

CIA: Installation, booting and initialization

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Abstract

This week we will be working with the experimentation machines. Each of you has been assigned one, though the part-timers might have to share theirs. We will first install an Ubuntu distribution, and then we will look at the way it boots and initializes the system. For installation we will use PXE booting.

These assignments include topics not yet covered during the lectures. We want you to try to find the right information yourself in order to complete the assignments. Choose your sources of information carefully and reference them to support your answers.

As previously stated you are to keep a log of your progress, including choices or assumptions made, problems encountered and answers to both the numbered and unnumbered questions posed.

1 Experimentation computers

Each student will use an experimentation computer during the year. You can find out which is yours in the list in Figure 1.

Some of you, notably those returning this year will have to make due with the old experimentation computers. You will not be given extra instructions on how to reach your computers as you should already know how...

2 Installation

We will install Ubuntu using PXE. You will connect to your machines remotely using the iDrac. In the time that we are waiting for the install to finish we will look at and find out about installation and booting.

2.1 Using the Drac

You can reach the Drac of your experimentation computer by visiting the web page at `drac.$name.studlab.os3.nl`. From there you can open a java program which will give you a window to the console of the computer.

1. What is a Drac and how does it work?

2.2 Before OS installation...

It would do you well to read about the installation procedure *before* installing.

2.3 Installation instructions

Connect to the console of your Experimentation Machine using the iDrac. Reboot the machine and use the BIOS option to start a PXE boot, then follow the directions to install Ubuntu. Use the `Ubuntu-12.04-server-amd64` option. Make sure you install the `ssh` daemon for remote access.

Questions during Install

2. What is PXE booting?
3. How does it work?
4. How does it compare to booting from the hard disk or a CD?
5. What is an MBR?
 - What is its layout?
 - What is a partition table?
6. What are primary and logical partitions?
 - Can you boot an OS from both?
7. What is fdisk, how does it work, and what can you do with it?

2.4 Trouble...

If you get into trouble during or after an install and you end up with an unbootable system, you can use PXE boot, option `Ubuntu-12.04-rescue-amd64` to boot into an Ubuntu rescue environment.

3 Post install...

Now that we have Ubuntu installed, we will look at the booting process and look at the partition table.

3.1 Booting

On how your system boots...

8. What is the bootloader and where does it reside on the system?
9. Describe in order all the steps required for booting the computer (not the OS!).

3.2 GRUB

There are two bootloaders that are generally in use today, LILO and GRUB. We will be looking at GRUB.

10. Grub is set up in stages, what stages are there and what do they do?
11. Why are they separate/necessary?
12. How do they communicate with each other, and with the kernel?
13. How does GRUB use or interact with the BIOS?
Do they always get along?

3.3 Partitions

Boot into Ubuntu and use the `dd` utility to dump the MBR and partition table into a file in your home directory.

Use a hex dump utility to look at the raw code in the file.

14. What index does the partition table start at?
15. Copy and dump the partition table in hex format in your Wiki page, and fully annotate the entries. Translate all sector information into human readable format.

Now start `fdisk` and have it print the partition table.

16. What are the differences between the original content (the dump), your annotations and the `fdisk` printout?
17. If you wanted to add a $(1 + \textit{your table number})$ GB primary partition to the table by hand, what values would you have to use for the entry in the raw table? And in the `fdisk` table?

4 Initialization

After the machine has booted up, the chosen OS is started and goes through a (large) number of steps before you end up at the login prompt. We will be looking at the startup procedure of Ubuntu, so be sure to have it installed before answering the following questions. . .

The startup sequence of Ubuntu can be different per version, and definitely different from other flavors of UNIX. Be sure not to copy other peoples mistakes. . .

Questions

18. Describe the entire startup process of Ubuntu. The subquestions below are leaders to help you along, they must be answered but by no means represent the entire startup process of Ubuntu. . .

What stages are there, and what are they for? (hardware, system configuration, system initialization, etcetera)

Where is the configuration kept, and how do you change it?

What are runlevels?

What happens when you log in?

...

19. Describe the entire startup process of the X windows subsystem

What stages are there, and what are they for? (hardware, system configuration, system initialization, etcetera)

Where is the configuration kept, and how do you change it?

Who owns the subsystem?

...

Student	Machine
Yuhda Agung Pribadi	Amsterdam
Fahimeh Alizadeh	Athens
Hanieh Bagheri	Belgrade
Aikaterini Barmpopoulou	Berlin
Remy de Boer	Bern
Victor Boteanu	Brussels
Nicolas Canceill	Budapest
Thijs Rozekrans	Copenhagen
Ralph Dolmans	Dublin
Wouter van Dullink	Helsinki
Lutz Engels	Kiev
Edwin Schaap	London
Renato Fontana	Luxembourg
Ioannis Giannoulatos	Madrid
Thijs Houtenbos	Minsk
Wouter Katz	Monaco
Ren Klomp	Oslo
Jurgen Kloosterman	Paris
Javy de Koning	Prague
Bjrgvin Ragnarsson	Rome
Michal Mioduszewski	Sofia
Pawel Oljasz	Stockholm
Dennis Pellikaan	Vienna
Rawi Ramdhan	Warsaw
Wicher Minnaard	Bristol
Stefan Plug	Cambridge
Remco van Vught	Derby
Jos van Dijk	Edinburgh
Tobias Fiebig	Hull
Nikos Sidiropoulos	Ipswich
Periklis Stefopoulos	Liverpool
Tim Timmermans	Manchester
Gabor Toth	Nottingham
Diederik Vandevenne	Oxford
Bas Vlaszaty	Plymouth
Tjebbe Vlieg	Sheffield
Merlijn Wajer	Torquay
Pieter Westein	Wakefield
Todor Yakimov	York
Michiel Appelman	Alpha
Dennis Cortjens	Beta
Tariq El Yassem	Gamma
Pieter Lexis	Delta
Iwan Hoogendoorn	Epsilon
Razvan Oprea	Zeta ⁵
Sebastian Dabkiewicz	Eta
Alexandre Ferreira	Theta
Marc Buijsman	Iota
Nick Barendregt	Kappa
Sebastian Carlier	Avocado
Kevin de Kok	Banana