CME211 Lecture 0 - Remote Computing

Often various resources (data, programs, high performance computing) are located somewhere other than the computer we have in front of us. There are many tools and methods for accessing remote computing resources. In CME211, we will use `ssh` to access the shared computing resources managed by Stanford Research Computing. In particular, we will be using the `corn` servers on the Farmshare system.

2016-09-19 Update: Farmshare user directory

These notes have been updated after recording of the lecture screencast to reflect issues between `AFS` and `git`. We were running into timeout issues when attempting to clone a repository from GitHub on to our AFS-based home directory on Farmshare. The solution is to use the farmshare user directory located at `/farmshare/user_data/[sunet_id]` instead of AFS. The notes have been updated to reflect this change. The screencasts will still refer to using AFS space.

See the sections on "GitHub Repo Cloning" and "Directory paths" on the Farmshare User Guide for some more information.

Structure of `corn`

The `corn` servers are accessed through the address `corn.stanford.edu`. The "master node" is called `corn`. This will send users to one of the worker nodes, designated `cornXX` where `XX` is a number.

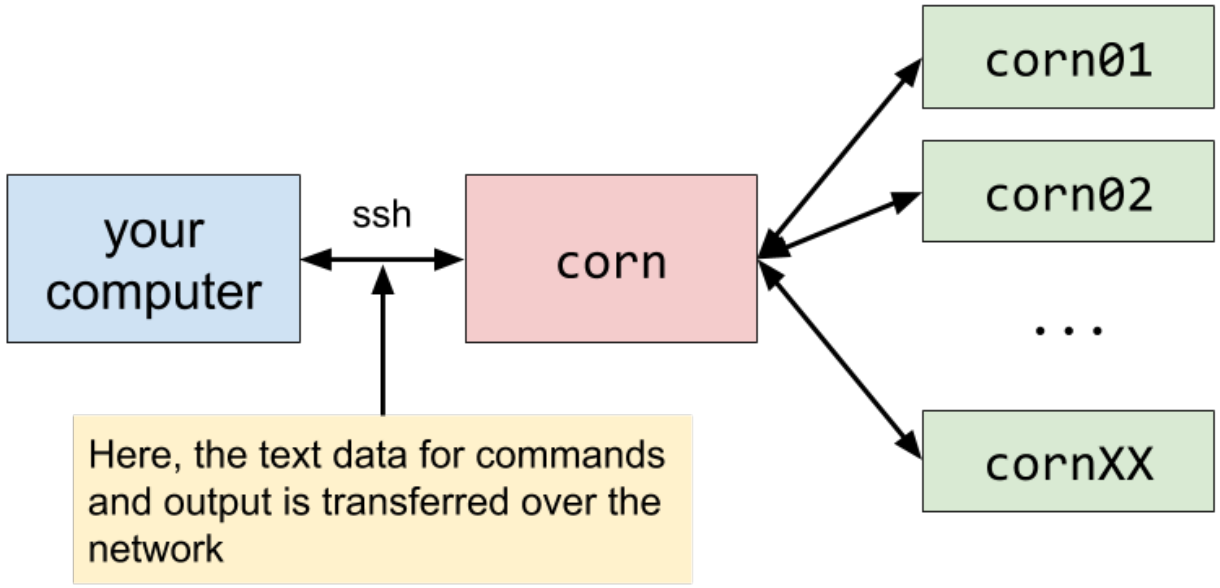

Figure 1: fig:corn

Log into `corn` using `ssh`

`ssh` stands for "secure shell". The program encrypts the communication between client and server. The command to log into `corn.stanford.edu` via ssh is:

```
$ ssh [stanford_username]@corn.stanford.edu
```

Here, [stanford_username] needs to be replaced by your username. SSH will then attempt to locate the server, authenticate the user, and provide access to a shell.

Here is the terminal output when I log into corn.stanford.edu.

```
$ ssh nwh@corn.stanford.edu
Warning: Permanently added the RSA host key for IP address '171.67.216.71' to the list of known hosts.
nwh@corn.stanford.edu's password:
Authenticated with partial success.
Duo two-factor login for nwh

Enter a passcode or select one of the following options:

1. Duo Push to XXX-XXX-XXXX
2. Phone call to XXX-XXX-XXXX
3. SMS passcodes to XXX-XXX-XXXX

Passcode or option (1-3): 1
Success. Logging you in...
Welcome to Ubuntu 14.04.5 LTS (GNU/Linux 3.13.0-85-generic x86_64)

# many lines omitted

For questions or concerns, please contact:
 research-computing-support@stanford.edu

[nwh@corn06 ~]
$ pwd
/afs/ir/users/n/w/nwh
# nwh is now logged into corn06!
```

For more information on SSH, see `$ man ssh`.

Transfer files to and from `corn` using `scp`

The `scp` (stands for "secure copy") tool can be used to copy files to and from a remote computer running an SSH server. The following command will copy from `source_file` to `dest_file`:

```
$ scp source_file dest_file
```

If one (or both) of the files is on a remote computer, then the user and server address must be specified. For example, I could copy the file `demo/kitty.txt` to my home directory on `corn` with the following command:

```
$ scp demo/kitty.txt nwh@corn.stanford.edu:~/
# authentication
kitty.txt                                     100%  187     0.2KB/s   00:00
```

Note the colon (`:`) between the server name and path in the above `scp` command.

Now looking on `corn`:

```
[nwh@corn06 ~]
$ ls
WWW  bin  config  kitty.txt
```

Farmshare user directory

The Farmshare remote computing resource offers another location for users to store files known as the "Farmshare user directory". This is located at `/farmshare/user_data/[sunet_id]`. For example, my `sunet_id` is `nwh`, therefore my Farmshare user directory is `/farmshare/user_data/nwh`.

Some important notes from the Farmshare User Guide:

- Your Farmshare user directory will likely **not exist** the first time you login. A script will run and notice your login and create the directory within about 30 minutes of your first Farmshare login.
- `/farmshare/user_data` is **NOT** backed up. Make sure your push your work to GitHub on a regular basis. You will learn how to do this in HW0.
- Space is limited on `/farmshare`. There currently is no quota system. Keep your Farmshare user directory under `5GB`.

You can `scp` files directly to your Farmshare user directory. For example (from the local `lecture-00` directory):

```
$ echo $HOSTNAME
nwh-mbpro.local    # this is my laptop
$ pwd
/Users/nwh/git/cme211-notes/lecture-00
$ scp demo/kitty.jpg nwh@corn.stanford.edu:/farmshare/user_data/nwh/
# authentication
kitty.jpg                                     100%  770KB 770.3KB/s   00:00
$ ssh nwh@corn.stanford.edu
# authentication
# now logged into corn.stanford.edu
$ echo $HOSTNAME
corn23.stanford.edu
$ cd /farmshare/user_data/nwh/
$ ls
kitty.jpg
```

Other tools

There are numerous software tools for working with files on remote computing systems. We link to a few here.

Web utilities

The Stanford WebAFS (https://afs.stanford.edu/) provides a web interface to files on Farmshare.

Google has a beta Chrome-based SSH client. This may not be around for long as Google will soon be deprecating Chrome Apps.

Programs for macOS

macOS comes with `ssh` and `scp`. The program Fetch provides a GUI for file transfer: https://uit.stanford.edu/software/fetch. The `rsync` command may be used to sync an entire directory:

```
$ rsync -avz -e ssh remoteuser@remotehost:/remote/dir /this/dir/
```

Search for "rsync over ssh" for more information on this.

Programs for Windows

Windows does not have a built-in unix-like terminal. PowerShell and `cmd.exe` are not suitable replacements. There are many programs that provide unix-like environments on Windows (listed below). The author of these notes has no experience with any of the following tools.

- https://msys2.github.io/
- https://www.cygwin.com/
- http://www.mingw.org/
- New! Ubuntu on Windows: https://insights.ubuntu.com/2016/04/14/howto-ubuntu-on-windows-2/

Here is a list of Windows GUI based tools to for accessing remote computers:

- SecureCRT: https://uit.stanford.edu/software/securecrt
- SecureFX: https://uit.stanford.edu/software/securefx
- PuTTY: http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html
- Bitvise SSH client: https://www.bitvise.com/ssh-client