

Root Manipulation with pivot_root

A MUUG Presentation
(c) 2026 Trevor E. Cordes



About Trevor Cordes

- **UNIX-head since 1992 (SunOS > AIX > RH > Fedora)**
- **Fedora, PHP & Perl fan (wanna fight?)**
- **MUUG Vice-President**
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Disclaimer & Warning

- Everything in this presentation is incredibly dangerous
- You can easily lose or trash all of your files
- And have lots of downtime
- Make backups
- The steps will have to be tailored to your distro and version, and will need to be modified over time
- MUUG & Trevor Cordes provide no warranty of any kind

Why?

- **A bare metal hosting provider in another city refused to deploy a box with anything other than the / (root) file system taking up 100% of the disk**
- **We prefer a separate home partition:**
 - To ensure / doesn't get full by accident
 - To allow a separate xfs quota setup just for user data
- **Is there a solution?**

Goal

- Shrink the root FS
- To make space for a new home or LVM partition

Another Scenario

- You have an older box that has been OS upgraded many times
- Your 400MB, 500MB, or 1GB /boot partition is no longer big enough
- Kernel updates are complaining or failing
- Change your /boot to be 2GB to be up to modern spec
- All over the network via ssh

Normally...

- If your box is beside you, boot into a gparted CD/USB
- Easy
- This works because the root filesystem can be unmounted when it's not controlling the OS currently running
- But nowadays you are often working with a box not easily accessible: at an office somewhere 60 minutes away, or in a datacenter with access restrictions, or with a hosting company in another city/country

Just Resize It!

- FS resize tools allow for online resizing for 15+ years
- Just shrink it!
- `resize2fs` and other tools can only grow running FS!
- Not shrink
- Doh!

Must Unmount

- So we first need to unmount /
- But it's running the system!
- It won't let me!
- "Device is busy"
- Doh!

Unbusy It

- So make it “unbusy”
- New intermediate quest:
- Make it so nothing in the running system is accessing anything on the FS

“Slight” Impediment

- But we still need to make sure the OS is running
- And can access all the disk tools we'll need to use
- And ssh keeps running no matter what!
- This is what `pivot_root` is for!

RTFM: PIVOT_ROOT(8)

- `pivot_root` – change the root filesystem
- `pivot_root` moves the root file system of the current process to the directory `put_old` and makes `new_root` the new root file system. Since `pivot_root(8)` simply calls `pivot_root(2)`, we refer to the man page of the latter

Overarching Paradigm

- Make a copy of important/needed parts of the running system into a tmpfs (a FS in RAM)
- pivot_root into that new RAM-only FS
- Stop everything using the old root
- Do your FS/partition manipulation
- Reboot back to normal

Prerequisites

- **RAM: enough to hold all of the important files**
- **On a small text-only server system it can easily be 2GB**
- **On a bigger system it can be 20GB**
- **But you can be more selective with binaries than my examples**
- **You still need enough RAM for the running system**
- **Most modern systems have more than enough RAM**

Swap & Other Partitions

- If you have a swap partition in the way
- Easiest to disable it, or even delete its partition
- Otherwise you'll have to account for it with the moves/resizes
- Can remake it later
- Other partitions you can move as needed

Help, I Screwed Up!

- At any point before the actual partition/FS manipulation you can just reboot
- Everything you did is forgotten
- It was only in RAM
- If you screw up with the partition/FS steps, try to undo them, otherwise kiss your FS goodbye!

Rebooting Safely(-ish)

- Modern systemd can easily hang when shutting down
- If things are not exactly as it expects
- Best to reboot with: `reboot -f`
- Especially after you've unmounted /
- It may not sync disks though, so make sure you do `sync` 3 times first
- Still a bit risky

Datacenter Press Button

- Or if you haven't unmounted yet, you can try normal reboot
- If it hangs, it's much easier to ask the datacenter people to press the reset button vs ssh in to fix your mess!

systemd Pain

- As usual, systemd makes your life harder
- systemd components leave open all sorts of file handles
- Some you have to be careful when restarting/stopping
- It makes a bunch of namespaces that still lock the device!

Demo

- Demo
- See demo notes
- Demo uses Fedora 44
- Some paths & daemons & programs will differ in other distros, but the general concepts apply