Introduction to Linux

Jerry Ebalunode

Computational Research and CyberInfrastructure Support Initiative

(CRCISI)

University of South Carolina

Columbia, SC

Overview

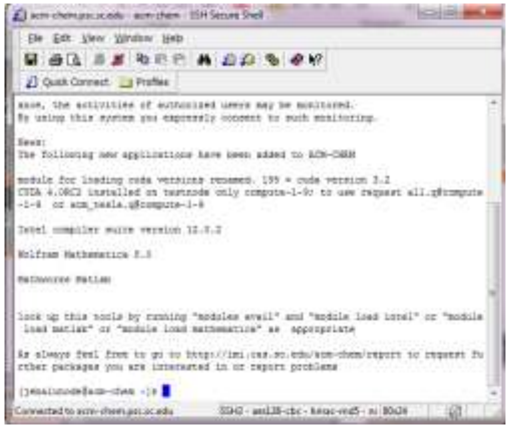
- Linux
  - What is Linux?
  - Why use Linux?
- Basic Commands
- Working with Files & Folders
- Text Editors
- I/O Redirection & Pipes
- Introduction to BASH
- Open Lab

First Access Your Account

- Log into your accounts
  - Accounts already created for you on the desktop
  - username = “vip01” thru “vip14”
  - Password = vip

The Role of an Operating System (OS)

- Software & data that <u>manages</u> computer hardware resources.


acm-chem.psc.sc.edu - acm-chem - SSH Secure Shell
File Edit View Window Help
Quick Connect Profiles

```
ason, the activities of authorized users may be monitored.
By using this system you expressly consent to such monitoring.

News:
The following new applications have been added to ACM-CHEM

module for loading cuda versions renamed. 155 = cuda version 3.2
CUDA 4.0RC2 installed on testnode only compute-1-9: to use request all.q@compute
-1-8  or acm_tesla.q@compute-1-8

Intel compiler suite version 12.0.2

Wolfram Mathematica 8.0

Mathworks Matlab


look up this tools by running "modules avail" and "module load intel" or "module
 load matlab" or "module load mathematica" as  appropriate

As always feel free to go to http://imi.cas.sc.edu/acm-chem/report to request fu
rther packages you are interested in or report problems

[jemalunode@acm-chem ~]$ 
```

Connected to acm-chem.psc.sc.edu
SSH2 - aes128-cbc - hmac-md5 - ni 80x24

- Provides a <u>platform</u> for running applications on desktops, servers, clusters.

What is Linux?

- Linux is an OS just like Windows or Mac OS X
  - Technically speaking, Linux is the kernel: the program in the system that allocates the machine's resources to the other programs that you run. Linux is normally used in combination with the GNU operating system: the whole system is basically GNU with Linux added, or GNU/Linux
- Under development since 1991, started by Linus Torvalds (Finnish software engineer)
- Why create Linux?
  - Personal computers were becoming popular
  - Needed compatibility with UNIX (IEEE POSIX)
  - Microsoft's DOS was too limiting
  - Commercial UNIX was expensive
  - Academic-use-only MINIX was restrictive

Linux Distributions

- Today, different versions of the Linux OS are called “distributions,” and there are lots of them (over 100):

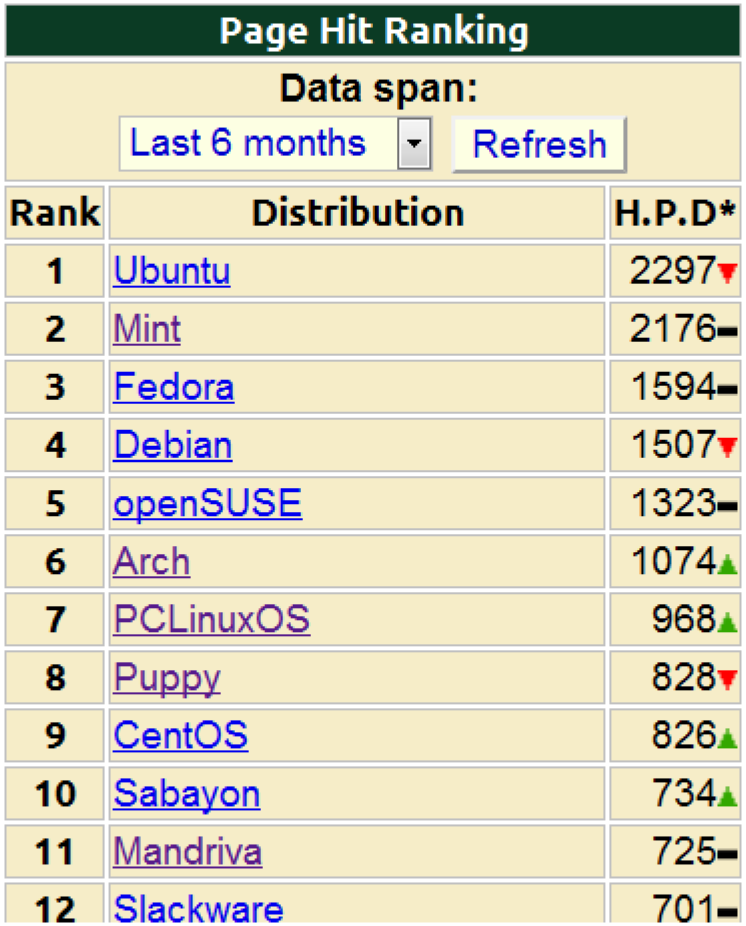
redhat
openSUSE
CentOS
debian
fedora
Mandriva
KNOPPIX
gentoo linux
Scientific
slackware linux
ubuntu
Deepin
Vinux
sabayon
SMS
Vector
Puppy
edubuntu
lubuntu
CHAKRA
archlinux
Linux Mint

- Each one offers a unique combination of features and applications to suit needs of different users.

Tracking Linux Distributions

Distrowatch

- Distrowatch.com provides news, comparisons, popularity ranking ….. of various Linux distributions



Page Hit Ranking

Data span: Last 6 months | Refresh

Rank	Distribution	H.P.D*
1	Ubuntu	2297▼
2	Mint	2176▬
3	Fedora	1594▬
4	Debian	1507▼
5	openSUSE	1323▬
6	Arch	1074▲
7	PCLinuxOS	968▲
8	Puppy	828▼
9	CentOS	826▲
10	Sabayon	734▲
11	Mandriva	725▬
12	Slackware	701▬

*H.P.D = hits per day

Why Use Linux?

- General features of Linux:
  - Most distributions are free
  - Open-source (completely customizable)
  - Portable to nearly any hardware platform
  - Highly scalable to lots of cores, or lots of memory
  - Highly efficient, therefore useful for computation
  - Robust and proven security model
  - Includes a complete development environment

Linux OS and CLI

- Linux can be a full-featured, user-friendly OS…
    - i.e. graphical user interfaces (GUIs)

- But in High Performance Computing (HPC), the command-line interface (CLI) is the most common way to access & use the OS.

- Therefore, knowing how to complete tasks from the **command line is critical**.

Getting Started

- Use your web browser to download intro2linux.zip archive from the tutorial web page to your home directory where you can begin working with it: then
- Open up a gnome terminal
  - Multiple ways to do this:
    - Click on the gnome-terminal icon on the top panel
  - Or
    - On mouse: right click and select terminal and click
- To immediately begin working with tutorial files in your gnome-terminal
  - cd “to_my_download_directory”
  - unzip intro2linux.zip
  - cd intro.linux

Basic Linux Commands

- **pwd** – prints your current working directory
- **whoami** – prints the name of the current user
- **who** – prints a list of all users who are logged-in
- **hostname** – prints the name of the system
- **date** – prints the current date and time
- **ps** – prints snapshot of current shell processes
- **ls** – list the contents of the directory you're in
- **env** – list all environment variables/settings
- **df** – prints summary of disk usage

Basic Linux Commands: Arguments

- Some commands accept "arguments" that change the behavior of the command, or tell the command exactly what to do.

`df -h`	– prints "human readable" disk usage
`echo $USER`	– prints contents of a variable
`mkdir [name]`	– creates a new directory
`cd [name]`	– change directory (move into that directory)
`cd ..`	– back up/out of the directory you're in
`cd ../..`	– back up 2 levels/directories
`which [command]`	– shows any command's full path

Working with Files

- Here are some commands that are useful for working with files and folders:

cp [file1] [file2]	– create a copy of a file
mv [file] [destination]	– move (or rename) a file
rm [file]	– delete a file (rm -r [dir] for a folder)
file [file]	– print the type of file
more [file]	– read a text file, one “page” at a time
less [file]	– similar to more, but a little better
head -n [file]	– print the first n lines of a file
tail -n [file]	– print the last n lines of a file
cat [file]	– print the contents of a file to the screen

Man Pages & History

- Nearly all commands available for use on a particular system have an accompanying "manual page":
  - man cp
  - man ls
  - man python
  - man man
  - apropos [topic]
    - or whatis [topic]
- Note: To exit the manual page (man page) viewer
  - simply type the letter Q.
- Use the "up" arrow to scroll through commands you've used.
- You can view the entire history of commands you have used by executing
  - history

Text Editors

- Nearly all Linux distributions come with a variety of text editors for writing and editing files.
- Some of the most common are nano, vi, vim, and emacs.

- Using nano
  - Example:
    - **nano hello.txt** - opens a file called hello.txt for editing
    - [write something]
    - **CTRL-o (^o)** to save
    - **CTRL-x (^x)** to exit nano

I/O Redirection

- By default, command line programs print to “stdout” (standard out = the computer monitor).
- I/O redirection is a way of manipulating the input/output of Linux programs, allowing you to capture the output in a file, or send it to another program.
- Get the first 9 words from the dictionary:
  - `head -9 dictionary.txt > temp.txt`
  - `head -n 9 dictionary.txt > temp.txt`
  - `more temp.txt`
  - `wc -l temp.txt` -counts the number of lines in a file

- The **“>”** character performs a “redirect,” taking the output of the head command and putting it into the file temp.txt.

I/O Redirection: Append & Pipes

- Use **“>>”** to append to a file without overwriting:
  - export DATE=`date`
  - echo “Right now it’s $DATE” >> temp.txt

- Another useful technique is to redirect one program's output (stdout) into another program's input (stdin). This is done using a “pipe” character.
  - **cat dictionary.txt**
  - **cat dictionary.txt | grep ing**
  - **cat dictionary.txt | grep ing | grep un**

FYI, **`my_linux_command`** returns or paste the results of a linux command as the argument rather than the command itself.

More Working with Files

- More advanced, but very useful commands to try:
  - **grep error [file]**
    - searches a file for lines containing “error” and prints them to stdout
  - **tar -cvzf** [compressed_archive].tar.gz [directory]
    - **“tars”** (like “zipping”) a directory into a single compressed file,

- useful for file transfers.
  - scp [file] usename@server:path_to_destination

- useful for directory or folder transfers.
  - scp -r [dir] usename@server:path_to_destination

- scp => Secure Copy. Used to copy a file or folder or directory to another computer where <u>you have a user account</u>.

Also,

```
scp  usename@server:path_to_remote_file    path_to_destination_file

scp  -r  usename@server:path_to_remote_dir   path_to_destination_dir
```

The Bash Shell

- BASH also known as Bourne-again shell
- The BASH shell (command line interpreter) is an open-source version of the original UNIX Bourne shell.
  - Allows users to type commands which cause actions
  - Typically run in a text window
- Usually the default shell in a Linux environment
- Similar to Explorer in Windows, or Finder in Mac OSX
- Uses specific syntax (like $ to indicate variable names)
- Need to use a different shell? Just run it: /bin/csh
- (Type exit or CTRL-D to return to your previous shell)

Writing a Bash Script

- Multiple commands can be issued in sequence using a script. Create a new file containing these lines and run the file like it’s an executable:

```
#!/bin/bash
 cd $HOME
 tar -cvzf example.tar.gz  intro.linux
 mkdir dustbin
 mv example.tar.gz  ./dustbin
 cd dustbin
 tar -xf example.tar.gz ; mv intro.linux newdir
 ls newdir > contents.txt
 cd $HOME
```

More Bash Scripting: Loops

- A simple FOR loop:

```
#!/bin/bash

for i in $(seq 1 10)
do
   echo -n This is iteration $i
      echo -n " and the time is "
      date +%T
done
```

See file: loop1.sh

- Another way to do same trick

```
#!/bin/bash

for ((i=1; i<=10; i++))
do
   echo -n This is iteration $i
      echo -n " and the time is "
      date +%T
done
```

See file: loop2.sh

More Bash Scripting

Why won't my "for loop" run?

- A simple FOR loop:

```
#!/bin/bash

for i in $(seq 1 10)

   echo -n This is iteration $i
      echo -n " and the time is "
      date +%T
done
```

Missing "do" command

```
#!/bin/bash

for ((i=1; i<=10; i++))
do
   echo -n This is iteration $i
      echo -n " and the time is "
      date +%T
```

Missing "done" command

More Bash Scripting

Flow Control: conditional "if" and "test"

- FOR loop with conditional if:

```
#!/bin/bash

for i in $(seq 1 10)
  do
   echo -n This is iteration $i
   if [ $i  -eq  5 ]
       then  break
  fi
done
```

See file: flow-control-loop1.sh

- Another way to do same trick

```
#!/bin/bash

for ((i=1; i<=10; i++))
do
   echo -n This is iteration $i
 test  $i  -eq 5 && break

done
```

See file: flow-control-loop2.sh & flow-control-loop3.sh

Customizing Your Shell

- Every time you log-in, the .bashrc script in your home directory is executed.
- You can add lines to the bottom of this file to run additional, custom commands when you log-in.
- After editing this file, you can execute the commands in this file using the source ~/.bashrc command.
- An example of a customized .bashrc file can be found here:
- /opt/tutorials/intro.linux/bashrc.example

A Little Awk and Sed

- AWK: a programming language for processing text-based data in files or data streams.
  - ls | awk '{print "mv " $1 " " $1 ".new" }' | bash
    - Causes files or directories to be renamed with a ".new" suffice
-
- sed: ("stream editor") a UNIX utility for parsing text files and implementing textual transformations.
  - sed 's/old/new/g' input.txt > output.txt
  - ls -1 *txt* | awk '{print "mv "$1" "$1}' | sed s/txt/blah/2 | bash

File & Directory Permissions

- Control access to files & directories by setting permissions
  - cd intro.linux
  - ls –l
    ```
    -rwxr-xr-x 1 jebalunode public 622783 2010-12-03 09:15 dictionary.txt
    -rwxr-xr-x 1 jebalunode public   8262 2010-12-03 09:15 icb.txt
    -rwxr-xr-x 1 jebalunode public 891777 2010-12-03 09:15 personnel.txt
    -rwxr-xr-x 1 jebalunode public   6599 2010-12-03 09:15 theraven.txt
    ```

- Setting permissions using read /write or executable :
  - chmod +r [file] --makes a file readable
  - chmod +w [file] –writes to the file are permitted
  - chmod +x [file] --makes a file executable
  - chmod +rwx [file] --makes a file executable, writable and readable

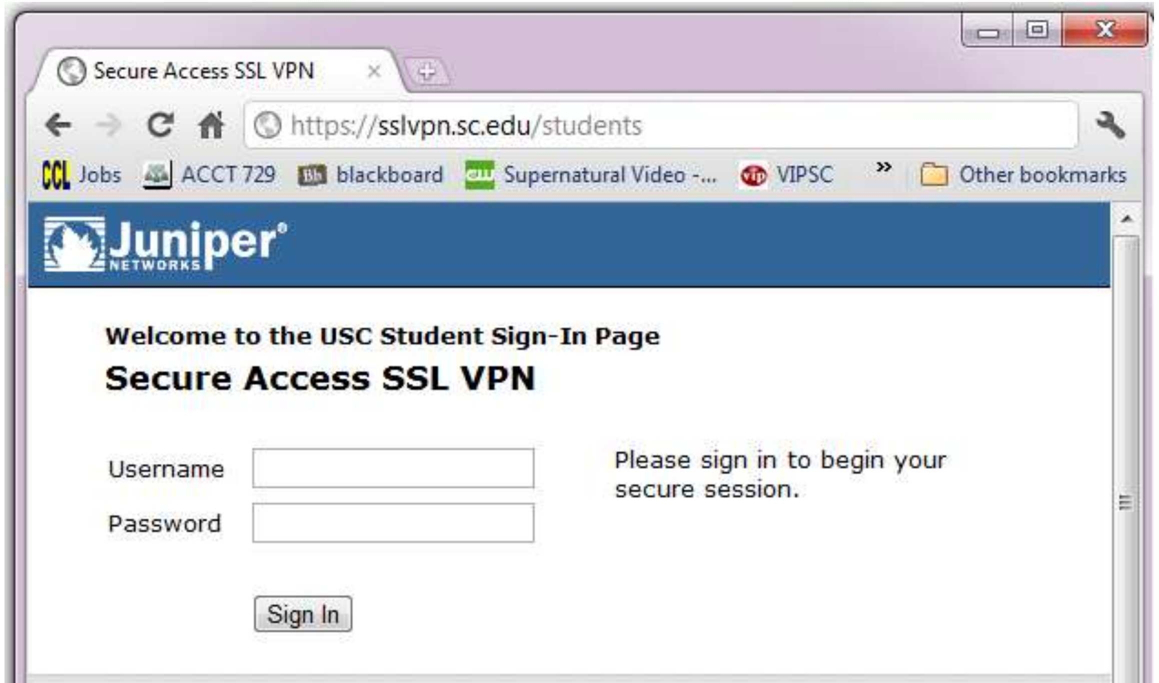
- For directorys you apply the recursive "R"
  - chmod -R +r [dir] --makes a directory readable

Also Good to Know

- top -will list processes/tasks running on your system
  - q or CTRL-c can help you get "unstuck"
- cd -will return you to your home/login directory
-
- basename - strip directory and suffix from filenames
  - basename we_are_young_and_old _and_old
    - output "we_are_young"
- tr -translate or delete characters
  - echo linux | tr [a-z] [A-Z]
  - echo linuxx | tr [a-z] [A-Z] | tr -s [X]
  - echo linuxe | tr [a-z] [A-Z] | tr -d [E]
- TAB -completion
- "Full path" to a location in the file system (/ vs. ~/)
- Change user or group ownership of a file:
  - chown [userid] [file]
  - chgrp [group name] [file]
- Find a file:
  - find ./ -name "name.of.my.file.txt"
  - locate name.of.my.file.txt
- Type **exit** to close your shell.

Connecting to USC Linux Systems from Home

- Requirements
  - Have Java installed
    - See do I have java URL
  - Have firefox, or microsoft explorer or google chrome installed
  - Goto USC VPN site to install VPN
    - For students the url is https://sslvpn.sc.edu/students



Secure Access SSL VPN

https://sslvpn.sc.edu/students

Jobs ACCT 729 blackboard Supernatural Video -... VIPSC Other bookmarks

Juniper NETWORKS

Welcome to the USC Student Sign-In Page

Secure Access SSL VPN

Username

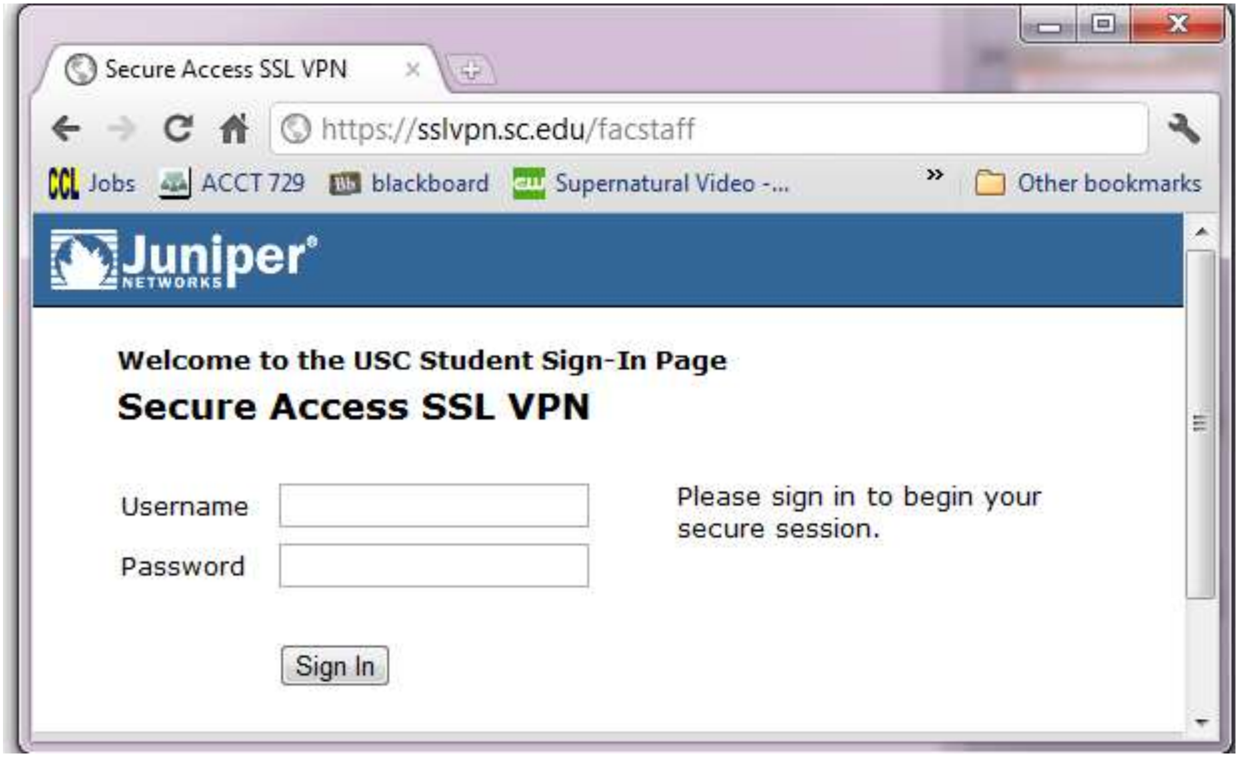
Password

Please sign in to begin your secure session.

Sign In

Connecting to USC Linux Systems from Home

- For faculty or staff go to https://sslvpn.sc.edu/facstaff



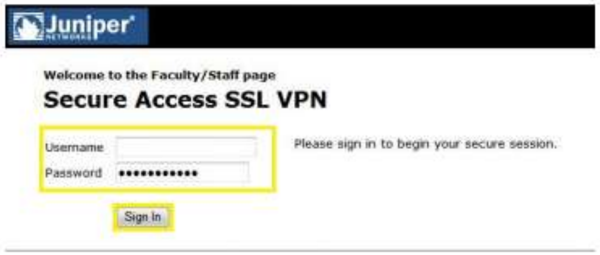
Welcome to the USC Student Sign-In Page

Secure Access SSL VPN

Please sign in to begin your secure session.

Connecting to USC Linux Systems from Home

1 Enter your network **username** and **password**, then click **Sign In.**



Welcome to the Faculty/Staff page

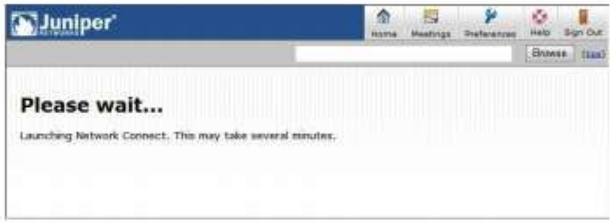
Secure Access SSL VPN

Username

Password ••••••••••••

Please sign in to begin your secure session.

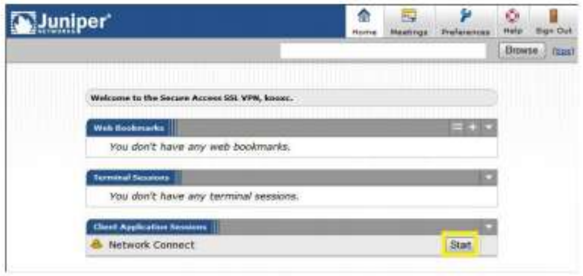
2 Wait while the initial setup begins. Please note that this may take several minutes.



Please wait...

Launching Network Connect. This may take several minutes.

3 Click **Start.**



Welcome to the Secure Access SSL VPN, kooxc..

Web Bookmarks

You don't have any web bookmarks.

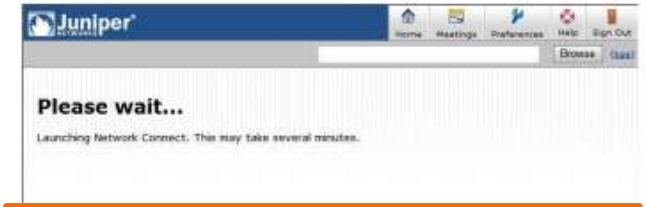
Terminal Sessions

You don't have any terminal sessions.

Client Application Sessions

Network Connect

4 Wait for the VPN client to launch for the first time.

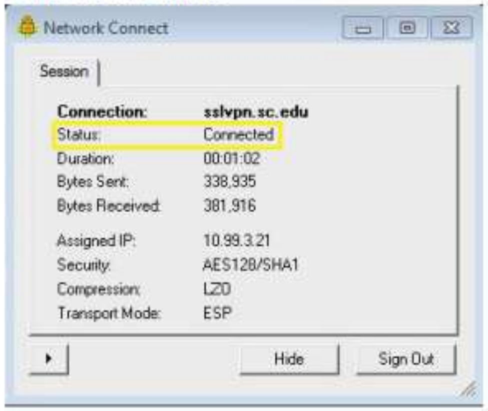


Please wait...

Launching Network Connect. This may take several minutes.

This is when the juniper vpn client (NC Connect) is installed if not done b4

5 A new window will pop up. Once the status shows **Connected** you have successfully logged into the VPN client.

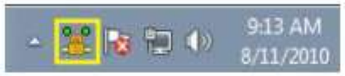


Network Connect

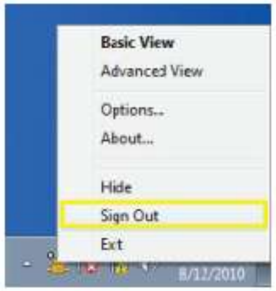
Session

Connection:	**sslvpn.sc.edu**
Status:	Connected
Duration:	00:01:02
Bytes Sent:	338,935
Bytes Received:	381,916
Assigned IP:	10.99.3.21
Security:	AES128/SHA1
Compression:	LZO
Transport Mode:	ESP

You will notice the folloing icon in your system tray.



6 To end your current VPN session right-click on the Juniper icon in your system tray and select **Sign Out.**



Open Lab ()

- Take a few minutes to try some of the commands you've learned. Perhaps try combining commands to give you very specific results.
- If you have not done so already, use your web browser to download intro2linux.zip archive from the tutorial web page to your home directory where you can begin working with it: then
  - cd "to_my_download_directory"
  - unzip intro2linux.zip
  - cd intro.linux
- execute the commands you learnt
- run the for loops
- Fun Exercise
  - use your "bash kungfu" to rename 50 files

    input1.old – input50.old

    INPUT1.new - INPUT50.new

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