Welcome to Gadget!

Gadget is a suite of tools for developing, deploying, and distributing your applications to C.H.I.P. Pro and Gadget supported devices.

This documentation starts by guiding you through the installation of Gadget then a quickstart “hello world” example to make sure everything is set up correctly. It then moves into more detailed instructions on how to build, share and deploy custom and community built applications. After going through the quickstart and how to build with Gadget sections, this documentation also offers helpful references and several example projects to start building with.

What is Gadget?

Gadget is made up of two pieces of software that work together to simplify embedded software development.

1) **GadgetCLI** is a command-line tool you use on your development machine. It lets you manage your code, add and build containers, and deploy your finished projects to Gadget supported hardware.

Supported Systems:

- Linux 64-bit (kernel 3.10+)
- OSX
- Windows 10 Pro 64-bit

2) **GadgetOS** is a Buildroot-based Linux operating system. It boots quickly, takes up a small amount of NAND, and is designed to work with GadgetCLI.

Buildroot is at the core of GadgetOS and features Docker support. The **GadgetCLI** communicates directly with the Docker daemon over ssh, using GadgetOS's USB ethernet connection.

C.H.I.P. PRO

- **Boot time** is ~5 seconds to shell on the UART. Depending on user optimization, containers can load in ~5 - 15 seconds.
- **NAND availability** for containers, files, assets, etc. is 350MB.

Set Up Gadget

To get started, download and install the following on your development machine and Gadget compatible device.

Install Docker

Note: Gadget requires Docker version 17.06 or greater. If Docker is already installed check which version of Docker you have with the command `docker -v`.

Gadget makes use of Docker's container system. Dependent on your development machine's OS, download and install the appropriate version of Docker.

- MacOS - Docker CE
- Windows 10 (Pro Edition)- Docker CE

- Linux - Docker CE

After you install Docker, you will need to run it once before using GadgetCLI. GadgetCLI uses the Docker daemon to pull images from Docker Hub or to build directly from local Dockerfiles. Learn more about Docker Hub and how to use it here.

ADDITIONAL SETUP FOR LINUX

BUILD AND RUN ARM DOCKER IMAGES

If your development machine runs Linux you may need to download extra packages and add missing files to the system for Docker to successfully build an `arm32v7/*` Docker image. Open a terminal window and install binfmt-support and qemu-user-static and then reboot.

```
sudo apt-get update
sudo apt-get install binfmt-support qemu-user-static
sudo reboot
```

In addition to installing these packages, your Linux distro may still be missing `qemu-user-static` files . Follow the instructions outlined here to check whether they are missing and how to obtain them.

Check the Troubleshooting section for specific errors you may be getting.

RUN DOCKER AS UNPRIVILEGED USER

In some instances, such as building NTC's Gadget-OS kernel, You need to run Docker as an unprivileged user. To set this up, follow Docker's Linux Post-install instructions.

Install Gadget

Download the zip file containing the latest release of GadgetCLI and GadgetOS here. Put the gadget binary in your system's PATH or precede all the commands with `./` e.g., `./gadget` while in the same directory.

PATH location:

MacOS

On a Mac, place the Gadget binary in this location:

```
/usr/local/bin
```

To view the current value of your PATH environment variable:

```
echo $PATH
```

To add a new path, open the /etc/paths file:

```
nano /etc/paths
```

Add the new path to the end of the file and save.

Windows 10

Put the gadget binary somewhere like C:\Program Files\gadget and edit the *Path* variable to point to that location.

Click the Windows icon to open the Start Menu. Search for *Advanced System Settings*. When the *System Properties* window opens click on *Environment Variables*.

Find and select the *Path* variable under *System Variables*. Click *Edit* and the *Edit Environment Variable* window will open. Click *New* and enter the directory path to the Gadget binary. Then click *OK*.

Linux

Put the Gadget binary here:

```
/usr/bin
```

To view the current value of your PATH environment variable:

```
echo $PATH
```

To add a new path to the current value after the default system paths of PATH use this command:

```
PATH=$PATH:/my/new/path
```

Flash GadgetOS

Use the web flasher to install GadgetOS on your C.H.I.P. Pro Dev Kit. The latest GadgetOS is required for GadgetCLI to be able to talk to your hardware device and found in the GitHub repo.

Once flashed, power cycle C.H.I.P. Pro Dev Kit by either unplugging it from the USB port or pressing the On/Off button.

Hello World

Get up and running in minutes with this straight forward *Hello World* example.

1. CREATE PROJECT A DIRECTORY

```
mkdir hello-world
cd hello-world
```

2. INITIALIZE PROJECT

```
gadget init
```

This command creates a template file called gadget.yml and generates a project called “hello-world” ready to be deployed.

Open gadget.yml using Nano or your favorite command-line text editor. The .yml file should look similar to what's below.

```
spec: "0.0"
name: directoryName
uuid: 1789cc27-e1a8-40ef-aa1f-324092e6eff7
type: docker
onboot:
- name: hello-world
  uuid: 1ef762fe-a500-41d1-8cf9-bbd621dd09b8
  image: arm32v7/hello-world
  directory: ""
  net: ""
  readonly: false
  command: []
  binds: []
  capabilities: []
  devices: []
services: []
```

3. BUILD

```
gadget build
```

4. DEPLOY

```
gadget deploy
```

5. START

```
gadget start
```

6. LOOK AT LOGS AND CHECK STATUS

Once the container runs, it outputs a “hello world” message to the log file. You can view these message by using the `gadget logs` command.

```
gadget logs
```

You should see a message with an intro similar to this:

```
Hello from Docker!
This message shows that your installation appears to be working correctly.
...
```

Congrats, you have built and deployed your first Gadget project!

7. STOP AND CLEANUP CONTAINER

To stop the running container use the `gadget stop` command.

```
gadget stop
```

To delete the container use the `gadget delete` command.

```
gadge delete
```

Set Up WiFi

GadgetOS comes with a quick and convenient way to connect to your device through the host computer's USB port, which is handy for things like setting up WiFi. To connect your computer to GadgetOS type the following command.

```
gadget shell
```

ENABLE WIFI AND FIND A NETWORK

Use connmanctl to enable WiFi, scan for available networks, and list all the networks in range.

```
connmanctl enable wifi
connmanctl scan wifi
connmanctl services
```

The `services` command will give output similar to:

```
WaffleHouse          wifi_xxxxxxxxxxxx_xxxxxx_managed_psk
                         wifi_xxxxxxxxxxxx_hidden_managed_psk
YOUR_NETWORK         wifi_xxxxxxxxxxxx_xxxxxx_managed_psk
                                 wifi_xxxxxxxxxxxx_xxxxxx_managed_none
Donut_Hut            wifi_xxxxxxxxxxxx_xxxxxxxxx_managed_psk
```

CONNECT

Copy the string to the right of the network name you want to connect to that starts with “wifi_.” If the string contains a `psk` at the end, it means the network is password protected. Follow the “Password Protected” section further down to connect.

NO PASSWORD

To connect to YOUR_NETWORK, which has no password, `services` shows two choices. You want the one without `psk` in the string. Use the `connect` command:

```
connmanctl connect wifi_xxxxxxxxxxxx_xxxxxx_managed_none
```

If your network is not password protected, you'll get some output that will indicate a successful connection, such as:

```
[  961.780000] RTL871X: rtw_set_802_11_connect(wlan0)  fw_state=0x00000008
[  962.070000] RTL871X: start auth
[  962.080000] RTL871X: auth success, start assoc
[  962.090000] RTL871X: rtw_cfg80211_indicate_connect(wlan0) BSS not found !!
[  962.100000] RTL871X: assoc success
[  962.110000] RTL871X: send eapol packet
[  962.290000] RTL871X: send eapol packet
[  962.300000] RTL871X: set pairwise key camid:4, addr:xx:xx:xx:xx:xx:xx, kid:0, type:AES
[  962.320000] RTL871X: set group key camid:5, addr:xx:xx:xx:xx:xx:xx, kid:1, type:AES
```

If your network is password protected, you'll get an error.

PASSWORD PROTECTED

To deal with passwords, you'll need to put ConnMan into interactive mode:

```
connmanctl
```

This command gives a `connmanctl` prompt:

```
connmanctl>
```

In the shell, turn the agent on so it can process password requests:

```
agent on
```

Now use the `connect` command with your pasted wifi network string:

```
connect wifi_xxxxxxxxxxxx_xxxxxx_managed_psk
```

Enter your password when prompted:

```
Agent RequestInput wifi_xxxxxxxxxxxx_xxxxxx_managed_psk
Passphrase = [ Type=psk, Requirement=mandatory ]
Passphrase?
```

You will be notified that you are connected:

```
Connected wifi_xxxxxxxxxxxx_xxxxxx_managed_psk
```

Exit connmanctl interactive mode:

```
quit
```

STEP 3: TEST CONNECTION

Test your connection with `ping`. Google's DNS server at the IP address 8.8.8.8 is probably the most reliable computer on the internet, so:

```
ping -c 4 8.8.8.8
```

The `-c 4` option means it will happen only 4 times. Expect ping to output some timing messages:

```
PING 8.8.8.8 (8.8.8.8): 56 data bytes
64 bytes from 8.8.8.8: seq=0 ttl=60 time=7.631 ms
64 bytes from 8.8.8.8: seq=1 ttl=60 time=7.474 ms
64 bytes from 8.8.8.8: seq=2 ttl=60 time=7.697 ms
64 bytes from 8.8.8.8: seq=3 ttl=60 time=9.004 ms

--- 8.8.8.8 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
round-trip min/avg/max = 7.474/7.951/9.004 ms
```

If you have issues connecting, read our "Troubleshooting Connection Problems" on the C.H.I.P. Pro Doc page.

STEP 4. EXIT GADGET SHELL

```
exit
```

Configuring Gadget.yml

At the heart of GadgetOS is a container system called Docker. While GadgetOS runs containers, GadgetCLI helps you build, run, and manage them. If you're new to containers, check out this primer. Together, GadgetOS and GadgetCLI make orchestrating container images easy by using one configuration file: **gadget.yml**.

Gadget.yml is where you define resources available to the container, issue commands to the running container, specify which containers to run in what order, and more. For example, the *hello world* demo uses a gadget.yml file that pulls a container available on Docker Hub.

There are two sections to define and configure containers in: **onboot** and **services**. You can put multiple container configurations in each section and you can use GadgetCLI to specify which container to control: all of them or just one.

To execute commands on all containers on your development machine run the gadget command without any container image name specified.

```
gadget [options] COMMAND
```

To execute a command on a particular container specify the container name.

```
gadget [options] COMMAND imageName
```

Onboot

Containers in the **onboot** section, like the *hello-world* example, are executed before containers in the **services** section. All containers in the gadget.yml file execute sequentially from top to bottom of the configuration file. When their command process exits, the container will stop.

To add a container to onboot, run the following command.

```
gadget add onboot projectName
```

Services

Containers defined under **services** run after containers listed in **onboot**. They are automatically restarted by Docker if it exits with a non-zero return code.

To add a service follow the format below.

```
gadget add service projectName
```

Configurations

When you add a project to **onboot** or **services** from the command-line, a template configuration is inserted into your gadget.yml file. You'll need to fill in some details depending on how your project needs to be built and what your container needs at runtime. Below are all the possible configurations and what each does.

Name: Name of project

This will reflect the name that you choose for your project.

```
gadget add service|onboot projectName
```

If you choose to edit the *Name* field after generation, the container will need to be built and deployed again.

Format: `name: projectName`

Uuid: Container ID

You can have several instances of the same image. These instances are identified by their UUID. For example, if you build an image then change the **command** configuration and build again you can see both instances on your development machine when you run:

```
docker images
```

Format: `cont-ainer-uu-i-d`

Image: Path of Docker Hub image

An entry for `image:` is generated when you add to onboot or services via the command:

```
gadget add service|onboot projectName
```

To pull a base image from Docker Hub change `image:` to the username and repository you would like to pull. By default, the “latest” tag of the image is used.

Format:

Generated: `image: parent_directory/projectname`

Docker Image: `image: username/repoName:tag`

Directory: Path to directory with Dockerfile

Images can be built locally, rather than pulling from an online registry. This is done by removing the value entered in `image:` and entering a path in the `directory:` entry. See the file structure below:

```
my_project/
├── container_a
│   ├── asset_01
```

```
│   ├── asset_02
│   └── Dockerfile
└── gadget.yml
```

In this particular case, the appropriate `directory:` value would be `"container_a"` or `"./container_a"`. The path must be relational. The Dockerfile can also exist in the same directory as the gadget.yml file as illustrated below:

```
my_project/
├── asset_01
├── Dockerfile
└── gadget.yml
```

Here, the `directory:` value would be `"."` or `"./"` (the Unix value for "here").

Format: `directory: projDir/`

Net: Define which network to use or none

By default, all containers have networking enabled and can make outgoing connections. Use the following arguments to choose which network you would like the container to use:

Network	Description
none	No networking in the container.
bridge	Connect the container to the bridge via veth interfaces.
host	Use the host's network stack inside the container.
container: [name-UUID]	Use the network stack or another container, specified via its **name** or **id**
NETWORK	Connects the container to a use created network (using `docker network create` command)

Format: `net: host`

Readonly - Mount the container's root filesystem as read only

Set to false by default.

Command - Run this command at start

Set a command to be executed automatically upon the start of a container. This also overwrites any `CMD` specified in a project's Dockerfile.

Format: `command: ['python', 'myPyScript.py']`

Binds - Mount a directory

Put any directories here that you would like to mount from the device into the container.

Format: `binds: ['/fromHostDir:/toContainerDir']`

Capabilities - Enable Linux capabilities

This is where specific Linux capabilities that bypass kernel permission checks get enabled. Some are enabled by default; all others are defined here depending on what is needed for the container at runtime.

Format: `capabilities: [SYS_RAWIO]`

Devices - Grant access to devices

Define a raw device in Linux to pass to a container. These are different from binds because Linux devices have several different modes of access.

Format: `devices: [/dev/mem]`

General Rules

- When listing items in an array, surround each item with single quotes. For example: `binds: ['/sys:/sys']` `command: ['python', 'myScript.py']`
- By default, Docker containers are not allowed to access any devices and are "unprivileged." To access a device and get privileges to Linux capabilities they need to defined in `capabilities` and `devices`. GadgetOS does not promote nor enable operators to pass the `--privileged` flag to Docker's run command.

Build With Gadget

To get more familiar with using gadget.yml, go through the following examples which pulls from an image on Docker Hub and builds and deploys an image from your development machine. Each example blinks an LED on C.H.I.P. Pro Dev Kit.

Pull Remote Image

1. SET UP

- Make sure to install all the necessary software outlined in Set Up.
- Connect C.H.I.P. Pro Dev Kit to your development machine via a USB cable.

2. CREATE PROJECT DIRECTORY

Fire up Terminal and create a space for your project to live in:

```
mkdir blinkdemo
```

3. INITIALIZE PROJECT

Enter your project directory and use `gadget init` to create a **gadget.yml** template file.

```
cd blinkdemo
gadget init
```

GadgetCLI will tell you that it created a new project:

```
Creating new project:
  in /Users/$USER/Documents/blinkdemo
```

4. ADD SERVICE

To build and run a project a container needs to be defined and configured either under **services** or **onboot** in the gadget.yml.

By default, gadget.yml is created with the example “hello-world” project along with a set of configurations. In this example, you’ll add another a service called gpio to the configuration file. To do this use the `add` command, set it as a **service**, and give it a **name**, such as “gpio”:

```
gadget add service gpio
```

5. EDIT GADGET.YML

In the project directory, open gadget.yml:

```
nano gadget.yml
```

The gadget.yml file now defines two containers: “hello-world” under **onboot** and “gpio” in **services**.

MAKE EDITS TO THE FOLLOWING FIELDS UNDER SERVICES:

- **image**

  ```
  image: nextthingco/gadget-blink-c
  ```

Specify an image to pull from the Docker Hub repo in this field. This example pulls an image from the “gadget-blink-c” repo under the “nextthingco” username.

Note: If an image does not receive a tag when built and pushed to Docker Hub you do not include it, like for this example. However, if an image is tagged when built and you want to pull it from Docker Hub the tag needs to be included. You can see available tags by clicking on the Tags tab in a Docker Hub repo. Sometimes tags are included in the images description on Docker Hub, but not always.

- **binds**

  ```
  binds:['/sys:/sys']
  ```

The finished file will look like this:

```
services:
- name: gpio
uuid: Your-Containers-U-U-ID
image: nextthingco/gadget-blink-c
directory: ""
net: ""
pid: ""
readonly: false
command: []
```

```
binds: ['/sys:/sys']
capabilities:[]
devices:[]
```

Save and close gadget.yml

7. BUILD, DEPLOY, AND START AN IMAGE

To build an image you must be in the same directory as the gadget.yml file. By default the GadgetCLI commands will effect all the containers specified in your gadget.yml file.

To work with one container, as you'll do in this example, specify it by name when running GadgetCLI commands. For example, to **only build the gpio image** run the following command:

```
gadget build gpio
```

When the image is done building, deploy, and start your container. Here's how:

```
gadget deploy gpio
gadget start gpio
```

If the container builds, deploys, and starts successfully you will see the following output messages and **Pin 34, CSID3 will start blinking**:

```
#### build output
  Building:
    'hello-world'
    'gpio'

#### deploy output
  Stopping/deleting older 'hello-world' if applicable
  Deploying: 'hello-world'
    Starting transfer..

  Stopping/deleting older 'gpio' if applicable
  Deploying: 'gpio'
    Starting transfer..

#### start output
  Starting:
    hello-world_58915d6b-2770-4988-8f16-b681f3fc5fc7
      - started
  Starting:
    gpio_582583nb-2770-7658-8f16-f681h6fc2bk8
      - started
```

If any of these processes fail, GadgetCLI will output an error along with suggestions of what may be the issue. Go to the troubleshooting section for more information.

8. STOP AND DELETE CONTAINERS

```
gadget stop gpio
gadget delete gpio
```

Build Image Locally

You will most likely build container images locally as you develop and test your applications. To build an image you need a Dockerfile and supporting files AKA the build's context. These files can either be written from scratch or cloned from an existing repo to your computer.

Built images are then deployed to hardware for testing and further iterations. You can share an image by pushing it to an online registry making it available to be pulled to other devices.

Follow along and build an example written in C that makes use of an GPIO pin on the C.H.I.P. Pro Dev Kit.

1. CREATE PROJECT DIRECTORY

```
mkdir blinkLocal
cd blinkLocal
```

2. CREATE DOCKERFILE

Create a Dockerfile:

```
nano Dockerfile
```

Copy and paste the following content into the new Dockerfile.

```
FROM debian:stretch-slim

WORKDIR .
RUN apt-get -yqq update
RUN apt-get install -y crossbuild-essential-armhf
COPY gpio.c .
RUN arm-linux-gnueabihf-gcc gpio.c -o gpio -static

FROM scratch
COPY --from=0 gpio .
CMD ["./gpio"]
```

For an explanation of what each line of this Dockerfile does, refer to the README file in the example's GitHub repo.

Dockerfiles are capable of holding many kinds of instruction. To learn more about what makes a Dockerfile and it's full capabilities refer to Docker's documentation.

3. CREATE SUPPORTING FILES

Create a .c file named "gpio":

```
nano gpio.c
```

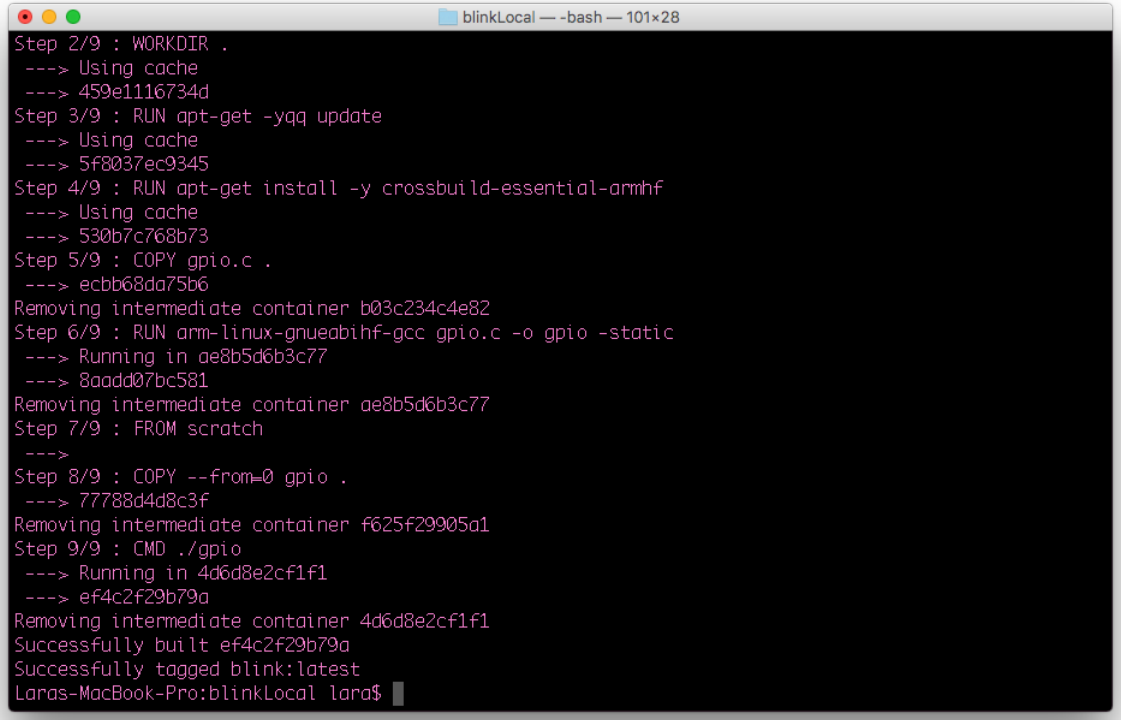
Copy and paste this program into the newly created file.

4. BUILD

While still in the project directory build the image. Use the -t flag to give the image a name, such as "blink".

```
docker build -t blink .
```

Docker will output all the build commands and tell you that it has successfully built.



5. DEPLOY

You are now ready to use GadgetCLI to deploy the image to your hardware.

Step up one directory and create a gadget.yml file:

```
cd ..
gadget init
```

6. ADD SERVICE

Add a new service:

```
gadget add service gpio-c
```

7. EDIT GADGET.YML

```
nano gadget.yml
```

MAKE EDITS TO THE FOLLOWING FIELDS UNDER SERVICES:

- **image**

  ```
  image: "" #leave empty
  ```

  This field is reserved for pulling images from Docker Hub, so for this workflow, it stays empty.

- **directory**

  ```
  directory:"blinkLocal"
  ```

In this field, put the path of the project directory containing the Dockerfile in relation to the gadget.yml file.

- **binds**

  ```
  binds:['/sys:/sys']
  ```

The `binds:` configuration mounts the /sys directory from the device into the container at /sys.

```
services:
- name: gpio-c
uuid: Your-Containers-U-U-ID
image: ""
directory: "blinkLocal"
net: ""
pid: ""
readonly: false
command: []
binds: ['/sys:/sys']
capabilities:[]
devices:[]
```

Save and close gadget.yml

8. BUILD, DEPLOY, AND START CONTAINER

```
gadget build gpio-c
gadget deploy gpio-c
gadget start gpio-c
```

Pin 34, CSID3 will start blinking!

9. STOP AND DELETE

When ready, stop the container and clean up:

```
gadget stop gpio-c
gadget delete gpio-c
```

10. SHELL INTO GADGETOS

With GadgetCLI you have the ability to shell into GadgetOS at any time:

```
gadget shell
```

Once inside GadgetOS, use Docker commands to see images, running containers and to check NAND storage availability.

```
docker images #existing images
docker ps #running containers
df -h #check NAND availability
```

To remove forgotten docker images from the host device:

```
docker rmi -f [image ID] #remove images
```

Exit shell:

```
exit
```

Share Image

Gadget makes use of the growing community of official and community supported Docker images. Images that are pushed to Docker Hub can be set to private or public. If public, they can be shared, pulled and used by coworkers, friends and the general public.

Share Source Files

For collaborators to deploy and run your containers, they will need to know the configurations that go into gadget.yml. We recommend sharing these in a GitHub repository.

1. CREATE REGISTRY AND REPO

For this process you will need:

- a Docker Hub registry to push and pull your built images to.
- a GitHub repository to hold all source files.

GitLab has their own container registry and ways of working with Docker.

2. LOGIN

Log into the Docker account you created. Enter your username and password when prompted.

```
docker login
```

3. TAG

Tag the image with a version number (optional) and create a repo for it. If an image is not tagged, it will automatically be tagged with the default of “latest.”

```
docker tag blink YourUserName/blink:v1
```

This command tags the image you created called blink with “v1”, specified it’s location within YourUserName, and in the repository “blink”.

4. PUSH

Push the image to your Docker Hub registry:

```
docker push YourUserName/blink:v1
```

5. PULL

After posting to your registry, the blink image is ready to share and pull to your device. From here, the workflow is the same as the one outlined in the Pull Image section. Visit the newly created Docker repo and fill in the description and add a link to your GitHub source files.

Example Images

Start a project with one of our example images. You can either pull an example from our official NTC Docker Hub or `git clone` the GitHub repository that includes all the example source files to your development computer. All Dockerfiles and supporting files are found here.

Docker Hub Images

- Web Server - Use Nginx to host web content from your device. Currently supported on MacOS and Windows.
- Blink in C - A gnu89 compatible C example of GPIO usage, easily translatable to C++. Cross compile C applications easily in a Dockerfile.
- Blink in Go - Written in Golang.
- Blink in Rust - Written in Rustlang.
- Blink in Node - Javascript example running on top of Node.
- Blink in Python - Python GPIO example using the community-run library CHIP_IO. Currently supported on MacOS and Windows.

Run an Example

- Follow the steps under Pull Remote Image.
- For the gadget.yml configurations, download and use the gadget.yml file found in the project directory from the source file links below.

Source files:

- Web Server
- Blink in C
- Blink in Go
- Blink in Rust
- Blink in Node
- Blink in Python
- Blink with Multiple Containers

Edit Examples

- Clone all the examples to your computer:

```
git clone https://github.com/NextThingCo/Gadget-Docker-Examples.git
```

- Edit the source files in a chosen project directory.
- Build and deploy the project from your development machine. Each project directory has a gadget.yml file that contains the needed configurations for that specific container.

> To successfully build an image in the project directory the gadget.yml config file needs to be removed from it first.

GadgetCLI Commands

To see all the available GadgetCLI commands and options:

```
gadget help
```

```
Options:

-C <path> Run in directory (default ".") #gadget -C <path> <command>
-v  Verbose execution

Commands:

init        Initialize gadget project
add         Add new container to config
build       Build container[s]
deploy      Deploy container[s]
start       Run container[s]
stop        Stop running container[s]
status      Fetch status of container[s]
delete      Remove container[s] from gadget
shell       Connect to remote device running GadgetOS
logs        Fetch logs(stdout) of container[s]
version     Print version information
help        Print this message
```

- Containers can be layered in the gadget.yml configuration file by adding them as services or at onboot. For optimization, one container can be targeted by adding its name after a `gadget` command. For example:

```
gadget build gpio
```

- A `gadget` command can be issued from a different directory. For example to build an project in a directory called “blinkdemo” from its parent directory:

```
gadget -C blinkdemo/ build
```

Docker Reference

Read up on and polish your Docker skills with these references.

- Dockerfile best practices
- Docker Run resources

Basic Docker Commands

- Docker ps - list containers
- Docker pull - pull an image from registry
- Docker images - list images
- Docker login - log in to a Docker registry
- Docker rmi - remove one or more images
- Docker tag - Create a tag TARGET_IMAGE that refers to SOURCE_IMAGE

Troubleshooting

Unable to `gadget deploy` image to board

PRIVATE KEY LOGIN ERROR

```
W:   Private key login failed, trying default key
E:   Default key login also failed
W:   Is the gadget connected and powered on?
W:   Was the gadget first used on another computer/account?
E:  Failed to connect to Gadget
```

- Directly after flashing GadgetOS to your C.H.I.P. Pro Dev Kit the board needs to reboot. Unplug from USB port and plug back in or power cycle using the On/Off button.
- As a security precaution, GadgetCLI generates a unique set of login credentials for each computer. This means that if you have deployed a project from one computer, you will not be able to deploy from another computer unless you transfer the authorized keys found in the host computer .ssh/ directory.

  File names:

  - gadget_default_rsa
  - gadget_rsa
  - gadget_rsa.pub

  File Locations:

  Linux: /home/$USER/.ssh

  Windows: C:/Users/$USER/.ssh

  Mac OSX: /Users/$USER/.ssh * A device's authorized keys can also be reset by re-flashing.

TRANSFERRING HAS SLOWED TO A CRAWL

Your NAND is most likely full. Power down your board and re-flash with GadgetOS.

To prevent this, connect to the host device with `gadget shell` and use `df-h` to check NAND availability. Docker image sizes can also be checked on the host with the `docker images` command.

Make sure to delete previous images as soon as you are done with them.

Unable to `gadget build` image

FAILED TO BUILD/VALID IMAGE ERROR

```
E:  Error response from daemon: repository jelly/spike not found: does not exist or no pull access
E:  Failed to build 'spike'
W:  Are you sure '%s' is a valid image [and tag]?
W:  Is the docker daemon installed and running?
```

The entry next to `image:` is not a valid Docker Hub username, repo or tag. Double check the entry.

If building an image from a local Dockerfile, leave this field blank and put the project's path in "directory."

UNKNOWN FLAG/FAILED TO BUILD ERROR

```
I:  Running in directory:
I:    ~/projectName
I:  Building:
I:    'projectName'
E:  Unknown flag: from
E:  Failed to build 'projectName'
W:  Is the docker daemon installed and running?
```

Your version of Docker may be out of date. Docker version 17.06 or greater is required. To check which version of Docker you have run the command `docker -v`.

Unable to `Docker build` an `arm32v7/*` image

"EXEC FORMAT ERROR"

```
standard_init_linux.go:187: exec user process caused "exec format error"
```

The latest versions of Docker for Windows and Docker for Mac can build non-native architecture containers which is not the case for some distributions of Linux. Additional files need to be downloaded and packages installed to enable the ability to build `arm32v7/*` Docker images. To obtain the necessary files, follow the instructions in the Setup for Linux section.

```
standard_init_linux.go:187: exec user process caused "no such file or directory"
```

If you get the error above while building an `arm32v7/*` image, you may have overlooked the second step to the Setup for Linux process. Or, the files did not copy over successfully. Head to the Setup for Linux section to complete the step of creating a directory `binfmt.d`, copying files over and restarting `systemd-binfmt.service`.

UNABLE TO `RESTART SYSTEMD-BINFMT.SERVICE`

```
Job for systemd-binfmt.service failed because the control process exited with error code.
See "systemctl status systemd-binfmt.service" and "journalctl -xe" for details.
```

Download the `binfmt-support` and `qemu-user-static` packages listed in the Setup for Linux section and reboot.