Accessing the CU Denver Math Server

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with help from Joe Malingowski

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1 Introduction

Think of the math server as a big computer with good mathematical software. As a CU Denver graduate student in the mathematics department, you can play with this cool toy. That is, you can use your math server account to run large computations. Benefits include your computations running (likely) much faster than they would on your personal computer, having access to more memory than on your personal computer, and allowing you to use your personal computer for other things while your computations run [like watching puppy videos online].

The intent of this document is to introduce you to the basics of connecting and using the server. If your research extends beyond this introductory guide, we suggest you

- talk to the department's Senior IT Professional - Joe Malingowski

- look at the CCM documentation - `http://ccm.ucdenver.edu/`

- talk to your advisor or other graduate students

- search the internet

2 Accessing the Network

In order to access the math server, you must first be connected to the proper network. There are two ways by which to attain this: being on the UCDenver campus network, or establishing a secured connection to the network.

2.1 Campus Network

If you are on the Auraria Campus, all you need to do is connect to the "UCDenver" wireless network, or connect to an internet port via an ethernet cable. Log-in information for the UCDenver wireless network is your university email username and password.

2.2 Virtual Private Network (VPN)

If you are off campus, you must first establish a secure connection to the campus network. This is achieved through a VPN client, which is available for download through CU Denver's Office of Information Technology at `http://www.ucdenver.edu/about/departments/ITS/NetworkSecurity/Pages/VPN.aspx`. Be sure to register with your UCD credentials and follow the installation instructions.

3 Accessing your Account

If you are in the department, you can access your account directly from a computer in the lab. To access your account from your own computer, you must first connect to the network by one of the methods described above. Then, accessing your account depends on your preferences and your computer.

3.1 Remote Desktop

If you like the point-and-click interface with graphics, a remote desktop client (RDC) will probably your favorite option. First, you will need to access a RDC. If you operate a Windows systems, it should come preloaded with a RDC (search 'remote' in start menu). If you operate MacOS X, you will need to find and install a RDC; "Microsoft Remote Desktop" is such a client that is also free. Set up the RDC to connect to the math server, `math.ucdenver.edu` (see Figure 1). If you do not set up your username and password
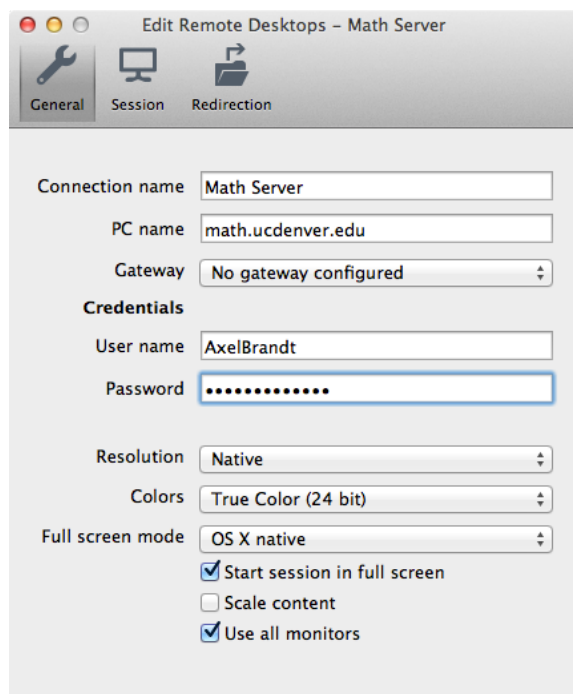
Figure 1: Microsoft Remote Desktop configured for Axel's account on the math server.

within the RDC, you will be prompted for it when you connect. Once connected, your

screen should look like your desktop in the computer lab, and you will have access to files saved on your account.

3.2 Secure Shell (SSH)

If you are comfortable, or want to become comfortable, with using the command prompt/terminal, then the SSH option may be your favorite option.

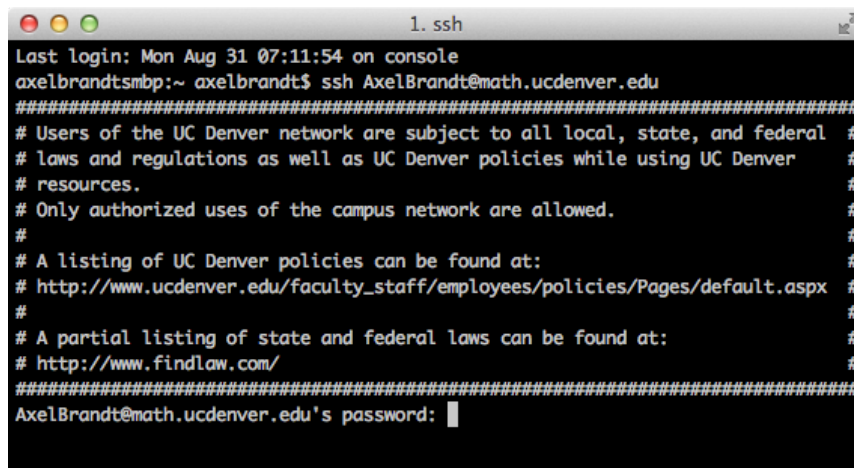**Windows:** You will need to install a secure shell client. Good options include

- SSH Secure Shell - see `http://math.ucdenver.edu/~dayorgov/gradseminar.html`

- PuTTY - `http://www.chiark.greenend.org.uk/~sgtatham/putty/`

- WinSCP - `https://winscp.net/eng/download.php`

Some graduate students are partial to SSH Secure Shell. Joe, our IT specialist/guru/hero, is partial to PuTTY. Follow the install instructions using the `math.ucdenver.edu` address and your math server username and password to configure your SSH client.

Mac OS X: Rather than the terminal, some graduate students are partial to using iTerm2, `https://www.iterm2.com/downloads.html`. Either way, you can SSH into your account by typing the following command:

<div align="center">

`ssh <user_name>@math.ucdenver.edu`

</div>

As show in Figure 2, you will be prompted for your math account password. If you want

Figure 2: SSH into Axel's account via the terminal.

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to run software from the server with graphics, you need to include graphics as an option in your ssh command as follows:

<div align="center">

`ssh -X <user_name>@math.ucdenver.edu`

</div>

MacOS X no longer automatically includes the libraries necessary for this action. However, the libraries to make this happen are available for download at `http://xquartz.macosforge.org/`.

3.3 Terminal Commands

Much like menus of files within subfolders, the terminal allows you to navigate your folders (referred to as directories). Below is a list of useful terminal commands for the terminal. To see full implementation for some commands, type the command followed by `-h` (and enter/return).

Command	Effect
passwd	changes the default account password
htop	tells you what processes are currently running
pwd	tells you what directory you are currently in
ls	lists the directory content
cd	changes the directory based on address following command
./ ../	reference to current and parent directory, respectively
scp, mv, rm	copy, move, delete a file; the `-r` option recursively applies to directory
screen	allows for jobs on the math server to continue if your computer loses connection
vim, nano	opens a file in the terminal for editing

VIM is highly customizable, but has an incredibly sharp learning curve. For quick VIM help, see the reference card posted on the seminar files page `http://math.ucdenver.edu/~AxelBrandt/seminar.php`.

4 Resources Available

As previously mentioned, the math server has a number of valuable resources. Among these resources include mathematical software.

Mathematica is accessible through the accessories menu.

MATLAB is accessible through the terminal. To start MATLAB, type `matlab` in the terminal.

R is accessible through the terminal. Type `R` to start R, and `q()` to quit R.

Sage is accessible through the terminal.

4.1 Servers

There are four servers accessible with your math account: `math`, `xvia`, `xvib`, and `game1`.

`math` hosts the websites for the department, department sponsored initiatives, and personal websites. To ensure these operate smoothly, computations are typically done on `xvia`, `xvib`, and `game1`. Note: Sage is only installed on `game1`. To move between each server, type `ssh -X` and then the server name (i.e. `xvia`, `xvib`, or `game1`) in the terminal. Using `htop` to find a server with a low computational load will help your job run faster.

4.2 Research Clusters

The department also hosts two research clusters `colibri` and `gross`, for which you need a special account (see Joe to get one). You can access these through the terminal by SSH. There are a bunch of specialized commands on these clusters; see `http://ccm.ucdenver.edu/` for help.