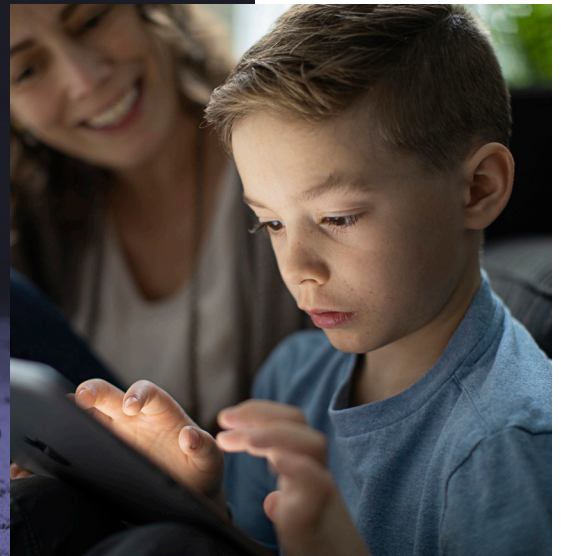




TECHNICAL PAPER



eSIM iPad setup with Jamf School



8 November, 2020

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Introduction

eSIM and Apple Mobile Devices

Traditionally, cellular devices included a slot where a small Subscriber Identity Module ("SIM") card could be inserted. Most of the time, devices came with a card already installed to link the device to a cellular carrier and service plan. Some modern devices are switching to use an Embedded SIM ("eSIM") that can store this information digitally, allowing cellular configuration to be managed remotely.

The following documents include information on Apple's implementation of eSIM technology:

[Deploy iPad with Cellular Connections](#)

[Apple's "Get Cellular Coverage" page listing devices that support eSIM](#)

This document demonstrates how Jamf School can be used to Install, update, and report on your devices' eSIMs, all from a central console.

Activating Cellular Service with eSIM without Jamf

Unless a device has been pre-configured, eSIM devices don't know which carrier will be providing their cell service when they're first turned on. There are no icons at the top of the screen to indicate cell service has been set up like there are when a carrier-specific physical SIM is installed.



When a consumer purchases a device with an included cellular plan, the retailer may configure the device for them. Or they can go into the cellular settings page on the device and pick a plan to purchase for themselves. In cases where the device was purchased directly from the carrier, Apple may already know that the device has a carrier and the device might provision its cell service automatically.

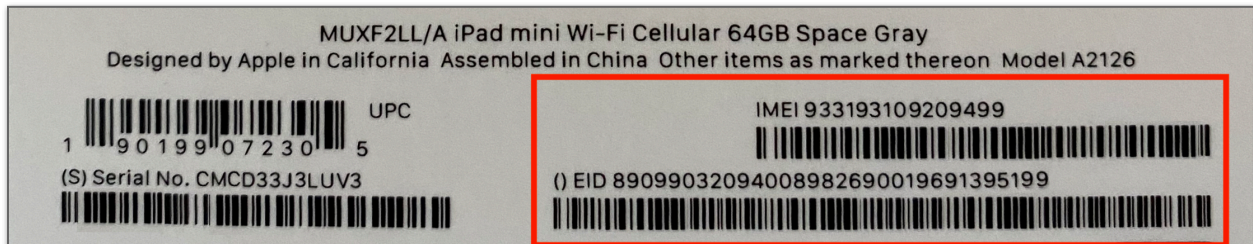
When an organization adds devices to its cellular plan, there are a number of manual methods available for setting up cell service with an eSIM. Most carriers have a web page with instructions for the methods they support. They may provide a URL and activation code that you can enter manually, a QR code to scan, an Apple App Store app, etc.

But going through the cellular configuration process is a lot of extra work if you're setting up a large number of devices and requires that you have physical access to the device. In these cases, we can use a Jamf School command to instruct the device (or many devices at once) to contact your carrier's eSIM servers and configure themselves. We'll show you how in the next section. Throughout this document, the term SM-DP+ server and eSIM servers are interchangeable.

When an organization needs to add eSIM devices to their cellular account, they'll need to provide the Mobile Equipment Identity ("IMEI") number and eSIM ID Number or Electronic Identification Document

("EID"). If you don't already have a list of these, ask your Apple representative to provide them. They can work with their sales team to create a list as soon as your iPads have shipped and their serial numbers are known. You can pass the list on to your cellular provider, so they have the device information associated with your account and set up in their eSIM servers when you're ready to configure the devices. Ask your carrier if there's any time limit on how long you have to download an eSIM profile to your devices.

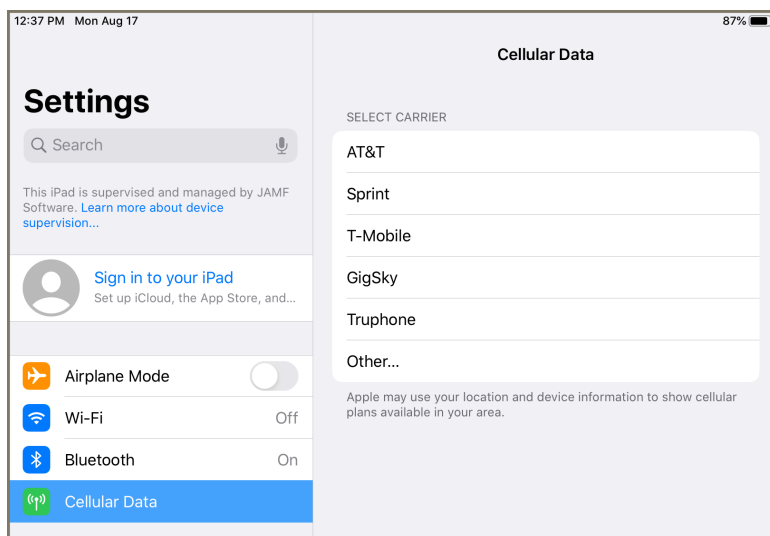
If you don't have a list of the cellular IDs for a device, you can find the IMEI and EID numbers on the outside of the iPad's box. You can read them in with a barcode scanner if one is available. It may also be helpful to include the device serial number in your list so the device can be referenced if you have to follow-up with your carrier should a device require troubleshooting.



The same information is also available on the device itself under "Settings > General > About".

Apple's <https://support.apple.com/en-us/HT209044> page has detailed information on these provisioning methods as well as tips for using an eSIM on a dual-SIM phone as might be the case when a corporate device has a separate SIM for personal or international use. Note that while some iPad models offer both a physical SIM slot and eSIM, they do not have dual-radio capabilities like some iPhones do—on an iPad, only one eSIM can be active at a time.

The image below shows the Cellular Data pane as it appears on an eSIM iPad that doesn't yet have an activated cellular data plan.



Automated Cellular Activation for iPad

Manual configuration of cellular settings in Settings is practical for consumer devices but too time-consuming when setting up large numbers of devices. Jamf products offer support for automated eSIM profile installation.

Typical Provisioning Workflow

In a common mass-deployment scenario, an organization is going to be distributing iPads to end-users for home use. They often want to configure the devices at a central location or service provider depot to make sure everything is correct before handing out or shipping the device. In education, the student may be young and not an expert troubleshooter. IT may not want staff and students to have the trouble of shipping a device back to IT if there's something wrong.

Boxes of new devices have been delivered by Apple cellular service has been purchased, and the cellular carrier has added the EID and IMEI numbers for the device eSIMs to your organization's data plan account. To get the devices ready for the users, we'll first need to enroll the devices in a Mobile Device Manager ("MDM") like Jamf School. Once that's done, we can manage the cellular setup from a central console without ever having to touch them.

There are a few ways to enroll devices in MDM when doing mass-deployment:

Automated Enrollment – In this method, Apple School Manager already knows your organization owns the devices so Apple School Manager will tell the devices to connect to your MDM automatically the first time they power on.

Apple Configurator – This is a free program available on the Mac App Store. It allows you to connect many iOS or iPadOS devices to a Mac via a multi-port USB hub and can install the initial software and settings you want. It's fast since it doesn't need to happen over a WiFi network.

Once the device is enrolled in Jamf School, it's easy to install more settings and software, or to push mobile device commands to large numbers of devices, for example, "Refresh Cellular Plans". This command tells the iPads to connect to your carrier to download an eSIM profile so they can start getting cellular data. That's a lot easier than setting up cell service on all your devices by hand.

Some helpful resources:

- [Deploy iPads with cellular connections](#)
- [Apple's "Get Cellular Coverage" page listing devices that support eSIM](#)
- [Apple School Manager Guide](#)
- [Jamf School Deployment Guide](#)
- [Deploying iOS and tvOS Devices Using Apple Configurator 2 and Jamf Pro](#)
- [Enrolling macOS, iOS, and tvOS Devices in Jamf Pro Using Automated MDM Enrollment](#)

Activating eSIMs with Jamf School

Activating a Single Device

Once a set of devices have been enrolled in Jamf School, we can view them under "Devices". When we click on a device to view its details and select "Network Information", we can see that the cellular plan information is blank because cell service hasn't been activated yet.

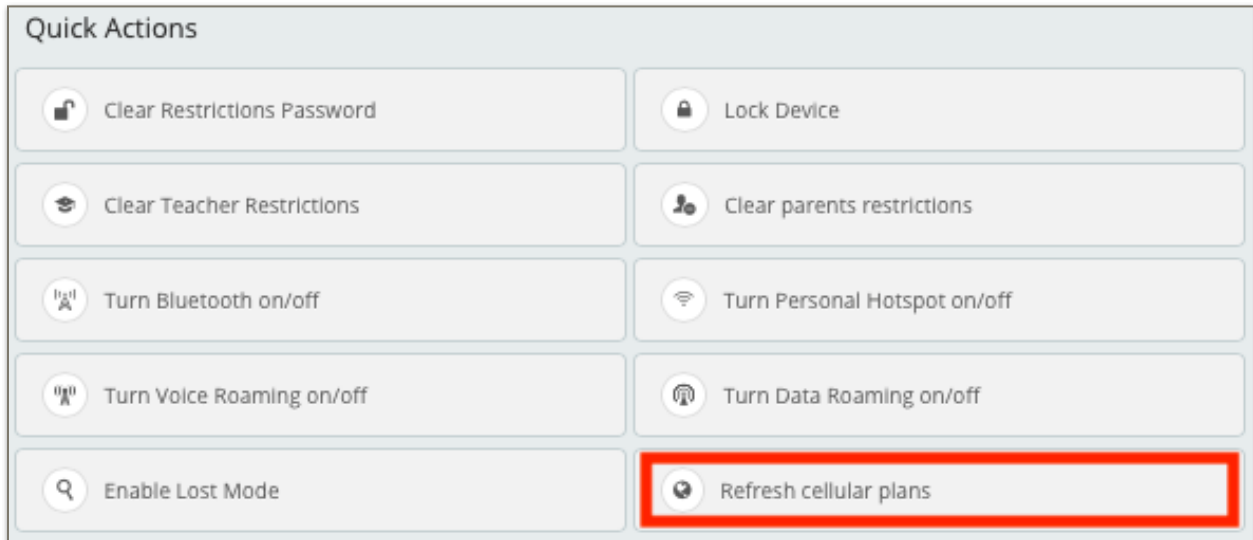
The screenshot shows the Jamf School interface for an iPad. The left sidebar contains a list of menu items: Device Details, Network Information, Updates, Owner History, Managed Profiles, Other Profiles, and Managed Apps. The main content area is titled "Network Information" and includes a "refresh" button. The network information is displayed in a table format.

Network Information			
Public IP	72.183.133.252	Phone number	-
WiFi MAC	34:a8:eb:07:54:2f	Voice Roaming enabled	✘
Ethernet MAC	-	Data roaming enabled	✘
Bluetooth MAC	34:a8:eb:05:2e:af	Is currently roaming	✘
Network Tethered	✘	Personal Hotspot enabled	✘
ICCID	-	Subscriber MCC	-
IMEI	35 317310 685540 4	Subscriber MNC	-
Carrier	-	Current MCC	65535
SIM Carrier	-	Current MNC	65535
Subscriber Carrier	-		
Carrier settings version	-		

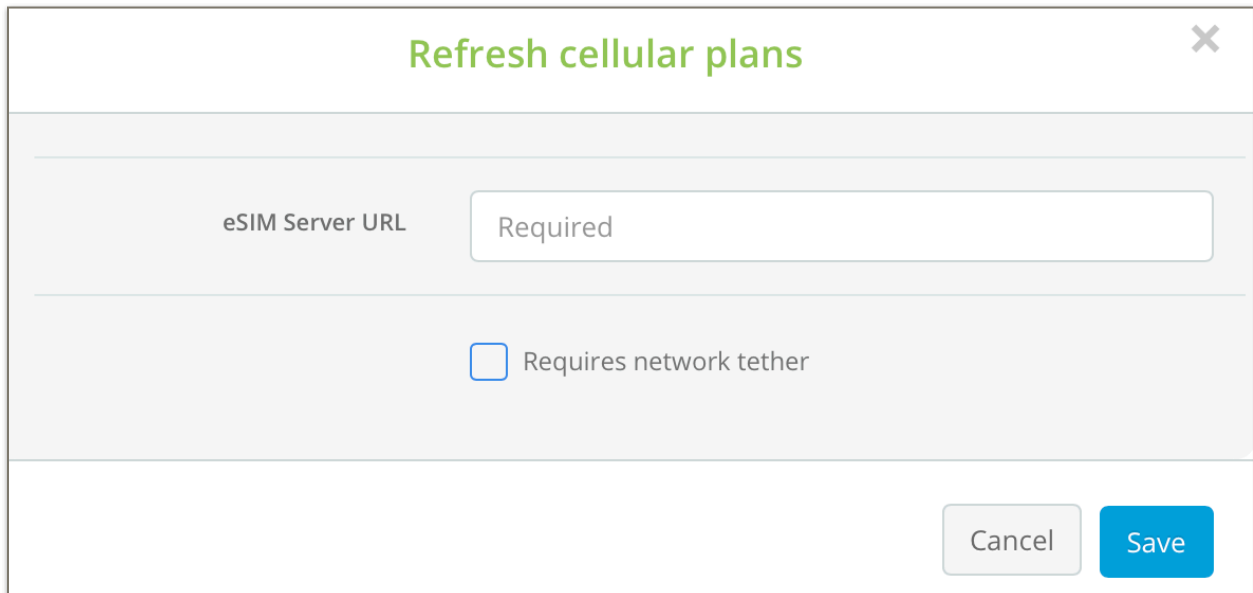
This is a duplicate of the screenshot above, showing the same Jamf School interface for an iPad. The left sidebar contains a list of menu items: Device Details, Network Information, Updates, Owner History, Managed Profiles, Other Profiles, and Managed Apps. The main content area is titled "Network Information" and includes a "refresh" button. The network information is displayed in a table format.

Network Information			
Public IP	72.183.133.252	Phone number	-
WiFi MAC	34:a8:eb:07:54:2f	Voice Roaming enabled	✘
Ethernet MAC	-	Data roaming enabled	✘
Bluetooth MAC	34:a8:eb:05:2e:af	Is currently roaming	✘
Network Tethered	✘	Personal Hotspot enabled	✘
ICCID	-	Subscriber MCC	-
IMEI	35 317310 685540 4	Subscriber MNC	-
Carrier	-	Current MCC	65535
SIM Carrier	-	Current MNC	65535
Subscriber Carrier	-		
Carrier settings version	-		

You can tell the device to contact your cellular carrier, download the eSIM profile, and activate its cell service by clicking the "Refresh cellular plans" button under "Quick Actions" in the lower-left of the detail page.

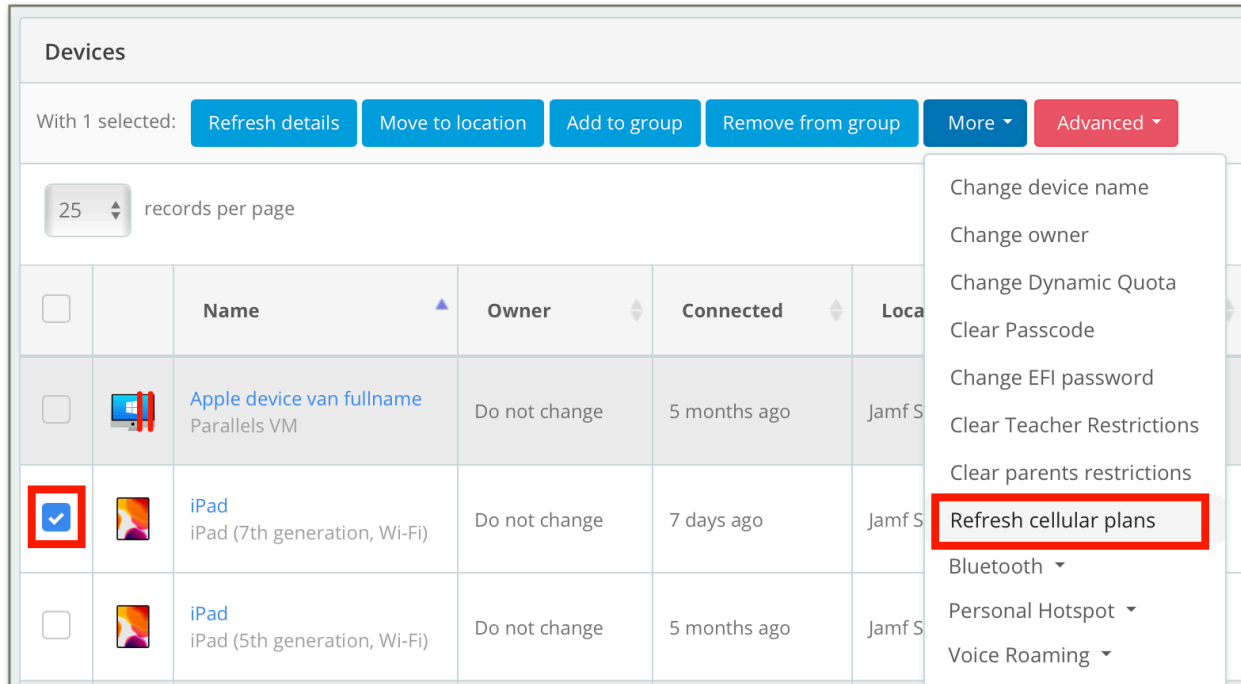


When this button is pressed, a dialog box will appear. Enter the eSIM Server URL for your carrier. If you're using network tethering, select the "Requires network tether" checkbox. Ref: [Setting up a shared Internet connection for iPhone and iPad](#).



Activating Multiple Devices

To quickly activate the cellular data plan on multiple devices, open the device listing and click the checkboxes next to the devices you want to activate. A filter on "Device Model" and/or "Location" may be helpful when locating your cellular iPad devices. Once you've indicated the devices to be configured, select "Refresh cellular plans" from the "More" drop-down menu.

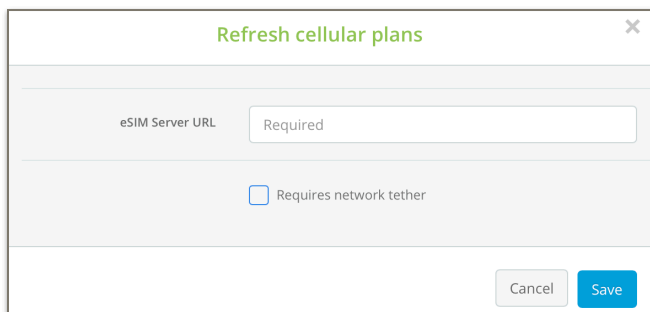


The screenshot shows the 'Devices' management interface. At the top, it indicates 'With 1 selected:' and provides buttons for 'Refresh details', 'Move to location', 'Add to group', 'Remove from group', 'More', and 'Advanced'. Below this is a '25 records per page' selector. The main area is a table with columns for selection, name, owner, connected status, and location. One iPad device is selected, and the 'More' dropdown menu is open, showing various actions. The 'Refresh cellular plans' option is highlighted with a red box.

<input type="checkbox"/>	Name	Owner	Connected	Location
<input type="checkbox"/>	Apple device van fullname Parallels VM	Do not change	5 months ago	Jamf S
<input checked="" type="checkbox"/>	iPad iPad (7th generation, Wi-Fi)	Do not change	7 days ago	Jamf S
<input type="checkbox"/>	iPad iPad (5th generation, Wi-Fi)	Do not change	5 months ago	Jamf S

- Change device name
- Change owner
- Change Dynamic Quota
- Clear Passcode
- Change EFI password
- Clear Teacher Restrictions
- Clear parents restrictions
- Refresh cellular plans**
- Bluetooth
- Personal Hotspot
- Voice Roaming

When this button is pressed, a dialog box will appear. Enter the eSIM Server URL for your carrier. If you're using network tethering, select the "Requires network tether" checkbox. Ref: [Setting up a shared Internet connection for iPhone and iPad](#).

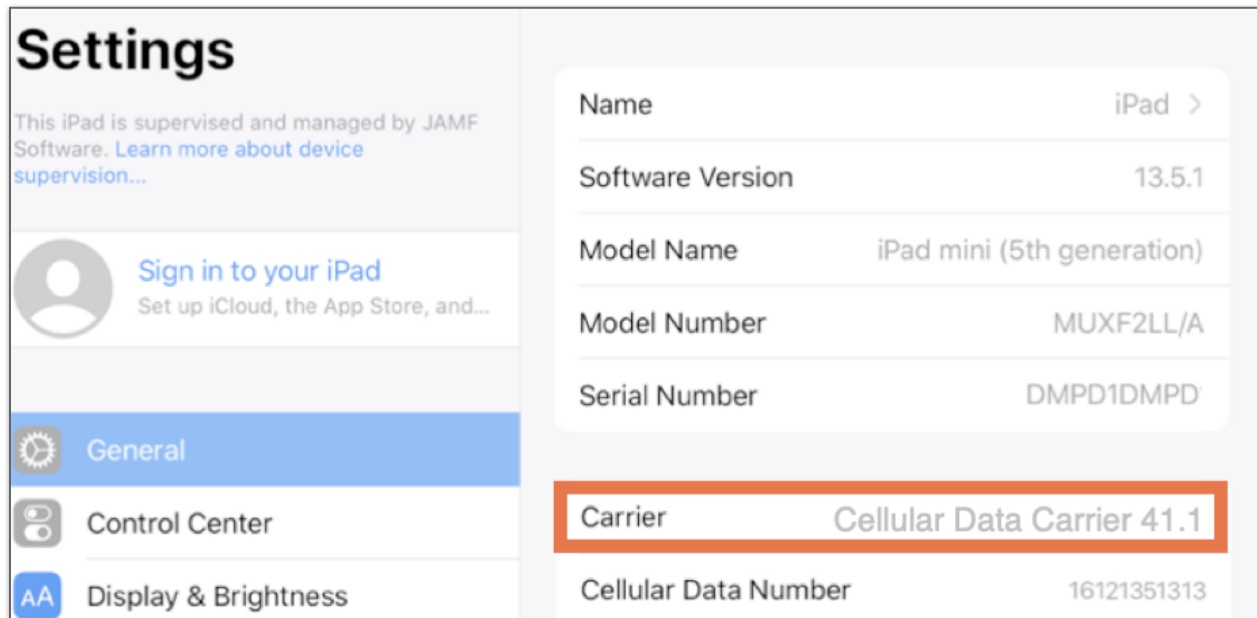


The dialog box titled 'Refresh cellular plans' contains the following fields and options:

- eSIM Server URL: Required (text input field)
- Requires network tether
- Buttons: Cancel, Save

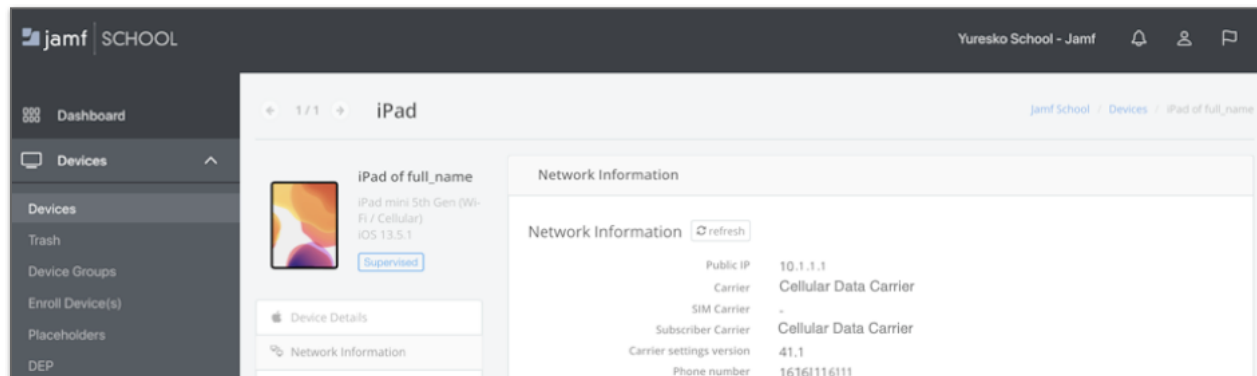
Click the "Save" button once you've filled in the information. Jamf School will send an MDM command to each of the selected devices. This command will direct the Apple device to identify itself to the carrier's eSIM server. The carrier will match this to your account and reply to the device with its activation information (i.e., an "eSIM profile"). The device will then connect to the cellular network without requiring any manual steps on the device.

There are a number of indications that the eSIM has been configured. On the iPad itself, the presence of



cell service is indicated by the LTE signal strength indicator at the top of the screen, and the cell carrier and details of your configuration are shown in Settings.

Much of the same data is also now available in the Network section of the device details page in Jamf School.



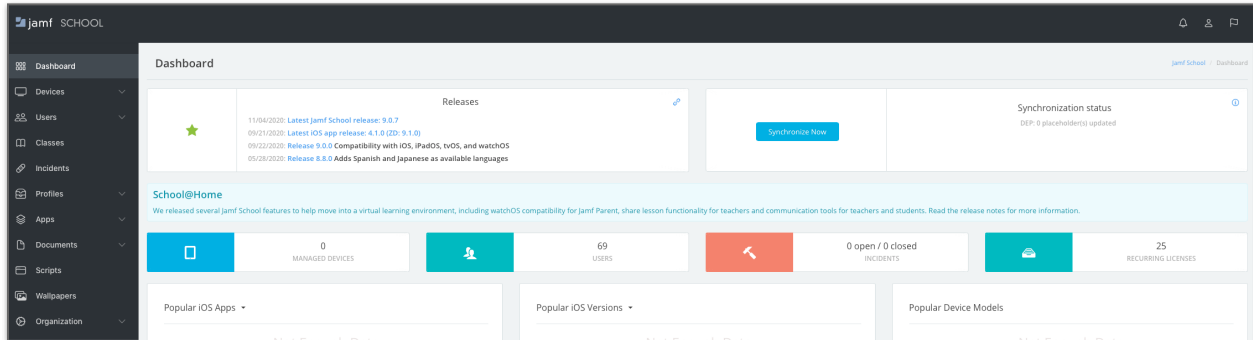
Activating eSIM with Device Enrollment Profile

One of the best features of mobile device management is Automated Enrollment. Jamf School takes that workflow a step further by incorporating eSIM activation with Automated Enrollment. This document is not a full discussion of Automated Enrollment.

For a complete discussion, consult the Jamf School Documentation at:

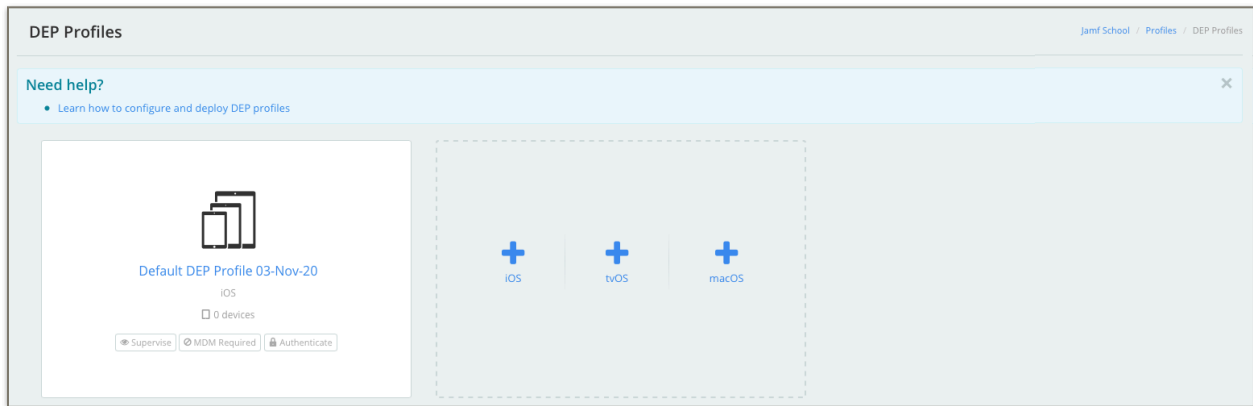
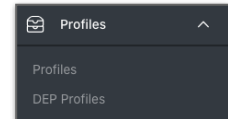
https://docs.jamf.com/jamf-school/deploy-guide-docs/Jamf_School_Deployment_Guide_and_Documentation.html.

The Jamf School Admin will navigate to their web console.



Next, navigate to the Profiles section of the console. Click the Profiles button and 2 choices will appear. Profiles and DEP Profiles are visible.

When DEP Profiles is selected, the following window will appear.

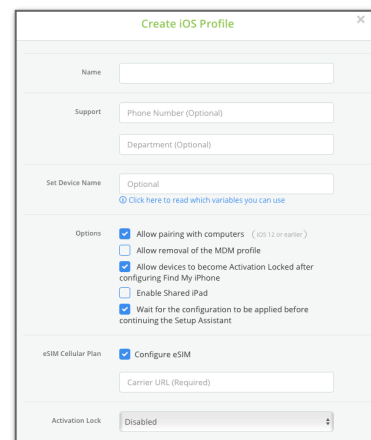


Now press the +iOS button to create a new DEP Profile for Cellular iPads.

At first glance, the profile looks the same as with previous versions. However, there is a new option for eSIM activation. Once a check mark is placed in the Configure eSIM checkbox, the Carrier URL will be displayed.

The Jamf School admin will enter the URL supplied by their cellular carrier.

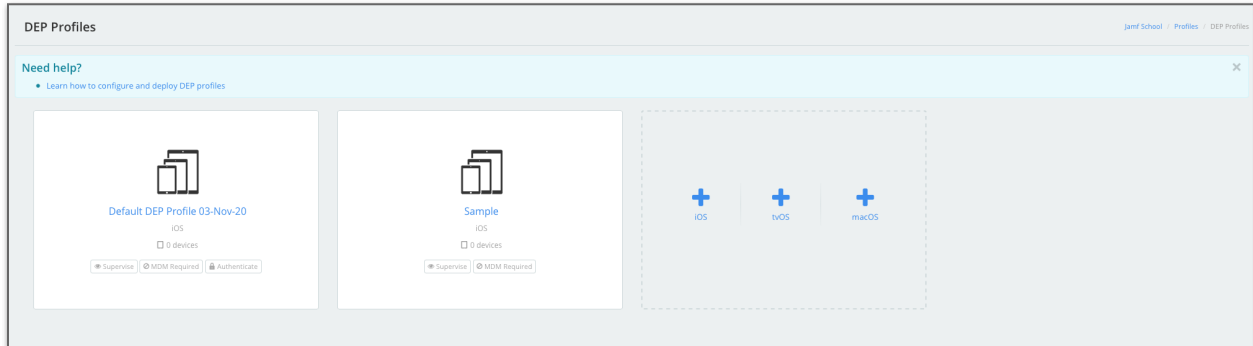
The Jamf School admin will complete entering and configuring the remaining details for Automated Enrollment.



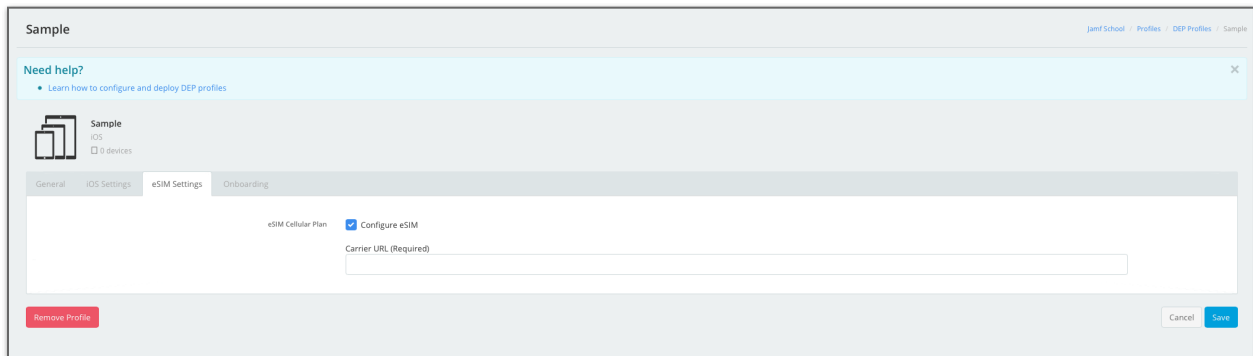
DEP devices will be assigned in the same manner as non-cellular devices. The best practice is to only assign an eSIM configured DEP Profile to devices needing eSIM profiles.

You can also update current DEP Profiles to include the eSIM Cellular Plan.

Select the DEP Profile. In this case, we will select Sample.



Once selected, navigate to a new tab called eSIM Settings.



When a check is placed in the eSIM Cellular Plan —> Configure eSIM, the Carrier URL (Required) option will appear. Enter URL supplied by the cellular carrier. Press Save.

Now the devices assigned to this type of profile will automatically activate their cellular data plan upon enrollment completion. No further action will be required by the Jamf School admin.

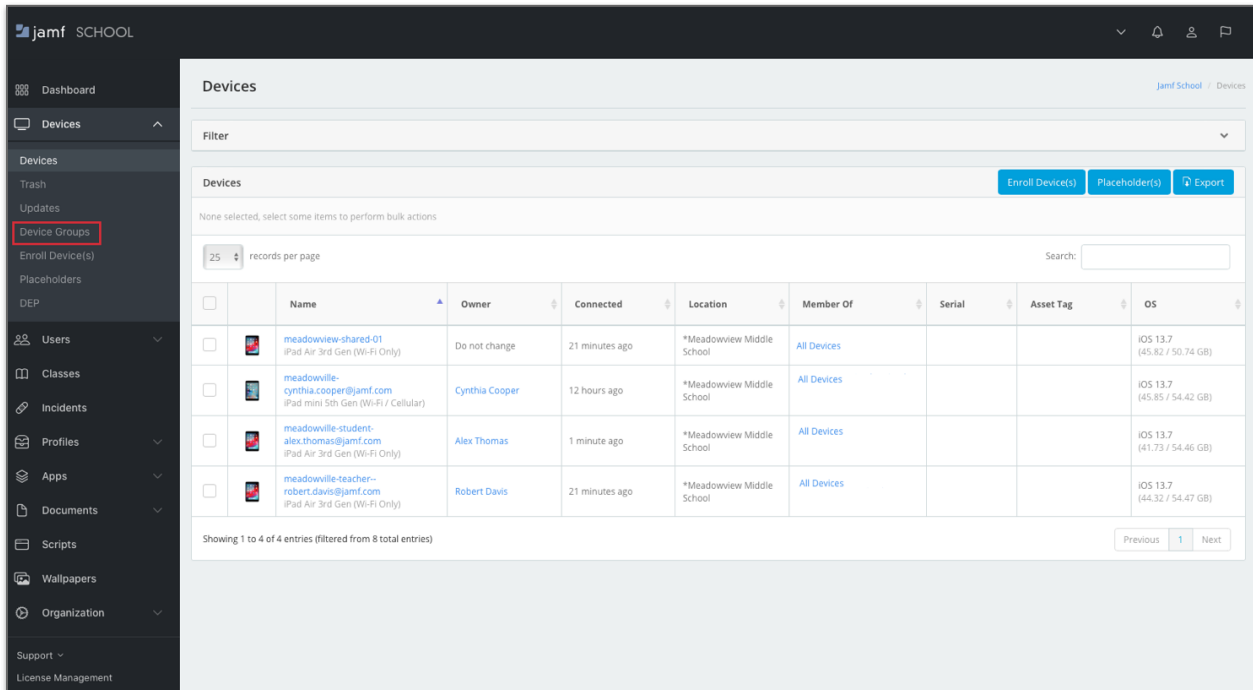
As with all deployments, establish a quality control system to ensure all devices are deployed correctly.

Should any issues occur, refer to the Troubleshooting section of this document on page 20.

Listing the devices that need cell service activated

Suppose we spent a morning enrolling a large group of new iPads into Jamf School using either the Apple Automated Enrollment or Configurator methods, and we want them to activate their cell service while we go to lunch. We can create a Smart Group of the devices to be activated and then tell Jamf School we want them to be setup for cell service all at once. It's a lot faster than clicking into each one individually and hitting the Refresh cellular plans button in the management tab.

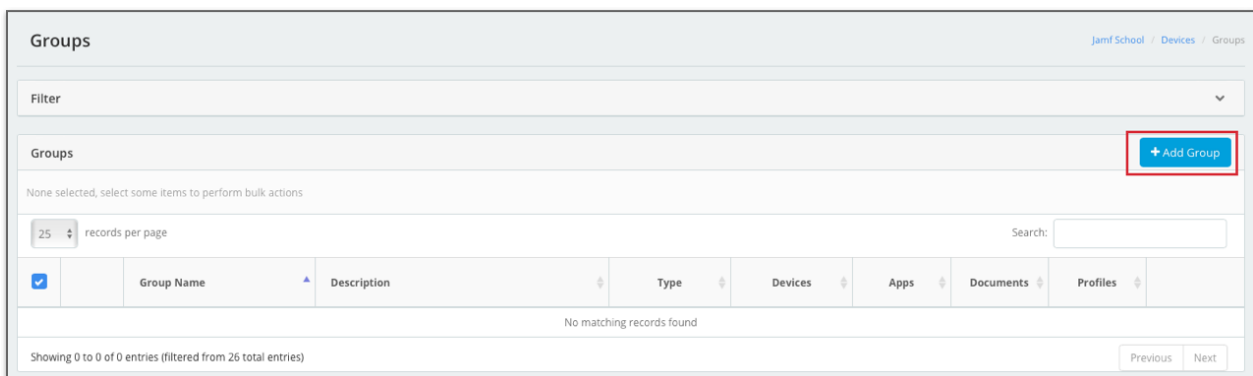
To begin, go to "Devices" and select the "Device Groups" button.



The screenshot shows the Jamf School interface. The left sidebar has a red box around the 'Device Groups' option. The main area is titled 'Devices' and shows a table of devices. The table has the following columns: Name, Owner, Connected, Location, Member Of, Serial, Asset Tag, and OS. There are four rows of device information.

Name	Owner	Connected	Location	Member Of	Serial	Asset Tag	OS
meadowview-shared-01 iPad Air 3rd Gen (Wi-Fi Only)	Do not change	21 minutes ago	*Meadowview Middle School	All Devices			iOS 13.7 (45.82 / 50.74 GB)
meadowville-cynthia.cooper@jamf.com iPad mini 5th Gen (Wi-Fi / Cellular)	Cynthia Cooper	12 hours ago	*Meadowview Middle School	All Devices			iOS 13.7 (45.85 / 54.42 GB)
meadowville-student-alex.thomas@jamf.com iPad Air 3rd Gen (Wi-Fi Only)	Alex Thomas	1 minute ago	*Meadowview Middle School	All Devices			iOS 13.7 (41.73 / 54.46 GB)
meadowville-teacher--robert.davis@jamf.com iPad Air 3rd Gen (Wi-Fi Only)	Robert Davis	21 minutes ago	*Meadowview Middle School	All Devices			iOS 13.7 (44.32 / 54.47 GB)

Here you will press the Add Group button. Now we will make a Smart Group. A Smart group in Jamf School is based on a series of filters which devices must meet in order to be a member. A Smart Group is dynamic and will change at each inventory update of devices.



The screenshot shows the Jamf School 'Groups' page. The '+ Add Group' button is highlighted with a red box. The page shows a table with the following columns: Group Name, Description, Type, Devices, Apps, Documents, and Profiles. The table is currently empty.

Group Name	Description	Type	Devices	Apps	Documents	Profiles
------------	-------------	------	---------	------	-----------	----------

Now the Add device group screen will appear. Here you will enter a name for your group and a description if desired. In this example, we have named our Smart Group “iPad is Current Cellular Data Carrier”. Once that is completed, press the Smart Group Button.

The screenshot shows the 'Add device group' screen. The progress bar indicates the 'Basics' step is active. The 'Name' field contains 'iPad is Current Cellular Data Carrier'. The 'Smart Group' button is highlighted with a red box.

Next you will have the many choices. We will only need to use the Members button for this Smart Group.

The screenshot shows the 'Add smart device group' screen. The progress bar indicates the 'Profiles' step is active. The filter rule configuration area shows 'Carrier equals iPad'. The 'Finish' button is visible at the bottom.

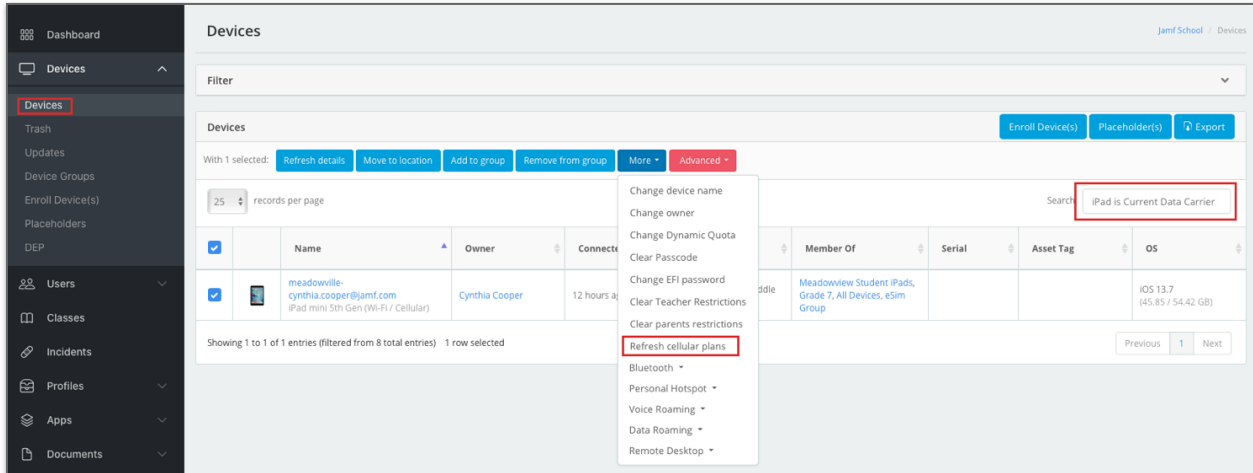
At this point Press the +Add Filter button located at the right. Once pressed, a list of Filter options will be presented. Scroll until you located the Network Section—Carrier option. You have have 4 options for Operators: equals, not equals, starts with, or contains. We have selected equals. In the data field, enter iPad and press Finish. Now when devices inventory, if they report iPad as their cellular carrier, they will be members of this Smart Group.

Now the Smart Group can be used a Filter in the Devices list so we can target the Refresh cellular plans command.

Sending the Refresh Cellular Data Plan Command

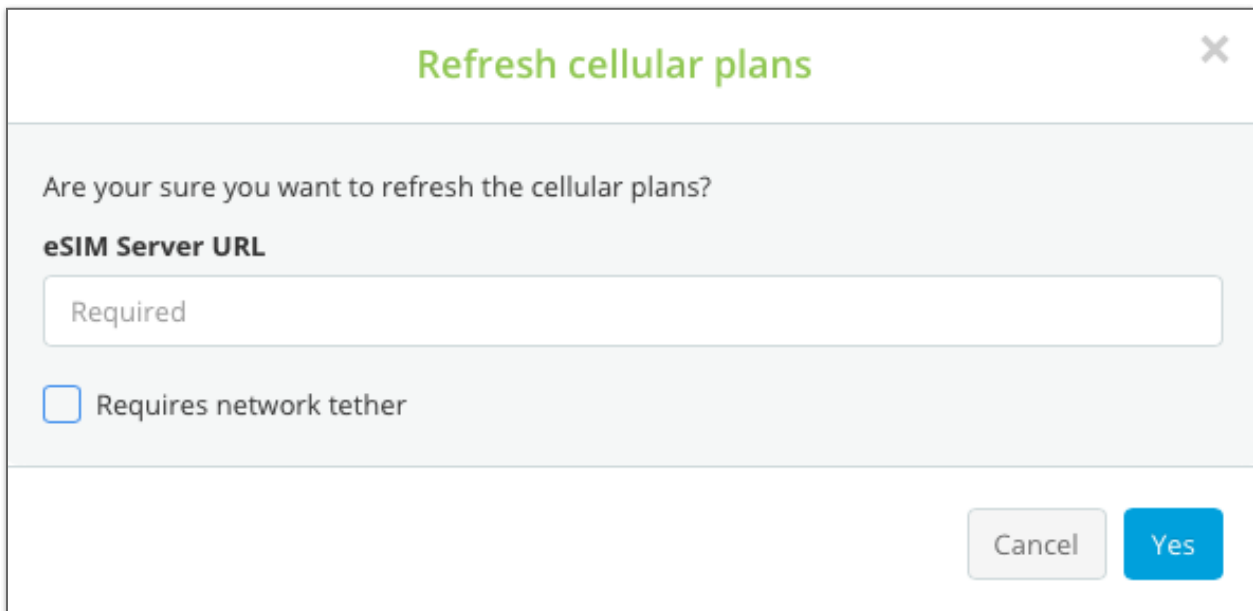
In the preceding section, we created a smart device group to provide a list of all iPads that report iPad as the cellular data carrier. We are using this resource to determine which devices need the Refresh cellular data plan command.

Go to your Devices listing and in the SEARCH Box, enter the name of your Smart Group. We have chosen “iPad is Current Data Carrier.” Now only devices in that Smart Group will appear. Now you can select the devices. Then go to the MORE menu. Select Refresh cellular plans command.



The screenshot shows the Jamf School interface for managing devices. On the left is a navigation sidebar with options like Dashboard, Devices, Trash, Updates, Device Groups, etc. The main area is titled 'Devices' and includes a search filter set to 'iPad is Current Data Carrier'. A table lists device details such as Name, Owner, and OS. A context menu is open over the table, with 'Refresh cellular plans' highlighted. Other menu items include 'Change device name', 'Change owner', 'Change Dynamic Quota', 'Clear Passcode', 'Change EFI password', 'Clear Teacher Restrictions', 'Clear parents restrictions', 'Bluetooth', 'Personal Hotspot', 'Voice Roaming', 'Data Roaming', and 'Remote Desktop'.

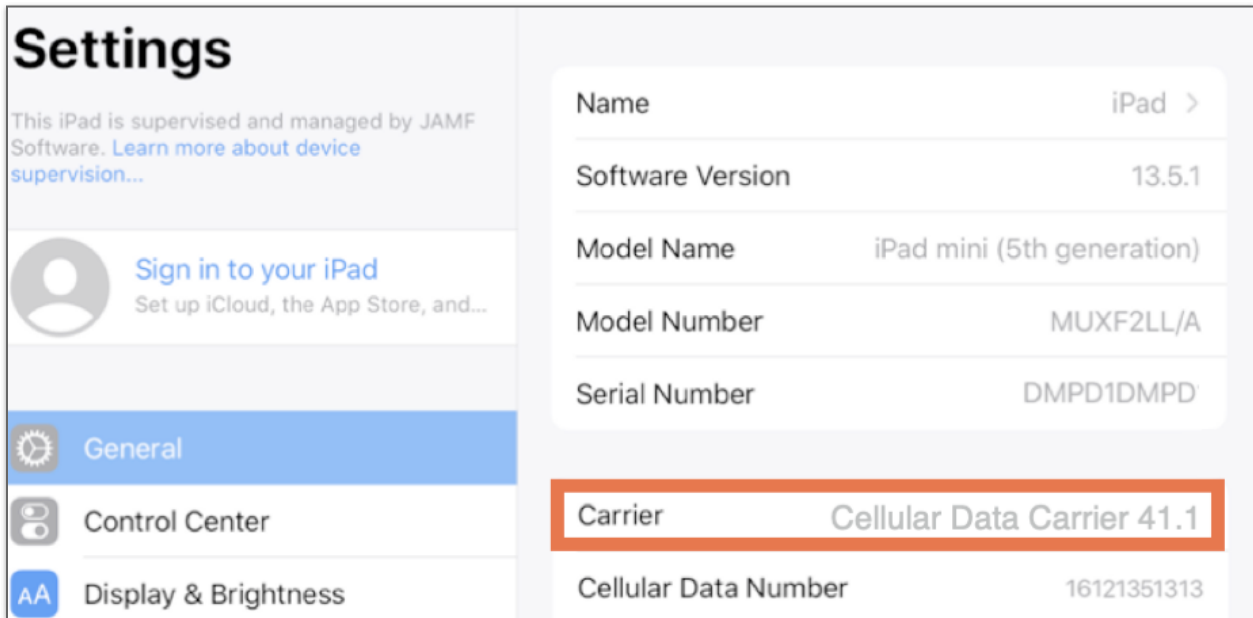
Now the Refresh cellular plans command window will appear. Here you will enter your eSIM Server URL and press Yes.



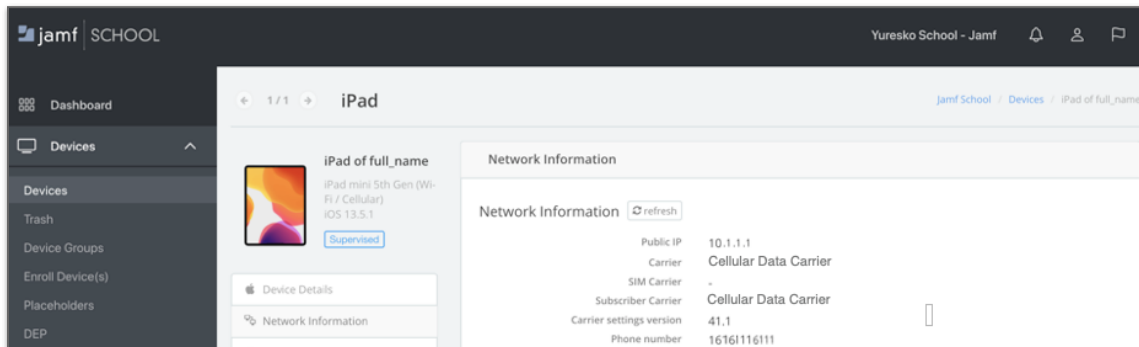
The screenshot shows a dialog box titled 'Refresh cellular plans'. It contains the question 'Are you sure you want to refresh the cellular plans?' followed by a label 'eSIM Server URL' and a text input field with the placeholder text 'Required'. Below the input field is a checkbox labeled 'Requires network tether'. At the bottom right of the dialog are two buttons: 'Cancel' and 'Yes'.

Jamf School will send the command to each device in the group. The devices will contact the carrier eSIM server you specified and retrieve their cell plan settings (the "eSIM profile"). Then they can connect to the cellular network without requiring any manual steps on the device.

When checking the iPads, we'll see the cell service signal strength in the upper-right corner of the screen and the carrier will be listed if we go into Settings > About on the iPad.



Once the device has submitted its next inventory, the details for the cell service will appear in Jamf School's device details page, including Carrier and Phone Number information.



You can test out the cellular connection by turning off WiFi on the iPad (if it's connected) and then opening a web page in Safari.

eSIM Implications for Device Reset

Device Reset and "Retain Cellular Plan" in iPadOS

Carriers may expire or remove device information from their eSIM servers once an eSIM profile has been downloaded, so unless you're changing to a new carrier, eSIM provisioning on an iPad should be considered a one-time event. We'll need to make sure the eSIM profile isn't accidentally erased. We can use Jamf to:

1. Prevent users from altering their cell plan.
2. Prevent users from deleting their eSIM profile via Settings's "Erase All Content and Settings" option.

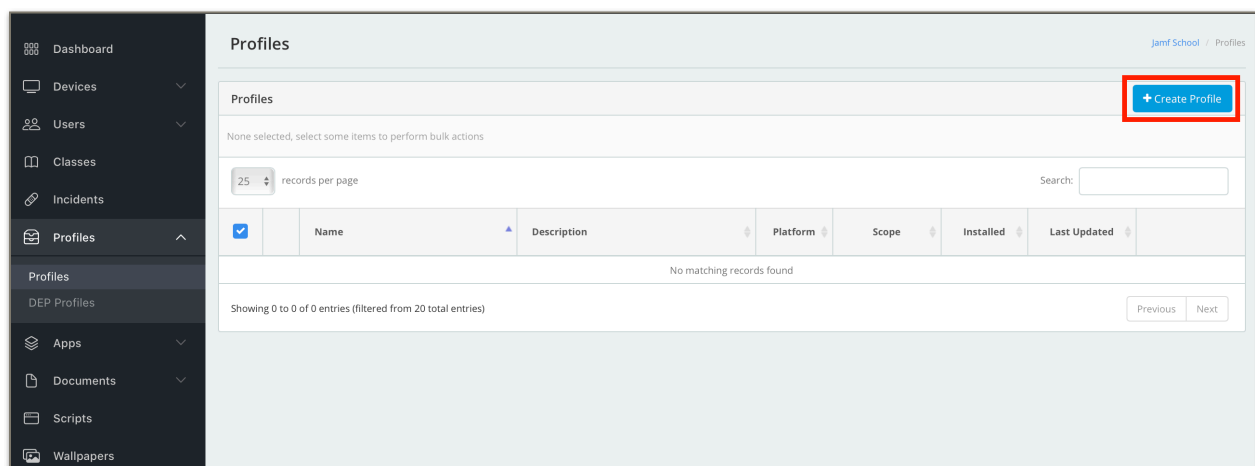
If cellular settings are unintentionally removed from a previously-activated eSIM device, by manually on the device in Settings, by sending a device wipe command via MDM, or by wiping the device with Apple Configurator, trying to reinstate it by sending the "Refresh cellular plans" MDM command probably won't work. The device is no longer in the carrier provisioning systems. The user will see a popup message on the iPad stating, *"Cellular Plan Cannot Be Added; This code is no longer valid. Contact your carrier for more information."* You'll need to contact your carrier and give them the device's IMEI and EID numbers so they can re-stage the eSIM profile for the device on their eSIM server. Once that's done, they may instruct you to restart the device. Then you should be able to re-activate the device's cellular service.

Because of all the carrier intervention required to get cell services back onto a device, we need to take precautions to prevent users from removing their cell plan inadvertently.

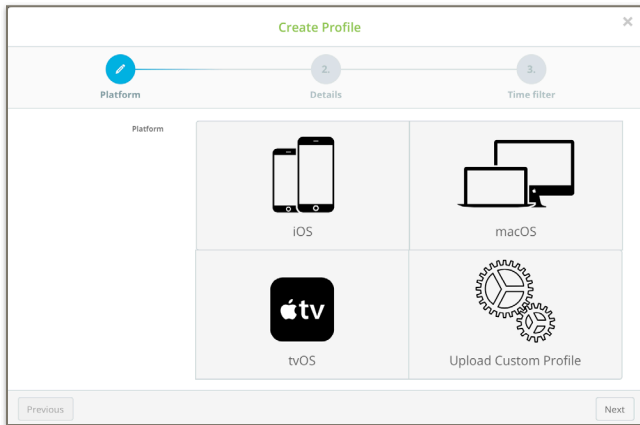
Restricting the user's ability to change cellular settings

We can create a restrictions configuration profile to ensure that users do not remove the cellular plan settings from their devices.

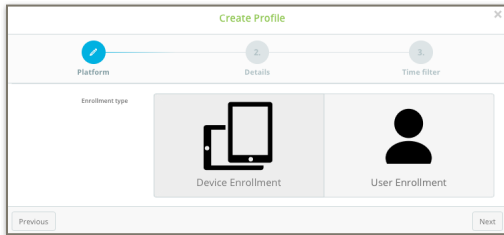
If you already have a standard restrictions profile for your devices, you can elect to edit it to add the cellular restrictions. Or, to create a new profile, go to "Profiles > Profiles > Create Profile".



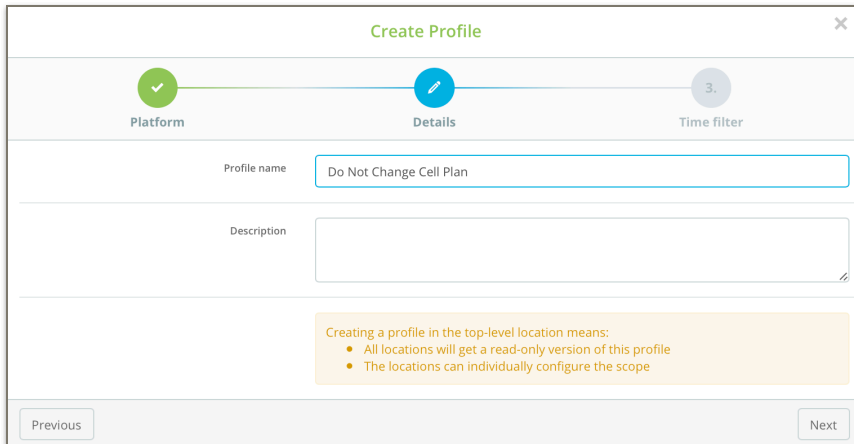
Select "iOS"



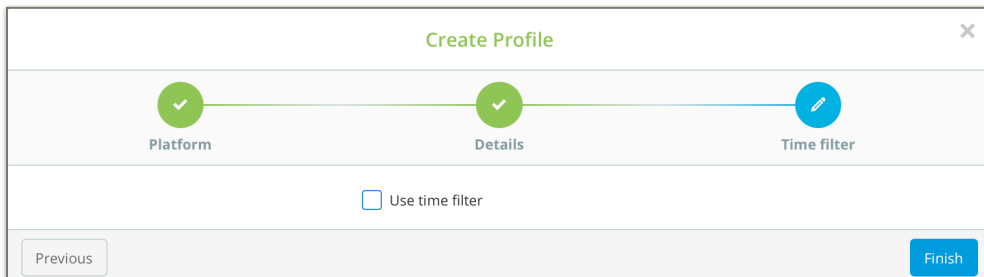
Select Device Enrollment, click "Next"



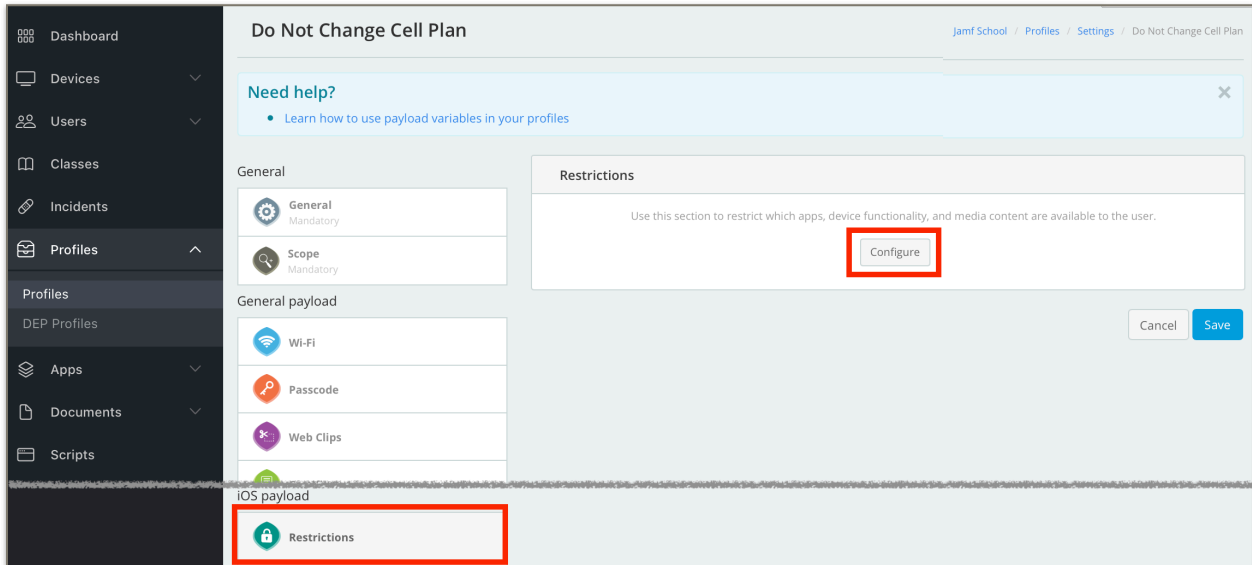
On the Details screen, provide a name for the Configuration Profile you can also choose to add a description. Click "Next"



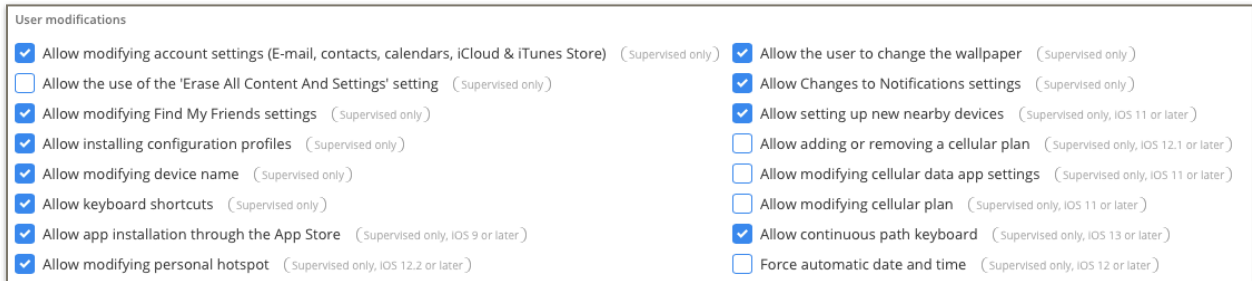
The final configuration step in the New Profile wizard is "Time Filter". We will not use this option when setting cellular restrictions. Click "Finish".



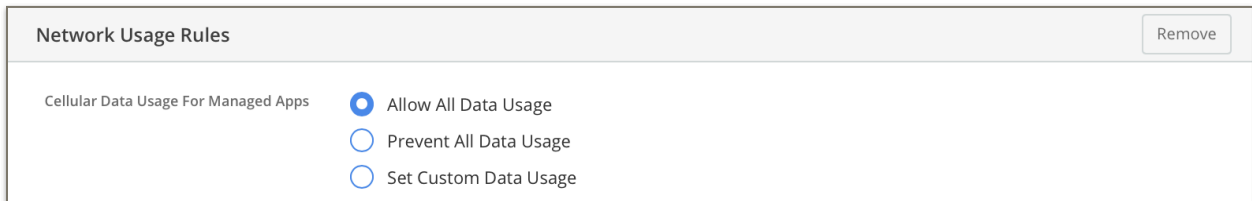
The newly created profile will now be in view. Click the "Restrictions" payload and then click "Configure".



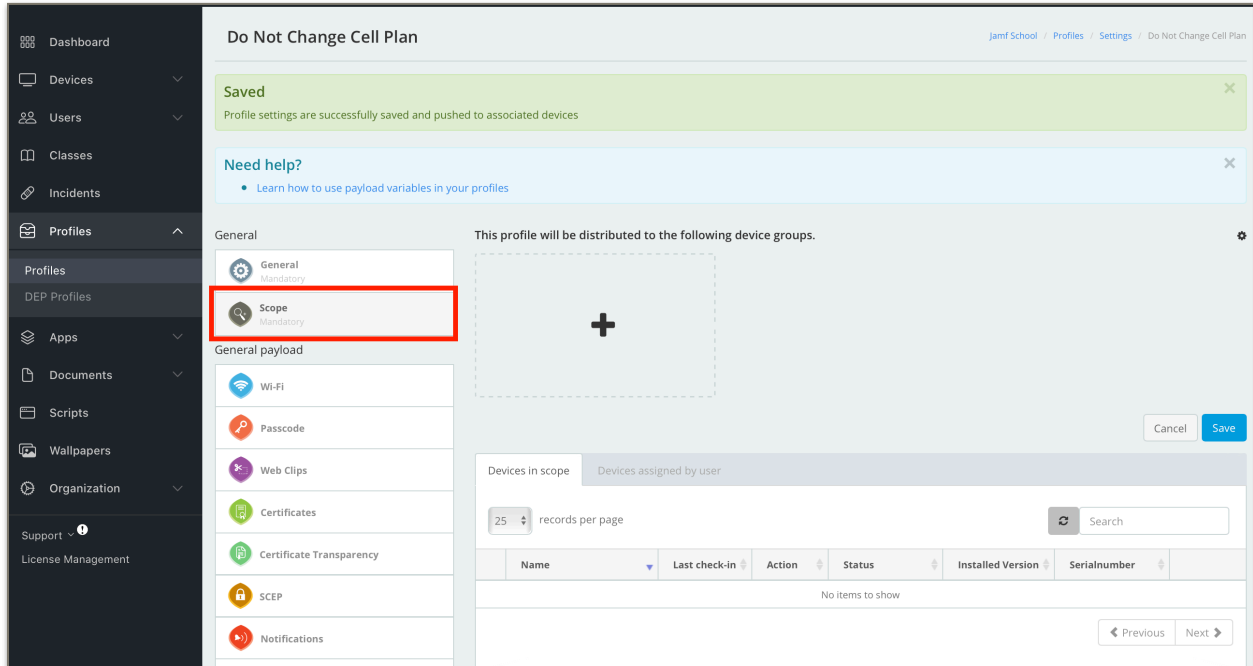
On the Functionality options page, scroll down to the "User modifications" section and uncheck "Allow adding or removing a cellular plan", "Allow modifying cellular plan", and "Allow the use of the 'Erase All Content and Settings' setting". Blocking the user from erasing their iPad is a good idea because they might do it incorrectly and remove their eSIM profile. It's safer to have an admin use Jamf School to erase the device if it's ever required. That way the admin can decide if the eSIM profile should be retained or not.



In the example above, the administrator has also unchecked the "Allow modifying cellular data app setting" option. This prevents the user from making changes to the apps that can use cellular data. Any app that can't use cellular data would have to run over WiFi. The Network Usage Rules payload will be used to determine which apps can use cellular data. The admin may elect to allow all apps to use cellular data as in the example below, or can set "Custom Data Usage" to allow only specific apps. For example, they might allow all apps to use cellular data except the YouTube app since a video app might consume a great deal of bandwidth.



Click on the "Scope" option to choose the devices that need these settings. This profile could be scoped to the device models that are cellular-capable. It's OK if you accidentally push it to others—it will have no effect on devices that don't have a cellular plan. Also, it's safe to push this profile to devices even before the cellular service has been activated because the "Refresh cellular plans" MDM command is not affected by these restriction settings. Save the profile once you've set your desired device scope.



Avoid auto-erase after a number of incorrect passcode attempts

Unless your organization has an information security policy that requires it, do not set the option in the passcode payload that will wipe a device after a certain number of failed passcode attempts as this will also delete the eSIM profile settings.

Apple Configurator Workflows

Remember that resetting a device using Apple Configurator will not preserve the eSIM profile. If you plan to use Apple Configurator as part of a workflow, coordinate with your cellular data network carrier to ensure new profiles will be provisioned for these devices. You will have to repeat the process for the device as if it were a new iPad.

Erasing Content and Settings

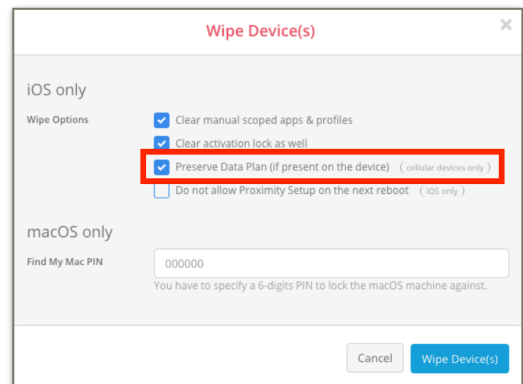
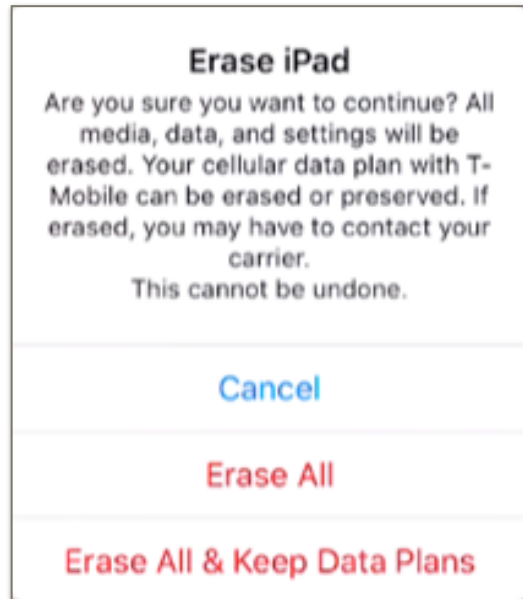
Erasing Content and Settings from an eSIM device

iPadOS allows users to erase content and settings from the device. If an eSIM profile is present on the device, iPadOS will offer two options. If the device is going to a new user but it will be on the same cellular plan, select the "Eraser All & Keep Cellular Plans" option. If you're going to be disposing of the device, transferring ownership, no longer want the device to have cellular service, or need to switch to a new cellular account, select the "Erase All" option.

By default, end-users have access to the erase command on their iPad and may not understand that they may need to retain their cellular plan. For this reason, consider using a restrictions profile to prevent an end user from erasing their own device. If a device erase is ever needed, an administrator can use the MDM command instead.

Sending the Device Wipe command to an eSIM device in Jamf School

To send a remote wipe command to a device (or to a series of devices) in Jamf School, check its box in the device listing and select Wipe Devices from the Advanced menu. In the resulting options menu, be sure that "Preserve Data Plan" is checked if you want the device to remain connected to your cellular carrier.



Bulk Activation Considerations

Apple's enrollment and app delivery systems can scale to handle huge demand surges, as can the cell carriers' device activation infrastructure. Your organization's WiFi network and internet connection are more limited however, and so is the capacity of the cell tower covering your site. We should give some thought to what we're asking our networks to do when considering a device setup workflow.

Even if you're enrolling very large numbers of devices, they're typically being configured in batches. So in most real-world workflows, network demand required for MDM enrollment and cellular service activation is distributed over time. We won't expect to see too many problems, but downloading iPadOS updates and apps can require significant bandwidth, and an MDM will be busy negotiating device check-ins and Apple Push/App Store transactions during this period. We might have some issues if we try to activate cell service on too many devices at once, or while the devices are busy doing other things.

Examples:

- A school sent the refresh cellular command to 500 devices that had been enrolled via Automated Enrollment. It took an hour for the devices to activate their cell service. In this case, the network admin noticed that the WiFi network and the school's connection to the Internet was saturated. The devices were downloading many apps that the admin had scoped to the devices so they were competing for bandwidth.
- A Jamf admin pushed new versions of their organization's in-house apps to 30,000 devices at the same time. A few cubes over, another admin was pushing the Refresh cellular plans command to some new devices she was setting up. She didn't know about the app installs and couldn't tell why her commands didn't seem to be going through. The admins found that both their management tasks and the app installations went much better when they broke their app installs into 5,000-device chunks with a few minutes break in-between.
- A group of IT staff members reserved a large conference room to use for their device setup project and recruited a team of assistants. Things went well at first but they ran into trouble after turning on a couple dozen devices. They discovered that the network administrator had placed a limit on the number of devices that could be connected to the conference room's WiFi access point.
- An organization decided to switch cellular providers and sent the Refresh cellular plans command to all their devices at once so they would activate with the new carrier. The switchover took longer than expected and failed on some devices.

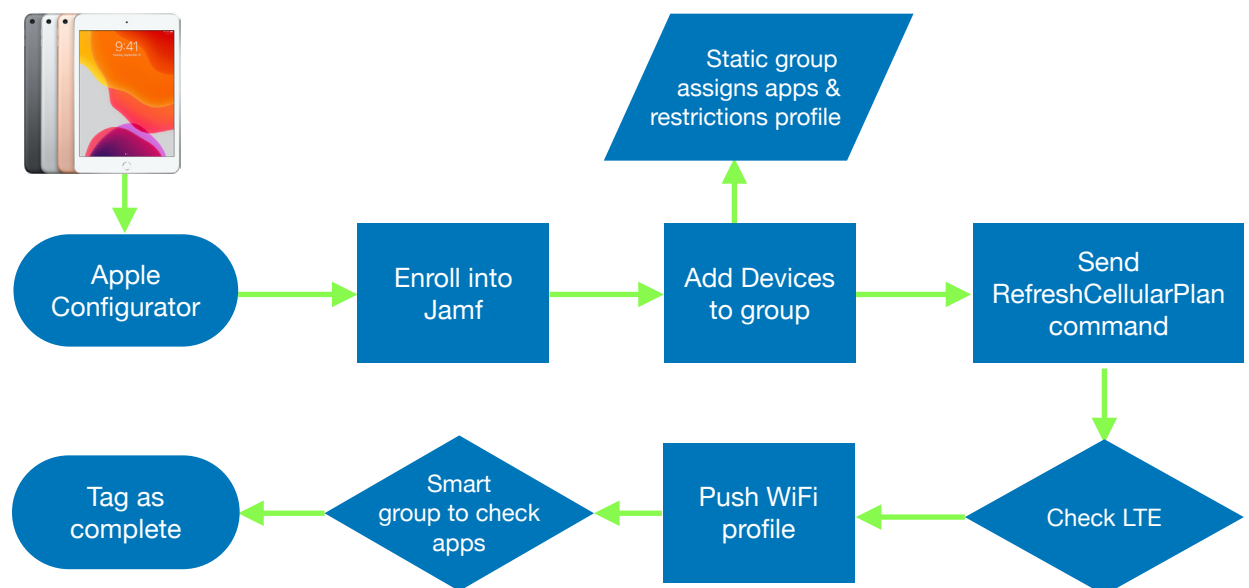
The main point here is that a setup workflow for hundreds of devices may need to include some extra time for downloads and processing. It's best to wait until data-intensive activities like OS/app updates are completed before sending the Refresh cellular plans command and we shouldn't try to activate 1,000 devices all at once on the first try. We may have better success if we activate a few devices to start and then increase the device count on subsequent batches as we observe success.

The use of Apple Caching Service can dramatically reduce the load on your organization's internet connection when Apple OS and App installations are needed. Ref: <https://support.apple.com/guide/mac-help/what-is-content-caching-on-mac-mchl9388ba1b/mac>

An Example Apple Configurator Workflow

One education customer was rolling out 1,200 new cellular iPads with a team of four working at a central location. The devices were intended for 1:1 user by younger students so the district wanted the devices to be fully configured and tested by IT prior to distribution. One team member unboxed devices for the 3 techs, each of whom tended an Apple Configurator workstation. The iPads were enrolled with Supervision and they used tethering to connect the devices to the network.

When the devices restarted following the Configurator phase, they received their apps, profiles, and the refreshCellularPlan MDM command from Jamf. The techs verified that the app installs and the cellular service was working. Initially, they saw some devices with incomplete app installs but this was resolved by turning on the Apple Caching service on their Mac workstations. A small number of devices needed to have the resetCellularPlan command pushed twice to get the cell service working. After all devices had cell service, they pushed out the WiFi profile. (They chose to delay installation of the WiFi profile so they could be sure they were running on cellular when they tested network connectivity after disconnecting the tether.)



STOP Remember that wiping a device with Apple Configurator will remove any existing eSIM data.

Cellular-related Popup Notifications

The following message may be seen in iPadOS.

“Carrier Settings Update”

Carriers may occasionally ask Apple to adjust some cellular radio and network settings on cellular-capable devices after they've been purchased. You might see a prompt informing you that such an update is available as you're activating your iPads. Select the “Update” or “OK” option if you see this prompt. Ref: <https://support.apple.com/en-us/HT201270>

“Cellular Plan is Ready to be Installed”

Once your carrier has entered the IMEI and EIDs for your devices into their system, you might see a prompt on an iPad saying that it's ready to set up cellular data. You can activate the cellular plan on these devices if you're doing manual setups. But if you're configuring lots of devices and don't want to tap the activation by hand, disregard this message and instead use the “Refreshing cellular plans” mass-action command in Jamf School.

“No SIM Card Installed”

It's OK if you see this message on an eSIM device. It just means that in addition to the eSIM, there's also a slot for a physical SIM card and it's empty. Once the eSIM is downloaded, you will see that the device has cellular service via the eSIM in “Settings->General->About” or by looking for the vertical signal-strength bars at the top of the home screen. Ref: <https://support.apple.com/en-us/HT201420>

“Unable to Update Cellular Plan”

We've seen this when there was a content filter on the customer network that blocked access to the carrier's eSIM server URL. See the Troubleshooting section of this document for more details.

“Unable to Complete Cellular Plan Change”

This occurs when the MDM has sent the Refresh cellular plans command to a device that is already activated. It won't hurt anything on the device if you accidentally send the command, but you should avoid doing so if a user already has the device so they aren't confused by the message.

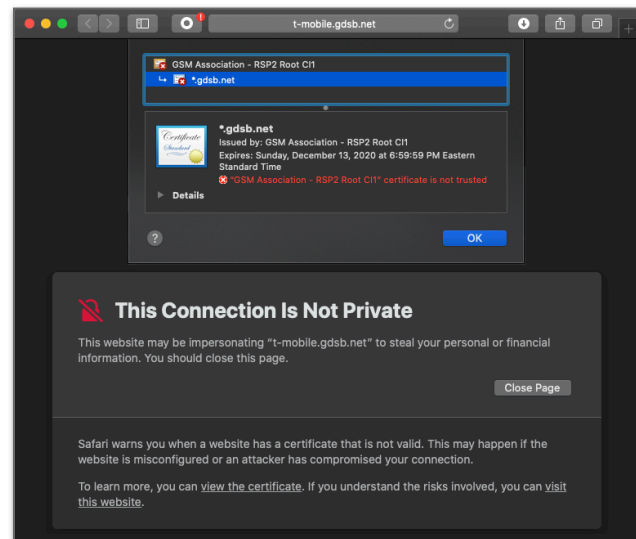
“Cellular Plan Cannot Be Added; This code is no longer valid.”

This happens if you send the “Refresh cellular plans” MDM command after removing the cellular settings on a previously activated eSIM device. The device's information is no longer active in the carrier's automated systems. You'll need to contact your carrier and give them the device's IMEI and EID numbers so they can re-enable the device in their eSIM servers. Once that's done, they may instruct you to restart the device. Then you should be able to re-activate the device's cellular service.

Troubleshooting

Cell service is not activating after sending the Refresh cellular plans command

1. Ensure your carrier had added your device IMEI and EID numbers to their eSIM server.
2. Check for a typo in the eSIM Server URL you sent to the device(s). Ensure it matches the URL provided by your carrier and does not include a trailing "/" .
3. Ensure device is turned on/charged.
4. Check that the device is on WiFi or has a tethered data connection so that it can communicate with Apple, Jamf, and your cell carrier.
5. A content filter (e.g., Cisco Umbrella, Lightspeed, etc.) on your network may be blocking access to your carrier's eSIM URL. In this case, you will see an *"Unable to Update Cellular Plan"* error message on the device when you push the Refresh cellular plans MDM command. To check, navigate to the carrier's eSIM Server URL in Safari. If you see a message saying that your content filter blocked the connection, contact your network administrator. If your network is allowing traffic to flow to the eSIM server, you will instead see a message stating that the "Connection Is Not Private". This warning is expected and indicates a successful test because eSIM servers use a private certificate trusted only for eSIM activation.
6. Perform the activation in a location where cellular service is available from your carrier.
7. Verify that there aren't any backlogged/pending MDM commands, OS updates, or app installs.



Carrier Switching

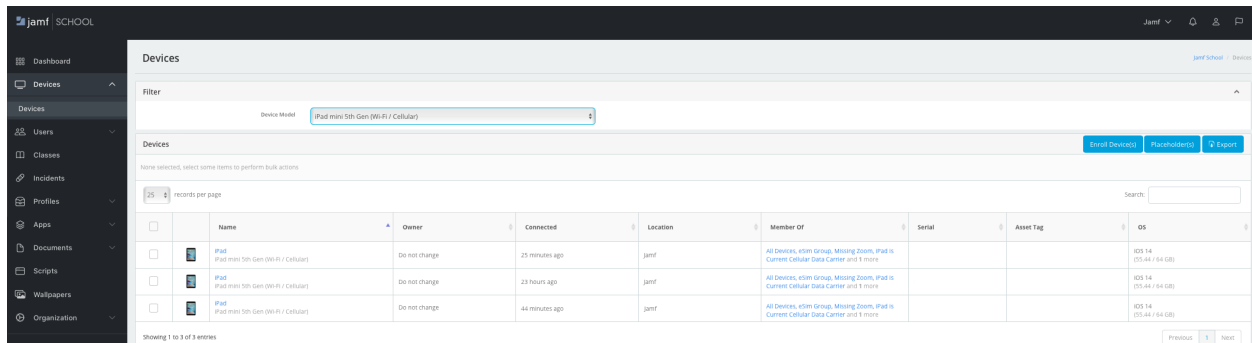
There may come a time when you and your team have a need to switch cellular data carriers. This need can occur with device acquisition, financial considerations, and many more reasons.

The workflow for “switching” is not that different from activation discussed earlier; however, there are some considerations and resources which can make your life easier.

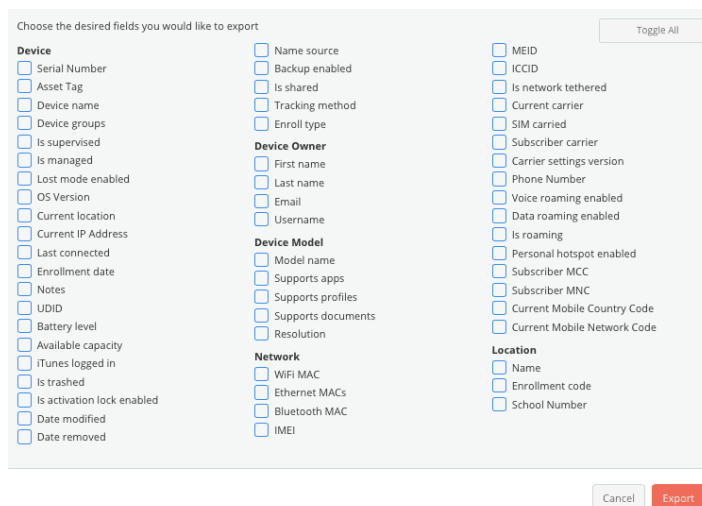
As with your initial deployment, you will need to gather some critical information. The key pieces of data will be the device’s IMEI and EID. Jamf School refers to the ISD as the eSIM number.

Gathering this data can be an easy task when your devices are running iPadOS 14 and using Jamf School. Your devices will report this information to the console in inventory.

Open your console and proceed to the Devices section. Expand the FILTER section and under DEVICE MODEL select the devices which have cellular data capability. Then press the EXPORT button.



When the new window appears, look in the Device Section and select Serial Number. And in the Network Section, select IMEI. Press Export. A CSV of your devices for this model will be ready for you to share with your new cellular data carrier. Repeat this process for all models having cellular data capabilities.



At this time, you will need to gather the EID or eSIM Identifier manually. This data is available on the device—> Network Information for iPadOS 14 systems. You also have these options as well.

- Collect the data from the exterior of the iPad’s original shipping box. This was discussed in depth on page 2.
- Gather the IMEI numbers from the devices themselves. This information is found in Settings > General > About.
- And as a final option, provide your serial numbers to your Apple Sales team and have them provide the needed data.

Once you have gathered your data, submit that information to the new cellular carrier, and the carrier will assign the new eSIM profile for the devices.

These eSIM profiles will be distributed from the SM-DP+ or eSIM server as discussed previously. As with new deployments, it is recommended that you plan your deployment to occur with the carrier recommended window to ensure a smooth migration. Be sure to verify with the new carrier the complete URL for your new SM-DP+ servers.

A suggested task prior to any action is to “test” your device’s ability to connect to the SM-DP+ server from the devices on the current cellular data and Wi-Fi networks. If you are planning a “switch” and only wish to use the cellular data network, be sure to test your device’s ability to connect to the SM-DP+ server on the cellular data network and not Wi-Fi. Again you may experience a warning as outlined in the Troubleshooting Section on page 18. This behavior is to be expected. Should you be unsuccessful in attempting to reach the URL, check with your network team to ensure that nothing is preventing the device from communicating with this server.

Then the process is the same as outlined in Activating eSIMs with Jamf School beginning on page 4. A tip here is to leverage the current carrier as your inventory or smart group filter.

The same Bulk Activation Considerations on page 16 and Troubleshooting on page 18 should be followed.

When the new eSIM profile is installed, you will notice there are now 2 Cellular Plans listed in Settings > Cellular Data. This result is expected and is no cause for alarm.

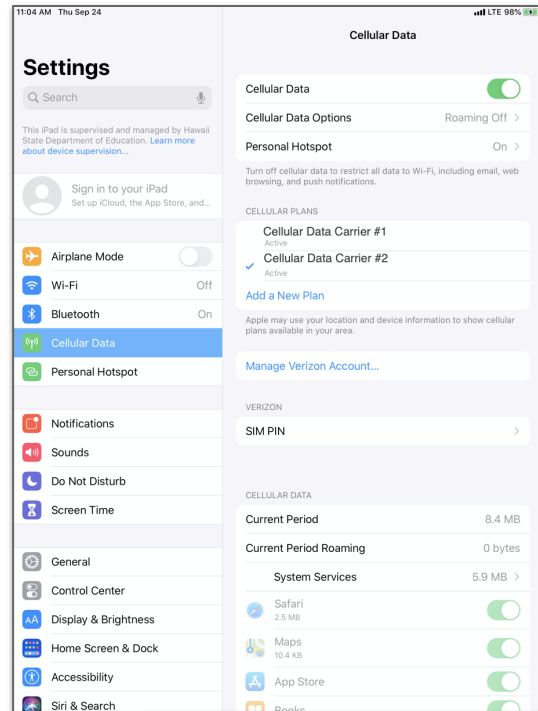
The reason for this behavior is that an eSIM can support multiple profiles with multiple carriers. In fact, some customers may have a need for multiple Cellular Data plans and desire the ability to switch between them. This action is very easy. The user simply presses the desired plan and it becomes active on the device. Remember, an iPad can only have 1 active cellular data network at a time.

At this point, if the user has the ability, they may delete the profile by “swiping” left on the old plan. Please note this action will not terminate the carrier service. The data plan owner must contact the “old” plan carrier and terminate the plan.

In a K-12 setting, deleting or switching is not desirable. Jamf administrators deploy a Configuration Profile which prevents the end user from being able to “Modify the cellular data plan” as well as other restrictions. In this scenario, the administrator would simply terminate the cellular data plan from the carrier. The user display is merely showing that an eSIM profile for that carrier is installed, even though the service has been terminated.

Keep in mind that the last installed eSIM profile is the default; therefore the newest profile in this example is the active profile, unless the end user selects the “old” plan.

As with all deployments, quality testing is the key. Take your devices and turn off Wi-Fi and make sure that information can travel only on the cellular data network. This simple test will save countless Help Desk calls.



Terms Related to eSIM iPad Provisioning

We've tried to avoid using excessive lingo in this document, but the following terms might come up when discussing eSIM iPads.

Cellular Networking

4G / 4G LTE "Fourth Generation/Long Term Evolution" is a mobile communications standard released in 2008 to improve speed and reliability. This is the most common cellular networking standard in use today.

5G "Fifth Generation" is a new mobile communications standard. Carriers and cellular device manufacturers are currently working on implementing 5G. It is anticipated that the significant speed improvement offered will lead to many new applications for mobile technology.

SIM A "Subscriber Identity Module" is a small plastic card that contains a chip to store the international mobile subscriber identity (IMSI) number and its key. This is used to identify and authenticate subscribers when they connect to a carrier network. They are usually specific to a particular carrier so changing service often requires a new SIM card.

eSIM An "embedded SIM" stores the same information as a physical SIM, but the data is written to memory within the device, eliminating the need for a carrier-specific physical SIM card.

eSIM Profile This "profile" is retrieved from a SM-DP+ server. The profile configures the eSIM so that a device may access a cellular network. iPads may have multiple eSIM profiles from different carriers. Keep in mind that the default profile will be the last profile installed on the device. iPads can only utilize one cellular data network at a time.

EID The "Electronic Identifier Document" is a unique number that identifies an eSIM.

IMEI The "International Mobile Equipment Identity" number is used to identify a physical device to cellular networks. The number identifies the hardware and is not tied to any particular carrier or subscriber. The IMEI can be found on an iPad or iPhone in the Settings App > General > About. On an iPhone, you can access the information by simply dialing "*#06#" using the Phone app. The IMEI is one of the values a cellular data carrier needs to provision an eSIM.

SM-DP+ "Subscription Manager - Data Preparation Plus" servers distribute the eSIM profiles needed to utilize a carrier's cellular data network. Data carriers will collect IMEI and EID numbers from subscribers and "provision" an eSIM for each device on their server. When you push an SM-DP+ URL to a device using the Refresh Cellular Plans MDM command, the device will contact the SM-DP+ server to download its eSIM profile. In this document, we have referred to these servers as "**eSIM servers**".

Apple Technologies and Services

Apple School Manager ("ASM") is accessed via a [web portal](#) and integrates with Jamf Products. It allows IT administrators to assign devices to Jamf for automated enrollment, to purchase apps and content, and to configure managed Apple IDs. ASM also adds the ability to integrate with a Student Information System to support the Apple Classroom app. Ref: <https://help.apple.com/deployment/education/>

Apple Configurator 2 is a macOS application used to prepare iOS, iPadOS and tvOS devices for use. Apple Configurator connects to these devices via a USB connection and assists in the deployment of settings, apps, and other data. Apple Configurator is available from the [Apple App Store](#).

Automated Enrollment combines features of an Apple device management program, Apple's OSs, and Jamf to [automatically enroll](#) an organization's devices in management when during the Setup Assistant flow on a new device.

Hotspot/Tethering is provided by a cellular device that shares its data connection with nearby devices, or by a network-connected Mac computer. A hotspot will act as an ad hoc wireless network on either Wi-Fi or Bluetooth PAN (Personal Area Network). Tethering allows data connections to be shared with another device via a cable and can be useful in the initial setup of new devices that do not yet have a configured Wi-Fi network.

For an additional resource, review the Apple resource "Deploying iPad with cellular connections." It is available online at <https://support.apple.com/guide/deployment-education/deploy-ipad-with-cellular-connections-apd36c581d6d/web>.

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