Linux From Scratch

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Motivation

Principles of Operating Systems

How can I make my own Ubuntu, OS X, Windows 10, etc

Linux Distributions

Linux Distribution

- Kernel: https://www.kernel.org

  - Handle Processes (running programs)

  - Handle Memory

  - Handle I/O devices (disk)

- All the other programs you want to run on your computer

  - Program is just a binary file on disk

  - Kernel can load and run these bits

Program included in Distributions

- Command Line Programs
  - Shell (command line), <u>coreutils</u> (*ls*), *fdisk*, *kill*, etc.
  - Networking and security programs
  - Cron and other sbin utilities
  - User Programs
    - Development (gcc, git, etc)
    - Editors (*vim*, *emacs*)
- Graphical User Interface Programs
  - GNOME
  - KDE
- Desktop Applications
  - Word Processor
  - Browser
  - Music Manager

How to make own Linux Distribution

Linux From Scratch

- Build own linux distribution
- Fully functioning that users could install onto computer

Linux From Scratch:

Organization Homepage

Book

Preparatory Work

Step 0

Have a base linux system to use in creating the distribution

Step 1

Create new Partition and File System

Step 2

Gather the source code of necessary programs

Step 3

Create a $LFS directory and mount new partition there

Example:

$LFS = /mnt/lfs

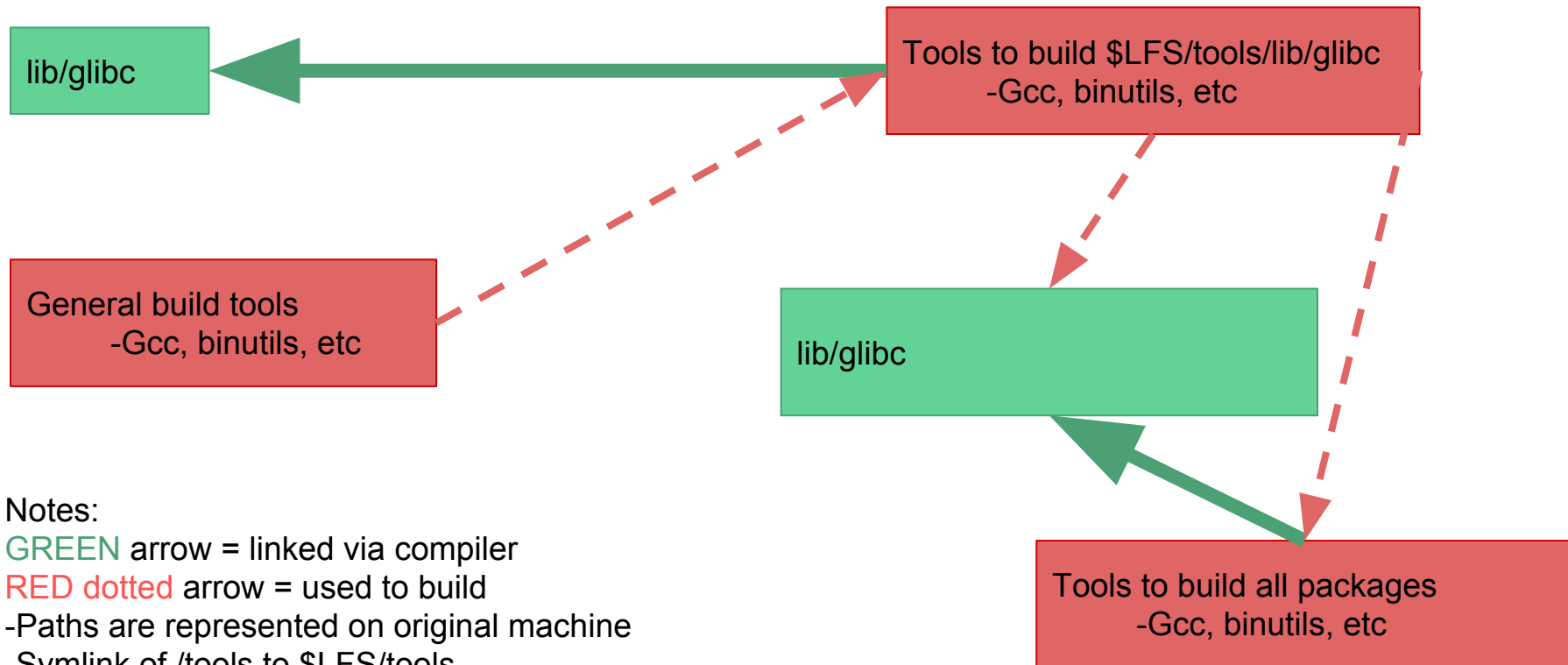$LFS will be location of the new distribution

Toolchain

Toolchain

- Compiling a program links it to shared libraries
- For a standalone distribution, can't have any program link to libraries on original partition

Solution: Independent Development & Compiler Tools

- Isolates new distro from base distro
- Tools will exist on new partition

/ $LFS/tools

lib/glibc

Tools to build $LFS/tools/lib/glibc
-Gcc, binutils, etc

General build tools
-Gcc, binutils, etc

lib/glibc

Tools to build all packages
-Gcc, binutils, etc

Notes:
GREEN arrow = linked via compiler
RED dotted arrow = used to build
-Paths are represented on original machine
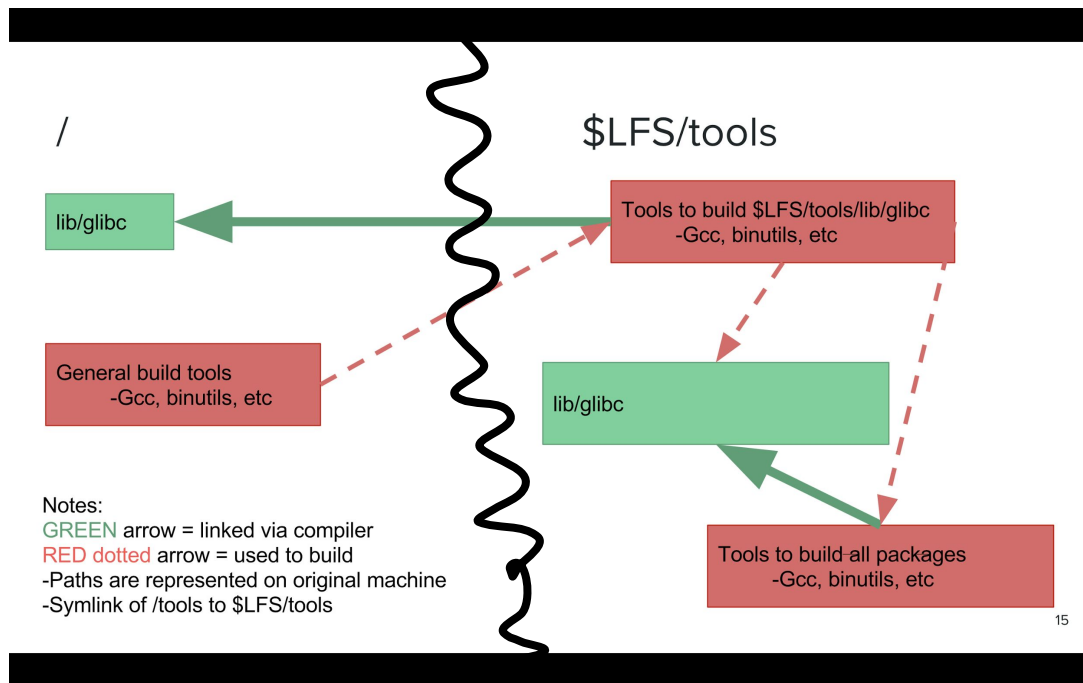-Symlink of /tools to $LFS/tools

Build Distribution

Step 1

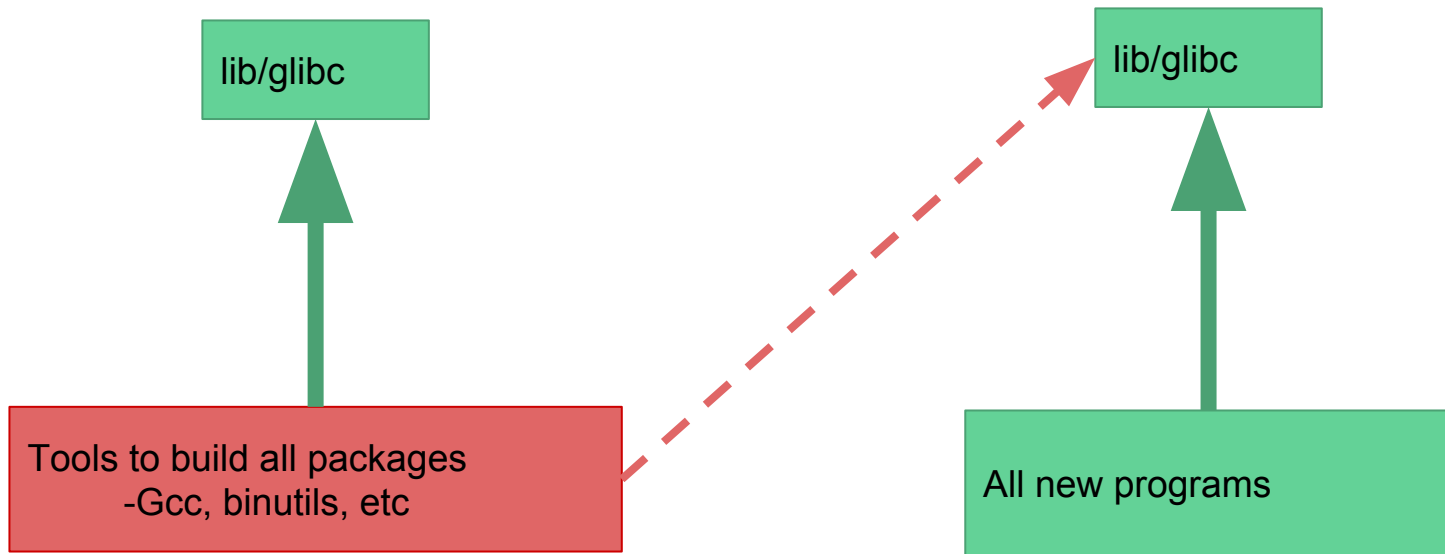Change root of file system to $LFS directory

/mnt/lfs => /

Step 2

Create core directories at new root

```
bin
boot
dev
etc
home
lib
lib64
lost+found
media
mnt
opt
proc
root
run
sbin
srv
sys
tmp
usr
var
```

/tools

/

lib/glibc

lib/glibc

Tools to build all packages
-Gcc, binutils, etc

All new programs

Notes:
GREEN arrow = linked via compiler
RED dotted arrow = used to build
-Paths are represented on LFS partition

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Building using new toolchain (on new partition)

./configure

make

make install

Cleanup

Delete Toolchain (backup first)

Add entry in Bootloader for new partition

Installation

How to make it installable

- Currently on disk (in new partition)
- Tar

How can users install the distribution?
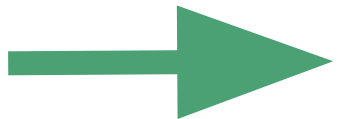
Need to do the following

1. Partition Disk
2. Format Partition (add filesystem)
3. Mount the partition
4. Extract LFS.tar.gz at partition root

Brand new computer?

Need to perform those operations on computer

Can't if you don't have an operating system

Solution: Live CD

Boots from USB or CD-rom rather than disk

Allows one to partition disk

Tiny Core Linux

http://www.tinycorelinux.net

Minimal Linux Distribution

Install Bootloader

GRUB

Why do this?

Benefits

- Appreciation for linux
- Solid understanding of components of linux system
- Complete customization
- Understanding:
  - How distributions are made
  - Kernel functions
  - Disks and Partitioning
  - Installation
- Practice building and testing various software
- Compiling open source software

Questions