1 Introduction to the Visualization Cluster

The Visualization cluster is a High Performance Computing resource that provides an advanced visualization capability to the end user's desktop. Users can connect to the cluster and take advantage of its advanced capabilities to render very large data sets interactively from their desktops without having any special graphics hardware on their workstation. The images are sent back to the user's desktop over the network and displayed on the desktop using a lightweight visualization client.
The Visualization cluster consists of a login node hpcviz (hpcviz.abudhabi.nyu.edu) and 15 render nodes. Each node has access to the same /home and /archive shared file system on the BuTinah HPC cluster.

To run any visualization software interactively on the cluster you will first need to connect to the login node and request resources. In simple terms, the login node will check which nodes in the cluster are available for you and will consequently allocate you the requested resources. You can then connect to your given visualization node and start your visualization session there.

Remote visualization method on the visualization cluster is implemented using Virtual Network Computing (VNC). VNC is a desktop sharing system which uses a protocol to remotely control another computer (one of the visualization cluster nodes for example). It transmits the keyboard presses and mouse clicks from one computer to another relaying the screen updates back in the other direction, over a network.

2 Visualization Cluster hardware and software

The visualization nodes have an Intel x86-64 architecture with Red Hat Enterprise Linux 6 (RHEL6) Workstation for operating system. Each visualization render node has:

- 6 cores Intel E5649 2.53GHz CPU
- 48GB of RAM
- 1 Nvidia Quadro FX 2800M GPU

Software on the visualization cluster can be accessed through the environment module system (module commands), similar to software access on BuTinah HPC cluster. Currently installed software includes Paraview, IDL, PyMOL, VMD, and Matlab.

3 Remote visualization session through VNC

A remote visualization session consists of connecting a Virtual Network Computing (VNC) client to a VNC server on a different computer over the network.

To connect to the cluster via a remote visualization session, you will first need to download a VNC client software on your local machine. The standard VNC client software which has been tested for connecting to the visualization cluster is TurboVNC and SSVNC.

Before you can request a remote visualization session on the login node hpcviz, and then start a session on your allocated node on the cluster, you will have to first create a VNC password, please choose a different one from your login password.

4 Starting a remote visualization session

A quick guide to start a VNC session on the visualization cluster is given in the following steps:

1) SSH to the login node hpcviz and request resources via the command “viz-tvnc &”;
2) (Necessary only once) create a VNC password;
3) Start a VNC client on your local machine and connect to your allocated node;
4) Start a 3D application inside your VNC session.
More detail descriptions of the steps above are given in the subsections below.

4.1 Log in to the visualization login node

In order to request resources on the visualization cluster you need to have a SSH client on your local computer. SSH client for Linux/Unix/Mac is normally already available as part of the operating system distribution. For Windows users, a free SSH client, Putty, can be downloaded from this link: http://www.chiark.greenend.org.uk/~sgtatham/putty/

Your visualization cluster login username is the login username created for you when you request for an account to use BuTinah HPC cluster.

4.1.1 For Linux/Unix/Mac clients

Open a new terminal window and SSH to the login node hpcviz, then type your password:

```bash
ssh username@hpcviz.abudhabi.nyu.edu
```

4.1.2 For Windows clients

Open a Putty session and connect to hpcviz. Then type your cluster login username and password.

4.2 Creating a VNC password (necessary only once)

If this is your first time using a remote VNC session on the visualization cluster, you create a VNC password. While logged in to the login node (c.f. Log in to the visualization login node) type “vncpasswd” in the terminal window and follow the instructions.
Note that you do not need to enter a view-only password. This is an extra option that allows collaborators to connect to and view your session without being able to interfere.

This above step can be repeated whenever your VNC password needs to be changed.

### 4.3 Requesting resources

9 While logged in to the login node hpcviz (c.f. Log in to the visualization login node), you can request an allocation of a visualization node by typing “viz-tvnc &” in the terminal window.

This will allocate a single visualization node for your exclusive use for a limited time period (presently 24 hours max usage). The node allocated below, for example, is hpcviz2.abudhabi.nyu.edu.

![Image of terminal output](image-url)

You can specify the geometry (size) of the remote visualisation session when starting viz-tvnc with the -g option:

- `-g DESKTOP_RESOLUTION`, `--geometry=DESKTOP_RESOLUTION`

  The resolution to run the desktop at. This can be any "<width>x<height>" value, and doesn't need to match any display device resolution. Larger resolutions may result in higher network bandwidth usage, CPU utilization and sluggish performance.
4.4  **Starting a VNC client**

VNC uses a random challenge-response system to provide authentication that allows you to connect to a VNC server. This is reasonably secure as the password is not sent over the network. However, once connected, the traffic between the client and the server is unencrypted, which might acceptable for local LAN connection. To make a direct VNC client-server connection, please follow the instructions in Direct connection.

If high security is important to you we recommend that you "tunnel" your VNC client connection through an encrypted channel like ssh. Please note that you will feel a reduced interactive response of your VNC session. If you wish to do this, you need to follow the steps described in Connection through SSH tunnel.

4.4.1  **Direct connection**

To make direct VNC connection, you need to have TurboVNC installed on your local machine first. TurboVNC can be found at this link: [http://www.virtualgl.org/Downloads/TurboVNC](http://www.virtualgl.org/Downloads/TurboVNC).

4.4.1.1  **For Linux/Unix/Mac clients**

In a new terminal, you can start the TurboVNC viewer as follow:

```
/opt/TurboVNC/bin/vncviewer viz_node:1
```

You need to replace viz_node with the name of the node allocated to you after you run viz-tvnc command in Requesting resources.
You will then be prompted to enter your password. This is the VNC password which you created previously in Creating a VNC password (necessary only once). The remote visualization session will then start. You can now go to Running applications inside the VNC session subsection to run your application.

4.4.1.2 For Windows clients
You can start the TurboVNC viewer by navigating through the following links: Start → All Programs → TurboVNC or TurboVNC 64-bit → TurboVNC Viewer. In the VNC server field, enter the name the node and display number allocated to you after you run viz-tvnc command in Requesting resources (display number is always 1).

A popup window will appear for you to enter your VNC password. This is the password which you created previously in Creating a VNC password (necessary only once).

The remote visualization session will then start. You can now go to Running applications inside the VNC session to run your application.

4.4.2 Connection through SSH tunnel
To make VNC connection via SSH tunnel, you need to have SSVNC installed on your local machine first. SSVNC is available here: http://www.karlrunge.com/x11vnc/ssvnc.htm. Please follow instructions in the Downloads and Quick Start sections on the previous link to download and unpack the binaries, as well as to start the GUI.

4.4.2.1 For Mac 64-bit clients
Note: For Mac OSX 64-bit local machine, you need to create an additional symbolic link before you can start the ssvnc GUI. After unpacking the ssvnc package, in a terminal window, go to the “bin” folder inside the ssvnc package and create the symbolic link below:

- cd ssvnc/bin
- ln -s Darwin.i386 Darwin.x86_64
Then follow the instructions in For Linux/Unix clients.

4.4.2.2 **For Linux/Unix clients**

After opening the ssvnc GUI, fill in the following text fields:

- **VNC Host:** localhost:1
- **VNC Password:** ***
- **Proxy/Gateway:** username@viz_node

*** is your VNC password; **username@viz_node** is your Visualization cluster username your allocated node obtained in Requesting resources. Then click “Use SSH” radio button and press “Connect” button. You will be prompted to enter your visualization cluster password (this is not your VNC password, but your SSH login password you use in Log in to the visualization...
login node). The remote visualization session will then start. You can now go to Running applications inside the VNC session to run your application.

4.4.2.3 For Windows clients
After opening the ssvnc GUI, fill in the following text fields:

VNC Host: Display: localhost:1
Proxy/Gateway: username@viz_node

username@viz_node is your Visualization cluster username and your allocated node in Requesting resources. Then click “Use SSH” radio button and press “Connect” button. You will be prompted to enter your visualization cluster password (this is not your VNC password, but your SSH login password you use in Log in to the visualization login node). After you enter your SSH login password, a popup window will appear for you to enter your VNC password.
Upon successful authentication, the remote visualization session will start. You can now go to Running applications inside the VNC session to run your application.

### 4.5 Running applications inside the VNC session

To run GPU enabled applications on the GPU device, you will need to append “vglrun” command when starting your application via the command line:

- vglrun application

For example as a simple test you can try:

- vglrun glxgears

You will see clockworks rotating.

Several 3D visualization applications are available locally through our environment module. You can use these applications by loading the appropriate module and then run the application via the vglrun command; for example:

- module load paraview
- vglrun paraview

### 5 Stopping a remote visualization session

If you just close your local VNC viewer window, your session will still be running on the visualization cluster and you could reconnect to it from a different computer for example.

To really terminate a VNC session on the visualization cluster, you should do one of the following actions:

- "Log out" from inside your VNC session, this will stop your session and allocation.  
- If you are unable to do so, you can "force quit" your allocation by using the "scancel" command on the login node hpcviz:

  1) First, log in to the login node (c.f. Log in to the visualization login node);
  2) Then to see your session ID use "sjstat":
     
      >sjstat  
  3) For example, the session ID below is 423, so to force kill your session, use "scancel ID":

     >scancel 423
Visualization Cluster – Getting Started

```
[visual-23-1 ~]$ sjstat

Scheduling pool data:

Pool   Memory  Cpus Total Usable  Free  Other Traits
viz*   48389Mb   6    15    15  14

Running job data:

JobID  User    Nodes Pool Status  Used Master/Other
423    hendra  1 viz  R    2:28:31 visual-23-2

[visual-23-1 ~]$ scancel 423

[visual-23-1 ~]$ ```