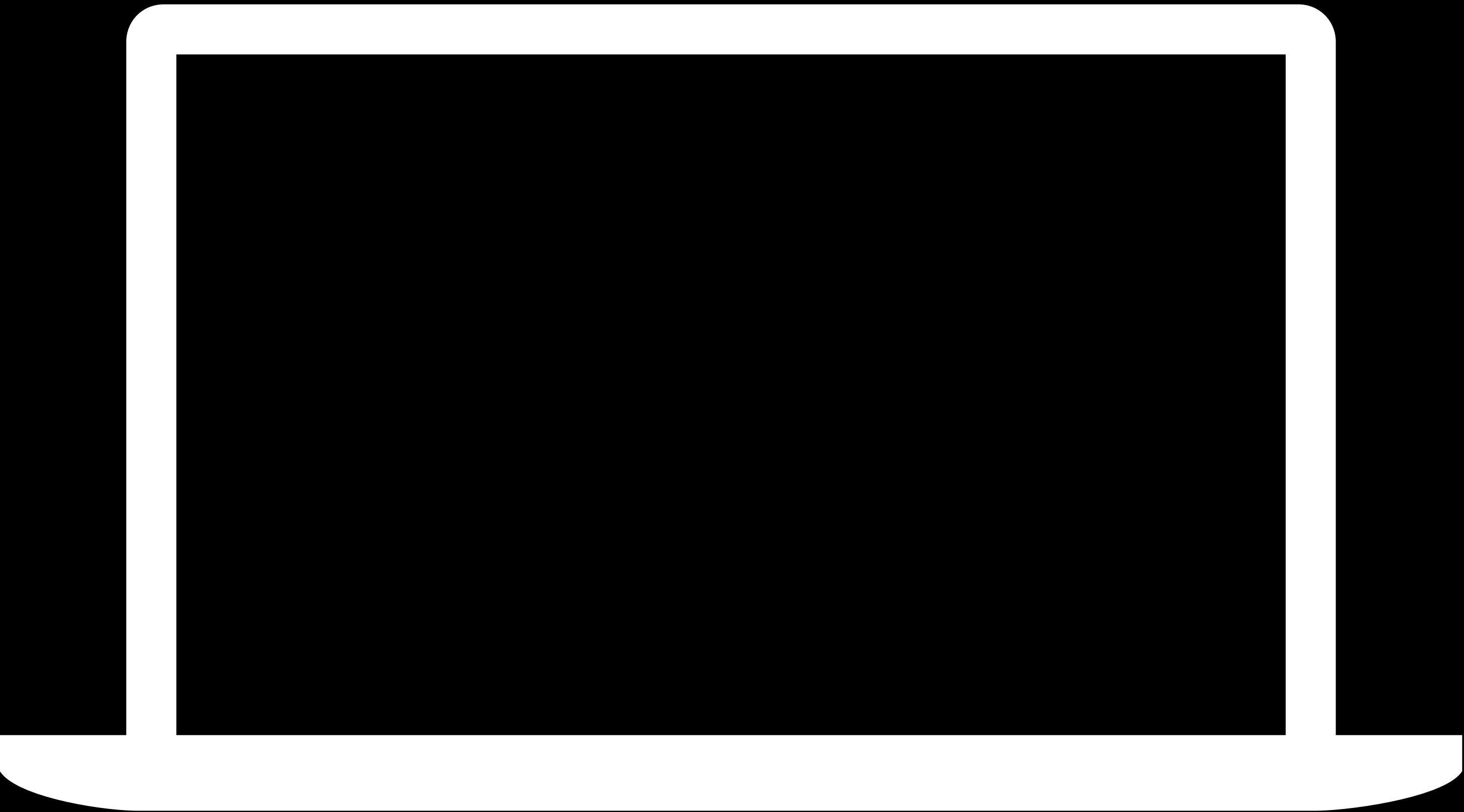
Nearby phone



PubKey 2



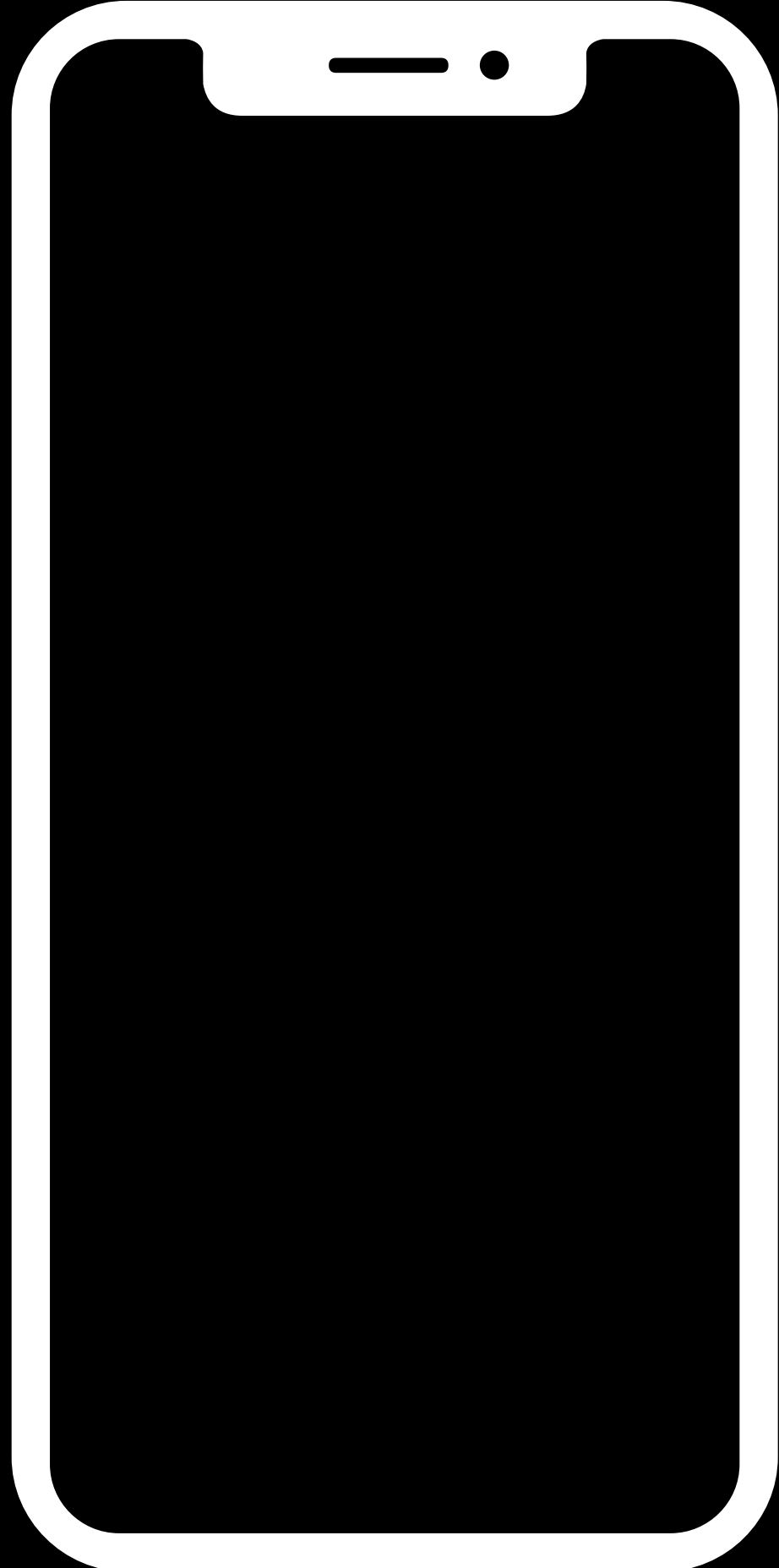
Owner



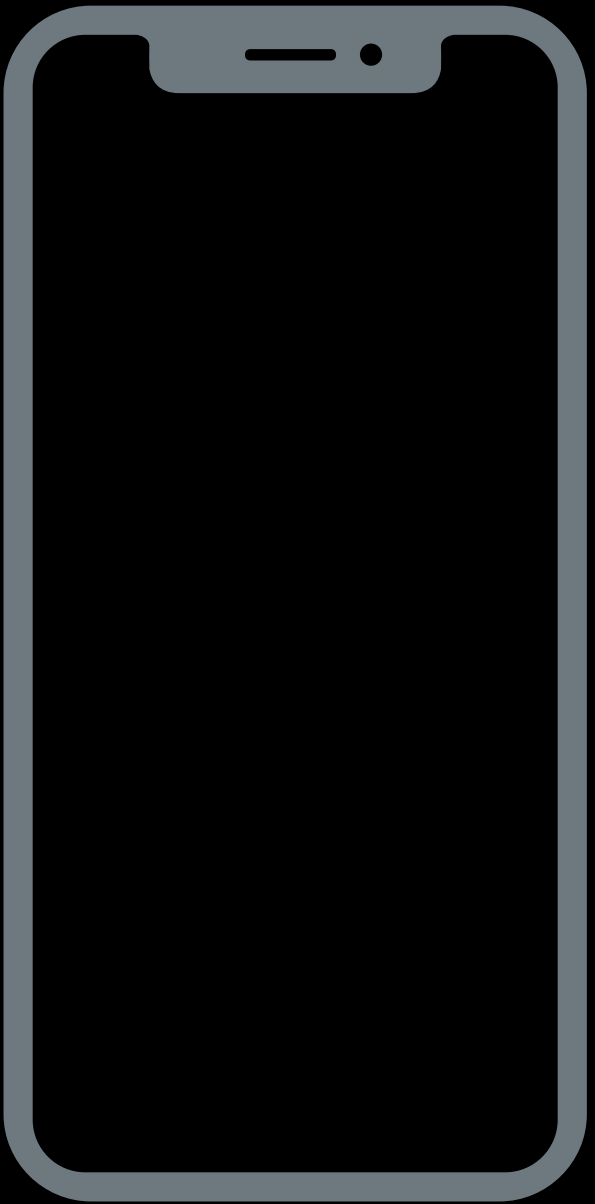
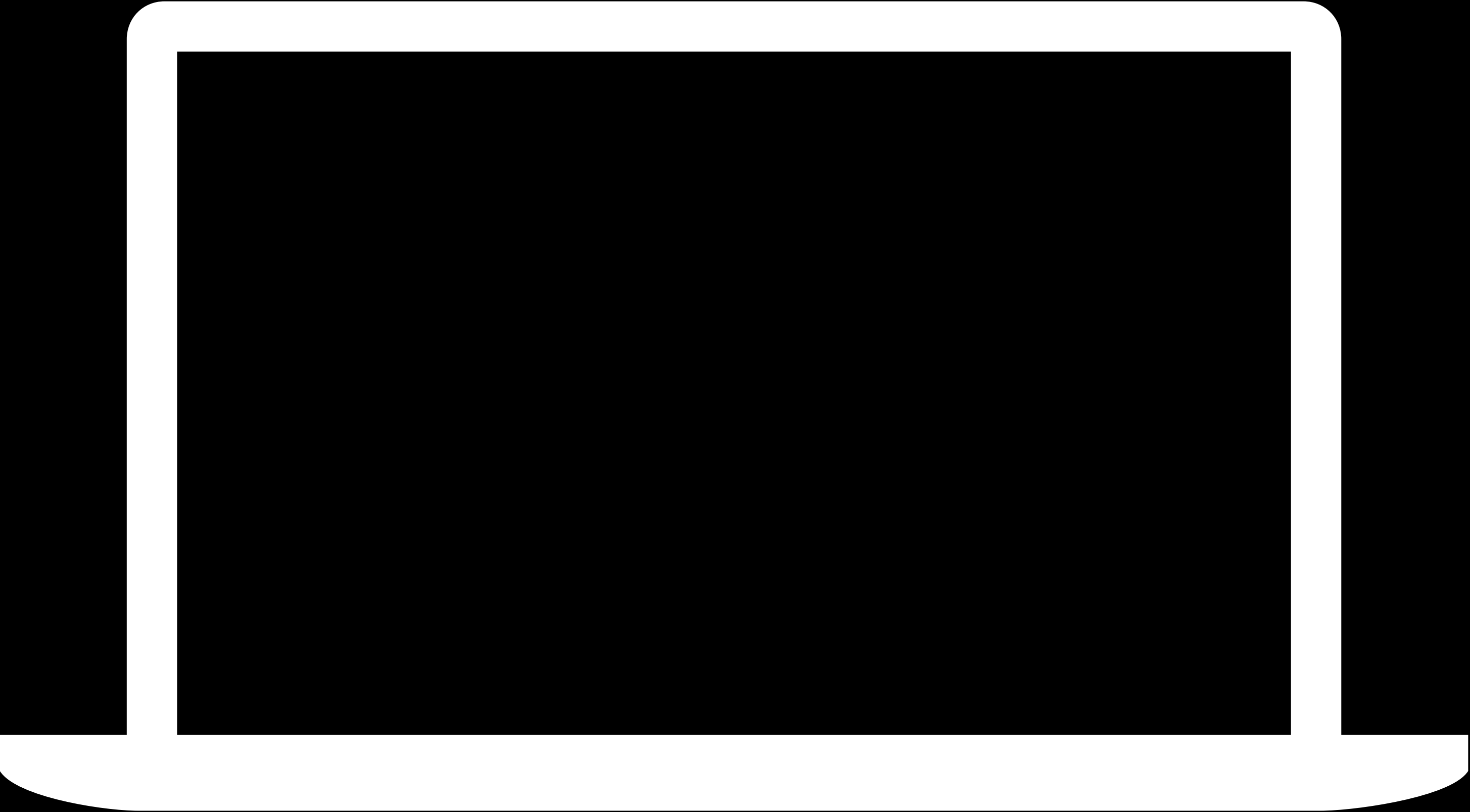
Nearby phone



PubKey 2



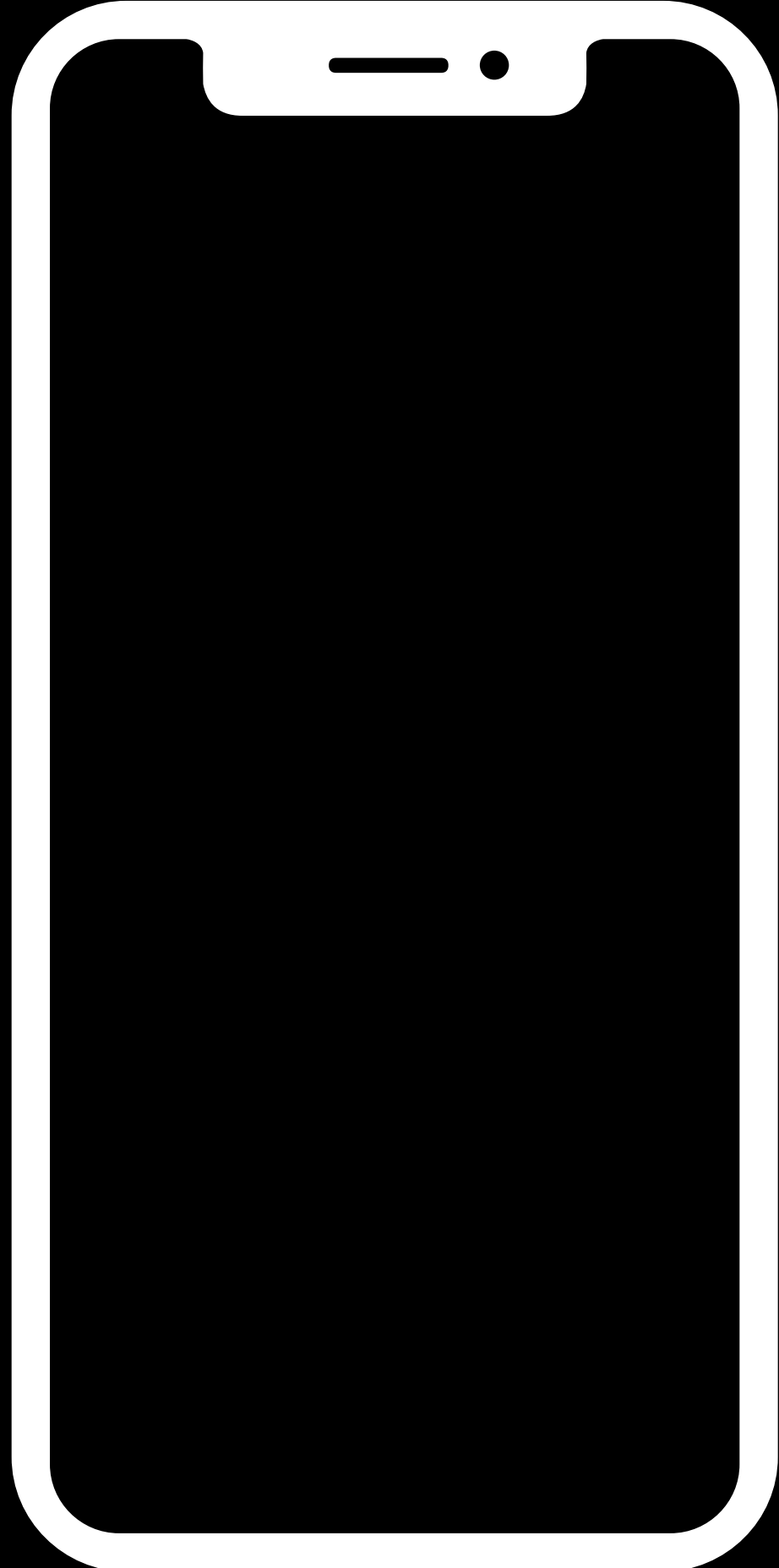
Owner



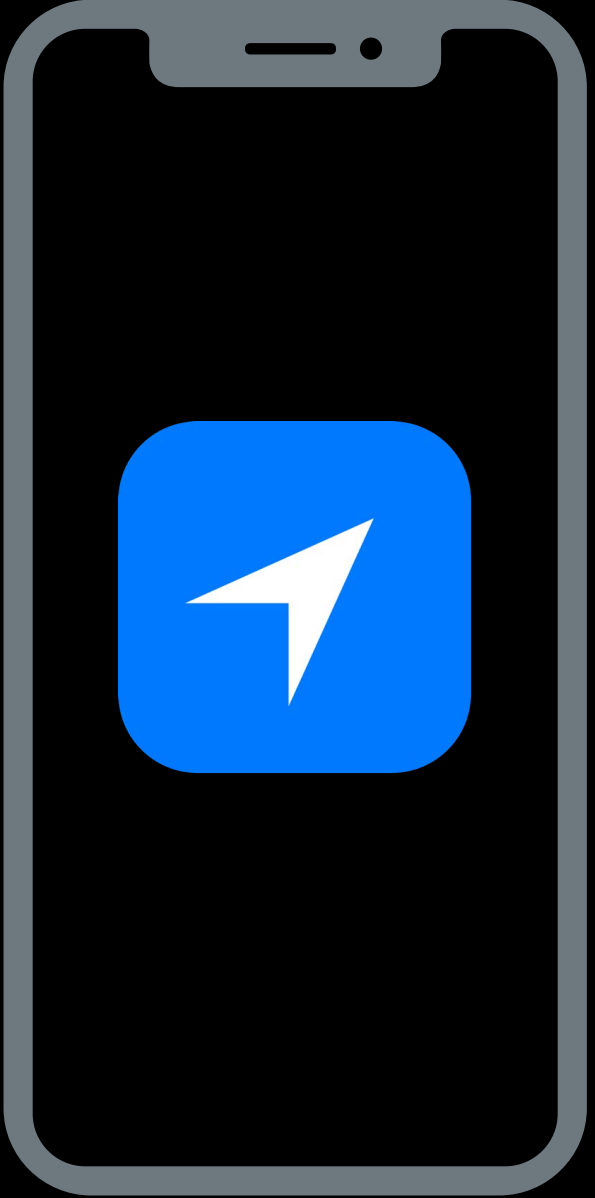
Nearby phone



PubKey 2



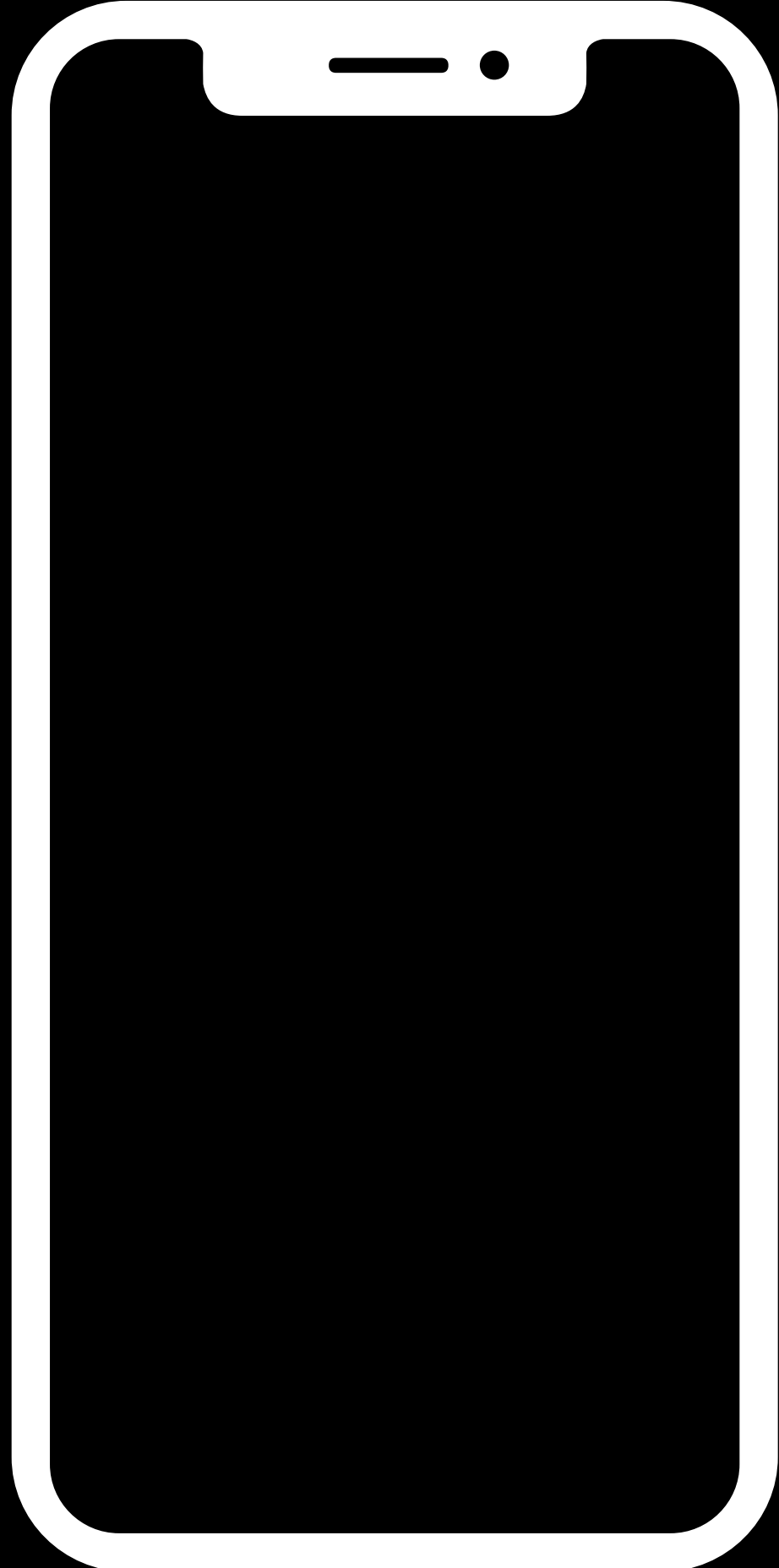
Owner



Nearby phone



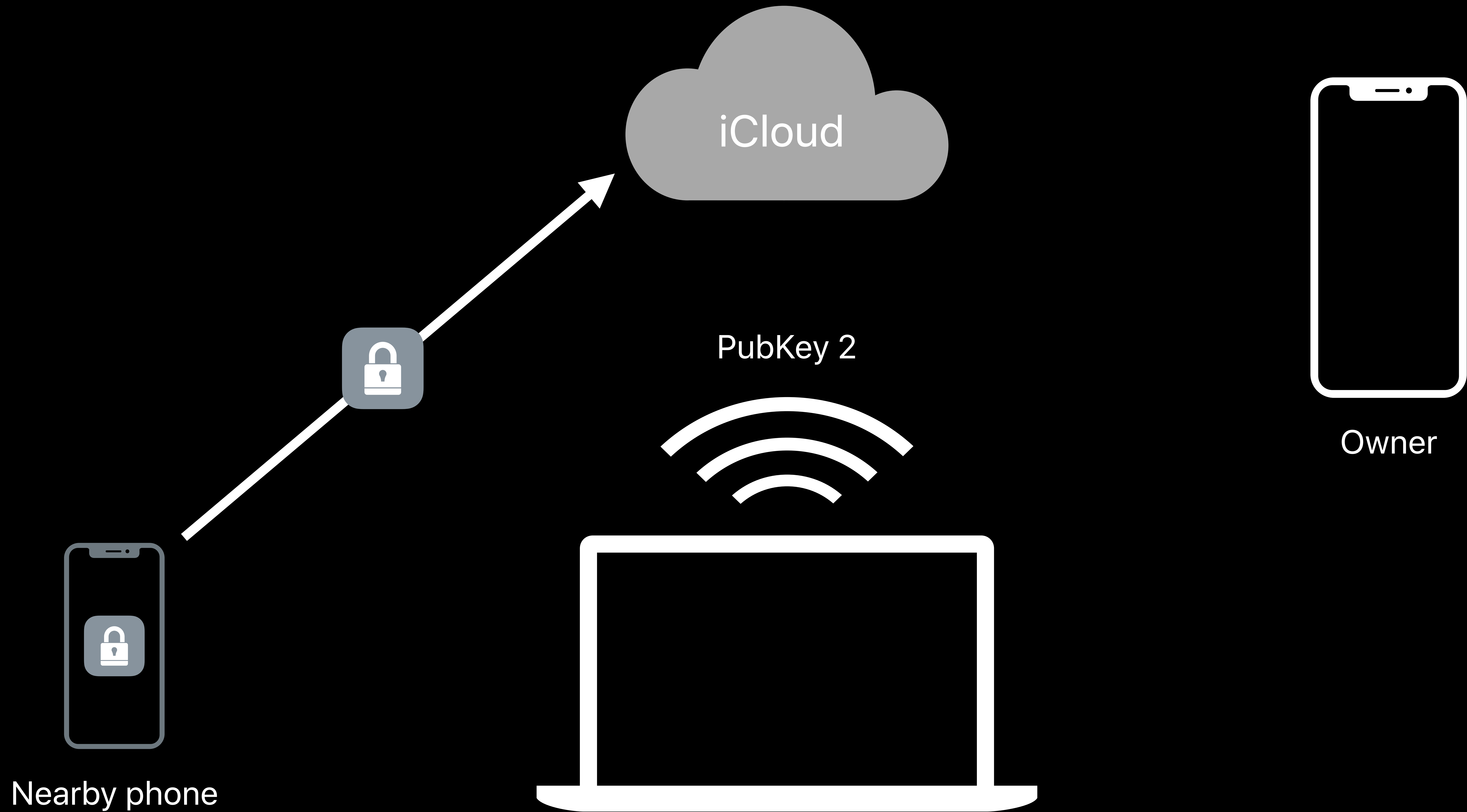
PubKey 2



Owner

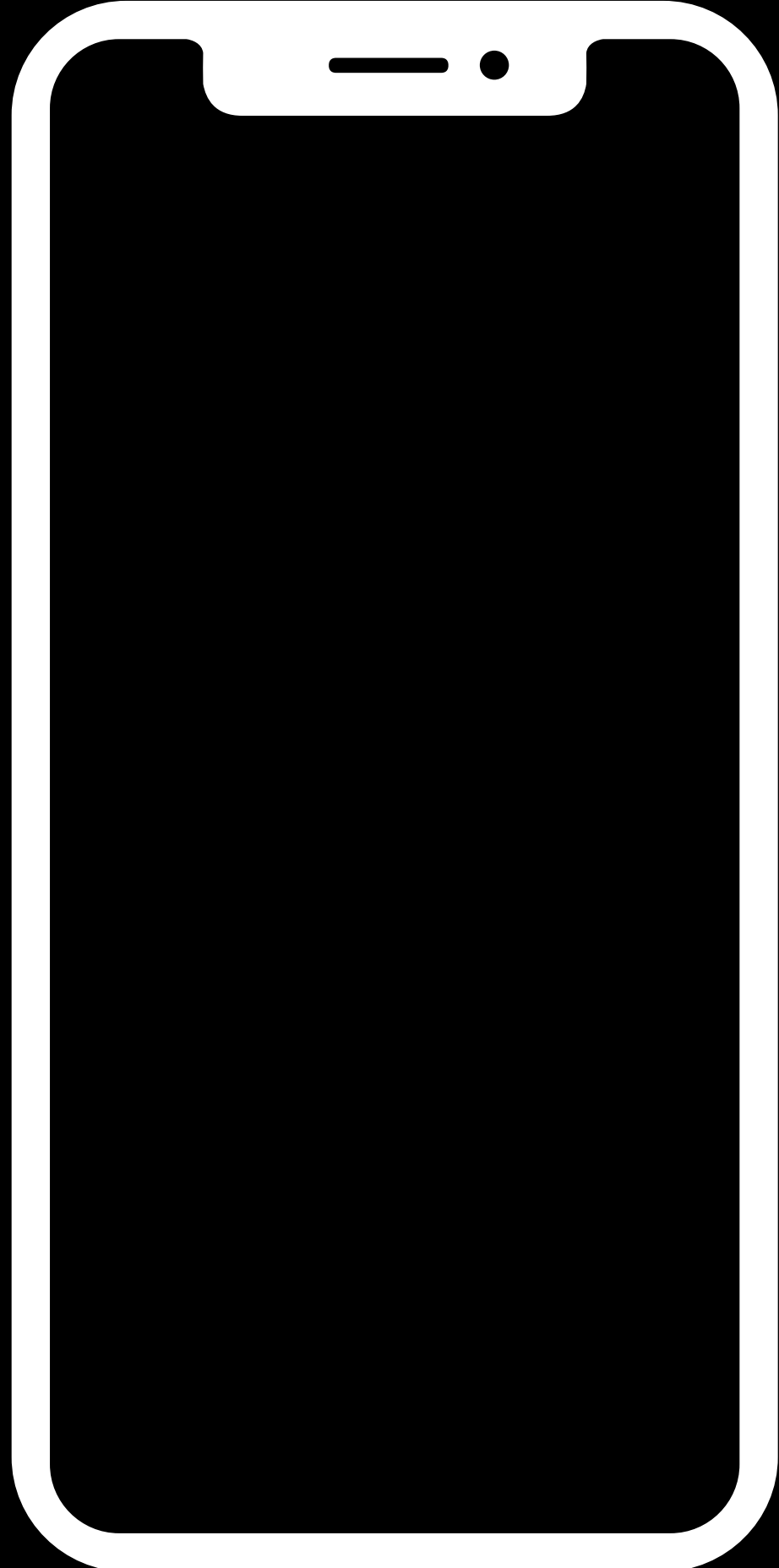
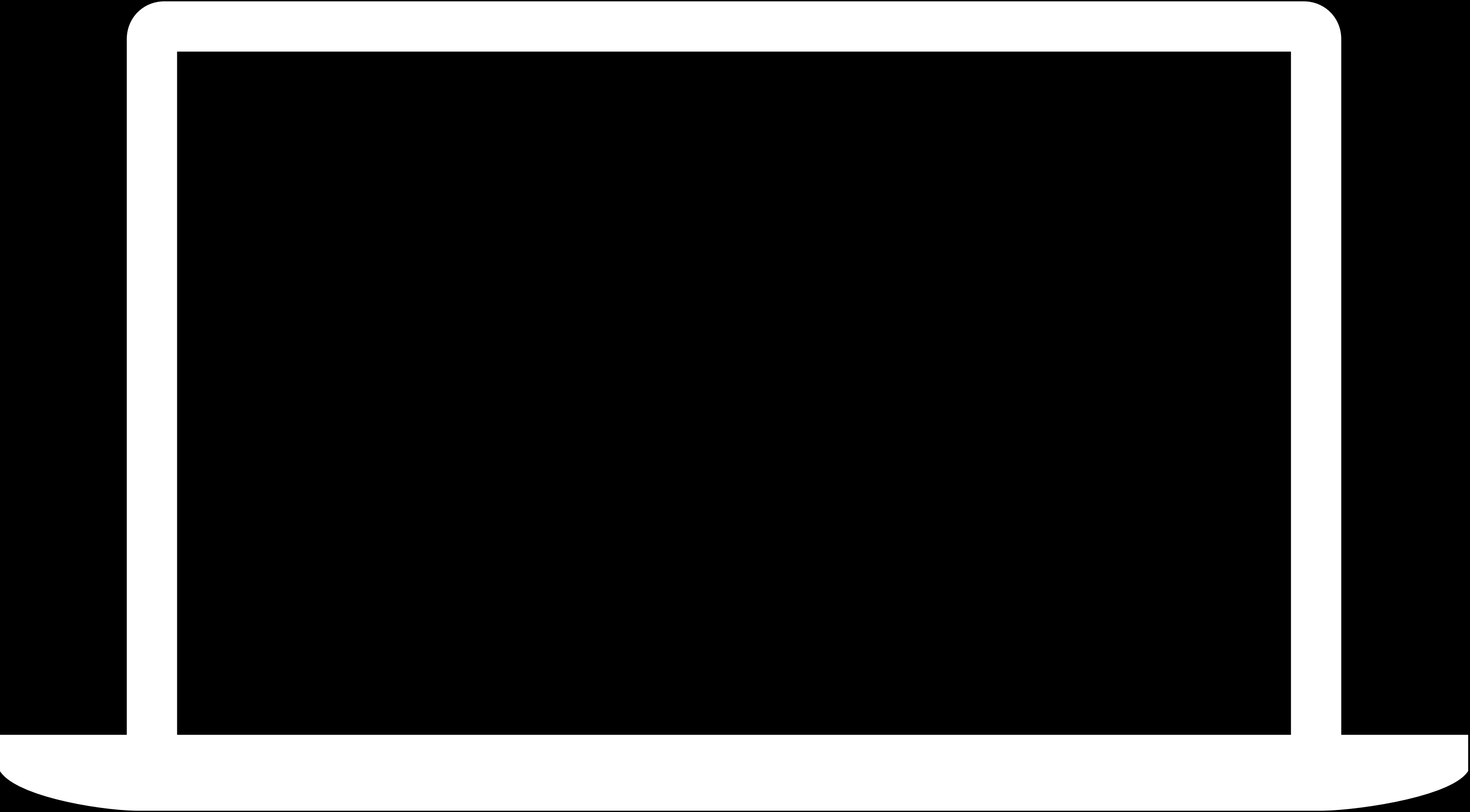


Nearby phone

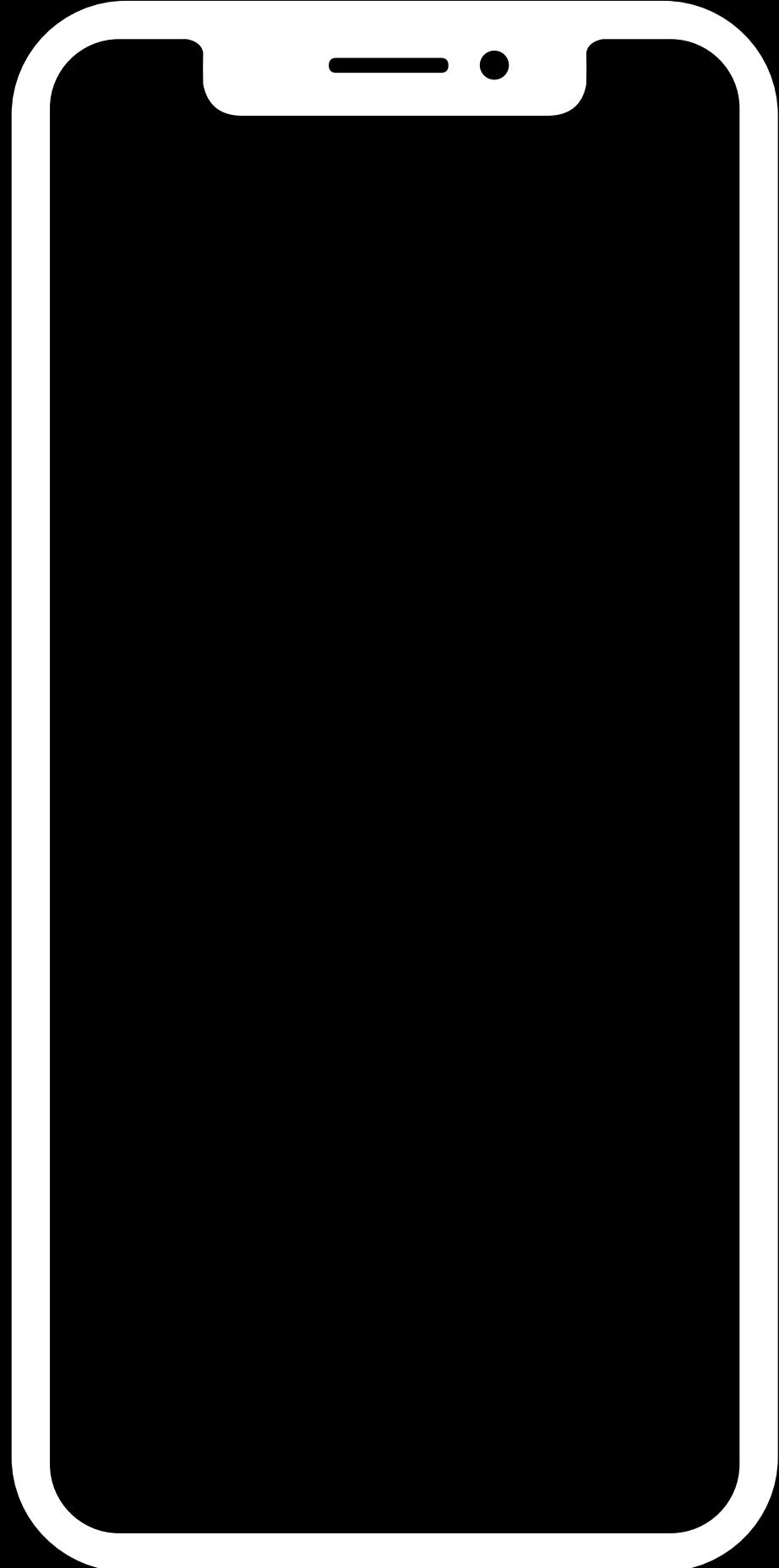




PubKey 2



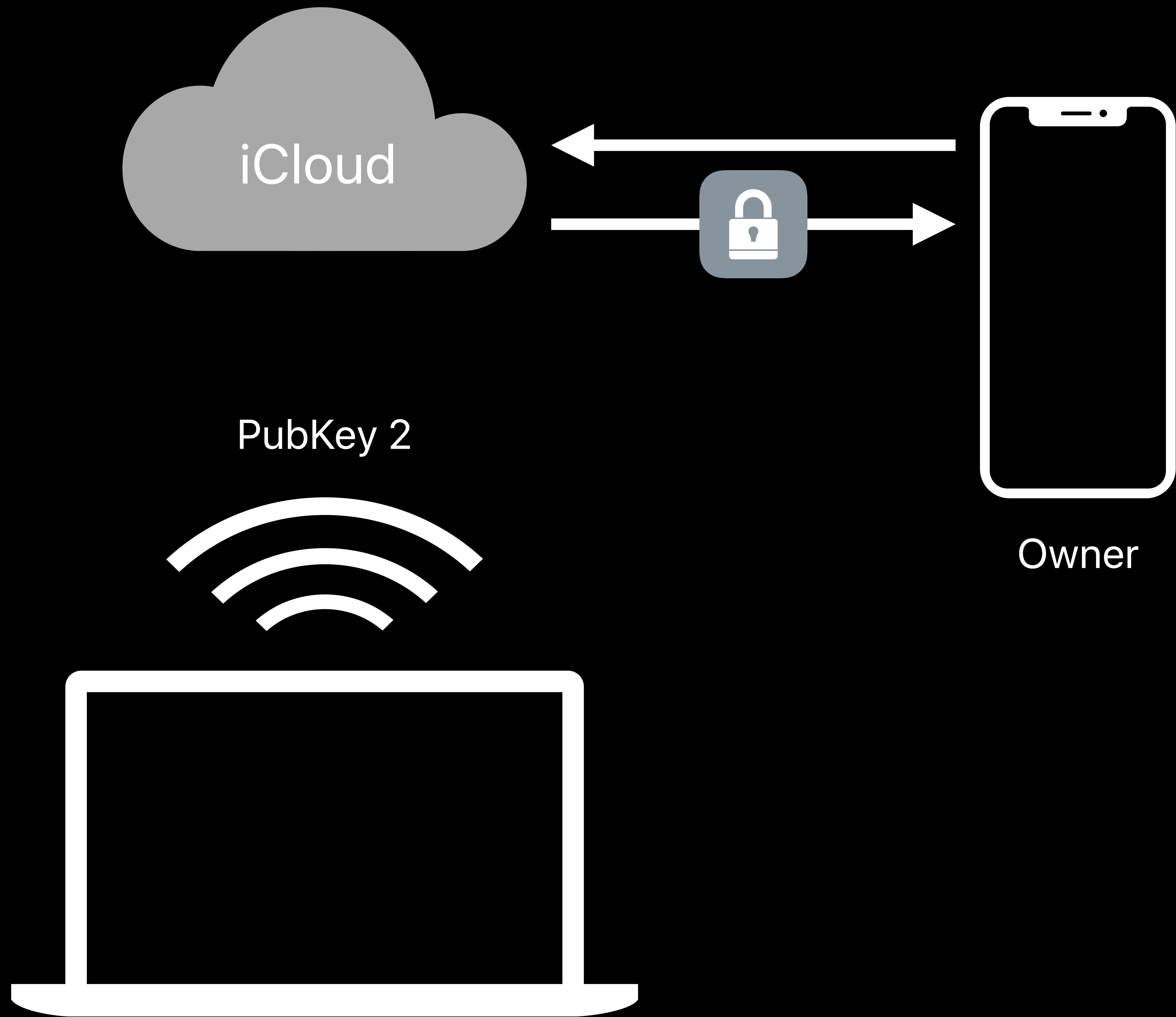
Owner



Owner

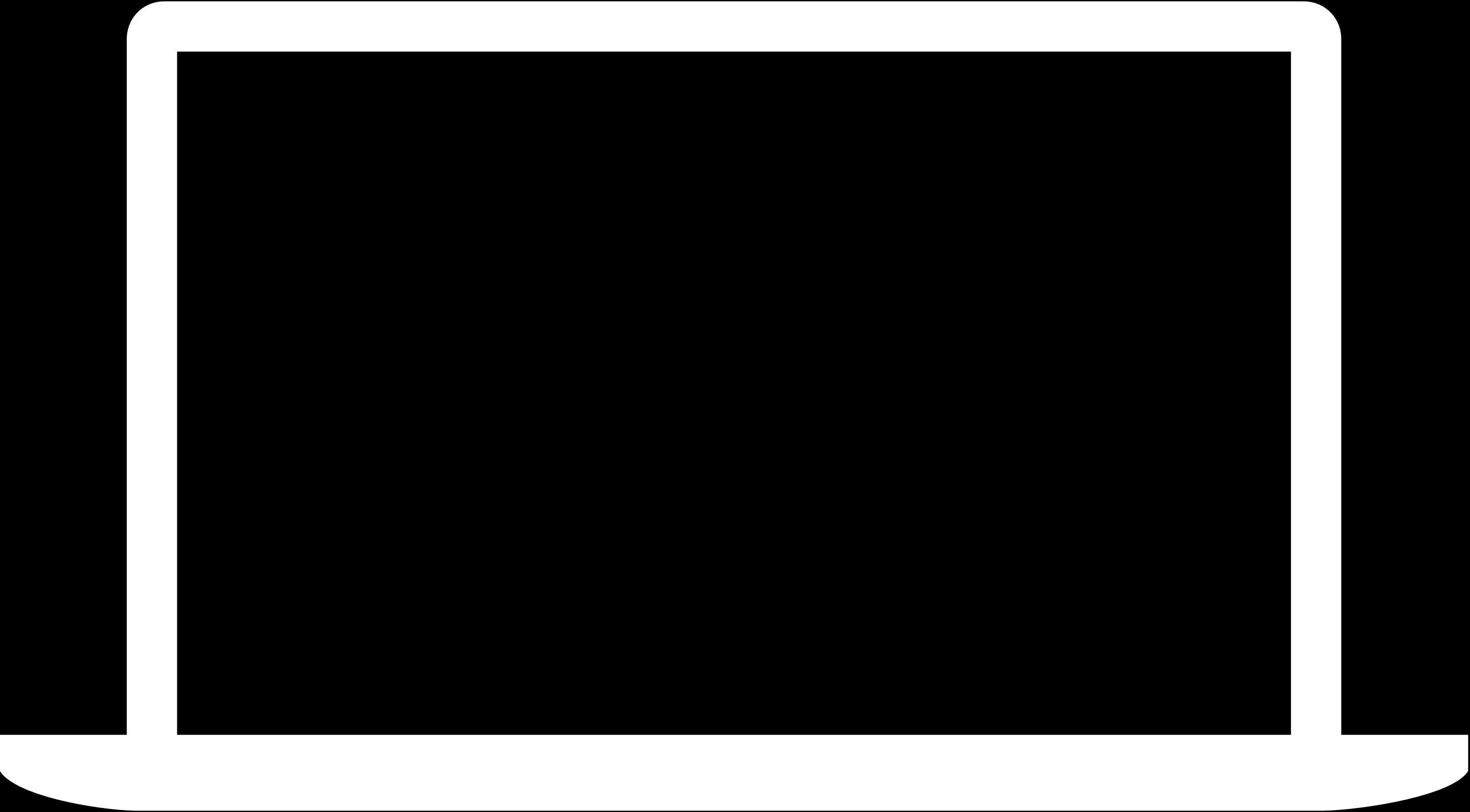
PubKey 2







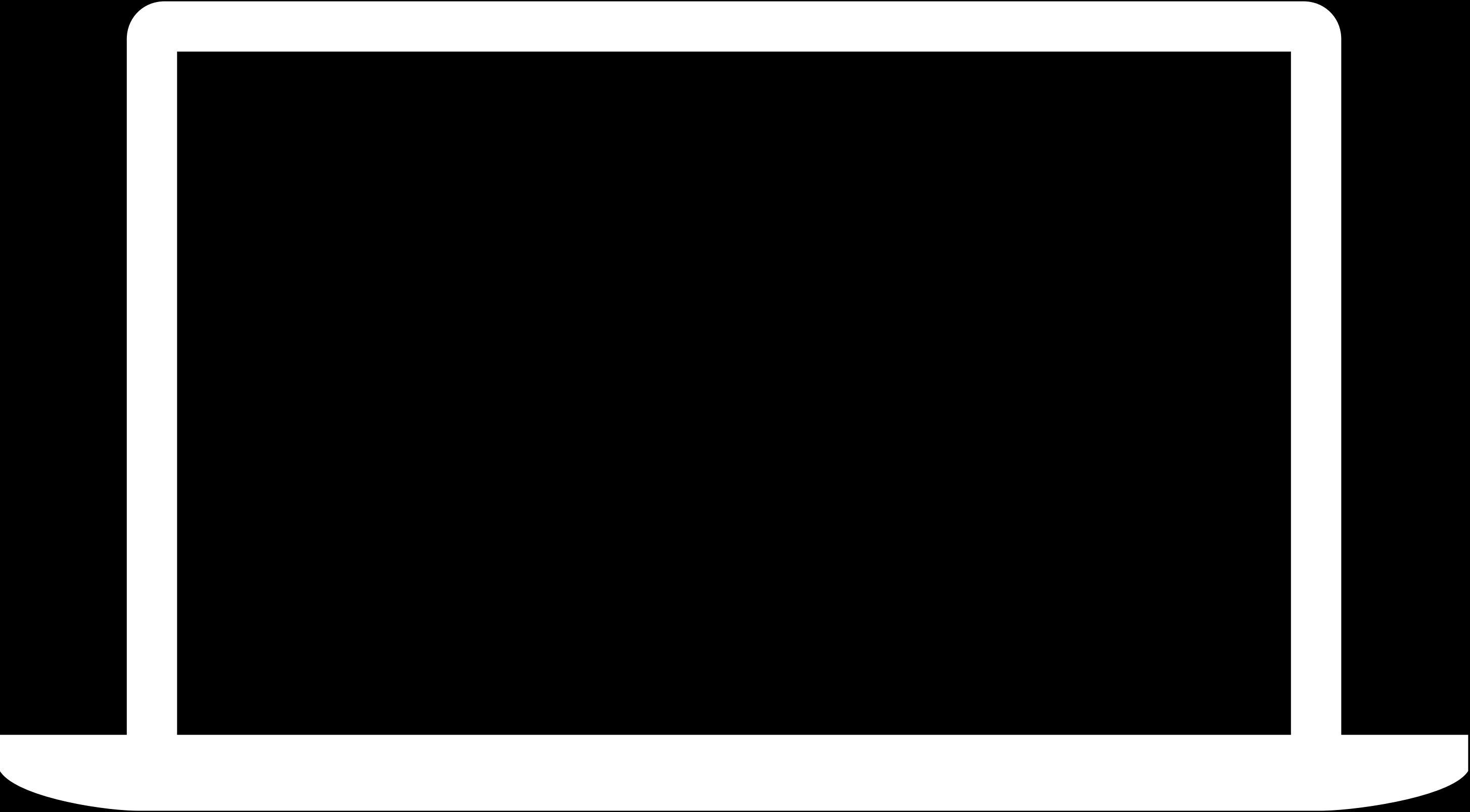
PubKey 2



Owner



PubKey 2



Owner



Apple does not know the location
of any offline devices or finders.



Machine Learning



Find My



Home



Home

Unexpected Bitcoin mining Cold homes Failed fridges

Denial of service Locked homes Mass surveillance

Intercepted communications Unexpected recordings

Compromised cameras Botnets Ransomware

Cold showers Loud music Uncontrollable alarms

Unexpected personal data sharing Failing dog feeders

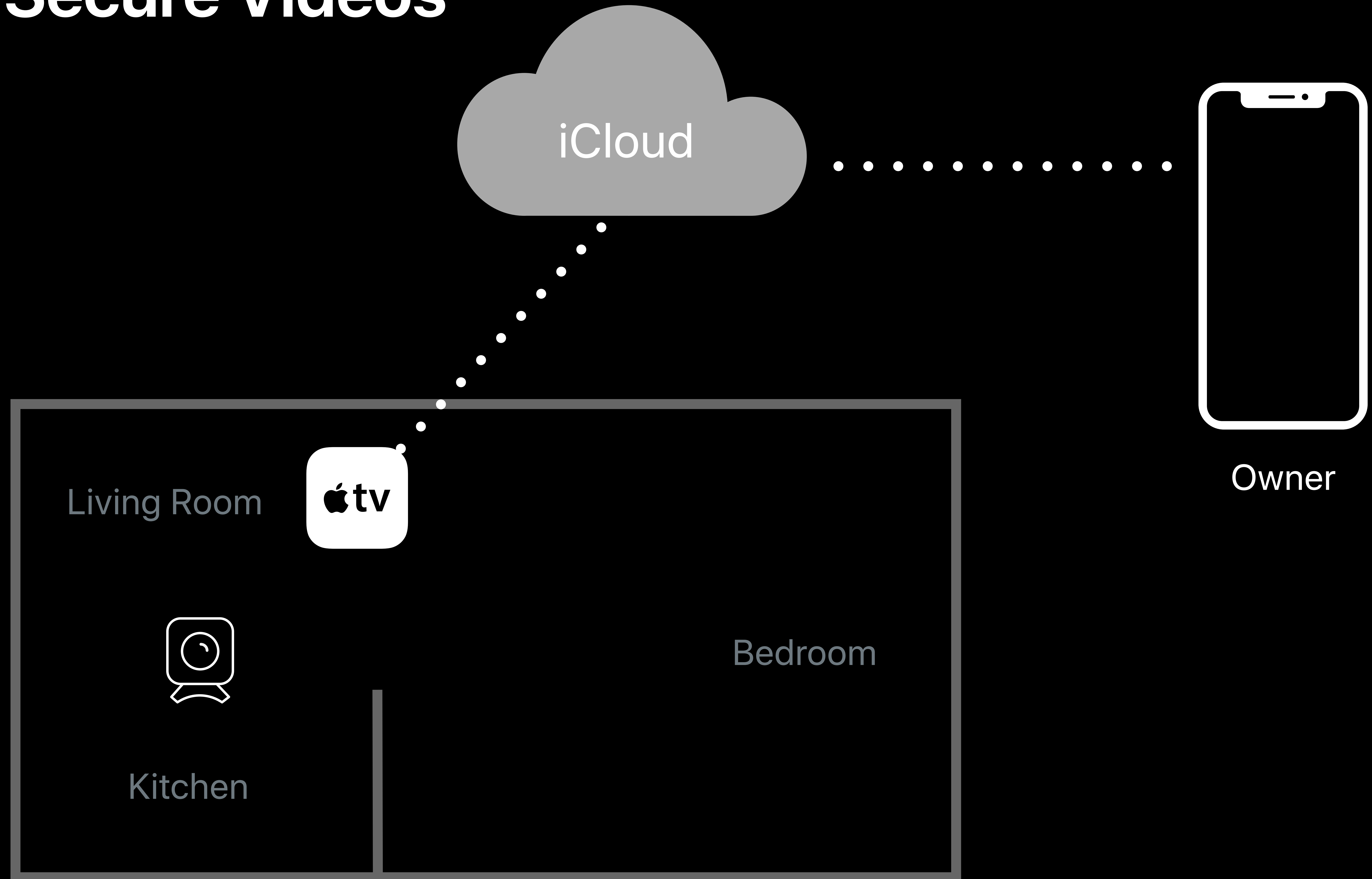
Compromised cameras

Home

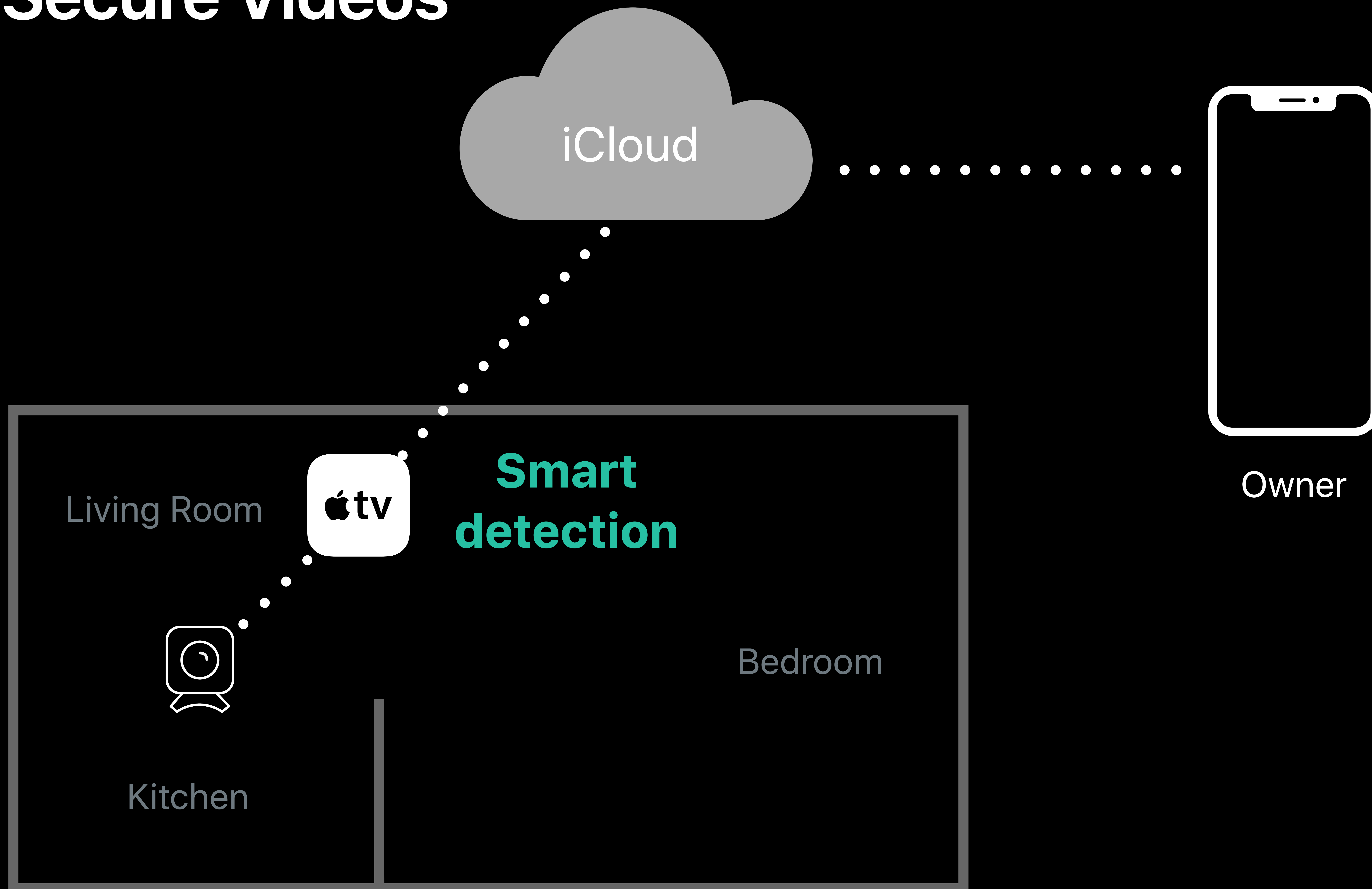
Allow users to view their security cameras from anywhere

- Without unexpectedly sharing camera videos with others
- Without allowing Apple to access camera content
- While enabling smart camera experiences

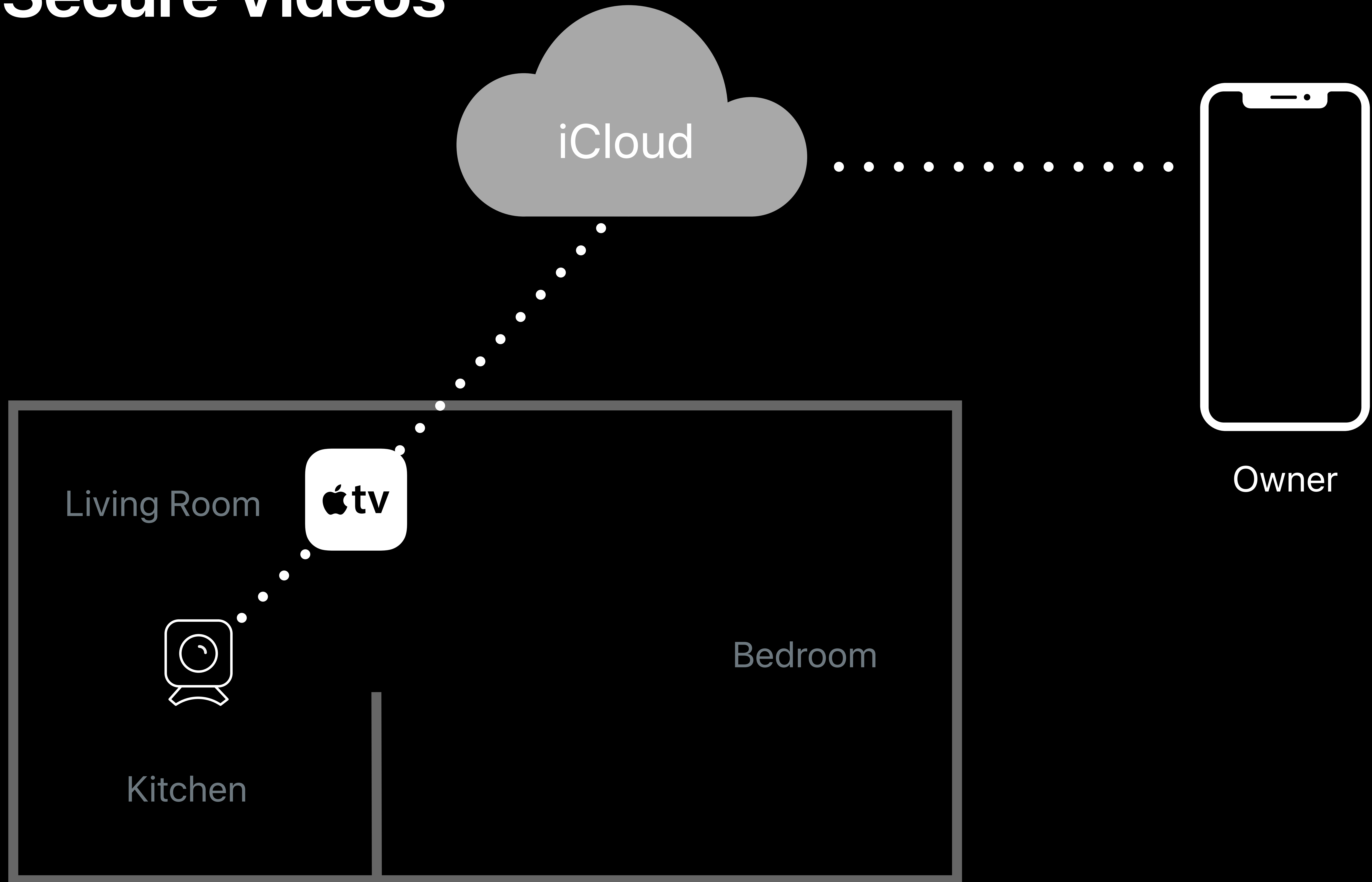
HomeKit Secure Videos



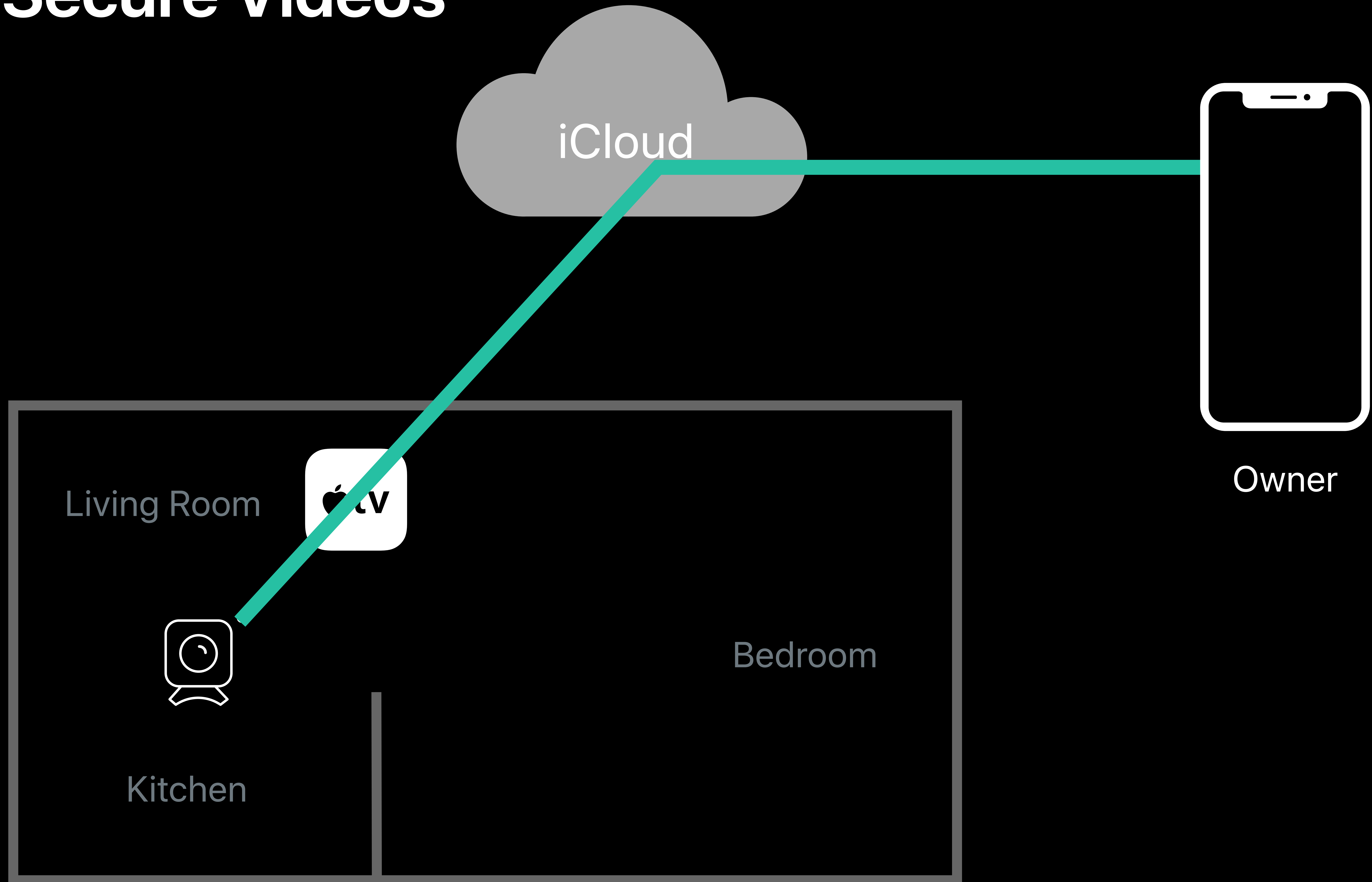
HomeKit Secure Videos



HomeKit Secure Videos



HomeKit Secure Videos





Only you can see the
video from your camera.



Machine Learning



Find My



Home

Great features and privacy.

Great features and privacy.

Summary

Summary

Design with privacy in mind

Summary

Design with privacy in mind

Privacy is chance to innovate

Summary

Design with privacy in mind

Privacy is chance to innovate

Share your privacy assurances with your users

More Information

developer.apple.com/wwdc19/708

Privacy Lab

Wednesday, 3:00

 WWDC19