JÜLICH
FORSCHUNGSZENTRUM

Visualization on JURECA

June 15, 2016

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Outline

- **Remote Rendering**
- In-Situ Visualization

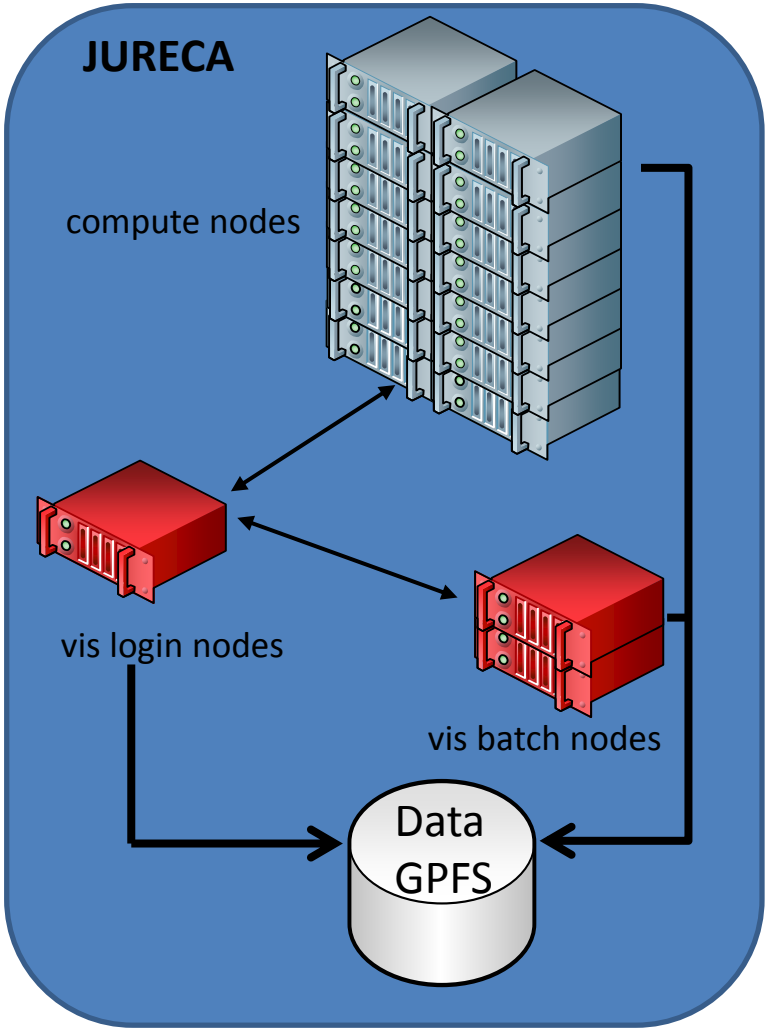
Visualization: General Hardware Setup

12 Visualization Nodes

- 2 GPUs Nvidia Tesla K40 per node
  - 12 GB RAM on each card

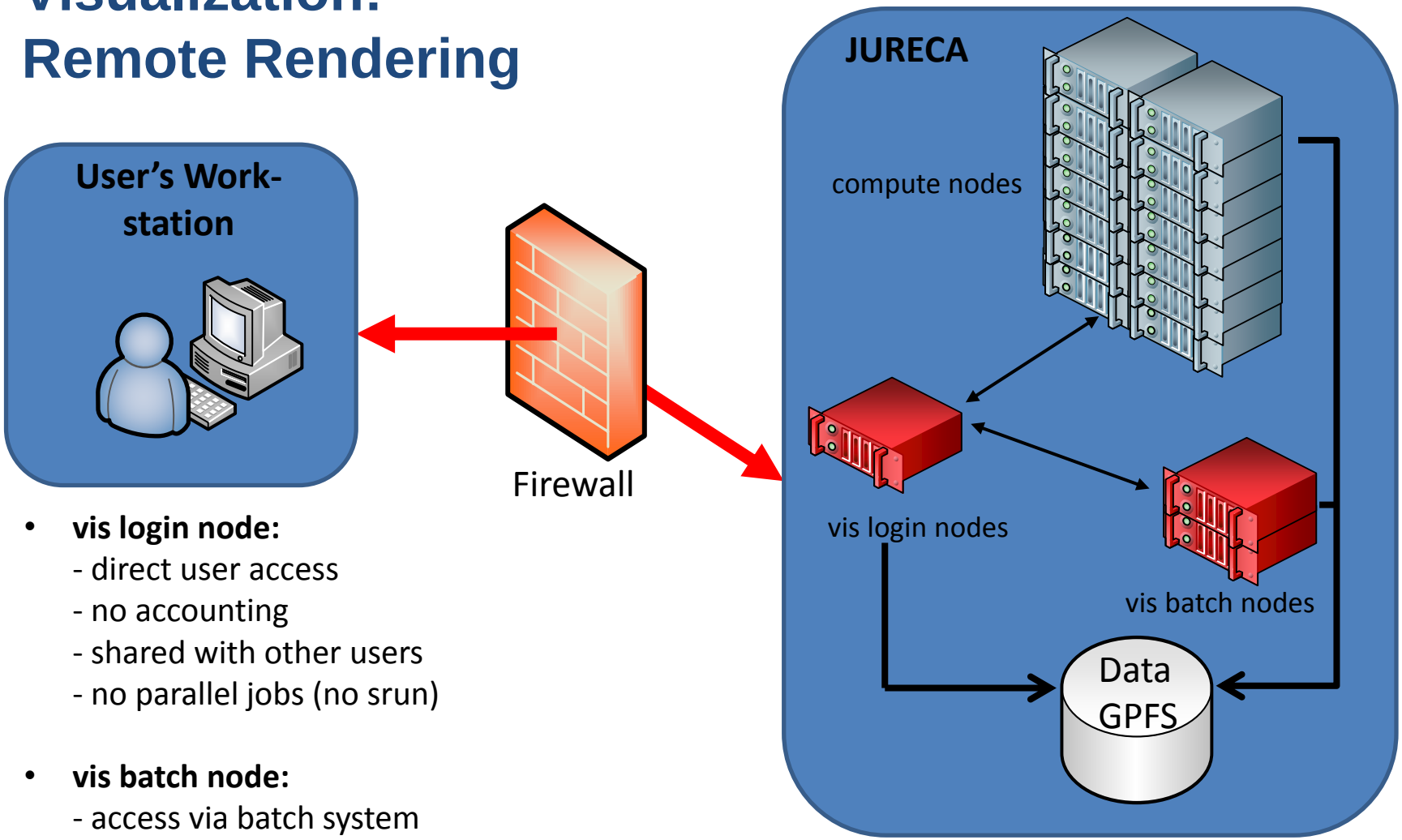
- **2 Login Visualization Nodes**
  - jurecavis.fz-juelich.de

- **10 Batch Visualization Nodes**
  - 8 nodes with 512 GB RAM
  - 2 nodes with 1024 GB RAM
  - Special partition named "**vis**"



Visualization also possible on nodes without GPU's (software rendering)

Visualization: Remote Rendering

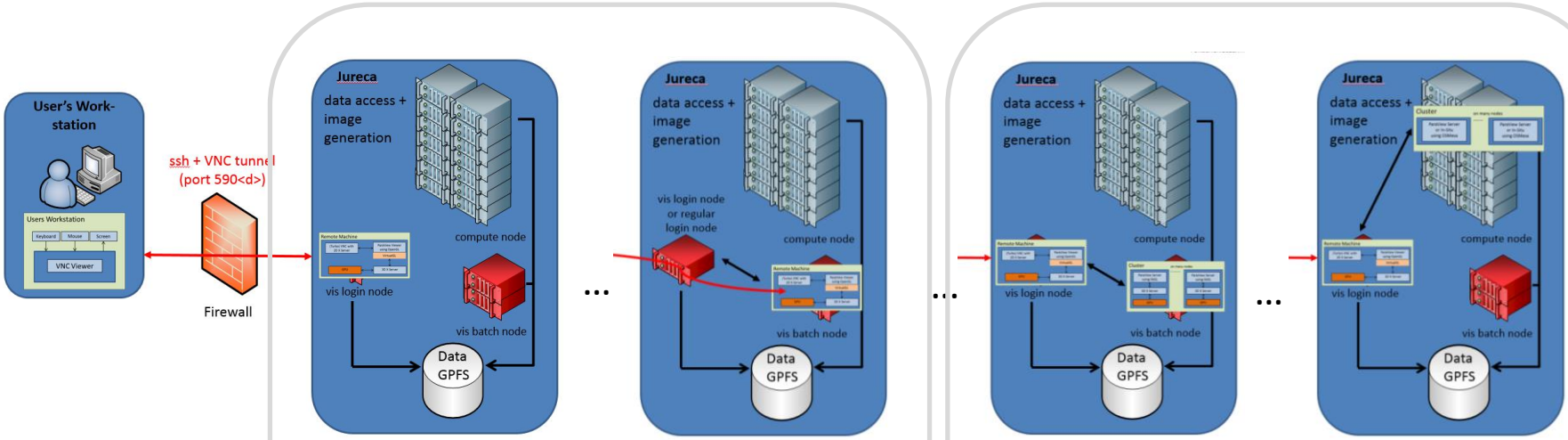


- **vis login node:**
  - direct user access
  - no accounting
  - shared with other users
  - no parallel jobs (no srun)

- **vis batch node:**
  - access via batch system
  - accounting
  - exclusive usage
  - parallel jobs possible

Visualization:
Remote Rendering

Visualization Scenarios:
using remote graphical desktop (with VNC)c



user -> ...

... -> vis login node ... -> vis batch node(s)

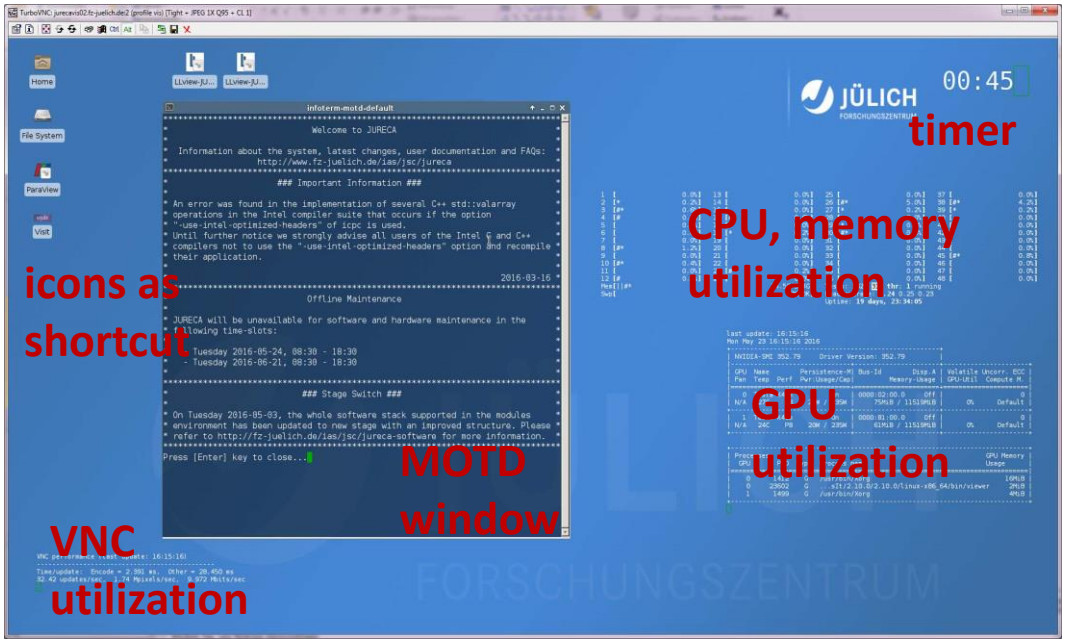
... -> vis login node
-> mult. vis batch nodes
-> mult. compute nodes

Visualization Scenarios: non-VNC
client runs on users workstation and connects to a server on JURECA

Visualization:
VNC – remote graphical desktop

- hardware rendering (GPU acceleration) with VirtualGL
- only (compressed) images are transferred
- interactive frame rates
  with moderate WAN bandwidth

- look-and-feel like a local desktop
- direct access to GPFS
- high network bandwidth,
  latency, quality of rendering



current VNC Profile “vis”

Attention:

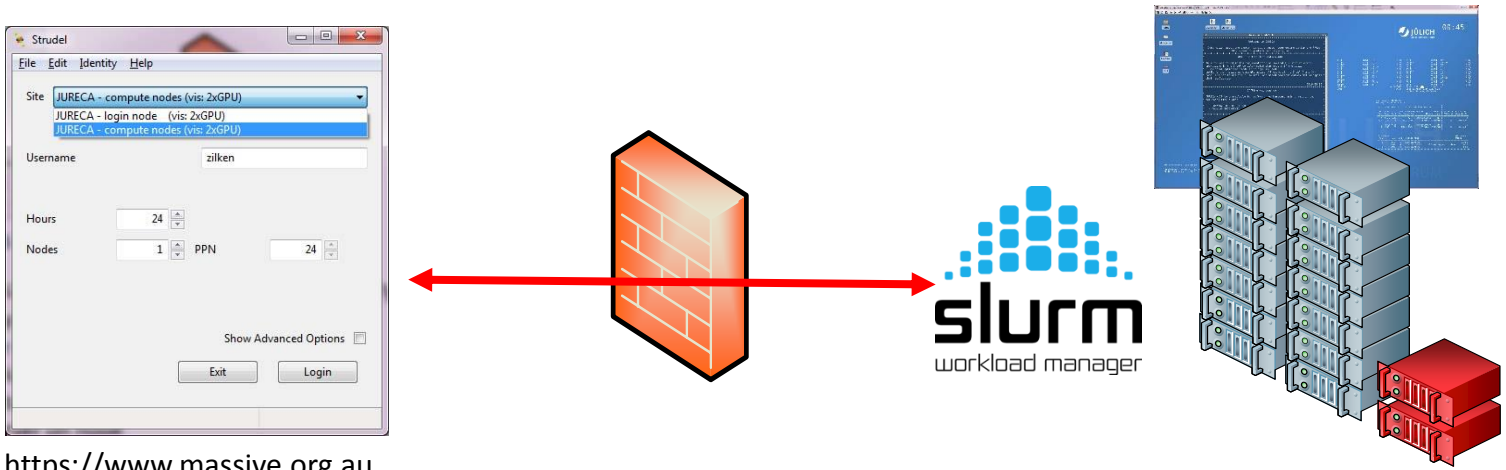
- start any OpenGL application with “vglrun”
- make sure it appear on the “GPU utilization” panel

https://trac.version.fz-juelich.de/vis/wiki/vnc3d

Visualization:
VNC – remote graphical desktop

Strudel (ScienTific Remote Desktop Launcher)

Complex VNC scenarios become easy to use for any user



https://www.massive.org.au

1) Install TurboVNC
2) Load your SSH key into the SSH key agent
3) Start Strudel and login

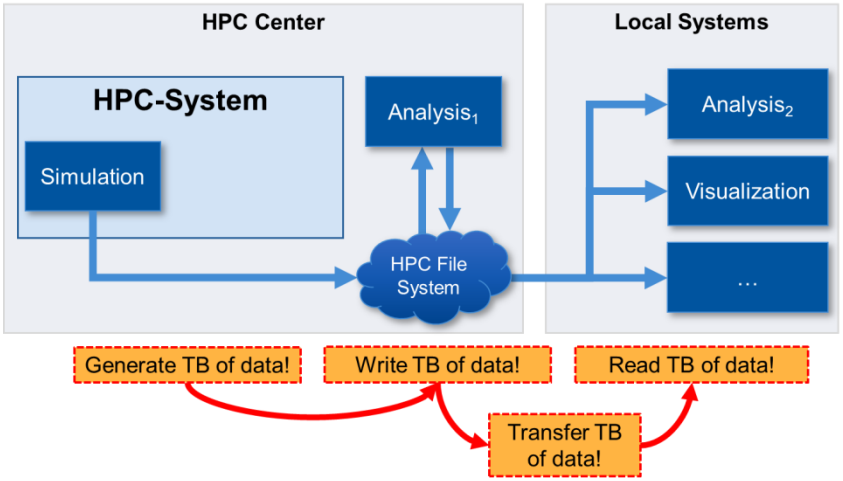
Download & Install instructions:
https://trac.version.fz-juelich.de/vis/wiki/vnc3d/strudel

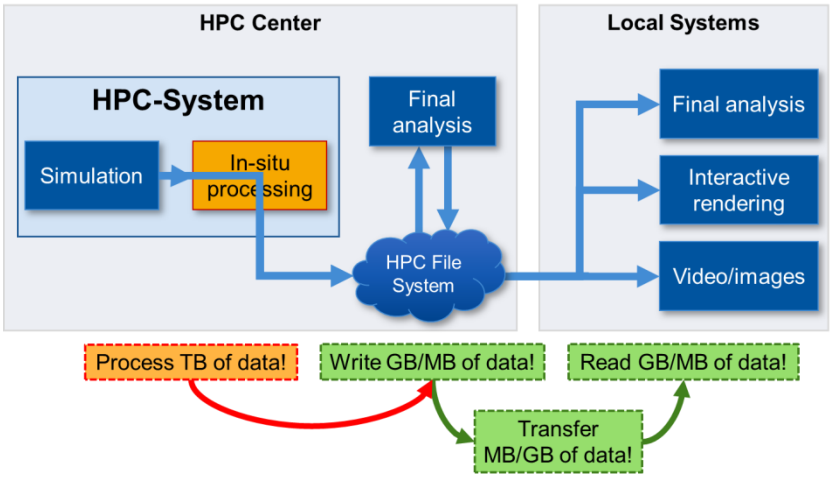
Outline

- Remote Rendering
- **In-Situ Visualization**

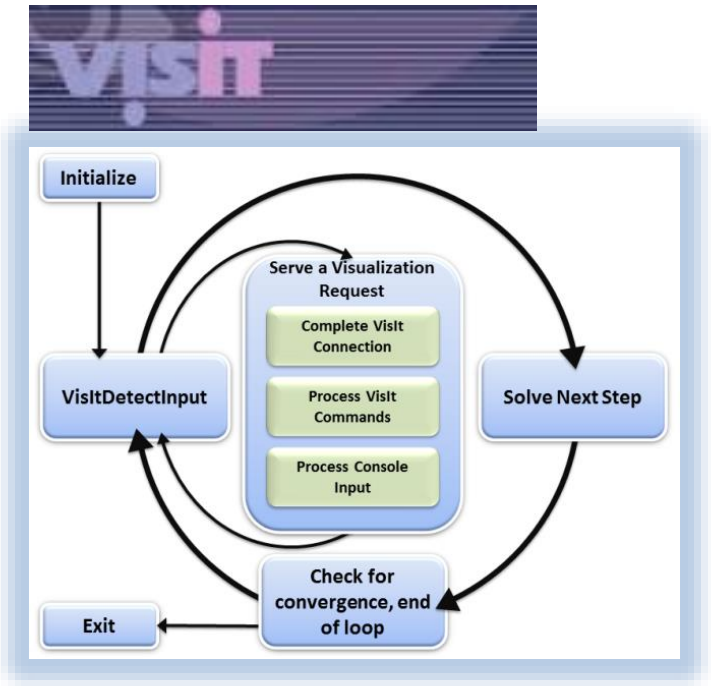
In-Situ Visualization: Motivation

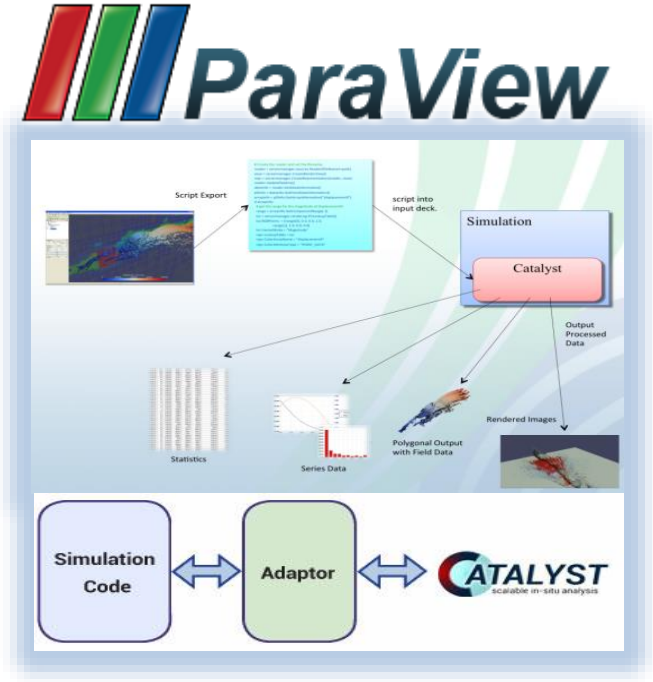
- Visualizing highly resolved simulations can easily result in large amount of data.
- Reading/Writing this data can become far too expensive.
- In-Situ visualization can avoid this unnecessary reading/writing.
- Not only for visualization, but for post-processing in general I/O can become a major bottleneck. **=> in-situ processing**





In-Situ Visualization: Common Software

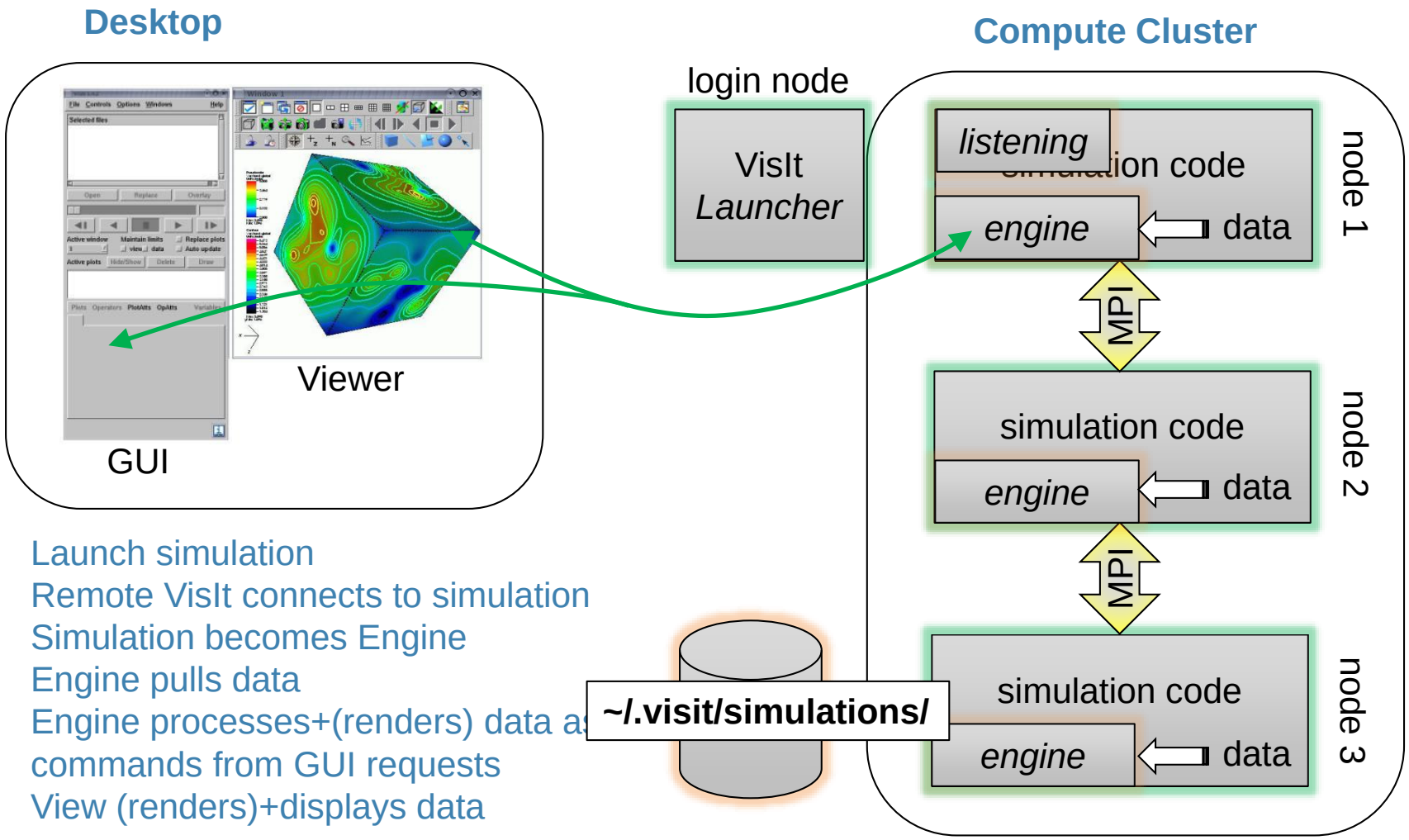




VisIt
developed by multiple national US labs
funded by Department of Energy (DOE)
initial release 2002
hosted at LLNL
open source (BSD)

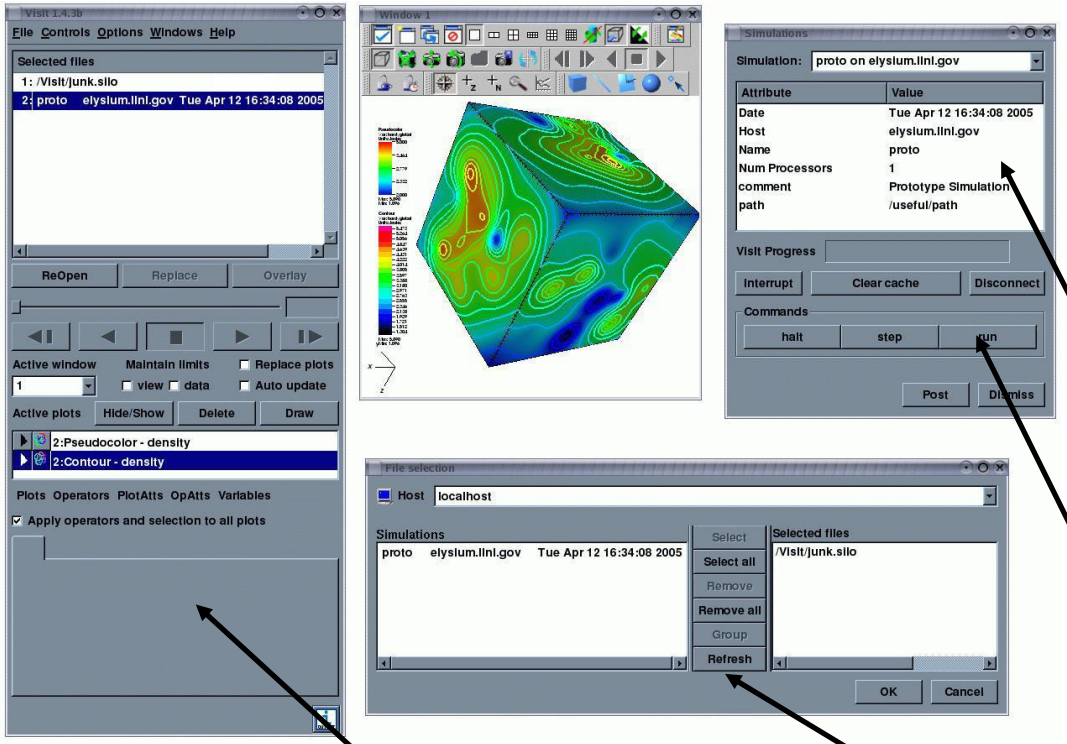
ParaView
developed by Kitware
+ Los Alamos National Lab
funded by Department of Energy (DOE)
initial release 2002
hosted by Kitware
open source (BSD)

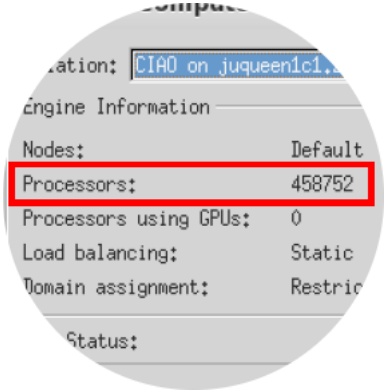
In-Situ Visualization: with VisIt/Libsim



1. Launch simulation
2. Remote VisIt connects to simulation
3. Simulation becomes Engine
4. Engine pulls data
5. Engine processes+(renders) data as commands from GUI requests
6. View (renders)+displays data

In-Situ Visualization: with VisIt/Libsim





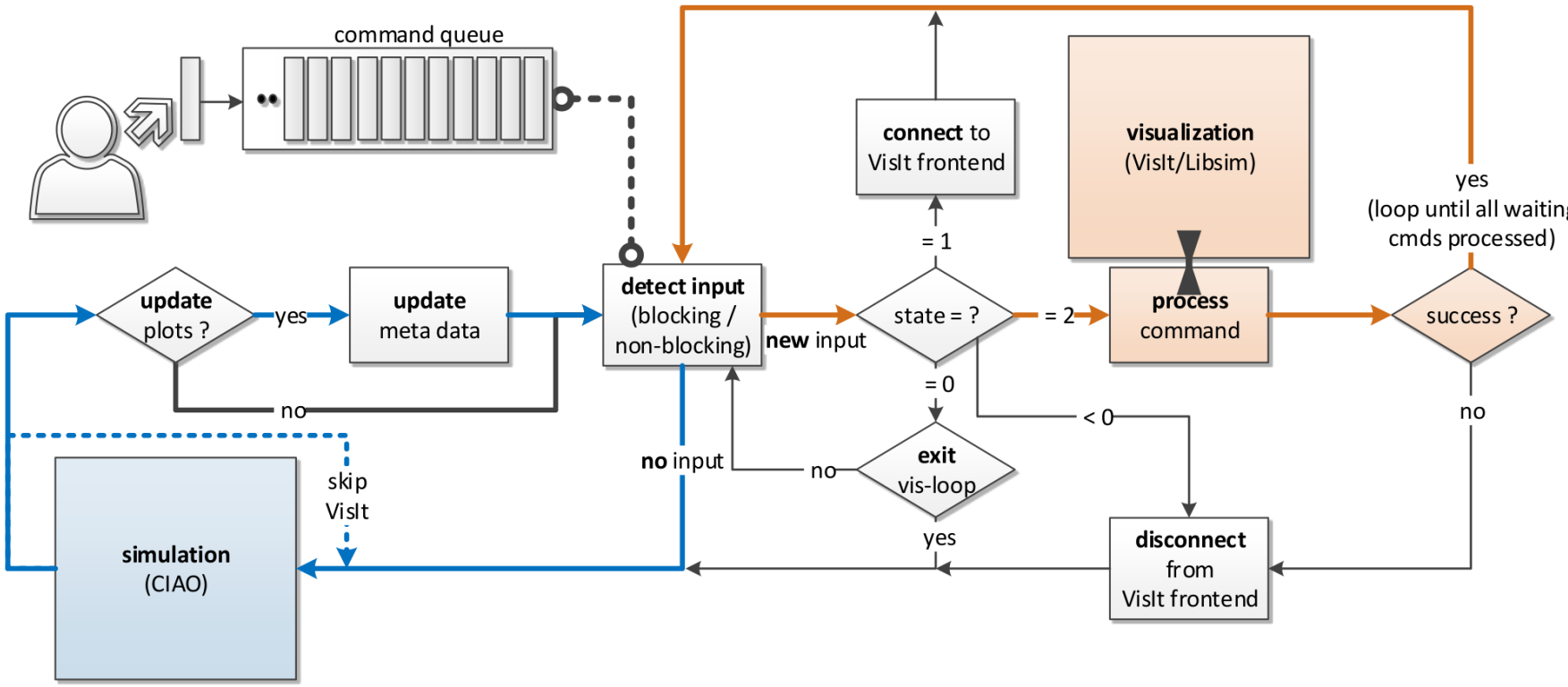
The simulation windows shows the meta-data about the running code

Control commands defined by the simulation code accessible here.

All VisIt existing functionality is accessible.

User selects running simulations to connect to as if they were files.

In-Situ Visualization: with VisIt/Libsim



https://trac.version.fz-juelich.de/vis/wiki/VisIt/libsim

In-Situ Visualization: Quick & Easy

Virtual-Box Images are available (on USB-stick) to have an easy start with In-Situ Visualization based on VisIt/libsim and JUSITU.

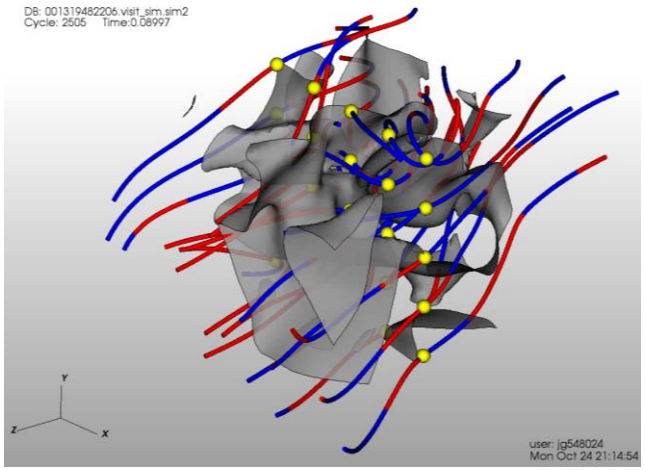
1) get the „JUSVis“ VirtualBox-Image
2) start VirtualBox and import appliance (File->Import Appliance)
   user: jscvis passwd: jscvis root-passwd: jscvis

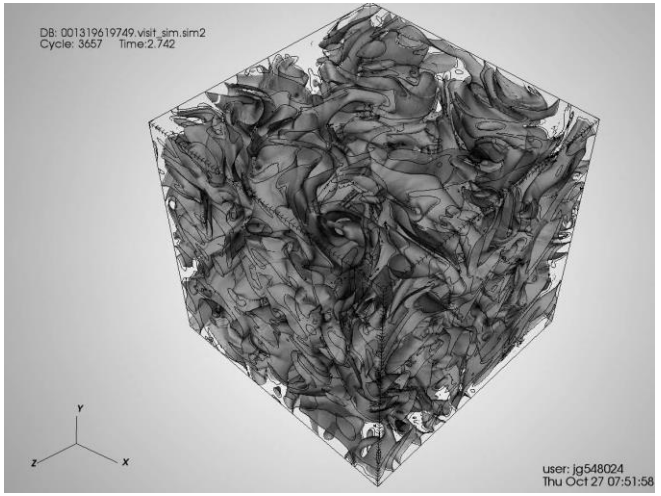
3) cd ~/Software/insitu/
4) mkdir jusitu-build; cd jusitu-build
5) cmake ../jusitu-15042016; make
6) cd examples/JUSSim; ./JUSSim

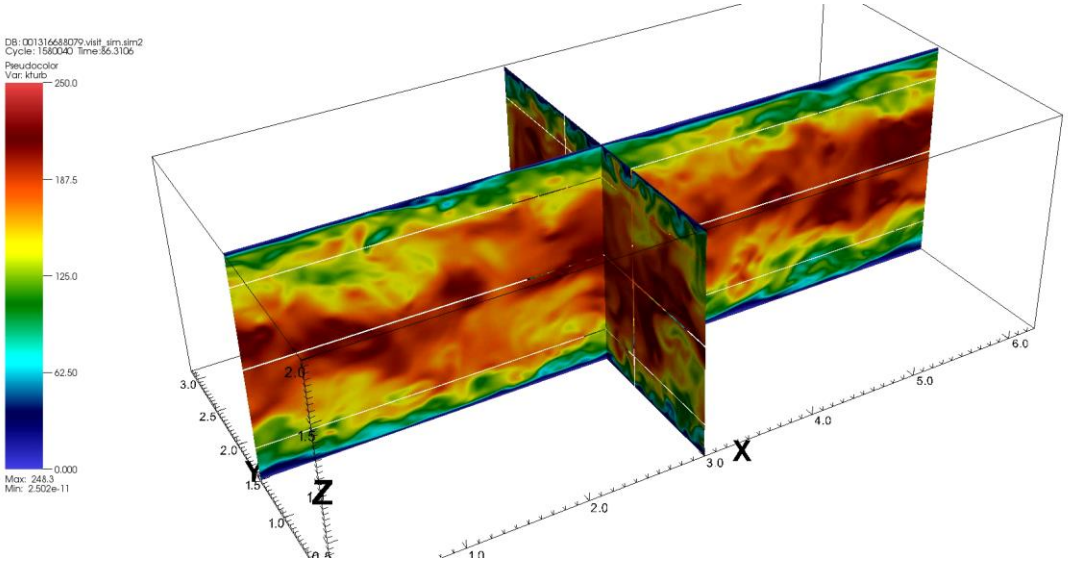
7) start VisIt and open ~/.visit/simulation/…simulation.sim2
8) Add-> Mesh3D; Draw

VisIt/Libsim examples
http://visit.ilight.com/svn/visit/trunk/src/tools/DataManualExamples/Simulations/

JUSITU - https://gitlab.version.fz-juelich.de/vis/jusitu


DB: 001319482206.visit_sim.sim2
Cycle: 2505 Time:0.08997
user: jg548024
Mon Oct 24 21:14:54


DB: 001319619749.visit_sim.sim2
Cycle: 3657 Time:2.742
user: jg548024
Thu Oct 27 07:51:58


DB: 001316688079.visit_sim.sim2
Cycle: 1580040 Time:86.3106
Pseudocolor
Var: kturb
250.0
187.5
125.0
62.50
0.000
Max: 248.3
Min: 2.502e-11
X
Z

Visualization with VisIt Tutorials

http://www.visitusers.org/index.php?title=

- Tutorial_Preparation
- VisIt-tutorial-basics
- VisIt-tutorial-data-analysis
- VisIt-tutorial-Python-scripting

http://www.visitusers.org/index.php?title=

- Blood_Flow_Aneurysm_Tutorial_Dataset_Exploration
- Blood_Flow_Aneurysm_Tutorial_Vector_Field_Visualization
- Blood_Flow_Aneurysm_Tutorial_Calculating_Flux

JURECA Visualization Related Documentation

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Entry point is
https://trac.version.fz-juelich.de/vis/

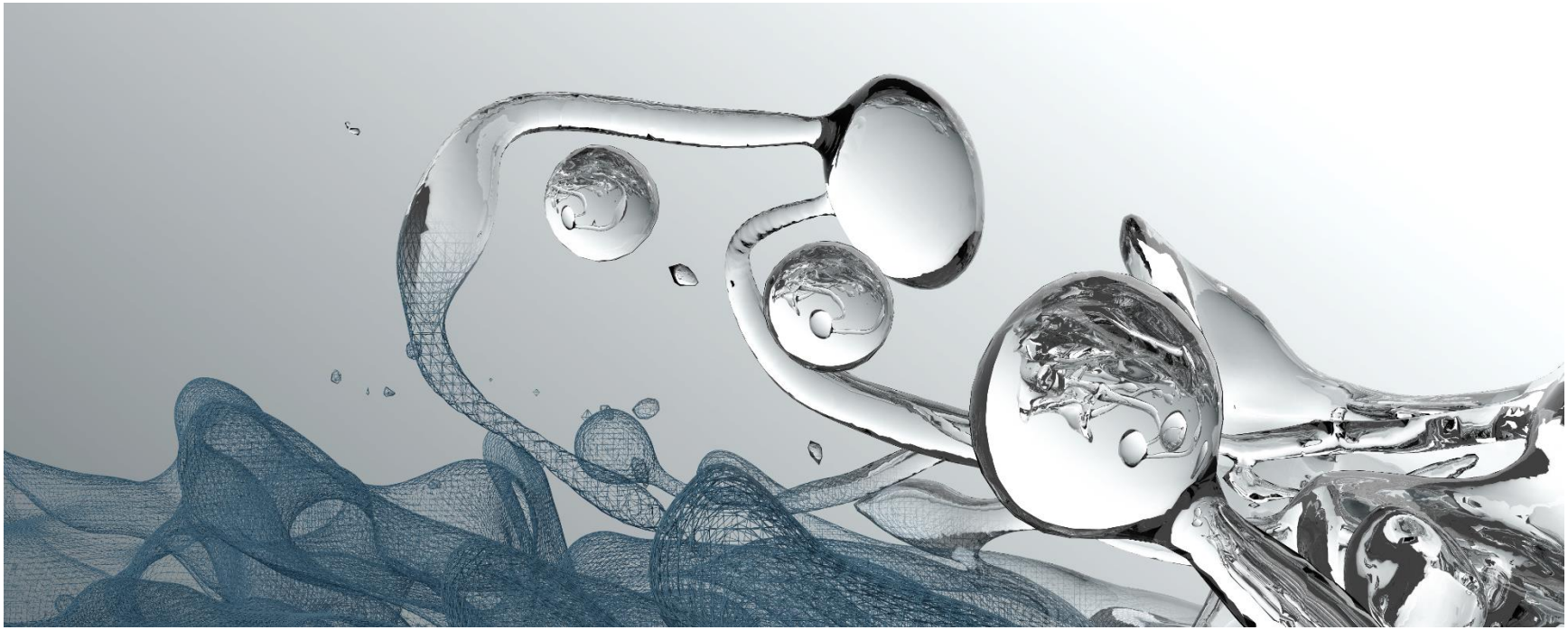
Docu related to VNC (remote graphical desktop)
https://trac.version.fz-juelich.de/vis/wiki/vnc3d

Docu related to VisIt:
https://trac.version.fz-juelich.de/vis/wiki/VisIt

Docu related to ParaView:
https://trac.version.fz-juelich.de/vis/wiki/ParaView

GitLab of JUSITU:
https://gitlab.version.fz-juelich.de/vis/jusitu

Thank you for your attention
Questions ?



rendered with Blender from a DNS of a diesel injection spray of ITV, RWTH Aachen University