

A New Remote Visualization Platform at CU

Timothy Dunn

timothy.dunn@colorado.edu

Shelley Knuth

shelley.knuth@colorado.edu

Link to survey on this topic: <http://goo.gl/forms/8VidcwOhRT>

Slides: https://github.com/ResearchComputing/Final_Tutorials/

Outline

- Background
 - Earth Lab
 - Analytics Hub
- Test Case – creating a plot
- NICE Description
- What NICE is and what it isn't
- NICE Demo
- Features

Background – Grand Challenge

- This new visualization platform was created as part of the Earth Lab project
- Grand Challenge
 - CU Boulder initiative
 - Use CU Boulder's strengths in earth, space, and social science to address global change
 - Inaugural initiative funded two projects, one of them being Earth Lab

Background – Earth Lab

- Mission: To harness the wave of Earth observations from space and integrate them to answer outstanding questions about the pace and pattern of environmental change, from our backyards to our world.
- Want to capitalize on deluge of data from space
- Use this data to better understand and predict Earth System change
- Train a new generation of data scientists that can address Earth Science questions

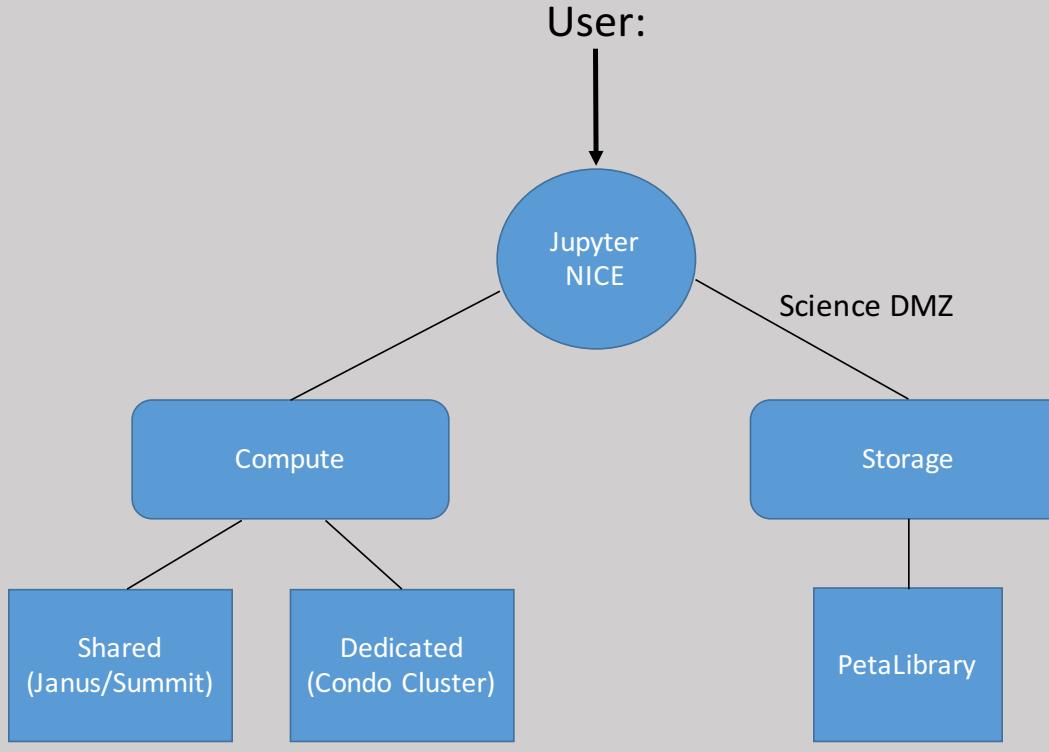
Background – Earth Lab

- One key component of Earth Lab is to lower the barrier of engagement of Earth science data collected from many varying sources
- Lowering these barriers of engagement will be accomplished through
 - Technical hardware
 - Consultations and personnel assistance
 - Educational initiatives
- These components make up the Analytics Hub

Background – Analytics Hub

- Utilizes existing infrastructure at CU combined with new tools and expertise to develop a virtual collaboration space for researchers
- Designed to allow a researcher who needs to solve a computational problem ease of doing so through user-friendly tools and software
 - Don't need to understand background technical details extraneous to work

CU Boulder Analytics Hub



- Two components to the technical portion of the Analytics Hub
 - Data Analytics
 - Data Visualization

Analytics Hub - Visualization

- Allows researchers to interact quickly and efficiently with applications on a remote system
 - For example, running ParaView on a supercomputer
- Do not actually need to understand how to operate a supercomputer
- Can easily share your screen with collaborators
- Also, you live next to your data instead of worrying about transfer

Practice

- Log into our tutorial nodes

`tutorial-login.rc.colorado.edu`

- Grab the data `8947.txt` in `/lustre/janus_scratch/knuths` and move it into your directory
- Using the meetup reservation, use Matlab to run the script `matlab_test_plot.m`
- Can we do better?

Remote Visualization

Using the NICE EnginFrame
Remote Visualization Platform

Going Native

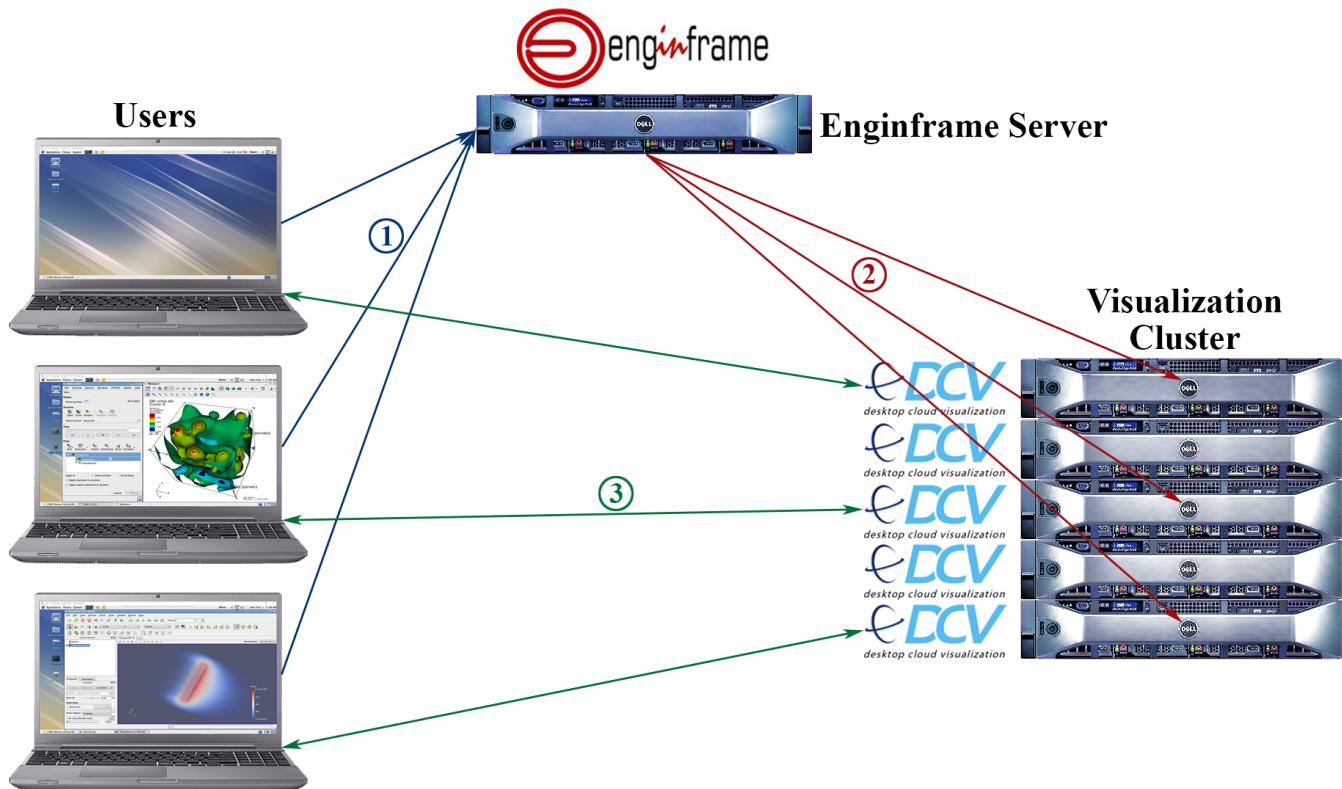
- Using native X-tunneling is hard and very slow.
- Using native VNC is less-hard, slightly faster but not always available.
- Using ‘native’ methods means you are transferring all of your data and updates back and forth so if you are playing with large datasets it could take a very long time for updates.
- If working only on a local machine you may not have decent or even required graphic capabilities.
- If working on a local machine you probably do not have a copy of your data and if you do it may be too large to run.
- Almost impossible to collaborate your work with others.

Remote HPC Visualization

- Using remote HPC visualization eliminates the X-tunneling connectivity issues!
- Only keystroke and mouse commands travel to the remote desktop and only updated screenshots travels back to the user so vastly less bandwidth issues!
- Remote visualization clusters utilize the latest and greatest graphic hardware!
- You work right beside your datasets!
- You can easily share your work, live, with other users.

EnginFrame Remote Desktop Architecture

1. User requests a remote desktop job via EnginFrame.
2. EnginFrame creates a new job and starts a DCV-VNC session and launches a Remote Desktop.
3. The user connects to the DCV Remote Desktop and does their desired work. Only keystroke and mouse commands travel to the Remote Desktop and only updated screen shots from the Remote Desktop travels to the user.



Requirements to Use EnginFrame

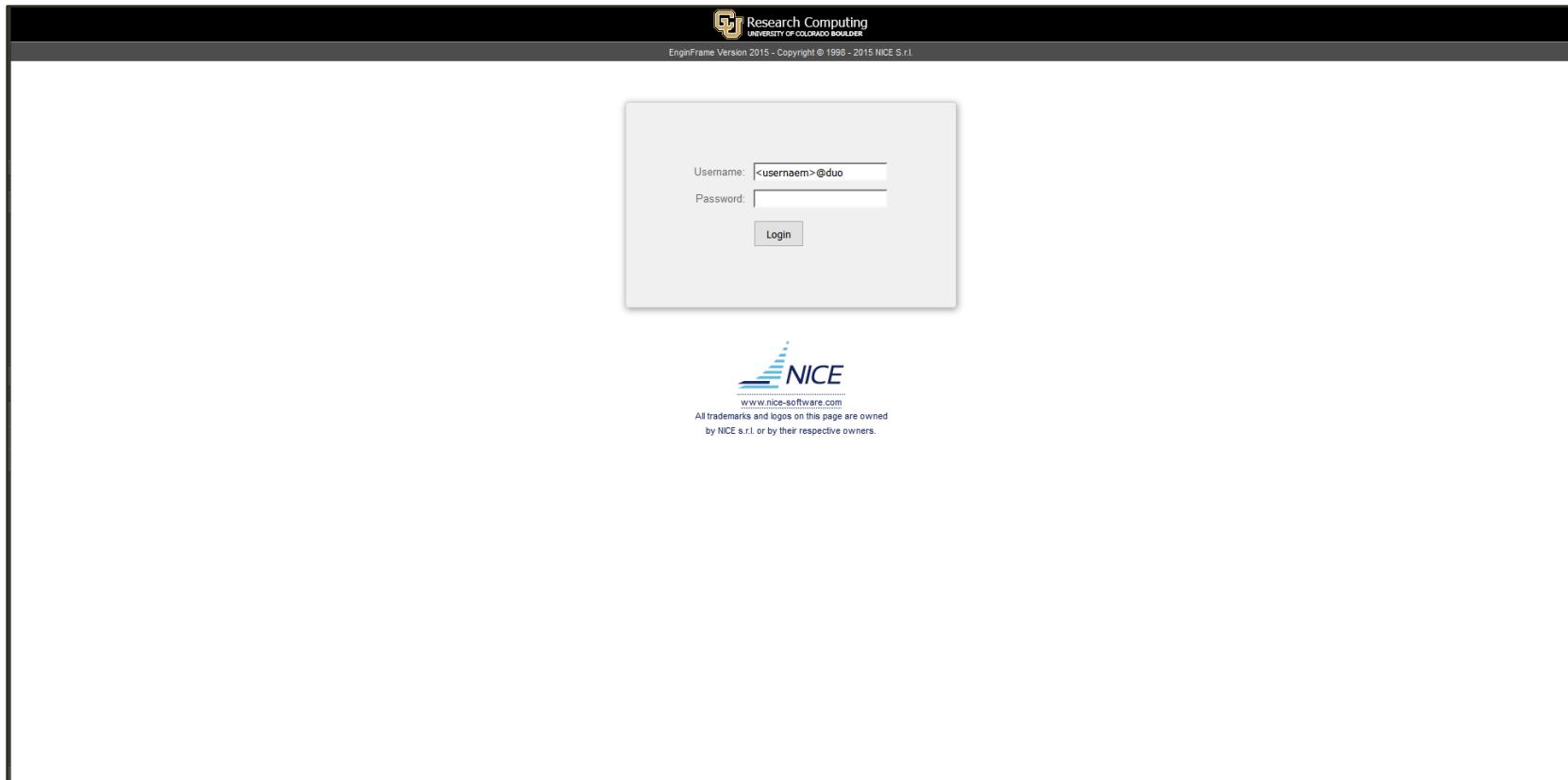
In order to access the visualization cluster, users must meet the following requirements:

- You must have an account with CU Research Computing.
- You must have a ‘Duo’ dual authentication account through CU Research Computing.
- You must have access to the internet and an internet browser.
- You must install the NICE DCV Endstation for your operating system. This can be obtained from;

<http://www.nice-software.com/download/nice-dcv-2016>

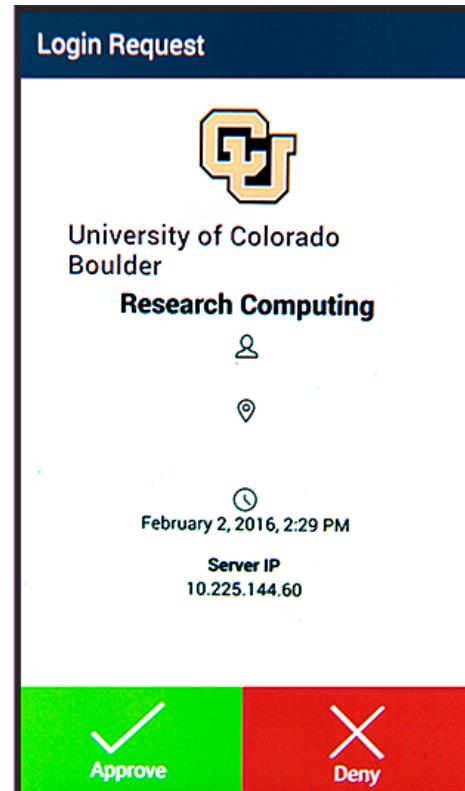
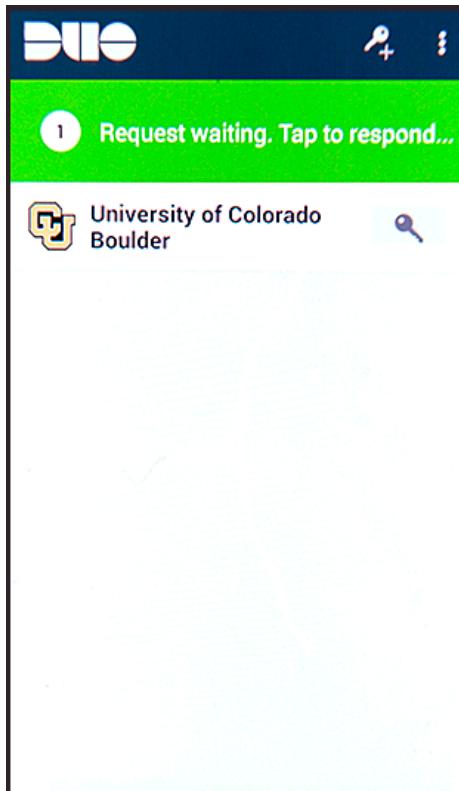
Logging into EnginFrame

- From a browser navigate to : <https://viz1.rc.colorado.edu/enginframe>.
- For ‘Username’ enter your username@duo.
- For Password enter your Identikey password.
- Click ‘Login’ to begin Duo authentication.



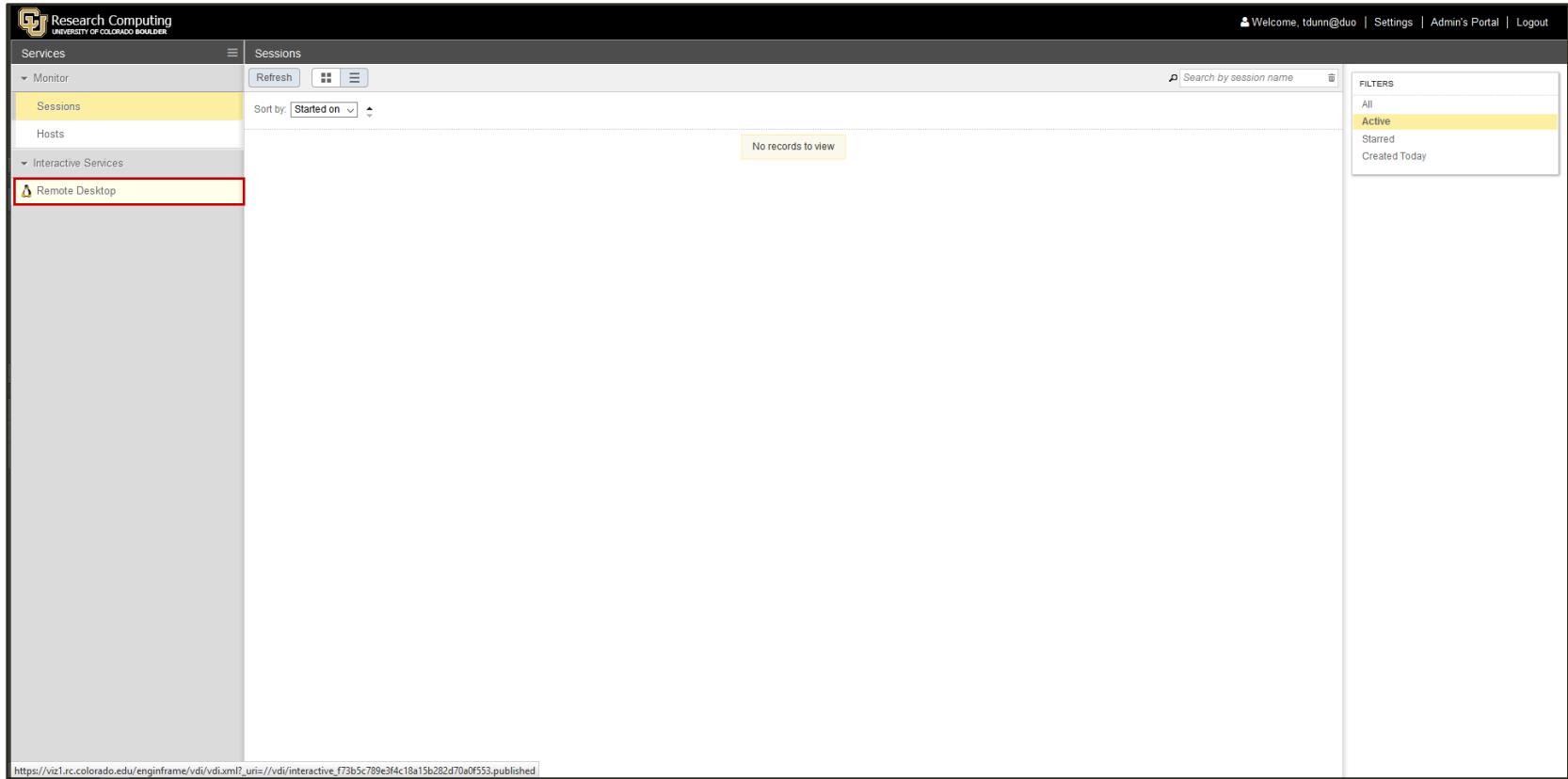
Duo Authentication

- After clicking on ‘Login’ your phone will alert you to an incoming Duo authentication.
- Open your Duo app and click on ‘Request waiting. Tap to Respond...’
- Next click on ‘Approve’.
- You will receive a message informing you authentication was approved and the EnginFrame VDI page will appear (see next slide).
- **Note:** App graphics will vary by phone type.



Starting a Remote Desktop Session

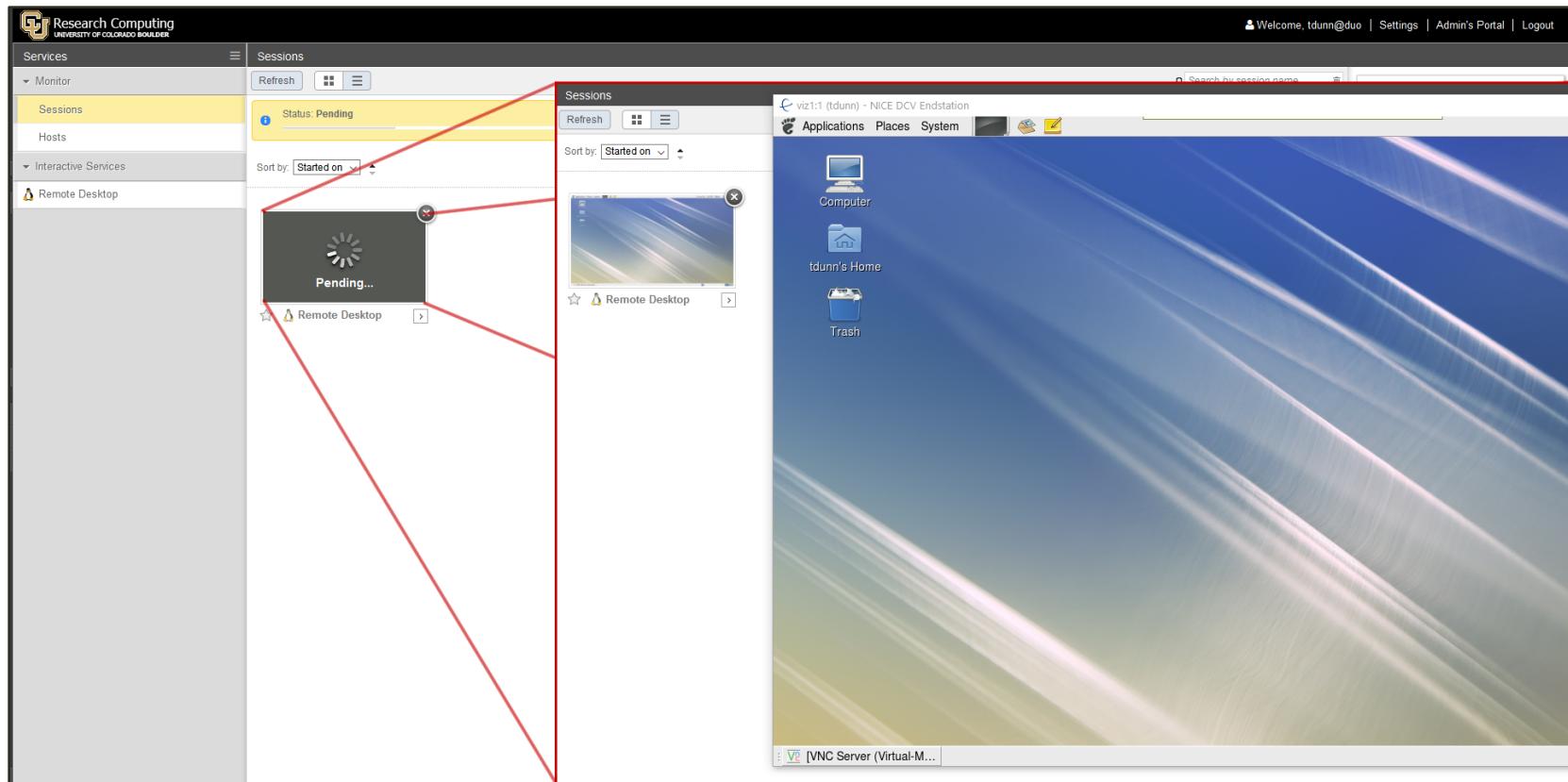
- To create a Remote Desktop click on the ‘Remote Desktop’ link under ‘Interactive Services’.



The screenshot shows the Research Computing web interface. The top navigation bar includes links for Welcome, Settings, Admin's Portal, and Logout. On the left, a sidebar titled 'Services' lists 'Monitor', 'Sessions' (which is selected and highlighted in yellow), 'Hosts', and 'Interactive Services'. Under 'Interactive Services', there is a link labeled 'Remote Desktop' which is also highlighted with a red box. The main content area is titled 'Sessions' and displays a table with a single row: 'No records to view'. At the bottom of the page, there is a URL: https://viz1.rc.colorado.edu/enginframe/vdi.xml?_urn=/vdi/interactive_f73b5c789e3f4c18a15b282d70a0f353.published.

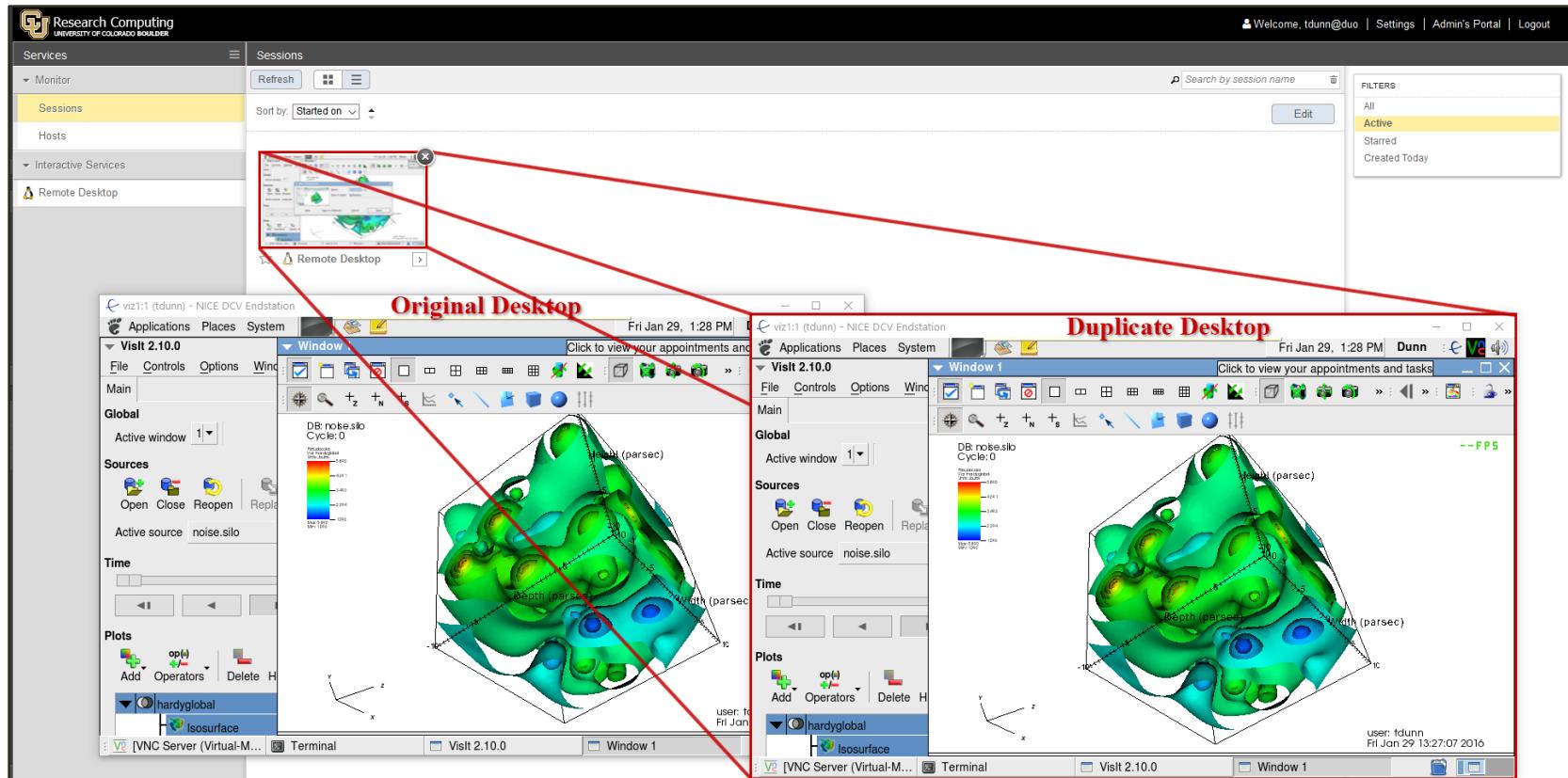
Connecting to a Remote Desktop Session

- You will be in a ‘Pending’ status state as you wait for the job scheduler, SLURM, to start a new job on the visualization cluster.
- Once a job has started the remote desktop will start and launch your VNC Linux Remote Desktop.
- A thumbnail of the remote desktop will be displayed in the Sessions browser



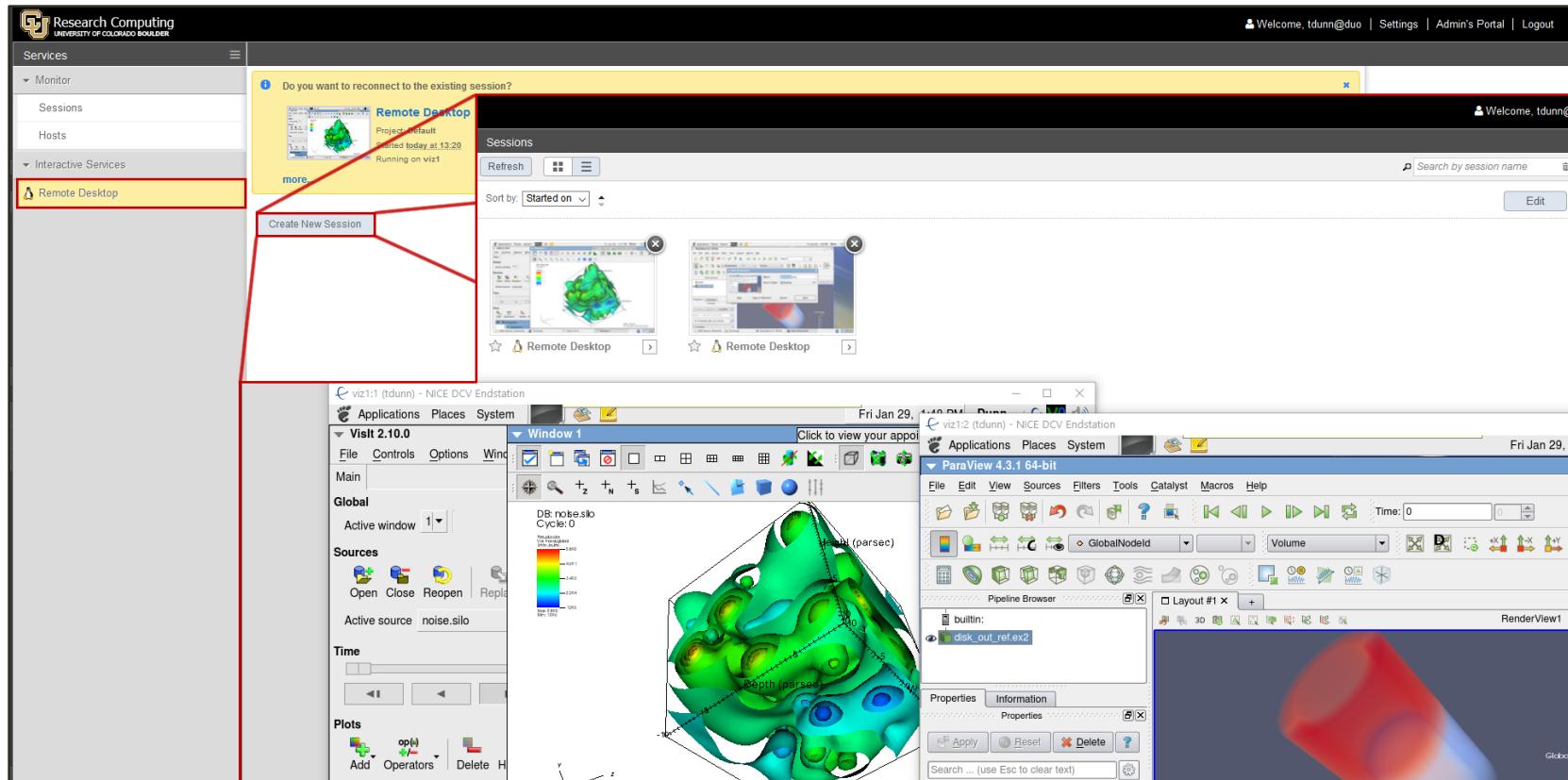
Creating Multiple Concurrent Sessions

- By clicking on your ‘Remote Desktop’ in the Sessions browser you can duplicate your ‘Remote Desktop’ session.
- Changes you make in one Remote Desktop is reflected in the duplicate session(s).



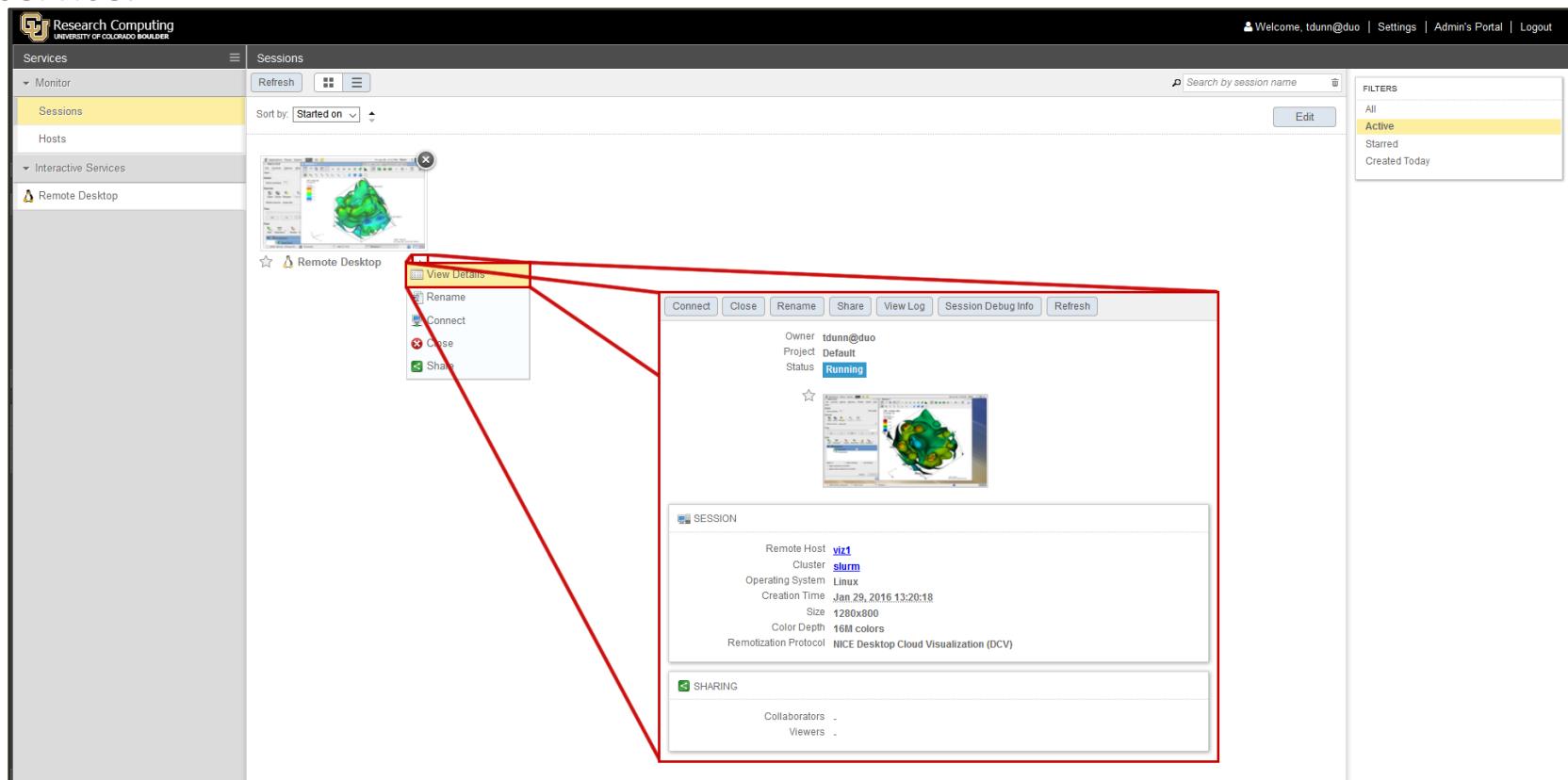
Creating Multiple Separate Sessions

- By clicking on your ‘Remote Desktop’ under ‘Interactive Services’ you can create a new, separate ‘Remote Desktop’ session.
- Changes you make in one Remote Desktop are NOT reflected in the new session(s).



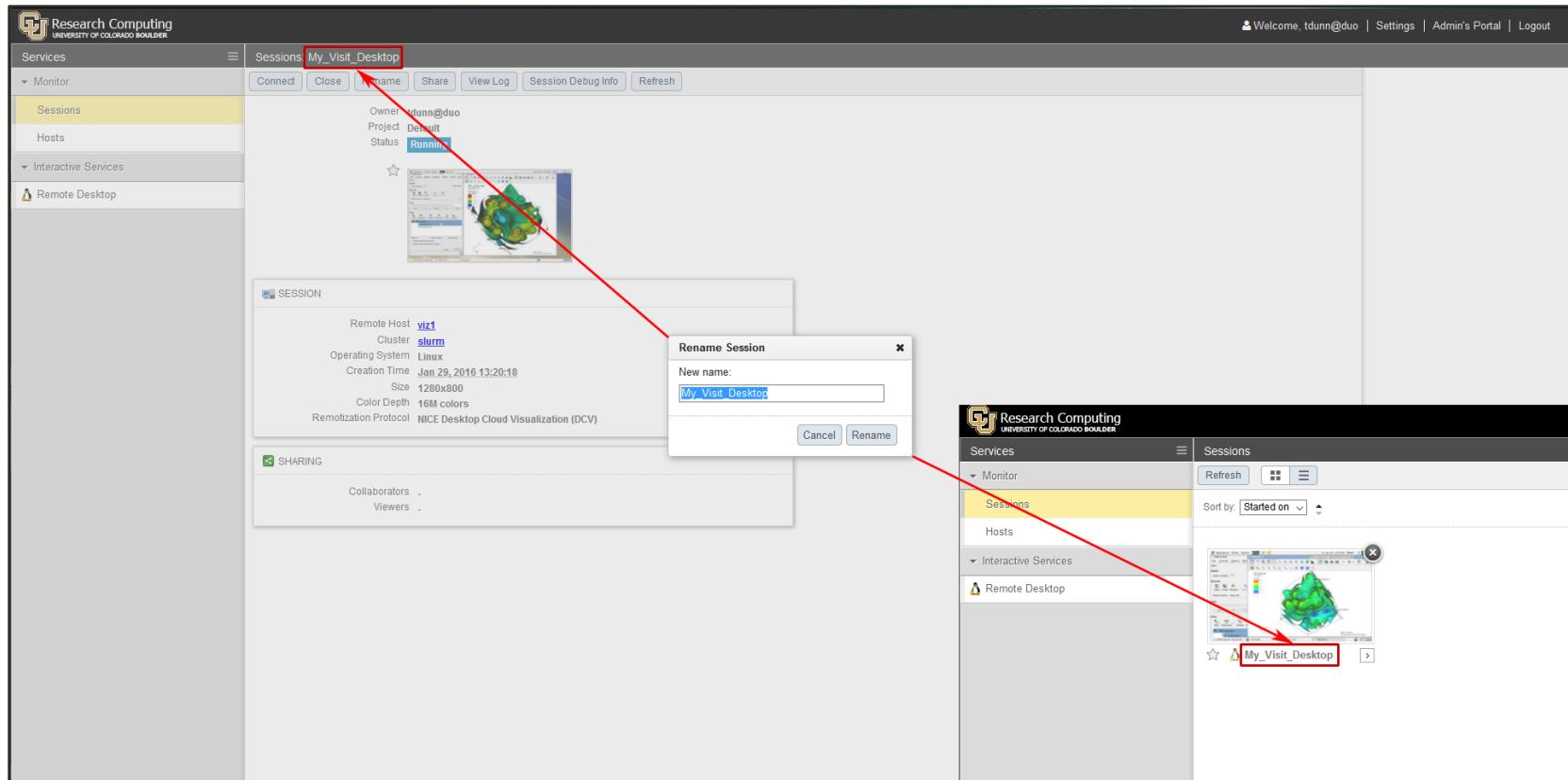
Session Details

- Clicking on the arrow next to your ‘Remote Desktop’ will open a hotkey menu.
- Selecting ‘View Details’ will send you to the ‘View Details’ page.
- The ‘View Detail’ hotkey menu and browser page allows you to ‘Connect’, ‘Close’, ‘Rename’, ‘Share’, ‘View’ logs, and ‘Refresh’ your remote desktop session(s).
- You can return to the Sessions browser by clicking on ‘Sessions’ under the ‘Monitor’ service.



Renaming Sessions

- Renaming allows you to change the name of your session so if you have multiple sessions and/or sharing your work with others they can be easily identified.



View Logs

- The ‘View Log’ and ‘Sessions Debug Info’ selections allow you to look at some of the various logs that EnginFrame generates.
- If you run into problems with your sessions and you need to submit a ticket to rc-help@colorado.edu, you may be asked to provide some of this information to help resolve your issues.

VNC Server Log File: "/opt/nice/enginframe/sessions/tdunn@duo/tmp/8602345192765289328/session.ef/vncserver.log"

VNC(R) Server Visualization Edition
Built on Dec 21 2015 11:41:07
Copyright (C) 2002-2015 RealVNC
VNC is a registered trademark of R
countries.
Protected by UK patent 2481870; l
See <http://www.realvnc.com> for info.
For third party acknowledgements
<http://www.realvnc.com/products/ei>

Running applications in /home/tdunn
VNC Server signature: 744b-fd-24-
Log file is /home/tdunn/.vnc/viz1:1.
New desktop is viz1:1 (10.225.144.
=====

Xvnc Log File: "/home/tdunn/.vnc/vi
=====

Underlying X server release 609000
VNC(R) Server (Virtual-Mode) Visu
Built on Dec 21 2015 11:42:59

Session Debug Info

| | | | | | | | | | | |
|--------------------------|-----------|--------------|----------------|---------|---------------|-------------------|--------------|-------------|---------|-------------------|
| generated.slurm.dcv.bash | shared-fs | session.info | screenshot.png | env.log | vncserver.log | gpu.balancer.conf | gpu.balancer | session.log | job.log | slurm-1201859.out |
|--------------------------|-----------|--------------|----------------|---------|---------------|-------------------|--------------|-------------|---------|-------------------|

```
[2016/01/29 13:21:12] INFO Logging job output to "/opt/nice/enginframe/sessions/tdunn@duo/tmp/8602345192765289328.session.ef/job.log"
[2016/01/29 13:21:12] INFO Current umask: 0027
[2016/01/29 13:21:12] INFO Original umask: 0022
[2016/01/29 13:21:13] INFO Directory PID: 142906, process group: 142906
[2016/01/29 13:21:13] INFO Environment saved to "/opt/nice/enginframe/sessions/tdunn@duo/tmp/8602345192765289328.session.ef/env.log"
[2016/01/29 13:21:13] INFO Screenshot support enabled.
[2016/01/29 13:21:13] INFO Detected VNC flavor: real.
[2016/01/29 13:21:13] INFO Detected RealVNC Visualization Edition 4.6.3
[2016/01/29 13:21:13] INFO Extracted gpu balancer
[2016/01/29 13:21:13] INFO Extracted gpu balancer configuration
[2016/01/29 13:21:13] INFO Launching VNC server...
[2016/01/29 13:21:13] INFO Using VNC authentication
[2016/01/29 13:21:13] INFO Executing: vncserver -depth 24 -alwaysshared -RandR 1280x800,1024x768,5120x2160 -UserPasswdVerifier VncAuth -SecurityTypes RA2,Vn
[2016/01/29 13:21:13] INFO Restoring umask from 0027 to 0022
[2016/01/29 13:21:13] INFO VNC server launched.
[2016/01/29 13:21:18] INFO Detected VNC Server running on display "1". Exporting DISPLAY variable.
[2016/01/29 13:21:18] INFO Detected Xvnc process "143076" with log "/home/tdunn/.vnc/viz1:1.log".
[2016/01/29 13:21:18] INFO Turning on DCV...
[2016/01/29 13:21:19] INFO DCV turned on.
[2016/01/29 13:21:19] INFO Balancer set RVN_LOCAL_DISPLAY to
[2016/01/29 13:21:19] INFO Detected screen size 1280x800, depth 24
```

Closing a Session

- You can close a session by clicking on ‘Close’ or clicking the ‘X’ button at the top right of a the sessions thumbnail image.
- Alternatively, to close one or more sessions at once from the Sessions browser, click on the ‘List’ view icon, choose which session(s) you desire to close and click on ‘Close’.

The screenshot shows the Research Computing Sessions browser interface. The left sidebar has categories: Services, Monitor (selected), Hosts, Interactive Services, and Remote Desktop. The 'Sessions' tab under 'Monitor' is selected and highlighted with a yellow background. On the right, there's a search bar ('Search by session name') and a 'FILTERS' sidebar with options: All, Active (selected), Started, and Created Today. The main table lists three sessions:

| Name | Status | Sharing | Project | Started on |
|------------------|---------|------------|---------|--------------------|
| My_Visit/Desktop | Running | Not shared | Default | Yesterday 14:38:42 |
| Remote Desktop 2 | Running | Not shared | Default | Yesterday 14:39:19 |
| Remote Desktop 3 | Running | Not shared | Default | Yesterday 16:02:23 |

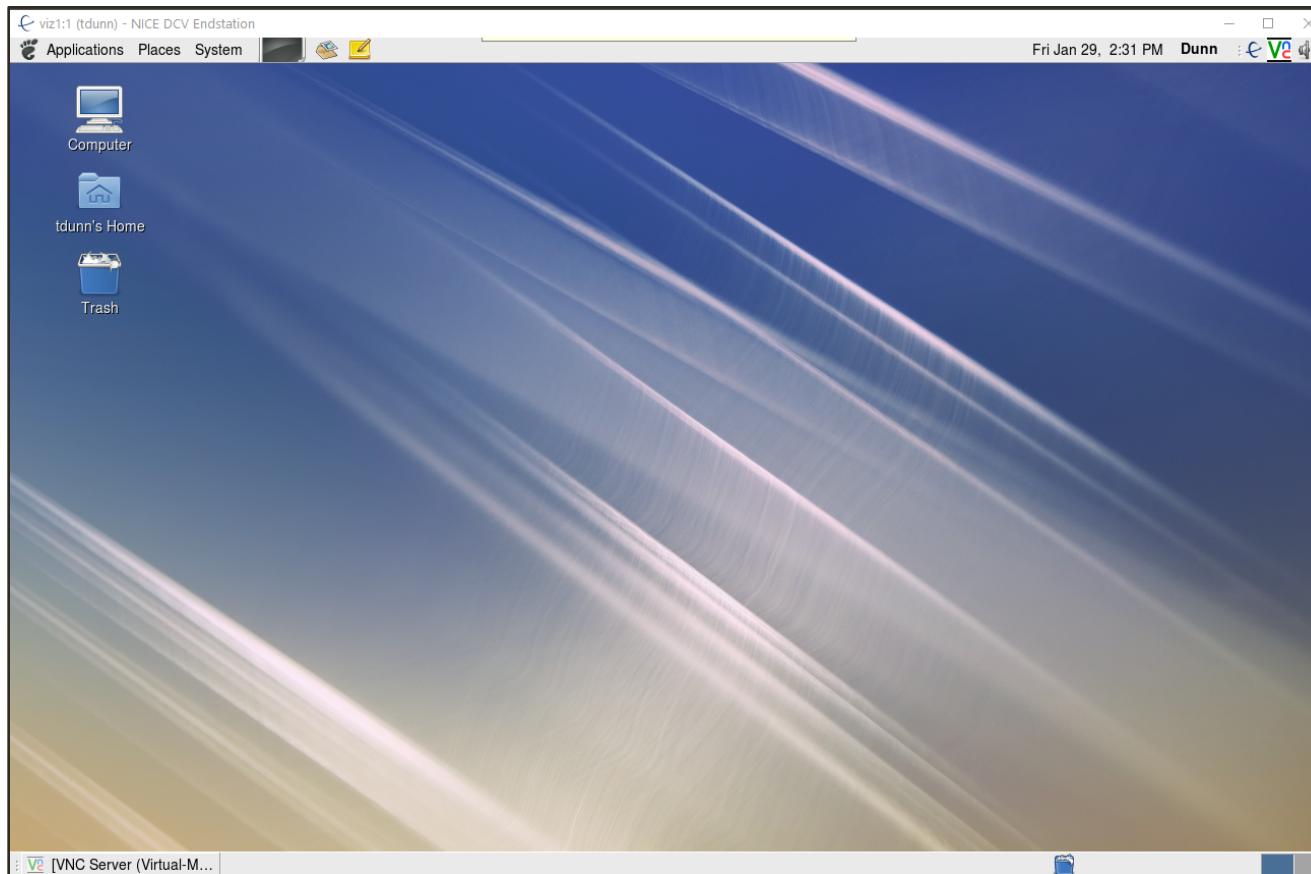
Pagination controls at the bottom show 'Page 1 of 1' and a dropdown for '50'. A note says 'View 1 - 3 of 3'.

Session Lifetime

- Any remote desktop session you create will be available for a maximum of 24 hours.
- During that 24 hour lifetime your session resides fully on the visualization cluster. Thus:
 - If you close your browser tab or even the browser itself, you can open a new browser/browser tab, log back into EnginFrame and reconnect to your session(s).
 - If you turn off your machine off or loose power to it you can restart it, log back into EnginFrame, and reconnect to your session(s).
 - After 24 hours you will loose anything not saved either by you or by an application specific backup file system.
 - If the visualization cluster loses power or if SLURM issues arise you may lose your session and any work not saved will be lost.

The Remote Desktop

- When your Remote Desktop starts you will have a new DCV desktop running Redhat Linux with a slim Gnome desktop.
- You will automatically be set to your default CURC home directory running what ever environment you have set up.

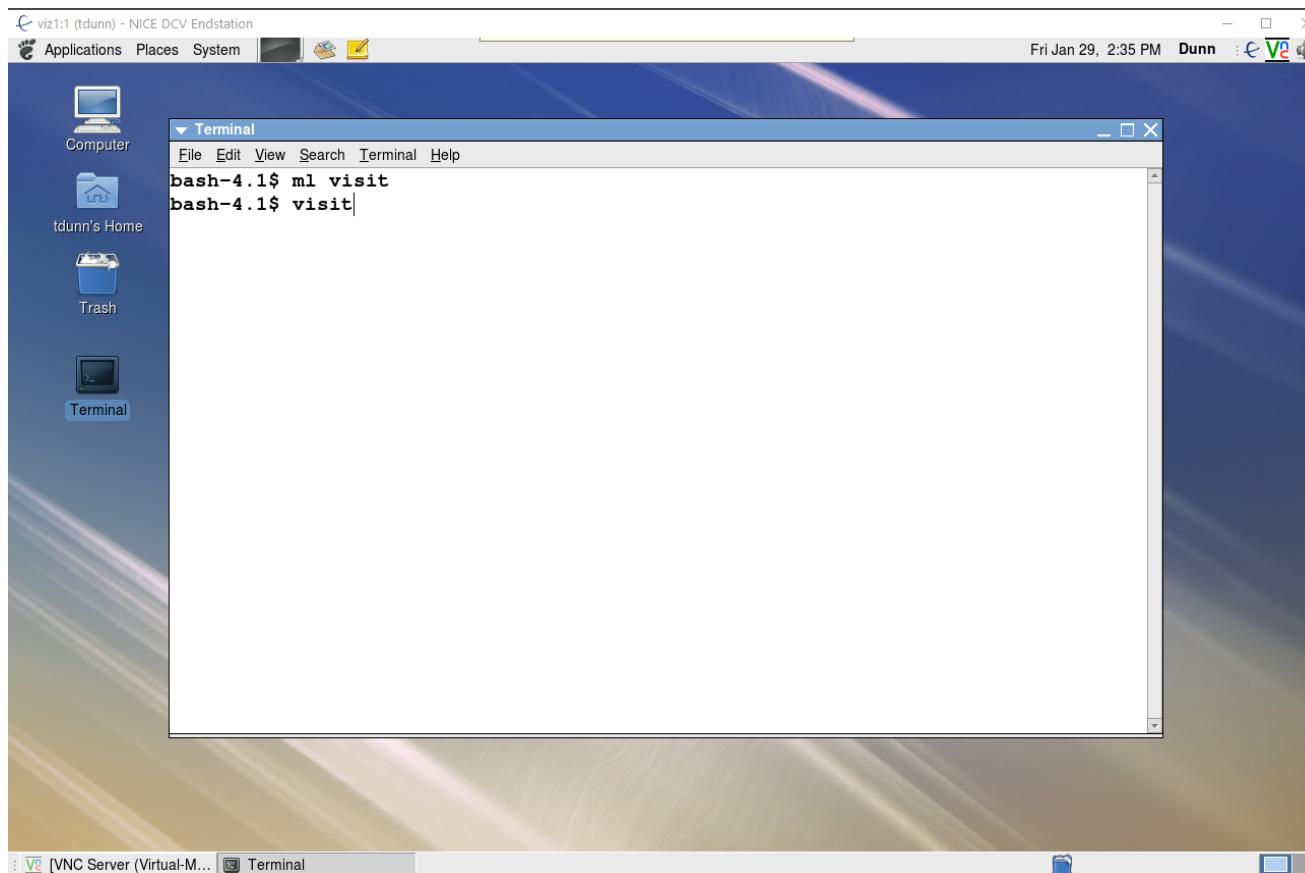


Running a Visualization Application

- To run a visualization application on the visualization cluster you may use either the ones installed on Janus (or Summit in a few months) by loading the appropriate module and then launching it.
- It is important to note that only the new LMOD module system will be accessible from the visualization cluster. If you already have an account on Janus then you just need to open a terminal window, making sure you are in your home directory, and typing;
`touch ~/.lmodrc.lua`
Next restart your terminal session and you will now be setup to access LMOD modules.
- If you have your own visualization application installed on Janus (or Summit) you can just start it as defined by how you setup your installation of the application.

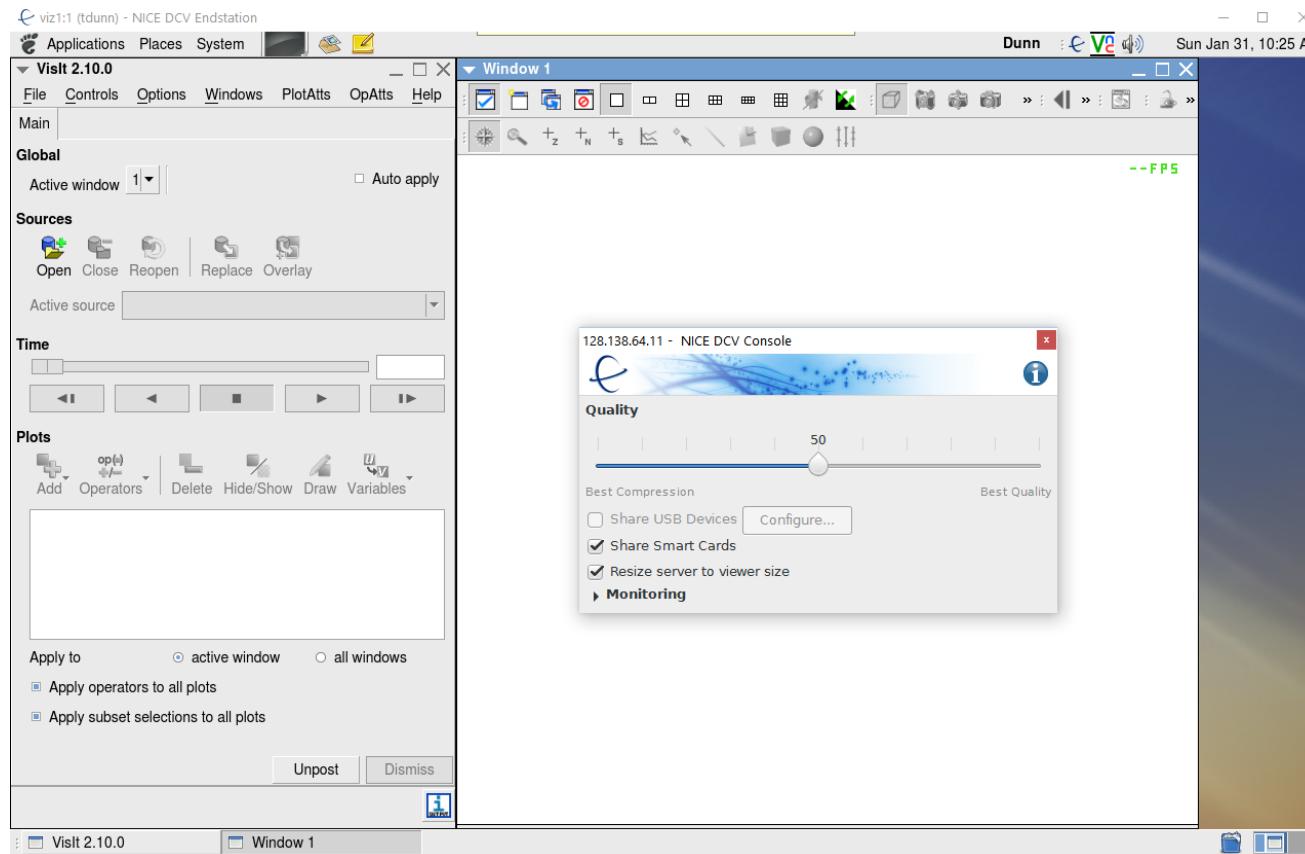
Running a Visualization Application

- To start a visualization application (e.g. Visit), open a terminal window and type the following commands.
- `ml <name of module>` where `ml` is LMOD's shorthand for module load.
- `<name of application to run>`



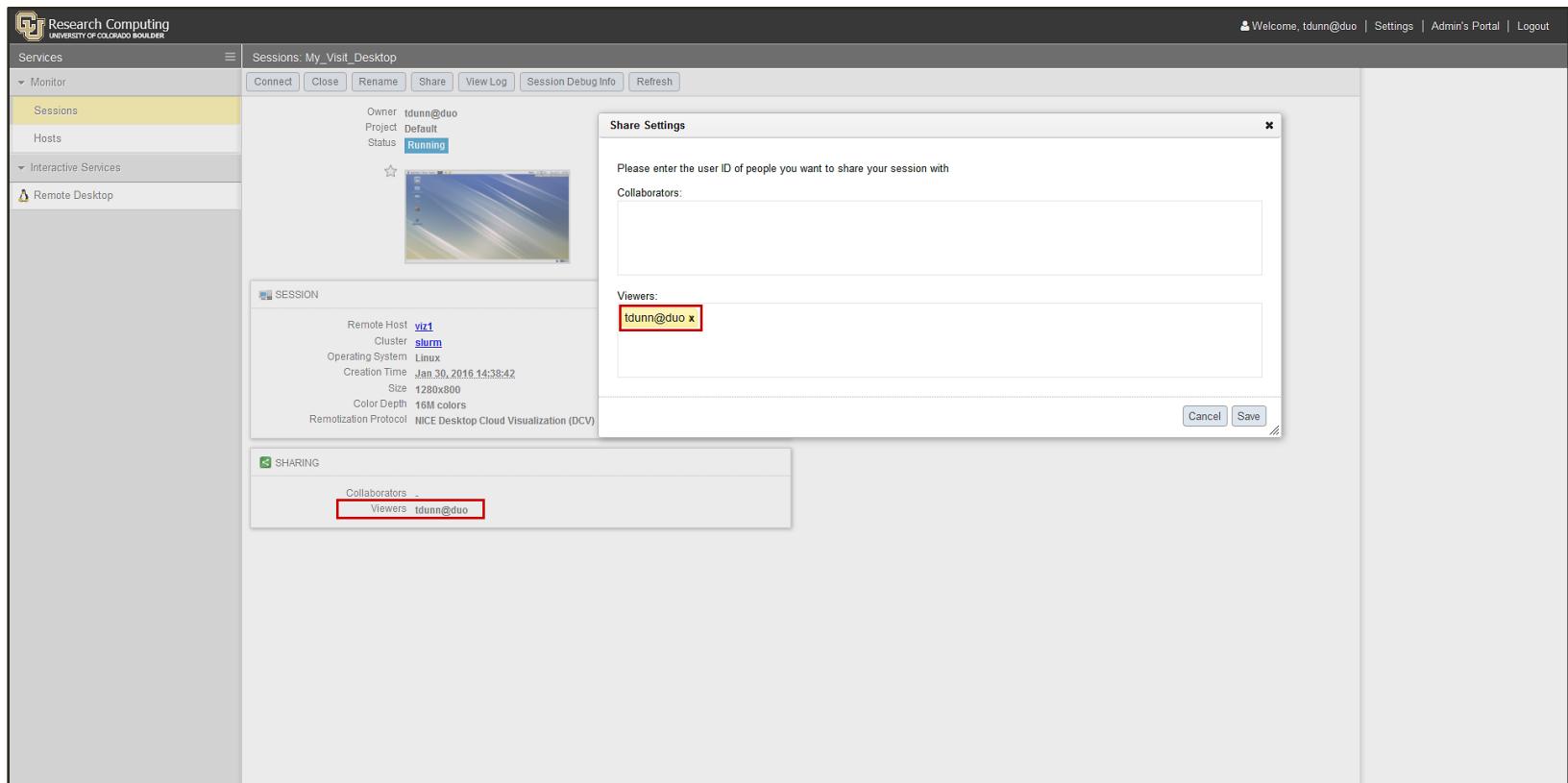
The NICE DCV Console

- You can adjust the Quality ↔ Frame Rate response by opening the NICE DCV Console by pressing;
 - For Windows: **ctrl+shift+F9**
 - For MacOS: **cmd+fn+9**
- Moving the ‘Quality’ slider to the left results in faster performance but lower quality.
- Moving the ‘Quality’ slider to the right results in lower performance but higher quality.



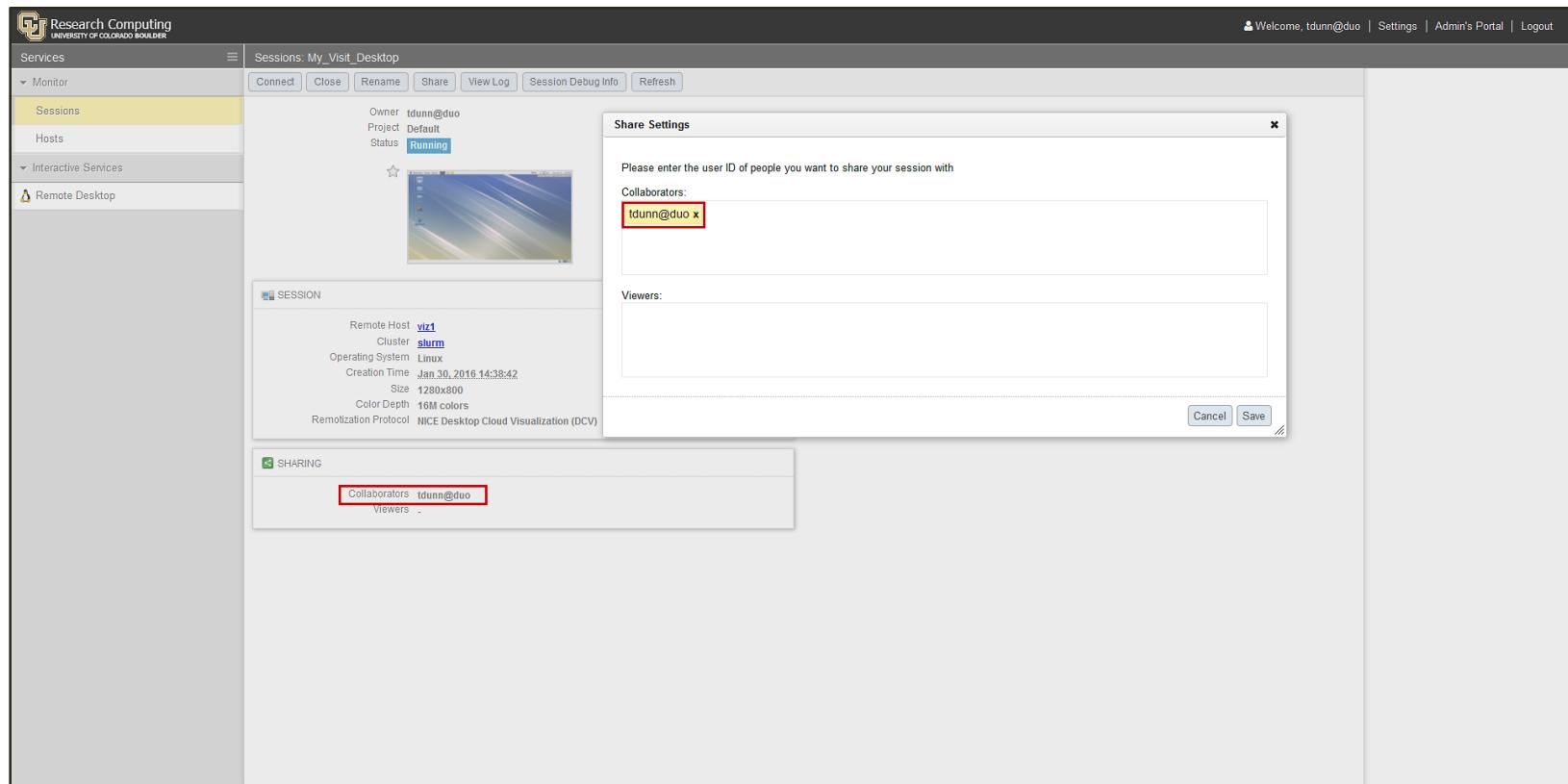
Sharing Sessions – Viewers

- You can share your session with other users by going to your session ‘Details’ and choosing ‘Share’.
- By clicking in the ‘Viewers’ box type the username+@duo. Once EnginFrame will locate the user(s) you specified click ‘Save’.
- By logging into EnginFrame your selected users will receive a notification and will be able to launch a remote desktop to watch work you are doing in the shared session.



Sharing Sessions – Collaborators

- You can share your session with other users by going to your session ‘Details’ and choosing ‘Share’.
- By clicking in the ‘Collaborators’ box type the username+@duo. Once EnginFrame will locate the user(s) you specified click ‘Save’.
- By logging into EnginFrame your selected users will receive a notification and will be able to launch a remote desktop to watch and contribute work to the shared session.



What NICE is and What it isn't

- It is:
 - A place to visualize data easily without knowing how to run jobs on a supercomputer.
 - Faster and easier than x-tunneling.
 - Easy to work with data because your data is next to you.
 - Provides a collaborative working environment.
 - It's one component of several parts of the Analytics Hub.
- What it isn't:
 - A place where plots are magically created
 - You still need to know your software!

Test Users

- We are looking for test users!
- Let us know what works, and what doesn't
- From today until April 30
- Contact us after the talk or email rc-help@colorado.edu
- Will make this available to all soon!

Questions?

- Email rc-help@colorado.edu
- Twitter: CUBoulderRC
- Link to survey on this topic:
<http://goo.gl/forms/8VidcwOhRT>
- Slides:
https://github.com/ResearchComputing/Final_Tutorials