VM and VSE Technical Conference

Redbooks
International Technical Support Organization

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Linux for S/390
Hands On Lab Introduction May 2000

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Topics

- Linux for S/390 history
- Linux for S/390 capabilities
- The Linux for S/390 way
- Linux for S/390 structure
- Linux for S/390 under VM
- Prepare to build a Linux for S/390 system
- Let's do it "hands on"
- References

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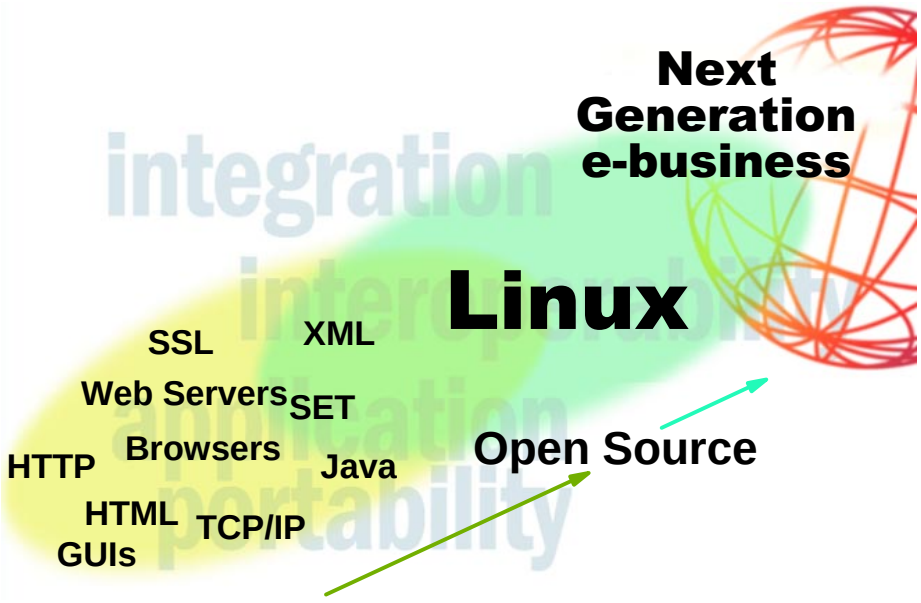
Next Generation Internet



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Linux/390: History

summer ’98: idea is born
autumn ’98: skunkwork starts
12/98: first kernel running
01/99: interactive bash
03/99: static ELF
spring ’99: Adtech Project
05/99: dynamic ELF
12/99: code drop
12/99: first distribution (120 packages)

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Do it the Linux way

Two major design principles:

Linux/390 remains Linux
The Linux structure, development rules and coding style remain unchanged

S/390 remains S/390
The mere S/390 hardware architecture is sufficient for implementing Linux

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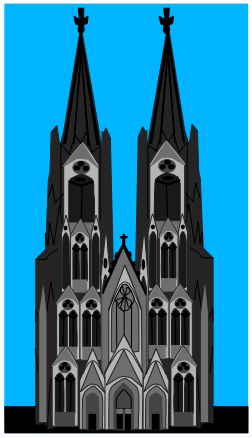
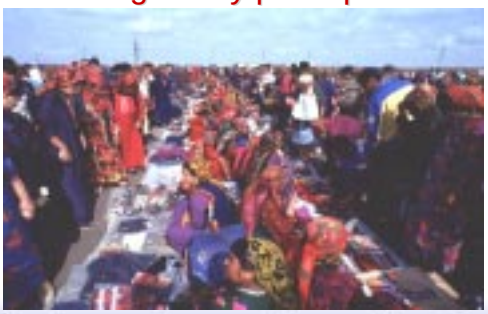
Do it the Linux way!

Established development process: Cathedral-Style



A different Culture: Bazaar

- flexible (re-) organization
- dynamic processes
- contents always up-to-date
- all tasks in parallel
- no idling
- designed by participants



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Linux for S/390 Capabilities

- **Pure Linux**
  - ASCII (i.e., no EBCDIC porting issues)
  - Needed platform support (as for other architectures)
- **Requires processor with Relative and Immediate instruction and CSP instruction support**
  - 9672 G3 or later
  - P/390
  - Multiprise 2000, Multiprise 3000
- **IEEE Floating-Point support**
  - Uses BFP hardware on G5 and later
  - Simulated on other processors

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Linux for S/390

- **With the release to open source, IBM did not**
  - Announce a product
  - Offer any new services
  - Create a Linux distribution
- **Since that time, IBM did**
  - Create a new organization in the Enterprise Systems Group
    - make all IBM server platforms Linux-ready
    - engage closely with the Linux community to help Linux evolve
    - make IBM technologies available to the Linux and open source communities
  - Linux for S/390 ITSO redbook SG24-4987
  - Announced
    - distributions by SuSE and TurboLinux
    - middleware support (DB2-coonect, DB@-UDB, JDK, WAS
    - connectors to IMS and CICS, Tivoli endpoint,

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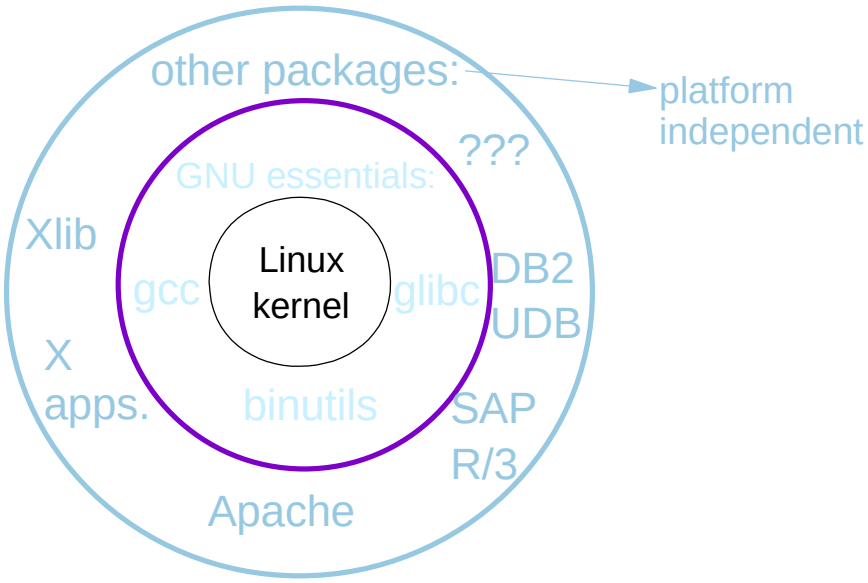
Linux: a sample distribution



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Achievements

Linux for S/390 characteristics:

- It runs on a native System, in an LPAR and as VM Guest
- Linux/390 is a true Linux, fully ASCII-based

Linux/390 specific deltas developed for...

- kernel, binutils, gcc, glibc, gdb, strace
- OSA2-module (OCO)

Patches integrated into official 2.2.14 kernel

First distribution built (available at Marist College)

- contains full System: Development Environment (GNU-Toolset) and Application Environment
- Systemutilities, Compiler, Debugger, Editors (emacs), package management (rpm), X11-Libraries and some X-applications

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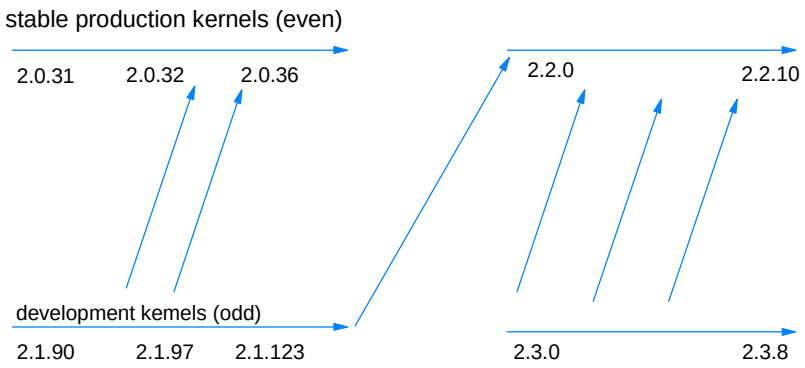
Linux kernel code streams



Version control under CVS, current stable and development kernels available on WWW

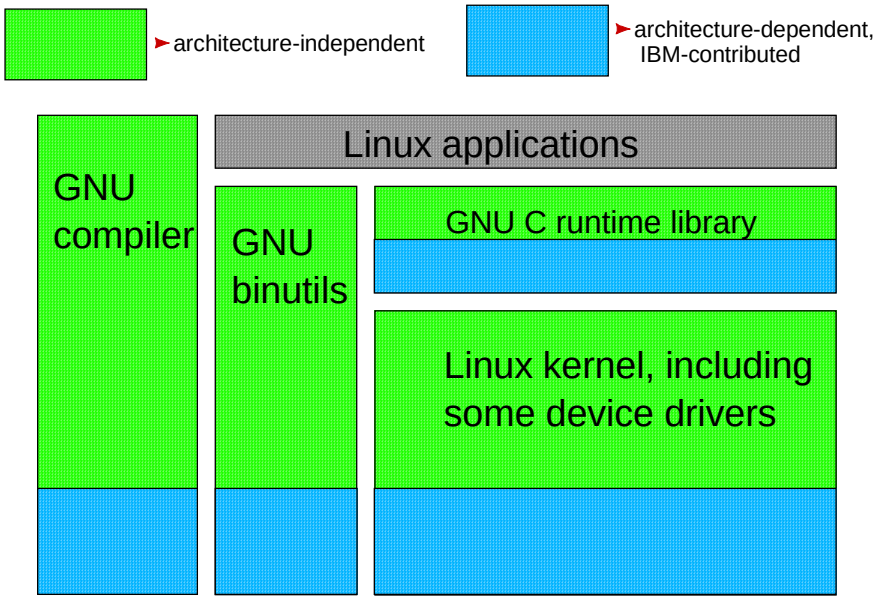
Development at warp speed

Development according to the rules of the open source world

- to have full awareness of architecture, design & development tasks
- to develop fast and with expected quality
- to release early + often
- to use established open standards
- to proclaim leadership by practicing leadership

Open a new world for S/390 platform with regards to technical and business targets

Linux for S/390 Structure



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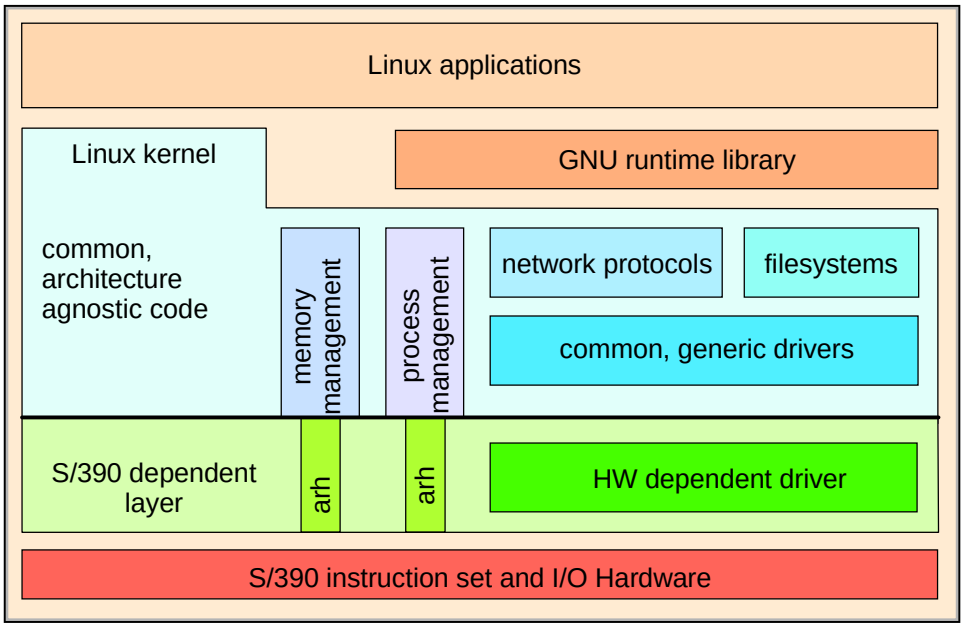
Linux block structure



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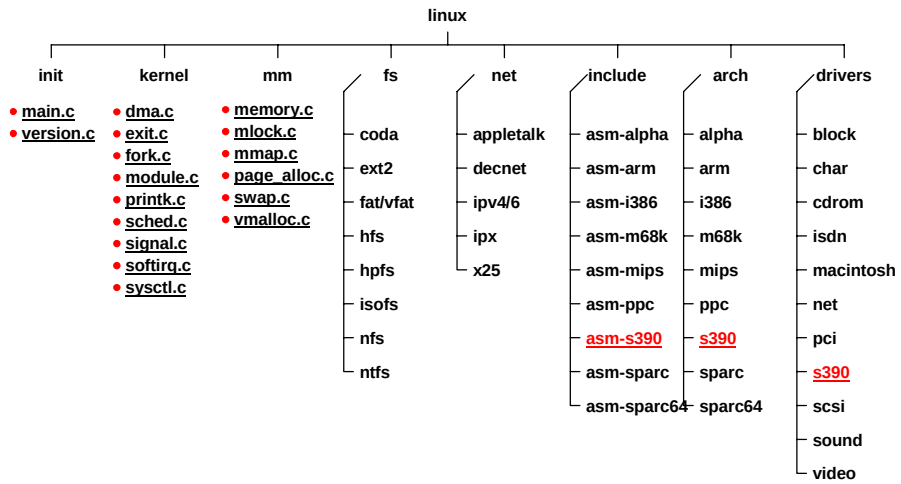
Linux for S/390 Kernel Code Tree



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Initialization process

SystemV init

runlevel 0: prepare the machine for turning off power, if the machine can turn the power off tell it to do so

runlevel 1: system administrator mode, all file systems mounted, only small set of kernel processes running, single user mode

runlevel 2: multi-user mode

runlevel 3: multi-user mode with remote file sharing, processes, and daemons

runlevel 4: user definable system state

runlevel 5: X11

runlevel 6: shutdown and reboot

runlevel 8: single-user mode, only root file system mounted

scripts in /etc/inittab, linuxconf as tool

telinit

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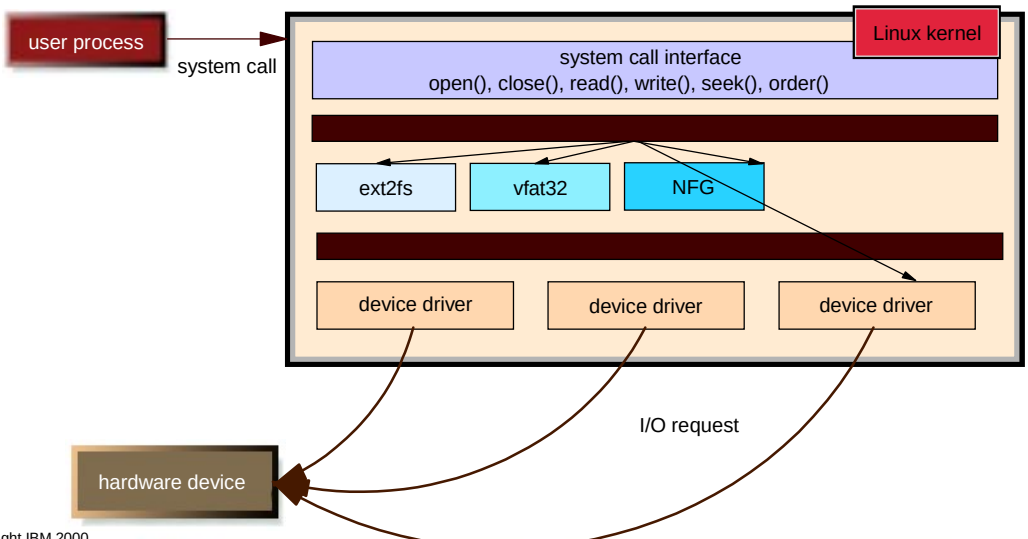
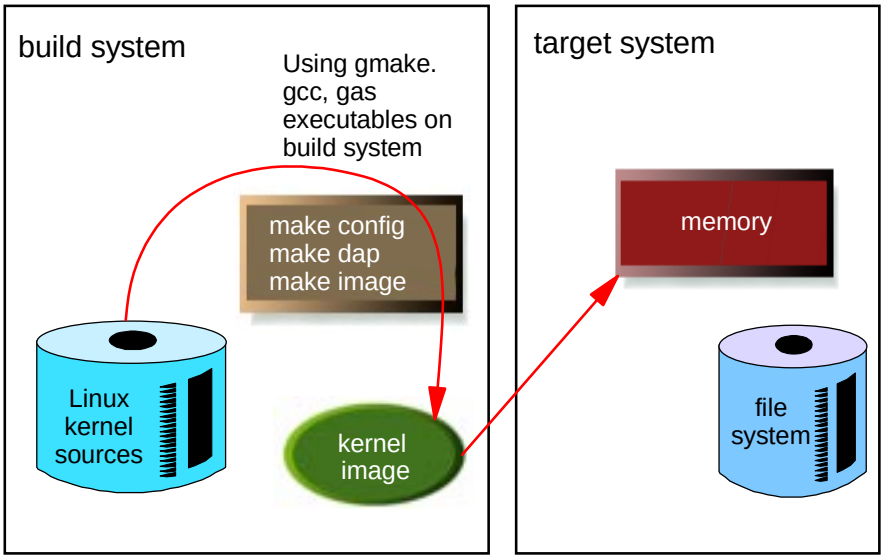
Virtual File System (vfs)

The VFS is an indirection layer which handles the file oriented system calls and calls the necessary functions in the physical filesystem code to do the I/O



Cross Compile Build Process



Linux under VM

- **Linux runs under VM (!)**
  - Like any other S/390 operating system
  - Performs more like CMS than OS/390
- **VM environment eased porting effort**
  - Debugging
  - Boot from virtual card reader
  - 3215 console driver
  - Minidisk driver (device-independent)
- **Linux exploits VM interfaces**
  - Virtual CTCA driver for IP connectivity
  - IUCV driver for IP connectivity

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Linux under VM Suggested Minimum Configuration

- **64MB virtual storage**
- **One 600MB minidisk big fs (CKD, ECKD, FBA)**
- **Virtual console**
  - Integrated console
  - 3215 (P/390, standard VM virtual console)
    - Local 3270
    - Telnet
    - SNA
- **Network connection**
  - LCS (OSA, 3172)
  - CTCA (Real, Virtual)
  - IUCV

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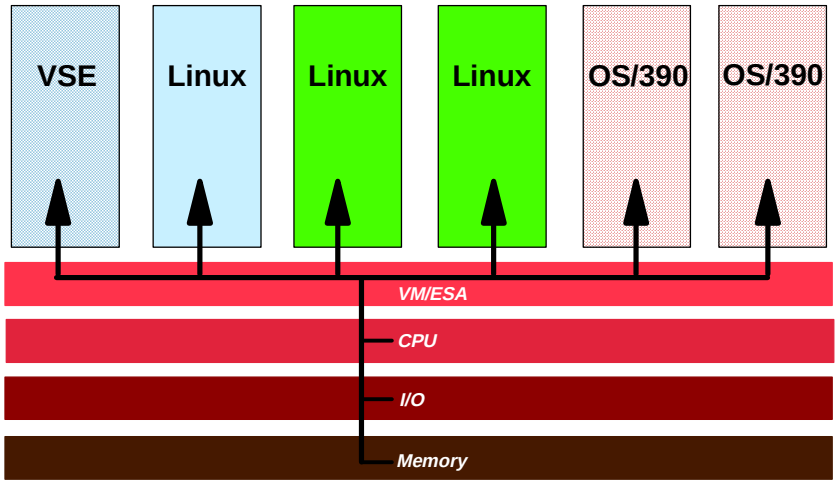
Linux under VM Virtual Machine Partitioning



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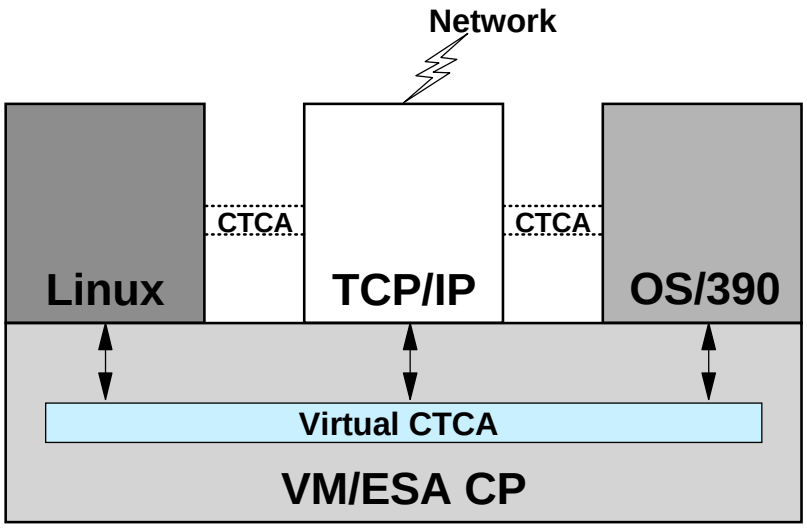
Linux under VM High-speed Networking



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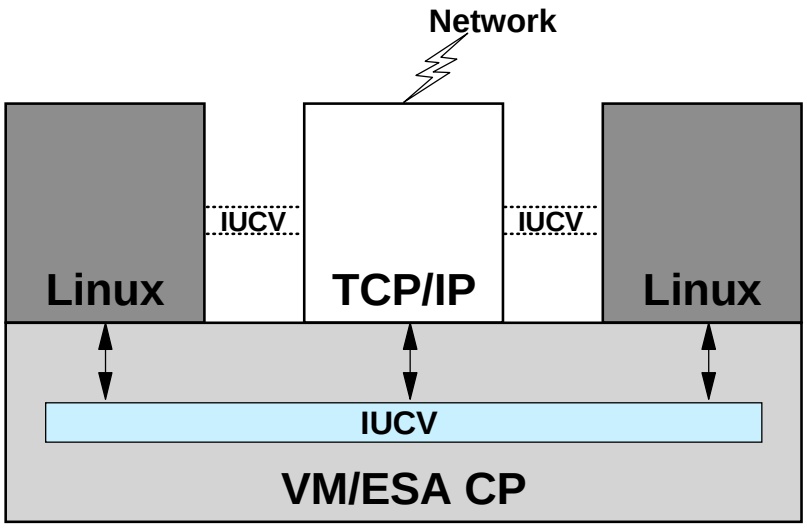
Linux under VM Higher-speed Networking



*Turbo G6 projected

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Prepare to build your system

- **VM-Userid incl. Minidisks/Dasds**
  - Format the Minidisks and Reserve
  - Leave Dasd (Linux Dasd type) unformatted
  - FTP Linux start files Kernel Image, Ramdisk
    - For RDR IPL FTP must be FB 80
    - For Tape IPL FTP must be FB 1024
  - Create Parm file according to Minidisk and or Dasd
  - Get the network parameter

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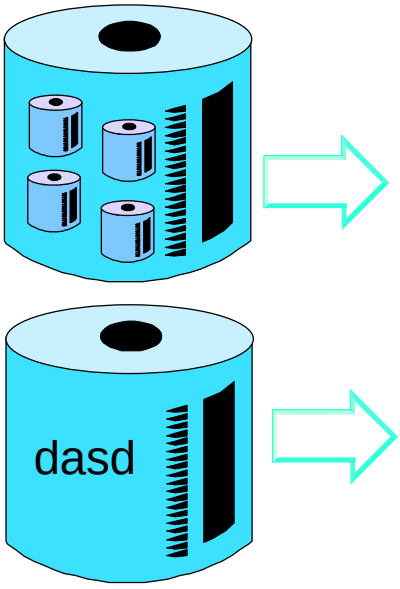
DASD or MINIDISK or both ??



- **minidisk (mnd-drv)**
  - CMS format
  - Reserve mdisk
  - mke2fs
- **minidisk as dasd (dasd-drv)**
  - dasdfmt
  - mke2fs
- **dasd**
  - dasdfmt
  - mke2fs

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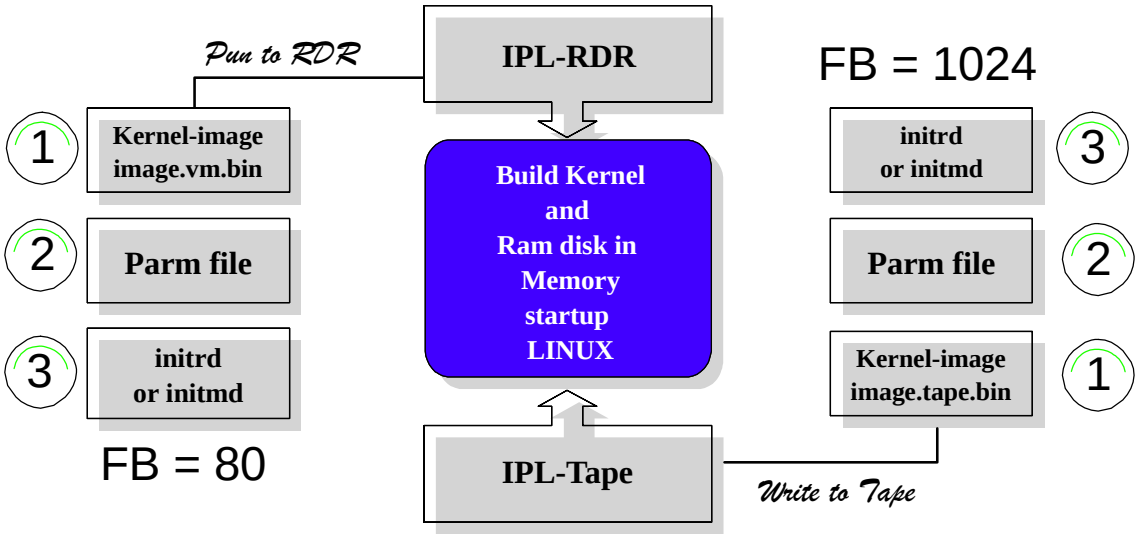
Linux first system build steps



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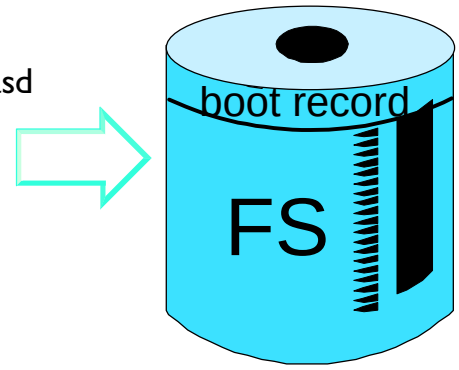
Build a Boot dev

- **What it takes to build a Boot/IPL dev**
  - dasdfmt ----- format dasd in Linux format
  - mke2fs ----- make a ext2 file system on dasd
  - mount the dasd
  - mkdir boot and copy boot information
  - edit parm line
  - silo ---- create IPL record on dasd



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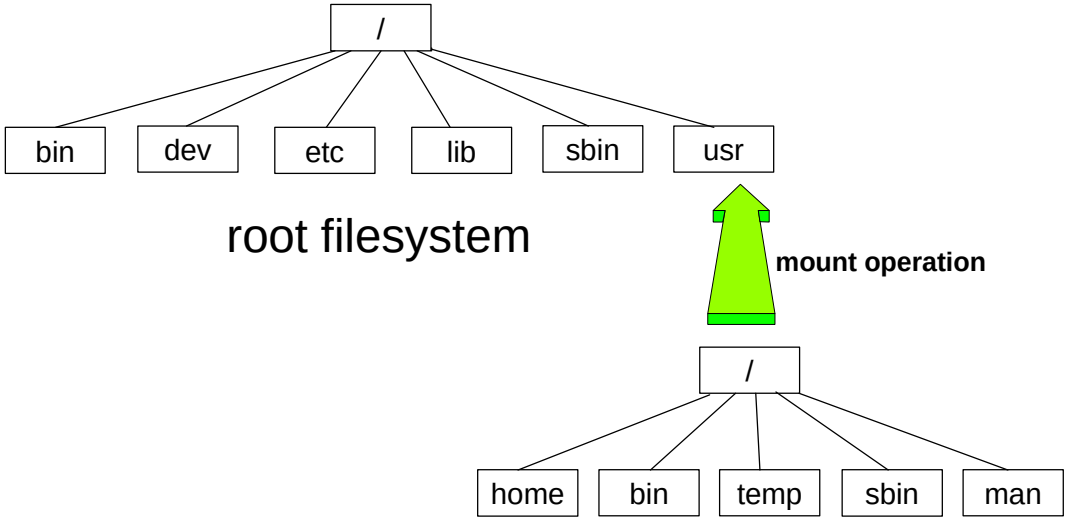
Filesystem and mount points



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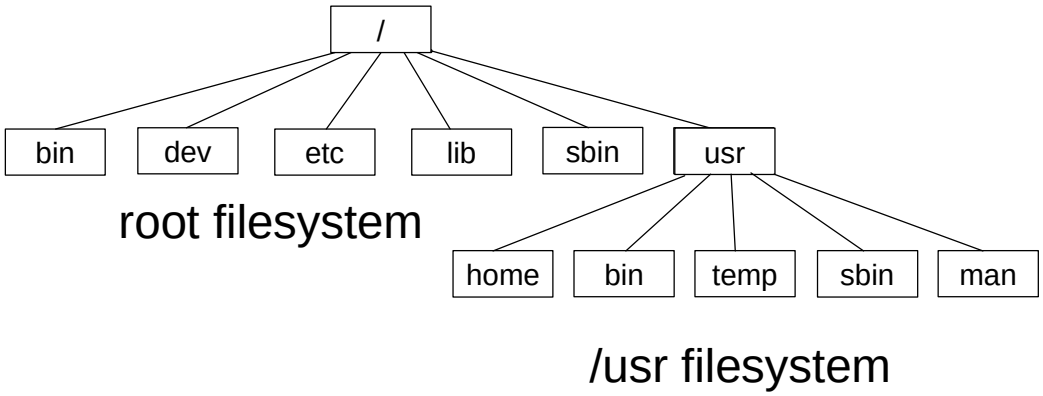
Filesystem and mount points



complete hierarchy after mounting /usr

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Linux for S/390 is up What's next ??

- **Install application software / packages**
  - RPM format comes in 2 flavors
    - with source code (tar file)
    - without source code
  - Source packages (tar file)
    - Configure (config.guess, config.sub)
    - Make or Make install
  - Binary packages (no source file)
  -

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Now let's do it

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