LESSON 2
ESSENTIAL COMMANDS
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# Table of Contents

Introduction and Objectives....................................................................................................................5  
Requirements and Setup..........................................................................................................................6  
  Requirements........................................................................................................................................6  
  Setup...................................................................................................................................................6  
Operating System: Windows.......................................................................................................................7  
  How to open a CLI window....................................................................................................................7  
  Commands and Tools (Windows/DOS)....................................................................................................7  
  Commands...........................................................................................................................................8  
  Tools...................................................................................................................................................9  
Game On: Taking Command......................................................................................................................12  
Operating System: Linux........................................................................................................................13  
  Feed Your Head: Console, Terminal or Shell?......................................................................................13  
  How to open a terminal window..........................................................................................................14  
  Linux Commands and Tools................................................................................................................14  
  Commands...........................................................................................................................................14  
  Tools...................................................................................................................................................17  
Operating System: OSX..........................................................................................................................18  
  How to open a Terminal window........................................................................................................18  
  Commands and Tools (OSX)................................................................................................................19  
  Commands...........................................................................................................................................19  
  Tools...................................................................................................................................................21  
Basic Command Equivalences for Windows, OSX and Linux..............................................................24
Lesson 2: Essential Commands

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Introduction and Objectives

Whether you’ve seen “hacking” in the 1995 movie Hackers or Trinity hacking into a UNIX system in The Matrix Reloaded, when you picture a hacker they’re working at the command line. For good reason.

You can do very big, very powerful things in the command line interface (CLI). You don’t have to be a master at the command line but you should be comfortable working with it.

Once you’ve mastered the basics of the CLI, you can start using these commands in text files (called scripts); it’s the easiest programming ever.

We will discuss commands and basic tools for Windows, OSX and Linux operating systems. You’ll need to know them for exercises in the following lessons. At the end of this lesson, you should be familiar with:

• General Windows, Linux and OSX commands
• Basic network commands and tools, including

```
  ping
  tracert/traceroute
  netstat
  ipconfig/ifconfig
  route
```
Lesson 2: Essential Commands

Requirements and Setup

Requirements
To complete this lesson you will need:
- A PC running Windows
- A PC running Linux
- Optionally a Mac running OSX
- Access to the Internet

Setup

![General Network Setup](image)

Figure 2.1: General Network Setup

This is the network in which we’ll do most of our work. It consists of your PC, the Internet, and the ISECOM Hacker Highschool test network, which you will access through the Internet.

Note that access to the ISECOM test network is restricted. In order to gain access to it, your instructor must contact the system administrator, as detailed on the [http://www.hackerhighschool.org](http://www.hackerhighschool.org) website.

However, you can also substitute any test network for these exercises. NEVER run tests against computers you don’t own! That may be a criminal offense, and can be dangerous in lots of other ways.

If you want to set up your own test network, it can be as easy as testing another computer in your classroom or home. No special set-up is needed! Of course if you want something more robust or something that lets you experience the challenges and flaws of accessing another computer over the Internet, then you’ll need an Internet-based test network. This can also be done by making alliances with other schools or homes and letting them access certain computers of yours remotely and you access theirs. But make sure you know what you’re doing in setting it up because what you don’t want is for those open computers to get hijacked by some random person on the Internet who does damage for which you will be responsible.
Operating System: Windows

In the days of yore, if we weren’t working in UNIX, we all worked in DOS. We didn’t need to open a CLI; we lived in one. Then UNIX developed “window” interfaces, an idea that eventually came to the PC with Microsoft Windows.

Once Windows arrived, we opened DOS in a window on our desktop and called that a command prompt. Long after Windows had moved beyond being DOS-based, Windows still has a CLI – and many people still call it a DOS box. It’s not really DOS any more, but for our purposes, it doesn’t matter. Here’s how you open one.

How to open a CLI window

The procedure is similar for all versions of Windows.

1. Click the START button.
2. Choose the RUN option (skip this in Vista and later).
3. Type command if you are using Windows 95/98 or cmd for all other versions of Windows and press Enter or click OK.
4. A window similar to the following will appear:

5. Now you can use the commands and tools listed below.

Commands and Tools (Windows/DOS)

Commands provide built-in operating system functions. Tools do more: they probe networks, search for hosts (which is, by the way, what we call computers attached to a network), and let you see or set your host’s routing information.
### Commands

Words in italics are options that you must enter.
Some commands have both long and short versions.

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>date</code></td>
<td>Display or set the date</td>
</tr>
<tr>
<td><code>time</code></td>
<td>Display or set the time</td>
</tr>
<tr>
<td><code>ver</code></td>
<td>Display the MS-DOS or Windows version</td>
</tr>
<tr>
<td><code>dir</code></td>
<td>Display the list of subdirectories and files in a directory.</td>
</tr>
<tr>
<td><code>cls</code></td>
<td>Clear the screen.</td>
</tr>
<tr>
<td><code>mkdir directory</code> or <code>md directory</code></td>
<td>Make a directory with the name <code>directory</code>:</td>
</tr>
<tr>
<td></td>
<td><code>md tools</code></td>
</tr>
<tr>
<td><code>chdir directory</code> or <code>cd directory</code></td>
<td>Change the current directory to another directory:</td>
</tr>
<tr>
<td></td>
<td><code>cd tools</code></td>
</tr>
<tr>
<td><code>rmdir directory</code> or <code>rd directory</code></td>
<td>Delete the directory:</td>
</tr>
<tr>
<td></td>
<td><code>rd tools</code></td>
</tr>
<tr>
<td><code>tree directory</code></td>
<td>Display the structure of folders and files in text-graphic format:</td>
</tr>
<tr>
<td></td>
<td><code>tree c:\tools</code></td>
</tr>
<tr>
<td><code>chkdsk</code></td>
<td>Check a disk and show a status report.</td>
</tr>
<tr>
<td><code>mem</code></td>
<td>Show the amount of memory used and free in the system.</td>
</tr>
<tr>
<td><code>rename source dest</code> or <code>ren source dest</code></td>
<td>Change the name of files:</td>
</tr>
<tr>
<td></td>
<td><code>ren pictures MyPics</code></td>
</tr>
<tr>
<td><code>copy source dest</code></td>
<td>Copy one or more files to another location:</td>
</tr>
<tr>
<td></td>
<td><code>copy c:\tools\myfile.txt c:\tmp\</code></td>
</tr>
<tr>
<td><code>move source dest</code></td>
<td>Move files and change the name of files and directories:</td>
</tr>
<tr>
<td></td>
<td><code>move c:\tools c:\tmp</code></td>
</tr>
<tr>
<td><code>type file</code></td>
<td>Display the content of one or more text files:</td>
</tr>
<tr>
<td></td>
<td><code>type c:\tools\myfile.txt</code></td>
</tr>
<tr>
<td><code>more file</code></td>
<td>Display the information screen by screen:</td>
</tr>
<tr>
<td></td>
<td><code>more c:\tools\myfile.txt</code></td>
</tr>
<tr>
<td><code>delete file</code> or <code>del file</code></td>
<td>Delete one or more files:</td>
</tr>
<tr>
<td></td>
<td><code>del c:\tools\myfile.txt</code></td>
</tr>
</tbody>
</table>
## Tools

Words in italics are options that you must enter.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| ping host| Verify contact with the machine host.  
This command sends ICMP (Internet Control Message Protocol) ping packets to another computer to see how long it takes to respond, or if it responds at all. You can use a hostname or an IP address:  
  - ping hackerhighschool.org  
  - ping 216.92.116.13  
Options include:  
  - ping -n 100 hackerhighschool.org  
which sends 100 ping packets, and  
  - ping -t 216.92.116.13  
which pings the host until stopped with CTRL+C.  
To see more options:  
  - ping /h |
| tracert host| Show the route that packets follow to reach the machine host.  
The DOS tracert command is an adaptation of the UNIX traceroute. (DOS commands could only be eight characters long, back in the day.) Both allow you to find the route that a packet follows from your host to the destination host, tracert also tracks how long each hop takes and travels, at the most, 30 hops. Often you can see the hostnames of the machines through which the packets travel:  
  - tracert hackerhighschool.org  
  - tracert 216.92.116.13  
Some options are:  
  - tracert -n 25 hackerhighschool.org  
to specify N, at the most, jumps, and  
  - tracert -d 216.92.116.13  
to hide hostnames.  
To see more options:  
  - tracert /? |
### Tool | Purpose
---|---
**ipconfig** | Used alone, displays information on your host’s active network interfaces (ethernet, ppp, etc.). It is similar to Linux **ifconfig**.

Some options are:

- `ipconfig /all`
to show more details

- `ipconfig /renew`
to renew the network connection when automatic configuration with DHCP is used, and

- `ipconfig /release`
to deactivate networking when DHCP is used.

More options:

- `ipconfig /?`

**route print** | Displays the routing table. **route** can also be used to set up or erase static routes.

Some options:

- `route print`
to show the list of routes,

- `route delete`
to delete a route, and

- `route add`
to add a route.

More options:

- `route/?`
### Tool

<table>
<thead>
<tr>
<th>netstat</th>
<th>Displays information on the status of the network and established connections with remote machines.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Some options:</td>
</tr>
<tr>
<td></td>
<td>netstat -a</td>
</tr>
<tr>
<td></td>
<td>to check all the connections and listening ports.</td>
</tr>
<tr>
<td></td>
<td>netstat -n</td>
</tr>
<tr>
<td></td>
<td>to display addresses and port numbers in numeric form, and</td>
</tr>
<tr>
<td></td>
<td>netstat -e</td>
</tr>
<tr>
<td></td>
<td>to sample Ethernet statistics.</td>
</tr>
<tr>
<td></td>
<td>Options can be used together:</td>
</tr>
<tr>
<td></td>
<td>netstat -an</td>
</tr>
<tr>
<td></td>
<td>To see more options:</td>
</tr>
<tr>
<td></td>
<td>netstat/?</td>
</tr>
</tbody>
</table>

For additional information on these commands and tools try these options:

- `command /h`
- `command /?`
- `help command`

from a CLI window.

For example, for additional information on the tool **netstat**, you have three possibilities:

- `netstat /h`
- `netstat /?`
- `help netstat`

### Exercises

2.1 Open a CLI window.

2.2 Identify the version of DOS or Windows that you are using.

2.3 Identify the date and time of the system. If they are incorrect, correct them.

2.4 Identify all the directories and files that are in c:/.

2.5 Create the directory c:\hhs\lesson2. Copy to this directory the files with the extension .sys that are in c:/. What files have you found?

2.6 Identify the IP address of your host.

2.7 Trace the route to www.hackerhighschool.org. Identify IP addresses of the intermediate routers.
Game On: Taking Command

“Macrosoft Fenestra is neither an operating system nor an interface. It is a graphical system built around Solitaire,” announced the technology teacher with bits of food stuck to the corners of his wet mouth. Mr. Tri was satisfied that the students bought that line of trash so he moved on. “Fenestra has a command interface, where you speak to the monitor and the computer does whatever it is that you want it to do. If you want a cup of coffee, just tell the monitor and a nice fresh cup of Joe appears.”

Jace was so close to strangling this man, wondering if the police and judge would be sympathetic to her murder plea considering how he was butchering computer technology.

“Wait, hold on Mr. Tri.” Jace hadn’t let a breath out in the last ten minutes so her face was a funny color. “Sir, Fenestra is a graphical user interface, GUI, like the used gum you keep in that jar.” Kids wrinkled their noses and giggled.

She got up and slid around him, getting behind the keyboard like a professional basketball player slipping past the defense. “Click Windows, type CMD, hit Enter. Check out the CLI. See that blinking line? That’s where you type. See how it says what folder you’re in?” Like a Formula 1 driver she never looked back; she just picked up speed.

“Now you can type CD C: and you’re into the system root.” Jace buried the throttle. “With a new system, you’ll want to know as much as you can about your environment. Start by typing in VER, that’s short for version. Now we can tell exactly what version of the operating system is running. See?” Students were staring. Mr. Tri was paralyzed.

Jace felt herself connecting with the computer, typing faster, becoming effortless. She mused out loud, “You can get a computer to spill its guts and tell you everything that’s happening inside of it.” Her fingers flew across the keyboard, dislodging a key and sending it into into the air where it landed in the moldy jar of old gum on the teacher’s desk. Three girls in the front swallowed their gum.

Jace took this as her cue to stop. She stood up abruptly, giving the keyboard back to her teacher. His face was white and there was spit on his lips. She pulled a laser pointer from her inside jacket pocket quickly as if she were drawing a gun and shone it on Mr. Tri’s forehead. A boy in the back of the class peed himself. Then turning it to the pathetic presentation slide on the screen at the front of the class, she calmly said, “These slides are so wrong they have to go.”

“Maybe it’s you who should go,” the teacher said, handing her a pass to the big man’s office, the Vice Principal, aka the Principal of Vice. Her third pass this week. Technology was going to be the end of her, or at least the loss of her free time with another night of detention.

Game Over
Operating System: Linux

Just like in Windows, when you’re using Linux, you run commands in a CLI window. You’ll see these called consoles, terminals and shells.

Feed Your Head: Console, Terminal or Shell?

Amaze your friends by knowing the difference.

- The console was actually the screen and keyboard attached directly to a computer back when the old people today used dumb terminals to access the computer remotely.

- You actually have your choice of shell in Linux, including bash, tcsh and zsh, among others. Different shells let you do very different things, and which one you like is almost a political issue. In most cases, you’ll use bash. When you connect to the Hacker Highschool test network, you’ll get an empty shell.

- When you open a console window what you’re technically opening is a terminal emulator or terminal window, that is, a “fake” dumb terminal running in a window on your desktop.

What can you do at the Linux command line? Everything you could possibly do in any GUI tool, plus vastly more. Race your Windows friends to set your IP address: they will have to drill through all kinds of interfaces to do it. In Linux you could do it with:

```bash
ifconfig eth0 192.168.1.205
```

Bet you can type that faster than they can click!
How to open a terminal window

Because there are many versions of Linux, there are several ways to start a console window.

1. Click the Start Application button.
2. If you see a “Run Command” option, click it and enter “konsole”, then Return.
3. Or look for Accessories, then choose Terminal.
4. Or on many systems you can press CTL-ALT-T.
5. A window similar to this will appear.
6. Now you can use the commands and tools listed below.

Linux Commands and Tools

Commands

Words in italics are options that you must enter.

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>date</td>
<td>Display or set the date.</td>
</tr>
<tr>
<td>time</td>
<td>Display or set the time.</td>
</tr>
<tr>
<td>fsck</td>
<td>Check a file system and show a status report.</td>
</tr>
<tr>
<td>cat file</td>
<td>Display the content of one or more text files:</td>
</tr>
<tr>
<td></td>
<td>cat /etc/passwd</td>
</tr>
<tr>
<td>pwd</td>
<td>Display the name of the current directory.</td>
</tr>
<tr>
<td>hostname</td>
<td>Display the name of the computer you are currently using.</td>
</tr>
<tr>
<td>finger user</td>
<td>Display information on a user:</td>
</tr>
<tr>
<td></td>
<td>finger root</td>
</tr>
<tr>
<td>Command</td>
<td>Purpose</td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
</tr>
</tbody>
</table>
| **ls** | List the contents of the current directory:  
  `ls -la`  
  List the contents of another directory:  
  `ls -la /etc` |
| **cd directory** | Change from current directory to `directory`. If no directory name is specified it changes to the home directory.  
  For the login name "fred" the command  
  `$cd`  
  changes the directory to `/home/fred`, and  
  `$cd -`  
  changes to the last visited directory (think of "subtracting" one directory), and  
  `$cd /tmp`  
  changes to the `/tmp` directory. |
| **cp source dest** | Copy the file `source` to the file `dest`.  
  Example:  
  `cp /etc/passwd /tmp/bunnies` |
| **rm file** | Delete files. Only users with proper access permissions (or root) can delete specific files.  
  Example:  
  `rm letter.txt` |
| **mv source dest** | Move or rename files and directories.  
  Example:  
  `mv secrets.zip innocent.zip` |
| **mkdir directory** | Make a directory with the name `directory`.  
  Example:  
  `mkdir tools` |
| **rmdir directory** | Delete the directory with the name `directory` but only if it is empty:  
  Example:  
  `rmdir tools`  
  Bonus question: how do you delete a directory with files in it? |
| **find / -name file** | Look for files, starting at `/`, with the name `file`:  
  Example:  
  `find / -name myfile` |
| **echo string** | Write `string` to the screen:  
  Example:  
  `echo hello` |
### Command		Purpose

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| `command > file` | Redirect the normal screen output of `command` to file:  
  `ls > listing.txt`  
  If this file already exist, it will get **clobbered**, meaning overwritten! |
| `command >> file` | Redirect the normal screen output of `command` to file. If the file already exists, it **appends** the output to the end of the file.  
  Example:  
  `ls >> listing.txt` |
| `man command` | Show the pages of the online manual about `command`:  
  `man ls` |

For additional information on these commands and tools try these options:

- `command -h`
- `command --help`
- `man command`
- `help command`
- `info command`

For example, for additional information on the `ls` command, type in either of these two possibilities:

- `ls --help`
- `man ls`
Tools
Words in italics are options that you must enter.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Purpose</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>ping host</td>
<td>Verify the contact with the machine host:</td>
<td>ping <a href="http://www.google.com">www.google.com</a></td>
</tr>
<tr>
<td>traceroute host</td>
<td>Show the route that the packets follow to reach the machine host:</td>
<td>tracert <a href="http://www.google.com">www.google.com</a></td>
</tr>
<tr>
<td>ifconfig</td>
<td>Display information on active network interfaces (ethernet, ppp, etc.).</td>
<td></td>
</tr>
<tr>
<td>route</td>
<td>Display the routing table.</td>
<td></td>
</tr>
<tr>
<td>netstat</td>
<td>Display information on your network connections.</td>
<td>netstat -an</td>
</tr>
</tbody>
</table>

Exercises

2.8 Identify the owner of the file passwd. (Note: first locate where this file is.)

2.9 Create the directory work in your own home directory (for example, if your login is fred, create the directory in /home/fred), and copy the file passwd to the directory work that you just created. Identify the owner of the passwd copy.

2.10 Create the directory .hide in the work directory (notice that the file name begins with a dot). List the contents of this directory. What did you have to do to see the contents of directory .hide?

2.11 Create the file test1 with the content, “This is the content of the file test1” in the work directory. Create the file test2 with the content, “This is the content of the file test2” in the work directory. Copy into a file with the name test the contents of both previous files.
Operating System: OSX

Just like in Linux, when you’re using OSX, you run commands in a CLI window. In OSX this application is called **Terminal**.

OSX is based on NetBSD and FreeBSD UNIX, ancestors of Linux. Its GUI and CLI approach is similar to Linux: you can do everything you could possibly do in any GUI tool, plus vastly more.

Some people think Windows stole the whole idea of a GUI from Mac. Actually, GUI interfaces and mouse pointers were used in a much older OS. You can know more than practically everybody by finding out which.

How to open a Terminal window

1. Click on the **Spotlight** icon, an icon of a magnifying glass typically located on the top right of your screen, and search for **Terminal**.

2. Then press Enter or click on it. You will see the Terminal window.

Typically Terminal is located under **Applications > Utilities**. Impress your friends by changing the Terminal style depending on your preferences. Press both the Command and comma
keys to get the Preference dialog for Terminal and choose your preferred colors. Usually this keyboard shortcut gives you access to program preferences in OSX.

**Commands and Tools (OSX)**

Mac ships with a bash shell, so almost all typical Linux commands work on OSX as well.

**Commands**

Words in italics are options that you must enter.

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>date</strong></td>
<td>Display or set the date.</td>
</tr>
<tr>
<td><strong>time command</strong></td>
<td>Display how long it takes for command to execute.</td>
</tr>
<tr>
<td><strong>fsck</strong></td>
<td>Check a file system and show a status report. If you use an OSX journaled volume such as Mac OSX 10.3 or later, in which journaling is enabled by default, you probably won’t need to run this command.</td>
</tr>
<tr>
<td><strong>cat file</strong></td>
<td>Display the content of one or more text files:</td>
</tr>
<tr>
<td></td>
<td><code>cat /etc/passwd</code></td>
</tr>
<tr>
<td><strong>pwd</strong></td>
<td>Display the name of the current directory.</td>
</tr>
<tr>
<td><strong>hostname</strong></td>
<td>Display the name of the computer you are currently using.</td>
</tr>
<tr>
<td><strong>finger user</strong></td>
<td>Display information on a user:</td>
</tr>
<tr>
<td></td>
<td><code>finger root</code></td>
</tr>
<tr>
<td><strong>ls</strong></td>
<td>List the contents of the current directory:</td>
</tr>
<tr>
<td></td>
<td><code>ls -la</code></td>
</tr>
<tr>
<td></td>
<td>List the contents of another directory:</td>
</tr>
<tr>
<td></td>
<td><code>ls -la /etc</code></td>
</tr>
<tr>
<td><strong>cd directory</strong></td>
<td>Change from current directory to directory. If no directory name is specified it changes to the user’s home directory.</td>
</tr>
<tr>
<td></td>
<td>For the login name “fred” the command</td>
</tr>
<tr>
<td></td>
<td><code>cd</code></td>
</tr>
<tr>
<td></td>
<td>changes the directory to /Users/fred, and</td>
</tr>
<tr>
<td></td>
<td><code>cd -</code></td>
</tr>
<tr>
<td></td>
<td>changes to the last visited directory (think of “subtracting” one directory), and</td>
</tr>
<tr>
<td></td>
<td><code>cd /tmp</code></td>
</tr>
<tr>
<td></td>
<td>changes to the /tmp directory.</td>
</tr>
<tr>
<td><strong>cp source dest</strong></td>
<td>Copy the file source to the file dest.</td>
</tr>
<tr>
<td></td>
<td><code>cp /etc/passwd /tmp/bunnies</code></td>
</tr>
<tr>
<td>Command</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><code>rm file</code></td>
<td>Delete files. Only users with proper access permissions (or root) can delete certain files.</td>
</tr>
<tr>
<td></td>
<td><code>rm letter.txt</code></td>
</tr>
<tr>
<td><code>mv source dest</code></td>
<td>Move or rename files and directories.</td>
</tr>
<tr>
<td></td>
<td><code>mv secrets.zip innocent.zip</code></td>
</tr>
<tr>
<td><code>mkdir directory</code></td>
<td>Make a directory with the name <code>directory</code>.</td>
</tr>
<tr>
<td></td>
<td><code>mkdir tools</code></td>
</tr>
<tr>
<td><code>rmdir directory</code></td>
<td>Delete the directory with the name <code>directory</code> but only if it is empty:</td>
</tr>
<tr>
<td></td>
<td><code>rmdir tools</code></td>
</tr>
<tr>
<td><code>find / -name file</code></td>
<td>Look for files, starting at <code>/</code>, with the name <code>file</code>.</td>
</tr>
<tr>
<td></td>
<td><code>find / -name myfile</code></td>
</tr>
<tr>
<td><code>echo string</code></td>
<td>Write <code>string</code> to the screen.</td>
</tr>
<tr>
<td></td>
<td><code>echo hello</code></td>
</tr>
<tr>
<td><code>command &gt; file</code></td>
<td>Redirect the normal screen output of <code>command</code> to <code>file</code>:</td>
</tr>
<tr>
<td></td>
<td><code>ls &gt; listing.txt</code></td>
</tr>
<tr>
<td></td>
<td><strong>Bonus question</strong>: how do you delete a directory with files in it?</td>
</tr>
<tr>
<td><code>command &gt;&gt; file</code></td>
<td>Redirect the normal screen output of <code>command</code> to <code>file</code>. If the file already exists, it appends the output to the end of the file.</td>
</tr>
<tr>
<td></td>
<td><code>ls &gt;&gt; listing.txt</code></td>
</tr>
<tr>
<td><code>man command</code></td>
<td>Show the pages of the online manual about <code>command</code>:</td>
</tr>
<tr>
<td></td>
<td><code>man ls</code></td>
</tr>
</tbody>
</table>

For additional information on these commands and tools try these options:

- `command -h`
- `command --help`
- `man command`
- `help command`
- `info command`

For example, for additional information on the `ls` command, type in either of these two possibilities:

- `ls --help`
- `man ls`
### Tools

Words in italics are options that you must enter.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **ping host** | Verify contact with the machine host. This command sends ping packets using ICMP (Internet Control Message Protocol) to another computer to see how long it takes to respond, or if it responds at all. You can use a hostname or an IP address:  

  ping www.hackerhighschool.org  
  ping 216.92.116.13

  Options include:  
  ping -c 100 www.hackerhighschool.org which sends 100 ping packets, and  
  ping -t 216.92.116.13 which pings the host until stopped with CTRL+C.  

  More options:  
  man ping |
| **traceroute host** | Show the route that packets follow to reach the machine host.  

  *traceroute* has the same scope as Windows *tracert* but uses different network protocols: traceroute uses UDP (User Datagram Protocol) and tracert uses ICMP (Internet Control Message Protocol). You may obtain different results using tracert and traceroute from same network source and destination.  

  Both allow you to find the route that a packet follows from your host to the destination host. Each also tracks how long each hop takes and travels for, at the most, 30 hops. Often you can see the hostnames of the machines through which the packets travel:  

  traceroute www.hackerhighschool.org  
  traceroute 216.92.116.13

  To specify the maximum (-m) number of hops:  
  traceroute -m 25 www.hackerhighschool.org

  To save DNS lookups by showing the IP address rather than a hostname:  
  traceroute -n 216.92.116.13

  To see more options:  
  man traceroute |
<table>
<thead>
<tr>
<th>Tool</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **ifconfig** | Used alone, displays information on your host's active network interfaces (ethernet, ppp, etc.). It is similar to Windows **ipconfig**.  
To show more details, meaning to be **verbose**:  

```bash
ifconfig -v
```
  
To show only the `en1` network interface information:  

```bash
ipconfig en1
```
  
To deactivate the network interface:  

```bash
ifconfig en1 down
```
  
To bring it up:  

```bash
ifconfig en1 up
```
  
Note: you must have permission to use this command, so you may need to put **sudo** in front of these commands. Then you will have to enter your password. **Use sudo carefully!**  

```bash
sudo ifconfig en1 up
```
  
More options:  

```bash
man ifconfig
```
| **netstat** | Displays information on the status of the network and established connections with remote machines. On BSD-like systems, **netstat** is also used to see your routing table.  
To sample all the connections and listening ports:  

```bash
netstat -a
```
  
To display the routing table:  

```bash
netstat -r
```
  
Used with `-n` to show addresses numerically:  

```bash
netstat -nr
```
  
To show information for `en1` network interface.  

```bash
netstat -r -ii en1
```
  
To see more options:  

```bash
man netstat
```
Exercises

2.12 Identify the name and the IP address of your machine.

2.13 Trace the route to www.hackerhighschool.org. Identify IP addresses of the intermediate routers and find your path.

2.14 In Windows use `tracert` to see the path between you and www.hackerhighschool.org as seen by Windows, and send the output on a file named `output.txt` for further analysis.

2.15 Then run the equivalent traceroute command on OSX and Linux from the same network, putting the output in files named `output2OSX.txt` and `output2Linux.txt`. Look at the output files carefully.

1. Are the paths the same or are there differences?
2. Did you find any lines containing the string: `***` What does it mean?
3. Repeat this test at least an hour later. Are the results always the same?
### Basic Command Equivalences for Windows, OSX and Linux

Words in italics are options that you must enter.

<table>
<thead>
<tr>
<th>Linux</th>
<th>OSX</th>
<th>Windows</th>
</tr>
</thead>
<tbody>
<tr>
<td>command --help</td>
<td>command --help</td>
<td>command /h,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>command /?</td>
</tr>
<tr>
<td>man command</td>
<td>man command</td>
<td>help command</td>
</tr>
<tr>
<td>cp</td>
<td>cp</td>
<td>copy</td>
</tr>
<tr>
<td>rm</td>
<td>rm</td>
<td>del</td>
</tr>
<tr>
<td>mv</td>
<td>mv</td>
<td>move</td>
</tr>
<tr>
<td>mv</td>
<td>mv</td>
<td>ren</td>
</tr>
<tr>
<td>more, less, cat</td>
<td>more, less, cat</td>
<td>type</td>
</tr>
<tr>
<td>lpr</td>
<td>lpr</td>
<td>print</td>
</tr>
<tr>
<td>rm -R</td>
<td>rm -R</td>
<td>deltree</td>
</tr>
<tr>
<td>ls</td>
<td>ls</td>
<td>dir</td>
</tr>
<tr>
<td>cd</td>
<td>cd</td>
<td>cd</td>
</tr>
<tr>
<td>mkdir</td>
<td>mkdir</td>
<td>md</td>
</tr>
<tr>
<td>rmdir</td>
<td>rmdir</td>
<td>rd</td>
</tr>
<tr>
<td>netstat -r</td>
<td>netstat -r</td>
<td>route print</td>
</tr>
<tr>
<td>traceroute</td>
<td>traceroute</td>
<td>tracert</td>
</tr>
<tr>
<td>ping</td>
<td>ping</td>
<td>ping</td>
</tr>
<tr>
<td>ifconfig</td>
<td>ifconfig</td>
<td>ipconfig</td>
</tr>
</tbody>
</table>
Today's teens are in a world with major communication and productivity channels open to them and they don't have the knowledge to defend themselves against the fraud, identity theft, privacy leaks and other attacks made against them just for using the Internet. This is the reason for Hacker Highschool.

The Hacker Highschool project is the development of security and privacy awareness learning materials for junior high and high school students.

Hacker Highschool is a set of lessons and a practical means of making hackers. Beyond just providing cybersecurity awareness and critical Internet skills, we need to teach the young people of today how to be resourceful, creative, and logical, traits synonymous with hackers. The program contains free security and privacy awareness teaching materials and back-end support for teachers of accredited junior high, high schools, and home schooling. There are multiple workbooks available in multiple languages. These are lessons that challenge teens to be as resourceful as hackers, including safe Internet use, web privacy, researching on the internet, avoiding viruses and Trojans, legalities and ethics, and more.

The HHS program is developed by ISECOM, a non-profit, open-source research group focused on security awareness and professional security development and accreditation.