Linux for S/390
Installation Hands-on Workshop

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Agenda

- Introduction
  - Brief History of Linux
  - Hardware Requirements, Connectivity Options and Distributions
  - Linux File System and Common Linux Commands
  - Intro to Lab and Installation Overview

- Basic Lab Exercises
  - Installation of Linux for S/390
    - Marist (2.2.16)
    - SuSE SLES7 (2.4.7)
    - Red Hat 7.2 (2.4.9)
  - Basic Linux for S/390 System Administration

- Elective Lab Exercises
  - Rebuild the Linux Kernel
  - Using Linux as a Firewall with Ipchains
  - Using Linux as a DNS with BIND-8
  - File serving with Samba
  - Apache Web Server Installation and Customization
  - KDE Installation
Brief History of Linux
What is Linux?

- Linux is the kernel of a UNIX® technology (-like) operating system, originally developed by Linus Torvalds.
- It was developed / tested by the Open Source community.
  - Highly disciplined / structured
  - High quality
  - Secure
  - Stable
- Not just for Intel® processor-powered PCs
  - PowerPC®, Sparc, Alpha, S/390
  - Over 100 platforms supported today.
What is Linux on zSeries?

- A native IBM @server zSeries™ operating environment
  - Pure Linux, an ASCII environment
  - Exploits IBM S/390 hardware, including IEEE floating point
  - Linux for S/390 - 32-bit
  - Linux for zSeries - 64-bit
- Not a unique version of Linux or other operating system
- Not a replacement for other IBM @server zSeries operating systems
The look and feel of Linux does not change on S/390 and zSeries
Hardware Requirements, Connectivity Options and Distributions
Hardware Exploitation

- **Multiple Supported Environments**
  - ESA/390 single image
  - S/390 or zSeries Logical Partition
  - z/VM™ (or VM/ESA®) Guest

- **Exploits IBM S/390 and zSeries Hardware**
  - Hardware Management Console (HMC)
  - 3380/3390 ECKD DASD
  - FBA (9336 or VDISK)
  - FICON / ESCON® / Parallel Channels
  - FCP attached SCSI devices
  - OSA/2 or OSA-Express Adapters
  - IEEE Floating Point
  - Expanded Storage
  - Magnetic Tape
  - HiperSockets™
Hardware Requirements

- **Processors**
  - 9672 G2 - G6 (IBM only supports G5+)
  - zSeries
  - Multiprise® 2000 (not supported by IBM)
  - Multiprise 3000
  - P/390, R/390, Integrated Server (not supported by IBM)
  - 64 MB central storage (128 MB recommended)

- **Connectivity**
  - Network connectivity is required to acquire installation materials

- **VM Linux guest support**
  - z/VM V4 Recommended
    - Can be run under VM/ESA Version 2 Release 4
Hardware Requirements

- **Devices**
  - DASD support via ECKD driver
    - One 3380 / 3390 / Multiprise internal disk volume
    - One 500 cylinder minidisk (VM)
  - System console function via
    - Hardware Management Console (LPAR or basic mode)
    - Virtual 3215 console (VM)
  - Network connection
  - Workstation with CD-ROM for installation
Network Connectivity

- **LPAR or VM**
  - Channel-to-Channel Adapter (CTCA)
    - ESCON and Parallel channels
  - LAN Channel Station (LCS)
    - OSA/2 adapter (Ethernet and Token-Ring)
  - Gigabit Ethernet
    - OSA-Express adapter on G5, G6 and zSeries
  - HiperSockets
    - zSeries

- **VM Only**
  - Virtual Channel-to-Channel Adapter (VCTCA)
  - Inter User Communication Vehicle (IUCV)
  - Guest LAN
Available Distributions

- **Marist College — linux390.marist.edu**
  - 2.2.16 kernel

- **SuSE — suse.de/en/**
  - Linux Enterprise Server 7 for S/390 and zSeries (31-bit 2.4 kernel)
  - Linux Enterprise Server 7 for zSeries (64-bit 2.4 kernel)
  - Linux Enterprise Server 8 for IBM Mainframes (31-bit and 64-bit 2.4 kernels)

- **Red Hat — www.redhat.com**
  - Red Hat Linux 7.2 for S/390 - (31-bit 2.4 kernel)
  - Red Hat Linux 7.1 for zSeries - (64-bit 2.4 kernel)

- **ThinkBlue — linux.s390.org/**
  - ThinkBlue Linux for S/390 (31-bit)
  - ThinkBlue/64 7.1a (64-bit) Linux for zSeries

- **Debian — www.debian.org/ports/s390/**
  - Debian GNU/Linux Version 3 for S/390 (31-bit 2.4 kernel)
One Important Web Site

www.linuxvm.org
Linux File System Structure
File System Structure (Marist Lab System)
Mounting a File System

root filesystem

mount operation
Mounting a File System (cont.)

complete hierarchy after mounting /usr
Directory Usage

/    root directory
/boot boot files (kernel, parm file, system map)
/home user directories
/dev device files that represent system hardware
/etc important system configuration files
/bin commands needed to start the system
/sbin critical system binaries, commands reserved for the superuser
/usr/doc documentation files
/usr/man manual files
/usr/src source code for the system software
/usr/src/linux the kernel sources
/tmp temporary files
/var configuration files (linked from /usr)
/lib shared libraries
/proc the process file system
/mnt mount point for temporarily mounted filesystems
/usr additional utilities and applications
Basic Configuration Files

/etc/fstab - tells Linux what filesystems to mount when it starts
/etc/inittab - parameters for the init process
/etc/rc.config - primary configuration file for SuSE Linux (includes network config)
/etc/sysconfig/network - general network configuration for Red Hat and Marist Linux

/etc/sysconfig/network-scripts/ifcfg-iucv0
/etc/sysconfig/network-scripts/ifcfg-ctc0
- interface specific configuration files for Red Hat and Marist Linux

/etc/motd - "Message of the Day" file, contents are displayed when users login
/etc/passwd - Contains user names, numbers, home directories, and login shell
/etc/group - Contains user groups
/etc/shadow - Contains passwords
/etc/hosts - Contains hostname to IP address assignments.
Common Commands
# Linux Commands Used in Class

<table>
<thead>
<tr>
<th>Command</th>
<th>Syntax</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>adduser</code></td>
<td>Creates a directory and an entry in the passwd file for a new user</td>
<td><code>adduser userid</code></td>
</tr>
<tr>
<td><code>cat</code></td>
<td>&quot;Concatenate&quot; View, create, and concatenate files</td>
<td><code>cat [options] [inputfile] [outputfile]</code></td>
</tr>
<tr>
<td><code>cd</code></td>
<td>&quot;Change Directory&quot; Used to change from your current working directory to another directory</td>
<td>`cd directory</td>
</tr>
<tr>
<td><code>cp</code></td>
<td>&quot;Copy&quot; Copy a file</td>
<td><code>cp source destination</code></td>
</tr>
<tr>
<td><code>dasdfmt</code></td>
<td>&quot;DASD Format&quot; Formats a device to be managed by the LINUX dasd driver</td>
<td>`dasdfmt [-tvy] [-s start_track] [-e end_track][-b blocksize] -f devicename</td>
</tr>
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<td><strong>df</strong></td>
<td>&quot;disk free&quot;&lt;br&gt;Reports file system disk space usage</td>
<td>df [-h]&lt;br&gt;where -h = display output in more human readable form</td>
</tr>
<tr>
<td><strong>du</strong></td>
<td>&quot;disk used&quot;&lt;br&gt;Reports the space occupied by the current (or named) directory and all directories within it</td>
<td>du [directory] [-sh]&lt;br&gt;where -h = display output in more human readable form&lt;br&gt;-s = display summaries only</td>
</tr>
<tr>
<td><strong>ed</strong></td>
<td>&quot;edit&quot;&lt;br&gt;Invokes the ed text editor</td>
<td>ed filename</td>
</tr>
<tr>
<td><strong>find</strong></td>
<td>Locate files in a directory based on search criteria</td>
<td>find [/directory]&lt;br&gt;[-name filename]&lt;br&gt;[-atime (+-)]&lt;br&gt;#days_since_last_access]&lt;br&gt;[-ok command {}]&lt;br&gt;[-mtime&lt;br&gt;#days_since_last_modified]&lt;br&gt;[-print]</td>
</tr>
<tr>
<td><strong>free</strong></td>
<td>Display amount of free and used memory</td>
<td>free</td>
</tr>
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<tr>
<td>gcc</td>
<td>gcc [-o output_filename] [options] source_filename</td>
<td>gcc -o mountpw mountpw.c</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compile the mountpw.c file into a binary executable file called mountpw.</td>
</tr>
<tr>
<td>ifconfi g</td>
<td>ifconfig [interface options</td>
<td>address]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Activate the iucv0 interface at IP address 9.130.240.161 with a point-to-point connection to IP address 9.130.240.101 using a Maximum Transmission Unit size of 9216 bytes.</td>
</tr>
<tr>
<td>kill</td>
<td>kill [PID] [-options]</td>
<td>kill 93 -HUP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stop process number 93 and restart</td>
</tr>
<tr>
<td>last</td>
<td>last</td>
<td>last</td>
</tr>
<tr>
<td>lastlog</td>
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<td>lastlog</td>
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<td><strong>ln</strong></td>
<td>&quot;link&quot;&lt;br&gt;Creates a link between one file and another. This allows the file to be located in one place and referenced in another.&lt;br&gt;<code>ln [-s] source linkname</code>&lt;br&gt;where: <code>-s = symbolic link</code></td>
<td><code>ln -s init.d/named S60named</code>&lt;br&gt;Creates a symbolic link which allows you to reference the file &quot;named&quot; in the &quot;init.d&quot; directory by the linkname of &quot;S60named&quot;.</td>
</tr>
<tr>
<td><strong>ls</strong></td>
<td>&quot;list&quot;&lt;br&gt;Displays the contents of a directory&lt;br&gt;<code>ls [-al]</code>&lt;br&gt;where: <code>-a = all</code>&lt;br&gt;<code>-l = long format</code></td>
<td><code>ls -al</code>&lt;br&gt;Lists all files in the current directory in the long format</td>
</tr>
<tr>
<td><strong>mkdir</strong></td>
<td>&quot;Make directory&quot;&lt;br&gt;Creates a sub-directory under the current working directory&lt;br&gt;<code>mkdir directory_name</code></td>
<td><code>mkdir boot</code>&lt;br&gt;Creates an empty directory called &quot;boot&quot;.</td>
</tr>
<tr>
<td><strong>mkswap</strong></td>
<td>&quot;make swap partition&quot;&lt;br&gt;Used to create a LINUX swap partition&lt;br&gt;<code>mkswap partitionname</code></td>
<td><code>mkswap /dev/mndb</code>&lt;br&gt;Makes minidisk device /dev/mndb a swap partition.</td>
</tr>
<tr>
<td><strong>mke2fs</strong></td>
<td>&quot;make ext2 file system&quot;&lt;br&gt;Creates a native LINUX ext2 file system.&lt;br&gt;<code>mke2fs devicename [-b blocksize]</code></td>
<td><code>mke2fs /dev/mnda -b 4096</code>&lt;br&gt;Creates a file system of type ext2 on device mnda with a blocksize of 4096.</td>
</tr>
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<td><strong>mount</strong></td>
<td>Tells the system that a device is available for use and specifies where in the filesystem you want it to be located.</td>
<td><code>mount [-t type] [-o accesstype] device mountlocation</code>&lt;br&gt;Makes device mnda, which contains an ext2 file system, accessible to the Linux system at location (directory) mnt, with read-only access.</td>
</tr>
<tr>
<td><strong>mv</strong></td>
<td>&quot;move&quot; Move or rename a file</td>
<td><code>mv source destination</code>&lt;br&gt;Renames the file ifcfg-ctc0 to ifcfg-iucv0</td>
</tr>
<tr>
<td><strong>nslookup</strong></td>
<td>&quot;name services lookup&quot; Tool provided with BIND-8. Interactively queries Internet domain name servers.</td>
<td><code>nslookup</code>&lt;br&gt;Usage: Enter &quot;nslookup&quot; to begin an interactive session with the tool. Enter a host name. nslookup will respond with the fully qualified name of the host and it's IP address. To end the interactive session, enter &quot;exit&quot;.</td>
</tr>
<tr>
<td><strong>passwd</strong></td>
<td>Create/set a password for a userid</td>
<td><code>passwd userid</code>&lt;br&gt;Enter the password when prompted.</td>
</tr>
</tbody>
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## Linux Commands Used in Class

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| **ps**  | "process" Displays the processes running on your system. Often used in conjunction with the kill command. | `ps [-efl]`  
where:  
e = select all processes  
f = provide full output listing  
l = display in the long form | `ps -ef` |
| **rm**  | "remove" Erase a file | `rm filename` | `rm apache_1.2.12.tar.Z` |
| **route** | Used to manipulate the Linux kernel's routing table. | `route [interface options]` | `route add -net default iucv0`  
Add the iucv0 interface to the routing table as the default interface. |
| **rpm** | "Redhat Package Manager" Installs products packaged by the Redhat Package Manager | `rpm [-ivh --nodeps] [-qlp] packagename.rpm`  
where:  
--nodeps = no dependency checking  
i = install a new package  
v = verbose  
h = display a progress indicator (hash marks)  
during installation  
q = query package info  
l = list all files in the package  
p = queries the packagefile | `rpm -ivh --nodeps bind-8.2.2p3-1_s390.rpm`  
Installs a new package with no dependency checking. A progress indicator and additional messages will be displayed. |
# Linux Commands Used in Class

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| **shutdown** | **shutdow**n**n** Shut the system down | **shutdown [-r | -h] [now]**  
where:  
|**h** = halt the system after it shuts down  
**r** = reboot after shutdown  
**now** = start the shutdown process immediately without warnings to users | **shutdown -h now**  
Shuts down the system immediately. |
| **silo** | Create an IPL/boot record on a device | **silo [-f image_file] [-d boot_device] [-p parmfile] [-b boot_sector_file] -t2**  
Note: -t2 indicates "test level 2". Although this is not a parameter you would expect to use, it is still necessary at the current kernel level to write the IPL record. | **silo -f image.vm.bin -d /dev/dasda -p image.vm.parm -b ipleckd.boot**  
Creates an IPL record on device /dev/dasda using the image.vm.bin kernel image, the image.vm.parm kernel parameter file, and the ipleckd.boot boot sector file. |
| **swapon** | "swap on" Activates or displays usage for a swap partition | **swapon partitionname [-s]**  
where:  
**s** = display usage information | **swapon /dev/mndb**  
Tells Linux to begin using the swap partition /dev/mndb |
| **tail** | View the end of a file | **tail [-number_of_lines] filename**  
The default number of lines shown is 10 | **tail -20 /var/log/messages**  
Displays the last 20 lines of the file "messages" |
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<td><strong>tar</strong></td>
<td>&quot;tape archive&quot;&lt;br&gt;Combines files and directory structure in one archive file or recreates files and directory structure from previous tar operations</td>
<td>`tar [-xzvfc] input_fn</td>
</tr>
<tr>
<td><strong>top</strong></td>
<td>Display top CPU processes</td>
<td><code>top</code></td>
</tr>
<tr>
<td><strong>umount</strong></td>
<td>&quot;unmount&quot;&lt;br&gt;Unmount a mounted file system</td>
<td><code>umount mountlocation</code></td>
</tr>
<tr>
<td><strong>uptime</strong></td>
<td>Tell how long the system has been running</td>
<td><code>uptime</code></td>
</tr>
<tr>
<td><strong>w</strong></td>
<td>Show who is logged on, and resource usage</td>
<td><code>w</code></td>
</tr>
<tr>
<td><strong>who</strong></td>
<td>Show who is logged on</td>
<td><code>who</code></td>
</tr>
<tr>
<td><strong>whoami</strong></td>
<td>Show effective userid</td>
<td><code>whoami</code></td>
</tr>
</tbody>
</table>
The ed editor has two modes:

- **Command mode** - everything you type in is considered to be a command. Some commands you will be using are:
  - `number` positions the editor at line number
  - `a` append (add) text after the current line
  - `c` change a line
  - `i` insert text before the current line
  - `d` delete the current line
  - `p` display (print) lines
  - `w` save (write) lines
  - `q` end (quit) the editing session
  - `.` refers to the current line
  - `$` refers to the last line

- **Input mode** - after you have entered the `a`, `c`, or `i` subcommands, everything that follows will be text, until a period (.) is entered on a line by itself.
Sample ed Session

```
ed fstab
1 .c
/dev/mnda   /   ext2   defaults,errors=remount-ro 0 1
. 1,$p
1,$w
q
```

- This sequence of commands will:
  - begin editing on the file "fstab"
  - position the editor at line 1 in the file
  - indicate that the line is to be changed
  - enter the exact text that should replace the current line of text
  - indicate the end of changes
  - position the editor at line 1 and display (print) the file
  - position the editor at line 1 and save (write) the file
  - end (quit) the editing session
Need Help?

- The Linux equivalent of HELP is \texttt{man} (manual)
  
  \textbullet{} Use \texttt{man <command>} to display help for that command.

  - Output is presented a page at a time. Use \texttt{b} to scroll backward, \texttt{f} or a space to scroll forward, and \texttt{q} to quit.
Installation Overview
Basic Installation Steps

- Acquire Linux Distribution
  - Kernel image
  - Ram disk
  - File system

- Prepare Environment
  - Configure virtual machine or LPAR
  - Gather network parameters
  - Create a boot parameter file

- Load the kernel, parm file and ram disk into storage
- Build the file system and configure system
Create Parameter File

- The parameter file provides information needed by the kernel at boot time

- Basic parameters include
  - `mem=` defines the amount of storage to be used by Linux
  - `mdisk=` specifies the devices to be used by the minidisk driver (VM)
  - `dasd=` specifies the devices to be used by the dasd driver
  - `iucv=` identifies the virtual machine(s) to be connected via IUCV (VM)
  - `root=` specifies the device containing the root file system
Initial System Build

1. Kernel-image VM based
2. Parm file
3. initrd

Blocksize = F 80

Pun to RDR

IPL-RDR

Blocksize = F 1024

initrd
Parm file
Kernel-image tape based

parm file
Kernel

usr bin etc dev

IPL-Tape

Write to Tape

x'000000'

HandsOnLab340
Build and Configure File System

- Now that Linux is up and running you can
  - Create the file system
    - FTP the tar file to your Linux system
    - Uncompress using the tar command
  - Create a swap volume
  - Make the system bootable
    - Format a boot device
    - Put boot files on the device
      - kernel image
      - parameter file
      - IPL text
    - Run Silo (2.2.16) or zipl (2.4)
Hands-On Lab - Virtual Machine Configuration

 mem=128m
 mdisk=200,202,400
 dasd=300
 root=/dev/mnda ro

Shared Volume
400 mdisk
/dev/mndc

memory
200 mdisk
/dev/mnda

Large file system
202 mdisk
/dev/mndb

swap partition
300 dasd
/dev/dasda

boot device

Shared Volume
400 mdisk
/dev/mndc
Hands-on Lab - Network Configuration

Multiprise 3000

LINLAB01

TCP/IP

9.82.56.1

9.82.56.131

CP

LINLAB01

OSA

x.x.x.x

x.x.x.x

x.x.x.x

Hands-OnLab370