jamf

Simplifying eSIM Cellular Plan Activation with Jamf

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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 provided by the carrier that would be providing cell service for the device. Most people never needed to touch it. Some more modern devices are switching to an eSIM, a chip built into the device that serves the same function. The advantage is that an eSIM takes up less space inside the device and it's more flexible since it works with any carrier that supports the standard. It eliminates the need for a new card when setting up service with a new carrier.

The following Apple reference lists the iPad models and countries/carriers that support eSIM: https://www.apple.com/ipad/cellular/.

Activating Cellular Service with eSIM without Jamf

eSIM devices don't know which carrier will be servicing the device when they're first turned on. There are no icons at the top of the screen to indicate cell service has been set up as typically appear 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 association and the device will provision its cell service automatically. Cell carriers may lock devices to their cell service depending on how it was purchased.

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 have a web page with instructions for the methods they support. They may provide an activation 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. And there may be cases where an employee or student has a device at home but needs to have their cell service activated and may not be able to do it on their own. In these cases, we can use a Jamf School or Jamf Pro MDM command to instruct the device (or many devices at once) to contact your carrier's activation servers and configure themselves. We'll show how in the next section.

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 ("EID"). If you don't already have a list of these, ask your Apple Rep to provide them. They can work with their SE team to create a list of this information as soon as your iPads have shipped and their serial numbers are known. That way, you can pass the list on to your cellular provider even before the iPads have arrived and there won't be any delay in getting them set them up the moment they do.

If you don't have a list of the cellular IDs for a device, you can find the IMEI and eSIM numbers on the outside of the iPad's box. You can read them in with a barcode scanner if one is available.

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 activation 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.

The images below show the Cellular Data pane as it appears on an eSIM iPad that doesn't yet have an activated cellular data plan. The image to the right shows the data plan purchase page for a carrier, in this example, T-Mobile.
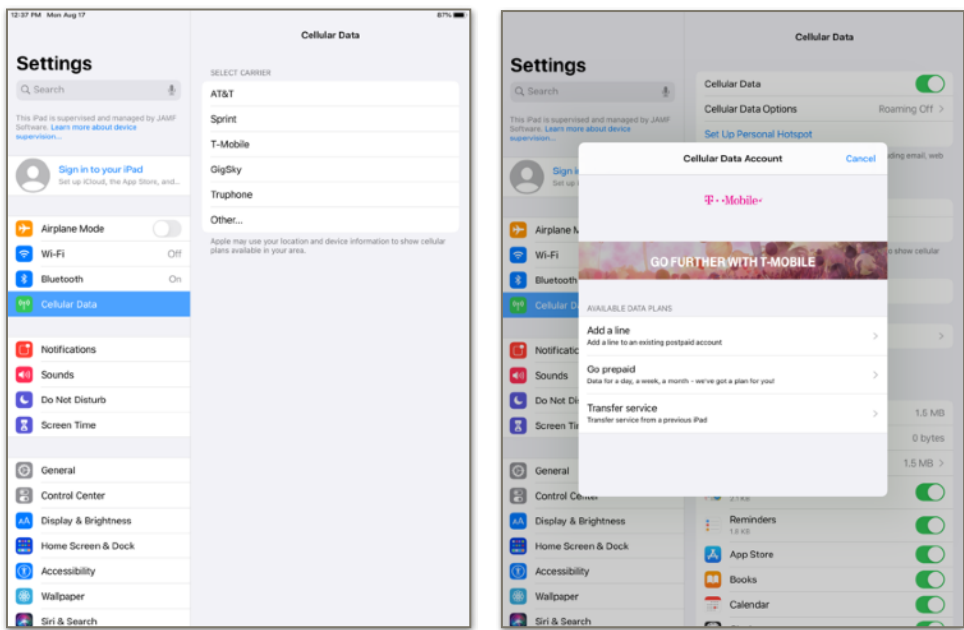
Automated Cellular Activation for iPad

Manual activation of cellular settings in settings.app is practical for consumer devices but too time-consuming when setting up large numbers of devices. Two Jamf products offer support for automated eSIM activation. Jamf School is purpose-built for management of educational devices. Jamf Pro is often used in other organizations, or by schools with large or complex management requirements.

*Note: the remainder of this document assumes LTE-enabled iPad devices were purchased directly from Apple or a reseller, and *not* directly from a Carrier. LTE-enabled iPad devices purchased directly from a Carrier may be locked to that carrier and its service will become active automatically upon device activation.

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. In business, IT may not want employees 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 (or their reseller), cellular service has been purchased, and the cellular carrier has added the EID 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 them devices in a Mobile Device Manager ("MDM") like Jamf Pro or Jamf School. Once that's done, we can do a lot of setup on the devices from a central console without ever having to touch them, including the cellular connection.

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

Automated Enrollment – In this method, Apple School Manager (or Business Manager) already knows your organization owns the devices so they'll tell them to connect to your MDM automatically the first time they're powered on.

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

Once the device is enrolled in Jamf Pro or Jamf School, it's easy to install more settings and software, or to push mobile device commands to large numbers of devices, including one to "Reset Cellular Plan". This command tells the devices to connect to your data carrier and active their eSIM so they start getting cellular data. That's a lot easier than setting cell service up on all the devices up by hand.

Some helpful references:

- Apple School Manager Guide / Apple Business 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
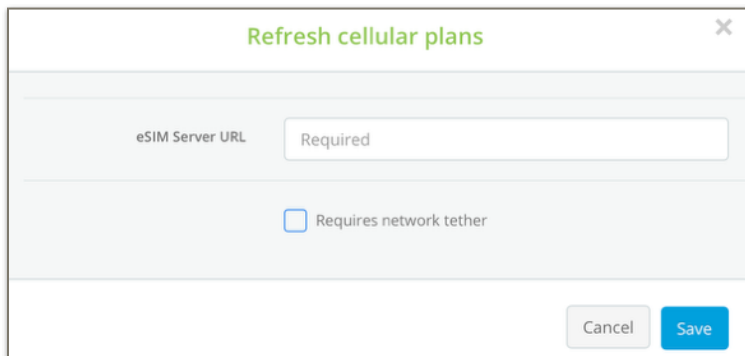
Activating a Single Device

Once a set of devices have been enrolled Jamf School, we can view them under "Devices". If we click on a device to view its details then select "Network Information", we can see that the cellular plan information is blank because cell service hasn't been activated yet.
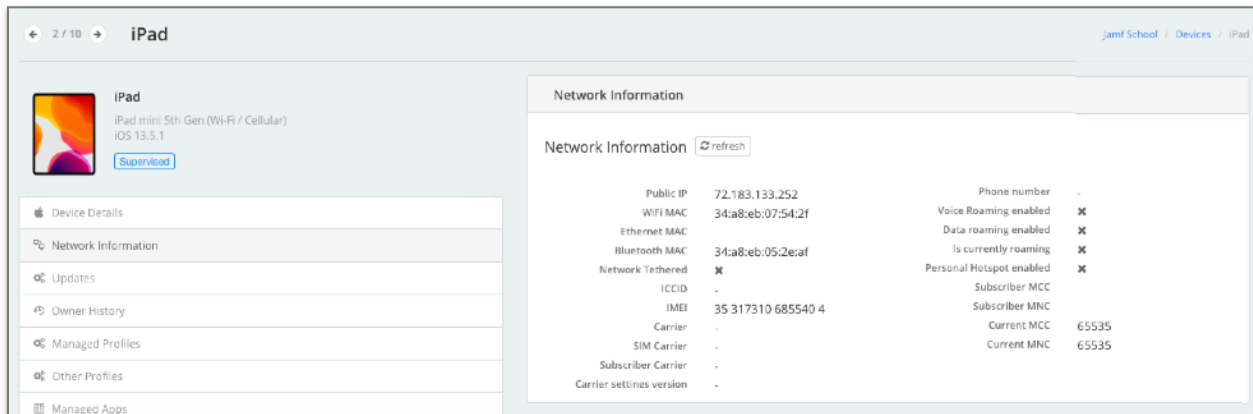
You can tell the device to contact your cellular carrier and activate its cell service by clicking the "Refresh cellular plans" button under "Quick Actions" in the lower-left of the detail page.
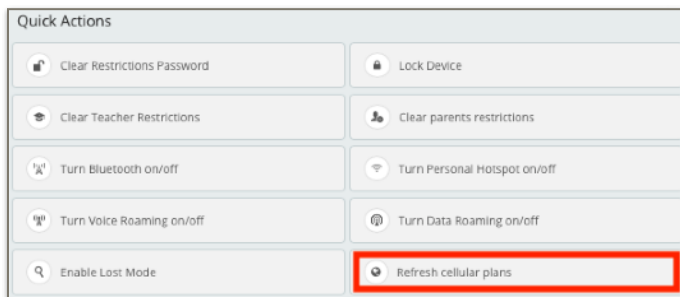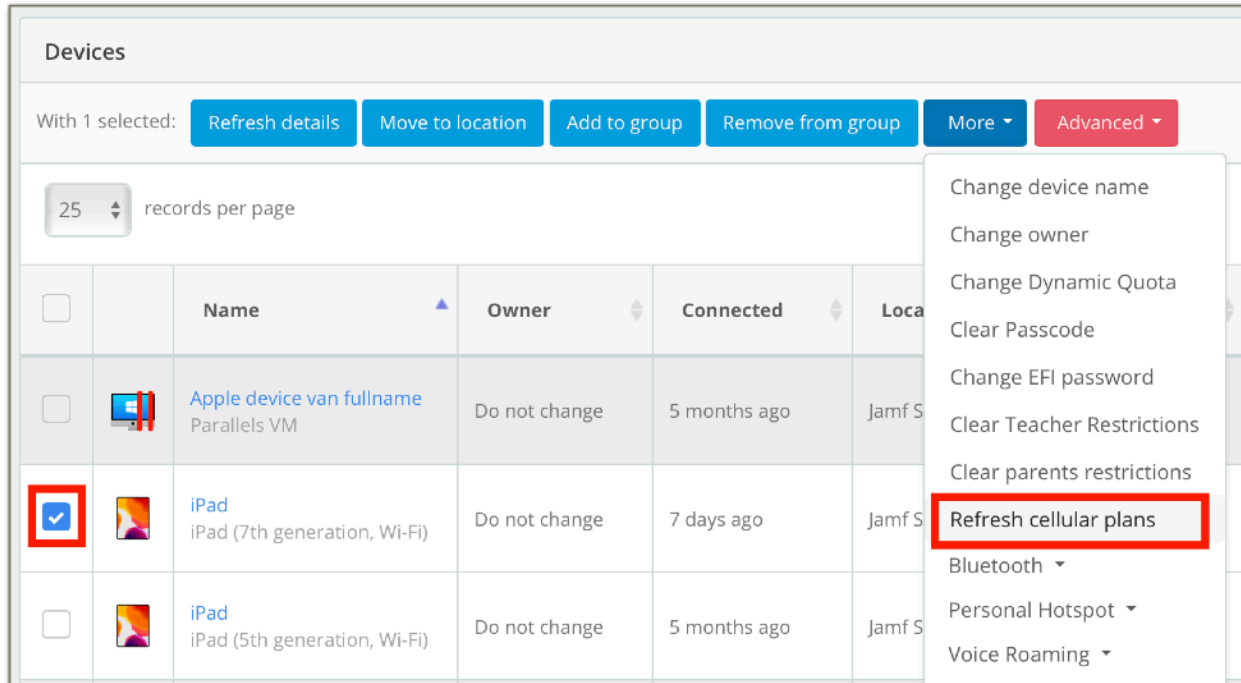

When this button is pressed, a dialog box will appear. Enter the eSim Server URL for your carrier. If you're using network tethering, select the "Requires network tether" checkbox. Ref: Setting up a shared Internet connection for iPhone and iPad.

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. Then select "Refresh Cellular Plans" from the "Advanced" drop-down menu.
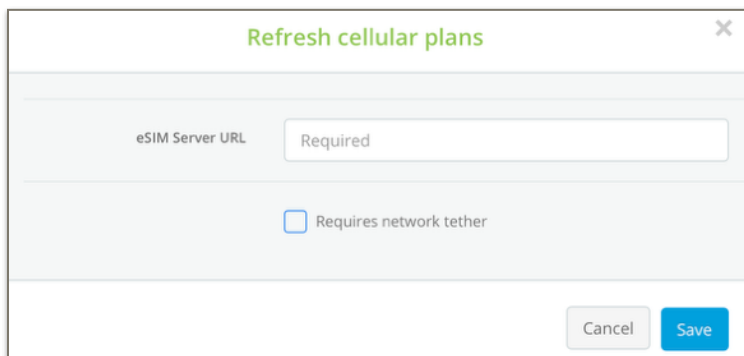

As with activations from the detail page for a single device, Jamf School will prompt you for your carrier's "eSIM Server URL". This will be provided by your carrier, or see the Notes section at the end of this document for examples for some common carriers.

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.

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 OS to contact the carrier's activation server and supply its eSIM ID number. The carrier will match this to your account and reply to the device

with its activation information. 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 and signal strength indicator at the top of the screen, and the cell carrier and details of your configuration are shown in Settings.app.
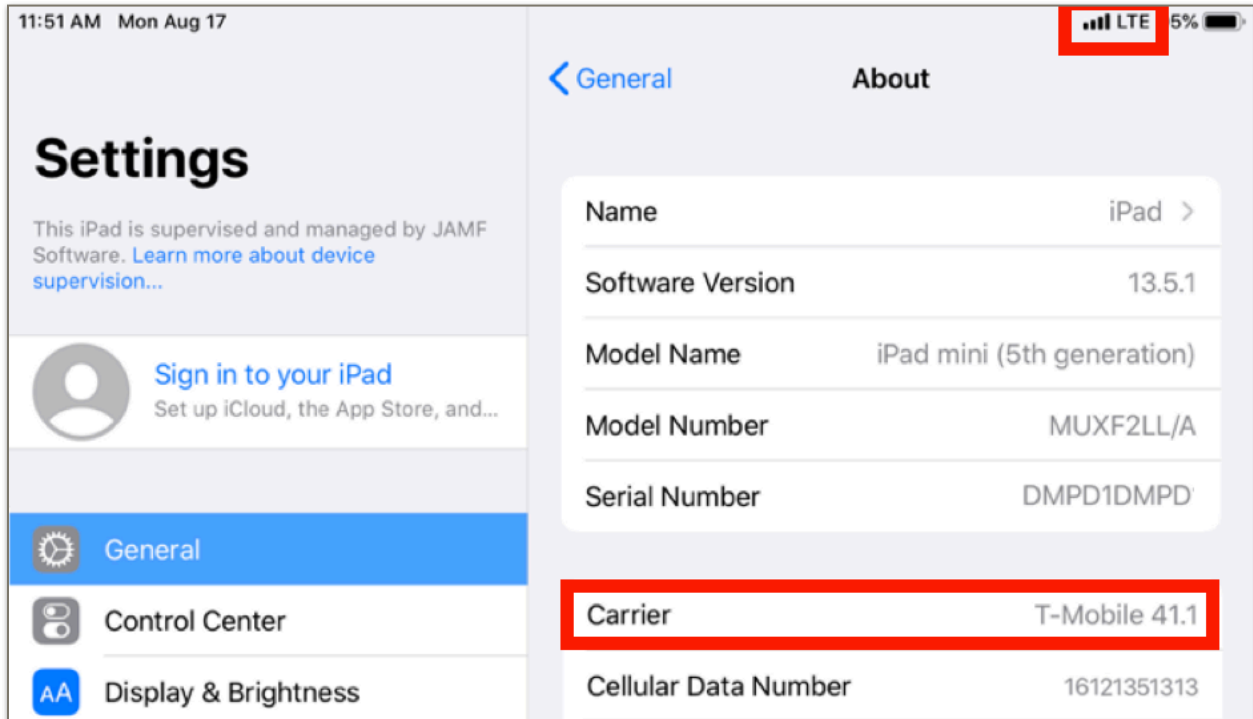
Much of the same data is also now available in the Network section of the device details page in Jamf School.
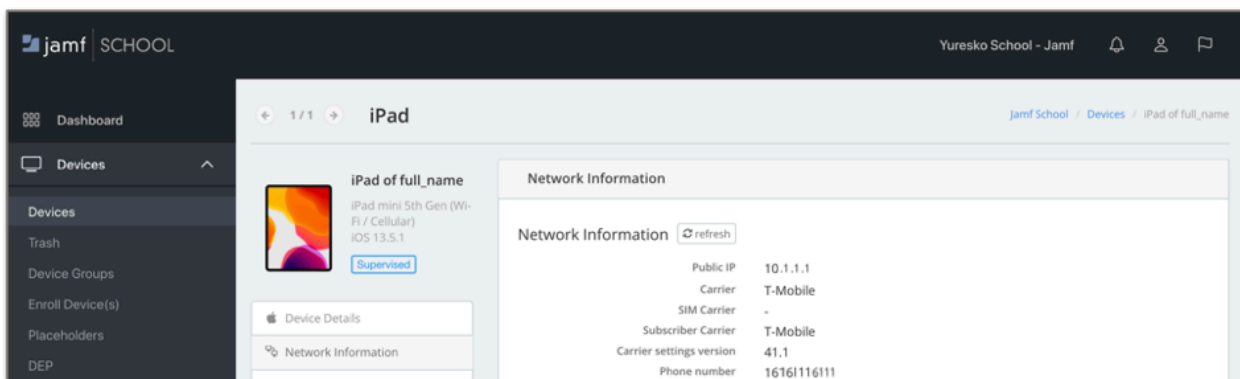
You can test out the cellular connection by turning off wifi on the iPad (if it's connected) and then opening a web page in Safari.

# Activating eSIM Cellular Service with Jamf Pro

When a brand-new device is enrolled in Jamf Pro, we can open its inventory details ("Devices > Search Inventory" > click on the device item in the list > Network section) and see that it's a cellular device because it has values in for things like the IMEI number. Because the eSIM on this device hasn't been activated yet, the Carrier Network fields say, "iPad".

The cellular fields will be blank for devices that don't have cellular capability. If we want to activate the cellular data services on this device, switch to the "Management" tab and click the "Refresh Cellular Plans" button.
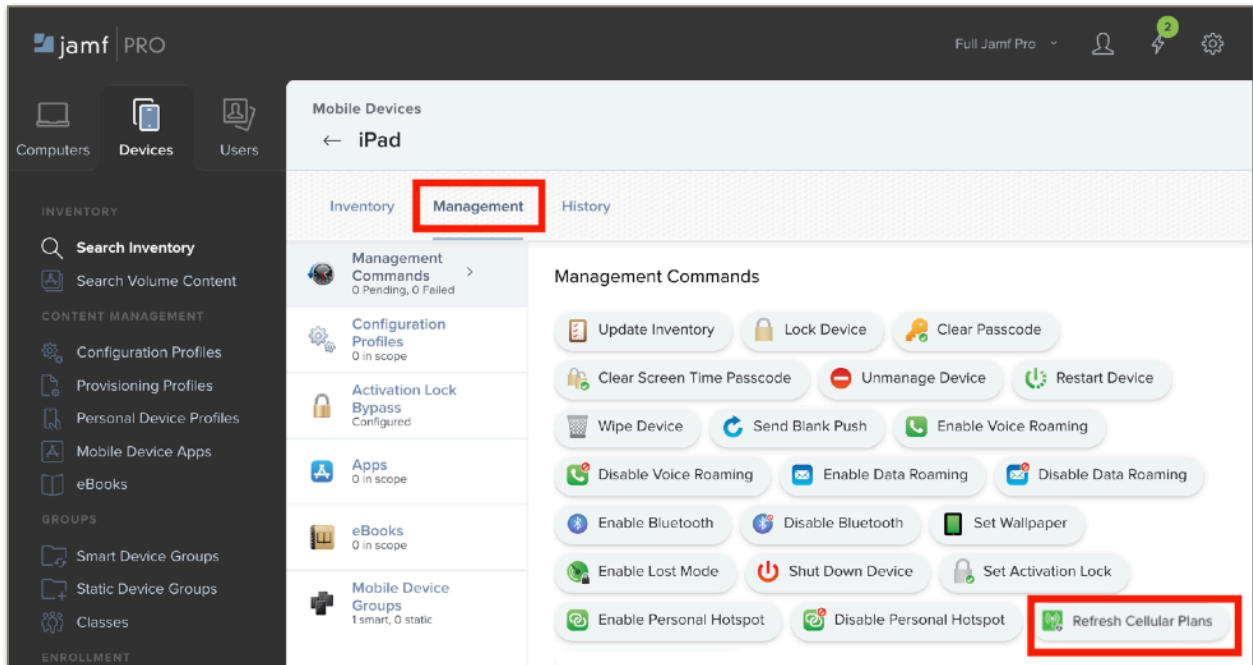
You'll be prompted for the "eSIM Server URL". Your carrier will supply this to you. A few of them are listed in the Notes section at the end of this document.
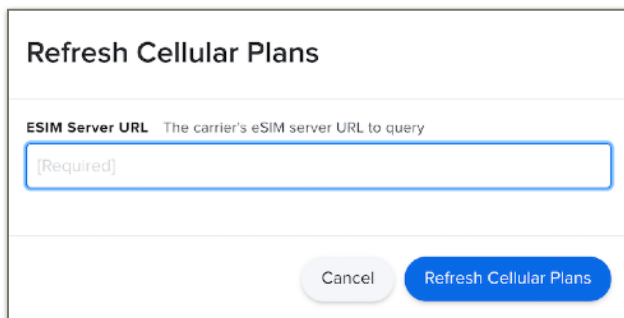
Upon completion, the device will be activated and show cellular bars in the upper corner of the home screen. You can view details about the cell service in "Settings.app > General" on the device and you'll see the carrier information filled in on the device's network inventory details page in Jamf Pro. If you don't, refresh the device's inventory information using the button in the Management tab.

Listing the Devices that Need to have their Cell Service Activated

Suppose we spent a morning enrolling a large group of new iPads into Jamf Pro 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 group of the devices to be activated and then tell Jamf Pro 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 click the "+New" button for Advanced Mobile Device Searches.
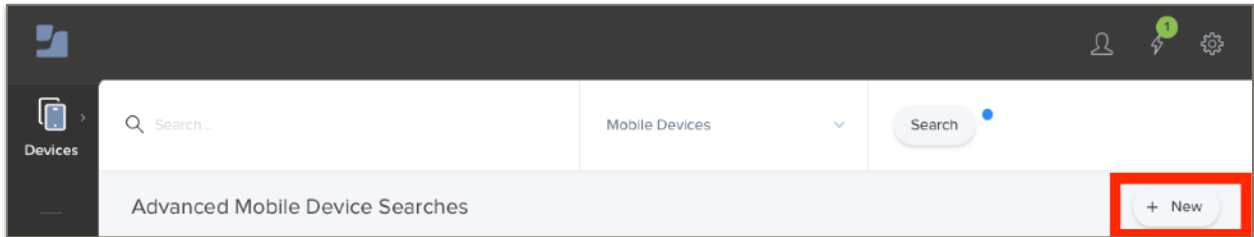
If you're going to be doing some additional batches of device enrollments later, you can save the search for later re-use by clicking the "Save this search" checkbox and supplying a name.
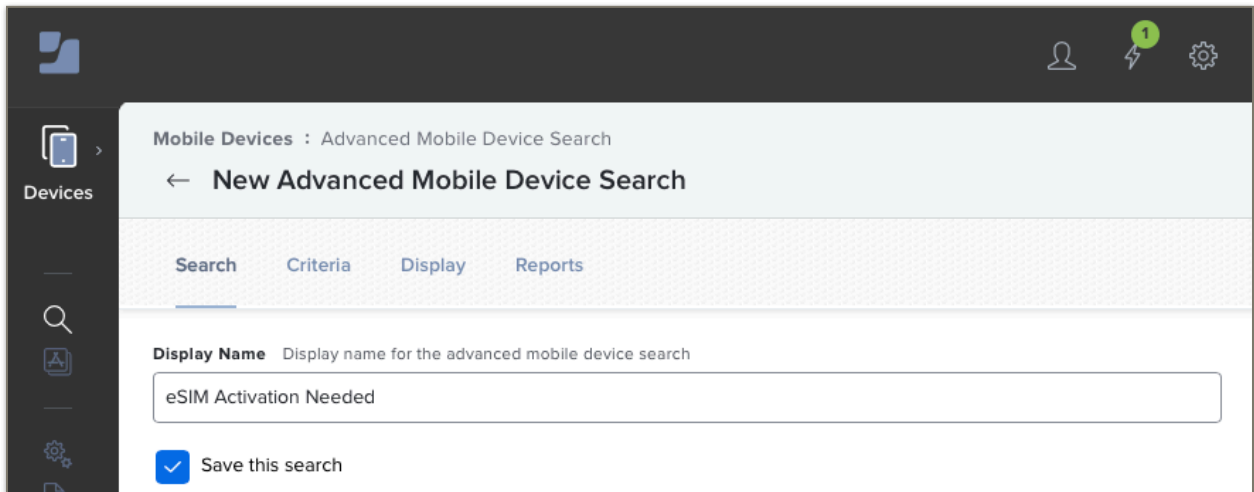
Next we'll fill in the "criteria" tab. When we looked at the network inventory details for an iPad that had been enrolled with Jamf Pro but had not yet been configured for cell service, we noted that that the "Current Network Carrier" field was set to "iPad". We can use this behavior to quickly create a set of all devices that need to be setup with their cell service plan.
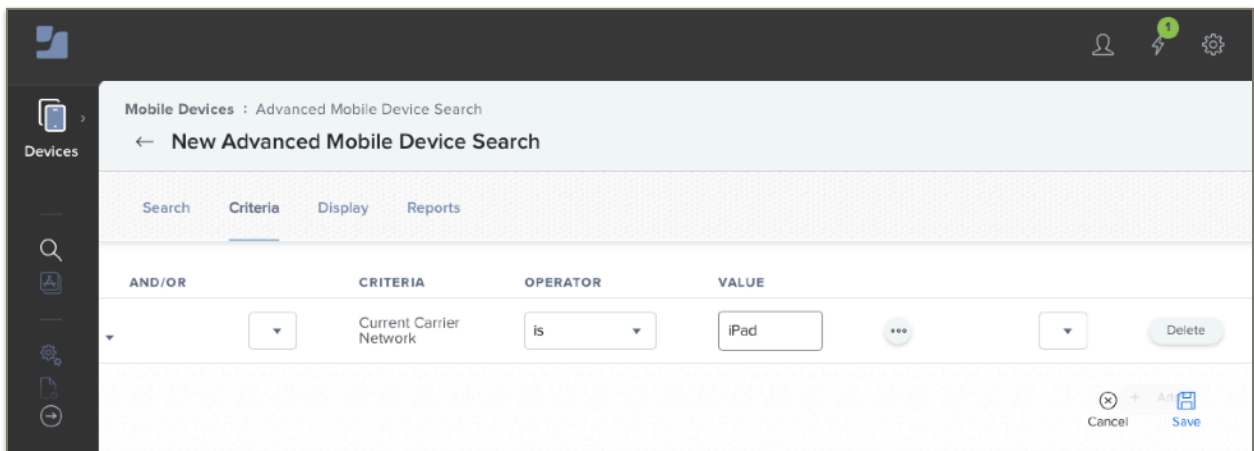
Once a device is activated with a carrier and inventory information has been updated, that field will change to the carrier's name and the devices will automatically drop out of the advanced search results.

Advanced Mobile Device Searches

In the preceding section, we created a simple advanced search to create a list of all iPads that still need to be activated. That would cover the majority of deployment scenarios, but there might be some more complicated cases. Jamf Pro has options to cover almost anything.

For example, if you're working over the course of a few days to set up lots of different iPads and only wanted to active a batch of "iPad Pros 11-inch (2nd generation)" that you enrolled today, your criteria might be:

This strategy is helpful because there may be cases where a device have activated its cell service but has not yet reported an updated inventory to Jamf Pro. In this case, just filtering for carrier = "iPad" could capture devices that already have their cell service running. In the above example, we're filtering on date and if this is the first time we've pushed out a cell plan reset commands, we'll know we're only updating the devices that are ready for it.

Suppose there are a few iPads that will only be used in the office and you don't intend to activate their cellular data plan. We could add a few "is not equal to" lines to exclude them by name, user, or serial number. If there were many such devices, we could create a "No Cell Service Needed" static group and add an "is not a member of" line to our advanced search to exclude them.

What if we're deploying lots of different models and the setup work is happening at many different sites? That might be the case with a large eduction deployment with staff at each of a district's schools setting devices up at the same time. We could create a separate "Activation Needed" advanced search for each location and filter on external IP address (if every school had a different one). If we are including a school abbreviation somewhere in the device names that we're applying with Apple Configurator, we could add a "Device name/contains/<school code>" line.

If you're doing a 1:1 deployment and assigning the devices to specific users, you can even use information like department of group membership from a directory service like Active Directory.

Bulk Cell Plan Activation in Jamf Pro

Once you have your Advanced Search criteria the way you want, click the "Save" button and then the "View" button at the bottom of the page to show the list of all the devices that meet your "Activation Needed" criteria. From the device listing screen, click the "Actions" button. Jamf Pro will display a list of things you can do to a group of devices. Select "Send Remote Commands" and click the "Next" button.
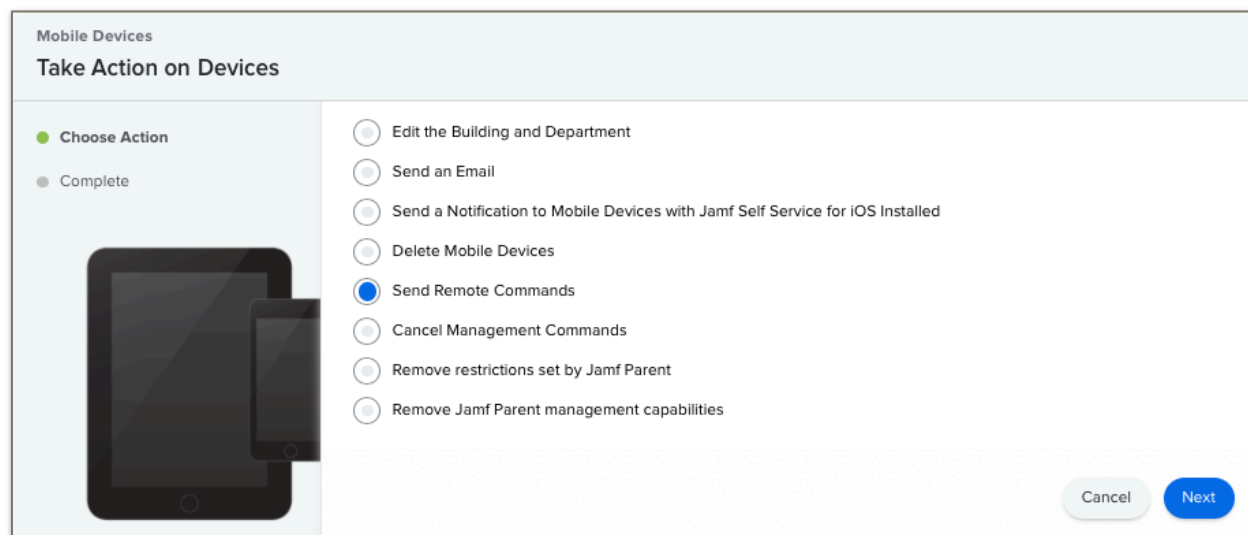
Select "Refresh Cellular Plan" and enter the activation URL provided by your carrier. (See the notes section at the end of this document for some common carriers.) Then click "Next".
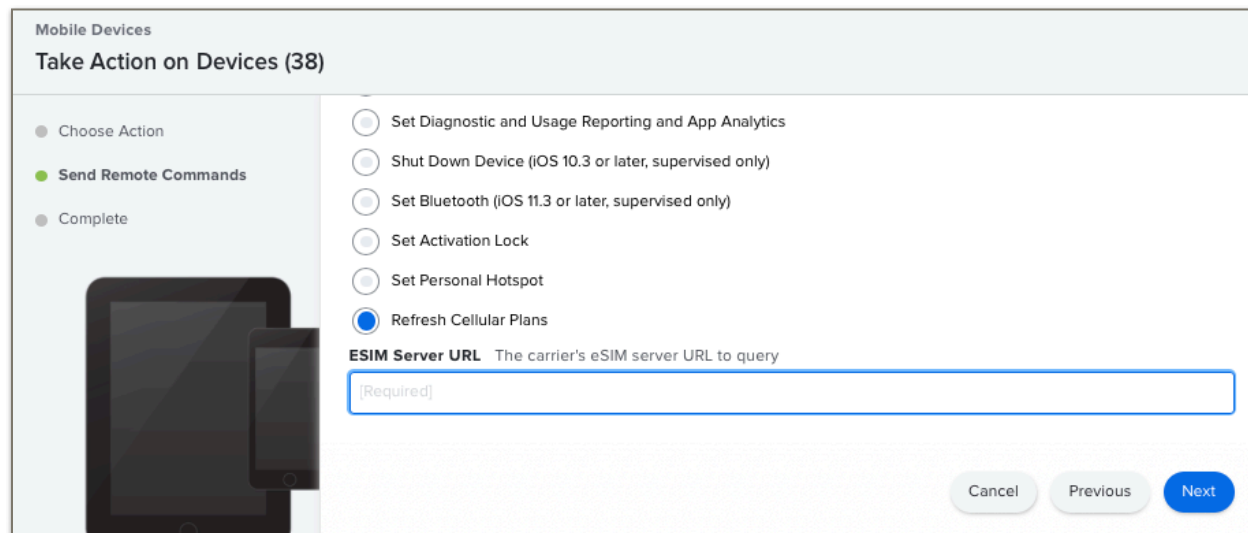
Jamf Pro will send the command to each device in the device list. The devices will contact the carrier activation server you specified and retrieve their cell plan settings. They'll connect to the cellular network without requiring any manual steps on the device.

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.
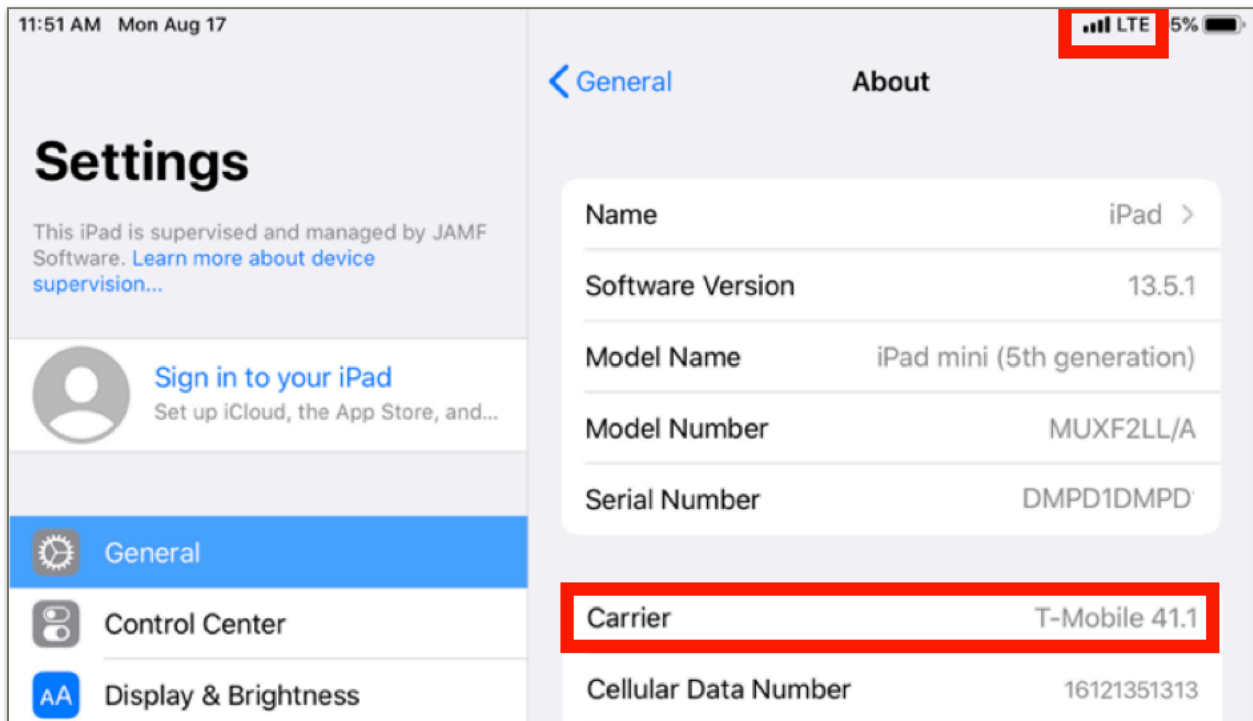
Once the device has submitted its next inventory, the details for the cell service will appear in Jamf Pro's device details page, including Carrier and Phone Number information.
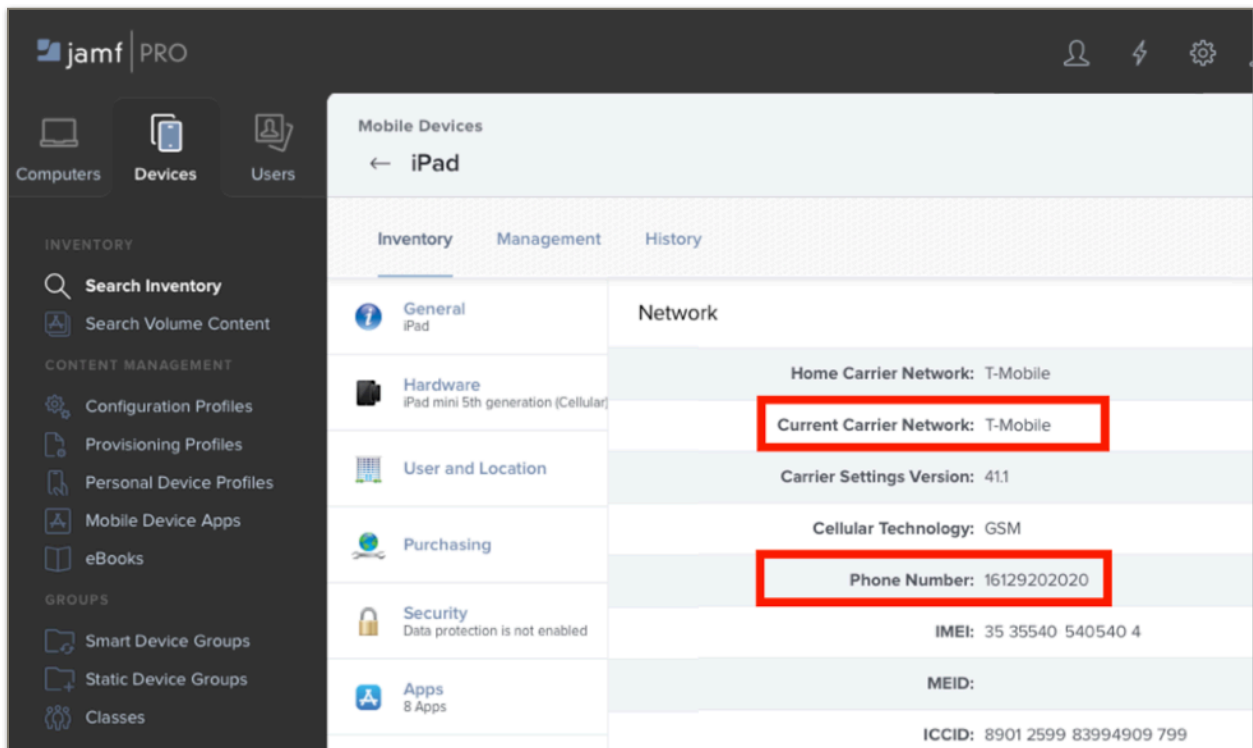
eSIM Implications for Device Reset and Plan Deletion

Device Reset and "Retain Cellular Plan" in iPadOS

Carriers remove device information from their activation servers once an eSIM has been activated so unless you're changing carriers, eSIM activation should be considered a one-time event. We need to be careful to:

1) Retain the cell plan on the device if we ever need to reset content and settings, as might be the case if we're transferring an iPad to a new user

2) Prevent users from altering cell plan data on their device

If cellular settings are unintentionally removed from a previously-activated eSIM device, either on the device itself in Settings.app, 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 plan" MDM command won't work. The user will see 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-enable the device in their activation 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.

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 — Jamf School

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".
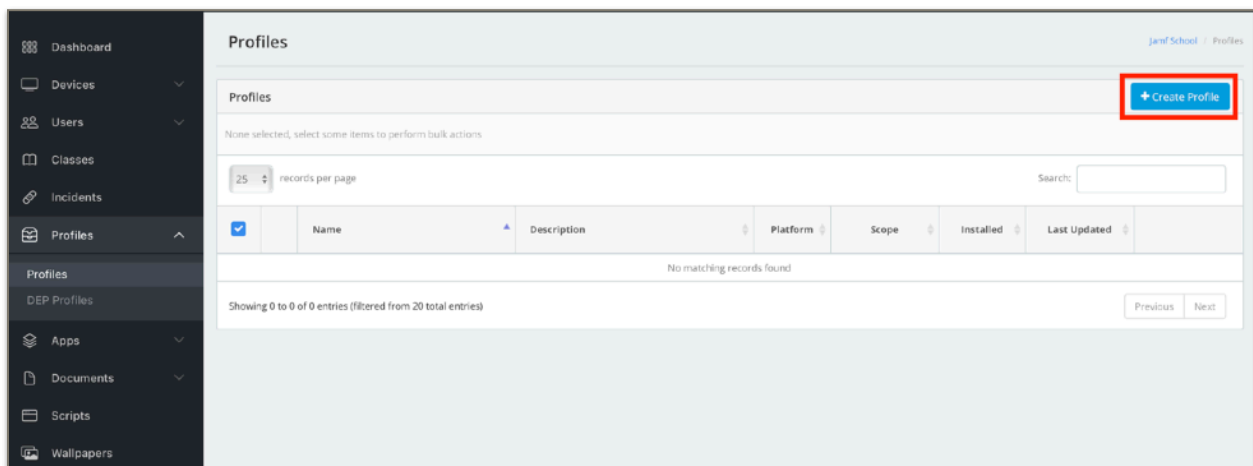
Select "iOS"
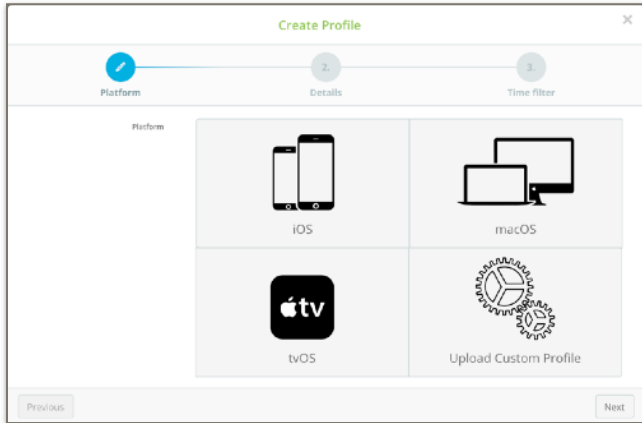
Select Device Enrollment, click "Next"
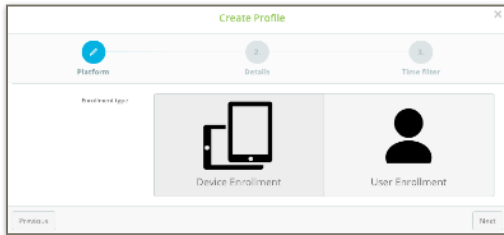
On the Details screen, provide a name for the Configuration Profile; you can also choose to add a description. Click "Next"
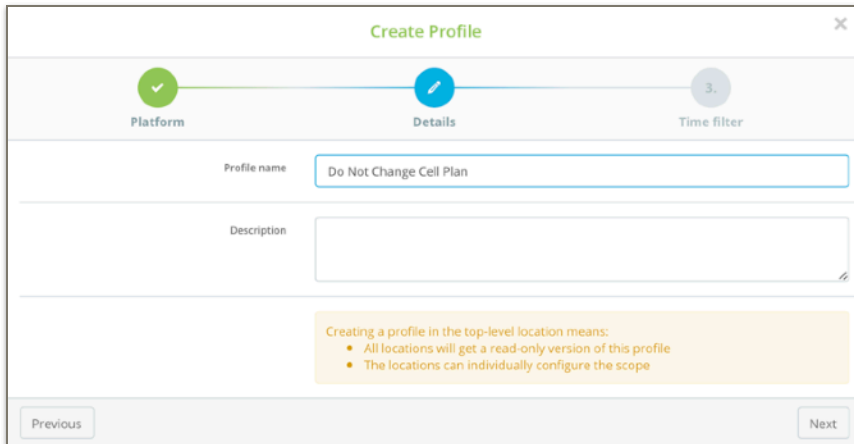
The final configuration step in the New Profile wizard is "Time Filter". We will not use this option when setting cellular restrictions. Click "Finish".
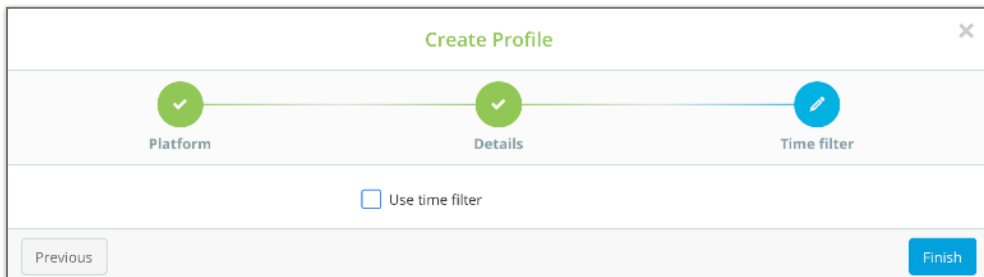
The newly created profile will now be in view. Click the "Restrictions" payload and then click "Configure".
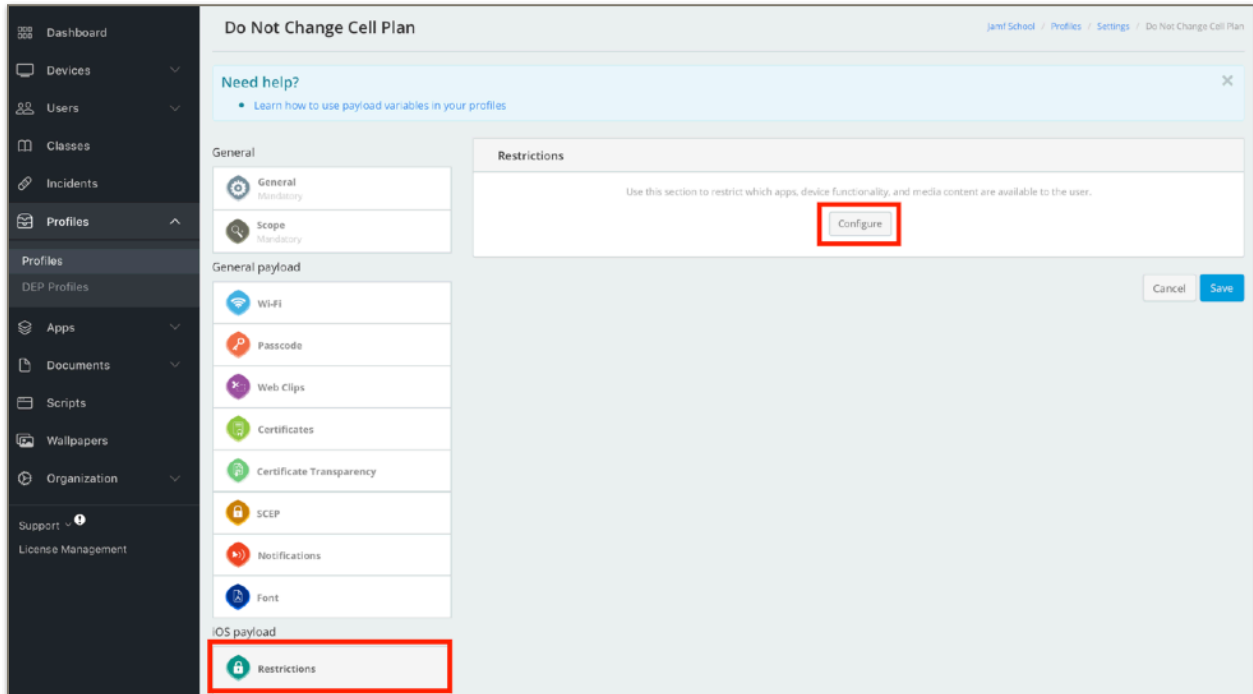
On the Functionality options page, scroll towards the bottom to the User Modifications section and uncheck the "Allow adding or removing a cellular plan" and "Allow modifying cellular plan" options.
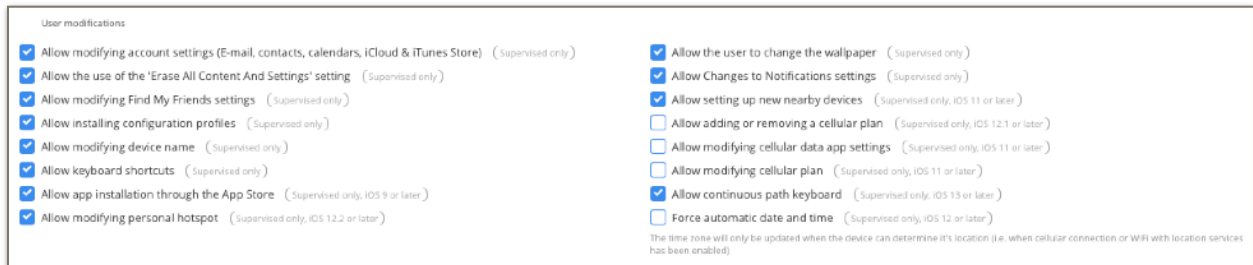
In the example above, the administrator has also unchecked the "Allow modifying cellular data app setting" option. This prevents the user from making changes to the apps that can use cellular data. Any app that can't use cellular data would have to run over WiFi. The Network Usage Rules payload will be used to determine which apps can use cellular data. The admin may elect to allow all apps to use cellular data, 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.
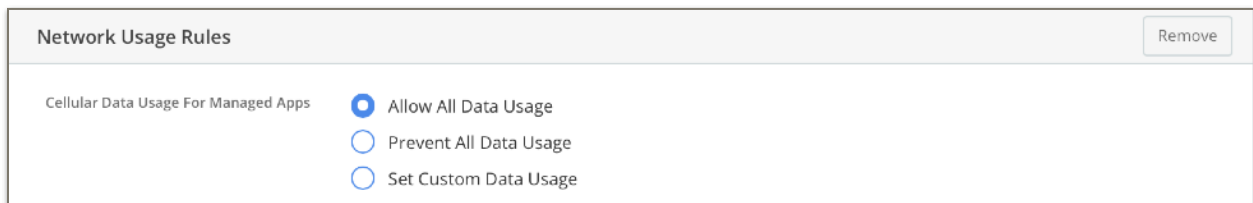
Click on the "Scope" option to choose the devices that need these settings. This profile could be scoped to the device models that are cellular-capable, but if you accidentally push it to others there will be no issue as it will have no effect on devices that do not have a cellular plan. Also, it's safe to push this profile to devices even before the cellular service has been activated because the "Refresh Cellular Plan" MDM command is not affected by these restriction settings. Save the profile once you've set your desired device scope.
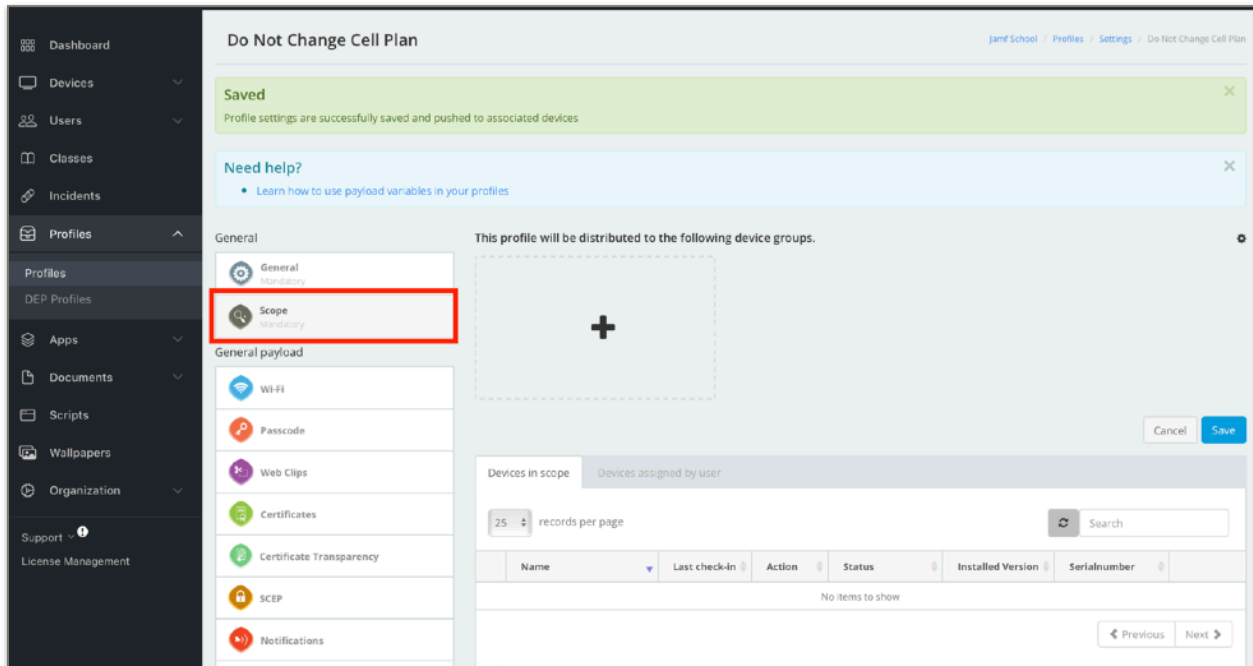
Restricting the user's ability to change cellular settings — Jamf Pro

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 may elect to edit it to add the cellular restrictions. Or, to create a new profile, go to "Devices > Configuration Profiles > New".
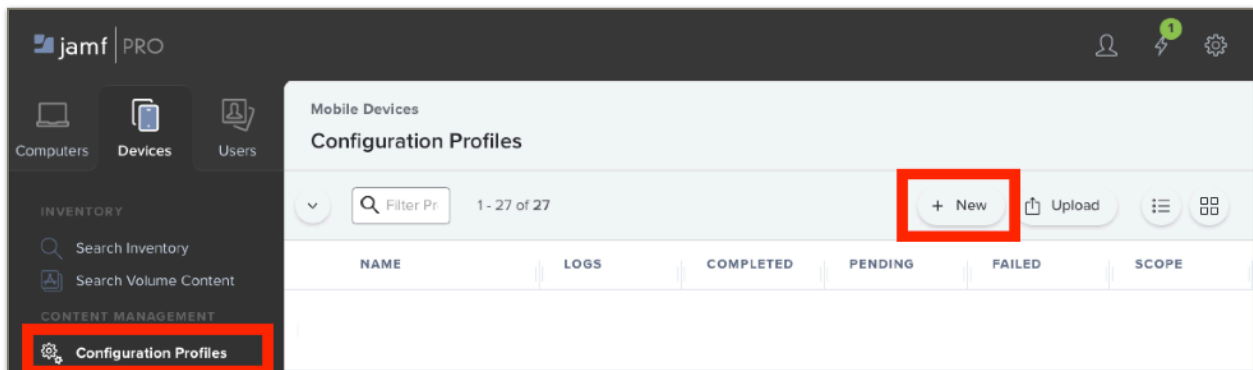
Give the profile a name in the General pane.
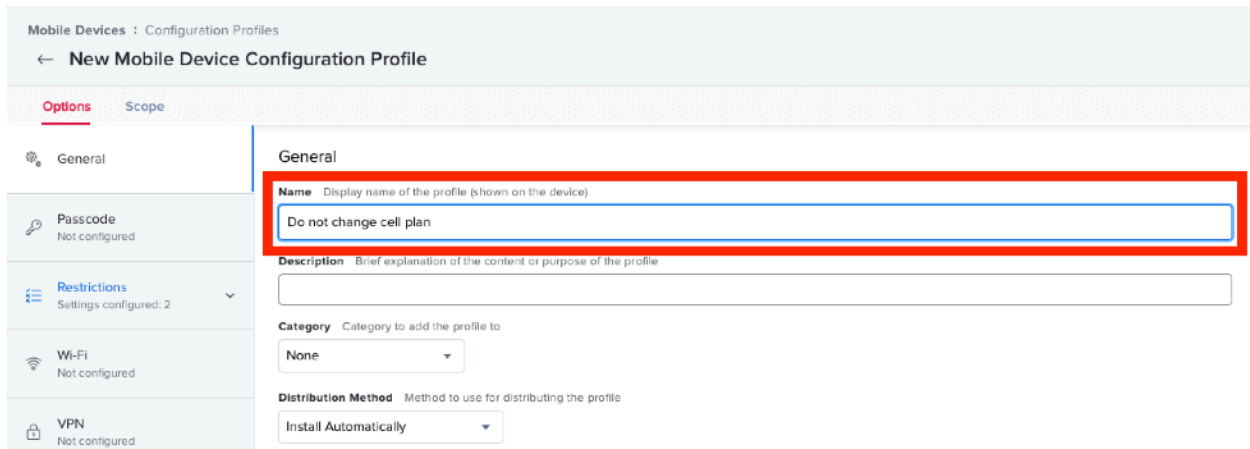
Next, switch to the "Restrictions > Functionality" pane and restrict "Modify cellular plan" and "Modify eSIM settings".
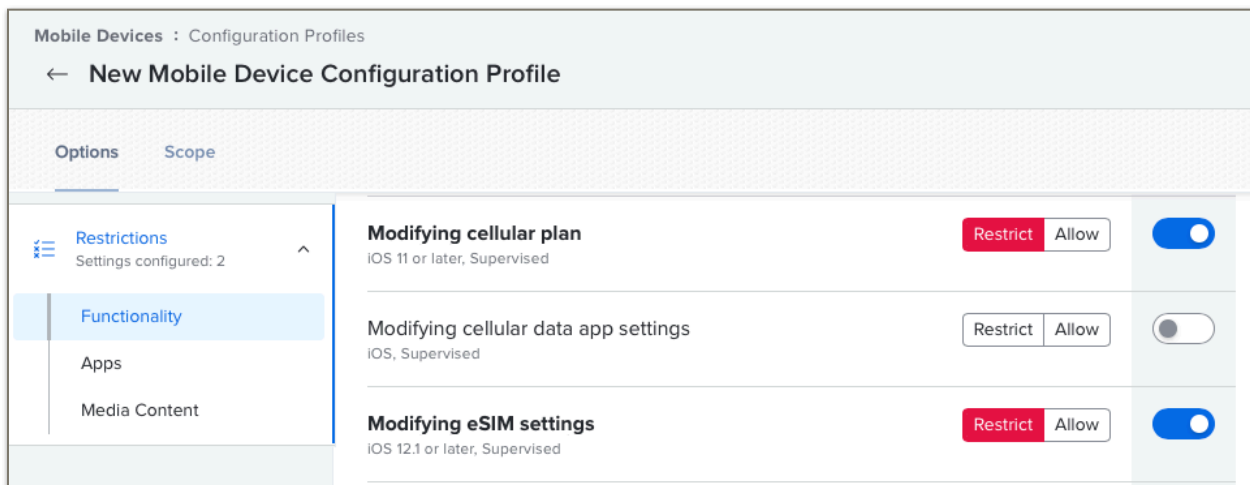
Note that in this example, we are allowing the users to decide which apps can use cellular data because we are not managing the "Modifying cellular data app settings". This might be a good approach on a corporate device where we are allowing users to install things like YouTube or Netflix but encourage them to turn off cellular data for these apps in favor of using WiFi. In education, we might restrict a student's ability to install their own apps from the App Store and specify which of the apps we're installing for them can use cellular data and which cannot with the "Network Usage Rules" profile payload. In this case we might want to restrict user modifications on the app cellular data settings.

Switch to the scope tab to select the devices that need these settings. This profile can be scoped to all mobile devices... it will have no effect on devices that do not have a cellular plan, or to a smart group with criteria of Mobile Carrier is not equal to "iPad" and is not equal to (no value). Save the profile once when you've completed the setup. The users will not be able to alter their cellular settings. It's safe to push this profile to devices even before the cellular service has been activated. The "Reset Cellular Plan" MDM command is not affected by this setting.

Consider avoiding auto-wipe after n incorrect passcode attempts

Unless your security requirements demand it, do not set the option in the passcode payload to wipe the device after a certain number of failed passcode attempts as this will delete the eSIM settings. You can also set the "Erase all content and settings" restriction to prevent users from wiping their iPad.

Removing Content and settings from an eSIM device

In the absence of any restriction profiles that might prevent a user from doing so, tapping "Erase all contents and settings" in "Settings.app > General > Reset" on a dual-SIM/eSIM device, iPadOS will give you two options. If you're going to be giving the device to a new user but it will be on the same cellular plan, select the "Erase All & Keep Cellular Plans" option. If you're going to be disposing of the device, transferring ownership, or switching to a new cellular account, select the "Erase All" option.
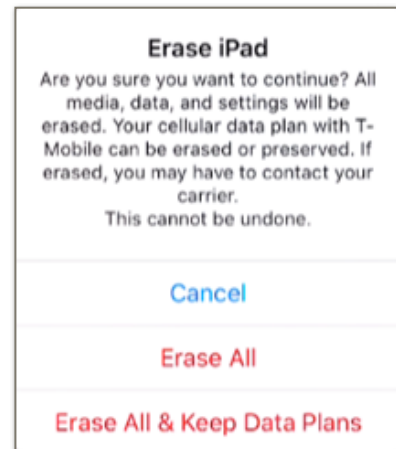
Sending the Device Wipe command to an eSIM device in Jamf School

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 Actions menu. In the resulting options menu, be sure to select "Preserve Data Plan" if you want the device to remain on your account.
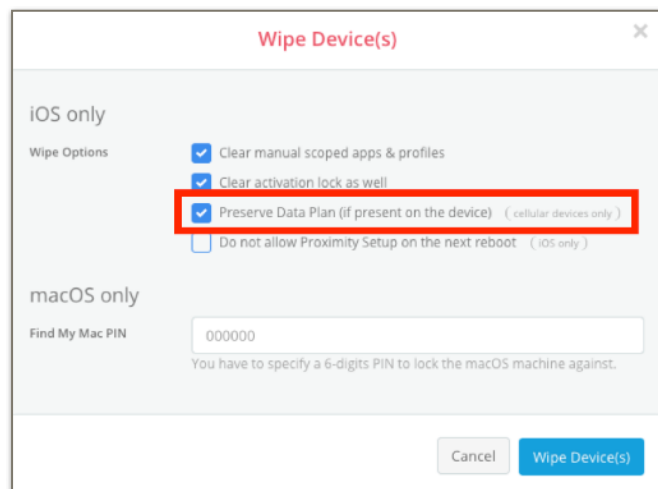
Sending the Device Wipe command to an eSIM device in Jamf Pro

If you're using Jamf Pro to wipe a device with a remote action, be sure to check the "Retain Cellular Data Plan" option unless you no longer want the device to have cell service with your carrier. This command can be sent to an individual device from the Management tab in its inventory detail page or as a mass-action to a group of devices in an Advanced Search or Mobile Device Group.
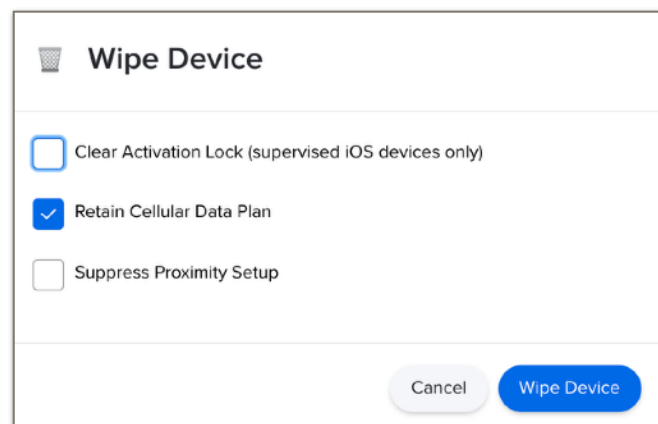
Cellular-related Popup Notifications

The following message may be seen in iPadOS.

"Carrier Settings Update"

Carriers may occasionally ask Apple to add some cellular radio and network settings to cellular-capable devices after they've been purchased. You might see a prompt informing you that such an update is available when you're activating your iPads. Select the "Update" 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 activation 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 Plan" mass-action command in Jamf School or Jamf Pro.

"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. You can 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 once the eSIM has been activated.

"Unable to Complete Cellular Plan Change"

This occurs when the MDM has sent the Refresh Cellular Plans 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 a "Reset cellular plan" 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 activation 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 activation 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.

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 the many apps that the admin had scoped to the devices so they were competing for bandwidth.

- A Jamf admin pushed new versions of their company's in-house apps to 30,000 devices at the same time. A few cubes over, another admin was pushing the Reset Cellular Plan 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 Plan 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 reset cellular plan 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*

Troubleshooting

Cell Service is not activating after sending the Refresh Cellular Plan command

1. Check for a typo in the Activation URL you sent to the device(s).

2. Ensure the device IMEI and EID numbers have been sent to carrier for activation

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. Perform the activation in a location where cellular service is available from your carrier.

6. Verify that there aren't any backlogged/pending MDM commands, macOS updates, or app installs.

Notes

Carrier eSIM Activation Server URLs ("SM-DP+" Servers) for use with "Reset Cellular Plan"

Carrier	URL
Verizon	https://2.vzw.otgeuicc.com
AT&T	https://cust-001-v4-prod-atl2.gdsb.net
T-Mobile	https://t-mobile.gdsb.net

Don't include a trailing "/" on the URL.

Let Jamf be a part of your Apple education success.

Put this workflow in place and empower your students and educators with the best Apple has to offer.

Get Started