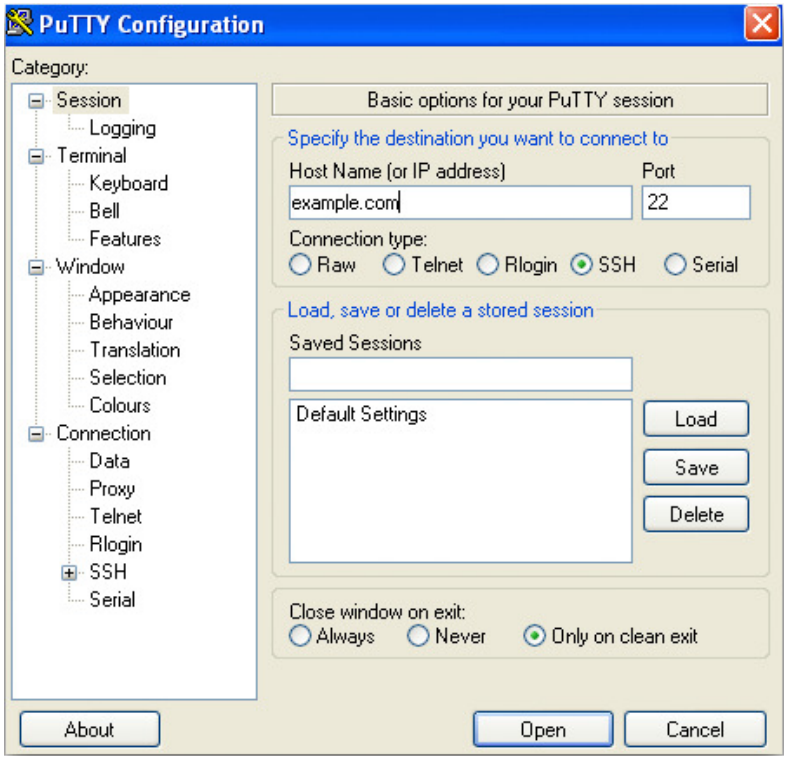
Basic Linux Tutorial

Remotely connecting to Linux Command Line Interface (CLI) from Windows

PuTTY is a free software application for Windows 95, 98, XP, Vista, and 7 which can be used to make an SSH connection to your server. You can download the application athttp://www.chiark.greenend.org.uk/~sgtatham/putty/download.html.

1. Download PuTTY from http://www.chiark.greenend.org.uk/~sgtatham/putty/ or another PuTTY download source. The "putty.exe" download is good for basic SSH.
2. Save the download to your C:\WINDOWS folder.
3. If you want to make a link to PuTTY on your desktop:
    - Open the C:\WINDOWS folder in Windows Explorer.
    - Right click on the putty.exe file and select Send To > Desktop
4. Double-click on the putty.exe program or the desktop shortcut to launch the application.
5. Enter your connection settings:



- Host Name: example.com OR s00000.gridserver.com
- Port: 22 (leave as default)
- Connection Type: SSH (leave as default)

6. Click Open to start the SSH session.
7. If this is your first time connecting to the server from this computer, you will see the following output. Accept the connection by clicking Yes.

8. Once the SSH Connection is open, you should see a terminal prompt asking for your username:

   ```
   login as:
   ```

   Connect with your SSH user of choice.

9. Next, enter your password. Please note that you will NOT see your cursor moving, or any characters typed (such as ******), when typing your password. This is a standard PuTTY security feature. Hit enter.

   ```
   Using keyboard-interactive authentication.

   Password:
   ```

10. You are now logged into your server with SSH. You should see output like this:

    ```
    example.com@n11:~$
    ```

Command Shells

A shell is a **command interpreter** which allows you to interact with the computer. The behavior of the command line interface will differ slightly depending on the *shell* program that is being used.

Depending on the shell used, some extra behaviors can be quite nifty. In this tutorial we will focus on **Bash**, since it is the most widely used and also one of the most powerful shells out there.

You can find out what shell you are using by the command:

```
$ echo $SHELL
```

Of course you can create a file with a list of shell commands and execute it like a program to perform a task. This is called a shell script. This is in fact the primary purpose of most shells, not the interactive command line behavior. This can be done by inserting the following line at the very top of your script.

```
#! /bin/bash
```

Linux Directories

File and directory paths in LINUX use the forward slash "/" to separate directory names in a path.

examples:

/	"root" directory
/home/myuserid	your HOME directory
/usr	directory usr (sub-directory of / "root" directory)
/usr/STRIM100	STRIM100 is a subdirectory of /usr

Moving around the file system

pwd	Show the "present working directory", or current directory.
cd	Change current directory to your HOME directory.
cd /usr/STRIM100	Change current directory to /usr/STRIM100.
cd INIT	Change current directory to INIT which is a sub-directory of the current directory.
cd ..	Change current directory to the parent directory of the current directory.
cd $STRMWORK	Change current directory to the directory defined by the environment variable 'STRMWORK'.
cd ~bob	Change the current directory to the user bob's home directory (if you have permission).

Listing directory contents:

ls	list a directory
ls -l	list a directory in long (detailed) format

for example:

```
$ ls -l
drwxr-xr-x    4 cliff    user        1024 Jun 18 09:40
WAITRON_EARNINGS
-rw-r--r--    1 cliff    user      767392 Jun  6 14:28 scanlib.tar.gz
^ ^  ^  ^     ^   ^       ^           ^      ^    ^      ^
| |  |  |     |   |       |           |      |    |      |
| |  |  |     | owner   group       size   date  time    name
| |  |  |     number of links to file or directory contents
| |  |  permissions for world
| |  permissions for members of group
| permissions for owner of file: r = read, w = write, x = execute -=no
permission
type of file: - = normal file, d=directory, l = symbolic link, and
others...
```

ls -a	List the current directory including hidden files. Hidden files start with "."
ls -ld *	List all the file and directory names in the current directory using long format. Without the "d" option, ls would list the contents of any sub-directory of the current. With the "d" option, ls just lists them like regular files.

Changing file permissions and attributes

chmod 755 filename	Changes the permissions of file to be rwx for the owner, and rx for the group and the world. (7 = rwx = 111 binary. 5 = r-x = 101 binary)
chgrp user file	Makes file belong to the group user.
chown cliff file	Makes cliff the owner of file.
chown -R cliff dir	Makes cliff the owner of dir and everything in its directory tree.

You must be the owner of the file/directory or be root before you can do any of these things.

Moving, renaming, and copying files

cp file1 file2	copy a file
mv file1 newname	move or rename a file
mv file1 ~/AAA/	move file1 into sub-directory AAA in your home directory.
rm file1 [file2 ...]	remove or delete a file
rm -r dir1 [dir2...]	recursively remove a directory and its contents BE CAREFUL!
mkdir dir1 [dir2...]	create directories

mkdir –p dirpath	create the directory dirpath, including all implied directories in the path.
rmdir dir1 [dir2...]	remove an empty directory

Viewing and editing files

cat filename	Dump a file to the screen in ascii.
more filename	Progressively dump a file to the screen: ENTER = one line down SPACEBAR = page down q=quit
less filename	Like more, but you can use Page-Up too. Not on all systems.
vi filename	Edit a file using the vi editor. All LINUX systems will have vi in some form.
emacs filename	Edit a file using the emacs editor. Not all systems will have emacs.
head filename	Show the first few lines of a file.
head –n filename	Show the first n lines of a file.
tail filename	Show the last few lines of a file.
tail –n filename	Show the last n lines of a file.

Environment variables

You can teach your shell to remember things for later using environment variables.
For example under the bash shell:

export CASROOT=/usr/local/CAS3.0	Defines the variable CASROOT with the value /usr/local/CAS3.0.
export LD_LIBRARY_PATH=$CASROOT/Linux/lib	Defines the variable LD_LIBRARY_PATH with the value of CASROOT with /Linux/lib appended, or /usr/local/CAS3.0/Linux/lib

By prefixing $ to the variable name, you can evaluate it in any command:

cd $CASROOT	Changes your present working directory to the value of CASROOT
echo $CASROOT	Prints out the value of CASROOT, or /usr/local/CAS3.0
printenv CASROOT	Does the same thing in bash and some other shells.

Interactive History

A feature of **bash** and **tcsh** (and sometimes others) you can use the up-arrow keys to access your previous commands, edit them, and re-execute them.

Filename and Command Completion

A feature of bash and tcsh (and possibly others) you can use the **TAB** key to complete a partially typed filename. For example if you have a file called constantine-monks-and-willy-wonka.txt in your directory and want to edit it you can type 'vi const', hit the **TAB** key, and the shell will fill in the rest of the name for you (provided the completion is unique).

Bash will even complete the name of commands and environment variables. And if there are multiple completions, if you hit TAB twice bash will show you all the completions. Bash is the default user shell for most Linux systems.

Redirection:

grep string filename > newfile	Redirects the output of the above grep command to a file 'newfile'.
grep string filename >> existfile	Appends the output of the grep command to the end of 'existfile'.

The redirection directives, > and >> can be used on the output of most commands to direct their output to a file.

Pipes:

The pipe symbol "|" is used to direct the output of one command to the input of another.

For example:

ls –l | more	This commands takes the output of the long format directory list command "ls -l" and pipes it through the more command (also known as a filter). In this case a very long list of files can be viewed a page at a time.
du –sc * | sort –n | tail	The command "du -sc" lists the sizes of all files and directories in the current working directory. That is piped through "sort -n" which orders the output from smallest to largest size. Finally, that output is piped through "tail" which displays only the last few (which just happen to be the largest) results.

Command Substitution

You can use the output of one command as an input to another command in another way called command substitution. Command substitution is invoked when by enclosing the substituted command in backwards single quotes. For example:

```
cat `find . -name aaa.txt`
```

which will cat (dump to the screen) all the files named aaa.txt that exist in the current directory or in any subdirectory tree.

Searching for strings in files: The *grep* command

`grep string filename`	prints all the lines in a file that contain the string

Searching for files : The *find* command

```
find search_path -name filename
```

`find . -name aaa.txt`	Finds all the files named aaa.txt in the current directory or any subdirectory tree.
`find / -name vimrc`	Find all the files named 'vimrc' anywhere on the system.
`find /usr/local/games -name "*xpilot*"`	Find all files whose names contain the string 'xpilot' which exist within the '/usr/local/games' directory tree.

Reading and writing backups and archives: The *tar* command

The tar command is the "standard" way to read and write archives (collections of files and whole directory trees).

Often you will find archives of stuff with names like stuff.tar, or stuff.tar.gz. This is stuff in a tar archive, and stuff in a tar archive which has been compressed using the gzip compression program respectively.

Chances are that if someone gives you a tape written on a LINUX system, it will be in tar format, and you will use tar (and your tape drive) to read it.

Likewise, if you want to write a tape to give to someone else, you should probably use tar as well.

Tar examples:

tar xv	extracts (x) files from the default tape drive while listing (v = verbose) the file names to the screen.
tar tv	lists the files from the default tape device without extracting them.
tar cv file1 file2	Write files 'file1' and 'file2' to the default tape device.
tar cvf archive.tar file1 [file2...]	create a tar archive as a file "archive.tar" containing file1, file2...etc.
tar xvf archive.tar	extract from the archive file
tar cvfz archive.tar.gz dname	create a gzip compressed tar archive containing everything in the directory 'dname'. This does not work with all versions of tar.
tar xvfz archive.tar.gz	extract a gzip compressed tar archive. Does not work with all versions of tar.
tar cvfI archive.tar.bz2 dname	Create a bz2 compressed tar archive. Does not work with all versions of tar

File compression: *compress*, *gzip*, and *bzip2*

A common compression utility is gzip (and gunzip). These are the GNU compress and uncompress utilities. gzip usually gives better compression than standard compress, but may not be installed on all systems. The suffix for gzipped files is .gz

gzip part	Creates a compressed file part.gz
gunzip part.gz	Extracts the original file from part.gz

The bzip2 utility has (in general) even better compression than gzip, but at the cost of longer times to compress and uncompress the files. It is not as common a utility as gzip, but is becoming more generally available.

bzip2 part	Create a compressed bzip2 file par.bz2
bunzip2 part.bz2	Uncompress the compressed part file.

Looking for help: The *man* commands

Most of the commands have a manual page which give sometimes useful, often more or less detailed, sometimes cryptic and unfathomable discriptions of their usage. Some say they are called man pages because they are only for real men.

Example:

`man ls` Shows the manual page for the ls command

Basics of the *vi* editor

`vi filename` Opening a file

Creating text
Edit modes: These keys enter editing modes and type in the text of your document.

`i` Insert before current cursor position
`I` Insert at beginning of current line
`a` Insert (append) after current cursor position
`A` Append to end of line
`r` Replace 1 character
`R` Replace mode
`<ESC>` Terminate insertion or overwrite mode

Deletion of text
`x` Delete single character
`dd` Delete current line and put in buffer
`ndd` Delete n lines (n is a number) and put them in buffer
`J` Attaches the next line to the end of the current line (deletes carriage return).
`u` Undo last command

Cut and paste
`yy` Yank current line into buffer
`nyy` Yank n lines into buffer
`p` Put the contents of the buffer after the current line
`P` Put the contents of the buffer before the current line

Cursor positioning
`^d` Page down
`^u` Page up
`:n` Position cursor at line n
`:$` Position cursor at end of file
`^g` Display current line number

h,j,k,l Left,Down,Up and Right respectively. Your arrow keys should also work.

String substitution

:n1,n2:s/string1/string2/[g]	Substitute string2 for string1 on lines n1 to n2. If g is included (meaning global), all instances of string1 on each line are substituted. If g is not included, only the first instance per matching line is substituted.
^	matches start of line
.	matches any single character
$	matches end of line

These and other "special characters" (like the forward slash) can be "escaped" with \ i.e to match the string "/usr/STRIM100/SOFT" say "\/usr\/STRIM100\/SOFT"

Examples:

:1,$:s/dog/cat/g	Substitute 'cat' for 'dog', every instance for the entire file - lines 1 to $ (end of file)
:23,25:/frog/bird/	Substitute 'bird' for 'frog' on lines 23 through 25. Only the first instance on each line is substituted.

Saving and quitting and other "ex" commands

These commands are all prefixed by pressing colon (:) and then entered in the lower left corner of the window. They are called "ex" commands because they are commands of the ***ex*** text editor - the precursor line editor to the screen editor vi. You cannot enter an "ex" command when you are in an edit mode (typing text onto the screen) Press **<ESC>** to exit from an editing mode.

:w	Write the current file.
:w new.file	Write the file to the name 'new.file'.
:w! existing.file	Overwrite an existing file with the file currently being edited.
:wq	Write the file and quit.
:q	Quit.
:q!	Quit with no changes.
:e filename	Open the file 'filename' for editing.
:set number	Turns on line numbering
:set nonumber	Turns off line numbering