



Leibniz Supercomputing Centre
of the Bavarian Academy of Sciences and Humanities



Remote Visualisation for LRZ Users

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What is Remote Visualisation?

- Idea to render images based on data, which is not stored locally on the system where you are observing the rendering
- Two different approaches are common
 - Remote computation (which we will not handle in detail)
 - Remote visualisation (at which we will have a closer look)

What is Remote Visualisation?



Developed by Thomas Köckerbauer at Institute of Graphics and Parallel Processing (GUP), JKU, Linz, AT in 2006



Remote Computation

- Remote side (server)
 - Data is stored remotely
 - Data is typically processed or generated remotely
- Transport mechanism
 - 3D content is streamed as 3D content
- Client side
 - 3D rendering is performed locally on the client side
- Implementation
 - Could be implemented by basic X-forwarding
 - Could be a proprietary solution (e.g. VisIt)

Remote Computation – Architecture

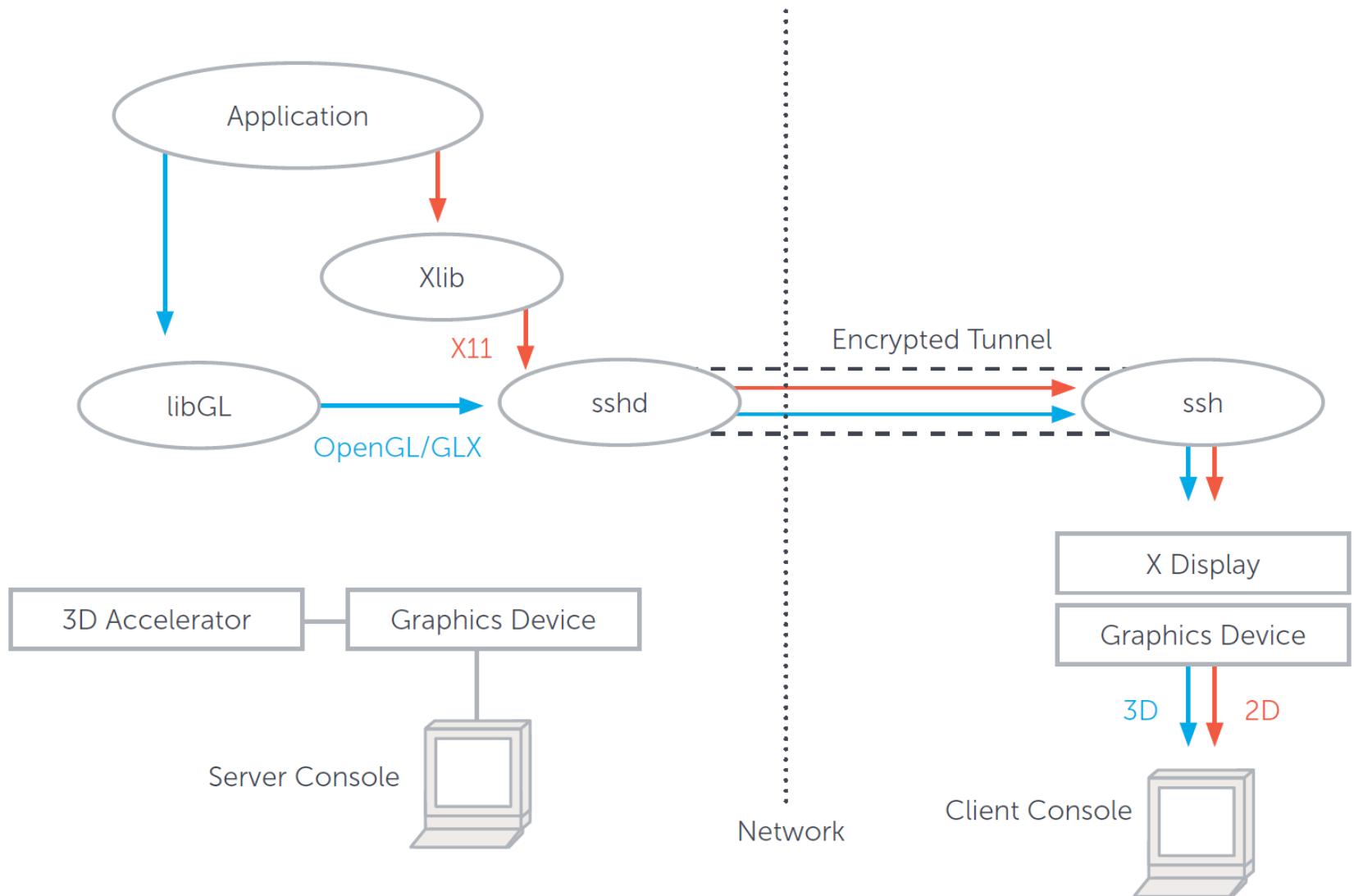


Image taken from: Rankin, S.; Calleja, P. & Coomer, J. *Remote visualisation using open source software and commodity hardware* Dell/Cambridge HPC Solution Centre, 2010



Remote Visualisation

- Remote side (server)
 - Data is stored remotely
 - 3D rendering is performed remotely
- Transport mechanism
 - Video stream is transferred
- Client side
 - Video rendering is performed locally
- Implementation
 - Remote rendering could be performed with VirtualGL
 - Local rendering could be performed with TurboVNC



What are VirtualGL and VNC

■ VirtualGL

- Graphics applications are either build on OpenGL or DirectX
- With OpenGL applications it is possible to “hijack” the stream of graphics commands

■ VNC

- TurboVNC
- TightVNC
- TigerVNC
- noVNC

Remote Visualisation – Architecture

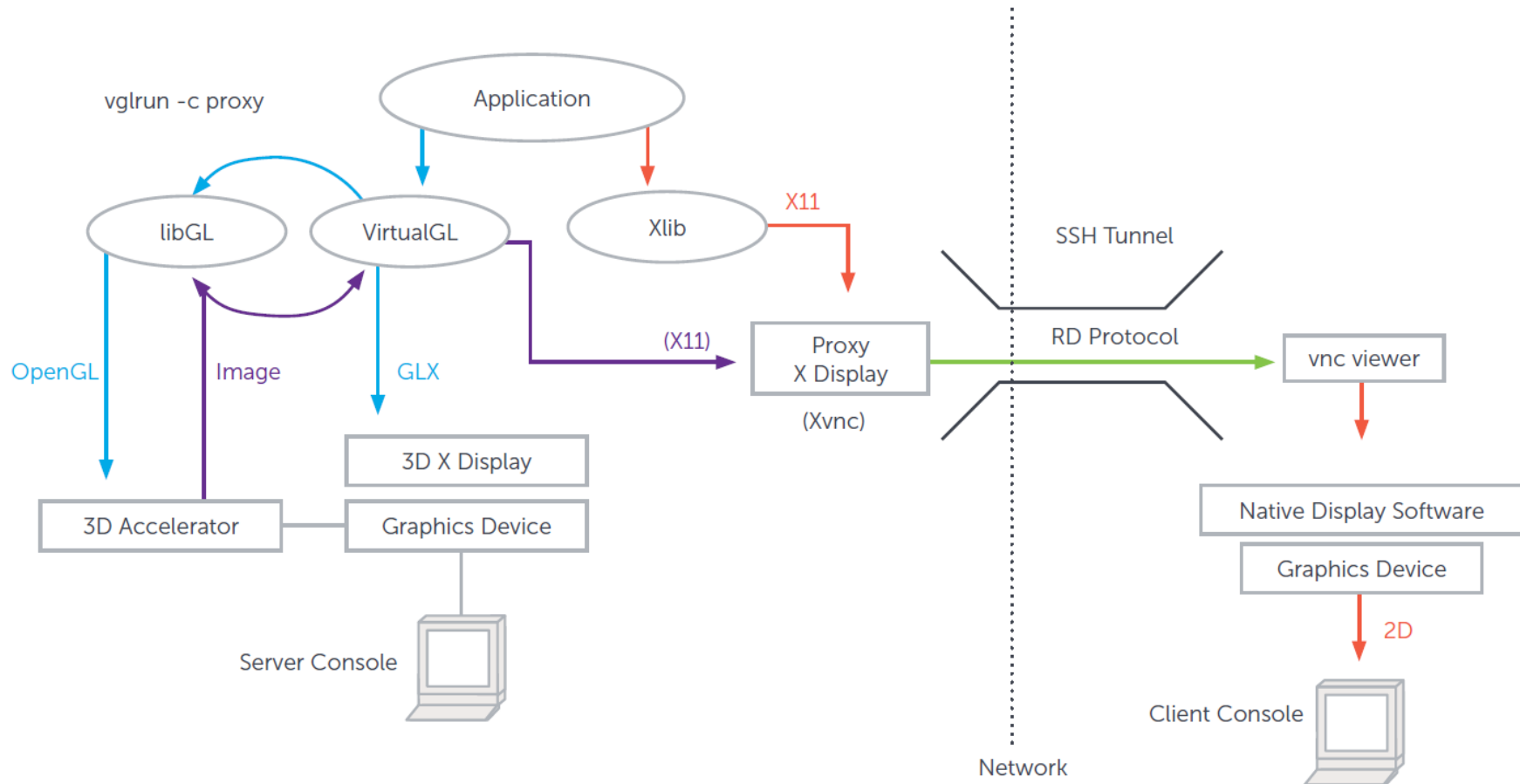


Image taken from: Rankin, S.; Calleja, P. & Coomer, J. *Remote visualisation using open source software and commodity hardware* Dell/Cambridge HPC Solution Centre, 2010

Why is RV usable?

- Where does it make sense?
 - Improved security
 - Less complex administration
 - Reduced hardware costs
 - Reduced software costs
 - Less data transfer
 - Immediate access to visualisation of computation results
- What are the requirements?
 - Basically access to the systems
 - A client system which can somehow perform rendering

■ Latencies

- **Transmission delay** - The time needed to push all the bits onto the link
- **Propagation delay** - The amount of time used by a digital signal to travel from input to output
- **Queuing delay** - Time lost in routing queues, when packet is waiting to be processed

■ Bandwidth requirements and artefacts

- Bandwidth and compression closely related



Infrastructure – Linux Cluster

- Login nodes: lxlogin1.lrz.de to lxlogin4.lrz.de

- Render nodes: gvs1 to gvs4
 - Sun x4600 server
 - 32 cores (8 quad core opterons)
 - 256 GB main memory
 - nVidia Quadro FX 5800

- Connected directories
 - \$WORK, \$HOME, \$SCRATCH



Infrastructure – SuperMUC RVS

- Login node(s): supermuc.lrz.de (5 login nodes)

- Render nodes: rvs1 to rvs6
 - nVidia Kepler GPGPU K20x
 - together with 128 GB RAM

 - Connected directories
 - \$HOME, \$SCRATCH_RVS



Available Software Packages

Amira	http://www.amiravis.com
Avizo	http://www.fei.com/software/avizo3d/
AVS/Express	http://www.avs.com/software/soft_t/avsxps.html
Blender	http://www.blender.org/
Maestro	http://www.schrodinger.com/Maestro/
Ensignt	http://www.ensight.com/ensight-gold.html
Paraview	http://www.paraview.org
PyMOL	http://pymol.org/
R	http://www.r-project.org/
Vapor	http://www.vapor.ucar.edu/
VisIt	http://www.llnl.gov/visit/
VMD	http://www.ks.uiuc.edu/Research/vmd/



Getting Access and Client Requirements

- Required accounts
 - Either Linux Cluster or
 - SuperMUC
 - Details were given in a previous talk

- Required SW on Linux client
 - TurboVNC (<http://sourceforge.net/projects/turbovnc/>)

- Required SW on Windows client
 - TurboVNC (<http://sourceforge.net/projects/turbovnc/>)
 - Putty (<http://www.putty.org/>)

Logging in and running an application

1. **Login to the login node**
 - Via terminal or putty
2. **Set VNC password on the render node**
 - Via terminal and ssh (potentially inside putty terminal)
3. **Reserve graphics pipe on the render node**
 - Via terminal and ssh (potentially inside putty terminal)
 - Reserve graphics pipe (via ssh on the render node)
 - Retrieve display id (will be printed in terminal)
4. **Run TurboVNC and connect (on local machine)**
 - Via terminal or click on desktop icon
 - Requires an SSH tunnel (in Win via putty)
5. **Run application (on remote machine inside the TurboVNC window)**



Logging in – Linux – RVS

1. Login to the login node

- `ssh supermuc.lrz.de`

2. Set VNC password on render node

- `ssh rvs1.cos.lrz.de /opt/TurboVNC/bin/vncpasswd`

3. Reserve graphics pipe on the render node

- `ssh rvs1.cos.lrz.de start_vnc 2`

4. Run TurboVNC and connect

- `vncviewer -via <user-id>@supermuc.lrz.de
rvs5.cos.lrz.de:4` (you receive this line from 3.)

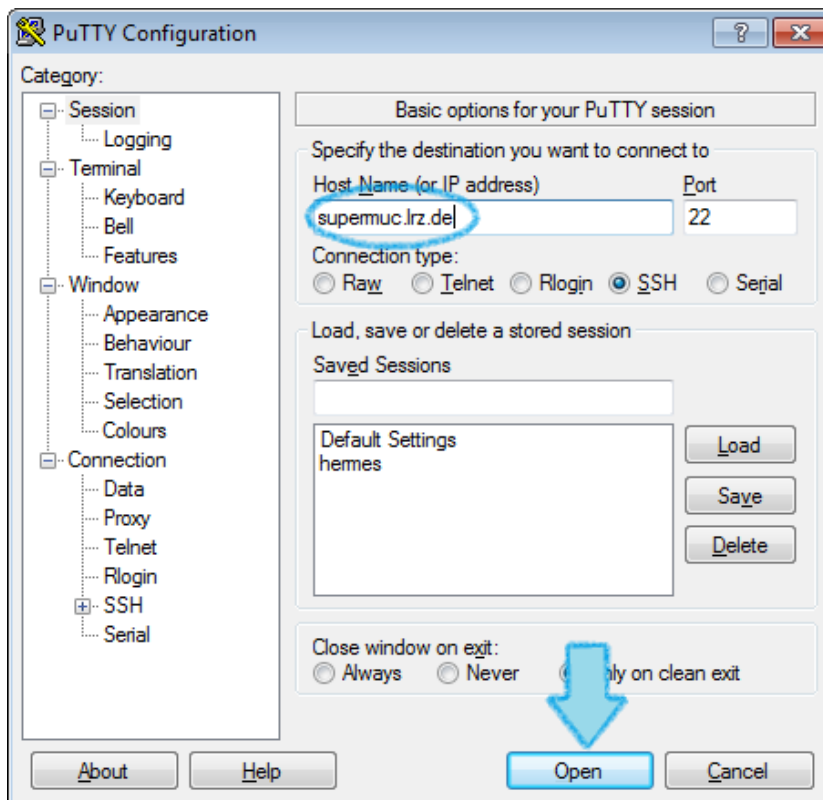
5. Run application

- 1) `module load vmd`

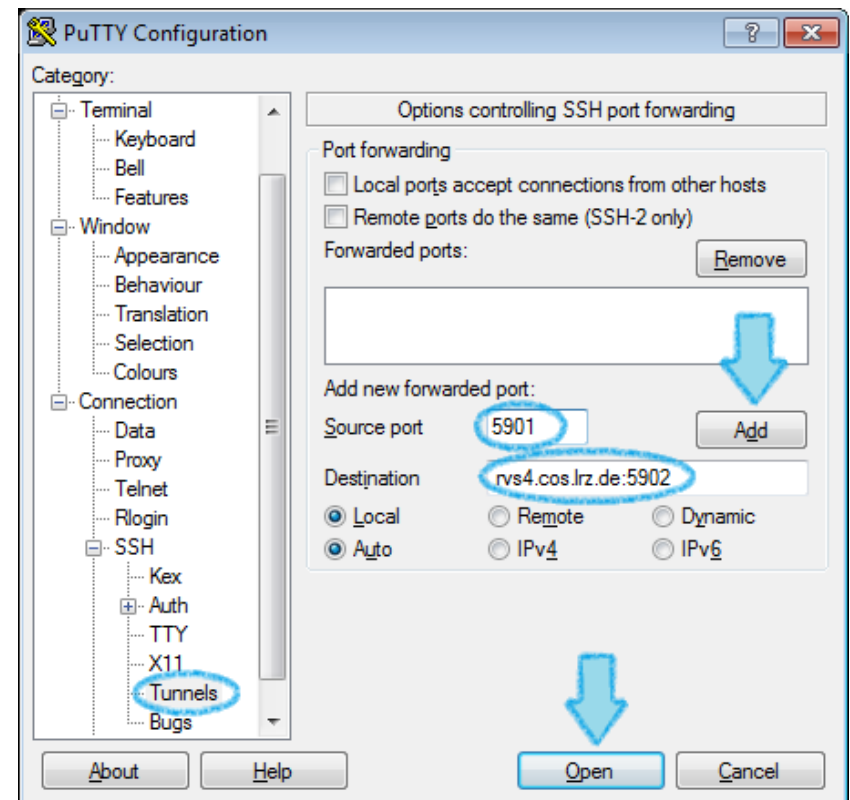
- 2) `vglrun vmd`

Logging in – Windows – RVS

- In general the same procedure as on Linux
- No SSH available in command shell, thus use of putty



Logging in via SSH



Setting up a tunnel

- In general
 - ssh – used for connecting to remote system
- On the remote machine
 - start_vnc and rvnc – scripts running the vncserver
 - vncpasswd – setting of the VNC password
 - module – call to the module system loading for example prerequisites
 - vglrun or rv – accelerated call/script for application
- On the local machine
 - vncviewer – start the TurboVNC viewer



Interacting

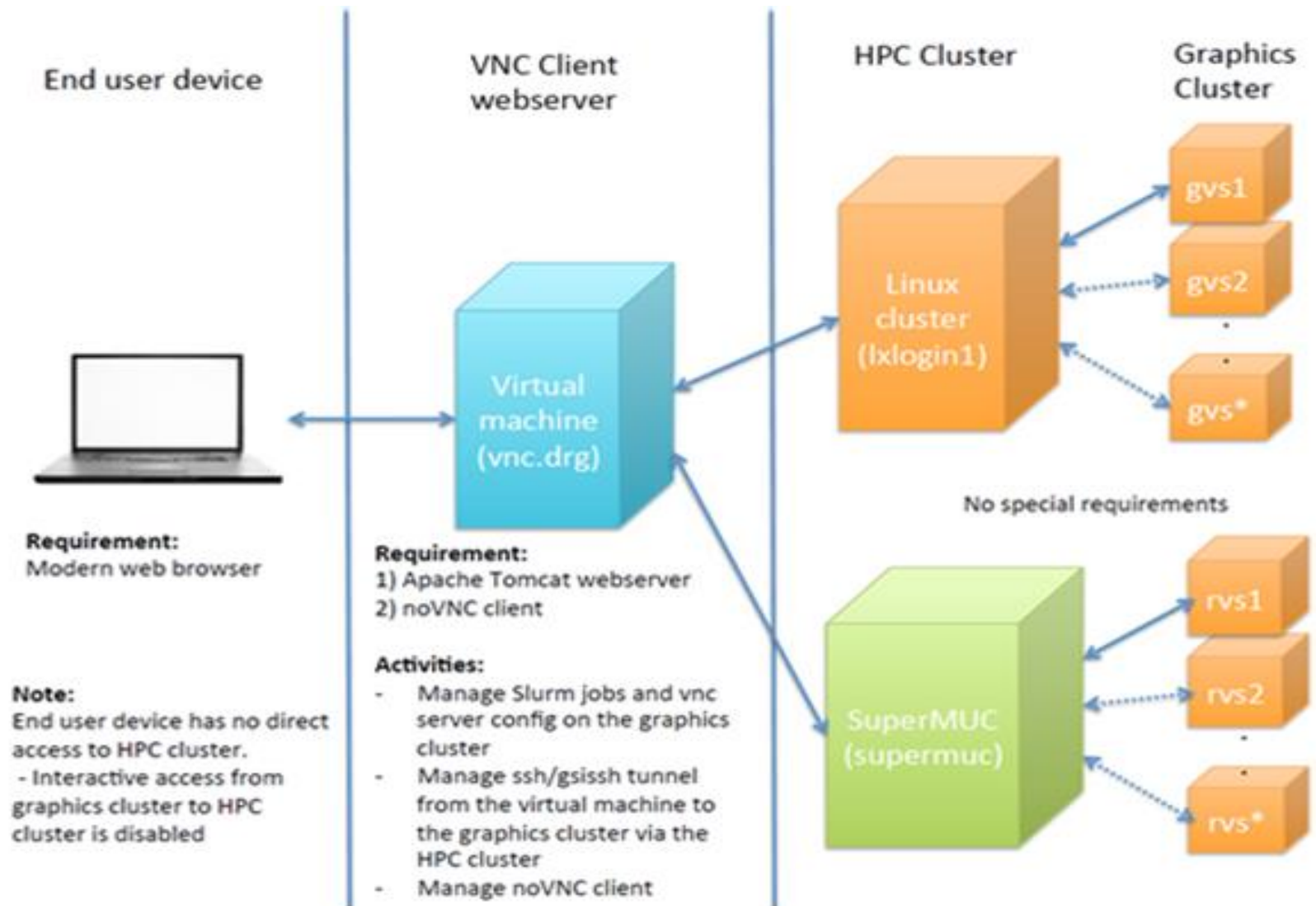
- You can specify the duration of your VNC session
- VNC Session will automatically terminate after 12 hours
- VNC Session will automatically terminate at 4:00am



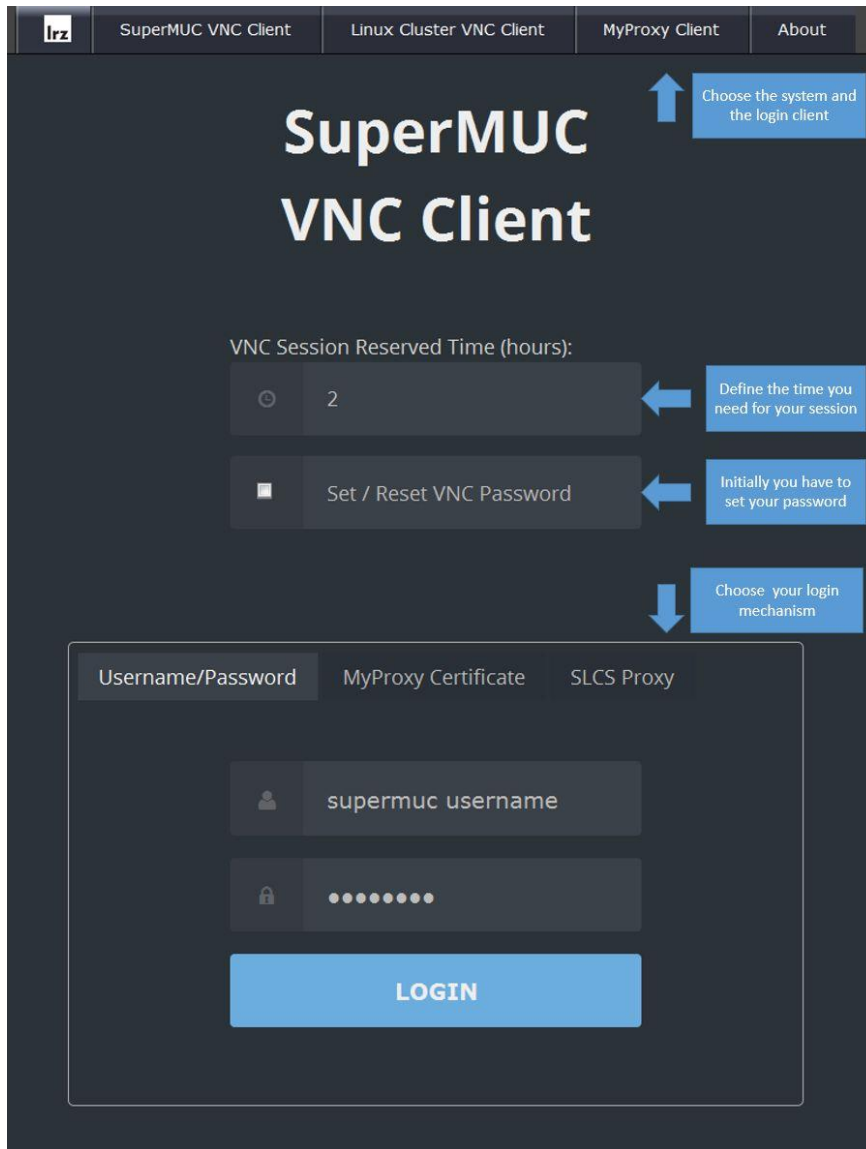
Webclient – Design

- In-house solution – idea to hide complexity and increase availability
- Designed and developed by Siew Hoon (Cerlane) Leong, VER (Distributed Resources Group)
- Support username-password (SSH) and certificate-based (GSISsh) authentication.
- Certificate-based authentication is based on MyProxy service and short lived credential service (SLCS)
- Rendering is redirected to an apache web server with a noVNC client
- User connects via web interface to web server
- Browser has to have a rather recent version

Webclient – Architecture



Webclient – Interface



The screenshot shows the 'SuperMUC VNC Client' web interface. At the top, there are navigation tabs: 'lrz', 'SuperMUC VNC Client', 'Linux Cluster VNC Client', 'MyProxy Client', and 'About'. The main heading is 'SuperMUC VNC Client'. Below this, there is a section for 'VNC Session Reserved Time (hours):' with a spinner control set to '2'. A button labeled 'Set / Reset VNC Password' is also present. At the bottom, there is a login section with three tabs: 'Username/Password', 'MyProxy Certificate', and 'SLCS Proxy'. The 'Username/Password' tab is active, showing a text input field with 'supermuc username', a password field with masked characters, and a blue 'LOGIN' button. Blue arrows and text boxes provide annotations: 'Choose the system and the login client' points to the navigation tabs; 'Define the time you need for your session' points to the session time spinner; 'Initially you have to set your password' points to the password button; and 'Choose your login mechanism' points to the login tabs.

- Choose your System
- Specify the duration
- Set your VNC password
- Choose your authentication method
- For example:
 - Provide your username
 - Provide your password
- Click on login
- Requirements for browser
 - Open ports: 6080-6200 (outgoing)
 - Allow pop-ups for this site



Webclient - https://vnc.drg.lrz.de/

LRZ: Leibniz-Rechenzentrum x +

www.lrz.de

Google

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