Configuration of the Linux PCs and the Cisco Routers

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This document provides information on software installations and configurations for the Linux PCs and the Cisco routers of the Internet Lab. We describe how to install RedHat Linux, how to install additional *Internet Lab Configuration* software, and how to set the configuration of the Cisco routers.

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General Information

Licensing Information: All software required for the PCs of the Internet Lab is provided under the GNU Public License (GPL) or similar licenses. This means that the software can be obtained without cost, that the software can be installed on any number of PCs, that the software can be copied and modified, and that there is no restriction on distributing the software.

Disclaimer: The configuration of PCs in the Internet Lab is not suitable for systems connected to the Internet. The configuration procedure described in this document will leave a system highly vulnerable to attacks.

If you use the information in this document for your own equipment, you will do so at your own risk. We cannot be held responsible for any damage that may result from the instructions or suggestions in this document.

Installing RedHat9.0

The following are instructions for the installation of RedHat 9.0 and the configuration of software for the PCs in the Internet Lab. The Internet Lab should work with different Linux distributions (Debian, SuSE, Slackware), but has been tested only for RedHat Linux.

 If you already have RedHat 9.0 installed on your system, proceed to the next section (*"Installing Software Packages for the Internet Lab"*). The instructions in this section are minimal. If you have not installed an operating system before, you may want to seek the help of a system administrator.

- If you require more extensive information on installing and running Linux, we recommend the following source:
  Running Linux, Fourth Edition, by Matt Welsh, Lar Kaufman, Matthias K. Dalheimer, Terry Dawson, O'Reilly & Associates. 4th edition, 2002

- A good source for detailed, and more basic, information on installing RedHat Linux is the following book:
  Learning Red Hat Linux, 2nd Edition. A Guide to Red Hat Linux for New Users, by Bill McCarty, 2nd Edition January 2002

- For information on Linux that covers multiple distributions, we recommend:
  Linux Administration Handbook. Evi Nemeth, Garth Snyder, Trent R. Hein, Adam Boggs, Prentice Hall, 2002.

- In addition, the Redhat website has a substantial amount of information:
  http://www.redhat.com/docs/manuals/linux

The PCs should satisfy the following minimum system requirements:
- 300 Mhz Intel-compatible PC (recommended: 1Ghz)
- 64 MB RAM (recommended: 256 MB)
- 1 CD Rom drive
- 10 GB hard disk
- 1 floppy drive
- 2 Ethernet cards
- 1 DB9 serial port
- a Linux compatible Video card
- mouse and keyboard with PS/2 connectors.

Step 1: Preparing RedHat 9.0 Software.

- If you have RedHat 9.0 CDs or have already downloaded a CD-ROM distribution (three CDs) for RedHat 9.0, skip this step and proceed to Step 2.

- Go to the website: **http://ftp.redhat.com/pub/redhat/linux/9/en/iso/i386/**, download the following ISO files.

  > shrike-i386-disc1.iso
  >
  > shrike-i386-disc2.iso
  >
  > shrike-i386-disc3.iso

- Burn each of the files to a separate CD-R, resulting in three CDs. Label the CDs as Disk1, Disk2, and Disk3.

  These CDs contain the files needed for the RedHat 9.0 installation on a PC.

Step 2: Starting the Installation.

- Insert Disk 1 in the CD-ROM drive. Reboot the machine and enter the BIOS setup program as soon as the machine starts. The BIOS setup mode is entered by typing certain keys, which are determined by the manufacturer of the PC, e.g., the "*Del*" key. Once you enter the BIOS setup program, select "*CDROM*" as the 1st boot device.

- In the BIOS program, select *"Save"* and *"Exit"*. This reboots the PC. When the PC reboots, it automatically enters the RedHat9.0 installation process. Follow the instructions on the screen to finish your customized installation step by step.

- *Select installation mode.* In the *Installation Mode Selection* screen, select "Lin*ux text"*.

- *Skip the CS media test process.* In the *CD Found* screen, select "skip". Otherwise, there is a lengthy process that tests the CD.

- *Select language.* In the *Language Selection* dialog box, select *"English".*

- *Select keyboard type.* In the *Keyboard Selection* dialog box, select *"US"*, or whatever applies to your keyboard.

- *Select mouse type.* In the *Mouse Selection* dialog box, select "Generic-3 Button *Mouse* (PS/2)".

- *Select installation type*. In the *Installation Type* dialog box, select *"Custom"*.

Step 3: Creating Partitions.

If you are installing Linux on a new PC, allocate and create partitions on the disk for the Linux operating system. If the PC is not new, you may want to delete existing partitions.

- *Select disk setup mode*. In the *Disk Setup* dialog box, choose *"Disk Druid",* to view, add, delete and modify the partitions for the Linux system. *In Disk Druid, create* a new Linux partition of type *"ext 2"* and with a size of at least

8 GB. Set the mount point of this partition to root directory "/". This partition will be used for installing Redhat9.0

- We recommend to create another partition of type *"swap"*. The size of this partition should be twice the size of the RAM. For example, if the PC has 256 MB of RAM, the size of the *"swap"* partition should be 512 MB.

- Delete partitions that are not needed.

- Press *"OK"* if the partitioning is finished.

Step 4: Configuring Boot Loader.

- *Select the Boot Loader.* In *the Boot Loader Configuration* dialog box, select *"Use GRUB Boot Loader*" (recommended) *or "Use LILO Boot Loader".*

- Don't type boot options.

- Unselect "*Use a GRUB Password*" in the boot loader configuration process.

- In the Boot Loader Configuration dialog box, change the Boot Label to "*RedHat 9.0*". Press "OK".

- *Choose the place where the Boot Loader is running.* In the *Boot Loader Configuration* dialog box, select "Master Boot Record (MBR)".

Step 5: Network Configuration.

- *Configure network.* In the *Network Configuration* dialog box for *eth0* and *eth1*, unselect *"Use bootp/dhcp".* For *eth0* select *"Activate on boot"*, and for *eth1 do not* select *"Activate on boot"*. Set the hostname to *"PC1"*, *"PC2"*, *"PC3",* or *"PC4* , and the IP addresses and netmasks as given in the following table.[1] Leave the entries for default gateway, primary nameserver, secondary nameserver and ternary nameserver blank. Press "*OK*".

Hostname	Interface eth0		Interface eth1	
PC1	IP address Netmask	10.0.1.11 255.255.255.0	IP address Netmask	10.0.2.11 255.255.255.0
PC2	IP address Netmask	10.0.1.12 255.255.255.0	IP address Netmask	10.0.2.12 255.255.255.0
PC3	IP address Netmask	10.0.1.13 255.255.255.0	IP address Netmask	10.0.2.13 255.255.255.0
PC4	IP address	10.0.1.14	IP address	10.0.2.14

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[1] The hostname and IP addresses are reset by a script from the *Internet Lab configuration* software. However, the installation procedure requires that you type an IP address.

	Netmask	255.255.255.0	Netmask	255.255.255.0

- *Select the security level.* In the *Firewall Configuration* dialog box, choose *"No firewall"* as the security level.

Step 6: Selecting Language Support and Time Zone.

- *Choose language support*. In the *Language Support* dialog box, select *"English (USA)"* or your preferred language.

- *Choose time zone*. In the *Time Zone Selection* dialog box, unselect *"Hardware clock set to GMT?",* choose your time zone and press "OK".

Step 7: Setting of Root Password, Setup of User Accounts.

- *Input the root password*. In the *Root Password* dialog box, type the root password twice. **Select the same password on all PCs**. **Make sure that you memorize the password.**

- *Choose password type.* In the Authentication Configuration dialog box, select "Use Shadow Passwords". Unselect "Enable MD5 Passwords", "Enable NIS", "Enable LDAP" and "Enable Kerberos". Press "OK".

   Note: The directions for the Internet Lab assume that each user logs in as root. The additional accounts can be added at the first time when the new RedHat9.0 system is booted.

Step 8: Selecting Packages and Completing RedHat Installation.

The RedHat installation can be customized by installing software packages of the distribution. For simplicity of the installation, we recommend to install all software packets. This requires roughly 6 GB of disk space.

- Select the packages to be installed. In the *Package Group Selection* dialog box, select "*Everything.*" This will install all packages. The storage need is 4.85 GB of hard disk space. Press "*OK*" if done.

- In the *Installation to begin* dialog box, press "OK".

- Next, the system begins to format the newly created partitions, configure the systems, and install the selected packages:

  - *Formatting:* A window, labeled *Formatting progress,* shows the process of the formatting of the created partitions.

  - *Copying files from the CD-ROM:* A window, labeled *Copying Files*, shows the progress of the transfer of software from the disk to the hard disk.

- *Installing packages:* Then a window with label *"Processing",* shows the progress of setting up the RPM files. A window, labeled *Package Installation*, shows the progress of the installation of the selected packages. Disc 2 and Disc 3 are needed during the package installation process. The time of the installation is approximately 90 minutes.

- When the installation is complete, you will be asked if you want to create a *bootdisk*. Proceed to Step 9.

Step 9: Creating a Bootdisk.

We strongly recommend to create a *bootdisk*. When the operating system fails to boot after changing some configuration files, the bootdisk, can be used to start the system, and correct any settings.

- In the Boot disk dialog box, choose "*Yes*".

- Insert a blank floppy into the floppy drive. Press "*OK*".

Step 10: Configuring the Monitor and X Windows.

- In the *Video Card Configuration* dialog box, press "*OK*".

- Next, determine the monitor configuration parameters, such as the type of monitor and the horizontal and vertical synchronization rates.

- In the displayed *Monitor Configuration* dialog box, the monitor will display the type and the parameters of the monitor detected by the system. Press "*Yes*" if this is correct.

- You can choose "*Change*" to modify the configuration of the monitor manually. **Note, however, that settings which do not match your monitor may damage the monitor.**

- Next, the system shows the *X Customization* dialog box, which is used to configure the X Windows setting. The system displays the default parameters, such as the color depth (e.g., High Color, True Color), resolution (e.g., 1024x768), and the default login (e.g., Graphical, Text).

- The recommended settings are: *color depth=True Color*, *resolution=1024x768*, and default *login=Graphical*.

- You can choose "*Change*" to modify the configuration of X windows. Press "OK" if the configuration is completed.

Step 11: Completing the Installation.
- Next, a dialog box, labeled *Complete,* is displayed. Pressing "OK" completes the installation process, and the PC reboots automatically.

Installing the Internet Lab Configuration software

After installing and customizing RedHat9.0 Linux, download and install additional software and configuration files for the PCs of the Internet Lab. This software called "*Internet Lab configuration software*" can be downloaded from the website **http://www.tcpip-lab.net/links/internetlab-software.html**.

The software includes:

- o A script that performs configurations of the Linux PCs.

- o Software, which is needed in the Lab, but not part of the RedHat Linux 9.0 software

These are the files included on the *Internet Lab configuration* software.

Files of the Internet Lab configuration software

README.txt -- Contains a table of contents

Configuration_of_PCs_and_Routers_v1.pdf -- this file

./hosts -- Files in this directory set the hostname and the network configuration files

   autoconf_hosts -- a shell script that performs the installation on a Linux PC
   host1.tar.gz -- configuration files for host1
   host2.tar.gz -- configuration files for host2
   host3.tar.gz -- configuration files for host3
   host4.tar.gz -- configuration files for host4

./labtools --   Files in this directory install and upgrade packages required by the lab exercises

   autoconf_labtools -- a shell script that performs the installation of packages on a PC
   binary.tar.gz -- binary codes of the following utility tools

     - mreceive -- Multicast receiver
     - msend -- Multicast sender
     - mtrace -- Multicast route trace tool

   namedpackage.tar.gz – DNS configurationfiles

   RPMinstall -- The rpm files in this directory install the following software packages

     - gbrctl-0.0-1.i386.rpm -- Linux ethernet bridge software
     - **mrouted-3.9b3-1.i386.rpm** -- multicast tools

Step 1: Download the software

- • Go to URL

    http://www.tcpip-lab.net/links/internetlab-software.html

This link points to a compressed file (in ZIP format), which contains the needed software and configuration files. The name of the file is

internetlab-rh90-20030604.zip

or similar. The acronym "rh90" refers to Redhat 9.0, if you have a more recent version of Linux installed on your system, look for the corresponding file.

- The size of the file is less than 200 KB. Download the file and copy it to a floppy disk.

Step 2: <u>Installation</u>

- On each PC, copy the content of the floppy disk to directory /root/swinstall on the PC. If the directory /root/swinstall does not exists, create it.:

   #mkdir /root/swinstall
   #mcopy a:internetlab-rh90-20030604.zip /root/swinstall

- Install the software and configuration files with the following commands:

   #cd /root/swinstall
   #unzip internetlab-rh90-20030604.zip
   #cd hosts
   #./autoconf_hosts
   #cd ../labtools
   #./autoconf_labtools

   These commands will execute scripts that copy modify the configuration of the Linux setting, and install additional software. Follow the instructions on the screen. When the installation is complete, reboot the PC.

Step 3: <u>Repeat for other PCs</u>

- Repeat Steps 1-2 for each PC in the Internet Lab.

> **Note:** Since the installation in Step 2 put the PC to a known state, execute step 2, whenever you want to reset the configuration of the PCs. You can edit the

Setting up a Cisco Router

This section discusses the setup for the Cisco routers in the Internet Lab. The Cisco routers in the lab should run IOS 11.2 or a later version. Each router must have 2 Ethernet interfaces (10 Mbps or 100 Mbps) and one synchronous serial interface.

There are numerous Cisco routers that are suitable for the Internet lab: Cisco 2514, Cisco 2611 with a serial WAN interface card, or Cisco 36xx, Cisco 7xxxx with suitable interface cards.

Label the routers as Router1, Router2, Router3, and Router4. You may also want to label the interfaces.

Step 1: Starting a router

A router is started by turning on the power switch. The operating system (IOS) boots from NVRAM or flash memory. If the router has a slotted chassis, then the interface cards must be installed in the slots of the router. Insert an Ethernet interface card in slot 0 and a synchronous serial interface in slot 1.

Step 2: Establishing a serial connection

Connect the console port of the router via a serial cable to the serial port of a PC or a dumb terminal. The console port of recent Cisco routers have a RJ-45 connector with rollover cabling.
If you are connecting to the console port from the serial console of a PC, you need a *DB-9 to RJ-45* adaptor. Older PCs routers have a DB-25 connector at the console port, and require different adapters.

Step 3: Accessing the router using Kermit

If you are working on a Linux PC, create a *kermit* session to establish a command interface to the router. Instructions can be found in Part 2 of Lab 3. Start *kermit* by typing. Here is the sequence of commands:

```
PC1% kermit
[/root]C-kermit>
[/root]C-kermit> set line /dev/ttyS0 (or /dev/ttyS1)
[/root]C-kermit> set carrier-watch off
[/root]C-kermit> connect
Router1>
```

IOS Configuration of the Cisco Routers

The following instructions set the default configuration for the Cisco routers.

New router

If you have a new Cisco Router, and access the router for the first time, the router enters the initial configuration ("setup") mode, where IOS asks to type a few configuration settings. These configurations do not require knowledge of IOS commands. See the Cisco website or the manual of the router for additional information. If you perform the initial configuration dialogue, set the following configurations (here shown for *Router1*):

- Set the hostname to *Router1*.

- Set the required passwords (enable secret, enable password, virtual terminal password). We suggest selecting all passwords to be identical. Make sure you write down the password.

- When asked about configuring a protocol, answer "*no*" to all questions, except to the question to configure *IP*.

- Eventually, IOS display a list of available interfaces. There should be 2 Ethernet interfaces (*Ethernet0* and *Ethernet1*, *Ethernet0/0* and *Ethernet0/1*, or *FastEthernet0/0* and *FastEthernet0/1*), and two serial WAN interfaces (*Serial0* and *Serial1*, *Serial1/0* and *Serial1/1*).

  Only configure the IP addresses of the two Ethernet interfaces. Do not configure the other interfaces. Set the IP addresses and subnet masks, as shown in the table below. Select the default for other configuration decisions.

Cisco Router	Interface `Ethernet0` or `Ethernet0/0` or `FastEthernet0/0`		Interface `Ethernet1` or `Ethernet0/1` or `FastEthernet0/1`	
`Router1`	IP address Netmask	10.0.1.1 255.255.255.0	IP address Netmask	10.0.2.1 255.255.255.0
`Router2`	IP address Netmask	10.0.1.2 255.255.255.0	IP address Netmask	10.0.2.2 255.255.255.0
`Router3`	IP address Netmask	10.0.1.3 255.255.255.0	IP address Netmask	10.0.2.3 255.255.255.0
`Router4`	IP address Netmask	10.0.1.4 255.255.255.0	IP address Netmask	10.0.2.4 255.255.255.0

- Continue with the instructions for used routers.

Used router

For a used router, you need to have the *enable secret* password available. When the router is new, the enable secrete is chosen in the initial configuration. Otherwise, you must know the enable secret. If you do not have the password, consult the Cisco website and find information on resetting the passwords of a router.

If the router is new, and you have set the IP addresses in the initial configuration, only type the commands in bold.

Below are the commands for Router1. Below the password is set to *root*.

```
>enable
# config term
(config)# hostname Router1
(config)# enable secret rootroot
(config)# no ip domain-lookup
(config)# no cdp run
(config)# interface Ethernet 0/0 (or eth0, fast0/0)
(config-if)# ip address 10.0.1.1 255.255.255.0
(config-if)# no shutdown
(config-if)# no cdp enable
(config-if)# interface Ethernet 0/1 (or eth1, fast0/1)
(config-if)# ip address 10.0.2.1 255.255.255.0
(config-if)# no shutdown
(config-if)# no cdp enable
(config-if)# line vty 0 4
(config-line)# login
(config-line)# password rootroot
(config-if)# end
(config)# show interface
(config)# write mem
(config)# exit
```

Now, when the router is rebooted, it has the IP addresses of the interfaces Ethernet 0/0 and Ethernet 0/1 already configured. You can view the current configuration by typing:

```
>enable
# show startup-config
```