Build IOx Apps with Vagrant and Virtualbox/VMWare

Contents

Introduction

This document describes how to build IOx applications using Vagrant and Virtualbox and deploy them in IOx local manager GUI.

Prerequisites

Windows/ MAC Intel/ Linux

- Git
- Vagrant
- Virtualbox

MAC ARM Based - M1/M2/M3

- Git
- Vagrant
- VMWare Fusion
- vagrant-vmware-desktop plugin

To download:

- Vagrant
- VirtualBox

Procedure to Set Up Build Environment Using Vagrant

Summary of Actions

- The **vagrantfile** configuration sets up a VM environment based on its host machine architecture.
- It configures the VM to use either VMware Fusion or VirtualBox, depending on the architecture

- It provisions the VM with necessary software and tools, including QEMU (Quick EMUlator) , Docker and **ioxclient.**
- Configruation automatically builds a sample iperf application for amd64 target Cisco platform devices.

Step 1. Clone the Github repository in your local system:

```
git clone https://github.com/suryasundarraj/cisco-iox-app-build.git
```

Alternatively, copy and paste the contents of the configuration enclosure into "**Vagrantfile**". This creates a file with the name "Vagrantfile" in the local system:

```
# -*- mode: ruby -*-
# vi: set ft=ruby :

# All Vagrant configuration is done below. The "2" in Vagrant.configure
# configures the configuration version (we support older styles for
# backwards compatibility). Please don't change it unless you know what
# you're doing.
Vagrant.configure('2') do |config|
  arch = `arch`.strip()
  if arch == 'arm64'
    puts "This appears to be an ARM64 machine! ..."
    config.vm.box = 'gyptazy/ubuntu22.04-arm64'
    config.vm.boot_timeout = 600
    config.vm.provider "vmware_fusion" do |vf|
      #vf.gui = true
      vf.memory = "8192"
      vf.cpus = "4"
    end
    config.vm.define :ioxappbuild
  else
    puts "Assuming this to be an Intel x86 machine! ..."
    config.vm.box = "bento/ubuntu-22.04"
    config.vm.network "public_network", bridge: "ens192"
    config.vm.boot_timeout = 600
    config.vm.provider "virtualbox" do |vb|
      #vb.gui = true
      vb.memory = "8192"
      vb.cpus = "4"
    end
    config.vm.define :ioxappbuild
  end

  config.vm.provision "shell", inline: <<-SHELL
    #!/bin/bash
    # apt-cache madison docker-ce
    export VER="5:24.0.9-1~ubuntu.22.04~jammy"
    echo "!!! installing dependencies and packages !!!"
    apt-get update
    apt-get install -y ca-certificates curl unzip git pcregrep
    install -m 0755 -d /etc/apt/keyrings
    curl -fsSL https://download.docker.com/linux/ubuntu/gpg -o /etc/apt/keyrings/docker.asc
    chmod a+r /etc/apt/keyrings/docker.asc
    echo "deb [arch=$(dpkg --print-architecture) signed-by=/etc/apt/keyrings/docker.asc] https://downlo
    apt-get update
    apt-get install -y qemu binfmt-support qemu-user-static
    apt-get install -y docker-ce=$VER docker-ce-cli=$VER docker-ce-rootless-extras=$VER containerd.io d
    # apt-get install -y docker.io docker-compose docker-buildx
    usermod -aG docker vagrant
    echo "!!! generating .ioxclientcfg.yaml file !!!"
    echo 'global:' > /home/vagrant/.ioxclientcfg.yaml
    echo '  version: "1.0"' >> /home/vagrant/.ioxclientcfg.yaml
    echo '  active: default' >> /home/vagrant/.ioxclientcfg.yaml
    echo '  debug: false' >> /home/vagrant/.ioxclientcfg.yaml
    echo '  fogportalprofile:' >> /home/vagrant/.ioxclientcfg.yaml
    echo '    fogpip: ""' >> /home/vagrant/.ioxclientcfg.yaml
    echo '    fogpport: ""' >> /home/vagrant/.ioxclientcfg.yaml
    echo '    fogpapiprefix: ""' >> /home/vagrant/.ioxclientcfg.yaml
    echo '    fogpurlscheme: ""' >> /home/vagrant/.ioxclientcfg.yaml
    echo '  dockerconfig:' >> /home/vagrant/.ioxclientcfg.yaml
    echo '    server_uri: unix:///var/run/docker.sock' >> /home/vagrant/.ioxclientcfg.yaml
    echo '    api_version: "1.22"' >> /home/vagrant/.ioxclientcfg.yaml
    echo 'author:' >> /home/vagrant/.ioxclientcfg.yaml
    echo '  name: |' >> /home/vagrant/.ioxclientcfg.yaml
    echo '    Home' >> /home/vagrant/.ioxclientcfg.yaml
    echo '  link: localhost' >> /home/vagrant/.ioxclientcfg.yaml
    echo 'profiles: {default: {host_ip: 127.0.0.1, host_port: 8443, auth_keys: cm9vdDpyb290,' >> /home/
    echo '    auth_token: "", local_repo: /software/downloads, api_prefix: /iox/api/v2/hosting/,' >> /h
    echo '    url_scheme: https, ssh_port: 2222, rsa_key: "", certificate: "", cpu_architecture: "",' >
    echo '    middleware: {mw_ip: "", mw_port: "", mw_baseuri: "", mw_urlscheme: "", mw_access_token: "
    echo '    conn_timeout: 1000, client_auth: "no", client_cert: "", client_key: ""}}' >> /home/vagran
    cp /home/vagrant/.ioxclientcfg.yaml /root/.ioxclientcfg.yaml
    chown vagrant:vagrant /home/vagrant/.ioxclientcfg.yaml
    arch=$(uname -m)
    if [[ $arch == x86_64 ]]; then
      # download page https://developer.cisco.com/docs/iox/iox-resource-downloads/
      echo "!!! downloading and extracting ioxclient for x86_64 architecture !!!"
      curl -O https://pubhub.devnetcloud.com/media/iox/docs/artifacts/ioxclient/ioxclient-v1.17.0.0/iox
      tar -xvf /home/vagrant/ioxclient_1.17.0.0_linux_amd64.tar.gz
      cp /home/vagrant/ioxclient_1.17.0.0_linux_amd64/ioxclient /usr/local/bin/ioxclient
      rm -rv /home/vagrant/ioxclient_1.17.0.0_linux_amd64
    elif  [[ $arch = aarch64 ]]; then
      # download page https://developer.cisco.com/docs/iox/iox-resource-downloads/
      echo "!!! downloading and extracting ioxclient for arm64 architecture !!!"
      curl -O https://pubhub.devnetcloud.com/media/iox/docs/artifacts/ioxclient/ioxclient-v1.17.0.0/iox
      tar -xvf /home/vagrant/ioxclient_1.17.0.0_linux_arm64.tar.gz
      cp /home/vagrant/ioxclient_1.17.0.0_linux_arm64/ioxclient /usr/local/bin/ioxclient
      rm -rv /home/vagrant/ioxclient_1.17.0.0_linux_arm64
    fi
    chown vagrant:vagrant /usr/local/bin/ioxclient
    echo "!!! pulling and packaging the app for x86_64 architecture !!!"
    docker pull --platform=linux/amd64 mlabbe/iperf3
    ioxclient docker package mlabbe/iperf3 .
    cp package.tar /vagrant/iperf3_amd64-$(echo $VER | pcregrep -o1 ':([0-9.-]+)~').tar
  SHELL
end
```

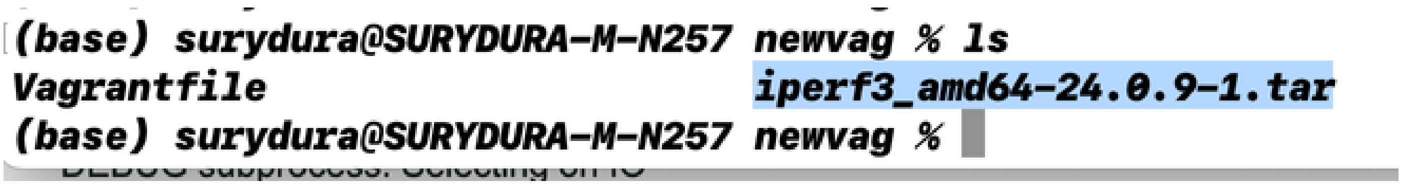
Step 2. Ensure that the **"export VER="5:24.0.9-1~ubuntu.22.04~jammy"** line is uncommented and all other export statement are commented. This corresponds to the Docker Engine version you wish to install in this Vagrant environment:

```
cisco@cisco-virtual-machine:~/Desktop/ioxappbuild$ cat Vagrantfile | grep 'export' | grep -v '#'
```

```
export VER="5:24.0.9-1~ubuntu.22.04~jammy"
```

Step 3. Start the Vagrant environment with the **vagrant up** command in the directory where the Vagrantfile resides and observe a successful build of the iperf IOx application for amd64 tar file:

```
vagrant up
```



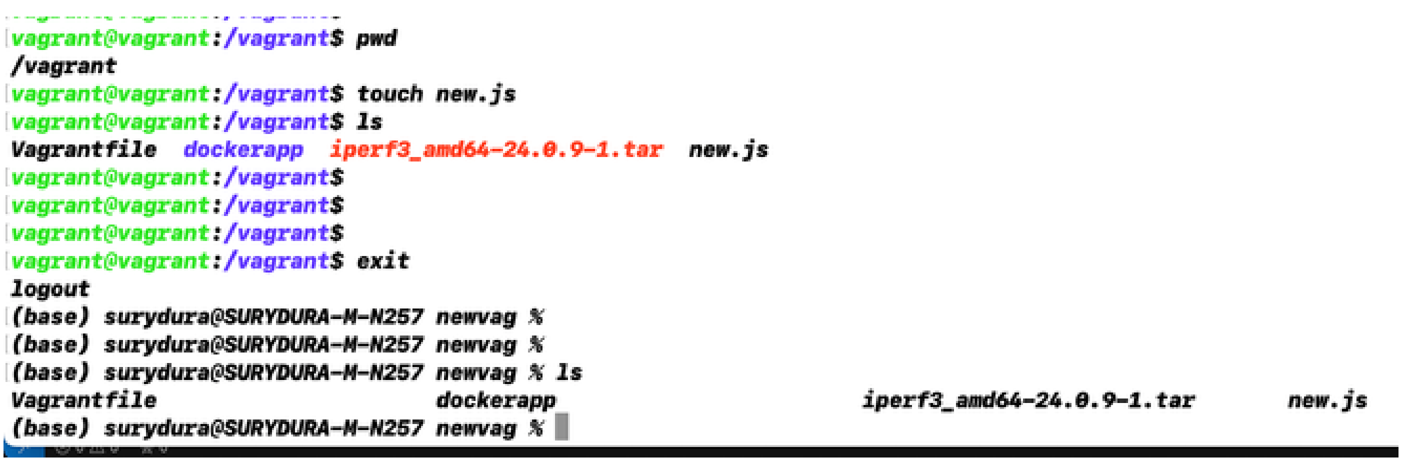
```
(base) surydura@SURYDURA-M-N257 newvag % ls
Vagrantfile                    iperf3_amd64-24.0.9-1.tar
(base) surydura@SURYDURA-M-N257 newvag %
```

Procedure to Build a Custom IOx Application

This section describes, how to build a custom IOx application using the vagrant environment.

Note: The directory "/vagrant" in the VM and the directory which contains the "Vagrantfile" in the host system are in sync.

As shown in the image, the new.js file is created inside the VM and is also accessible on the host system:



```
vagrant@vagrant:/vagrant$ pwd
/vagrant
vagrant@vagrant:/vagrant$ touch new.js
vagrant@vagrant:/vagrant$ ls
Vagrantfile  dockerapp  iperf3_amd64-24.0.9-1.tar  new.js
vagrant@vagrant:/vagrant$
vagrant@vagrant:/vagrant$
vagrant@vagrant:/vagrant$
vagrant@vagrant:/vagrant$ exit
logout
(base) surydura@SURYDURA-M-N257 newvag %
(base) surydura@SURYDURA-M-N257 newvag %
(base) surydura@SURYDURA-M-N257 newvag % ls
Vagrantfile                        dockerapp                        iperf3_amd64-24.0.9-1.tar        new.js
(base) surydura@SURYDURA-M-N257 newvag %
```

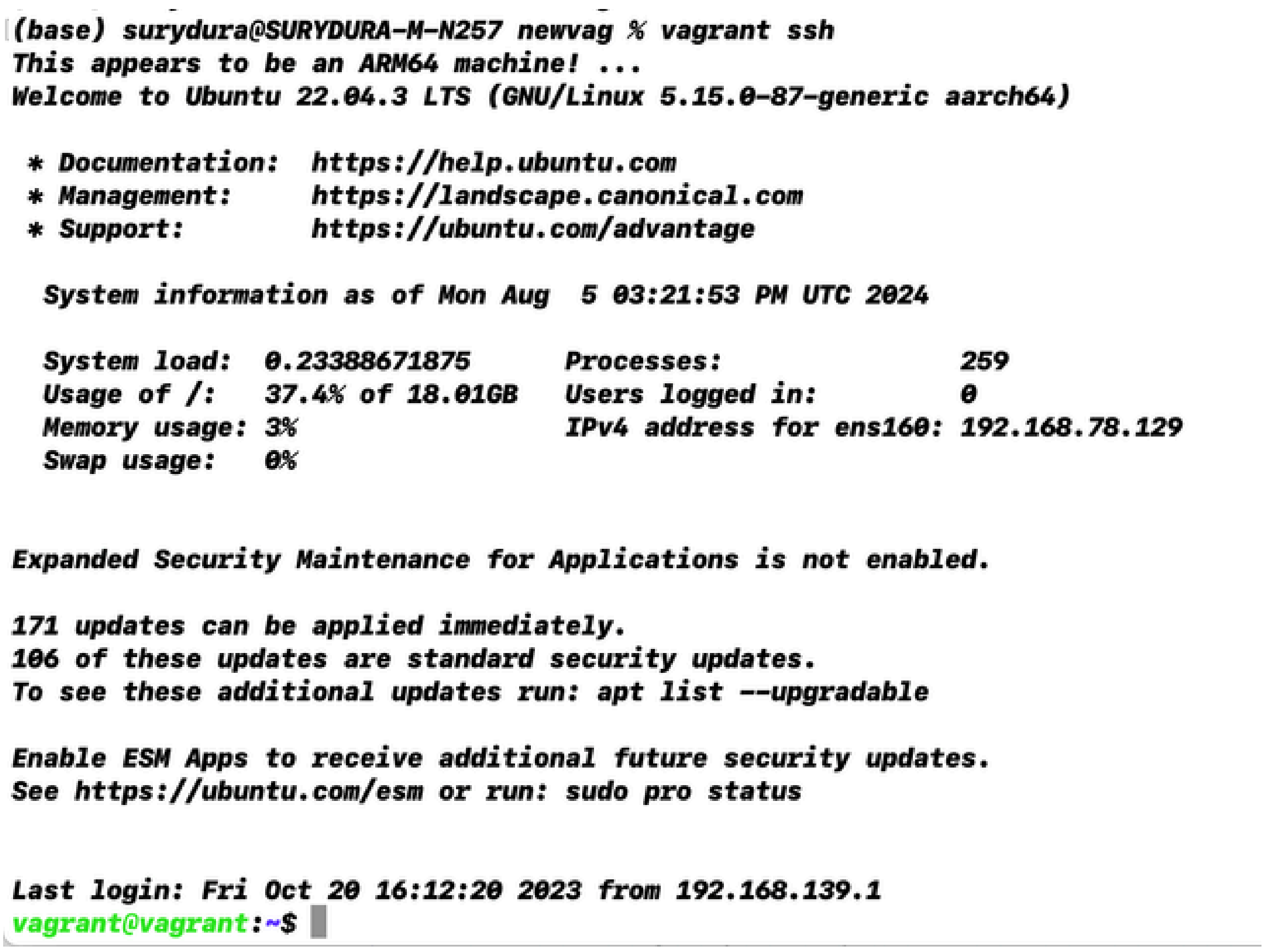
Step 1. Clone a sample application to the same folder where "**Vagrantfile**" resides. On this example "**iox-**

multiarch-nginx-nyancat-sample" application is used:

```
git clone https://github.com/etychon/iox-multiarch-nginx-nyancat-sample.git
```

Step 2. SSH into the vagrant machine:

```
vagrant ssh
```

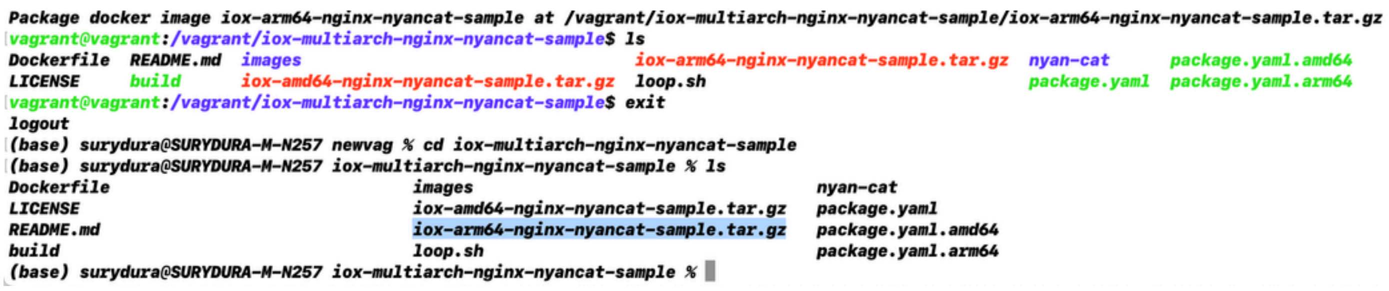


```
(base) surydura@SURYDURA-M-N257 newvag % vagrant ssh
This appears to be an ARM64 machine! ...
Welcome to Ubuntu 22.04.3 LTS (GNU/Linux 5.15.0-87-generic aarch64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  System information as of Mon Aug  5 03:21:53 PM UTC 2024

  System load:  0.23388671875      Processes:             259
  Usage of /:   37.4% of 18.01GB   Users logged in:       0
  Memory usage: 3%                 IPv4 address for ens160: 192.168.78.129
  Swap usage:   0%


Expanded Security Maintenance for Applications is not enabled.

171 updates can be applied immediately.
106 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status


Last login: Fri Oct 20 16:12:20 2023 from 192.168.139.1
vagrant@vagrant:~$ 
```

Step 3. Build the application:

```
cd /vagrant/iox-multiarch-nginx-nyancat-sample/
chmod +x build
sh ./build
```

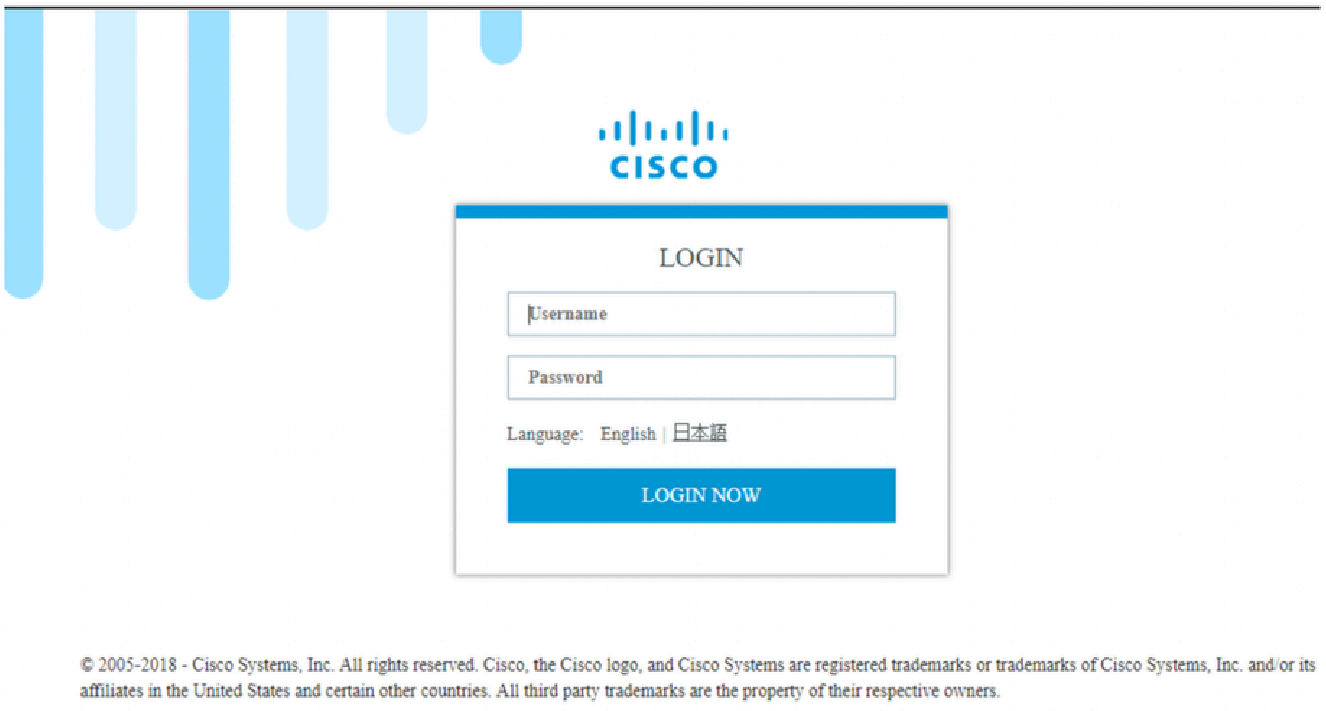
After the build process is completed, you now have two IOx applications ready for deployment (**"iox-amd64-nginx-nyancat-sample.tar.gz" for amd64 and "iox-arm64-nginx-nyancat-sample.tar.gz"** for target platforms):



```
Package docker image iox-arm64-nginx-nyancat-sample at /vagrant/iox-multiarch-nginx-nyancat-sample/iox-arm64-nginx-nyancat-sample.tar.gz
vagrant@vagrant:/vagrant/iox-multiarch-nginx-nyancat-sample$ ls
Dockerfile  README.md  images                               iox-arm64-nginx-nyancat-sample.tar.gz  nyan-cat      package.yaml.amd64
LICENSE     build      iox-amd64-nginx-nyancat-sample.tar.gz  loop.sh                                package.yaml  package.yaml.arm64
vagrant@vagrant:/vagrant/iox-multiarch-nginx-nyancat-sample$ exit
logout
(base) surydura@SURYDURA-M-N257 newvag % cd iox-multiarch-nginx-nyancat-sample
(base) surydura@SURYDURA-M-N257 iox-multiarch-nginx-nyancat-sample % ls
Dockerfile                              images                                  nyan-cat
LICENSE                                 iox-amd64-nginx-nyancat-sample.tar.gz   package.yaml
README.md                               iox-arm64-nginx-nyancat-sample.tar.gz   package.yaml.amd64
build                                   loop.sh                                 package.yaml.arm64
(base) surydura@SURYDURA-M-N257 iox-multiarch-nginx-nyancat-sample %
```

Deploy the IOx Application

Step 1. Access the IR1101 with the use of the web interface:



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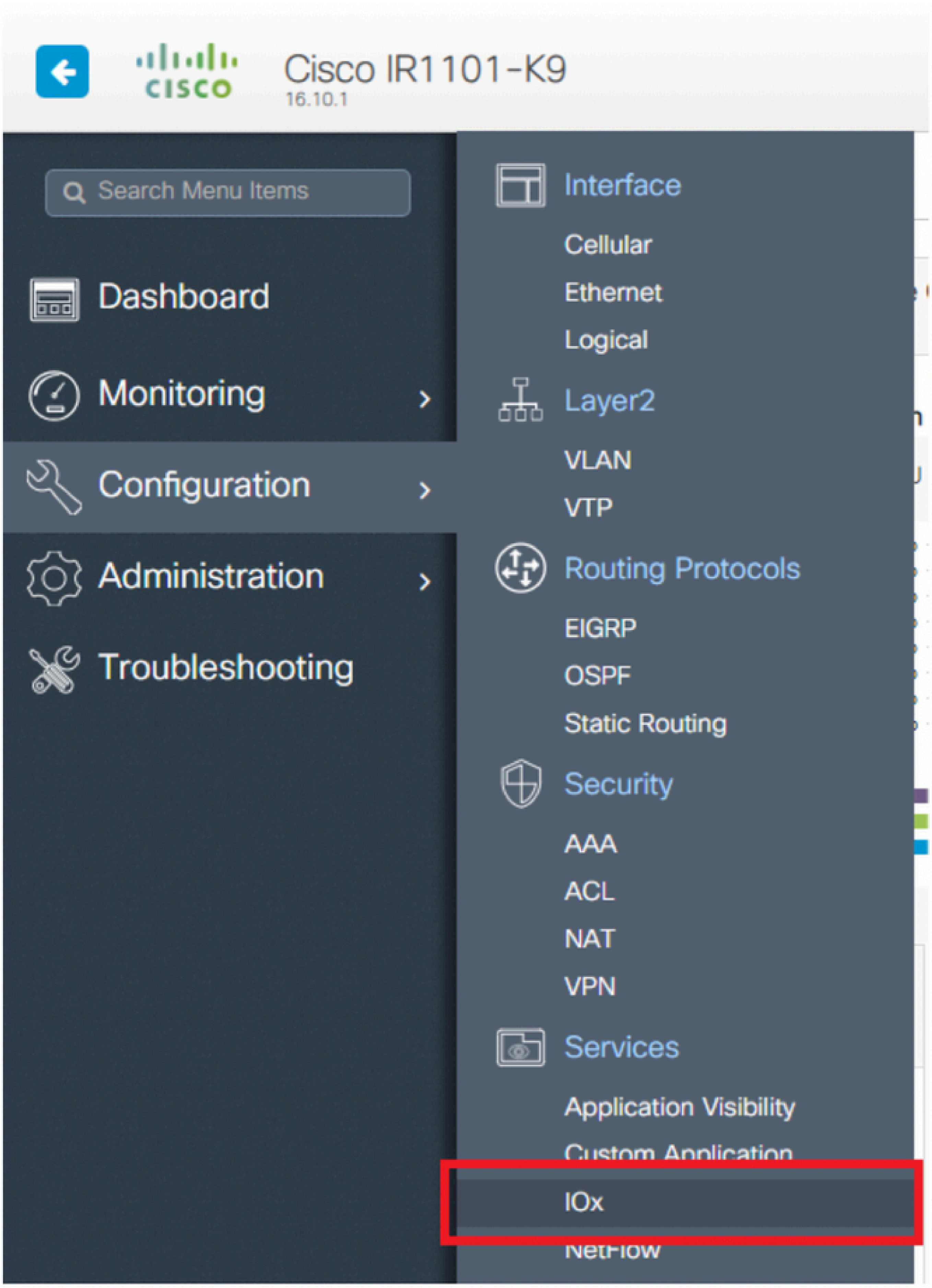
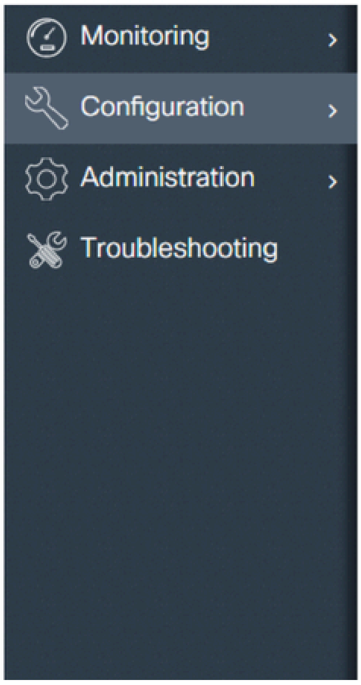
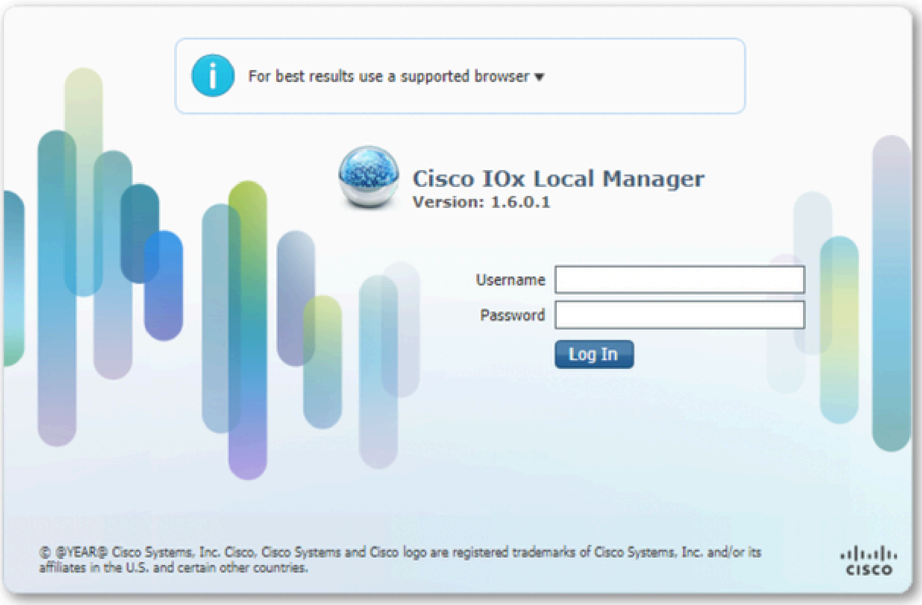
Step 2. Use the privilege 15 account:



Step 3. In the IOx Local Manager login, use the same account to continue as shown in the image:




For best results use a supported browser
Cisco IOx Local Manager
Version: 1.6.0.1
Username
Password
Log In
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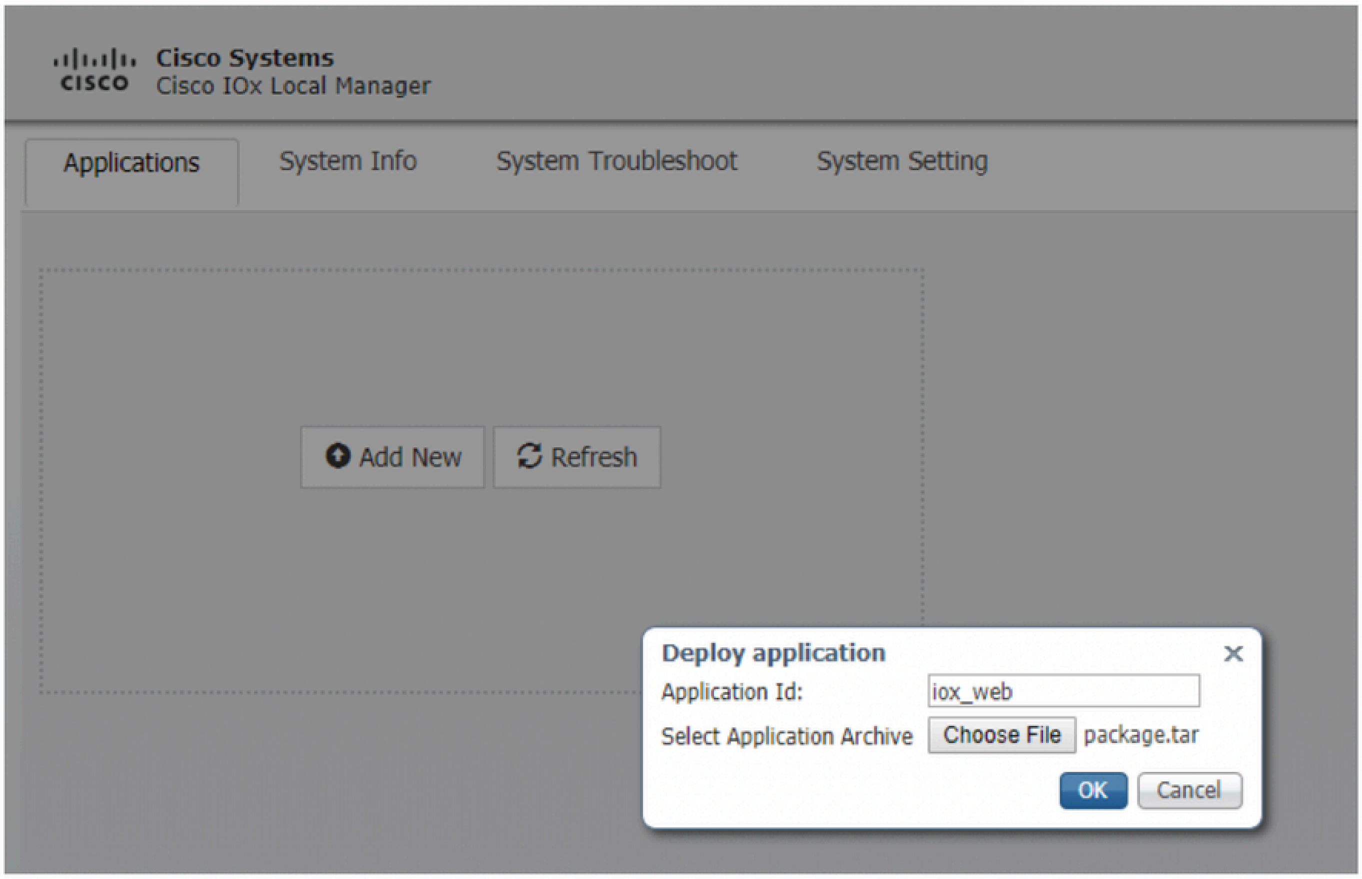
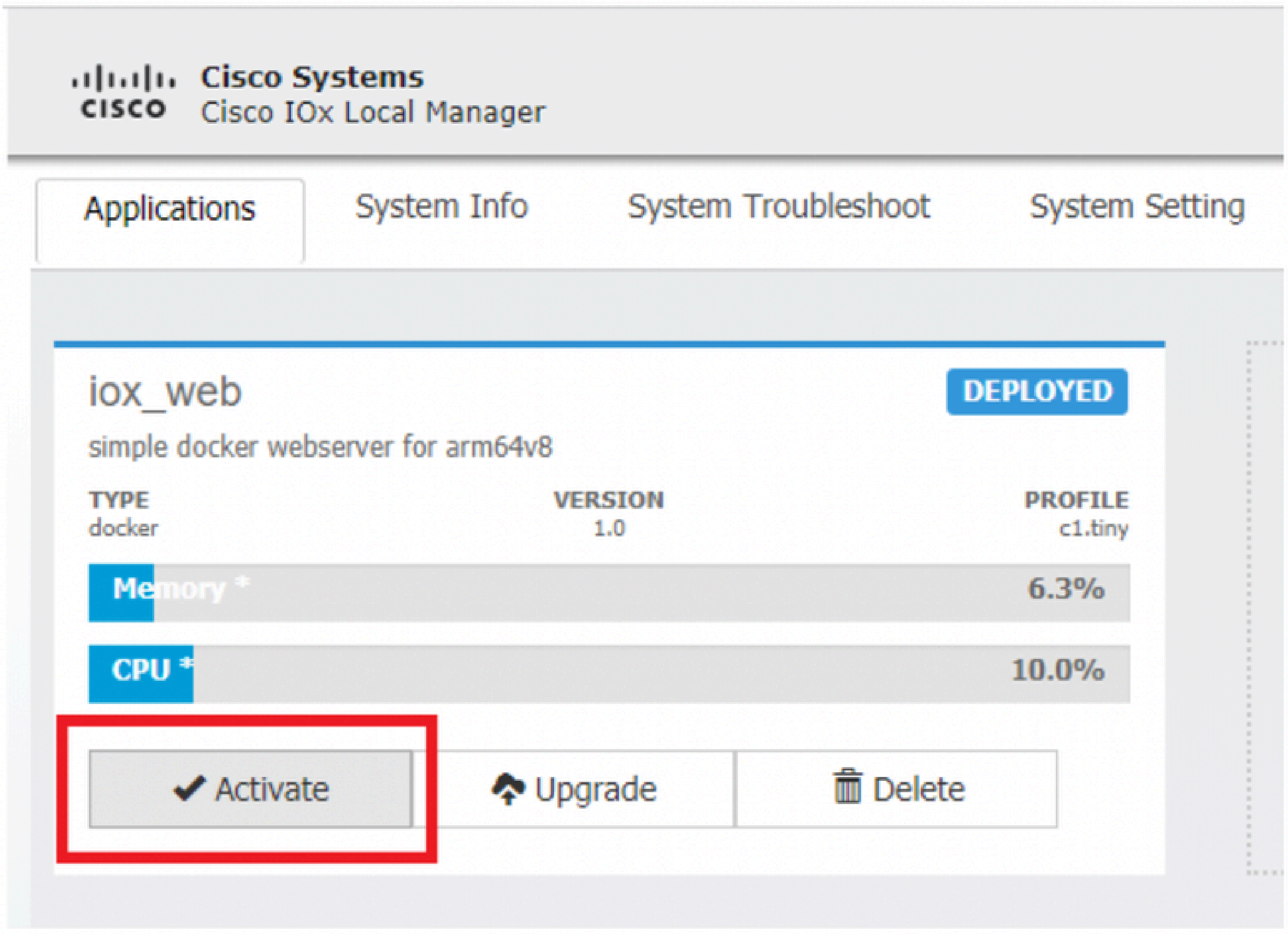
Step 4. Click **Add New**, select a name for the IOx application, and choose the package.tar which was built in Step 3 of the **Procedure to Set Up Build Environment Using Vagrant** section, as shown in the image:



Application Id: iox_web
Select Application Archive package.tar

Step 5. Once the package is uploaded, activate it as shown in the image:



iox_web

DEPLOYED

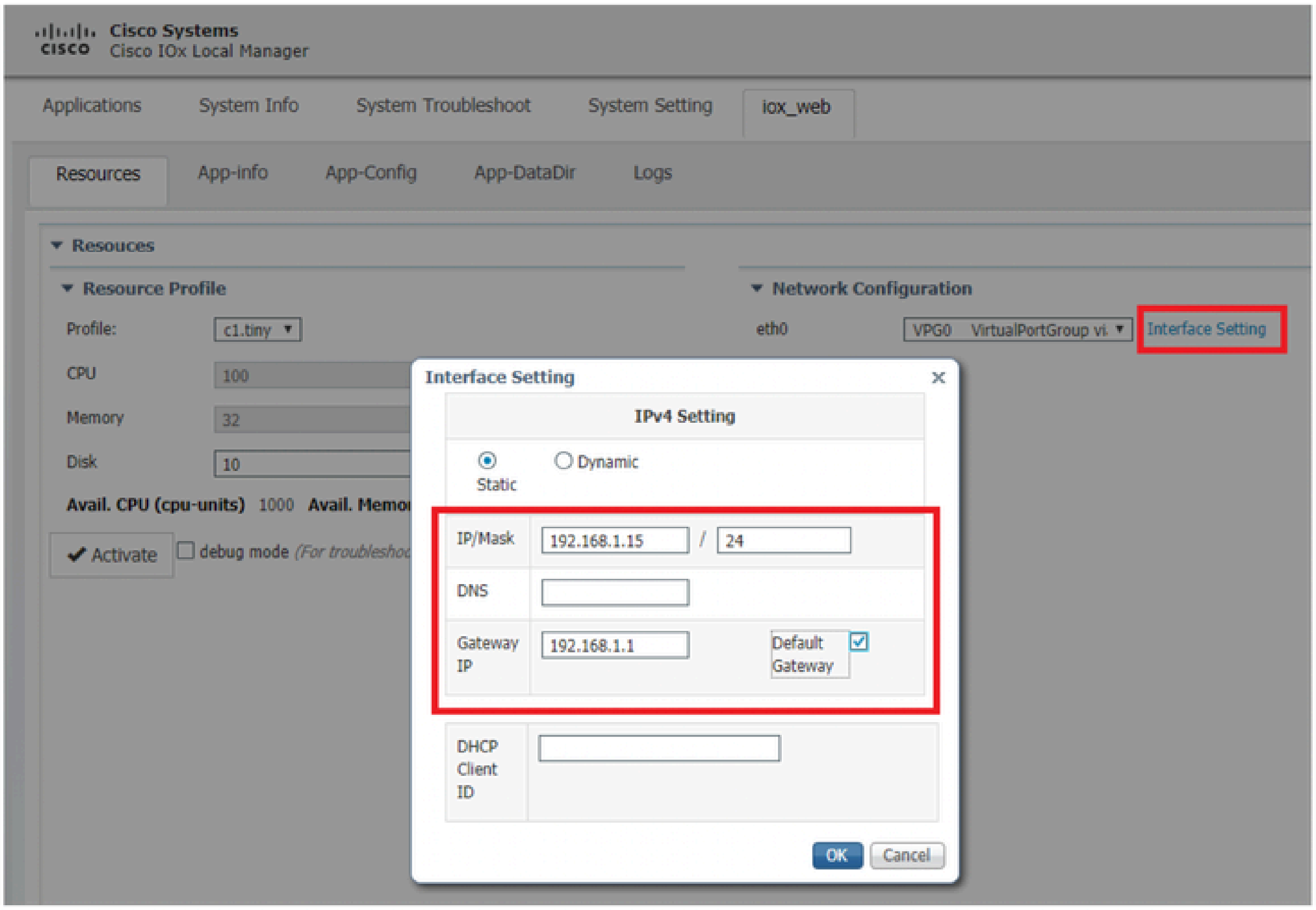
simple docker webserver for arm64v8

TYPE docker
VERSION 1.0
PROFILE c1.tiny

Memory * 6.3%

CPU * 10.0%

Step 6. In the **Resources** tab, open the interface setting in order to specify the fixed IP that you want to assign to the app as shown in the image:


Interface Setting

IPv4 Setting

[✓ Static] Dynamic

IP/Mask: 192.168.1.15 / 24

DNS:

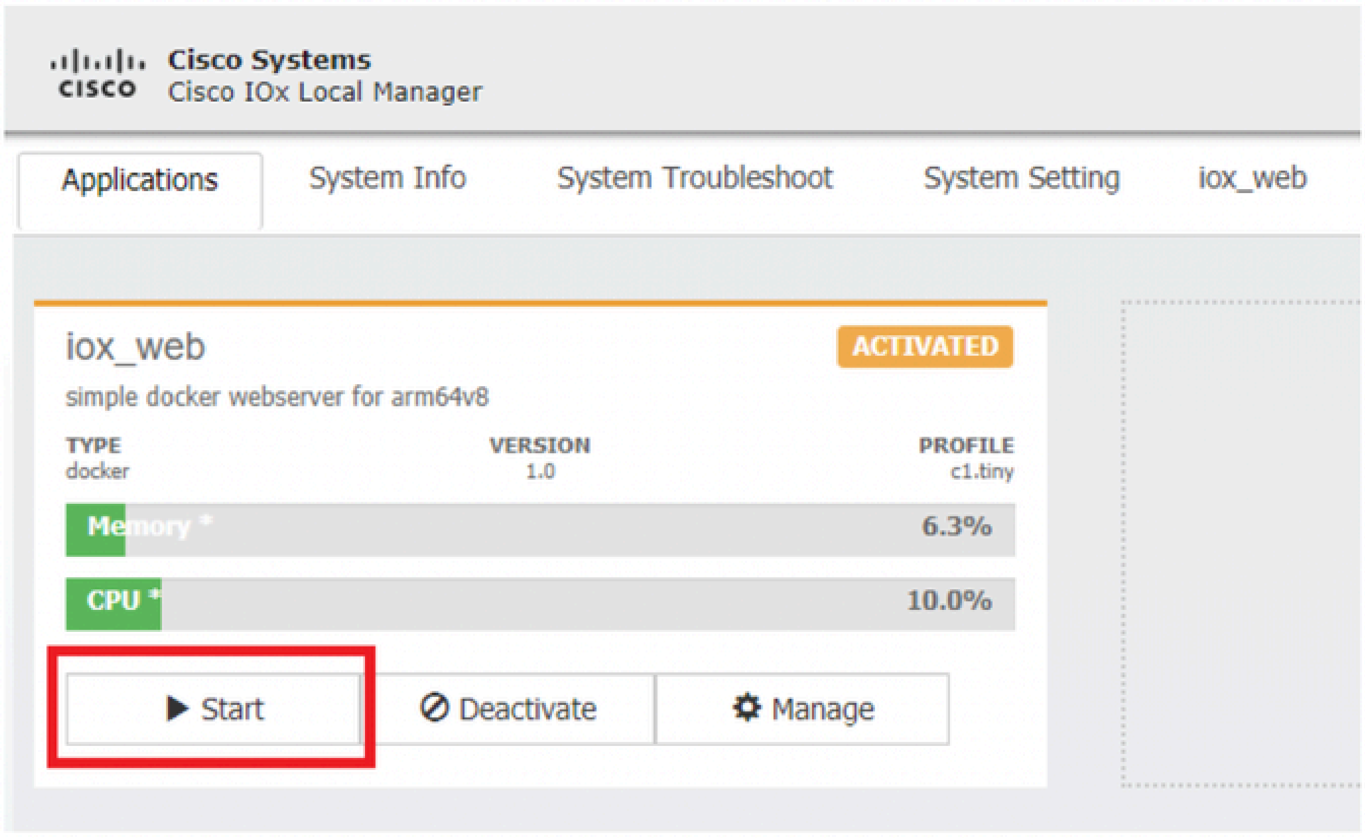
Gateway IP: 192.168.1.1 — Default Gateway ✓

DHCP Client ID:

Profile: c1.tiny
CPU: 100
Memory: 32
Disk: 10

eth0: VPG0 VirtualPortGroup vi

Step 7. Click **OK**, then **Activate**. Once the action completes, navigate back to the main Local Manager page (**Applications** button on the top menu), then start the application as shown in the image:


iox_web — ACTIVATED

simple docker webserver for arm64v8

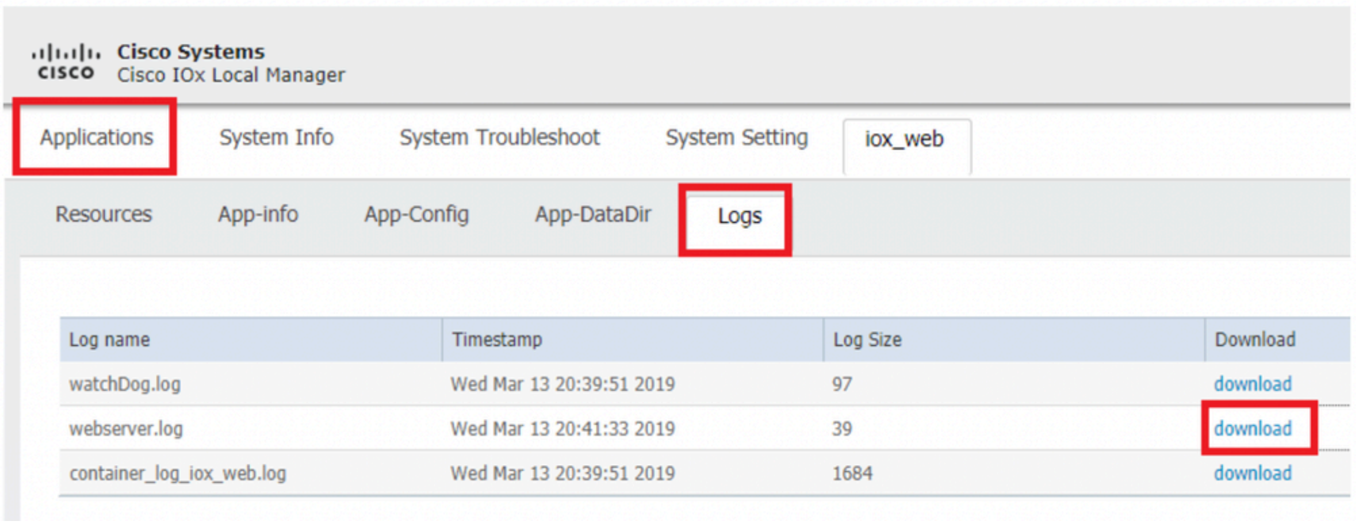
TYPE: docker
VERSION: 1.0
PROFILE: c1.tiny

Memory *: 6.3%
CPU *: 10.0%

After you go through these steps, your application is ready to be running.

Troubleshoot

In order to troubleshoot your configuration, check the log file which you create in the Python script using a local manager. Navigate to **Applications**, click **Manage** on the **iox_web** application, then select the **Logs** tab as shown in the image:



Log name	Timestamp	Log Size	Download
watchDog.log	Wed Mar 13 20:39:51 2019	97	download
webserver.log	Wed Mar 13 20:41:33 2019	39	download
container_log_iox_web.log	Wed Mar 13 20:39:51 2019	1684	download