



Hewlett Packard
Enterprise

BEST PRACTICES FOR OPERATING AND MAINTAINING SLINGSHOT FABRICS

Forest Godfrey and Ryan Tidwell
Assisted by Jesse Treger

May 5, 2025



FORMAT OF THE TUTORIAL

- Review requirements
- Get the tutorial up and running on your laptops!
- Brief Overview of Orchestrated Maintenance
- Tutorials
 - Start an emulated fabric
 - Demonstrate the functionality of “Not Present”
 - Incremental Buildout With Zero Downtime
 - Use of Custom Policies
 - Port Control
 - Basic Maintenance
- With any extra time, Q&A
- We will break for coffee between 10am and 10:30am



REQUIREMENTS TO GET THIS DEMO RUNNING

- Linux! VM or Baremetal
 - This will not work on a Mac or Windows, unless you are in a Linux VM
 - It is going to be assumed that you are comfortable working in the Linux command line
 - If you are not, find a (new) friend now who is!
- System Requirements
 - About 8GB of free disk space in the VM
 - Probably actually only about half that, but let's be safe
 - 8GB of RAM
 - 6 to 8 hyperthreads worth of CPUs in your Linux VM (or bare metal)
- Some container technology
 - Docker, Podman and Nerdctl should work out of the box
 - Anything else will need adjustment; you are going to have to do that yourself
 - For licensing reasons, the examples will use “nerdctl”
- Equivalent of “docker compose” on your technology
 - Has been tested with current and original “docker-compose” shell script
- A USB A port
 - I have a USB C -> A if anyone needs to borrow it



ARCHITECTURE OF WHAT YOU'RE LOADING

- Uses docker-compose to bring up a bunch of containers
- Production 2.3.0 Build of the Containerized Fabric Manager and CLI
 - These containers are supported as a product and were released with 2.3.0
 - In production, the CLI container installs a bunch of commands on the host that “docker exec” into the CLI container
 - In order to not “contaminate” your Linux VM, that step will not be done here
 - To run FM commands, the following command starts a shell inside the CLI container:

```
- docker exec -it slingshot-cli bash
```
- For the purposes of this tutorial, the Slingshot Certificate Manager is not being used
 - Consumes more resources & time to provision switches in this constrained environment
 - Would be running if this were a real containerized FM installation
- Emulated Rosetta Switch
 - Includes some ASIC emulation as well
 - This container is not released as a product and will not be supported beyond this tutorial in any way
- Hypothetically, this demo could be attached to a live system but that would require a lot of hardware, so we're going to use your laptops instead!



LOAD THE DEMO

- Eventually, you're going to want at least two shell/terminal windows
- First, copy the contents of the provided USB drive to your system
- Copy **cug-2025-slingshot-om-tutorial.tar.gz** to your Linux VM and unpack it in a directory of your choosing
 - sha256sum: `4e36475fa6e352243db41eec6e7ddcac353aa74ff5796a2db265e3e8fe43bc37`
- Ensure you have an SSH key in your home directory on your Linux VM
 - Run `ssh-keygen` if you don't!
 - If you want to use a different SSH public key
 - `export SSH_PUB_KEY=<path>` before the next step
 - Will end up in `authorized_keys` in one of the containers

```
fgodfrey — fgodfrey@lima-default: ~/cug2025 — ssh · limactl shell default — 120x40
cug-2025-om-tutorial/tutorials/basic_maintenance.md
cug-2025-om-tutorial/tutorials/port_control.md
cug-2025-om-tutorial/tutorials/not_present.md
cug-2025-om-tutorial/tutorials/incremental_fabric_buildout.md
cug-2025-om-tutorial/tutorials/custom_policies.md
cug-2025-om-tutorial/tools/
cug-2025-om-tutorial/tools/fixup-hosts.sh
cug-2025-om-tutorial/tools/setup-virtualenv.sh
cug-2025-om-tutorial/tools/generate_docker_compose.py
cug-2025-om-tutorial/tools/requirements.txt
cug-2025-om-tutorial/tools/generate-docker-compose.sh
cug-2025-om-tutorial/README.md
cug-2025-om-tutorial/slingshot-cli-tools-2.3.0-container.tar
cug-2025-om-tutorial/helpers.sh
cug-2025-om-tutorial/fabric_template.json
cug-2025-om-tutorial/docker-compose.yml
cug-2025-om-tutorial/steps-host/
cug-2025-om-tutorial/steps-host/03_start_missing_switch
cug-2025-om-tutorial/steps-host/05_show_down_ports
cug-2025-om-tutorial/steps-host/01_stop_one_container
cug-2025-om-tutorial/slingshot-daemons-2.3.0-container.tar
cug-2025-om-tutorial/slingshot-fabric-simulation-switch-2.3.0-container.tar
cug-2025-om-tutorial/steps/
cug-2025-om-tutorial/steps/05_B_port_control_up
cug-2025-om-tutorial/steps/04_A_custom_switch_policies
cug-2025-om-tutorial/steps/01_fabric_bringup.sh
cug-2025-om-tutorial/steps/03_B_bring_switch_online
cug-2025-om-tutorial/steps/06_show_routing_state
cug-2025-om-tutorial/steps/06_A_switch_enter_maint
cug-2025-om-tutorial/steps/02_set_not_present
cug-2025-om-tutorial/steps/03_C_show_routing_graph
cug-2025-om-tutorial/steps/03_A_show_routing_graph
cug-2025-om-tutorial/steps/06_B_switch_exit_maint
cug-2025-om-tutorial/steps/06_show_link_state
cug-2025-om-tutorial/steps/06_C_offline_link
cug-2025-om-tutorial/steps/06_D_online_link
cug-2025-om-tutorial/steps/04_B_custom_port_policies
cug-2025-om-tutorial/steps/05_A_port_control_down
cug-2025-om-tutorial/install-demo.sh
fgodfrey@lima-default:~/cug2025$
```



INSTALL THE DEMO

- Run the installer from the unpacked directory: `mkdir cug-demo-cli-files; ./install-demo.sh`
 - Copies the ssh public key to the right location
 - Loads the prebuilt containers into Docker

```
fgodfrey@lima-default: ~/cug2025/cug-2025-om-tutorial — ssh ◀ limactl shell default — 120x40
fgodfrey@lima-default:~/cug2025/cug-2025-om-tutorial$ mkdir cug-demo-cli-files;./install-demo.sh
mkdir: cannot create directory 'cug-demo-cli-files': File exists
/usr/bin/docker
Loading container images. This may take awhile...
Loading slingshot-cli-tools-2.3.0-container.tar...
8c5ef43df363: Loading layer [=====>] 562.9MB/562.9MB
72c6ddcc0e0f: Loading layer [=====>] 421.6MB/421.6MB
dd119f98decd: Loading layer [=====>] 18.4MB/18.4MB
8ec75dff63c7: Loading layer [=====>] 2.524MB/2.524MB
ec14d0ece5db: Loading layer [=====>] 2.528MB/2.528MB
482a887c62c5: Loading layer [=====>] 2.53MB/2.53MB
c3ba72d136c8: Loading layer [=====>] 608.3MB/608.3MB
b252d0a791d2: Loading layer [=====>] 2.56kB/2.56kB
a54fbe6101eb: Loading layer [=====>] 2.56kB/2.56kB
a7aa48fe2431: Loading layer [=====>] 8.192kB/8.192kB
Loaded image: localhost/slingshot-cli-tools:2.3.0
Loading slingshot-daemons-2.3.0-container.tar...
29a522564de2: Loading layer [=====>] 388.8MB/388.8MB
e22e9d0d0e51: Loading layer [=====>] 17.88MB/17.88MB
2b5ee30b2301: Loading layer [=====>] 2.523MB/2.523MB
17240d85e8e1: Loading layer [=====>] 2.527MB/2.527MB
f55d87774aca: Loading layer [=====>] 2.53MB/2.53MB
71ce5b04306a: Loading layer [=====>] 2.533MB/2.533MB
8122d2989430: Loading layer [=====>] 2.534MB/2.534MB
59ecd0f15e4e: Loading layer [=====>] 59.44MB/59.44MB
b015b8f0f817: Loading layer [=====>] 48.23MB/48.23MB
bee9e5c95cf3: Loading layer [=====>] 66.41MB/66.41MB
7c55379432a1: Loading layer [=====>] 765MB/765MB
acb9f820ffef: Loading layer [=====>] 11.26kB/11.26kB
Loaded image: localhost/slingshot-daemons:2.3.0
Loading slingshot-fabric-simulation-switch-2.3.0-container.tar...
24dd6212423c: Loading layer [=====>] 81.53MB/81.53MB
8fdc2bb0b358: Loading layer [=====>] 259.3MB/259.3MB
2fe0e7e91b12: Loading layer [=====>] 1.544GB/1.544GB
8d973f9b7348: Loading layer [=====>] 66.51MB/66.51MB
a06233afad51: Loading layer [=====>] 11.68MB/11.68MB
acd4c7606db7: Loading layer [=====>] 634.4kB/634.4kB
eda01567c259: Loading layer [=====>] 3.072kB/3.072kB
88989986a10f: Loading layer [=====>] 3.237MB/3.237MB
02fff3960079: Loading layer [=====>] 207.9MB/207.9MB
```



START THE DEMO!

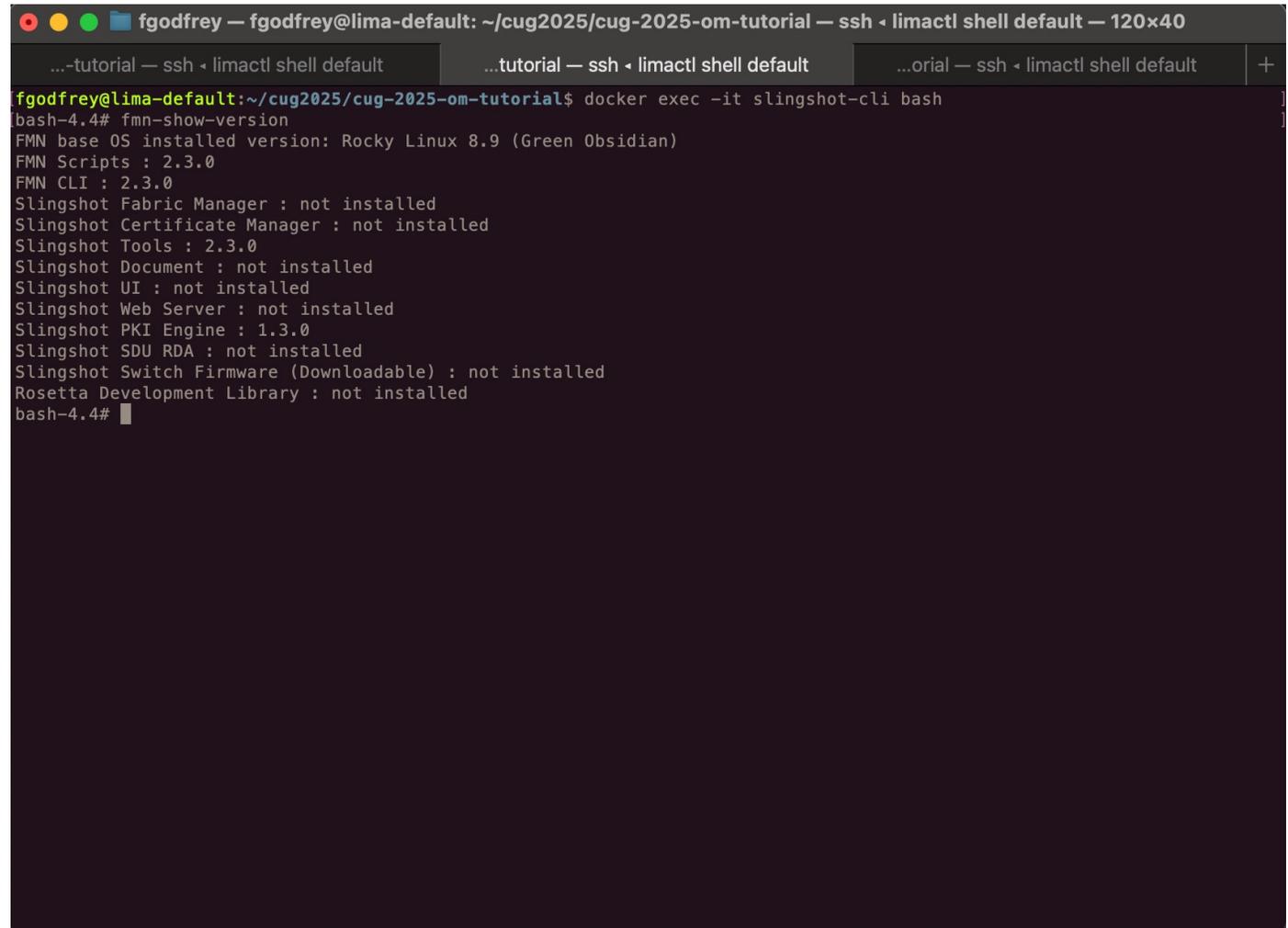
- "cd" into the demo directory
- Run "docker compose up" (or your equivalent)
- Wait.... The above command will "tail -f" the container logs so it will never complete; do not control-C!

```
fgodfrey@lima-default: ~/cug2025/cug-2025-om-tutorial — ssh - limactl shell default — 120x40
fgodfrey@lima-default:~/cug2025/cug-2025-om-tutorial$ docker compose up
[+] Running 8/8
 ✓ Network cug-2025-om-tutorial_cug-2025-demo-net      Created           0.3s
 ✓ Container x3000c0r40b0                             Created           0.3s
 ✓ Container slingshot-cli                             Created           0.3s
 ✓ Container x3004c0r39b0                             Created           0.3s
 ✓ Container fm                                       Created           0.3s
 ✓ Container x3000c0r41b0                             Created           0.3s
 ✓ Container x3000c0r42b0                             Created           0.3s
 ✓ Container x3000c0r39b0                             Created           0.3s
Attaching to fm, slingshot-cli, x3000c0r39b0, x3000c0r40b0, x3000c0r41b0, x3000c0r42b0, x3004c0r39b0
x3000c0r41b0 | Starting syslog server
x3004c0r39b0 | Starting syslog server
x3000c0r40b0 | Starting syslog server
x3000c0r39b0 | Starting syslog server
x3000c0r42b0 | Starting syslog server
fm           | May 05, 2025 3:12:35 AM com.hosts.fabric.BaseFabricHost <clinit>
fm           | WARNING: Audit configuration not found
fm           | SLF4J: Failed to load class "org.slf4j.impl.StaticLoggerBinder".
fm           | SLF4J: Defaulting to no-operation (NOP) logger implementation
fm           | SLF4J: See http://www.slf4j.org/codes.html#StaticLoggerBinder for further details.
fm           | WARNING: An illegal reflective access operation has occurred
fm           | WARNING: Illegal reflective access by com.esotericsoftware.kryo.util.UnsafeUtil (file:/opt/slingshot/li
b/slingshot-fabric-manager-2.3.0-7-jar-with-dependencies.jar) to constructor java.nio.DirectByteBuffer(long,int,java.lan
g.Object)
fm           | WARNING: Please consider reporting this to the maintainers of com.esotericsoftware.kryo.util.UnsafeUtil
fm           | WARNING: Use --illegal-access=warn to enable warnings of further illegal reflective access operations
fm           | WARNING: All illegal access operations will be denied in a future release
fm           | [1] [W] [2025-05-05T03:12:35.792Z] [1] [8000] [initialize] [
fm           | #####
fm           | ## TLS server certificate verification is NOT enabled. ##
fm           | ## This is NOT secure. Please consider enabling verification. ##
fm           | #####
fm           | ]
fm           | [2] [I] [2025-05-05T03:12:35.799Z] [1] [8000] [start][FabricHost starting.]
fm           | [3] [W] [2025-05-05T03:12:36.042Z] [1] [8000] [startImpl] [
fm           | #####
```



OPEN SHELLS

- Open two shells. One in the CUG Demo directory on your Linux host
- The other in the Docker container with the Fabric Manager cli
 - `docker exec -it slingshot-cli bash`



```
fgodfrey@lima-default: ~/cug2025/cug-2025-om-tutorial — ssh • limactl shell default — 120x40
...-tutorial — ssh • limactl shell default  ...-tutorial — ssh • limactl shell default  ...-orial — ssh • limactl shell default  +
fgodfrey@lima-default:~/cug2025/cug-2025-om-tutorial$ docker exec -it slingshot-cli bash
bash-4.4# fmn-show-version
FMN base OS installed version: Rocky Linux 8.9 (Green Obsidian)
FMN Scripts : 2.3.0
FMN CLI : 2.3.0
Slingshot Fabric Manager : not installed
Slingshot Certificate Manager : not installed
Slingshot Tools : 2.3.0
Slingshot Document : not installed
Slingshot UI : not installed
Slingshot Web Server : not installed
Slingshot PKI Engine : 1.3.0
Slingshot SDU RDA : not installed
Slingshot Switch Firmware (Downloadable) : not installed
Rosetta Development Library : not installed
bash-4.4#
```



TUTORIAL 1: FABRIC BRINGUP

- Show bringup of the fabric in the emulator
- Before we do that, though, we will stop one of the switch containers
 - We will add it back in one of the later steps
 - This requires running steps on the host and inside the CLI container
- Run “`fmn-show-status`” to see the links come up

```
fgodfrey@lima-default: ~/cug2025/cug-2025-om-tutorial — ssh • limactl shell default — 120x40
...-tutorial — ssh • limactl shell default ... ..tutorial — ssh • limactl shell default ...-orial — ssh • limactl shell default +
bash-4.4# cd
bash-4.4# cd demo/
bash-4.4# ./steps/01_fabric_bringup.sh
+ cp fabric_template.json /opt/cray
+ fmn-update-fabric-policy
--
Creation of HealthMap started...
Creating HealthMap...
Creation of HealthMap successful

Creation of Forwarding Engine started...
Creating Default Forwarding Engine
Using default Forwarding Engine Refresh rate of 10 seconds
Forwarding Engine policy configured for resiliency to intermittent fabric link availability
LAG configuration set to default unspecified
Creation of Forwarding Engine successful

Creating Deployment Engine
Using default Deployment Engine Refresh rate of 10 seconds
Creation of DeploymentEngine successful

Creating Forwarding State Deployment Engine
Creation of forwarding state deployment engine successful

Creating Policy Validator Engine
Creation of PolicyValidatorEngine successful

Creating Forwarding Initialization Sync Task
Creation of Forwarding Initialization Sync Task successful

Creating Health Engine
Creation of HealthEngine successful

Creation of TopologyPolicy started...
Creation of TopologyPolicy successful

Overall Script execution status: Successfully created Fabric policy resources
+ fmn-create-switch-inventory
System has not been booted with systemd as init system (PID 1). Can't operate.
Failed to connect to bus: Host is down
```

```
fgodfrey@lima-default: ~/cug2025/cug-2025-om-tutorial — ssh • limactl shell default — 120x40
...-tutorial — ssh • limactl shell default ... ..tutorial — ssh • limactl shell default ...-orial — ssh • limactl shell default +
fgodfrey@lima-default:~/cug2025/cug-2025-om-tutorial$ ./steps-host/01_stop_one_container
Setting DEMO_TOP to /home/fgodfrey.linux/cug2025/cug-2025-om-tutorial
/usr/bin/docker
+ docker stop x3004c0r39b0
x3004c0r39b0
+ exit 0
fgodfrey@lima-default:~/cug2025/cug-2025-om-tutorial$
```



TUTORIAL 2: DEMONSTRATE “NOT PRESENT” FUNCTIONALITY

- Run `fmn-show-status --details` and notice that it is quite messy
- Run Step 2 in the CLI Container
 - This puts all the switches that are not actually running right now into “nor present” mode
- Return `fmn-show-status --details` and notice that it is now clean and can be easily read



TUTORIAL 3: INCREMENTAL BUILDOUT

- Demonstrate addition of a switch to a running fabric with no downtime; we will be bringing back the switch we stopped in Step 1
 - x3004c0r39b0
- Run Step 3A. Notice that the switch is not present in the routing graph
- Run Host Step 3
- Run Step 3B
- Wait about 60 seconds
- Run Step 3C and `fmn-show-status`
- The switch is now up and running



TUTORIAL 4: CUSTOM SWITCH AND PORT POLICIES

- Step 4A demonstrates the creation of a custom switch policy
- Step 4B demonstrates the creation of custom port policies
 - Puts all the edge ports on x3004c0r39b0 into an “io-policy”
 - Run `fmn-show-status` to see how organizing ports this way can easily allow you to see whether a group of ports has any issues



TUTORIAL 5

- Tutorial Step 5A takes all the Edge Ports on a switch and brings them down
 - Useful if the edge nodes are going to be worked on and may boot into an undesirable state
- Host Step 5 shows the ports on the switch using the switch debug status
- Tutorial Step 5B brings the ports back up



TUTORIAL 6: BASIC MAINTENANCE

- Steps 6A and 6B put a switch into maintenance mode and then take it back out
 - Use **06_show_routing_state** to observe the switch being removed from the “live map” used to compute fabric routing tables
- Steps 6C and 6D put an individual link into maintenance mode and then take it back out
 - Use **06_show_link_state** to observe the link being removed from the “live map” used to compute fabric routing tables



Q&A

