



Visualisation à distance
Concepts et Utilisation

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Plan

- Vocabulaire
- VirtualGL
 - Concept
 - Configuration
 - Utilisation

Vocabulaire

- Serveur X
- Client X
 - **DISPLAY** = hostname:displaynumber.screennumber
- DRI
- OpenGL / GLX
- Window manager
- Session manager

Serveur X

Serveur(s) X

- gère l'interaction entre les clients X et le matériel
- X.org (+AIGLX), XFree86, Xgl, Cygwin/X, Apple X11,...

Window Manager :

- Gère l'affichage des fenêtres graphiques

Session manager :

- Gère l'affichage des fenêtres graphiques et le contexte de travail: kde, gnome, ...

<http://fr.wikipedia.org/wiki/X.Org>

DISPLAY

`DISPLAY = hostname:displaynumber.screennumber`

- Indique à un application (client X) comment accéder le Serveur X
 - Hostname: nom de la machine exécutant le serveur X
 - Displaynumber : indique la carte graphique où la sortie graphique
 - Screennumber : indique le moniteur sur la sortie graphique

Serveur X : vérifications

- `export DISPLAY=h:d.s` `setenv DISPLAY h:d.s`
- `xclock`
- `xdpyinfo`
- `/var/log/Xorg.0.log`
- `/etc/X11/xorg.conf`

OpenGL

OpenGL : Open Graphics Library

- Evolution d'IrixGL (interface de programmation 3D propriétaire de SGI)
- Interface de programmation 3D (API) ouverte
- Multi-plateforme, multi-constructeur

GLX : *OpenGL Extension to the X Window System*

- API pour utiliser OpenGL avec le serveur X
- Extension du protocole X pour envoyer des commandes de rendu 3D du client au serveur X
- Extension du serveur X recevant les commandes de rendu 3D du client et les envoyant au driver graphique

DRI (**Direct Rendering Infrastructure**)

- Interface de rendu 3D

Implémentation :

- MesaGL implémentation libre de OpenGL
- Driver propriétaire (NVidia, AMD/ATI, Intel, ...)

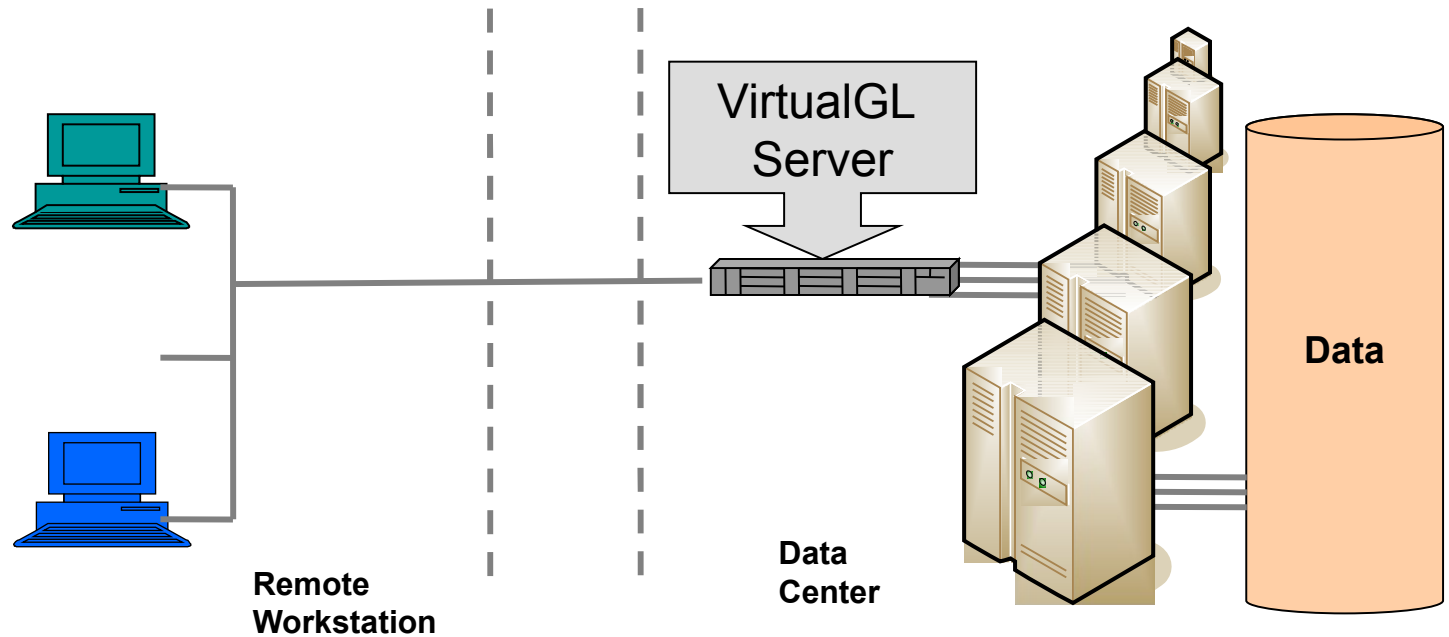
Configuration / vérification

- `nvidia-settings`, `nvidia-xconfig`, (ATI:`fglrx`)
- `glxinfo`

OpenGL : exemple

```
dpy = XOpenDisplay(...);
vi = glXChooseVisual(...);
cx = glXCreateContext(...);
cmap = XCreateColormap();
win = XCreateWindow(...);
XMapWindow(...);
glXMakeCurrent(...);
glMatrixMode(...);
glClearColor(..);
glFlush();
While(1)
    glBegin(GL_LINE_STRIP);
    glVertex..(...);
    glEnd();
    glXSwapBuffers();
```

Concept Virtual GL

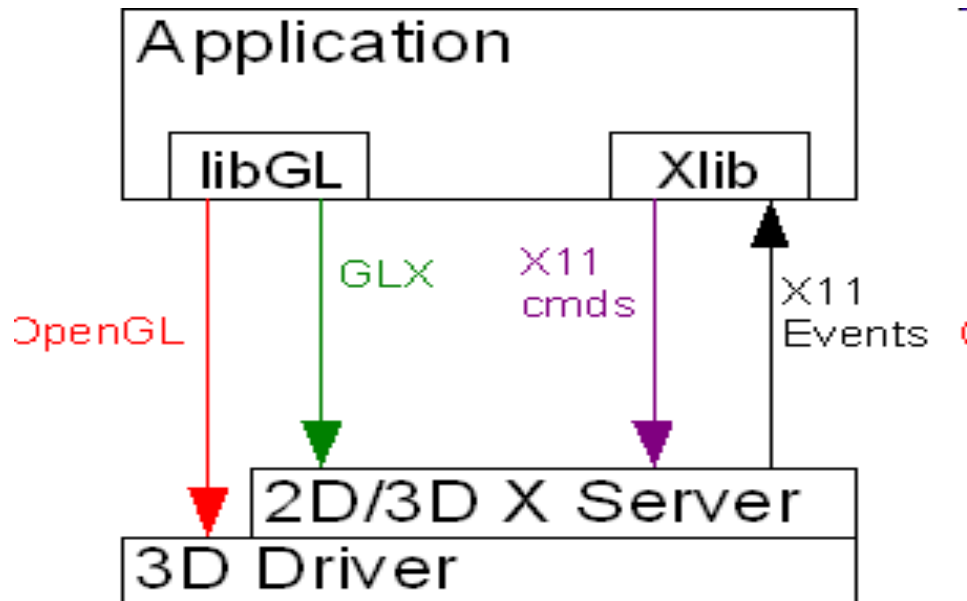


Principe :

- Intégration du Serveur de Visualisation dans le réseau de calcul
- Traitement lourd proche des données
- Déport des fenêtres de visualisation

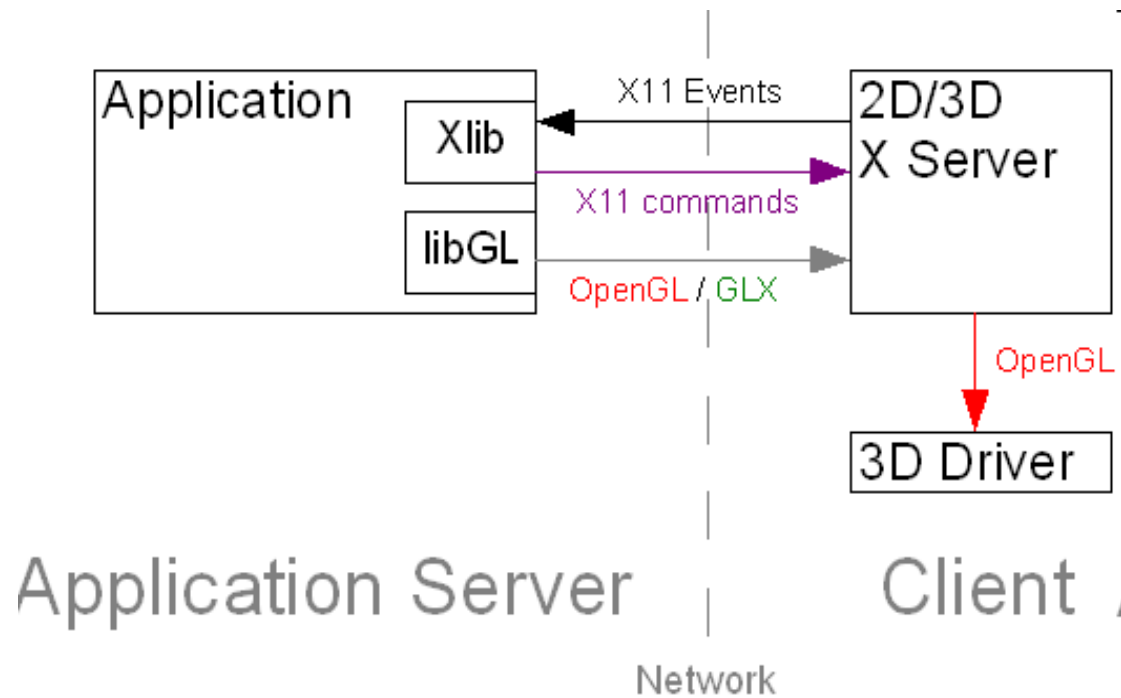
Visualisation OpenGL locale

- Direct OpenGL Rendering w/ X-Window



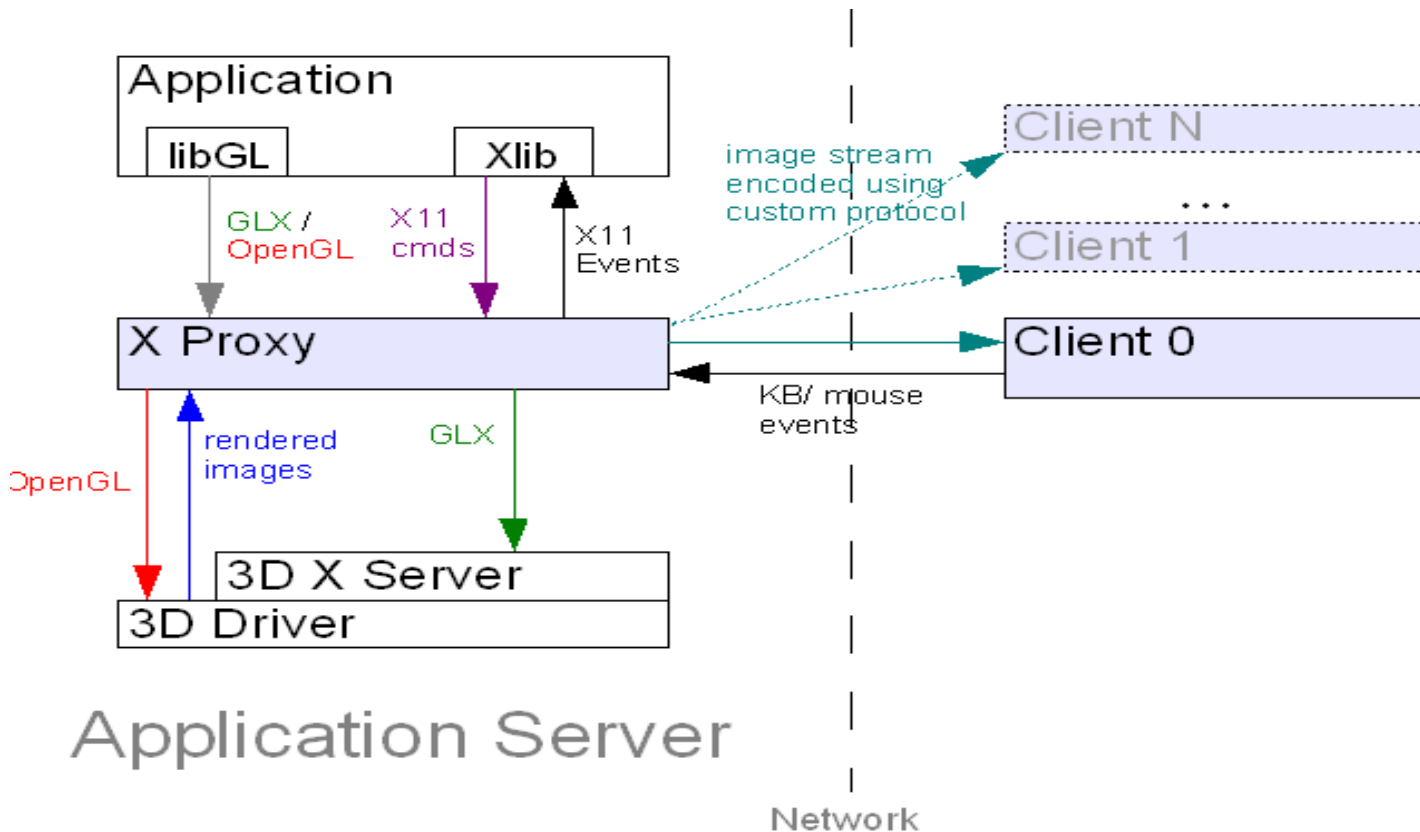
Visualisation OpenGL distante

- Indirect OpenGL Rendering w/ X-Window & GLX



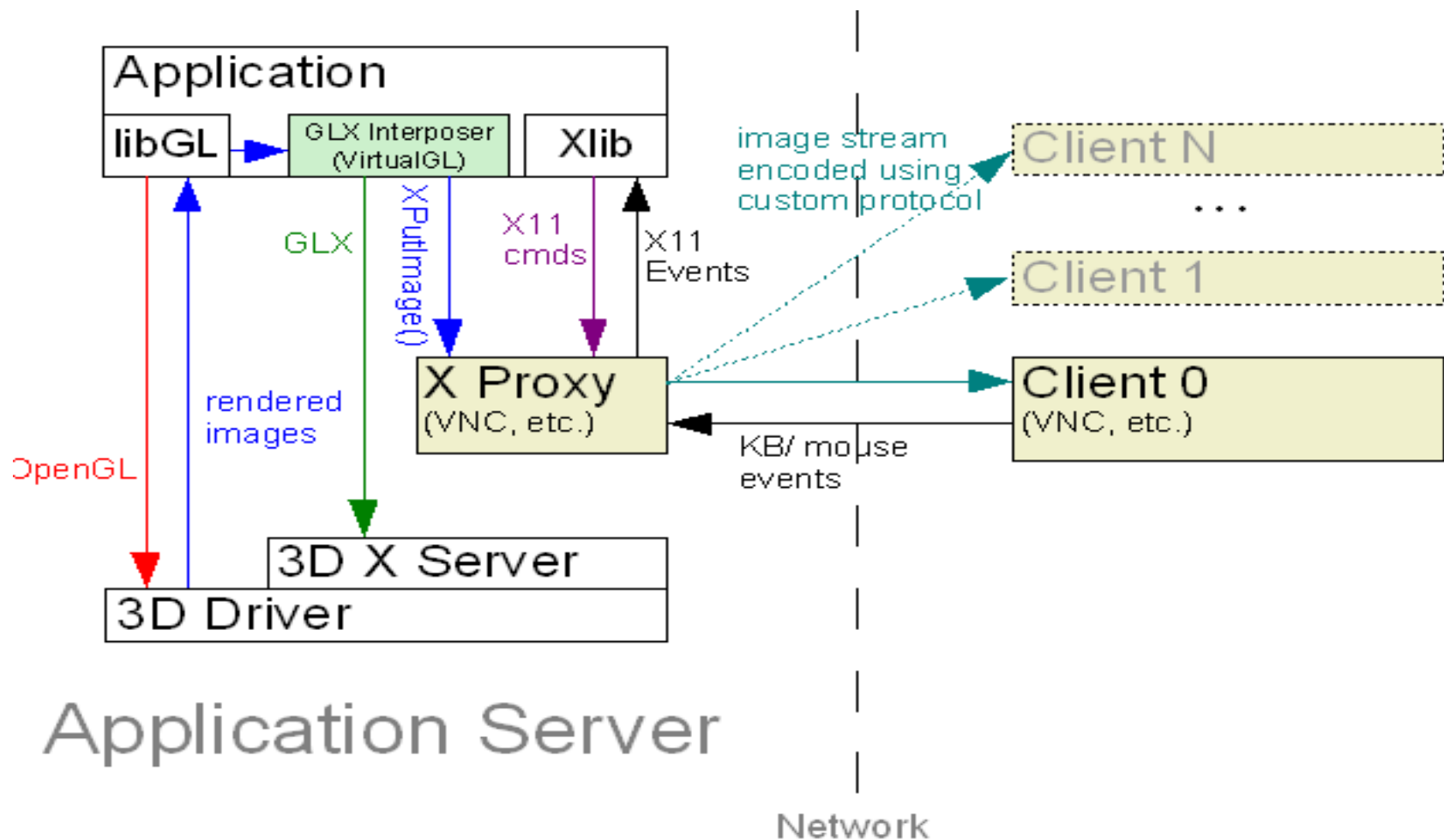
Visualisation indirecte par interposition

- Out-of-Process GLX Forking
- Out-of-Process Image Encoding



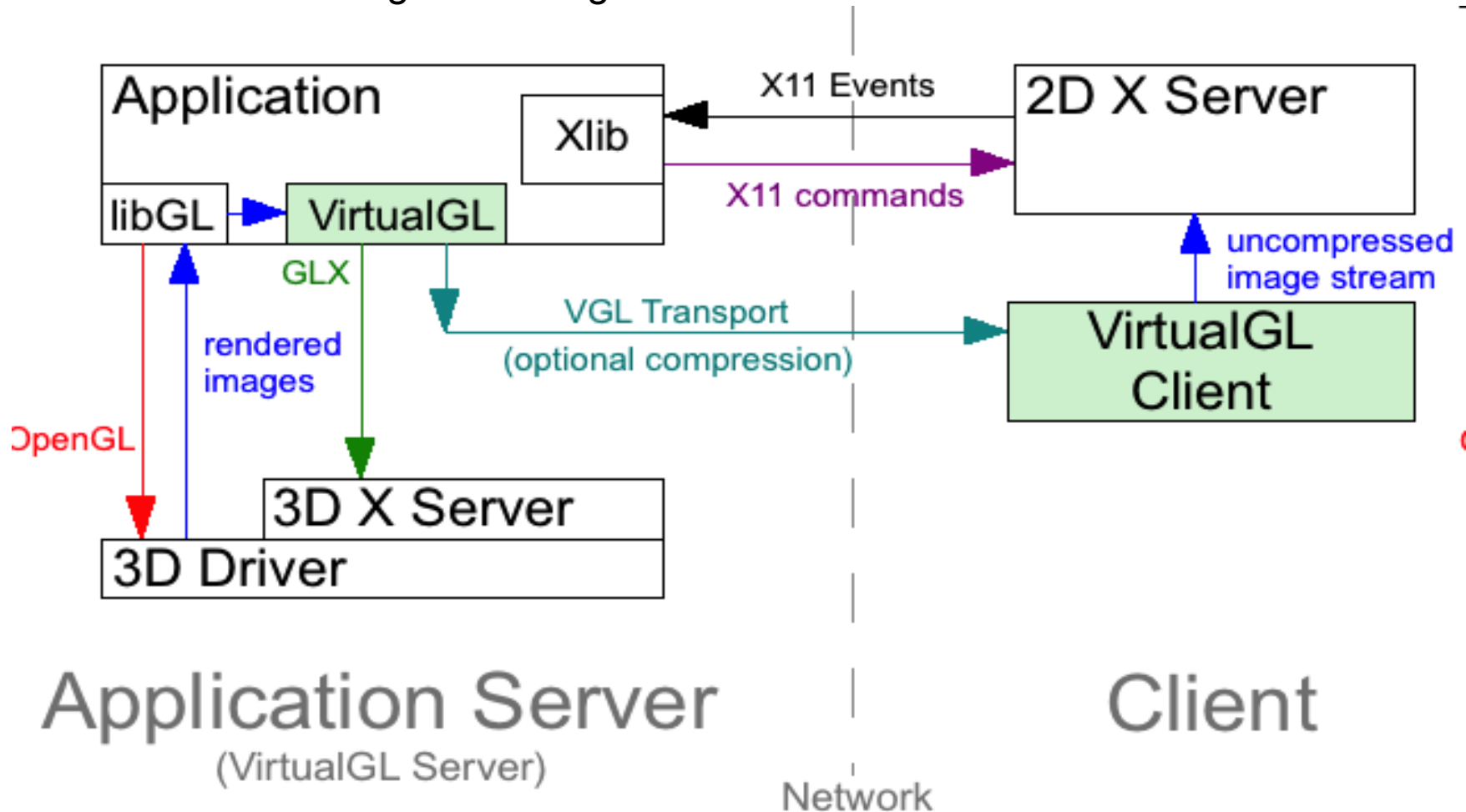
Visualisation indirecte par interposition : mode VNC

- In-Process GLX Forking
- Out-of-Process Image Encoding



Visualisation par transport d'image : mode VGL

- In-Process GLX Forking
- In-Process Image Encoding



Implémentation VirtualGL / Valenciennes

Serveur Graphique VirtualGL: fortune

- SLES 11SP1, « Linux »
- Carte graphique NVidia QuadroFX 5000
- Driveur graphique NVidia 270.41.19
- VirtualGL 2.2.1
- *VNC , (TightVNC 1.3.9, TurboVNC 1.0.2, TigerVNC 1.1.0)
- Applications graphiques (Paraview 3.10.1)

- <http://www.virtualgl.org>

Implémentation VirtualGL

Client VirtualGL

- Linux, Windows, OSX
- Mode VNC:
 - *VNC (TightVNC, TurboVNC, TigerVNC)
 - ...
- Mode VGL :
 - VirtualGL 2.2.1
 - Serveur X fonctionnel
 - ssh, (putty)

Commandes VirtualGL

- *vglclient*
- *vglconfig*
- **vglconnect**
- *vglgenkey*
- *vgllogin*
- **vglrun**
- *vglserver_config*
- *glxinfo*
- *glxspheres / glxspheres64*
- *cpustat*
- *nettest*
- *tcbench*

vglconnect

USAGE: /usr/bin/vglconnect

[-display <d>] [-s] [-x] [-k] [-force] [user@]hostname

[Additional SSh options]

- display <d>** = Local X display to use when drawing VirtualGL's images
(default: read from DISPLAY environment variable)
- s** = Tunnel VGL image transport and X11 through SSh (default: tunnel only X11)
- x** = Do not tunnel X11 or the VGL image transport, but create an xauth key and add it to the VirtualGL server's keyring so that the VirtualGL server (and any that share its home directory) can use this X display
- k** = Do not connect to server, but create an xauth key for this X display and add it to the local keyring so that any VirtualGL servers that share the same home directory as this machine can use this X display
- g** = Use gsissh from Globus Toolkit to make all SSh connections
- force** = Force a new vglclient instance (use with caution)

Options vglrun

Usage: vglrun [options] [--] <OpenGL app> [OpenGL app arguments]

-c <c> :

proxy : Send 3D images uncompressed using X11 transport[default for local X connections]

jpeg : Compress 3D images using JPEG/send using VGL transport[default for remote X connections]

rgb : Encode 3D images as RGB/send using VGL transport

xv : Encode 3D images as YUV420P/send using XV Transport

yuv : Encode 3D images as YUV420P/send using the VGL Transport and display on the client using X Video

[If an image transport plugin is being used, then <c> can be any number ≥ 0 (default=0).]

-nodl : If an app uses dlopen() to explicitly access libGL.so, don't force it to open VirtualGL instead (see docs)

-d <d> : <d> = the X Display or GLX device to use for 3D rendering[default = :0.0]

-fps <f> : Limit client/server frame rate to <f> frames/sec

-gamma <g>: Set gamma correction factor to <g> (see docs)

-ge : Fool application into thinking that LD_PRELOAD is unset

-ms <s> : Force VirtualGL to use OpenGL multisampling with <s> samples (<s> = 0 forces multisampling to be disabled)

-np <n> : Use <n> CPUs to perform image compression [default = 1]

+/-pr : Enable/disable performance profiling output [default = disabled]

Options vglrun

- q <q>** : Compression quality [1 <= <q> <= 100] [default = 95 for JPEG/VGL Transport. Has no effect with X11 Transport]
- samp <s>** : Chrominance subsampling factor <s> = gray, 1x, 2x, 4x
[default = 1x for JPEG/VGL Transport. Has no effect with X11 Transport or RGB encoding]]
- +/-s** : Enable/disable SSL encryption of VGL Transport or custom image transport, if applicable.
[default = disabled. Has no effect on the VGL Transport unless VirtualGL was built with OpenSSL support]
- +/-sp** : Turn on/off frame spoiling [default = enabled]
- st <s>** :
 - left = Send only left eye buffer of stereo application
 - right = Send only right eye buffer of stereo application
 - quad = Use quad-buffered stereo if available, otherwise use red/cyan (anaglyphic) stereo [default]
 - rc = Always use red/cyan (anaglyphic) stereo
- +/-sync** : Enable/disable strict 2D/3D synchronization [default = disabled]
- +/-tr** : Enable/disable function call tracing (generates a lot of output) [default = disabled]
- trans <t>**: Use transport plugin contained in library libvgltrans_<t>.so
- +/-v** : Enable/disable verbose VirtualGL messages [default = disabled]
- 64** : (Solaris only) Preload VirtualGL only into 64-bit apps
- 32** : (Solaris only) Preload VirtualGL only into 32-bit apps

vglclient

USAGE: `vglclient [-h|-?] [-display <name>] [-port <p>] [-sslport <port>] [-sslonly] [-nossll] [-l <file>] [-detach] [-force] [-v] [-x] [-gl]`

-h or **-?** = This help screen

-display = The X display to which to draw the images received from the VirtualGL server (default = read from the DISPLAY environment variable)

-port = TCP port to use for unencrypted connections from the VirtualGL server (default = automatically select a free port)

-detach = Detach from console (used by `vglconnect`)

-force = Force VGLclient to run, even if there is already another instance running on the same X display (use with caution)

-kill = Kill all detached VGLclient processes running under this user ID

-l = Redirect all output to <file>

-v = Display version information

-x = Use X11 drawing (default for x86 systems)

-gl = Use OpenGL drawing (default for Sparc systems with 3D accelerators)

glxinfo

freeglut-080721-21.9

Usage: `glxinfo [-v] [-t] [-h] [-i] [-b]`
`[-display <dname>]`

- display <dname>:** Print GLX visuals on specified server.
- v:** Print visuals info in verbose form.
- t:** Print verbose table.
- h:** This information.
- i:** Force an indirect rendering context.
- b:** Find the 'best' visual and print it's number.
- l:** Print interesting OpenGL limits.

VirtualGL-2.2-20101019

Usage: `glxinfo [-b|-c|-h|-i|-l|-t|-v]`
`[-display <dname>]`

- c:** Print table of GLXFBConfigs instead of X Visuals
- display <dname>:** Print table of GLX visuals on the specified X server
- v:** Print visual info in verbose form.
- t:** Print verbose table.
- h:** Display this screen.
- i:** Force an indirect OpenGL rendering context.
- b:** Find the 'best' visual and print it's number.
- l:** Print interesting OpenGL limits.

glxspheres

USAGE: **glxspheres [-h|-?] [-c] [-i] [-l] [-m] [-o] [-s] [-fs] [-p <p>]**

- c** = Use color index rendering (default is RGB)
- fs** = Full-screen mode
- i** = Interactive mode. Frames advance in response to mouse movement
- l** = Use fewer than 24 colors (to force non-JPEG encoding in TurboVNC)
- m** = Use immediate mode rendering (default is display list)
- o** = Test 8-bit transparent overlays
- p <p>** = Use (approximately) <p> polygons to render scene
- s** = Use stereographic rendering initially
(this can be switched on and off in the application)
- 32** = Use 32-bit visual (default is 24-bit)

nettest

nettest

USAGE: nettest -client <server name or IP> [-old]

or nettest -server

or nettest -findport

or nettest -bench <interface> [interval]

Configuration VirtualGL sur serveur graphique

- Configuration (root)

```
init 3
```

```
/opt/VirtualGL/bin/vglserver_config
```

- Créer le groupe vglusers dans /etc/group

```
init 5
```

- Création clé d'authentification

```
xauth merge /etc/opt/VirtualGL/vgl_xauth_key
```

- Vérification

```
xdpyinfo -display :0
```

```
/opt/VirtualGL/bin/glxinfo -display :0
```

Utilisation VirtualGL : mode VGL

- Pré requis sur station de travail :
 - VirtualGL installé
 - Serveur X fonctionnel :
 - implicite sur Linux,
 - explicite sur Windows, OSX
 - Utilitaire de connexion ssh
- Pré requis sur serveur graphique :
 - VirtualGL installé et configuré
 - ssh configuré
 - Applications X / GLX installée

Utilisation VirtualGL : mode VGL

Linux, OSX

- OSX : Lancement serveur X11
- Ouverture connexion ssh

```
/opt/VirtualGL/bin/vglconnect {user}@{server}
```

- Lancement application X

```
/opt/VirtualGL/bin/vglrun /opt/VirtualGL/bin/glxspheres
```

- Lancement application X avec compression

```
/opt/VirtualGL/bin/vglrun -c jpeg /opt/VirtualGL/bin/glxspheres
```

Utilisation VirtualGL : mode VGL

Windows Cygwin/X

- Lancement serveur X11
- Ouverture connexion ssh

```
/opt/VirtualGL/bin/vglconnect {user}@{server}
```

- Lancement application X

```
/opt/VirtualGL/bin/vglrun /opt/VirtualGL/bin/glxspheres
```

- Lancement application X avec compression

```
/opt/VirtualGL/bin/vglrun -c jpeg  
/opt/VirtualGL/bin/glxspheres
```

Utilisation VirtualGL : mode VNC

- Pré requis sur station de travail :
 - Client VNC installé (vncviewer)
 - Utilitaire de connexion ssh
- Pré requis sur serveur graphique :
 - VirtualGL , *VNC installé et configuré (vncserver)
 - ssh configuré
 - Applications X / GLX installées

Utilisation VirtualGL : mode VNC

- Création d'une session

```
ssh {user}@{server}
```

- Lancement de vncserver, récupération
{display}

```
vncserver
```

New 'X' desktop is igloo-uv:1

Starting applications specified in /home/sgi/.vnc/xstartup
Log file is /home/sgi/.vnc/igloo-uv:1.log

- Lancement du viewer *VNC

```
vncviewer {server}:{display}
```

Utilisation VirtualGL : mode VNC

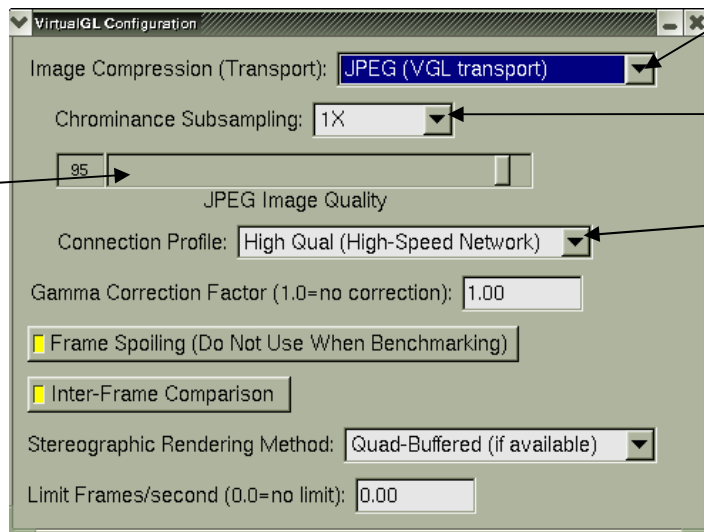
- Lancement de l'application sur le serveur

```
/opt/VirtualGL/bin/vglrun /opt/VirtualGL/bin/glxspheres
```


Configuration VirtualGL

CTRL-SHIFT-F9

Qualité JPEG

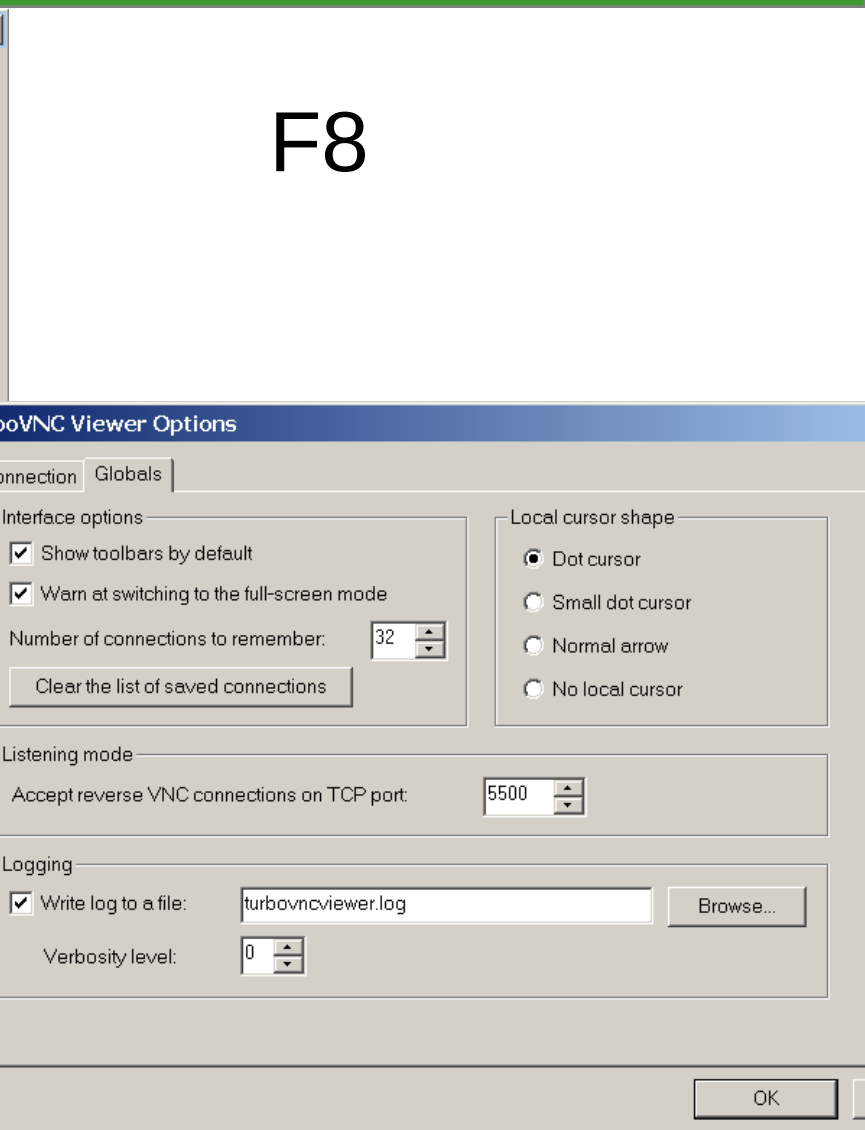
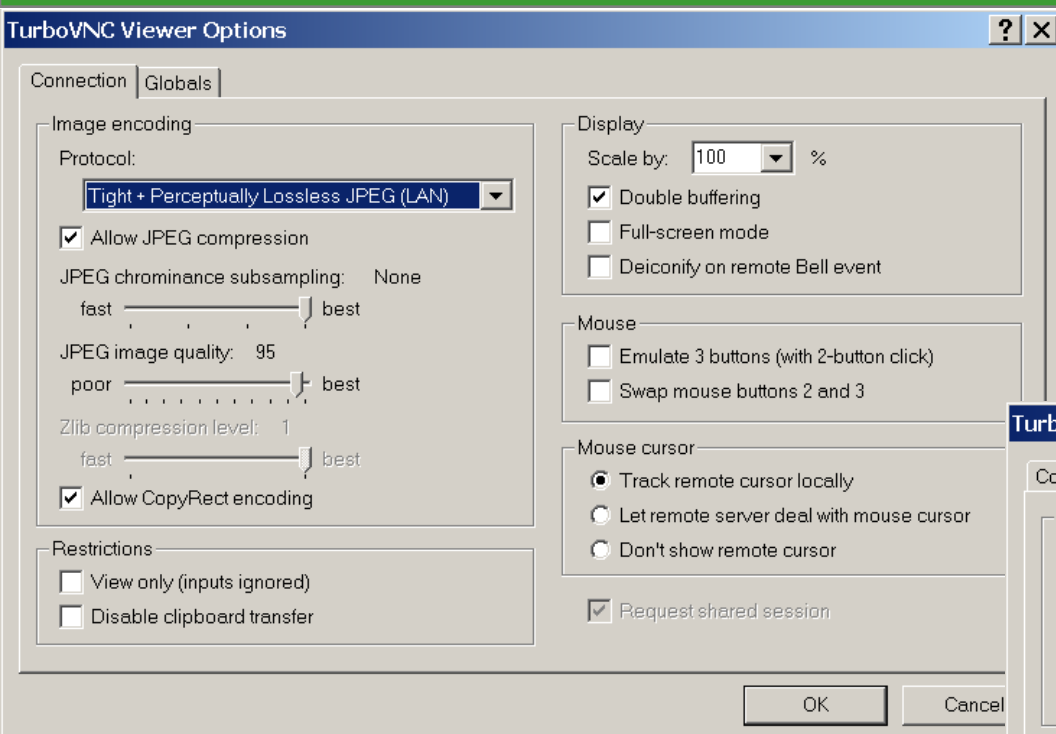


X11, VGL, RGB

Grayscale, 1X, 2X, 4X

Low, Medium, High Qual

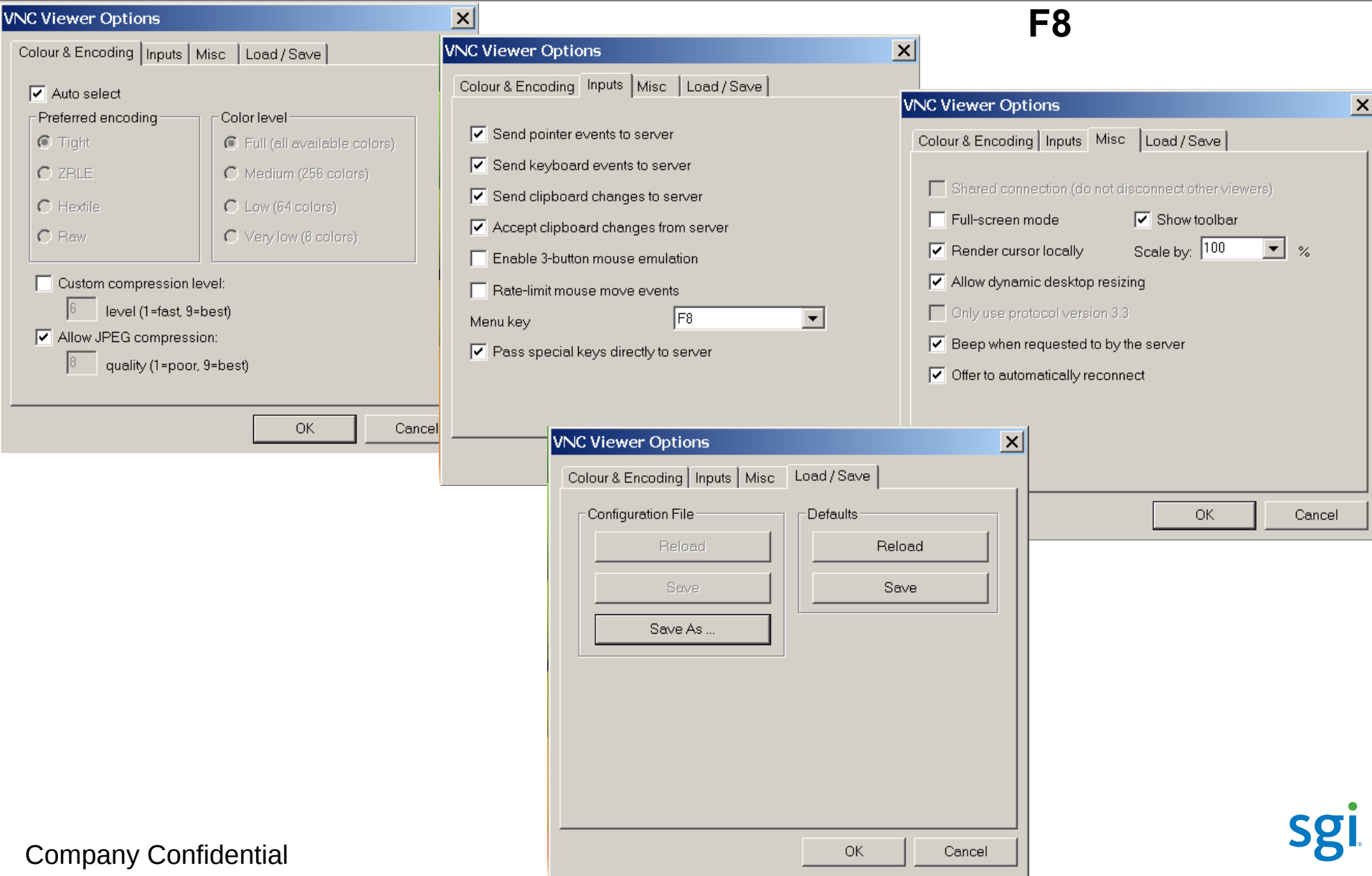
Configuration TurboVNC



F8

Configuration TigerVNC

F8



Commandes VNC

Génériques :

- vncpasswd
- vncserver
- vncviewer
- Xvnc

TurboVNC, TightVNC :

- vncconnect

TigerVNC :

- vncconfig
- x0vncserver

Mode VNC : vncserver

vncserver -help

TightVNC Server version 1.3.9

Usage: vncserver [<OPTIONS>]
[:<DISPLAY#>]

vncserver -kill :<DISPLAY#>

<OPTIONS> are Xvnc options, or:

-name <DESKTOP-NAME>

-depth <DEPTH>

-geometry <WIDTH>x<HEIGHT>

-pixelformat rgb<NNN>

-pixelformat bgr<NNN>

/opt/tigervnc/bin/vncserver -help

usage: vncserver [:<number>] [-name <desktop-name>]
[-depth <depth>]

[-geometry <width>x<height>]

[-pixelformat rgbNNN|bgrNNN]

[-fp <font-path>]

<Xvnc-options>...

vncserver -kill <X-display>

/opt/TurboVNC/bin/vncserver -help

TurboVNC Server v1.0 (build 20101020)

Usage: vncserver [<OPTIONS>] [:<DISPLAY#>]

vncserver -kill :<DISPLAY#>

vncserver -list

<OPTIONS> are Xvnc options, or:

-name <DESKTOP-NAME>

-depth <DEPTH>

-geometry <WIDTH>x<HEIGHT>

-pixelformat rgb<NNN>

-pixelformat bgr<NNN>

-fp <FONT-PATH>

-novncauth

-nootp

-nopam

-noauth

Mode VNC : vncserver(s)

- **file /usr/bin/vncserver**

```
/usr/bin/vncserver: a /usr/bin/perl script text  
$geometry = "1200x900";
```

- **ls -l ~/.vnc**

```
-rw----- 1 vue users      8 2010-05-07 11:10 passwd  
-rw-r--r-- 1 vue users 1145 2010-12-01 15:18 vuevsm:4.log  
-rw-r--r-- 1 vue users     5 2010-12-01 15:17 vuevsm:4.pid  
-rwxr-xr-x 1 vue users   575 2010-05-07 13:43 xstartup  
-rwxr-xr-x 1 vue users  1234 2010-05-07 11:10 xstartup.turbovnc
```

Mode VNC : vncviewer

```
vncviewer [options] [host][:display]
```

```
vncviewer [options] [host][::port]
```

```
vncviewer [options] -listen [display]
```

```
{tigervnc} vncviewer -help
```

Mode VNC : divers

- firefox `http://{server}:{5800+n}`
-> utilise java
- tunel ssh
 1. `ssh -L {5900+n}:localhost:{5900+n} {user}@{server}`
 2. `vncviewer localhost:{n}`

VirtualGL configuration avancée

- Variables d'environnement serveur :

- VGL_CLIENT = {c}
- VGL_COMPRESS = proxy | jpeg | rgb | xv | yuv
- VGL_DISPLAY = {d}
- VGL_FORCEALPHA = 0 | 1
- VGL_FPS = {f}
- VGL_GAMMA = {g}
- VGL_GLLIB = {l}
- VGL_GUI = {k}
- VGL_INTERFRAME = 0 | 1
- VGL_LOG = {l}
- VGL_LOGO = 0 | 1
- VGL_NPROCS = {n}
- VGL_PORT = {p}
- VGL_PROFILE = 0 | 1
- VGL_QUAL = {q}
- VGL_READBACK = none | pbo | sync
- VGL_SAMPLES = {s}
- VGL_SPOIL = 0 | 1
- VGL_SPOILLAST = 0 | 1
- VGL_SSL = 0 | 1
- VGL_STEREO = left | right | quad | rc
- VGL_SUBSAMP = gray | 1x | 2x | 4x | 8x | 16x
- VGL_SYNC = 0 | 1
- VGL_TILESIZE = {t}
- VGL_TRACE = 0 | 1
- VGL_TRANSPORT = {t}
- VGL_TRAPX11 = 0 | 1
- VGL_VERBOSE = 0 | 1
- VGL_X11LIB = {l}
- VGL_XVENDOR = {v}

VirtualGL configuration avancée

Variables d'environnement client :

- VGLCLIENT_DRAWMODE = *ogl* | *x11*
- VGLCLIENT_LISTEN = *sslonly* | *nossl*
- VGLCLIENT_PORT = {*p*}
- VGL_PROFILE = 0 | 1
- VGLCLIENT_SSLPORT= {*p*}
- VGL_VERBOSE= 0 | 1

VirtualGL configuration avancée

Outils d'analyses:

- nettest
- cpustat
- tcbench

Tests VirtualGL

Applications :

- glxspheres
- paraview
- ...

Virtual : Documentations

- /opt/VirtualGL/doc
- /opt/share/man/man1
- /opt/TurboVNC/man/man1/
Xserver.1 Xvnc.1 vncconnect.1 vncpasswd.1 vncserver.1
vncviewer.1
- /opt/tigervnc/man/man1
vncconfig.1 vncpasswd.1 vncserver.1 vncviewer.1 x0vncserver.1
- <http://www.virtualgl.org>
- <http://sourceforge.net/projects/tigervnc/>

VirtualGL

Questions

sggi[®]
accelerating
results[™]

