

Environment Setup for SEED Labs

Highlights

- There is no need for a physical lab space for any of the lab exercises.
- Students can work on the labs using their own computers.

1 Operating Systems

We use two operating systems as the base of our SEED labs: one is `Minix 3` and the other is `Linux`. `Minix 3` is an instructional operating system, and is widely used in computer science courses, such as Operating System and Networking. Because of its small size, modifying and rebuilding `Minix` operating system is a manageable task for average students in a semester-long course. We use this operating system for the design and implementation labs that require a significant amount of effort in kernel-level coding (several of our labs involve adding a new security mechanisms to operating systems, and thus require kernel-level coding). `Minix 3` can be downloaded from <http://www.minix3.org/>.

Many of the SEED labs, especially the vulnerability/attack labs and exploration labs, are based on the `Linux` operating system. When we designed and tested our SEED labs, we used `UbuntuLinux`. Most of the lab activities can be conducted in other distributions of `Linux`, such as `Fedora`, but the descriptions of the lab activities, especially the involved commands and configuration, may differ. Therefore, we suggest instructors to use `Ubuntu` to avoid unnecessary trouble.

Since some of the SEED labs require quite a lot installations of additional software, we have made a pre-built virtual machine image of `Ubuntu 9`. We have tested all our labs on top of this virtual machine. Using this pre-built operating system, students can immediately work on the SEED labs, without the need to install any additional software package, unless we otherwise specify in the lab descriptions. We have written a manual for this pre-built `Ubuntu` virtual machine; they are attached in the appendix.

We are in the process of finding a web server to host this virtual machine image (about 3 GB). Before that happens, anybody who is interested in getting a copy of this image can send an email to wedu@syr.edu. We can either send you a DVD or let you download the image from us.

2 Computers

SEED labs do not require a dedicated laboratory; all SEED labs can be carried out on students' personal computers. This is made possible by the virtual machine technologies. To be able to run `Minix` and `Linux` (sometimes multiple instances of them) conveniently in a general computing environment, we use virtual machine softwares. Students create "virtual computers" (called *guest* computers) within a physical computer (called *host* computer). The host computer can be a general computing platform, while each guest computer can run its own operating system, such as `Minix` and `Linux`. The guest computers and the host computer can form virtual networks. These virtual machines and virtual networks form our SEED instructional environment.

For students who do not have personal computers, instructors can ask their system administrators to install virtual machine software on the machines in public laboratories. However, since students need their own individual virtual machines, and each virtual machine needs 300 MB to 2 GB disk space, this approach creates a high demand on disk space on public machines, which is impractical in many institutions. This can

be solved with the help of less expensive portable storage media: students can store their virtual machines on portable hard-disks or flash drive, and work on their lab assignments on any public machines that have VMware installed.

3 Virtual Machines Software

The SEED environment can be created using virtual machine software, such as VMware, Virtual PC, and VirtualBox. These softwares are free. VirtualBox is an open-source virtual machine software, and it is free; Virtual PC software can be downloaded free of charge from Microsoft's website; VMware has established an academic program that makes the license of all VMware software free for educational uses. Although VMware also offers a free product called VMware Player, we recommend not to use the Player, but instead get a free licence of WMware Workstation via VMware's acadmic program, because there are several important features that are not supported by the Player (such as taking snapshots).