C²S CONSULTING

GNU/Linux Basic Part 3

FREE TECHNOLOGY ACADEMY

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GNU/Linux Basic operating system

These slides are designed to follow the text book

GNU/LINUX BASIC

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- X-Window workshop

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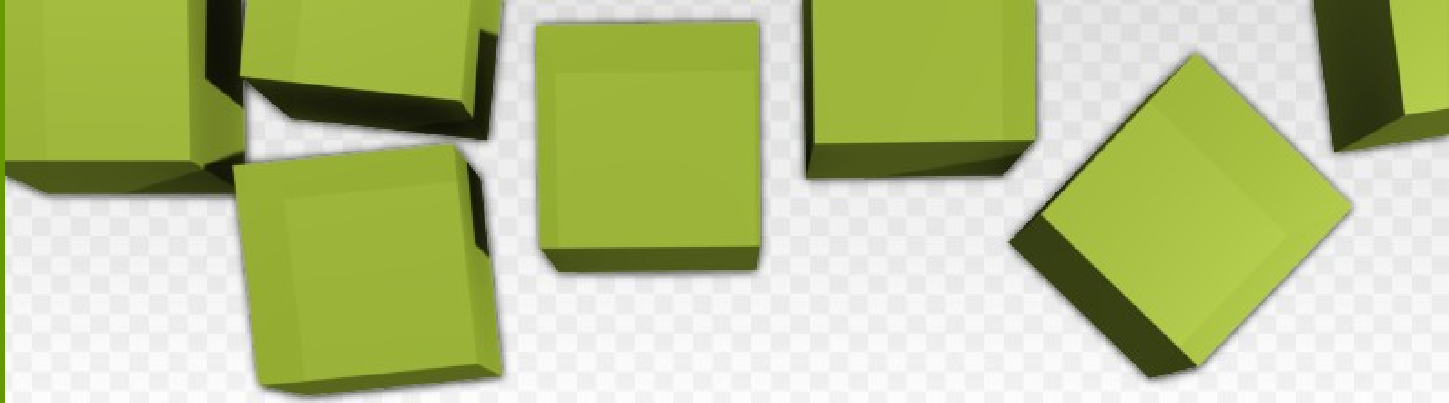

The installation or applications

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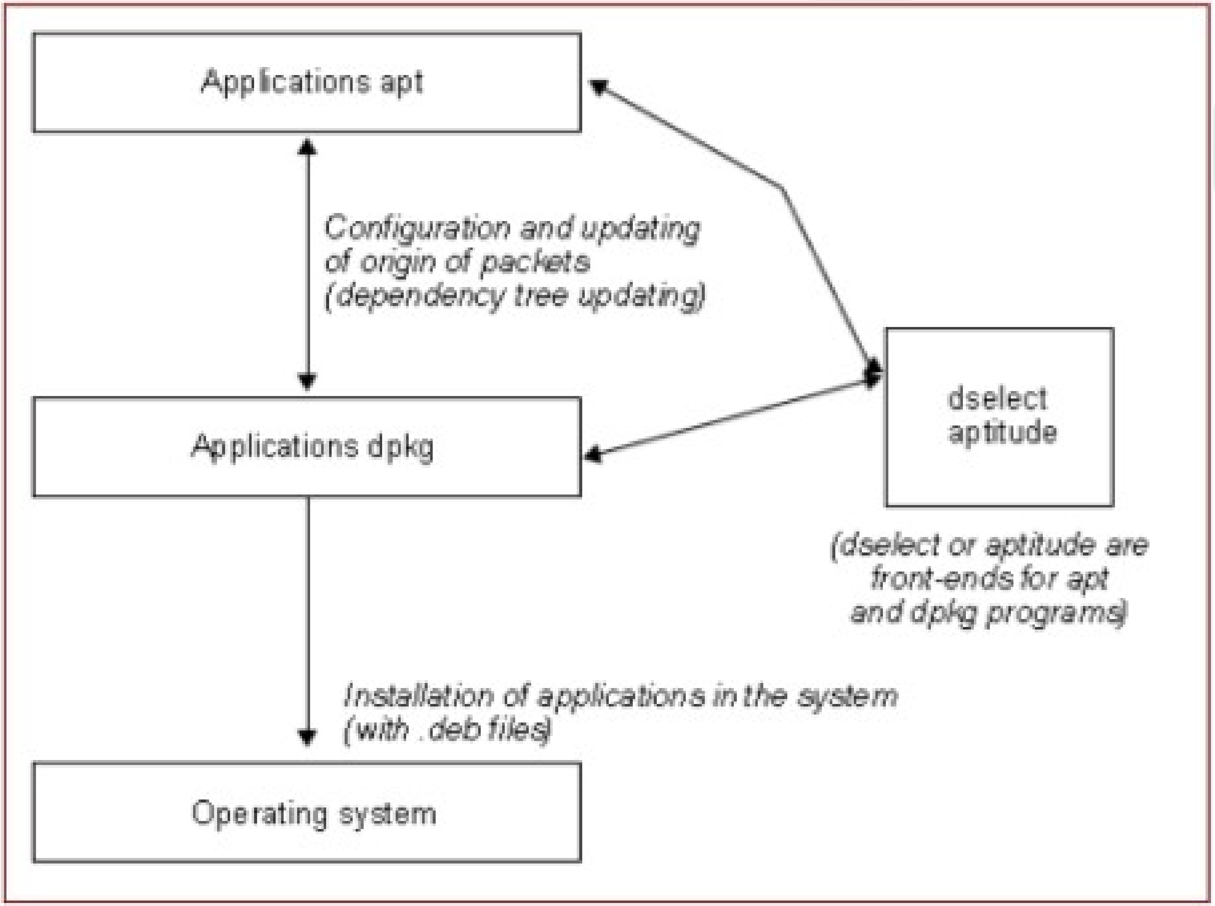
Powered by
debian
GNU/Linux

Debian package management

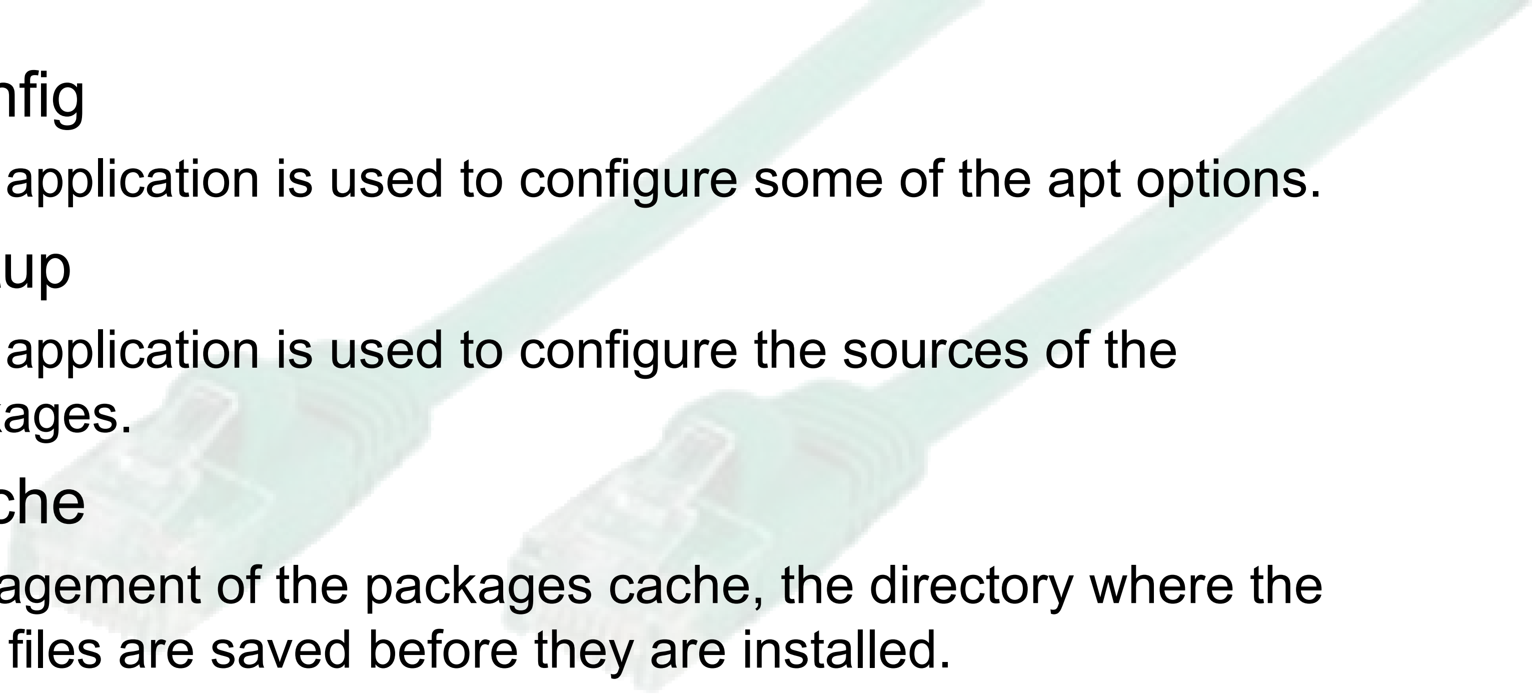
Aplications that are used to manipulate the Debian GNU/Linux packaging system are:

- Advanced Packaging Tool (APT)
  - Configures where packages are obtained from.
  - Which packages are needed.
  - Resolves any dependencies and conflicts with others.
  - Uses `dpkg` to install packages.
- Debian Package (`dpkg`)
  - Install packages.
  - Configure them.
  - Find out which ones have been installed etc.
- Aptitude
  - Manipulate the apt and dpkg programs, providing, in one single environment, interactive tools.

Debian package management



Advanced Packaging Tool (APT)



- apt-config
  - This application is used to configure some of the apt options.
- apt-setup
  - This application is used to configure the sources of the packages.
- apt-cache
  - Management of the packages cache, the directory where the .deb files are saved before they are installed.
- apt-cdrom
  - Application for managing the CD-ROMs that contain packages.
- apt-get
  - Updating, installing or downloading the packages.

/etc/apt/sources.list

- List of configured APT data sources.
- Designed to support any number of active sources and a variety of source media.
- The file lists one source per line, with the most preferred source listed first.
- The information available from the configured sources is acquired by apt-get update.
- The format for a sources.list entry using the deb and deb-src types is:

```
deb [ options ] uri distribution [component1] [component2] [...]
```

/etc/apt/sources.list

```
$ sudo vi /etc/apt/sources.list
# deb http://ftp.ie.debian.org/debian/ wheezy main

deb http://ftp.ie.debian.org/debian/ wheezy main
deb-src http://ftp.ie.debian.org/debian/ wheezy main

deb http://security.debian.org/ wheezy/updates main
deb-src http://security.debian.org/ wheezy/updates main

# wheezy-updates, previously known as 'volatile'
deb http://ftp.ie.debian.org/debian/ wheezy-updates main
deb-src http://ftp.ie.debian.org/debian/ wheezy-updates main

# Updating packages with vulnerabilities or bugs (Added OB 5/1/2014)
deb http://security.debian.org/ stable/updates main contrib non-free
~
:wq!
```

/etc/apt/sources.list

```
$ sudo apt-get update
Get:1 http://ftp.ie.debian.org wheezy Release.gpg [1,672 B]
Get:2 http://ftp.ie.debian.org wheezy-updates Release.gpg [836 B]
Get:3 http://ftp.ie.debian.org wheezy Release [168 kB]
Get:4 http://ftp.ie.debian.org wheezy-updates Release [124 kB]
Get:5 http://ftp.ie.debian.org wheezy/main Sources [5,958 kB]
Get:6 http://ftp.ie.debian.org wheezy/main amd64 Packages [5,848 kB]
Get:7 http://ftp.ie.debian.org wheezy/main Translation-en [3,852 kB]
Get:8 http://ftp.ie.debian.org wheezy-updates/main Sources [2,981 B]
Hit http://ftp.ie.debian.org wheezy-updates/main amd64 Packages/DiffIndex
Hit http://ftp.ie.debian.org wheezy-updates/main Translation-en/DiffIndex
Get:9 http://security.debian.org wheezy/updates Release.gpg [836 B]
Get:10 http://security.debian.org stable/updates Release.gpg [836 B]
Get:11 http://security.debian.org wheezy/updates Release [102 kB]
Get:12 http://security.debian.org stable/updates Release [102 kB]
Get:13 http://security.debian.org wheezy/updates/main Sources [74.3 kB]
Get:14 http://security.debian.org wheezy/updates/main amd64 Packages [139 kB]
Get:15 http://security.debian.org wheezy/updates/main Translation-en [82.1 kB]
Get:16 http://security.debian.org stable/updates/main amd64 Packages [139 kB]
Get:17 http://security.debian.org stable/updates/contrib amd64 Packages [14 B]
Get:18 http://security.debian.org stable/updates/non-free amd64 Packages [14 B]
Get:19 http://security.debian.org stable/updates/contrib Translation-en [14 B]
Get:20 http://security.debian.org stable/updates/main Translation-en [82.1 kB]
Get:21 http://security.debian.org stable/updates/non-free Translation-en [14 B]
Fetched 16.7 MB in 7s (2,330 kB/s)
Reading package lists... Done
```

Package selection – apt / yum

- Advanced Packaging Tool (APT)
- Aptitude, front-end for APT.

```
$ apt-cache search unetbootin
unetbootin - installer of Linux/BSD distributions to a partition or USB drive
unetbootin-translations - translations for the unetbootin distribution installer

$ sudo apt-get install unetbootin
```

- Yellowdog Updater, Modified (YUM)

```
$ yum search unetbootin
unetbootin - installer of Linux/BSD distributions to a partition or USB drive
unetbootin-translations - translations for the unetbootin distribution installer

$ sudo yum install unetbootin
```

Package manager – deb / rpm

- Debian Package Manager (dpkg)

```
$ dpkg -l                                              (-l List)
Desired=Unknown/Install/Remove/Purge/Hold
| Status=Not/Inst/Conf-files/Unpacked/halF-conf/Half-inst/trig-aWait/Trig-pend
|/ Err?=(none)/Reinst-required (Status,Err: uppercase=bad)
||/ Name           Version      Architecture Description
+++-==============-============-============-=================================
ii  adduser        3.113+nmu3   all          add and remove users and groups
ii  apt            0.9.7.9      amd64        commandline package manager
ii  apt-listchange 2.85.11      all          package change history notificati
ii  apt-utils      0.9.7.9      amd64        package managment related utility
```

- RedHat Package Manager (RPM)

```
S rpm -qa                                              (-qa  Query All)
filesystem-2.4.0-1
comps-extras-11.1-1.1
gnome-mime-data-2.4.2-3.1
glibc-2.5-12
```

Package manager – deb / rpm

- Install a .deb package.

```
$ sudo dpkg -i tcl8.4_8.4.19-2_amd64.deb                    (-i Install)
Selecting previously deselected package tcl8.4.
(Reading database ... 94692 files and directories currently installed.)
Unpacking tcl8.4 (from tcl8.4_8.4.19-2_amd64.deb) ...
Setting up tcl8.4 (8.4.19-2) ...
Processing triggers for menu ...
Processing triggers for man-db …
```

- Install a .rpm package.

```
$ sudo rpm -ivh  MySQL-client-3.23.57-1.i386.rpm
Preparing...                ########################################### [100%]
   1:MySQL-client           ########################################### [100%]
```

rpm command and options

```
-i : install a package
-v : verbose
-h : print hash marks as the package archive is unpacked.
```

dpkg

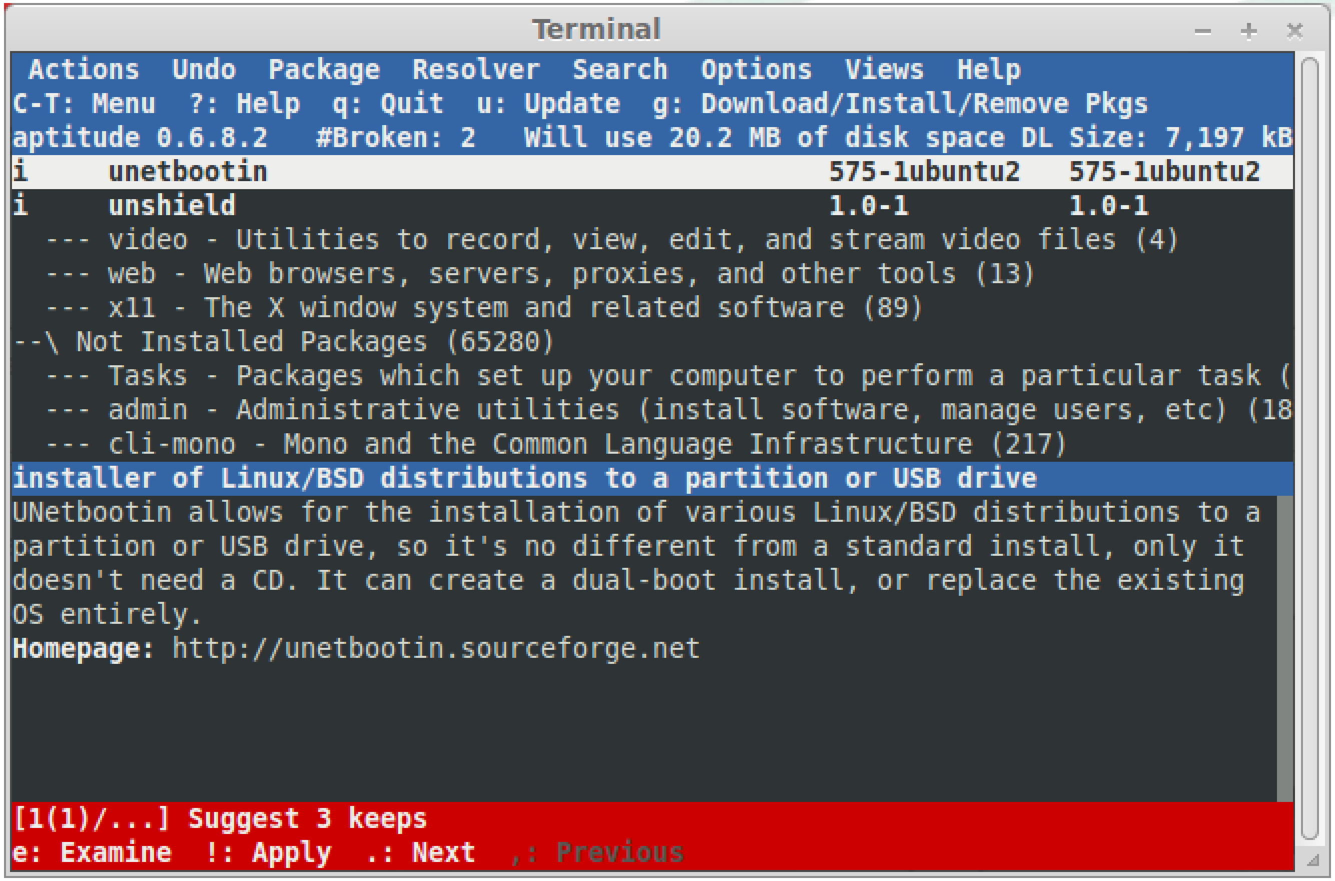
- **dpkg-divert**: Used to override a package's version of a file.
- **dpkg-reconfigure**: Reconfigure an already installed package.
- **dpkg-scanpackages**: This program can be used to scan a specific directory of the system that contains .deb files, to generate an index file.
- **dpkg-scansources**: This is an application with the same functions as the preceding one but for packages of source code.
- **dpkg-split**: This program is used to divide and unify a package in various different files.

dpkg --force-things

- Another very interesting parameter is `--force-things` X (where X is one of the following options):
  - **auto-select**: This automatically selects the packages that must be installed or uninstalled with the new package that we choose.
  - **downgrade**: This installs the package even if there are more recent versions of it.
  - **remove-essential**: Although this package is considered essential for the system, this will delete it.
  - **depends**: This does not take the dependencies into account, but considers them as alerts.
  - **depends-version**: This does not take any of the dependencies of the version of packages into account.
  - **conflicts**: This installs the package, even if it is in conflict with any other package in the system.

Package selection – aptitude

- Aptitude, front-end for APT.



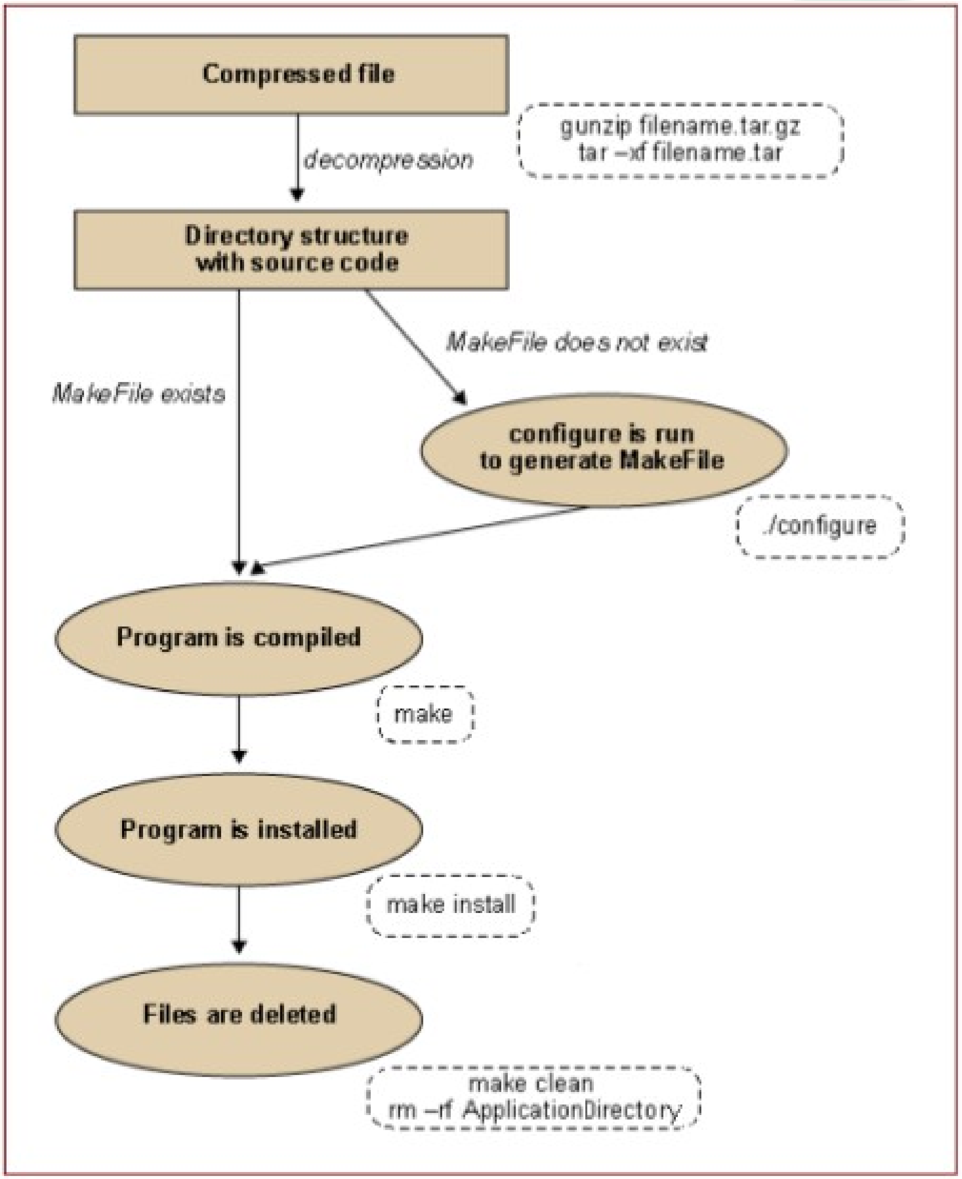
```
 Actions  Undo  Package  Resolver  Search  Options  Views  Help
C-T: Menu  ?: Help  q: Quit  u: Update  g: Download/Install/Remove Pkgs
aptitude 0.6.8.2   #Broken: 2   Will use 20.2 MB of disk space DL Size: 7,197 kB
i     unetbootin                                 575-1ubuntu2   575-1ubuntu2
i     unshield                                   1.0-1          1.0-1
  --- video - Utilities to record, view, edit, and stream video files (4)
  --- web - Web browsers, servers, proxies, and other tools (13)
  --- x11 - The X window system and related software (89)
--\ Not Installed Packages (65280)
  --- Tasks - Packages which set up your computer to perform a particular task (
  --- admin - Administrative utilities (install software, manage users, etc) (18
  --- cli-mono - Mono and the Common Language Infrastructure (217)
installer of Linux/BSD distributions to a partition or USB drive
UNetbootin allows for the installation of various Linux/BSD distributions to a
partition or USB drive, so it's no different from a standard install, only it
doesn't need a CD. It can create a dual-boot install, or replace the existing
OS entirely.
Homepage: http://unetbootin.sourceforge.net




[1(1)/...] Suggest 3 keeps
e: Examine  !: Apply  .: Next  ,: Previous
```

Compiling of new programs

- Before code can be compiled the `build-essentials` package is required, it includes amongst others.
  - make - A utility for directing compilation.
  - g++ - GNU C++ compiler.
  - gcc - GNU C compiler.
  - libc - Embedded GNU C Library.

```
$ sudo apt-get install build-essentials
```

Compilation of new programs



Compressed file

decompression

```
gunzip filename.tar.gz
tar –xf filename.tar
```

Directory structure with source code

MakeFile exists

MakeFile does not exist

configure is run to generate MakeFile

```
./configure
```

Program is compiled

```
make
```

Program is installed

```
make install
```

Files are deleted

```
make clean
rm –rf ApplicationDirectory
```

Compiling Source Code

- Four Stages to Compiling Source Code.
  - **Preprocessing**
    - This checks the syntax of your C source.

      ```
      $ gcc -E myfile.c
      ```

  - **Compilation**
    - This stage creates an ASCII text file of the symbolic assembly language for the processor of the machine you are working on. This file is created by:

      ```
      $ gcc -S myfile.c
      ```

    - Results in a new file called `myfile.s`. Do this then cat the file and you will see i386, Sparc symbolic assembly language or whatever processor your computer has

Compiling Source Code

- Four Stages to Compiling Source Code
  - **Assembly**
    - This stage creates an object file with a .o extension. The object file is a partial binary code file however some function code is missing because it is either in libraries or in other object files:

```
$ gcc -c myfile.c
```

    - You will now find a myfile.o file has been created.
  - **Linking**
    - This is the final stage, which creates the executable file. It links the code from the object files and the libraries together to create a single executable file:

```
$ gcc -o exe_file myfile.c
```

- You will now find an executable called `exe_file` file has been created.

Compiling Source Code

- Of course with `gcc` all the above can be completed with one instruction but it is important to have an understanding of the processes involved particularly when there are multiple source code files that are interdependent.

```
$ cat main.c
int main() {
   hello();
}

$ cat  hellow.c
#include <stdio.h>
void  hello() {
   printf("Hello World welcome to Linux\n");
}
```

Compiling Source Code

- Here is a simple package of C source code files, which are interdependent upon each other. The `main.c` program calls a function `hello()` from the `hellow.c` program. An executable can be created with the command:

```
$ gcc -c main.c
$ gcc -c hellow.c
$ gcc -o hello main.o hellow.o
```

  - or I can use an abbreviated version of the above in one command:

```
$ gcc -o hello main.c  hellow.c
```

- This creates an executable called hello.

```
$ ./hello
Hello World welcome to GNU/Linux
```

make and makefile

- Well now that we understand the process involved in creating an executable from multiple object files which are interdependent.
- Imagine also if different teams to slightly different schedules are developing these object files.
- This makes it difficult for the user to create the final executable.
- To assist the developing team creates a makefile
  - This file defines the interrelationships between the different files and checks each source file to see if it is newer that its corresponding object file, if not then it ignores that step and checks the next file etc...
  - In this way only source files that have been changed from the previous use are compiled. Then all files are linked.

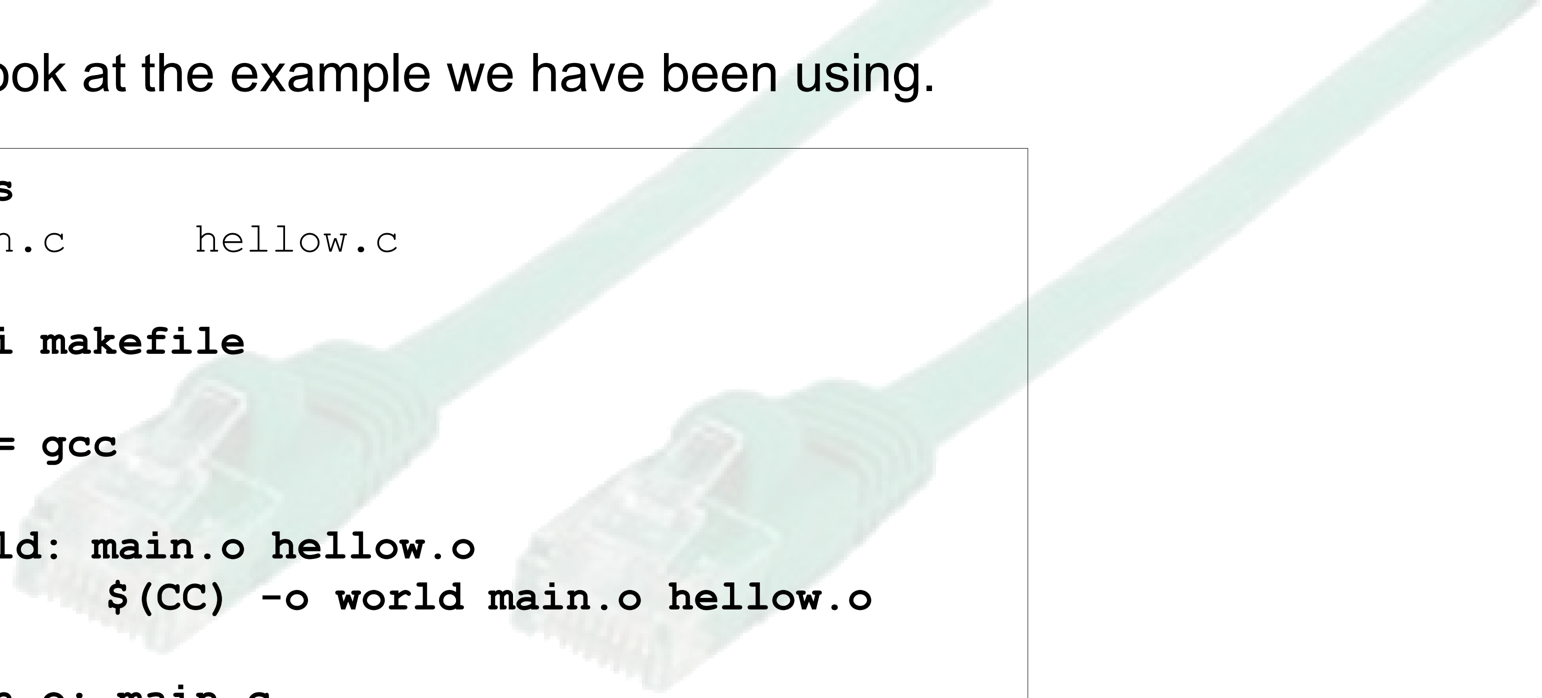
make and makefile

- The user uses a utility called `make` to operate on the `makefile`.
  - It basically executes the instructions in the `makefile` as outlined above.
  - One of the earliest lines in the `makefile` is a definition of the compiler in use.
  - The compiler name is assigned to a variable (usually `CC`), which is used throughout the program. By changing this variable before executing the `make` utility you can define the compiler you use. (on Linux this is typically the `gcc` GNU C Compiler or the `g++` GNU C++ Compiler).

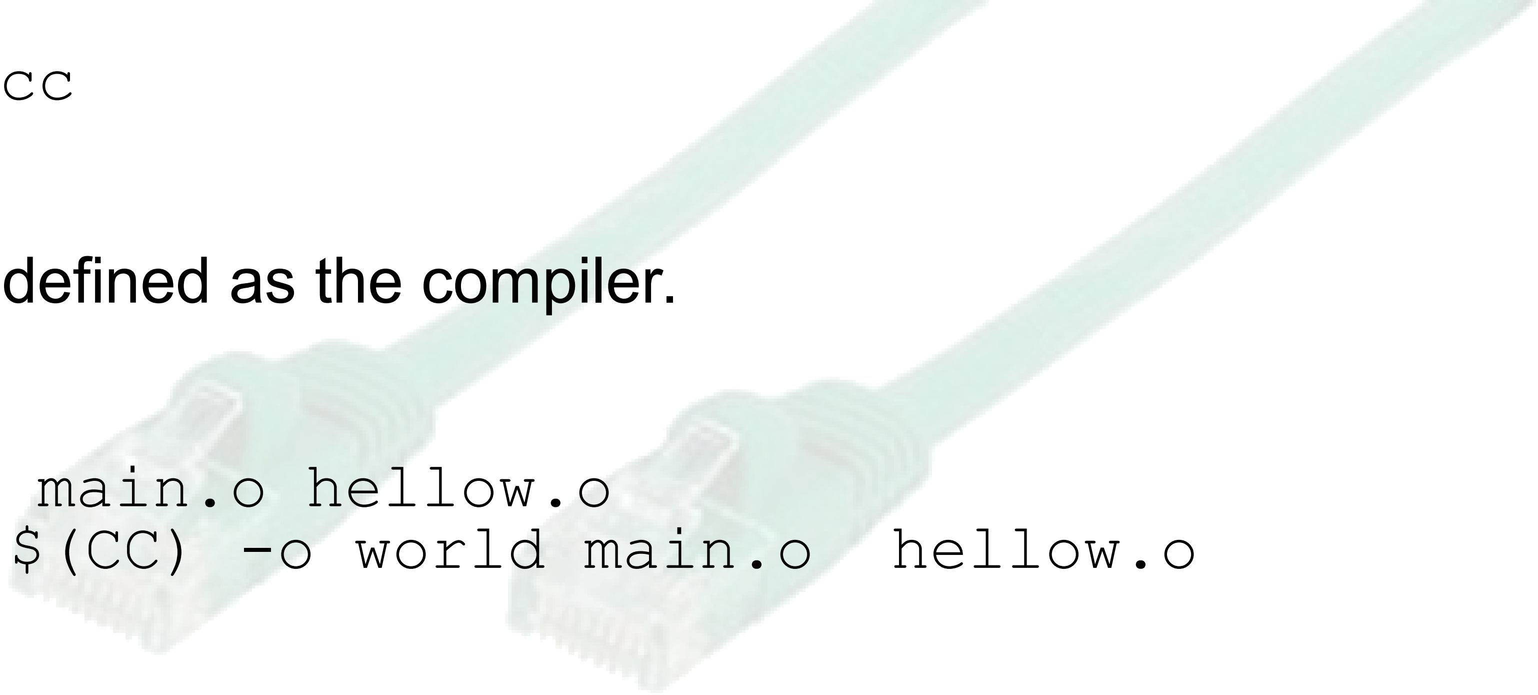
make and makefile

- Let us look at the example we have been using.

```
$ ls
main.c     hellow.c

$ vi makefile

CC = gcc

world: main.o hellow.o
       $(CC) -o world main.o hellow.o

main.o: main.c
       $(CC) -c main.c

 hellow.o: hellow.c
       $(CC) -c hellow.c


~
~
:wq!
```



make and makefile



```
CC = gcc
```

- `gcc` is defined as the compiler.

```
world: main.o hellow.o
      $(CC) -o world main.o  hellow.o
```

- The `world:` tag identifies an executable name which must be created by the linking of the object files `main.o` and `hellow.o`. The next line is basically the command we have seen earlier as `$(CC)` is replaced by `gcc`.

make and makefile

```
main.o: main.c
       $(CC) -c main.c
```

- Under the same label the dependency of `main.o` on `main.c` is shown. In other words if `main.c` is newer than `main.o` then execute the associated line which will create a new object file `main.o` from the new `main.c` file. If `main.o` was newer or the same age as `main.c` then this step would be skipped.

```
hellow.o:  hellow.c
       $(CC) -c  hellow.c
```

- The same process is carried out for `hellow.o` and `hellow.c`.

Creating the executable using `make`

- Now for the simple bit. Simply run the make utility and the executable is created.

```
$ ls
main.c     hellow.c     makefile

$ make
$ ls
main.c     hellow.c     makefile   world

$ ./world
Hello World welcome to Linux
```

configure

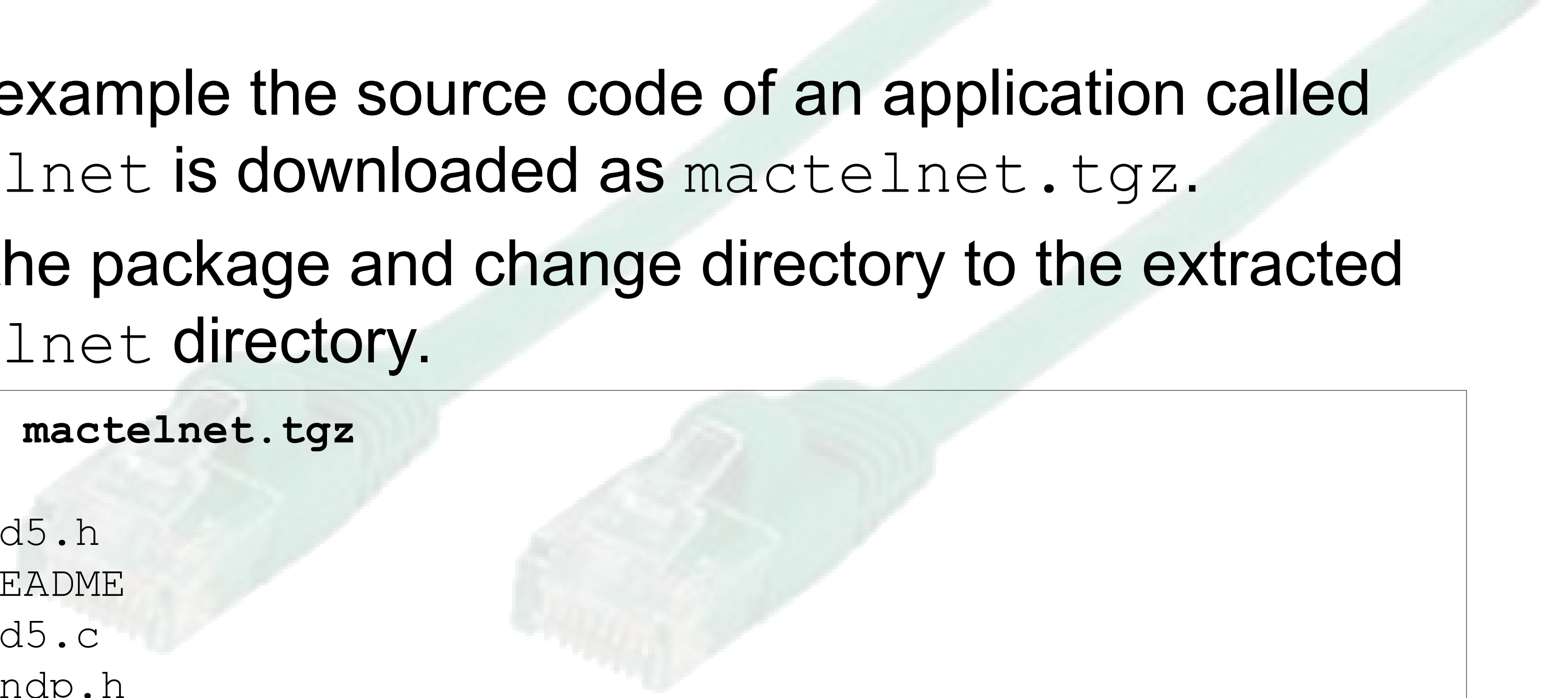
- A shell script that is distributed with a package that configures the package for you automatically.
- It will probe the system through a set of tests that allow it to automatically generate the ´`Makefile`' from a template stored in a file called ´`Makefile.in`'.
- To install the software, '`make`' must be explicitly invoked again with the target '`install`'.

Placement of files during install

- Executables
  - `/usr/local/bin`
- Libraries
  - `/usr/local/lib`
- Header files
  - `/usr/local/include`
- Man pages
  - `/usr/local/man/`
- Info files
  - `/usr/local/info`
- if you want to install the package to your home directory instead of `/usr/local`, you would use the ‘`prefix`’ option:

```
$ configure --prefix=/home/foo
```

mactelnet



- As an example the source code of an application called `mactelnet` is downloaded as `mactelnet.tgz`.
- Untar the package and change directory to the extracted `mactelnet` directory.

```
$ tar -xzvf mactelnet.tgz
mactelnet/
mactelnet/md5.h
mactelnet/README
mactelnet/md5.c
mactelnet/mndp.h
mactelnet/mactelnet
mactelnet/Makefile
mactelnet/protocol.h
mactelnet/mactelnet.c

$ cd mactelnet
mactelnet $ ls
mactelnet  mactelnet.c  Makefile  md5.c  md5.h  mndp.h  protocol.h
README
```

mactelnet

- `make clean` deletes all the already compiled object files.
- `make` determines which pieces of the program need to be recompiled, and issue the commands to recompile them.

```
mactelnet $ make clean
rm -f mactelnet

mactelnet $ ls
mactelnet.c  Makefile  md5.c  md5.h  mndp.h  protocol.h  README

mactelnet $ make
gcc -Wall mactelnet.c md5.c -o mactelnet -I/usr/local/include/libnet11
-L/usr/local/lib/libnet11 -lnet -lpcap

mactelnet $ ls
mactelnet  mactelnet.c  Makefile  md5.c  md5.h  mndp.h  protocol.h
README

mactelnet $ ./mactelnet
MAC-Telnet 0.03
Usage: mactelnet [ interface ] [ MAC address ]
Example: mactelnet eth0 ee:11:cc:ee:ee:ff
```

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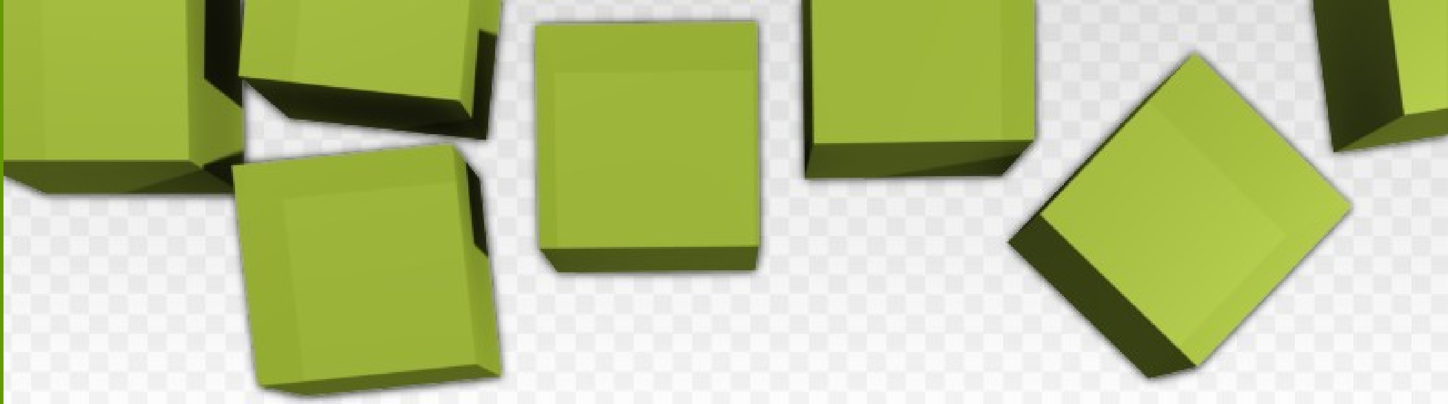

Workshop on basic configurations

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FREE TECHNOLOGY ACADEMY

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X-Window architecture

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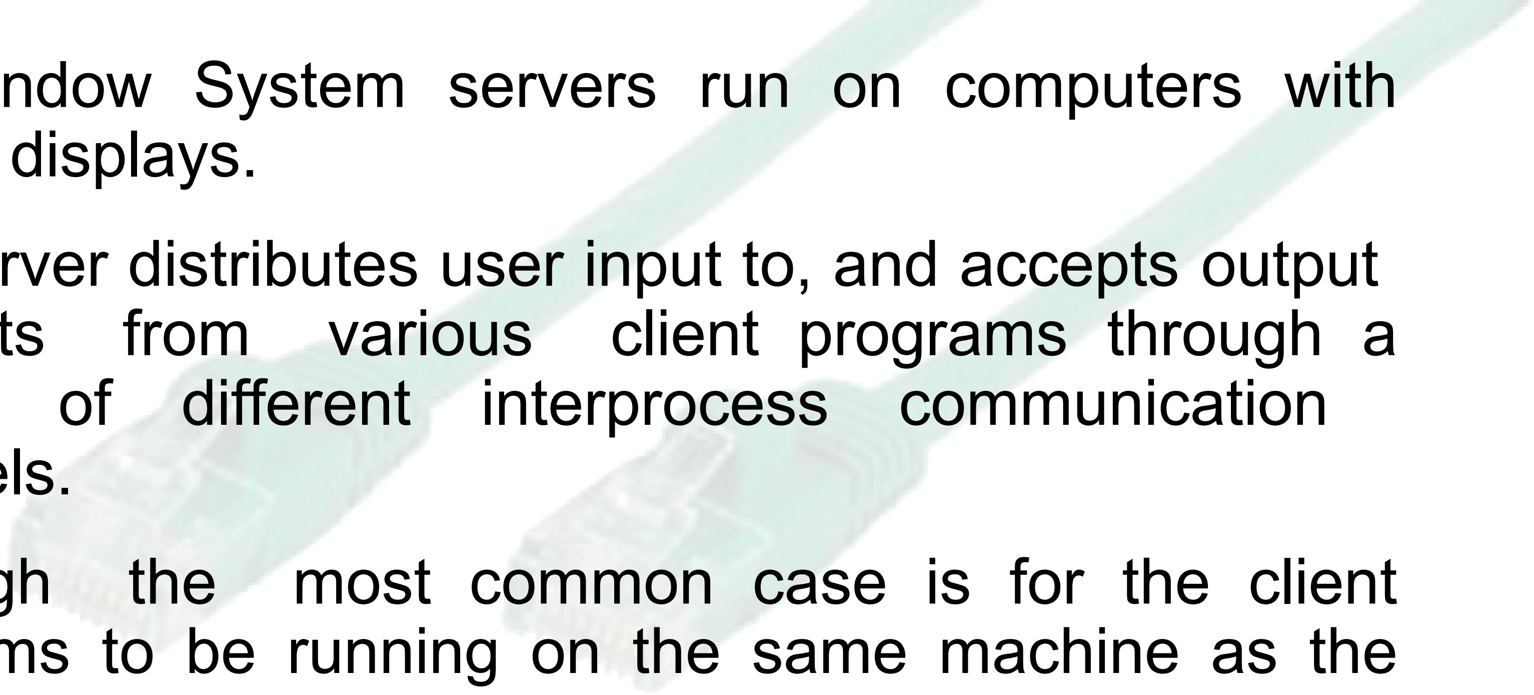
X

- Is a portable, network-transparent window system
- The X Window System is a network transparent window system which runs on a wide range of computing and graphics machines.
- It should be relatively straightforward to build the X Consortium software distribution on most ANSI C and POSIX compliant systems.
- Commercial implementations are also available for a wide range of platforms.

X

- X11 is the graphical system most widely used on Unix-like systems.
- X11 had a rough start, but the 1990's saw XFree86 emerge as the reference implementation because it was free software, portable, and maintained by a collaborative community.
- The rate of evolution slowed down plus a very controversial license change, led to the X.org fork in 2004.
- This is the current reference implementation, and Debian Wheezy uses X.org version 7.7.
- **Note:** From this version, X no longer creates `/etc/X11/xorg.conf` configuration file.

X

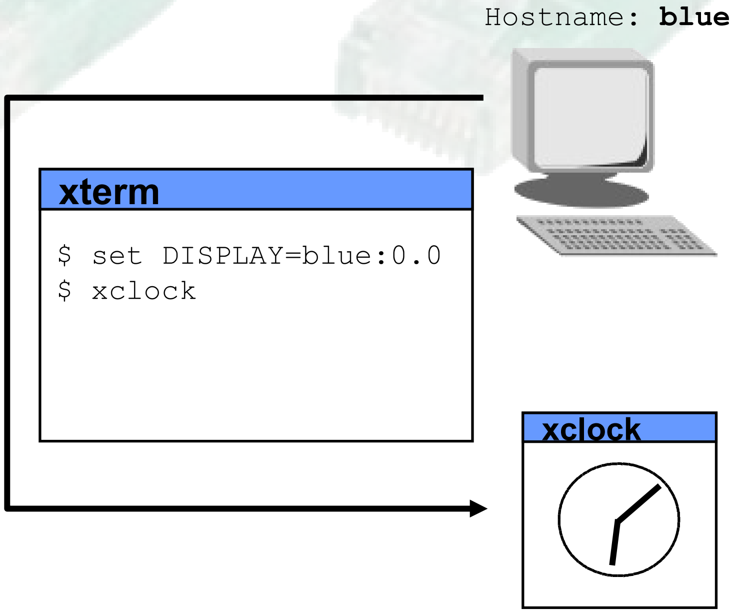


- X Window System servers run on computers with bitmap displays.
- The server distributes user input to, and accepts output requests from various client programs through a variety of different interprocess communication channels.
- Although the most common case is for the client programs to be running on the same machine as the server, clients can be run transparently from other machines (including machines with different architectures and operating systems) as well.

X

- Computer Runs X Server (X).
- Applications are sent to the X Server defined in the $DISPLAY variable.
- On single machine the display is sent from the X Client to the X Server on that machine, thus the DISPLAY Variable is :0.0 by default.

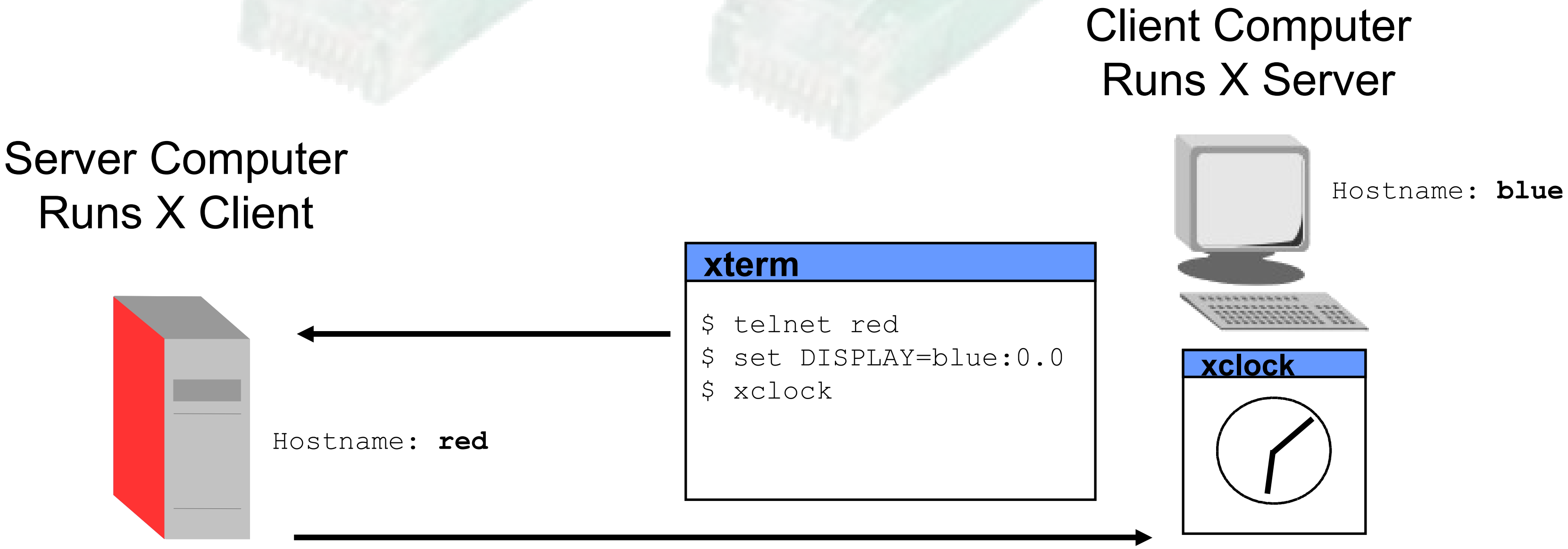
```
gluais:/ # echo $DISPLAY
:0.0
```



```
$ set DISPLAY=blue:0.0
$ xclock
```

X

- Client machine runs an X Server and an `xterminal`, connects to the remote Server.
- On the Server the client changes the `DISPLAY` variable to point to the X Server on the client machine.
- When the `xclock` is called it is run on the Server computer but the display is on the Client computer.



Client Computer
Runs X Server

Server Computer
Runs X Client

Hostname: **blue**

Hostname: **red**

xterm

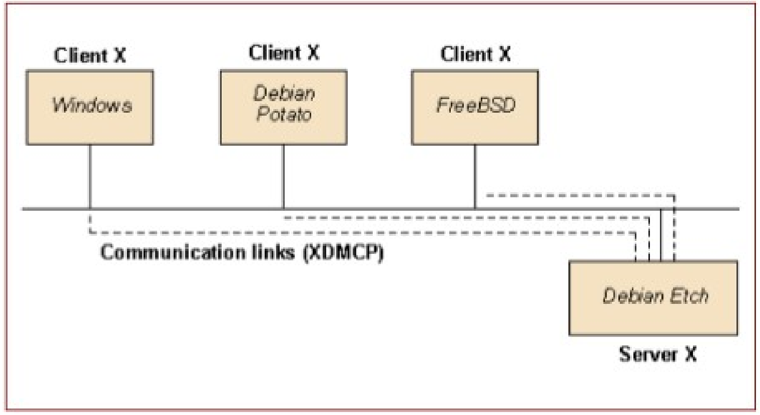
```
$ telnet red
$ set DISPLAY=blue:0.0
$ xclock
```

X

```
$ X -version

X.Org X Server 1.12.4
Release Date: 2012-08-27
X Protocol Version 11, Revision 0
Build Operating System: Linux 3.2.0-4-amd64 i686 Debian
Current Operating System: Linux debian-OB 3.2.0-4-686-pae #1 SMP Debian
3.2.51-1 i686
Kernel command line: BOOT_IMAGE=/boot/vmlinuz-3.2.0-4-686-pae
root=UUID=db1ab3ae-bb9a-4c4f-bcf9-87233c66ad50 ro quiet
Build Date: 17 December 2013  08:37:13PM
xorg-server 2:1.12.4-6+deb7u2 (Julien Cristau <jcristau@debian.org>)
Current version of pixman: 0.26.0
        Before reporting problems, check http://wiki.x.org
        to make sure that you have the latest version.
```

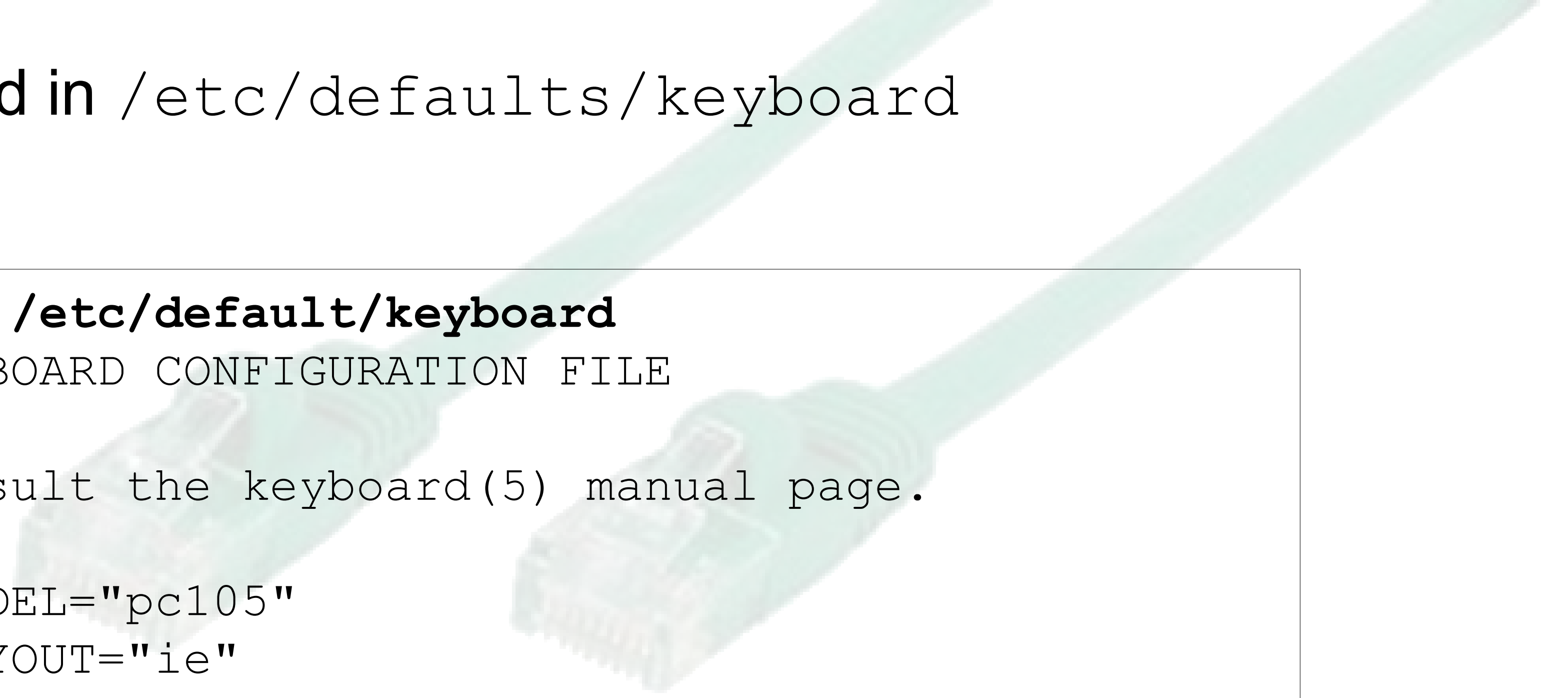
X Display Mgr Control Protocol (XDMCP)

- XDMCP uses UDP port 177.
- The display manager displays its login screen by connecting to the X server as a regular X client.
  - The X Server is the device with access to the screen, keyboard, mouse etc.. The X Client is on the device requiring its information to be displayed on the X Server.
- During the session, the X Client will exchange KeepAlive packets to the X Server at intervals.
- One problem with XDMCP is that the authentication takes place unencrypted.
- It is more secure to use an `ssh` tunnel for X traffic.



Keyboard

- Defined in `/etc/defaults/keyboard`



```
$ cat /etc/default/keyboard
# KEYBOARD CONFIGURATION FILE

# Consult the keyboard(5) manual page.

XKBMODEL="pc105"
XKBLAYOUT="ie"
XKBVARIANT=""
XKBOPTIONS=""

BACKSPACE="guess"
```

Chipsets and Video drivers

- Discover chipset and loaded drivers.

```
$ lspci -v | grep VGA
01:00.0 VGA compatible controller: NVIDIA Corporation NV41
[Quadro FX Go1400] (rev a2) (prog-if 00 [VGA controller])

$ cat /var/log/Xorg.0.log |grep Matched
[    19.011] (==) Matched nouveau as autoconfigured driver 0
[    19.011] (==) Matched nv as autoconfigured driver 1
[    19.011] (==) Matched vesa as autoconfigured driver 2
[    19.011] (==) Matched fbdev as autoconfigured driver 3
```

- The `Nouveau` display driver provides support for NVIDIA Riva, TNT, GeForce, and Quadro cards.
- The `NV` display driver provides support for NVIDIA Riva, TNT, GeForce, and Quadro cards.
- The `VESA` display driver uses the standard VESA interface provided on all video cards, but runs unaccelerated.
- The `fbdev` display driver provides the driver for the Linux framebuffer device.

Display manager

- Graphical interface only provides display space and running the X server by itself only leads to an empty screen.
- A display manager is used to display a user authentication screen and start the graphical desktop.
- Popular display managers today are:
  - gdm3 (GNOME Display Manager),
  - kdm (KDE Display Manager)
  - xdm (X Display Manager).
  - Xfce.
- Lighter Window Managers include: WindowMaker, Afterstep, fvwm, Icewm, blackbox, fluxbox, openbox.

Window Manager - Menu

- Menu links file.

```
/usr/share/menu$ ls
aisleriot             gnuplot-nox          shotwell
aptitude              gucharmap            sound-juicer
baobab                iceweasel            synaptic
bash                  imagemagick          tasksel
bc                    info                 telnet
brasero               inkscape             thunar
dash                  libreoffice-base     tomboy
dc                    libreoffice-calc     totem
eog                   libreoffice-draw     transmission-gtk
evince                libreoffice-impress  vinagre
evolution             libreoffice-math     w3m
file-roller           libreoffice-writer   x11-apps
gcalctool             mutt                 x11-utils
gedit                 nano                 x11-xserver-utils
gimp                  nautilus             xfce4-appfinder
gksu                  procps               xfce4-mixer
gnome-control-center  psmisc               xfce4-utils
gnome-dictionary      python2.6            xfdesktop4
gnome-media           python2.7            xfwm4
gnome-nettool         README               xscreensaver
gnome-system-monitor  reportbug            xterm
gnome-terminal        rhythmbox            yelp
gnuchess              seahorse
```

Window Manager - Menu

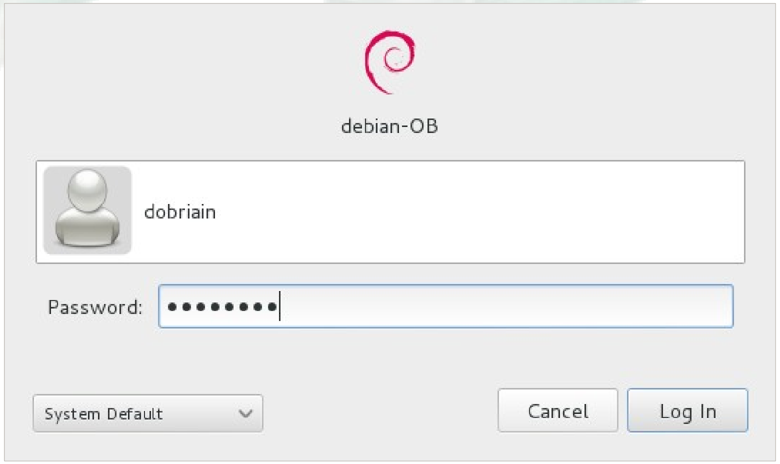
- Menu links file.

```
/etc/menu-methods $ ls
lang.h  menu.config  menu.h  README  translate_menus

/etc/menu-methods $ cat menu.config
verbosity=quiet
method=stderr

/etc/menu-methods$ cat translate_menus
# Applications

translate section->section
  Apps/Hamradio "Apps/Amateur Radio"
endtranslate

translate section->section
  Apps/Databases "Apps/Data Management"
endtranslate

translate section->section
  Apps/Net Apps/Network
Endtranslate

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```

Window Manager - Default

- Default Display Manager

```
$ cat /etc/X11/default-display-manager
/usr/sbin/gdm3
```

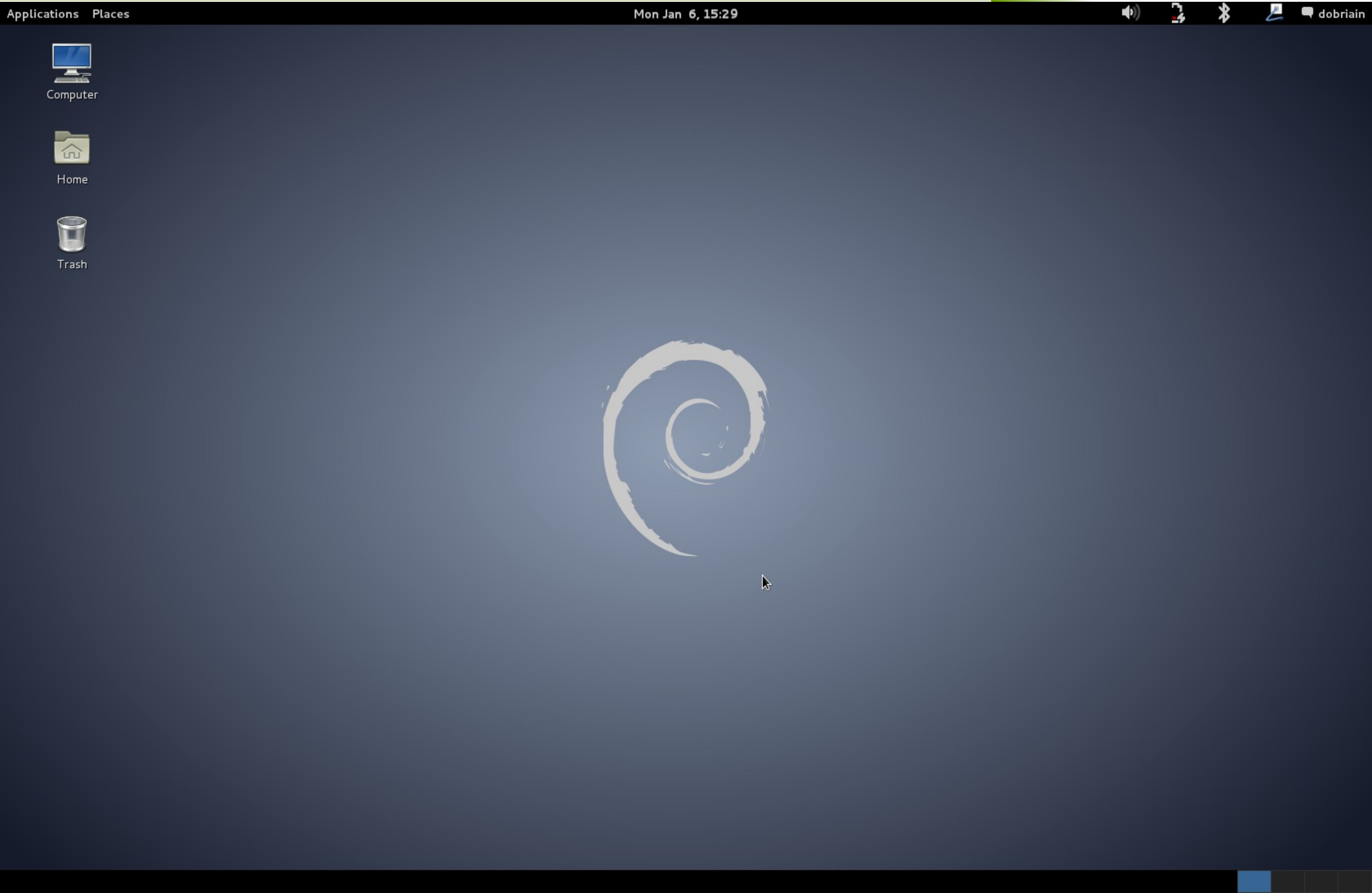


debian-OB

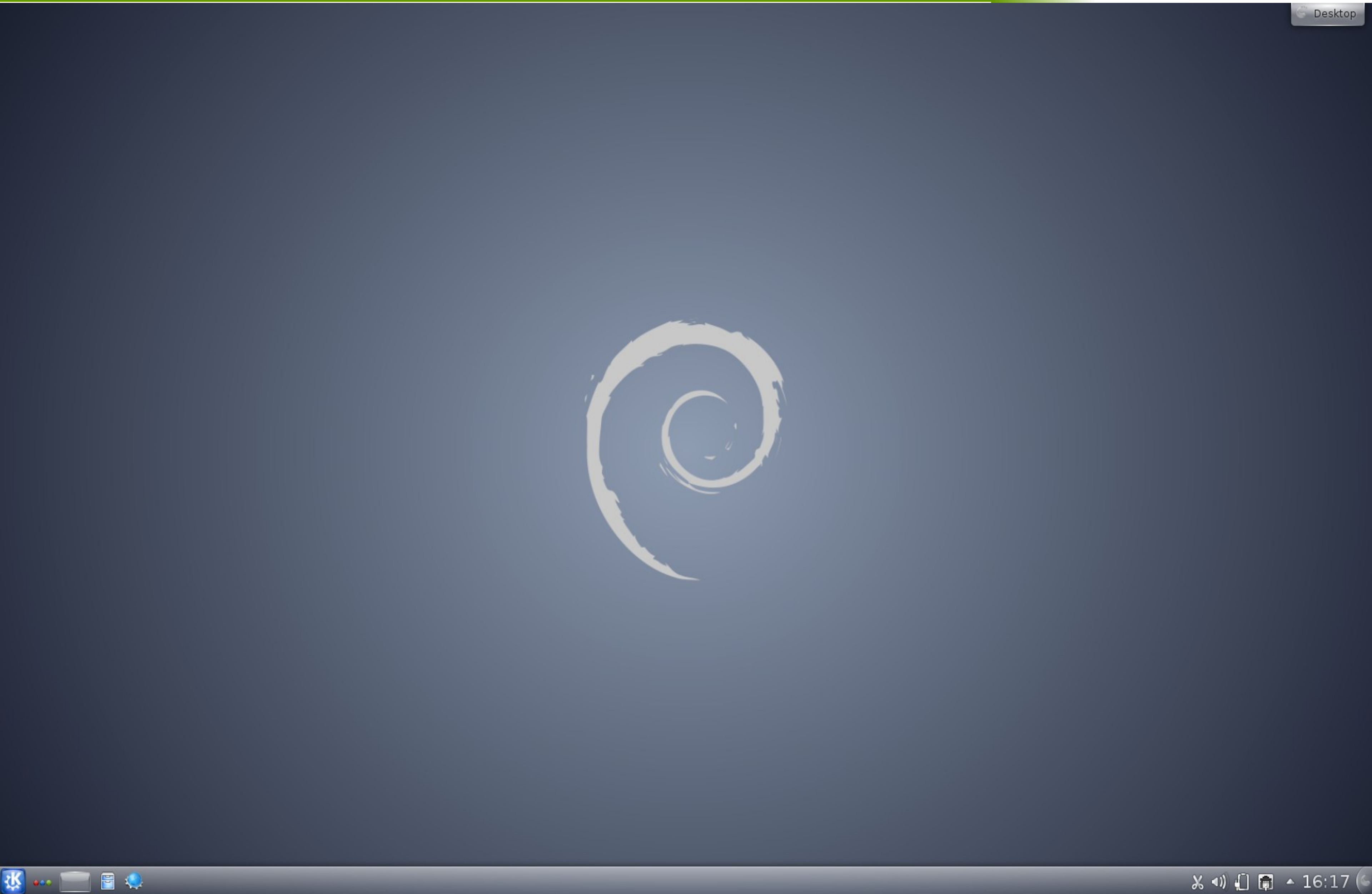
dobriain

Password: ••••••••

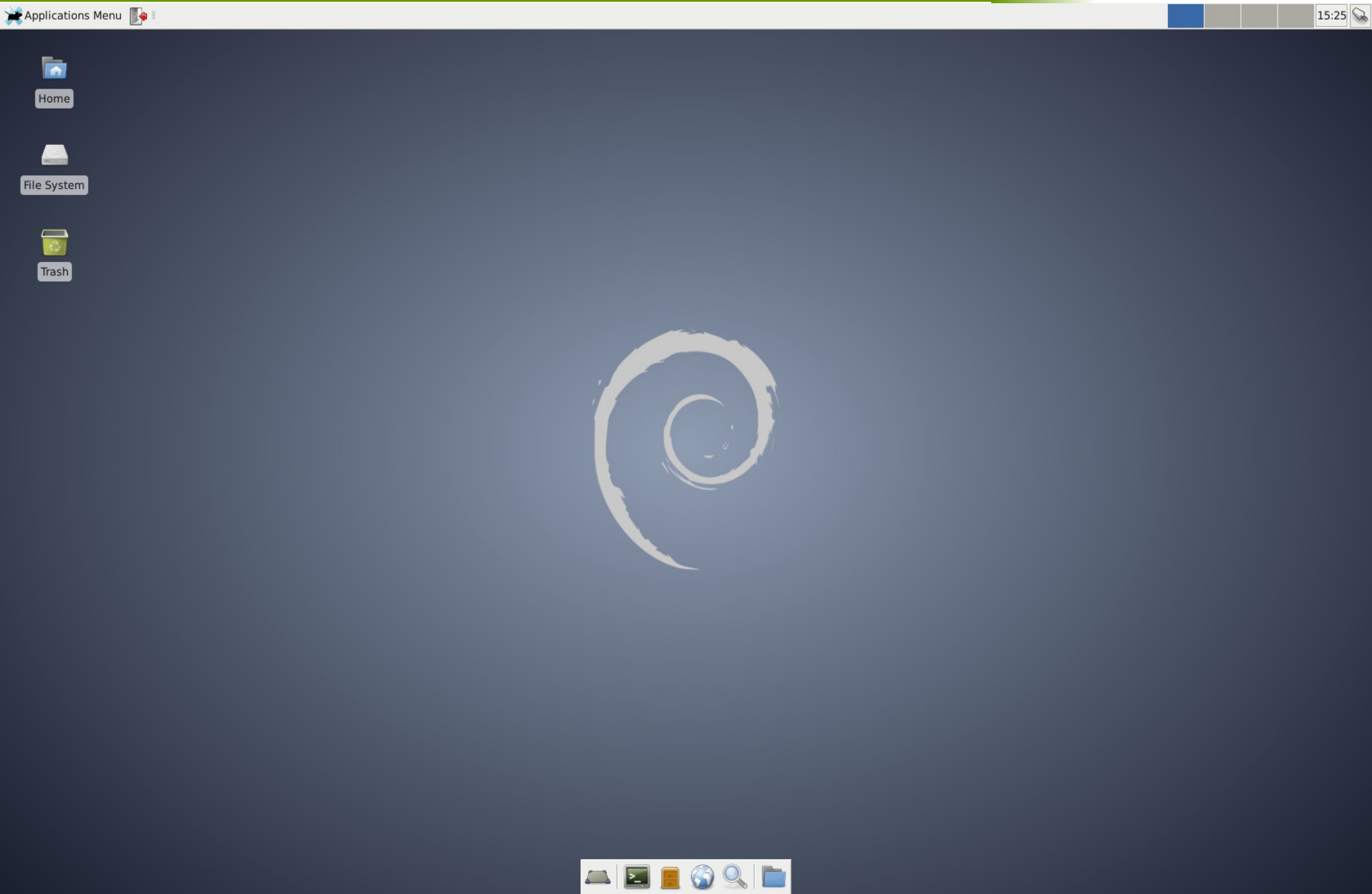
Gnome


Applications
Places
Mon Jan 6, 15:29
dobriain
Computer
Home
Trash

KDE



Xfce



C^{2}S CONSULTING

X-Window Workshop

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FREE TECHNOLOGY ACADEMY

Thank you