National Aeronautics and Space Administration

How Can I Speed up my Interactive Connection to NAS?

Virtual Network Computing:

Improving X11 communication performance over long haul networks

www.nasa.gov

Why is VNC faster than X11?

- **X11 transmits many short messages each with its own overhead (latency).**
- **VNC uses Remote Frame Buffer (RFB) protocol to transmit a block of data and screen coordinates**
- **VNC's own Xvnc process communicates internally with the user's X11 application (Totalview, Tecplot, etc) using sockets or shared memory for better efficiency**

Other VNC Benefits

- **A transmission line disconnect doesn't terminate VNCserver**
  - The user can recover the working desktop upon reconnection
- **VNC desktops can be shared between colleagues and/or consultants**
  - Each user must have a valid NAS user account
  - The "owner" of the desktop provides a VNC password to others to access the desktop
- **VNCviewers are free downloads and run on most desktops/laptops**

Network Security & Convenience

- **Both X11 and RFB lack transmission security**
- **Using ssh to forward/tunnel provides the same security as other ssh traffic**
- **No port/firewall changes: if ssh is already working from one point on the network to NAS, then VNC will also work**
- **Users have a choice of TWM, MWM and KDE desktops that run on Pleiades**

VNCviewers

- **Linux distributions often include both the server and the viewer**
  - Ask your admin for the viewer
- **Apple Macintosh users can download "Chicken of the VNC" from Apple's website.**
- **Microsoft Windows users can download VNCviewers from:**
  - TightVNC
  - RealVNC
  - UltraVNC

Four Steps to Faster Visualization

0. setup NAS passthrough
1. ssh connection to a bridge or a pfe node
2. start a vncserver on the node
3. create a tunnel using your ssh connection
4. connect your VNCviewer to your side of the tunnel

NAS passthrough

- This example .ssh/config file provides the means to access NAS systems by providing a connection to sfe(1/2) and to a specified NAS host in a single step. For a VNC user passthrough simplifies creating a VNC tunnel.
- Notice that we have X11 forwarding turned off since we won't be using X11 protocol for our VNC connections.
- See http://www.nas.nasa.gov/hecc/support/kb/entry/232 for detailed instructions

```
art@jazz ~
$ more .ssh/config
#ForwardX11 yes
ForwardX11 no

Host sfe
        # Replace sfe1 by sfe2 if sfe1 is unavailable
        HostName                sfe1.nas.nasa.gov

Host sfe sfe?.nas.nasa.gov dmzfs?.nas.nasa.gov
        ForwardAgent            yes

Host sfe sfe?.nas.nasa.gov dmzfs?.nas.nasa.gov sup*.nas.nasa.gov
        LogLevel                info
        ProxyCommand            none

Host pfe pfe-last pfe.nas.nasa.gov pfe-last.nas.nasa.gov
        HostKeyAlias            pfe1.nas.nasa.gov
        ProxyCommand            ssh -oCompression=no sfe /usr/local/bin/ssh-balance %h

# Add additional hosts to the list below as needed
Host *.nas.nasa.gov lou lou? cfe? pfe? pfe?? columbia2? bridge? sfe pfe pfe-last
        ForwardAgent            yes
        HostbasedAuthentication no
        ProxyCommand            ssh -oCompression=no sfe /usr/local/bin/ssh-proxy %h
        ServerAliveInterval     10m

        # Replace <NAS_login_name> with your NAS username
        User                    alazanof

        # Enabling compression may improve performance for slow connections
        #Compression            yes

        # Uncomment this line if you are using OpenSSH 4.7 or later
        MACs                    umac-64@openssh.com,hmac-md5,hmac-sha1
```

Pleiades VNC startup

- **Start a VNC; in a previously created .vnc directory one can see a couple of log files:**
  - labeled starting with the Pleiades front-end name and the X11 style console number
  - Plain ASCII; can have useful diagnostic info
- **The passwd file contains the user's read/write and read-only passwords (encrypted).**
- **The xstartup file is a customizable script, by default starts up a TWM window**
  - Use script to specify alternative window managers & terminal configuration choices.
- **Issue the vncserver command specifying the geometry of our screen and the "–localhost" option**
  - LCD displays produce their best image at their native resolution (1280x1024, 1920x1200, etc).
  - If you choose a smaller size, you should maintain the same aspect ratio as the native
- **For security, always include –localhost as the last option on the vncserver list**
- **Console number has several purposes**
- **In .vnc after starting the server: can see a .pid file and a new log file for this session**
  - If you can't recall your pfe or console number, the pid file provides both.

```
-bash-3.2$ ls -l .vnc
total 28
-rw------- 1 alazanof scicon 6061 Jan 20 17:02 bridge3:1.log
-rw------- 1 alazanof scicon 4116 Jan 30 18:06 bridge4:1.log
-rw------- 1 alazanof scicon    8 Jan 30 18:02 passwd
-rwxr-xr-x 1 alazanof scicon  212 Aug 18 00:48 xstartup
-rwxr-xr-x 1 alazanof scicon  150 Nov 10  2008 xstartup.orig
-bash-3.2$ vncserver -geometry 1920x1080 -localhost

New 'X' desktop is bridge4:1

Starting applications specified in /u/alazanof/.vnc/xstartup
Log file is /u/alazanof/.vnc/bridge4:1.log

-bash-3.2$ ls -l .vnc
total 28
-rw------- 1 alazanof scicon 6061 Jan 20 17:02 bridge3:1.log
-rw------- 1 alazanof scicon 2025 Jan 30 18:28 bridge4:1.log
-rw------- 1 alazanof scicon    6 Jan 30 18:28 bridge4:1.pid
-rw------- 1 alazanof scicon    8 Jan 30 18:02 passwd
-rwxr-xr-x 1 alazanof scicon  212 Aug 18 00:48 xstartup
-rwxr-xr-x 1 alazanof scicon  150 Nov 10  2008 xstartup.orig
-bash-3.2$
```

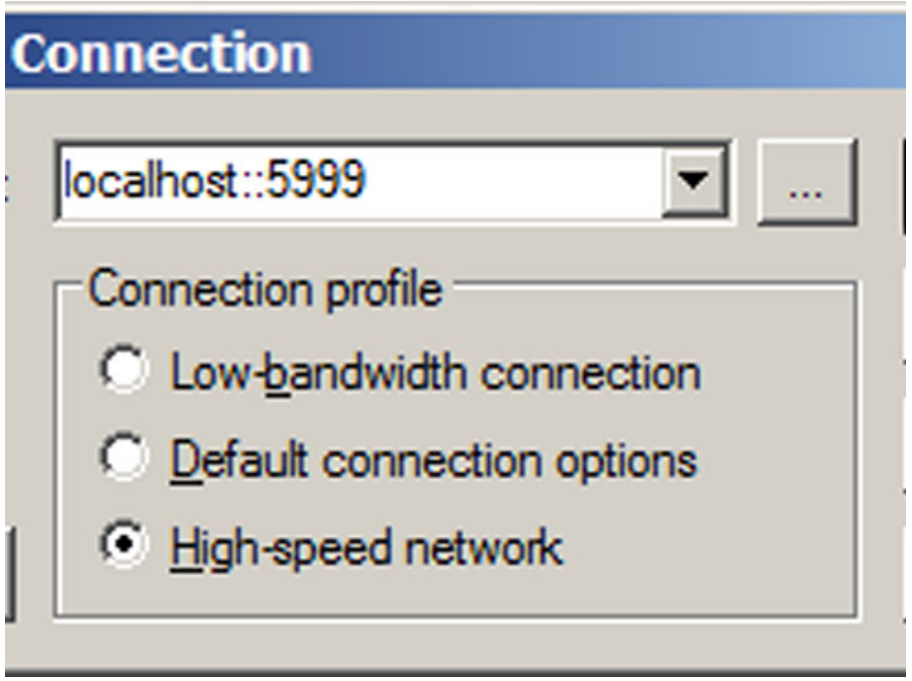
Create SSH tunnel for VNC (RFB)

- **With a console number can now create a tunnel**
  - VNC's RFB protocol uses a TCP/IP port range of 5900-5999.
  - Port number of your VNC connection is console number + 5900
  - When you create a ssh tunnel, specify port numbers for each side of the tunnel
    - » The NAS system will be the right-hand side of localhost
    - » your own desktop/laptop's port number is the left-hand side of localhost
- **To get to this ssh prompt, you enter an ssh escape sequence: ~ C (uppercase C) and NO carriage return or linefeed.**
  - It might take ssh a moment or two to respond.
  - ssh prompt is how you'll know that ssh is ready for the tunnel command.
- **Choice of the user's port number is arbitrary but note:**
  - Macs use port 5900 for their own remote desktop and linux systems consider ports < 1024 as privileged
  - You could run multiple VNC servers on different remote platforms by choosing different desktop/laptop port numbers for each remote system

```
-bash-3.2$
ssh> -L 5999:localhost:5901
Forwarding port.
```

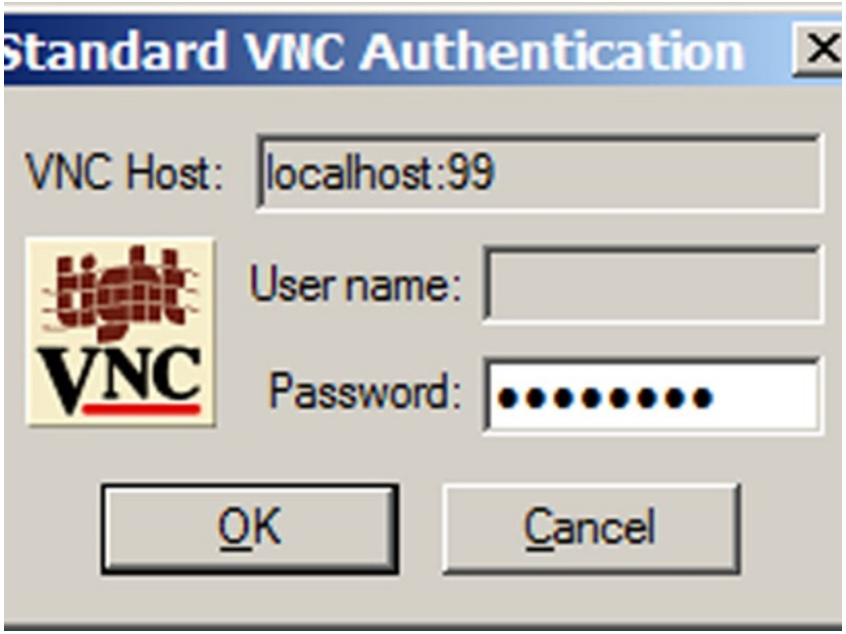
Desktop Viewer Startup

- **After starting the VNC/ssh tunnel, we are ready to connect desktop viewer to our end of tunnel**
  - Note: use “localhost” and port # that we supplied on the left-hand side of the tunnel command
  - No need to specify remote system since our ssh connection to it is what tunnel will use

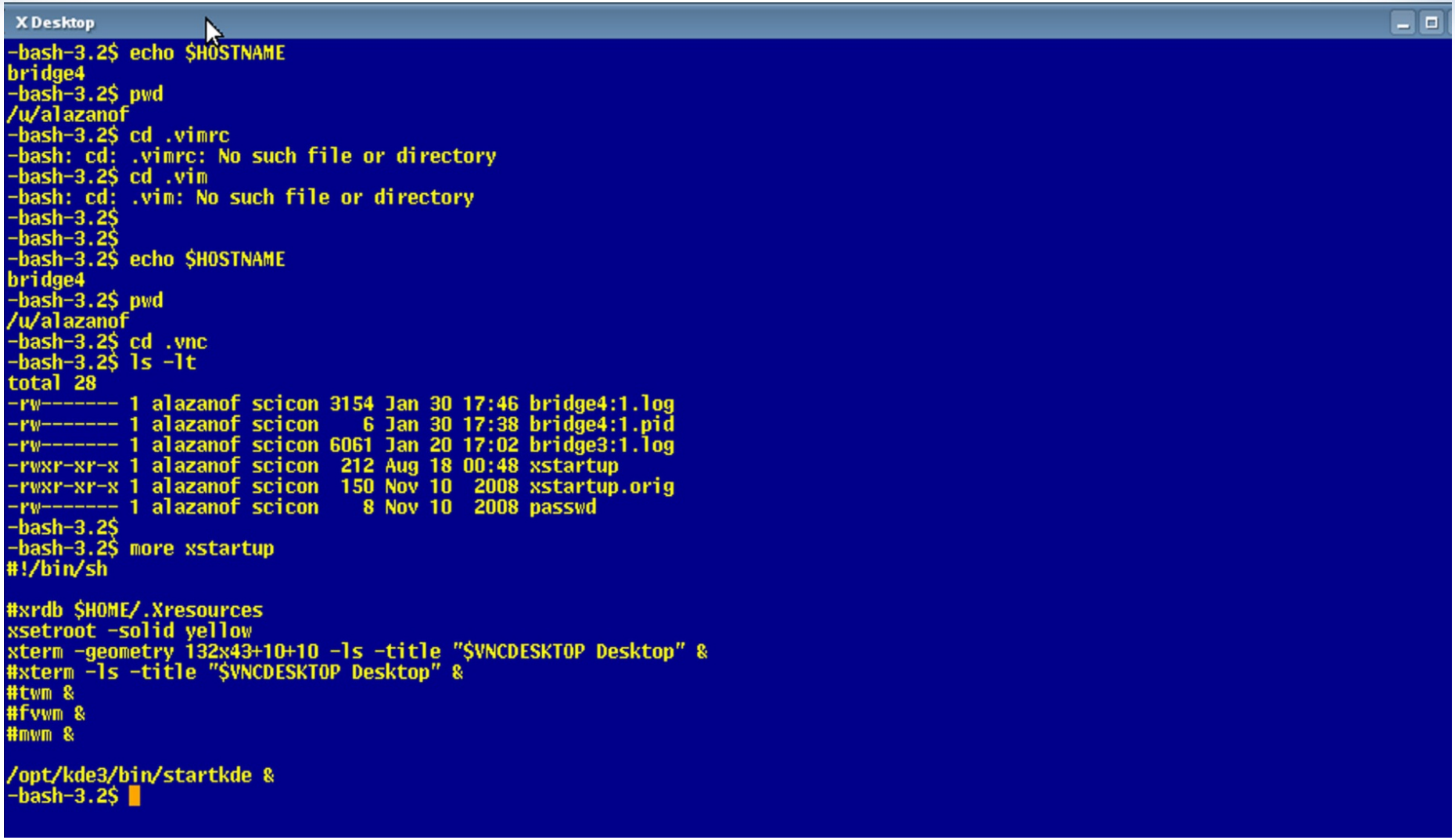


Desktop VNC Authentication

- **Desktop client asks for the VNC client password**
  - not your NAS login password
- **After OK, have completed VNC session startup**
  - next display is produced by TWM, MWM or KDE



Pleiades View—KDE xterm



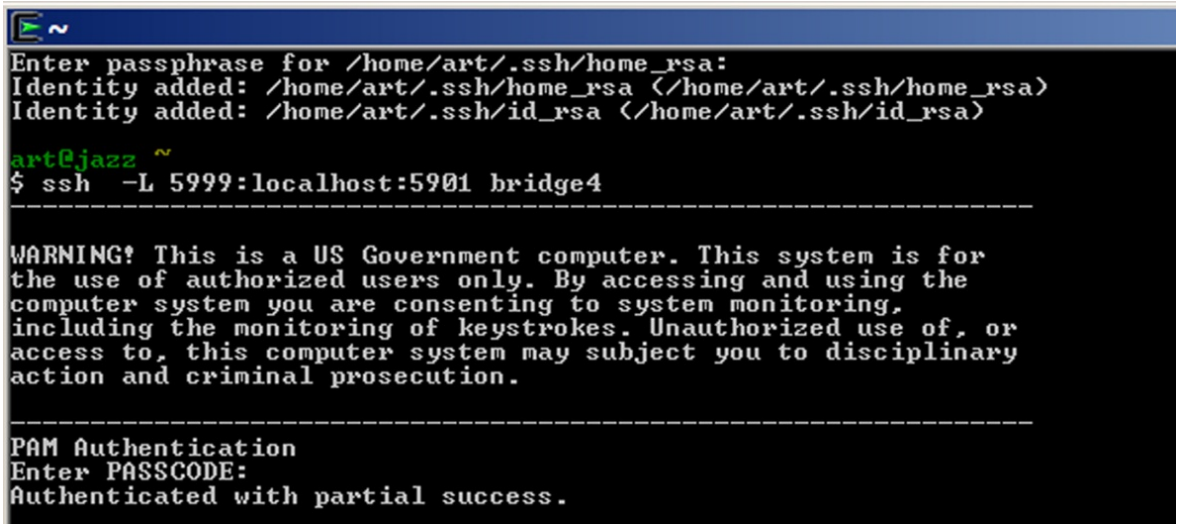
Change VNC Login Password

```
-bash-3.2$ ps -u $USER
  PID TTY          TIME CMD
35878 ?        00:00:00 sshd
35879 pts/1    00:00:00 bash
52459 pts/1    00:00:00 ps
-bash-3.2$ cd .vnc
-bash-3.2$ ls -lt
total 28
-rw------- 1 alazanof scicon 5517 Jan 30 17:53 bridge4:1.log
-rw------- 1 alazanof scicon 6061 Jan 20 17:02 bridge3:1.log
-rwxr-xr-x 1 alazanof scicon  212 Aug 18 00:48 xstartup
-rwxr-xr-x 1 alazanof scicon  150 Nov 10  2008 xstartup.orig
-rw------- 1 alazanof scicon    8 Nov 10  2008 passwd
-bash-3.2$ rm passwd
```

Recover VNC Session

- **To reconnect/recover from comm. line drop**
  - can specify the same tunnel option on the ssh command that you first used
    - » Will make the connection and the tunnel in one step
    - » then you can start your desktop's VNCviewer
- **Must reconnect to the same Pleiades front-end used at the time of the disconnect**
  - ssh pfe-last
  - ssh pfe*n*

    where *n* is the specific PFE you were using



Closedown

- **Don't consume resources when you aren't actively using VNC; see**
  - number of processes that a KDE desktop can use
  - Proper way to end VNCserver session
- **VNCserver's own "–kill" option will**
  - terminate window manager's processes, delete socket and lock files, terminate the Xvnc server
- **`kill –9 Xvnc` will leave processes, socket and lock files behind**
- **We can support up to 30 VNC users per Pleiades front-end**
- **We ask all our VNC users to do a proper VNC shutdown**

```
-bash-3.2$ vncserver -geometry 1920x1080 -localhost

You will require a password to access your desktops.

Password:
Verify:
Would you like to enter a view-only password (y/n)? n

New 'X' desktop is bridge4:1

Starting applications specified in /u/alazanof/.vnc/xstartup
Log file is /u/alazanof/.vnc/bridge4:1.log

-bash-3.2$ ps -u $USER
  PID TTY          TIME CMD
35878 ?        00:00:00 sshd
35879 pts/1    00:00:00 bash
41167 ?        00:00:00 famd
56805 pts/1    00:00:00 Xvnc
56811 pts/1    00:00:00 xterm
56812 pts/1    00:00:00 startkde
56823 pts/14   00:00:00 bash
56854 ?        00:00:00 kdeinit
56857 ?        00:00:00 dcopserver
56859 ?        00:00:00 klauncher
56861 ?        00:00:00 kded
56866 pts/1    00:00:00 kwrapper
56868 ?        00:00:00 ksmserver
56869 ?        00:00:00 kwin
56871 ?        00:00:00 kdesktop
56873 ?        00:00:00 kicker
56874 ?        00:00:00 kio_file
56883 ?        00:00:00 knotify
56885 ?        00:00:00 klipper
59820 pts/1    00:00:00 ps
-bash-3.2$ vncserver -kill :1
Killing Xvnc process ID 56805
-bash-3.2$
```

.vnc After Closedown

- **Here we can see that we now have a bare minimum number of processes and the the .vnc/*.pid files have been removed.**

```
-bash-3.2$
-bash-3.2$ vncserver -kill :1
Killing Xvnc process ID 73618
-bash-3.2$ ls -l .vnc
total 28
-rw------- 1 alazanof scicon 6061 Jan 20 17:02 bridge3:1.log
-rw------- 1 alazanof scicon 5754 Jan 30 18:40 bridge4:1.log
-rw------- 1 alazanof scicon    8 Jan 30 18:02 passwd
-rwxr-xr-x 1 alazanof scicon  212 Aug 18 00:48 xstartup
-rwxr-xr-x 1 alazanof scicon  150 Nov 10  2008 xstartup.orig
-bash-3.2$ ps -u $USER
  PID TTY          TIME CMD
72878 ?        00:00:00 sshd
72879 pts/1    00:00:00 bash
81513 pts/1    00:00:00 ps
-bash-3.2$
```

VNC Sockets & Processes

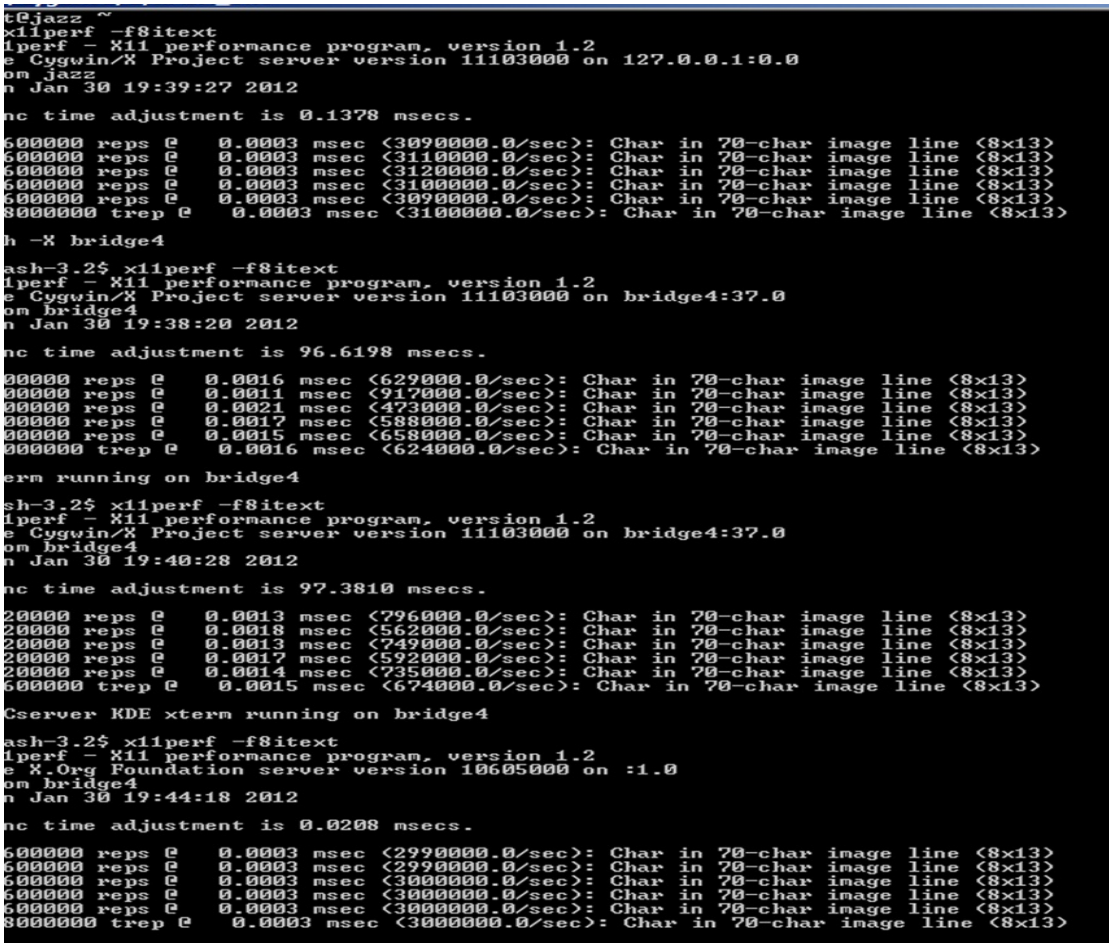
- **Each VNC session consumes**
  - one lock: /tmp/.X1-lock
  - one socket: /tmp/.X11-unix/X1
- **While you can remove these manually, these files will be removed by**
  - vncserver –kill :1 command

```
-bash-3.2$ ps -aef | grep Xvnc
alazanof 82956     1  0 18:43 pts/1    00:00:00 Xvnc :1 -desktop X -httpd /usr/share/vnc/classes -auth /u/alazanof/.Xauthority -geom
etry 1920x1080 -depth 24 -rfbwait 120000 -rfbauth /u/alazanof/.vnc/passwd -rfbport 5901 -fp /usr/share/fonts/misc:unscaled,/usr/shar
e/fonts/local,/usr/share/fonts/75dpi:unscaled,/usr/share/fonts/100dpi:unscaled,/usr/share/fonts/Type1,/usr/share/fonts/URW,/usr/shar
e/fonts/Speedo,/usr/share/fonts/truetype,/usr/share/fonts/uni,/usr/share/fonts/CID -noreset -localhost
alazanof 86173 83040  0 18:48 pts/17   00:00:00 grep Xvnc
-bash-3.2$ ls -la /tmp/.X*
-r--r--r-- 1 alazanof scicon   11 Jan 30 18:43 /tmp/.X1-lock

/tmp/.X11-unix:
total 576
drwxrwxrwt  2 root     root     4096 Jan 30 18:43 .
drwxrwxrwt 77 root     root   581632 Jan 30 18:47 ..
srwxrwxrwx  1 alazanof scicon      0 Jan 30 18:43 X1
-bash-3.2$
```

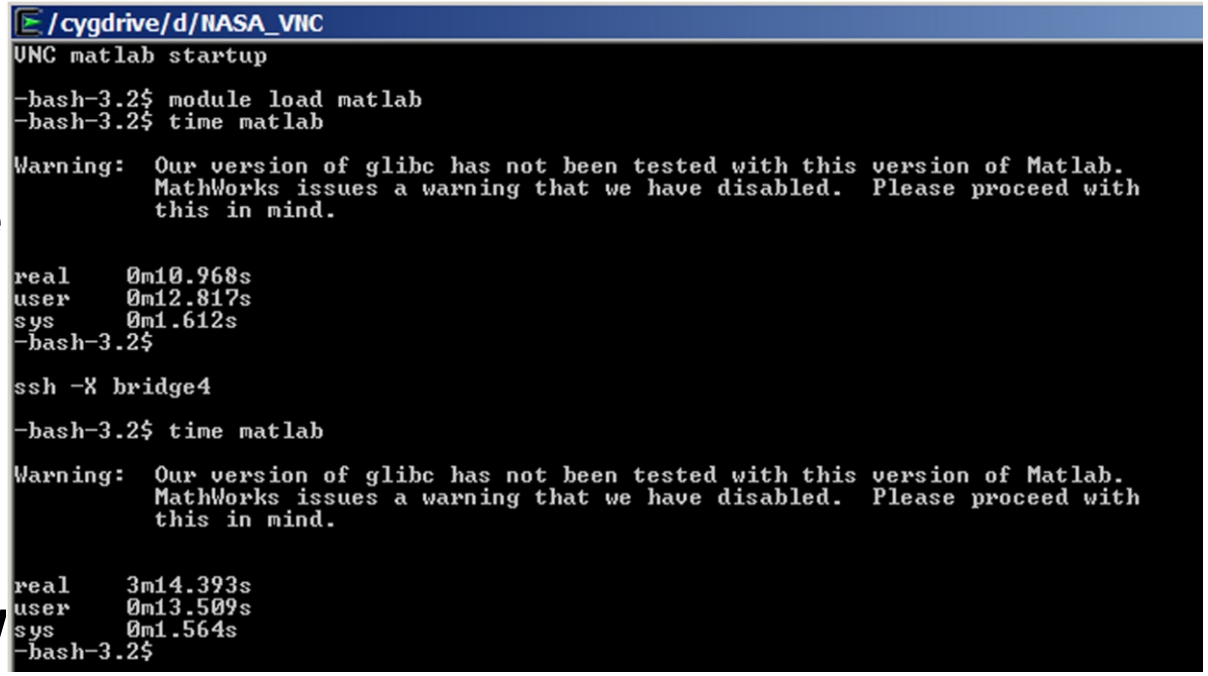
X11perf Performance

- **Use `x11perf` to test latency and performance of a variety of graphics components, for example**
  - The first run shown is a stand-alone desktop
  - The next two runs use bridge4 with `x11perf` sending a display back to a local X11 server, and a test running an xterm on bridge4
  - Last test is a VNC test running x11perf using a xterm on Pleiades and a vnc viewer for local display. In this example, VNC's times are comparable to the locally run test. VNC is best used for remote graphics and video.
- **Plain text windows will generally do better than VNC**



MATLAB Startup

- The first time of ~11s is the VNC time it takes for a usable display and an exit command. The second time shows 3m 14s for a conventional X11 remote display.
- Besides the longer startup latency, every event like pulling a window down to make a selection is intolerably slow for many people. If the user is further away on the public network, the startup times grow even larger.



Slides Prepared by Art Lazanoff

pdf and recording of this webinar will be available shortly at:
http://www.nas.nasa.gov/hecc/support/training.html

Next webinar
"How Can I Speed Up My Data Transfers to/from NAS?"
tentatively scheduled on March 7, 2012

Suggestions for future webinar topics are welcome