



Lab 3: Release, Modify, and OTA Firmware with the DMS

Avnet BCM4343W IoT Starter Kit

Overview

A typical firmware design cycle is:

1. Development and test the firmware
2. Release the firmware
3. Deploy the new firmware to devices in the field

This lab intends to describe how this process is done using the Zentri Device Management Server (DMS) and ZentriOS SDK.

This lab is split into the following sections:

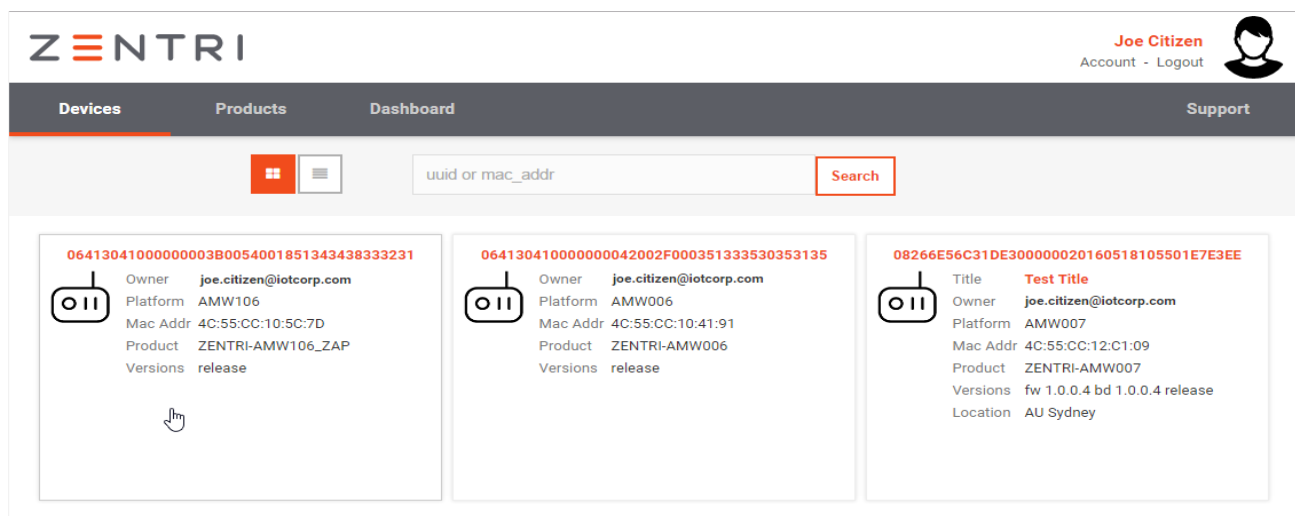
- **Develop and test the ZAP** – This lab uses the ZAP from lab1
- **Release the ZAP to the DMS using the ZentriOS SDK** – This section describes how to create a 'Product' and release a 'Bundle' for the Product
- **Clone and modify the bundle using the DMS** – Via <https://dms.zentri.com>, this describes how to clone an existing bundle and modify files; in this section `message.txt` is modified which is later printed on the LED matrix
- **Claim and activate your device(s) with your DMS 'Product'** – This section is optional; it describes how new devices may be provisioned in the field or during manufacturing
- **Update your device's firmware via OTA** – This section describes how to update devices in the field; after the update is complete the new `message.txt` is printed on the LED matrix

Requirements

- ZentriOS SDK (version 3.2.0.2 or later)
- Serial Console application (eg. TeraTerm or Putty)
- Internet Browser on Lab Computer with internet access
- Avnet BCM4343W IoT Starter Kit
- Adafruit Mini 8x8 LED Matrix Display Backpack (I2C), fitted with Pmod-compatible 6x1 right-angle connector
<https://www.adafruit.com/products/870>
- Account with <https://dms.zentri.com>

DMS Documentation Online

<https://docs.zentri.com/dms/latest/>



The screenshot shows the Zentri DMS web interface. At the top, the Zentri logo is on the left, and the user 'Joe Citizen' is logged in on the right. Below the header is a navigation bar with 'Devices', 'Products', and 'Dashboard' tabs. The 'Devices' tab is active. A search bar is present with the placeholder text 'uuid or mac_addr'. Below the search bar, there are three device cards. Each card displays a device icon, a unique ID, and details about the owner, platform, MAC address, product, and versions.

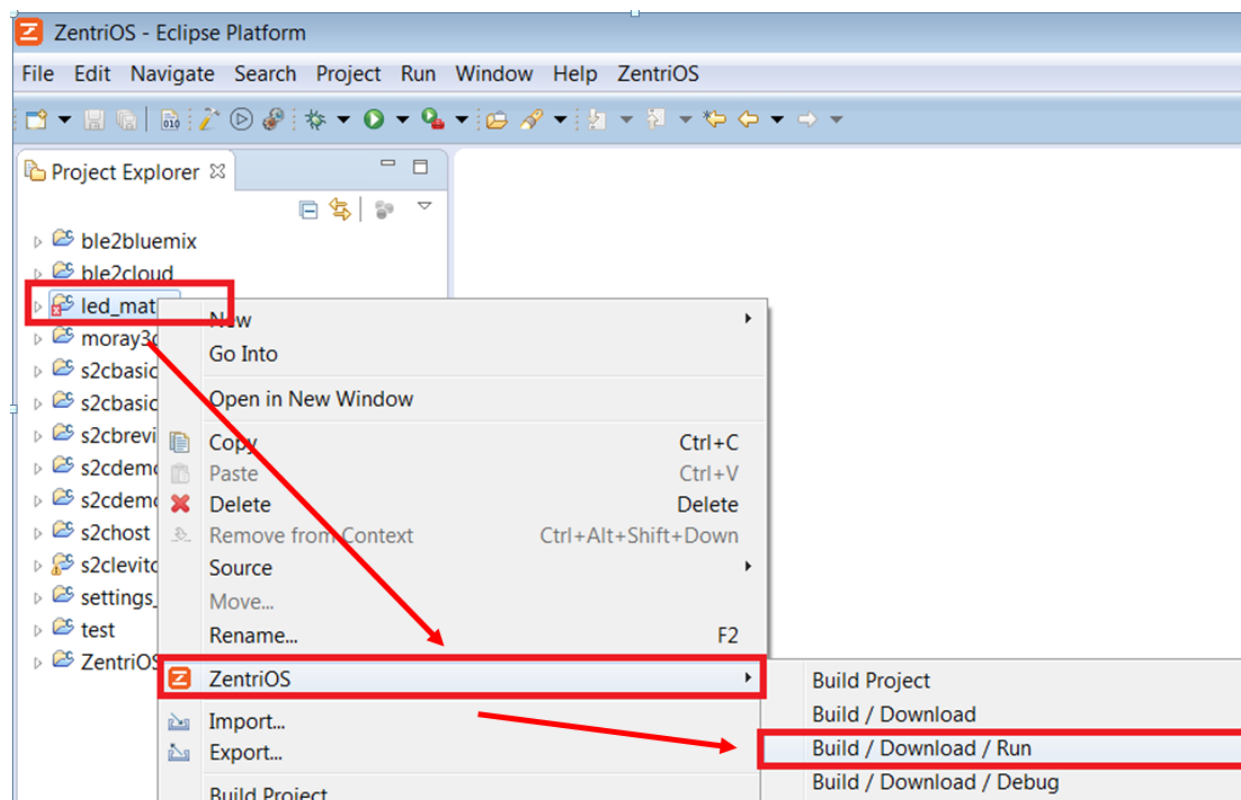
ID	Owner	Platform	Mac Addr	Product	Versions
06413041000000003B005400185134343833231	joe.citizen@iotcorp.com	AMW106	4C:55:CC:10:5C:7D	ZENTRI-AMW106_ZAP	release
064130410000000042002F000351333530353135	joe.citizen@iotcorp.com	AMW006	4C:55:CC:10:41:91	ZENTRI-AMW006	release
08266E56C31DE300000020160518105501E7E3EE	joe.citizen@iotcorp.com	AMW007	4C:55:CC:12:C1:09	ZENTRI-AMW007	fw 1.0.0.4 bd 1.0.0.4 release



Procedure

Develop and test the ZAP

The rest of this lab uses the same ZentriOS SDK `led_matrix` project from lab1. Refer to the lab1 documentation for more information.



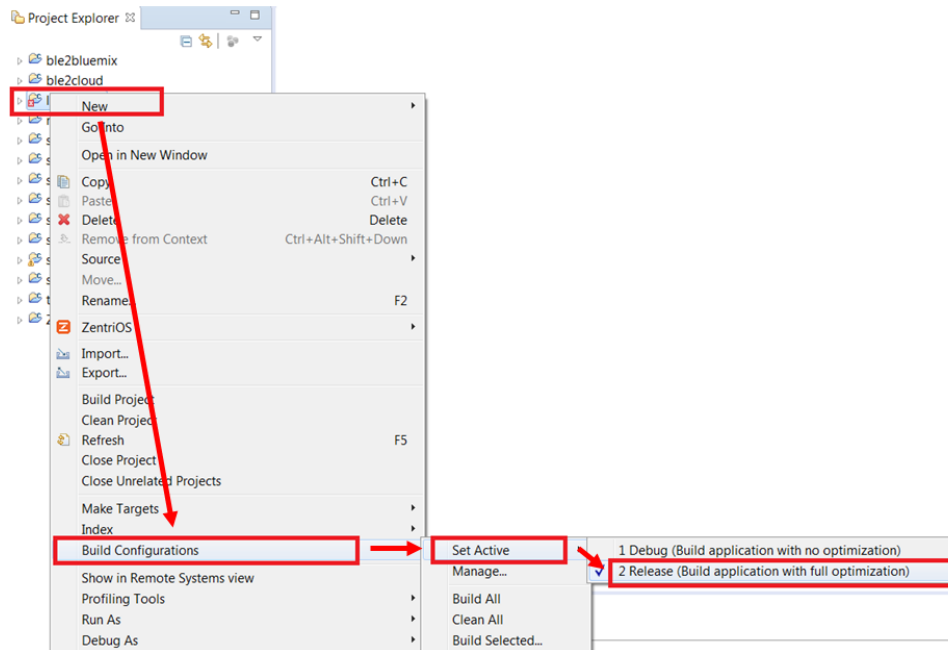
Alternatively, refer to Workshops/Lab 3/`led_matrix` of the USB thumb drive for the completed project.



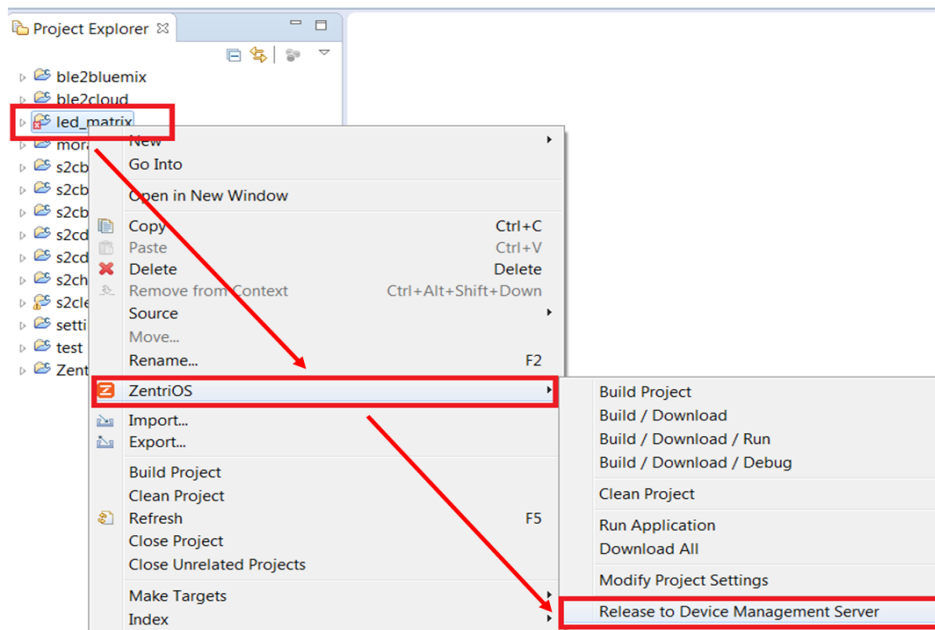
Release the ZAP to the DMS using the ZentriOS SDK

Now that the ZAP is developed and thoroughly tested, it is time to release it to the DMS.

- 1) Ensure the project is built in 'release' mode: Right-click on the project → Build Configurations → Set Active → 2 Release



- 2) Start the bundle release process: Right-click on the project → ZentriOS → Release to Device Management Server



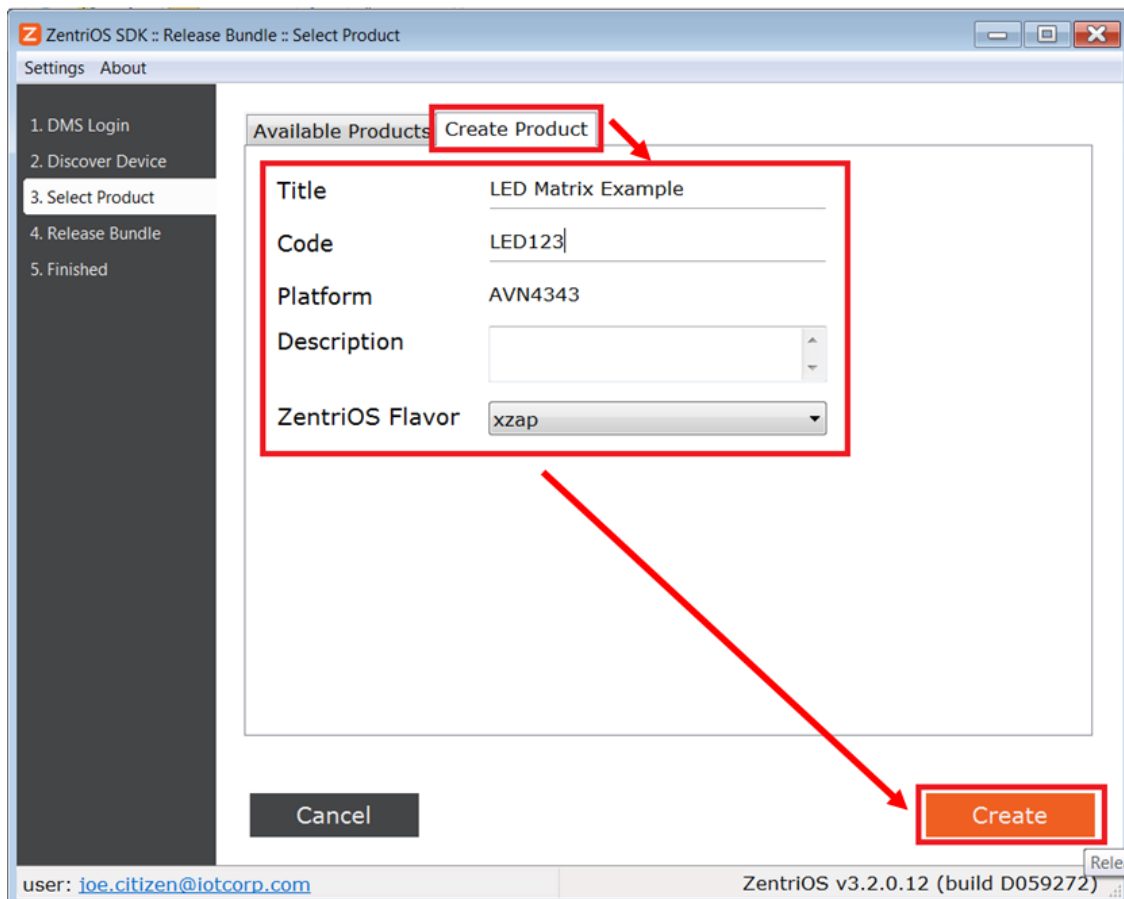


- 3) Once the release process is started, a GUI will appear which:
 - a. Logs into the DMS
 - b. Discovers the device connected to the computer
 - c. Requests to select or create a product

In this step we either select an existing product or create a new one. In this lab we will create a new product.

Note: Typically when releasing a ZAP you would use an existing product.

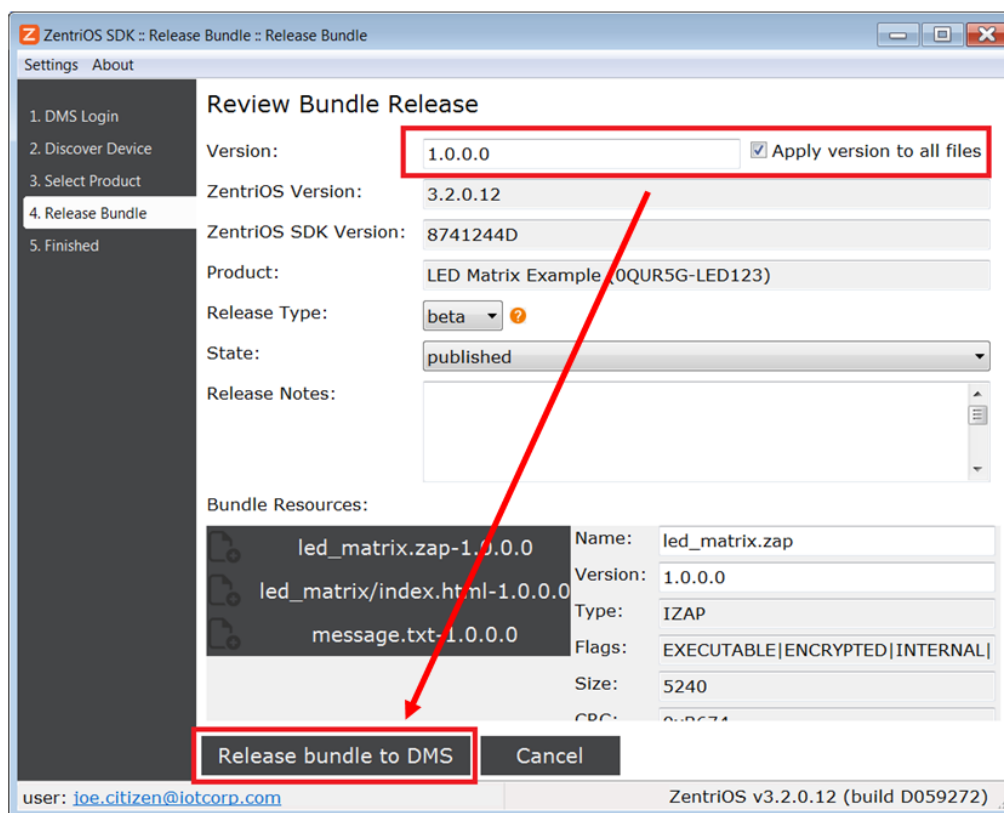
- 4) Select the 'Create Product' tab, fill in the fields, then click the 'Create' button:



After clicking the create button your new product will be created in the DMS. You may go to <https://dms.zentri.com> to view your newly created product.

Note: You can also create products using <https://dms.zentri.com> .
See <https://docs.zentri.com/dms/latest/products#creating-a-product>

- 5) Next we review the files in the bundle we are about to release and give them a version. Once finished press the 'Release bundle to DMS' button:

ZentriOS SDK :: Release Bundle :: Release Bundle

Settings About

1. DMS Login
2. Discover Device
3. Select Product
4. Release Bundle
5. Finished

Review Bundle Release

Version: ☒ Apply version to all files

ZentriOS Version: 3.2.0.12

ZentriOS SDK Version: 8741244D

Product: LED Matrix Example_0QUR5G-LED123

Release Type: beta

State: published

Release Notes:

Bundle Resources:

Name	Version	Type	Flags	Size	Checksum
led_matrix.zap-1.0.0.0	1.0.0.0	IZAP	EXECUTABLE ENCRYPTED INTERNAL	5240	0-8674
led_matrix/index.html-1.0.0.0	1.0.0.0				
message.txt-1.0.0.0	1.0.0.0				

user: joe.citizen@iotcorp.com ZentriOS v3.2.0.12 (build D059272)

Note that a Bundle = ZentriOS (a.k.a Firmware) and our ZAP + custom files. The ZentriOS version is determined during the Device Discovery step by querying the connected device. The ZAP is built against this specific ZentriOS version.

You may go to <https://dms.zentri.com> to view your newly released Bundle for your Product.

That's it! We have released our ZAP to the DMS.

Note that the bundle was released as BETA. We need to go to the DMS and change its tag to RELEASE for it to be officially released. Refer to the next section for more details.

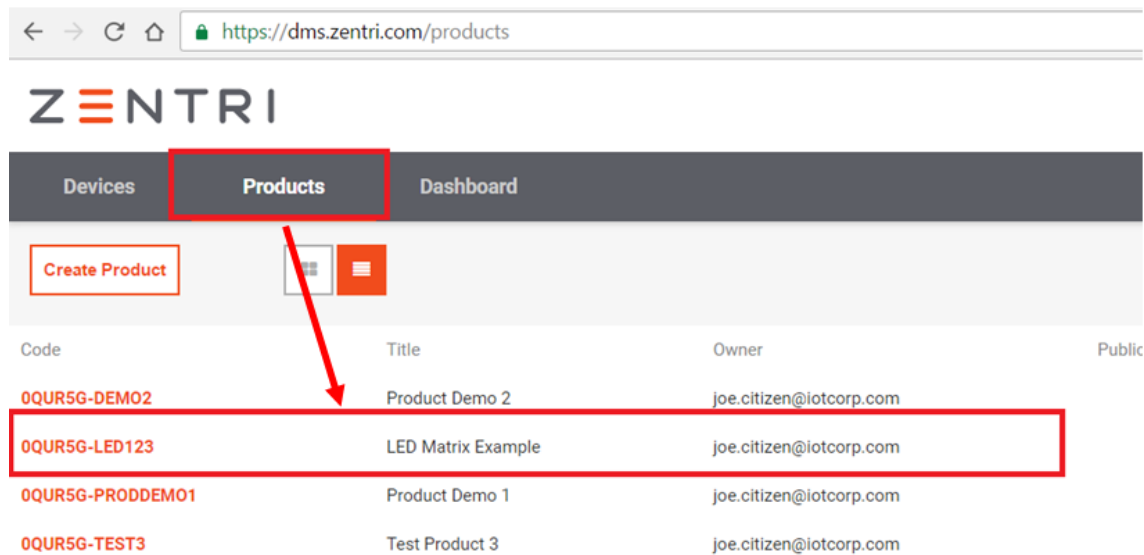


Clone and modify the bundle using the DMS

Now that we have released our bundle to the DMS, let's clone and modify it.

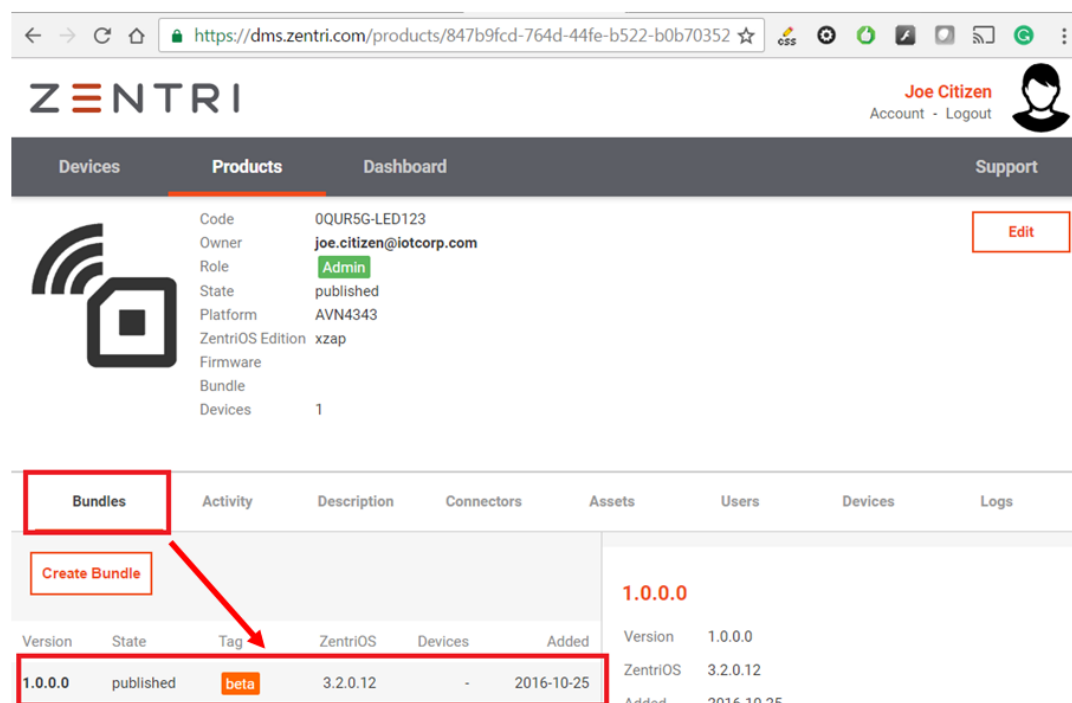
Note: This section is optional. You may use the SDK to release all bundles. It is, however, recommended to change your bundle's tag from BETA to RELEASE. See the last step of this section.

- 1) If you have not done so already, go to <https://dms.zentri.com>, find your product, and select it:



Code	Title	Owner	Public
0QUR5G-DEMO2	Product Demo 2	joe.citizen@iotcorp.com	
0QUR5G-LED123	LED Matrix Example	joe.citizen@iotcorp.com	
0QUR5G-PRODDemo1	Product Demo 1	joe.citizen@iotcorp.com	
0QUR5G-TEST3	Test Product 3	joe.citizen@iotcorp.com	

- 2) Next select your newly released bundle:



Version	State	Tag	ZentriOS	Devices	Added
1.0.0.0	published	beta	3.2.0.12	-	2016-10-25




- 3) Scroll to the bottom where there is a text field and 'Clone' button. In the text field enter a new version then press the 'Clone' button:

Devices

Products

Dashboard

Support



Code

00UR5G-LED123

Owner

joe.citizen@iotcorp.com

Role

Admin

State

published

Platform

AVN4343

ZentriOS Edition

xzap

Firmware

Bundle

Devices

1

Edit

Bundles

Activity

Description

Connectors

Assets

Users

Devices

Logs

Create Bundle

Version	State	Tag	ZentriOS	Devices	Added
1.0.0.0	published	beta	3.2.0.12	-	2016-10-25

Clone this Bundle

Version for new Bundle


1.1.0.0

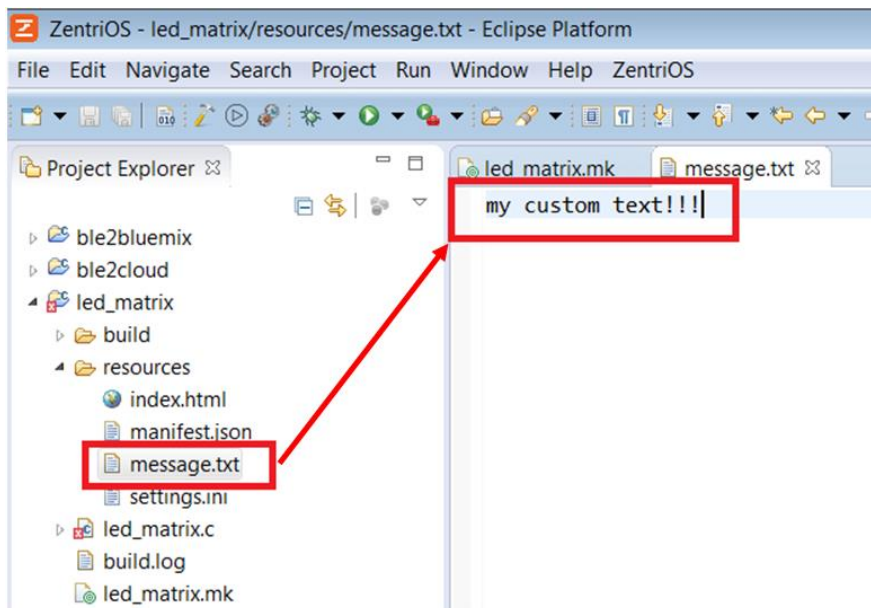
Version must be in range (0-31).(0-63).(0-8191).(0-255) - if you leave version blank, the next available RC version will be used.

Clone




4) After the bundle is cloned a new bundle is created. Initially this bundle is in a 'Preview' state. In this state you may modify the bundle. Modify the cloned bundle by:

- Delete the `message.txt` file by pressing the  button next to it
- In your ZentriOS SDK **led_matrix** project, modify the `resources/message.txt` file with some custom text:



- Save your changes
- Drag and drop the modified `message.txt` file from the **led_matrix** project to the DMS where it says 'Drop a file here to upload'



Code

0QUR5G-LED123

Owner

joe.citizen@iotcorp.com

Role

Admin

State

published

Platform

AVN4343

ZentriOS Edition

xzap

Firmware

Bundle

Devices

1

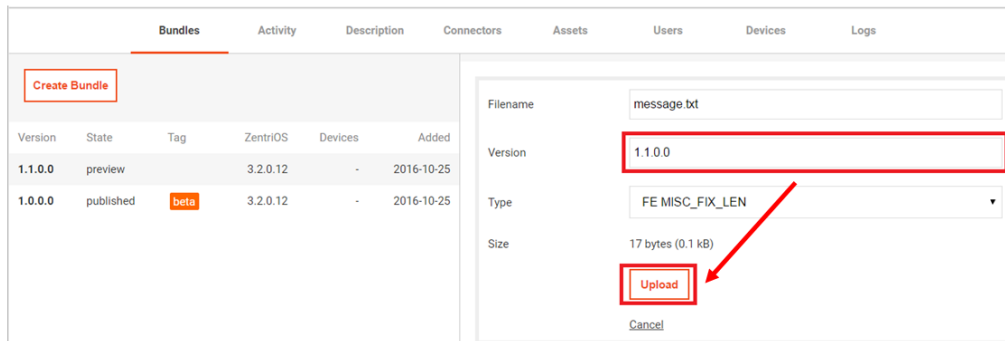
Edit

Bundles	Activity	Description	Connectors	Assets	Users	Devices	Logs
<div>Create Bundle</div>				ZentriOS	3.2.0.12		
				Added	2016-10-25		
				State	<div>preview</div> <div>Set</div>		
				Description	(Click to edit Description)		
Version	State	Tag	ZentriOS	Devices	Added		
1.1.0.0	preview		3.2.0.12	-	2016-10-25		
1.0.0.0	published	beta	3.2.0.12	-	2016-10-25		

Drop a file here to upload



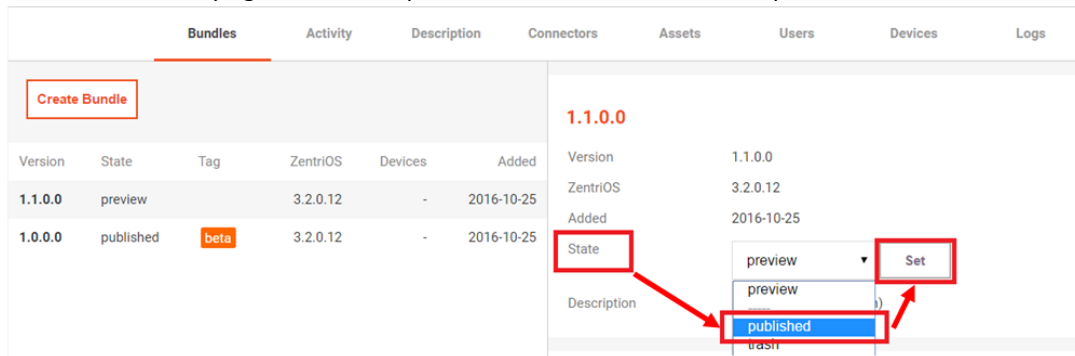
- e. Update the file's version to 1.1.0.0 and press the 'Upload' button



Version	State	Tag	ZentriOS	Devices	Added
1.1.0.0	preview		3.2.0.12	-	2016-10-25
1.0.0.0	published	beta	3.2.0.12	-	2016-10-25

Filename: message.txt
 Version: 1.1.0.0
 Type: FE_MISC_FIX_LEN
 Size: 17 bytes (0.1 kB)
 Upload
 Cancel

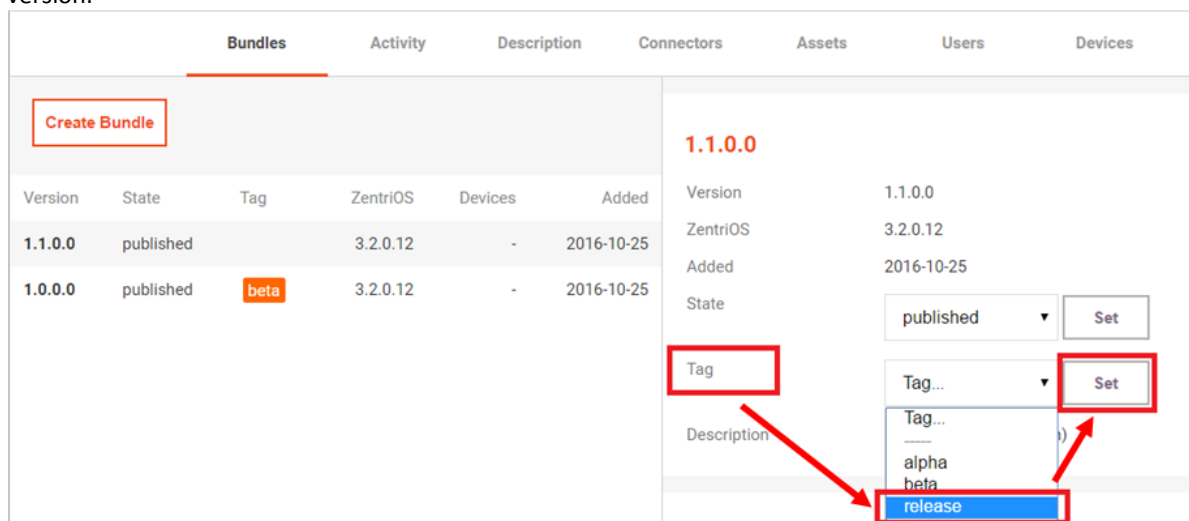
- f. We are done modifying the bundle, update its 'State' to **Published** and press the 'Set' button:



Version	State	Tag	ZentriOS	Devices	Added
1.1.0.0	preview		3.2.0.12	-	2016-10-25
1.0.0.0	published	beta	3.2.0.12	-	2016-10-25

1.1.0.0
 Version: 1.1.0.0
 ZentriOS: 3.2.0.12
 Added: 2016-10-25
 State: preview
 Description: preview
 Set
 published

- 5) At this point our new bundle is 'live' on the DMS, but devices must specifically request the bundle version to update to it. Let's set the bundle's 'tag' to **release** so that devices may automatically update to this version without knowing the specific version:



Version	State	Tag	ZentriOS	Devices	Added
1.1.0.0	published		3.2.0.12	-	2016-10-25
1.0.0.0	published	beta	3.2.0.12	-	2016-10-25

1.1.0.0
 Version: 1.1.0.0
 ZentriOS: 3.2.0.12
 Added: 2016-10-25
 State: published
 Tag: Tag...
 Description: Tag...
 Set
 Tag...
 alpha
 beta
 release

After pressing the 'Set' button a dialog will appear. Press the 'Confirm' button

That's it! We have modified and released a bundle using the DMS. Devices activated with our product may now OTA our newly released bundle. Refer to the next section for more details on how to 'activate' a device to our product.



Claim and activate your device(s) with your DMS 'Product'

Now that our bundle is released for our product, we need to 'claim' and 'activate' our devices with the product.

'Claiming' a device means associating the device with your DMS account. The DMS needs to know you own the device before it will OTA your firmware bundle to it.

'Activating' a device means telling the DMS a device is a specific product. The DMS needs to know which of your products the device is so the correct firmware bundle is OTA'd to it.

There are several ways claiming and activating a device can be done:

- During device manufacturing using a Zentri-provided programmer
 - This method is typically used for volume orders
- Use the ZentriOS SDK and JTAG programmer
 - The ZentriOS SDK 'Zap Store' will claim, activate, and program the device
- Use the ZentriOS commands
 - Standard ZentriOS provides serial commands to claim and activate a device

This section describes how to **claim** and **activate** your device using ZentriOS serial commands.

Note that claiming and activating your device only needs to be done once. Also note that this section is not required for your development device as the SDK automatically claims and activates your device when your bundle is released to the DMS.

Claiming a device

Before a device can be activated with your product, it needs to be claimed by your DMS account. This is done with the following serial command:

```
dms claim <DMS username> <DMS password>
```

Example:

```
> dms claim joe.citizen@iotcorp.com joespassword
Request POST /claim
Connecting (https): ota.zentri.com:443
Starting TLS
{"result":"ok"}
```

More details about the DMS claim command are available online: <https://docs.zentri.com/zentrios/w/latest/cmd/commands#dms>

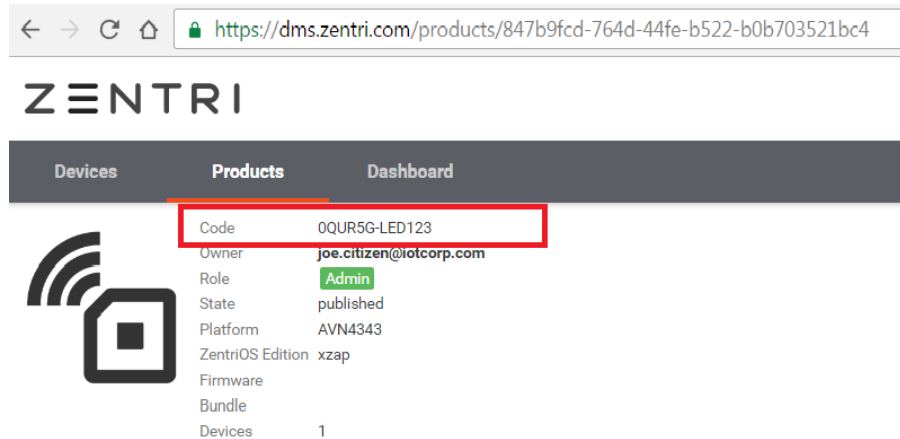


Activating a device

Now that the device is claimed, the next step is to activate with your product. This is done with the following serial command:

```
dms activate <DMS Product Code>
```

In this lab, our product code is **0QUR5G-LED123**:




← → ↻ 🏠 <https://dms.zentri.com/products/847b9fcd-764d-44fe-b522-b0b703521bc4>

ZENTRI

Devices

Products

Dashboard



Code	0QUR5G-LED123
Owner	joe.citizen@iotcorp.com
Role	Admin
State	published
Platform	AVN4343
ZentriOS Edition	xzap
Firmware	
Bundle	
Devices	1

Example:

```
> dms activate 0QUR5G-LED123
Request POST /activate
Connecting (https): ota.zentri.com:443
Starting TLS
{"result":"ok"}
```

More details about the DMS activate command are available online:

<https://docs.zentri.com/zentrios/w/latest/cmd/commands#dms>



Verify the device

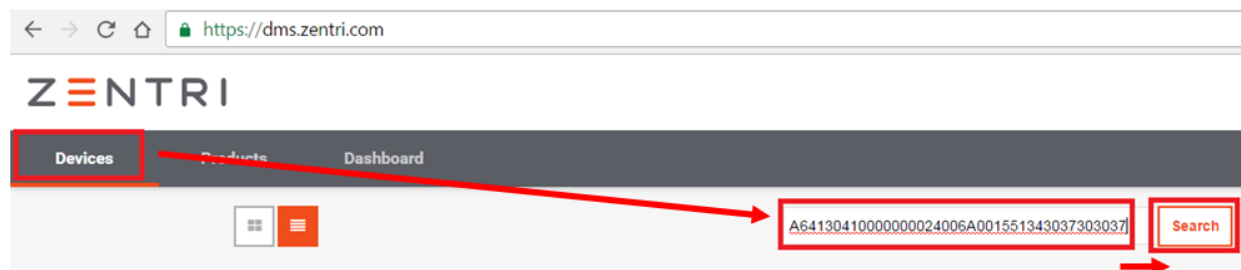
Let's verify that the device is claimed and activated by looking up the device in the DMS. Obtain the device's UUID with the following ZentriOS serial command:

```
get system.uuid
```

Example:

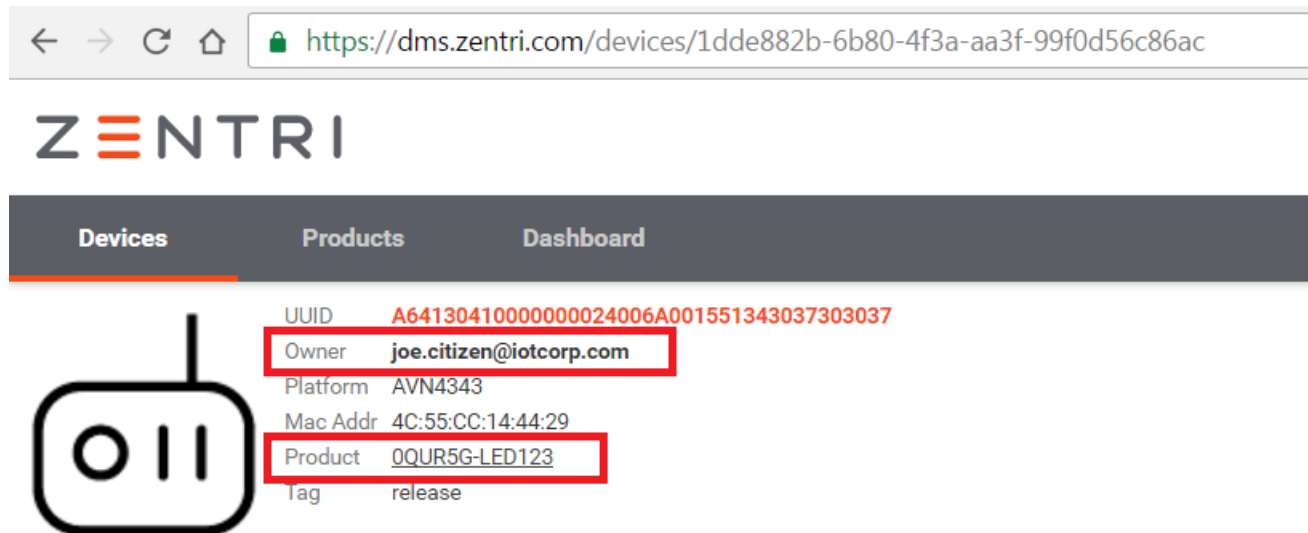
```
> get system.uuid  
A64130410000000024006A001551343037303037
```

Go to the DMS, select the 'Device's tab, enter the UUID in the search field, and press the 'Search' button:



The device details should appear. (Ensure the UUID is correct and there is no white shape in the search if not).

In the device details you should see that the owner is your DMS username and the product is your product code:



After the device is activated with our product it can OTA its firmware bundles. Refer to the next section for more details on device OTA.



Update your device's firmware via OTA

Now that our devices are activated to our product, we may update to our released firmware bundle.

Updating a device's firmware is done with the ZentriOS serial command:

```
ota [-f / -b <version> / -q]
```

Where:

- **-f** – Optional, force update to the latest released firmware bundle regardless of version
- **-b <version>** – Optional, update to a specific firmware bundle version
- **-q** – Optional, query the DMS and determine if a firmware update is available
- If no argument is supplied then only update files that are missing or out-dated

More details about the OTA command are available online: <https://docs.zentri.com/zentrios/w/latest/cmd/commands#ota>

Query the DMS

First let's check if a firmware update is available for our device. Issue the ZentriOS serial command:

```
ota -q
```

Example:

```
> ota -q
Request GET /ota?bundle_id=97ad1460-be9c-42b9-93ff-f032a076a3e8
Connecting (https): ota.zentri.com:443
Starting TLS
200,0QUR5G-LED123-1.1.0.0, 2016-10-25T18:56:57Z, ZentriOS-XZ-3.2.0.12
```

The command returned a 200 code meaning an update is available. The new firmware version string is:

```
0QUR5G-LED123-1.1.0.0, 2016-10-25T18:56:57Z, ZentriOS-XZ-3.2.0.12
```



OTA Update

Since an update is available, let's perform the update with the ZentriOS serial command:

```
ota
```

Example:

```
> ota
[2016-10-25 | 21:03:28: Disassociated]
UUID: A64130410000000024006A001551343037303037
Connecting to network
Security type from probe: WPA2-AES
Request POST /ota
Connecting (https): ota.zentri.com:443
Starting TLS
Bundle size: 856064, Free space: 671744, Core size: 581632
Starting partial update
Bundle version: 0QUR5G-LED123-1.1.0.0, 2016-10-25T18:56:57Z, ZentriOS-XZ-3.2.0.12
Bundle ID: c8dae599-17ae-4dcb-98c6-7878c337c3be
Downloading new firmware...
Downloading: sys/kernel.bin-3.2.0.12 (OK)
Downloading: sys/wifi_fw.bin-7.45.45.17 (OK)
Downloading: sys/safemode.bin-3.2.0.12 (OK)
Updating Kernel to version: 3.2.0.12
UUID: A64130410000000024006A001551343037303037
Connecting to network
Security type from probe: WPA2-AES
Request POST /ota
Connecting (https): ota.zentri.com:443
Starting TLS
Bundle version: 0QUR5G-LED123-1.1.0.0, 2016-10-25T18:56:57Z, ZentriOS-XZ-3.2.0.12
Bundle ID: c8dae599-17ae-4dcb-98c6-7878c337c3be
Downloading new firmware...
Downloading: sys/safemode.bin-3.2.0.12 (OK)
Downloading: sys/services.bin-3.2.0.12 (OK)
Downloading: led_matrix.zap-1.0.0.0 (OK)
Downloading: sys/bluetooth_fw.bin-3.1.0.1 (OK)
Downloading: message.txt-1.1.0.0 (OK)
Downloading: led_matrix/index.html-1.0.0.0 (OK)
Updating firmware files...
Updating file: sys/services.bin to version: 3.2.0.12
Updating zap
Setting boot image to sys/services.bin (0)
Booting to new imageýJTAG debug enabled
Posting OTA result to DMS
[2016-10-25 | 21:05:25: Associating to larry]
> Security type from probe: WPA2-AES
[2016-10-25 | 21:05:28: Associated]
> Request POST /ota/result
Connecting (https): ota.zentri.com:443
Starting TLS
```



```
JTAG debug enabled
OTA completed successfully
[2016-10-25 | 21:05:31: Ready]
```

After the firmware update, our new v1.1.0.0 firmware bundle is now downloaded to the device and our ZAP begins to run. You should see the custom `message.txt` scrolling across the LED matrix.

Verify the Update

Let's verify the firmware version running on the device with the ZentriOS serial command:

```
ver
```

Example:

```
> ver
0QUR5G-LED123-1.1.0.0, 2016-10-25T18:56:57Z, ZentriOS-XZ-3.2.0.12
```

This is the version the 'ota -q' command returned.

Let's also verify the files on the device by using the ZentriOS serial command:

```
ls -l
```

Example:

```
> ls -l
! # Type  Flags  Hnd    Size      Version  Filename
# 0 e-FE   0041   136    7578     3.2.0.12  .recovery.html
# 1 e-FE   0001   159    4504     1.0.0.0   led_matrix/index.html
# 2 e-FE   0081   158     17      1.1.0.0   message.txt
# 3 e-06   0001   153   16841    3.1.0.1   sys/bluetooth_fw.bin
# 4 i-00   001B    64  212736    3.2.0.12  sys/kernel.bin
# 5 e-84   0005    90     820     3.2.0.12  sys/safemode.bin
# 6 i-81   001B    0  230760    3.2.0.12  sys/services.bin
# 7 e-01   0001    0  363886    7.45.45.17 sys/wifi_fw.bin
```

We see the ZentriOS system files, our `led_matrix/index.html` file as well as our `message.txt` file.

More details about the file list command available online: <https://docs.zentri.com/zentrios/w/latest/cmd/commands#ls>



Conclusion

In this lab we learned how to release firmware bundles to the DMS using the ZentriOS SDK, how to modify bundles using the DMS, how to claim & activate devices, and how to OTA update devices.

These tasks are essential to the firmware development cycle. The ZentriOS SDK and Zentri DMS enable a secure and robust architecture for performing these operations.

Useful Links:

ZentriOS SDK Getting Started:

<https://docs.zentri.com/zentrios/wz/latest/sdk/user-guide/getting-started>

Zentri DMS account registration:

<https://dms.zentri.com/signup>

ZentriOS SDK Installer Download:

http://resources.zentri.com/zentrios_sdk/ZentriOS_SDK_Installer.exe

Avnet IoT Kit documents and reference designs:

<http://cloudconnectkits.org/product/avnet-bcm4343w-iot-starter-kit>

Avnet Technical Support Discussion Forums:

<http://cloudconnectkits.org/forum>

Zentri documentation:

<http://docs.Zentri.com>
