Fedora Remix Lab

A collection of scripts to create and manage a Fedora-based virtual lab environment using KVM/libvirt. This lab creates two VMs that can communicate with each other, perfect for testing Ansible automation, clustering, or multi-node applications.

> 📘 **Using Fedora Remix Lab ISO?** See the Quick Start Guide for streamlined instructions when the lab is pre-installed.

Prerequisites

Install the required packages:

```
sudo dnf install qemu-kvm libvirt virt-manager libguestfs-tools virt-viewer
```

Ensure libvirtd is running:

```
sudo systemctl enable --now libvirtd
```

Quick Start

1. Download the base image (or place your own `Fedora43Lab.qcow2` in this directory):

   ```
   ./download-image.sh
   ```

2. Create the lab environment:

   ```
   sudo ./create-lab-vms.sh
   ```

3. Start the VMs:

```
sudo ./start-lab-vms.sh
```

4. Add host entries to your local machine:

```
sudo ./manage-hosts.sh add
```

5. Check status:

```
sudo ./lab-status.sh
```

6. Connect to a VM:

```
sudo virt-viewer FedoraLab1
```

   Or via SSH:

```
ssh ansibleuser@fedoralab1.example.com
```

Lab Configuration

Network

Setting	Value
Network Name	`labnet`
Subnet	`192.168.100.0/24`
Gateway	`192.168.100.1`
Domain	`example.com`

Virtual Machines

VM Name	IP Address	FQDN	Hostname
FedoraLab1	192.168.100.10	fedoralab1.example.com	fedoralab1
FedoraLab2	192.168.100.11	fedoralab2.example.com	fedoralab2

VM Specifications

Resource	Value
Memory	1 GB
vCPUs	2
Disk	Overlay on base image

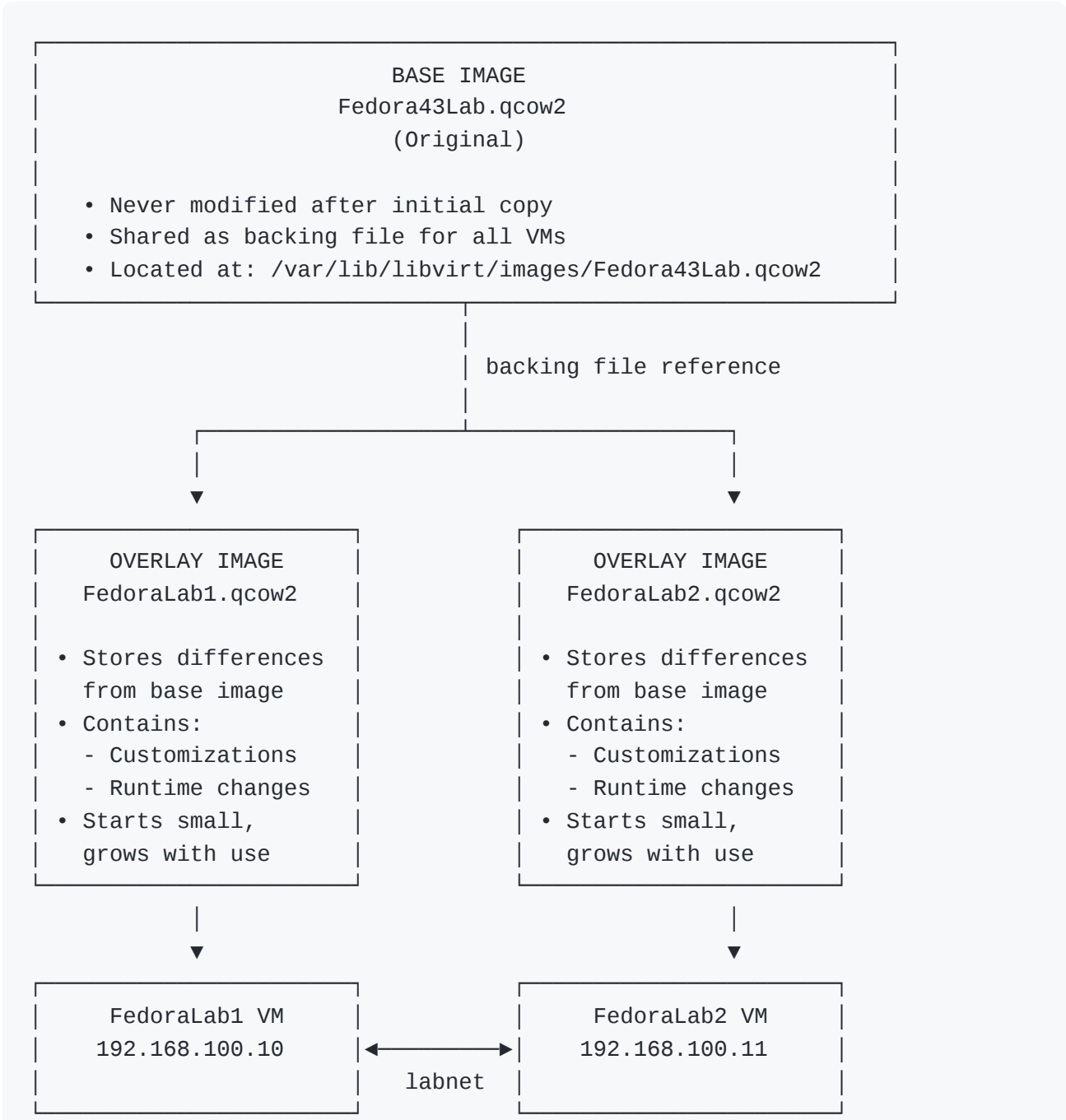
User Account

Setting	Value
Username	`ansibleuser`
Password	`Automation!`
Sudo	Passwordless (`NOPASSWD: ALL`)

How It Works

Disk Image Architecture

The lab uses a **copy-on-write overlay** architecture to efficiently manage disk images. This approach keeps the base image pristine while allowing each VM to have its own independent storage.



Creation Process

1. **Copy base image** to libvirt storage:

```
Fedora43Lab.qcow2 → /var/lib/libvirt/images/Fedora43Lab.qcow2
```

2. **Create overlay images** (copy-on-write):

```
qemu-img create -f qcow2 -b Fedora43Lab.qcow2 -F qcow2
FedoraLab1.qcow2
```

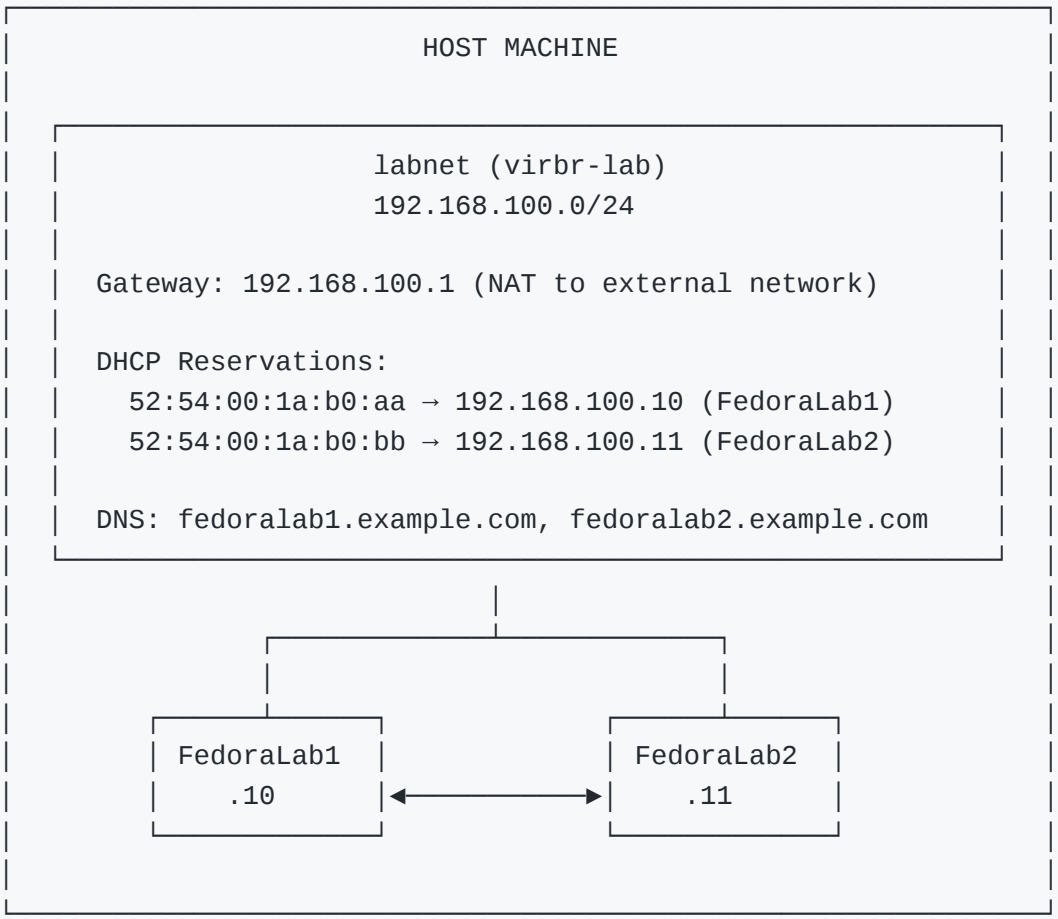
The overlay references the base image and only stores blocks that differ.

3. **Customize overlays** using `virt-customize`:
   - Create user account (`ansibleuser`)
   - Set hostname, locale, timezone
   - Configure `/etc/hosts`
   - Disable initial-setup wizard
   - SELinux relabel
4. **Generate libvirt XML** definitions for each VM with:
   - Static MAC addresses (for DHCP reservation)
   - Network attachment to `labnet`
   - UEFI firmware, TPM, etc.

Benefits of This Architecture

Benefit	Description
Disk Efficient	Overlays only store differences (~500MB vs 10GB full copy)
Fast Creation	No need to copy the entire base image for each VM
Base Image Preserved	Original image never modified; easy to recreate VMs
Independent VMs	Changes in one VM don’t affect the other
Easy Reset	Delete overlay and recreate for a fresh VM

Network Architecture



The VMs use static IPs assigned via DHCP reservations based on MAC address. This ensures consistent IP addresses across reboots while still using DHCP for network configuration.

Scripts

> **Note:** Most scripts require `sudo` to interact with libvirt system domains.

download-image.sh

Downloads the Fedora43Lab.qcow2 base image from Google Drive to `/var/lib/libvirt/images/`.

```
sudo ./download-image.sh
```

- Downloads directly to libvirt's standard image location
- Sets proper ownership (`qemu:qemu`) and permissions
- Uses `gdown` for reliable large file downloads from Google Drive
- Offers to install `gdown` if not present
- Requires `sudo` to write to `/var/lib/libvirt/images/`

create-lab-vms.sh

Creates the complete lab environment including:

- Virtual network (`labnet`) with static IP assignments
- Overlay disk images for each VM (preserving the base image)
- Pre-configured VMs with user accounts, locale, and `/etc/hosts`
- XML definitions for libvirt

```
sudo ./create-lab-vms.sh
```

What it configures on each VM:

- Hostname (FQDN)
- Timezone (America/New_York)
- Locale (en_US.UTF-8)
- User account with passwordless sudo
- `/etc/hosts` entries for all lab VMs
- Disables initial-setup wizard

start-lab-vms.sh

Registers and starts the lab VMs. Ensures the lab network is active.

```
sudo ./start-lab-vms.sh
```

lab-status.sh

Displays comprehensive status of the lab environment:

- Network status and DHCP leases
- VM states (running, stopped, not defined)
- IP addresses and hostnames
- Connectivity checks (ping and SSH)
- Host configuration status

```
sudo ./lab-status.sh
```

manage-hosts.sh

Manages `/etc/hosts` entries on the host machine for easy VM access by hostname.

```
# Add entries
sudo ./manage-hosts.sh add

# Remove entries
sudo ./manage-hosts.sh remove

# Update entries (remove and re-add)
sudo ./manage-hosts.sh update

# Check status (can run without sudo)
./manage-hosts.sh status
```

reset-lab.sh

Destroys and recreates the entire lab environment. Useful for starting fresh.

```
# Full reset with confirmation prompt
sudo ./reset-lab.sh

# Full reset without confirmation
sudo ./reset-lab.sh -y

# Reset only VMs, keep the network
sudo ./reset-lab.sh --vms-only

# Only destroy, don't recreate
sudo ./reset-lab.sh --destroy-only
```

Options:

Option	Description
`--full`	Full reset including network (default)
`--vms-only`	Reset only VMs, keep the network intact
`--destroy-only`	Only destroy, don’t recreate
`-y, --yes`	Skip confirmation prompt

Common Tasks

Start the Lab

```
sudo ./start-lab-vms.sh
```

Stop the Lab

```
sudo virsh shutdown FedoraLab1
sudo virsh shutdown FedoraLab2
```

Or force stop:

```
sudo virsh destroy FedoraLab1
sudo virsh destroy FedoraLab2
```

Connect to VMs

Via Virt-Viewer (graphical console):

```
sudo virt-viewer FedoraLab1
sudo virt-viewer FedoraLab2
```

Via SSH:

```
ssh ansibleuser@fedoralab1.example.com
ssh ansibleuser@fedoralab2.example.com
```

Or by IP:

```
ssh ansibleuser@192.168.100.10
ssh ansibleuser@192.168.100.11
```

Reset the Lab

Use the reset script to completely recreate the lab (destroys all VM data):

```
# Full reset (with confirmation)
sudo ./reset-lab.sh

# Full reset (skip confirmation)
sudo ./reset-lab.sh -y

# Reset VMs only, keep network
sudo ./reset-lab.sh --vms-only
```

Or manually:

```
# Stop VMs
sudo virsh destroy FedoraLab1 2>/dev/null
sudo virsh destroy FedoraLab2 2>/dev/null

# Undefine VMs
sudo virsh undefine FedoraLab1 --nvram
sudo virsh undefine FedoraLab2 --nvram

# Remove network
sudo virsh net-destroy labnet
sudo virsh net-undefine labnet

# Remove files
sudo rm -rf /var/lib/libvirt/images/fedora-lab

# Recreate
sudo ./create-lab-vms.sh
sudo ./start-lab-vms.sh
```

Check VM Connectivity

From the host:

```
ping fedoralab1.example.com
ping fedoralab2.example.com
```

From FedoraLab1 to FedoraLab2:

```
ssh ansibleuser@fedoralab1.example.com
ping fedoralab2.example.com
ssh fedoralab2
```

File Locations

File	Location
Base image	`/var/lib/libvirt/images/Fedora43Lab.qcow2`
VM overlay disks	`/var/lib/libvirt/images/fedora-lab/*.qcow2`
VM XML definitions	`/var/lib/libvirt/images/fedora-lab/*.xml`
Network XML	`/var/lib/libvirt/images/fedora-lab/labnet.xml`
Local hosts file	`./hosts.local`
Ansible inventory	`./inventory`

Troubleshooting

VMs show “not defined”

Run `sudo ./start-lab-vms.sh` to register and start the VMs.

Network not found

Run `sudo ./create-lab-vms.sh` to create the network.

Permission denied errors

All scripts must be run with `sudo` because the VMs use libvirt’s system connection.

Can’t ping VMs from host

Ensure the lab network is active:

```
sudo virsh net-start labnet
```

Ensure `/etc/hosts` entries are added:

```
sudo ./manage-hosts.sh add
```

SSH connection refused

The VM may still be booting. Wait a moment and try again, or check status:

```
sudo ./lab-status.sh
```

Initial setup screen appears

If you see the Fedora initial setup screen, the virt-customize step may have failed. Recreate the VMs:

```
sudo ./create-lab-vms.sh
```

Using with Ansible

The lab is designed for Ansible automation testing. Create an inventory file:

```
[lab]
fedoralab1.example.com
fedoralab2.example.com

[lab:vars]
ansible_user=ansibleuser
ansible_become=yes
```

Test connectivity:

```
ansible -i inventory lab -m ping
```

License

This project is part of the Fedora Remix project.