



# Building And Utilizing Purpose-Built GNU/Linux Distribution Images Using Mkosi

**Akashdeep Dhar**

Red Hat Community Platform Engineering  
Elected Representative, Fedora Council





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# Motivation

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# First Interaction With Minimalism



Setting up Arch Linux distribution manually

**USING PACSTRAP**



Picking packages and services that you need and

**NOTHING MORE**



Enabling distribution support in wide spectrum of

**PHYSICAL HARDWARE**



Creating bespoke configuration settings catered to

**CUSTOM PURPOSES**



# Tools From Other Distributions



Debian Linux

## Debootstrap

- Installs the base system into a subdirectory
- Needs access to the Debian Linux repositories
- Usable on another operating systems
- Supports creating images for other architectures
- Alternatives with Chroot support are available



Fedora Linux

## Supermin

- Creates minified purpose-built appliances
- Part of Libguestfs suite for virtual machines
- Usable on another operating systems
- Can build QEMU-runnable virtual machines
- Previously was called Febootstrap until v3.x



# Exploring Distro Agnostic Tools



Supports various cloud-centric distributions

## Cloud-Init

- Requires a custom template image to start with
- Used in Ubuntu Linux, CentOS Stream etc.
- Runs on first boot for initializing installations
- Configures users, partitions, networking etc.
- Uses a YAML-styled configuration format



Supports various container-optimized distributions

## Ignition

- Requires a custom template image to start with
- Used by Fedora CoreOS, Red Hat CoreOS etc.
- Runs on first boot for initializing installations
- Configures users, partitions, networking etc.
- Uses a JSON-based configuration format



# Something More With Mkosi



Minimal images are usable across various scenarios

**FROM SCRATCH**



Settings are human readable and extensively customizable

**INI-STYLED CONFIGURATION**



Generated images are predictable across environments

**CONSISTENTLY REPRODUCIBLE**



As containers and virtual machines or on physical hardware

**DIVERSELY DEPLOYABLE**



# Something More With Mkosi



Fine grained control is ensured on the system's behaviour

## **SYSTEMD INTEGRATED**



Images can be generated to facilitate building and testing

## **ENVIRONMENT ISOLATION**



Wraps most well-known package managers for building

## **PACKAGE MANAGEMENT**



Injecting custom scripts per build event is possible

## **CUSTOMIZATION HOOKS**



# Configuration Sections



Localizing customization on multiple images

**MATCH**



Localizing customization on single image

**CONFIG**



Selecting GNU/Linux base for image

**DISTRIBUTION**



Customizing image format attributes

**OUTPUT**



Tailoring images and injecting scripts

**CONTENT**



Customizing secure boot attributes

**VALIDATION**



Executing as container or virtual machine

**HOST**





# Examples

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# Configuration Example

mkosi.conf (Page 1 of 2)

## [Distribution]

**Distribution**=centos

**Release**=9

**Architecture**=x86-64

**Mirror**=https://centos-stream.excellmedia.net/

**RepositoryKeyCheck**=no

## [Output]

**Format**=disk

**Output**=centos-stream

**ManifestFormat**=json,changeLog

**ImageVersion**=0.0.1

**ImageId**=centos-stream

## SECTION NAME

Distribution name

Release version

System architecture

Mirror location

Verify repository

## SECTION NAME

Image format

Image name

Metadata types

Image version

Image identifier



# Configuration Example

mkosi.conf (Page 2 of 2)

## [Content]

**Bootable**=yes

**Bootloader**=systemd-boot

**Packages**=kernel,systemd,systemd-boot,udev,dnf,iproute,ncurses,basesystem

**WithRecommends**=no

**WithNetwork**=yes

**CleanPackageMetadata**=yes

**Locale**=en\_US.UTF-8

**Timezone**=Asia/Kolkata

**Hostname**=centos-stream

**RootPassword**=centos-stream

**RootShell**=/usr/bin/bash

**AutoLogin**=no

## SECTION NAME

Bootable

Bootloader name

Packages installable

Optional dependencies

Enable network

Clear repodata

Default locale

Default timezone

Default hostname

Password for ROOT

Shell for ROOT

Allow autologin



# Usecase Example

mkosi.postinst.chroot (Page 1 of 1)

```
useradd -c centosuser -G wheel -m centosuser  
echo "centosuser:password" | chpasswd
```

```
echo 'nameserver 8.8.8.8' >> /etc/resolv.conf  
dnf install unzip python3-pip --releasever=9-stream --assumeyes  
python3 -m pip install poetry  
mkdir /home/centosuser/test/
```

```
curl https://example.net/main.zip -o /home/centosuser/test/main.zip  
unzip /home/centosuser/test/main.zip -d /home/centosuser/test/  
cd /home/centosuser/test/main  
python3 -m poetry check
```

Creating user  
Modifying auth

Setting nameserver  
Installing packages  
Installing modules  
Creating directory

Downloading artifact  
Extracting artifact  
Changing directory  
Checking config



# Build



# Application Examples



Immutable environments for consistency

## INFRASTRUCTURE



Environment for customized purposes

## EMBEDDED



Including the initialization services

## CONTAINERIZATION



Isolated environments for checks

## TESTING



Reproducible environments for learning

## EDUCATION



Specific yet disposable environment

## DEVELOPMENT



Manage software development lifecycle

## CI/CD PIPELINES



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# Demonstration

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# Usage Environments



Flashing generated image on a drive to boot from  
**PHYSICAL HARDWARE**



Isolating generated image in a shared namespace  
**CHROOT JAIL**



Isolating generated image in a separate namespace  
**SYSTEMD NSPAWN**



Utilizing generated image as a virtual machine  
**QEMU/KVM/LIBVIRT**





# Burn



# Chroot



# Boot



# Qemu



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# Contribute





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# Thank you!

 <https://www.linkedin.com/in/gridhead>

 <https://twitter.com/gridheader>

 <https://t.me/gridhead>

 <https://matrix.to/#/@t0xic0der:fedora.im>

 <https://github.com/gridhead>

 <https://gitlab.com/gridhead>