

Bioinformatics Basics

08/03/2026

Preamble

- **Command Shell**
 - A command shell, also known as a command-line interpreter, is a text-based interface that allows users to interact with a computer's operating system by typing commands. It reads user input, evaluates it, and executes it as a shell command or passes it to the OS for execution. Essentially, it's a program that sits between the user and the operating system, interpreting commands and managing the system's resources.
- **Key aspects of command shells:**
 - **Text-based interface:** Unlike graphical user interfaces (GUIs), command shells require users to type commands.
 - **Command execution:** The shell interprets commands and executes them, either directly or by passing them to the operating system.
 - **Scripting:** Many shells can also execute commands from script files, allowing for automation and repetitive tasks.
 - **Programming features:** Some shells include programming features like variables, flow control, and functions, making them capable of more complex operations.
 - **Terminal:** A terminal is the application that provides the text-based interface for hosting a command shell.
- **Examples of command shells:**
 - **Windows Command Shell (cmd):** The original command-line interpreter on Windows, used for basic system management.
 - **Windows PowerShell:** A more powerful shell on Windows, with object-oriented capabilities and extensive cmdlets (commands).
 - **Bash:** A popular shell on Linux and macOS, known for its scripting capabilities and extensive command set.
 - **zsh:** Another popular shell on macOS, known for its features like autocompletion and plugins.
 - **AI Shell:** An interactive shell used to communicate with AI services.
 - **netsh:** A network shell on Windows for configuring and displaying network components.

Background

- In order to use the latest tools in bioinformatics you need access to a linux based operating system (or Mac OS X).
- The linux operating system is based on the UNIX operating system (by a guy named Linus Torvalds), but is freely available (UNIX was developed by a private company). There are a number of implementations of linux that go by different names: e.g. Ubuntu, Debian, Fedora, and OPENsuse.
- You typically need a) something that allows you to log on to a terminal and b) the ability to transfer files to and from the remote server and your machine.

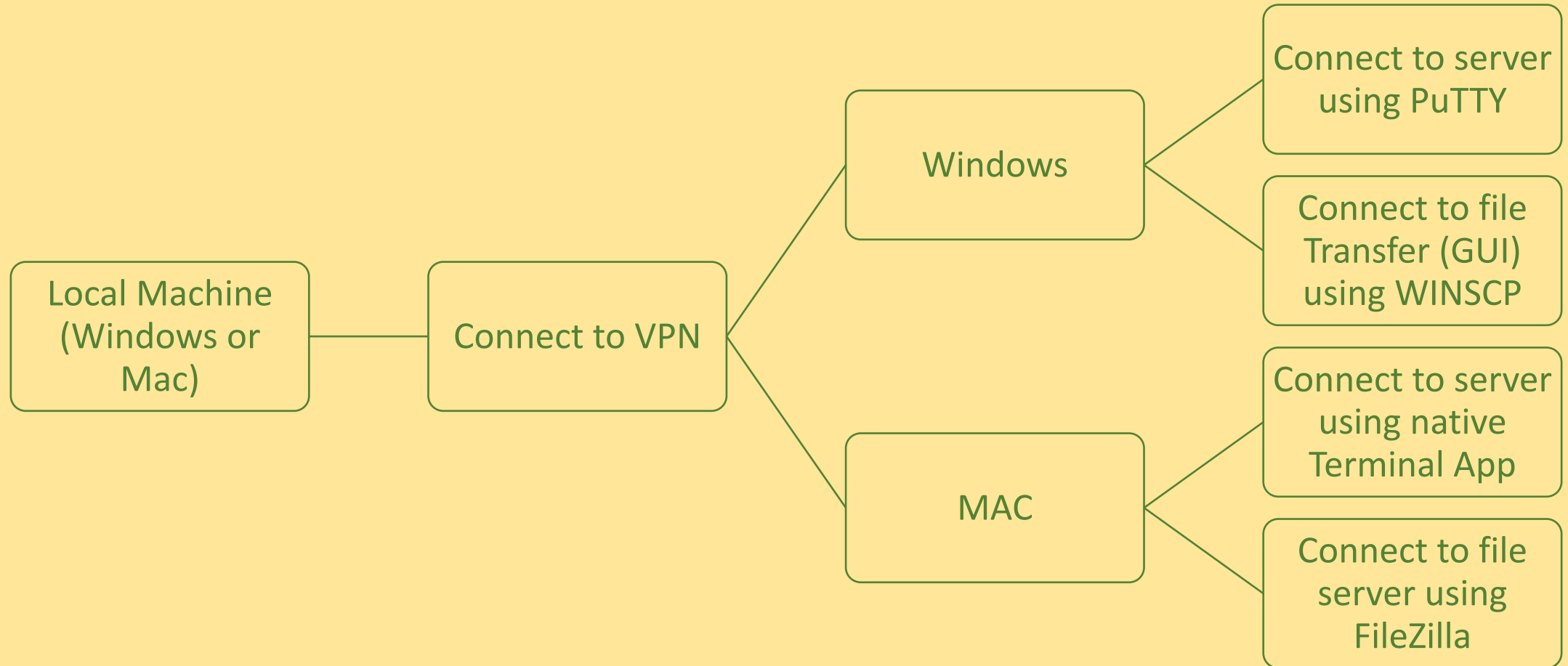
A) Connecting to a Terminal

- SSH (Use Secure Shell): SSH, also known as Secure Socket Shell, is a network protocol that provides administrators with a secure way to access a remote computer. SSH also refers to the suite of utilities that implement the protocol. Secure Shell provides strong authentication and secure encrypted data communications between two computers connecting over an insecure network such as the Internet. SSH is widely used by network administrators for managing systems and applications remotely, allowing them to log in to another computer over a network, execute commands and move files from one computer to another. To install an SSH client:
 - On Unix/Linux: OpenSSH is freely usable and re-usable by everyone under a BSD license. OpenSSH is available from <http://www.openssh.org/portable.html>.
 - On Windows: To get a terminal window you can use a program called PuTTY. So download the program PuTTY (which is just the file called PuTTY.exe) and create a subdirectory in your Program Files directory called PuTTY. Then save PuTTY.exe in the directory you just created.
 - On Mac OS you can access the terminal directly through the Terminal app.

B) Transferring Files between local machines and Linux / UNIX systems

- Connect to the Virtual Private Network (VPN)
- For transferring data from Mac / Windows computers to MSI Unix computers, any SFTP or SCP software can be used. Connect to the server using your username and password, and you will be able to transfer files to and from your home directory and group shared directory.
 - For Windows, we recommend WinSCP.
 - For Mac OS X, we recommend using FileZilla.

Overview



Tips and Tricks

- **Command Line Shortcuts**

- cd = change directory
- ls = list files within a folder
- mkdir = create a new folder
- git + clone + pathfile + filename = copying a folder from another source
- head = look at the first 10 lines of a file
- clear = remove a command
- -i = input file
- -o = output file
- mote.emperor = 3D plot package for ordination and clustering

***** To copy any line code from the tutorial to the terminal window on windows, select the code and hit CTRL + C, then in the control window right click and it will copy the code**

***** To quit any command that is running in the terminal, hit q**

*****Remember that unix command are case sensitive**

Resources

- General VPN
 - <https://it.umn.edu/services-technologies/virtual-private-network-vpn>
- For Mac VPN, check
 - <https://it.umn.edu/services-technologies/how-tos/hstahc-vpn-remote-desktop-setup>
- For File transfer check
 - <https://www.msi.umn.edu/support/faq/how-do-i-use-filezilla-transfer-data>