



# Container Live Migration

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# Red Hat Blog:

## Container migration with Podman on RHEL

<https://www.redhat.com/en/blog/container-migration-podman-rhel>

# Definition:

# Container Live Migration

# Transfer Running Container

# Serialize on Source System

# Transfer to Destination System

# Checkpoint/Restore in Userspace

## CRIU

# Multiple Integrations Exist



# CRIU

# First Step: Checkpointing

# Seize Process Using `ptrace()`

# Collect Details From

```
/proc/<PID>/*
```

# Parasite Code

# Parasite Code

## Most favorite part

# Parasite Code

## And the craziest

# Parasite Code

Injected into the process



# Parasite Code

Daemon waiting for commands

# Parasite Code

Removed after usage

# Checkpointing Finished

Checkpointing Finished

All relevant information written

Checkpointing Finished

Target process is killed

Checkpointing Finished  
Or continues to run

# Container Live Migration

## SELinux

### Linux Security Summit EU 2019

<https://sched.co/Tymj>

# Second/Last Step: Restoring



# Read Checkpoint Images

`clone()` For Each PID/TID

LPC: CRIU and the PID dance

Maybe `clone3()` in the future

<https://linuxplumbersconf.org/event/4/contributions/472/>

# CRIU Morphs Itself

Open and position file descriptors

# CRIU Morphs Itself

Map memory pages

# CRIU Morphs Itself

## Load security settings

# CRIU Morphs Itself

Jump into restored process

# Container Live Migration

# Container Live Migration

## OpenVZ



# Container Live Migration

## Borg

# Container Live Migration

## LXC/LXD

# Container Live Migration

## Docker

# Container Live Migration

## Podman

# Podman: daemonless

# Podman: rootless

# Podman: Checkpoint/Restore

## October 2018

# Podman: Checkpoint/Restore

## Required runc and CRIU changes



# Podman: Container Live Migration

June 2019

# Podman: Container Live Migration

Required runc, CRIU, SELinux  
changes

```
1 # podman run --rm -d adrianreber/wildfly-hello
2 699f33eb7fecbc5bbb00400be0aa79c888dbc63a54cac7bd2eed836a57d8a68a
3 # podman inspect -l --format "{{.NetworkSettings.IPAddress}}"
4 10.88.0.247
5 # curl 10.88.0.247:8080/helloworld/
6 0
7 # curl 10.88.0.247:8080/helloworld/
8 1
9 # podman container checkpoint -l --export=/tmp/chkpt.tar.gz
10 699f33eb7fecbc5bbb00400be0aa79c888dbc63a54cac7bd2eed836a57d8a68a
11 # scp /tmp/chkpt.tar.gz rhel08:/tmp
```

```
1 # podman container restore --import=/tmp/chkpt.tar.gz
2 699f33eb7fecbc5bbb00400be0aa79c888dbc63a54cac7bd2eed836a57d8a68a
3 # podman inspect -l --format "{{.NetworkSettings.IPAddress}}"
4 10.88.0.247
5 # curl 10.88.0.247:8080/helloworld/
6 2
7 # curl 10.88.0.247:8080/helloworld/
8 3
```

```
1 # podman container restore --import=/tmp/chkpt.tar.gz -n hello1
2 d02feeec894d77f66cc82484fe77ae369396a85f6d05594dc156c21e685942dd
3 # podman container restore --import=/tmp/chkpt.tar.gz -n hello2
4 735efb4fee6961d3eee069beb28dde5cbc6fc46c1a32a43ecc993d04c02015b2
5 # podman inspect --format "{{.NetworkSettings.IPAddress}}" hello1
6 10.88.0.248
7 # podman inspect --format "{{.NetworkSettings.IPAddress}}" hello2
8 10.88.0.249
9 # curl 10.88.0.248:8080/helloworld/
10 2
11 # curl 10.88.0.249:8080/helloworld/
12 2
```

<https://lisas.de/~adrian/container-live-migration-article.pdf>  
<https://asciinema.org/a/249922>  
<https://asciinema.org/a/249918>  
<https://lisas.de/~adrian/posts/2019-Apr-10-criu-and-selinux.html>  
<https://criu.org/Podman>  
[https://twitter.com/adrian\\_\\_reber](https://twitter.com/adrian__reber)  
<https://www.redhat.com/en/blog/container-migration-podman-rhel>  
<https://cfp.all-systems-go.io/ASG2019/talk/E88Z7V/>  
<https://sched.co/Tymj>  
<https://linuxplumbersconf.org/event/4/contributions/472/>

