



Indoor Maps Program

Information and FAQ

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Contents

Indoor Maps Program	3
Overview	3
Indoor positioning: a particular challenge	3
Who should join the Indoor Program.....	4
Indoor maps in Apple Maps.....	5
Indoor maps in your own apps and websites	5
About Apple indoor positioning.....	6
About IMDF	7
Indoor map updates	7
Updating indoor maps in Apple Maps.....	7
Updating indoor maps in your own apps and websites	7
Indoor positioning updates	8
How to join the Indoor Program	8
Communicating with Apple as a member of the Indoor Program	8
Indoor Program Summary	9
Additional resources	11
IMDF and IMDF updates	11
Occupants and occupant updates	11
Testing and Viewing your IMDF.....	12
Apple Indoor Survey app.....	12
Adding indoor wayfinding to you apps.....	13
Third party platforms	13
Answers to common questions	15
Where is the Indoor Maps Program available	16

Indoor Maps Program

Overview

Finding your way inside a large and unfamiliar building can be difficult, and when you're pressed for time, not knowing which way to go can be incredibly stressful.

Apple is trying to make indoor wayfinding easier in two ways.

First, by adding indoor maps of airports and shopping centers to Apple Maps. Carefully curated and frequently updated, these indoor maps provide a beautiful 2D and 3D mapping experience together with a detailed directory of all the shops, restaurants and amenities within the facility. There are over 50 airports as well as hundreds of shopping centers live in Apple Maps today and more are being added every week.

Second, Apple is providing a way for the developer community to add indoor maps to their own apps and websites, whether the maps be for the general public or for their staff. In either case, Apple allows the facility owner to have full control over who is permitted to see the indoor map.

Indoor positioning: a particular challenge

Just having an indoor map is not enough for wayfinding. You also need to know where you are inside the building.

However, when indoors, satellite positioning systems signals can be blocked and as a result location accuracy can be significantly reduced.

Access to your accurate indoor location, or "blue dot", is a fundamental requirement to support indoor wayfinding. There are also many other use cases where an accurate location is vital. These include room-finders and apps for the mobility or visually impaired.

Indoor positioning can also be used to improve enterprise efficiency when employed in apps for building operations, facilities management, situational awareness or emergency response.

The Indoor Maps Program allows organizations to enable accurate indoor positioning inside their facilities. In airports and shopping centers, Apple commonly performs the necessary work to enable indoor positioning in publicly accessible areas. Inside other types of buildings or non-public areas, Apple provides organizations with the tools to enable indoor positioning by themselves.

Who should join the Indoor Program

The Indoor Maps Program is appropriate for the owners or operators of almost any large venue, public or private.

	Indoor maps for your apps and websites?	Indoor positioning for iOS?	Indoor maps in Apple Maps?
Airport	✓	✓	✓
Convention center	✓	generally not	
Corporate campus	✓	✓	
Factory	✓	✓	
Hospital	✓	✓	
Hotel or resort	✓	✓	
Museum	✓	✓	
Shopping center	✓	✓	✓
Stadium	✓	✓	
Subway station	✓	✓	
Train or bus station	✓	✓	
University	✓	✓	
Warehouse	✓	sometimes not	

The exceptions are as follows:

- **Convention centers:** accurate indoor positioning requires a relatively stable Wi-Fi network to be present. In the exhibition halls of convention centers this is generally not the case as the Wi-Fi is commonly changed for each event.
- **Warehouses:** it can be difficult to provide accurate indoor in large empty warehouses. However, if the warehouse is filled with equipment, shelves or other objects this is less of an issue and indoor positioning can be made to work well.
- **Any small building, office, shop or restaurant:** the basic rule is that if the space is so small you can't get lost, then indoor positioning is not appropriate for that location.

Indoor maps in Apple Maps

Apple is adding indoor maps of [airports](#) and [shopping centers](#) to Apple Maps.

These indoor maps are always based on data Apple receives from the organization that owns or operates the facility and only show the publicly accessible areas. In an airport this includes the areas beyond the security checkpoints, sometimes known as the “sterile” areas.

“Back-of-the-house” or “secure areas” are not shown in Apple Maps, but can still be shown in your own apps or websites, using the maps and apps that you develop for your staff.

If your organization agrees to contribute floor plans so that they can be displayed in Apple Maps, Apple will work closely with your organization to make sure that the maps are correct and kept up-to-date, and that only publicly accessible areas are shown.

It is important to note that the indoor maps displayed in Apple Maps are not made available via [MapKit](#) or [MapKit JS](#). In this way your organization retains control over which developers are able to use indoor maps of your facilities.

Indoor maps in your own apps and websites

Apple can help streamline the inclusion of indoor maps in your apps and your websites. For example, you might want to create an indoor wayfinding app for patients at your hospital or an app for your campus allowing students to report emergencies in a building, or a facilities management app for your staff, so that employees can easily report broken fixtures or rooms that need servicing.

In order to make these apps and websites truly useful you will also need indoor positioning. Apple provides the tools that make it easy to enable Apple indoor positioning technology inside your buildings.

Apple indoor positioning works in any iOS app as well as websites viewed in Safari or other WebKit compatible browsers on iOS devices.

In order to use indoor maps and enable indoor positioning you will need to:

1. Convert floor plans of your buildings to Indoor Mapping Data Format ([IMDF](#)) and upload the IMDF files to your organization’s [Apple Business Register](#) account.
2. Perform a radio frequency (RF) survey of your buildings using Apple’s [Indoor Survey app](#) to enable indoor positioning.
3. Display the indoor maps in your apps and websites and use Apple indoor positioning via the CoreLocation API or Safari on iOS.

Once your floor plans are converted to IMDF they become easy to display in your apps and websites. Both MapKit and MapKit JS provide APIs with controls for a more stylized presentation of your indoor map.

About Apple indoor positioning

Apple indoor positioning can typically provide GPS level accuracy when inside a building. It also returns floor level as an integer value: zero for ground floor, positive numbers for floors above ground and negative numbers for floors below ground.

The technology determines the device location by using the sensors in the iOS device to determine direction of travel and speed, and by using radio frequency “fingerprints”. It relies on the fact that the radio frequency patterns emitted by fixed Wi-Fi access points inside a building are unique depending on location. The radio frequency (RF) patterns are measured using Apple’s [Indoor Survey app](#), running on an iPhone, and associated with known latitude and longitude locations inside the building. The Indoor Survey app requires a floor plan of the building in IMDF, correctly geo-referenced to latitude and longitude. Thus IMDF allows the Indoor Survey app to tie the RF patterns to precise locations.

Once a building is surveyed using the Indoor Survey app, indoor positioning is generally available within 24 hours. It is accessed via the [Core Location APIs](#) or via Safari on iOS. The Core Location APIs are smart enough to use positioning information from satellites when the device is outside and use the Wi-Fi fingerprinting when the device is inside. This makes it incredibly easy for developers to deal with indoor/outdoor transitions as there is only the one API to call in all situations.

It is important to note:

- An iOS device does not need to be connected to any Wi-Fi network in order to get an indoor position fix.
- Wi-Fi must be ‘on’ on the device.
- The indoor positioning technology uses 2.4GHz Wi-Fi exclusively. If your organization uses 5GHz then the 2.4GHz radio in each Wi-Fi access point should be turned on in “beaconing mode” so that it is broadcasting a radio frequency pattern. The SSID for the 2.4GHz radio can be hidden so no users will discover and try to attach to it.
- The indoor positioning technology does *not* use BLE beacons.
- Any 2.4GHz Wi-Fi in the area is used for indoor positioning. This could be public, secure, hidden or even third party Wi-Fi from neighboring buildings.
- Coverage of indoor positioning can be increased by simply installing additional Wi-Fi access points and enabling beaconing mode. The access points do not need to be connected to any network and their SSID can be hidden so they are not discoverable.

About IMDF

IMDF stands for Indoor Mapping Data Format. IMDF is a data model that is used to describe an indoor space. IMDF is output as a set of GeoJSON files. There are many APIs available to display GeoJSON, making it easy to add indoor maps to your apps or websites. The easiest way to do this is to use MapKit or MapKit JS. Both include APIs for displaying your indoor map in IMDF format on top of Apple Maps.

Apple uses IMDF inside the Indoor Survey app so that Apple indoor positioning can be enabled inside a building.

For details on the IMDF specification see register.apple.com/resources/imdf/ .

There are a number of ways that you can create IMDF from your floor plans. See [Additional resources](#) for more information.

If your organization owns or operates airports or shopping centers then Apple can help convert your floor plans, which may be in CAD, BIM or GIS formats, to IMDF. Apple will also consider converting floor plans of other large public venues to IMDF on a case by case basis.

Indoor map updates

Changes can happen frequently inside buildings. Most common changes involve changes to the occupants of rooms and spaces. For example, in a shopping center or an airport the retail tenants change often, so the space occupied by a fast food restaurant today might be occupied by a coffee shop next month.

Floor plan changes happen too, but usually they happen less frequently than occupant changes. In many cases floor plan changes involve simple splitting and merging of spaces, but in some environments the construction never stops.

Updating indoor maps in Apple Maps

Apple Maps shows indoor maps of airports and shopping centers. Apple is keen to make sure that the indoor maps are kept up-to-date. In order to do that Apple needs to stay in constant contact with the owners and operators of these facilities.

Occupant changes can be communicated via an updated IMDF or via a simple spreadsheet. Structural changes to the building can be communicated via an updated IMDF or floor plans delivered in CAD, BIM or GIS formats.

Updating indoor maps in your own apps and websites

You can update the maps in your own apps and websites on your own. There is no need for any communication with Apple to make the updates. However, if you make major structural changes to your building, for example if you add a new floor or a new wing to a building, then a re-survey of the building using Apple's Indoor Survey app is required in order to provide indoor positioning in the new parts of the building. See section on Indoor positioning updates below.

Indoor positioning updates

Apple indoor positioning relies on the unique radio frequency patterns created by the radios inside Wi-Fi access points. Minor changes to the set of Wi-Fi access points, for example the addition or a deletion of a Wi-Fi access point, will have little to no effect on indoor positioning performance. However, if the set of Wi-Fi access points is upgraded or relocated throughout the building or facility then a re-survey of the building using Apple's Indoor Survey app will be required to keep the indoor positioning performant.

Major changes to interior walls might also affect the quality of indoor positioning and might cause the need for a re-survey.

Indoor positioning can be tested using the Indoor Survey app by using it in 'Positioning' mode.

Your organization is free to perform the re-survey using Apple's Indoor Survey app. If Apple has already added indoor maps of your buildings to Apple Maps, then Apple may also perform the re-survey on your behalf.

How to join the Indoor Program

To join the Indoor Program a representative from your organization should sign up at the Apple Business Register website. See register.apple.com/indoor. Once Apple has received your application a response will normally be provided in a few days. In the event an additional member of your organization attempts to join the program, the current administrator for your organization will be notified of the colleague's interest and asked to invite the employee directly to the organization. This gives your company complete control over the program membership.

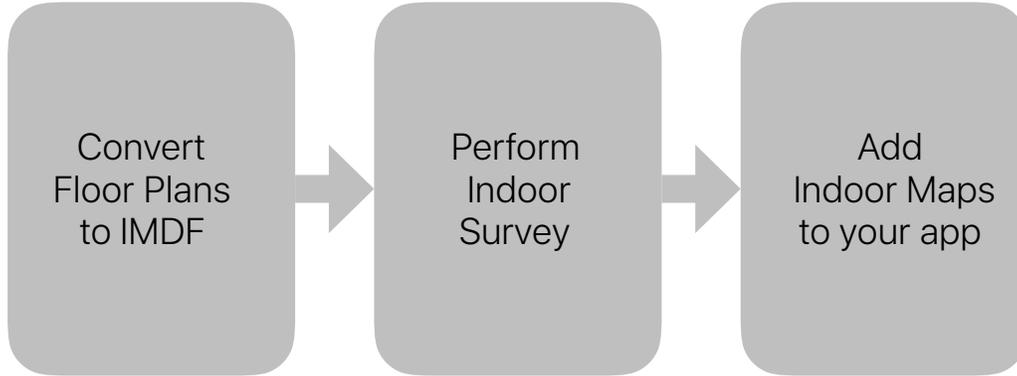
To learn more about the indoor program and the entire workflow see [WWDC2019 Session 245: Introducing the Indoor Maps Workflow](#)

Communicating with Apple as a member of the Indoor Program

Generally all communication is performed via the Apple Business Register website. See register.apple.com/indoor. Once your application for the Indoor Program has been approved your organization will use Apple Business Register to upload floor plans and details about your buildings, for example retail tenant information. Your organization will also use this website to upload indoor map updates.

Indoor Program Summary

	For Apple Maps	For your own apps / websites
Indoor maps	Airports and shopping centers. Publicly accessible areas only.	Any large building. Public and/or private areas.
Indoor positioning	Any large building. Conference centers and empty warehouses not recommended.	
Indoor positioning requirements	Any 2.4GHz Wi-Fi; can be public, secure, hidden or third party. No Wi-Fi connection required, but Wi-Fi must be 'on' on the device. No BLE beacons required.	
Receiving indoor positioning location updates	<p>Accessed via Core Location</p> <p>CLLocationManager must be configured with kCLLocationAccuracyBest or kCLLocationAccuracyBestForNavigation</p> <p>CLLocationManager configured with activityType other</p> <p>CLLocation objects are delivered to the CLLocationManagerDelegate with the optional property "floor" populated. For "floor", '0' represents the ground floor</p> <p>Altitude will always be invalid. For more information see: https://developer.apple.com/documentation/corelocation/cllocation</p>	
Indoor Survey	Performed by Apple staff or facility owner/operator.	Performed by facility owner/operator.
Accepted floor plan formats	IMDF (preferred) CAD, GIS, BIM Vector PDF	IMDF
Accepted occupant formats	IMDF (preferred) Indoor Occupant CSV	IMDF
Accepted update formats: floor plans	IMDF (preferred) CAD, GIS, BIM Vector PDF	IMDF
Accepted update formats: occupants	IMDF (preferred) Indoor Occupant CSV (preferred) CAD, GIS, BIM Vector PDF	IMDF
Accepted data upload methods	Upload manually via Apple Business Register website. Upload via API: requires API key; available via Apple Business Register website	
Data download methods	Download manually via the Apple Business Register website	



Typically involves converting floor plans from CAD, BIM or GIS formats.

There are many ways to do the conversion. See [Additional resources](#) section below for more information.

Apple can perform conversion work for airports and shopping centers at no charge.

The Indoor Survey app is used to perform the survey. It runs on an iPhone.

Indoor positioning is enabled as a result of the survey.

Indoor positioning is made available via Core Location or via Safari on iOS.

Indoor maps can be easily displayed in your app and website using MapKit and MapKit JS.

See [Additional resources](#) section below for more information.

Additional resources

IMDF and IMDF updates

The full IMDF specification is at register.apple.com/resources/imdf/ . In order to create IMDF from your floor plans there are a number of options:

- **Airports and shopping centers:** Apple can create IMDF from your CAD drawings, BIM files or GIS files. You must also include details on the occupants of each space inside the building, for example retailers, and tie this information to a unique, permanent identifier for each space. This occupant information can be delivered in a variety of ways. See below for more information.
- **Other large public venues:** such as stadiums, train stations and museums. Apple may be able to provide some assistance to create IMDF from your floor plans, however, requests are considered on a case-by-case basis.
- **All other buildings, facilities or venues:** you will need to create IMDF yourselves. The good news is there are a number of third party platforms and tools that can make creating and updating IMDF easier. See section on [third party platforms](#) below.

Occupants and occupant updates

Occupants of spaces inside your buildings can change frequently. In a shopping center or airport they are generally retailers or facilities and amenities. In a non-public building or non-public area they might be people or equipment.

Because Apple is adding indoor maps of airports and shopping centers to Apple Maps, Apple needs to know basic information about the occupants in the public areas, for example the location of shops, restaurants or the location of information desks, restrooms/toilets. Apple also needs category information, for example "Shoes" or "Pizza", as well as a retail tenant's phone number, website and operating hours. Apple does not need to know *any* information about the occupants of private buildings or the private areas of public buildings.

In all cases it is very important that a unique and permanent room or unit identifier be used for each space inside the building. This is to make it easier for your organization to provide updates about the occupants of each space.

So, for example, on your floor plan you might identify retail spaces as "Unit 101", "Unit 102" et cetera. You can then use this identifier and tie it to the occupant of each space. So "Unit 101" might currently be occupied by "Joe's Pizza" and "Unit 102" might be occupied by "Pete's Coffee". Then, next month when the leases change, "Unit 101" might become occupied by "Tony's Pizza" and "Unit 102" might become occupied by "Phil's Coffee".

The occupant information may be delivered to Apple in two ways:

- **As part of the IMDF:** IMDF can be used to describe both the geometry of a building as well as its occupants.
- **In an "Indoor Occupant" CSV file:** the CSV file specifies the occupants and related details and ties it to the unique, permanent space identifier as identified in your floor plans. In this way updates on the occupants can be delivered without having to redeliver floor plans. The specification for the Indoor Occupant CSV file can be found at register.apple.com/resources/indoor/IndoorOccupants.zip. The specification includes a sample file.

For creation of the initial map, shopping centers and airports may deliver occupant information as part of their floor plans or in a separate document, for example a PDF file. However, indoor to make updates efficient, it is essential that unique, permanent space identifiers be defined for each space.

If spaces inside a building get divided or merged or if other more significant structural changes happen, then a redelivery of the building geometry would be required together with appropriate updates to the unique identifiers to each space.

Testing and Viewing your IMDF

Once you have created or updated an IMDF you can easily view it using the IMDF sandbox. See <https://register.apple.com/indoor/imdf-sandbox>. This sandbox can be used to view IMDF files, run validations, as well as make minor edits to the data.

Additionally, when you upload an IMDF into your account on Apple Business Register, a detailed validation of the IMDF is performed. The resulting report can be used to correct any errors or warnings in the IMDF.

Apple Indoor Survey app

The [Indoor Survey app](#) is used to enable indoor positioning on iOS. It can also be used to test the performance of indoor positioning once it has been enabled. This is useful to help identify areas of the building that might require better Wi-Fi coverage to enhance the performance of indoor positioning. It can also be used to help debug the positioning in any iOS apps or web sites you develop. Theoretically the "blue dot" should appear in the same location in your own app or website as it does in the Indoor Survey app. If they disagree it may mean your indoor map is not correctly geo-referenced to latitude / longitude or it may mean you have a bug in your code.

Performing an indoor survey to enable indoor positioning using the Indoor Survey app is very easy and intuitive, however, surveying requires some specific techniques to produce the best results. For more information please see the tutorial on this [help page](#). Rendering your indoor map in your apps and websites

Once you have an IMDF of your buildings, the simplest way to display (or "render") your indoor map in your apps or websites is to use [MapKit](#) or [MapKit JS](#). IMDF is expressed as a set of GeoJSON files and both MapKit and MapKit JS provide APIs to render GeoJSON as overlays on top of Apple Maps. The APIs also provide methods to customize the overlays, so your indoor maps can be made to match your specific color and style guidelines.

As your users move around your buildings CoreLocation provides the `CLLocation` points that include a value for the current floor. You can use this floor value to automatically display the appropriate floor plan so the user doesn't have to figure it out themselves. You can also use this value to provide automatic floor level switching as the user transitions from one floor level to another. For more detail see [2019 WWDC Session 241: Adding Indoor Maps to your Apps and Website](#)

Once Apple indoor positioning is enabled for your buildings it is easy to add it to your iOS apps using the [Core Location](#) framework. If you're developing a web site that includes indoor maps then you can enable indoor positioning for iOS users viewing your site in Safari. In Safari on iOS floor level is exposed as `geolocation.floorNumber`.

Adding indoor wayfinding to you apps

Apple's indoor positioning (or "blue dot") provides the solid foundation needed for indoor wayfinding (or "blue line"). Apple does not provide an API for indoor wayfinding However, there are many organizations that provide such APIs. See section on [third party platforms](#) below.

Third party platforms

Apple works with a number of third parties that provide platforms for creating and updating IMDF as well APIs to display IMDF. Some of these platforms also provide APIs for other indoor features such as indoor wayfinding. See table below.

Provider Product	Create / Edit IMDF	Manage Content	Map Display API	Indoor Wayfinding API	Notes
Arora Engineers	✓	✓	✓	✓	Arora is a full service engineering firm with expertise in IMDF generation and conversion, IoT integration with Maximo.
Autodesk Bim360 Ops			✓	✓	Autodesk BIM 360 Ops is a mobile-first asset and maintenance management solution. Transform a Revit file into IMDF for use in BIM 360 Ops with Apple Indoor Positioning to show technicians and vendors a path to their assigned ticket or a nearby asset, track mobile assets with iBeacons, and view a list of new tickets as a heat map on a floor plan for better triaging.
Compathnion		✓	✓	✓	Provides site surveys, SDK toolkits, content management platform, and analytics services using different big data, artificial intelligence and edge computing technologies.

Provider Product	Create / Edit IMDF	Manage Content	Map Display API	Indoor Wayfinding API	Notes
Esri <u>ArcGIS Indoors</u>	✓	✓	✓	✓	ArcGIS Indoors provides an indoor mapping system for assembling, managing, and sharing building and campus information.
Jibestream	✓	✓	✓	✓	Provides a platform that gives application developers the tools to create and manage tailored map-enabled solutions, with SDKs, APIs and a CMS.
LocusLabs	✓	✓	✓	✓	Provides a content management system for indoor mapping. LocusLabs works with many airports and casinos.
MappedIn	✓	✓	✓	✓	Provides a content management system for indoor mapping. MappedIn works with many shopping center operators.
Mapxus	✓	✓	✓	✓	Provides an indoor mapping technology platform that provides indoor map services for global applications.
Point Consulting	✓	✓	✓	✓	Point Consulting's Point Map solution enables the creation and integration of indoor maps and wayfinding into mobile apps and web sites.
Safe Software	✓				Provides a general purpose platform for data conversion and data pipelines. The platform includes comprehensive data format translation tools and validators for IMDF.
VisioGlobe	✓	✓	✓	✓	Provides a web based platform for map creation and map visualization with support for IMDF and Apple Indoor Positioning.

Answers to common questions

Q: Will Apple add indoor maps of your buildings to Apple Maps?

A: Apple will add indoor maps of the publicly accessible areas of shopping centers and airports to Apple Maps, but only after having received the explicit permission from the owner/operator. Apple Maps does not include indoor maps of other kinds of buildings, public or private.

Q: Will Apple make your IMDF files or indoor maps available to third parties, for example Apple developers?

A: No. Indoor maps shown in Apple Maps are not made available via MapKit or MapKit JS. In that way your organization retains control over which developers have access to your indoor map. You can easily display your indoor map on top of the MapKit/MapKit JS map using the available overlay APIs in MapKit and MapKit JS.

Q: Do I need to re-survey if I change the location of my Wi-Fi access points?

A: Generally not for minor changes, for example the addition or deletion of a Wi-Fi access point. However, if you replace your entire Wi-Fi network a re-survey of the building will need to be completed using Apple's [Indoor Survey app](#). Major changes to interior walls might also affect the quality of indoor positioning and might cause the need for a re-survey.

Q: How do I get access to the current floor level information provided by Apple indoor positioning?

A: Floor level is provided by the Core Location API and also by the Safari browser on iOS. It is returned as an integer: zero for ground floor; positive numbers for above ground, negative numbers for below ground. You can correlate these number to the floor names in your app or website.

Q: Does the user need a data connection to use indoor positioning?

A: As the user approaches the building, indoor positioning data is automatically downloaded to a user's iOS device. This requires a data connection. Once this data is downloaded indoor positioning can work well with no data connection.

Q: Do I need to enhance my Wi-Fi network to offer indoor positioning?

A: If there is sufficient coverage to support Wi-Fi connectivity throughout the building, whether the Wi-Fi be public or private, then it should be sufficient to support indoor positioning. The Wi-Fi access points must be broadcasting a radio signal at 2.4GHz. No connection to any Wi-Fi network is required for indoor positioning, but Wi-Fi on the device must be switched on.

Q: Are BLE beacons required to enable indoor positioning?

A: No. Apple does not use beacons for indoor positioning. However [iBeacon](#) can be used to complement indoor positioning, for example to trigger an alert on a user's iPhone when they approach a customer service desk.

Q: Does Apple provide an indoor wayfinding API?

A: No. There are a number of third party developers that specialize in providing this capability. See section on [third party platforms](#).

Q: Does Apple indoor positioning work on platforms other than iOS?

A: No.

Where is the Indoor Maps Program available

Registration is open to organizations in the following countries at this time:

Argentina	Ireland	Seychelles
Australia	Israel	Singapore
Austria	Italy	South Africa
Belgium	Japan	South Korea
Brazil	Macau	Spain
Canada	Malaysia	Sweden
Chile	Malta	Switzerland
Colombia	Mexico	Taiwan
Czech Republic	Morocco	Thailand
Denmark	New Zealand	The Netherlands
Egypt	Norway	Turkey
Finland	Panama	Ukraine
France	Peru	United Arab Emirates
Germany	Philippines	United Kingdom
Greece	Poland	United States
Hong Kong	Portugal	Uruguay
Hungary	Qatar	Vietnam
India	Russia	
Indonesia	Saudi Arabia	