

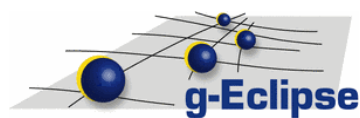


The GVK/GVid Approach: Visualization on the Grid

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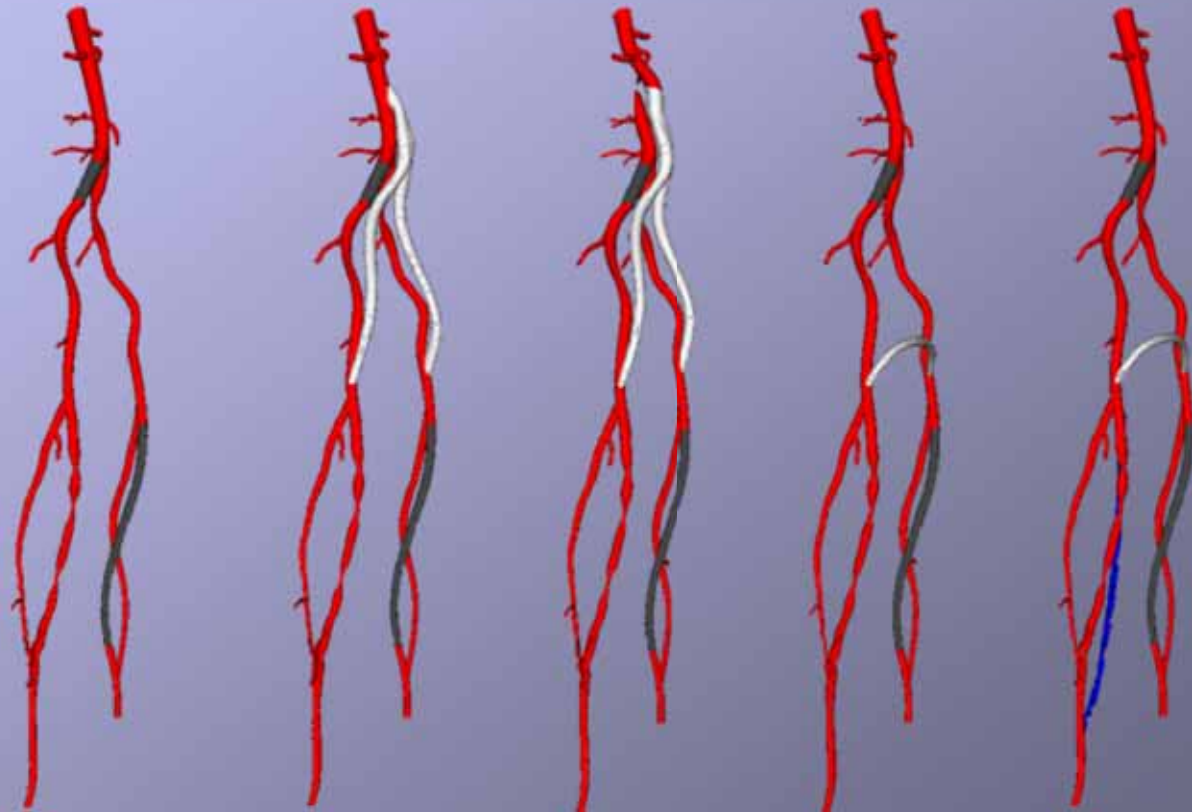
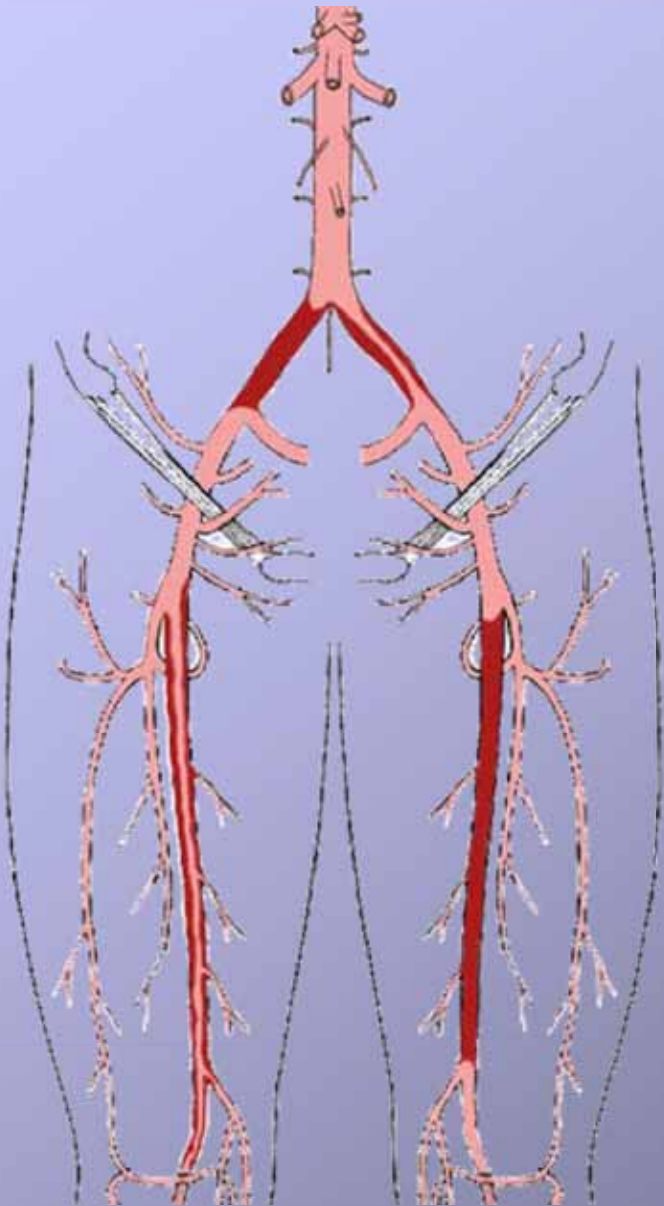
Example: Biomedical Investigation

1. Obtain data from medical scanner
2. Perform simulation on medical data on the grid
3. Analyze results from simulation





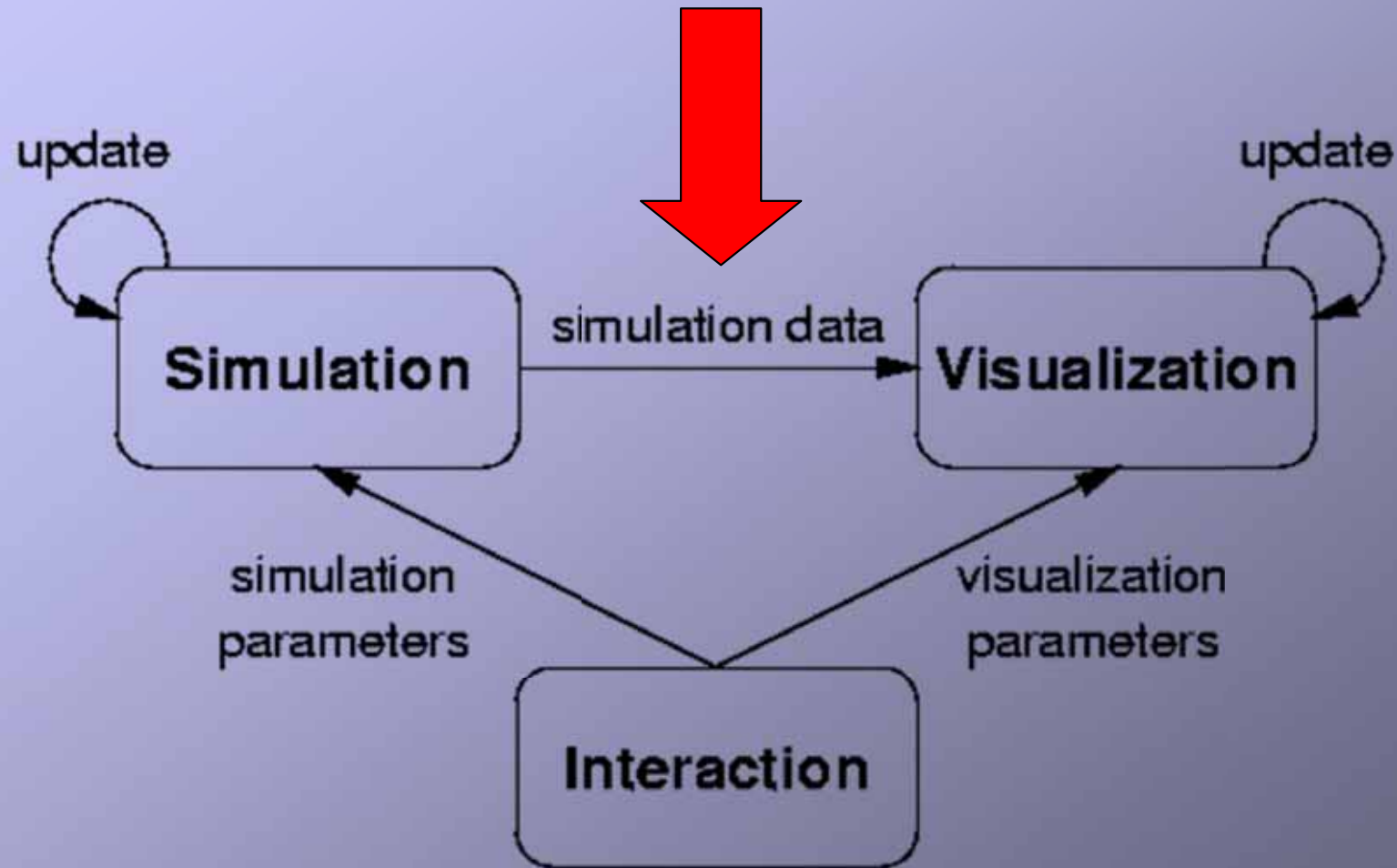
Influencing the Simulation



Change parameters and see how they influence the results of the simulation

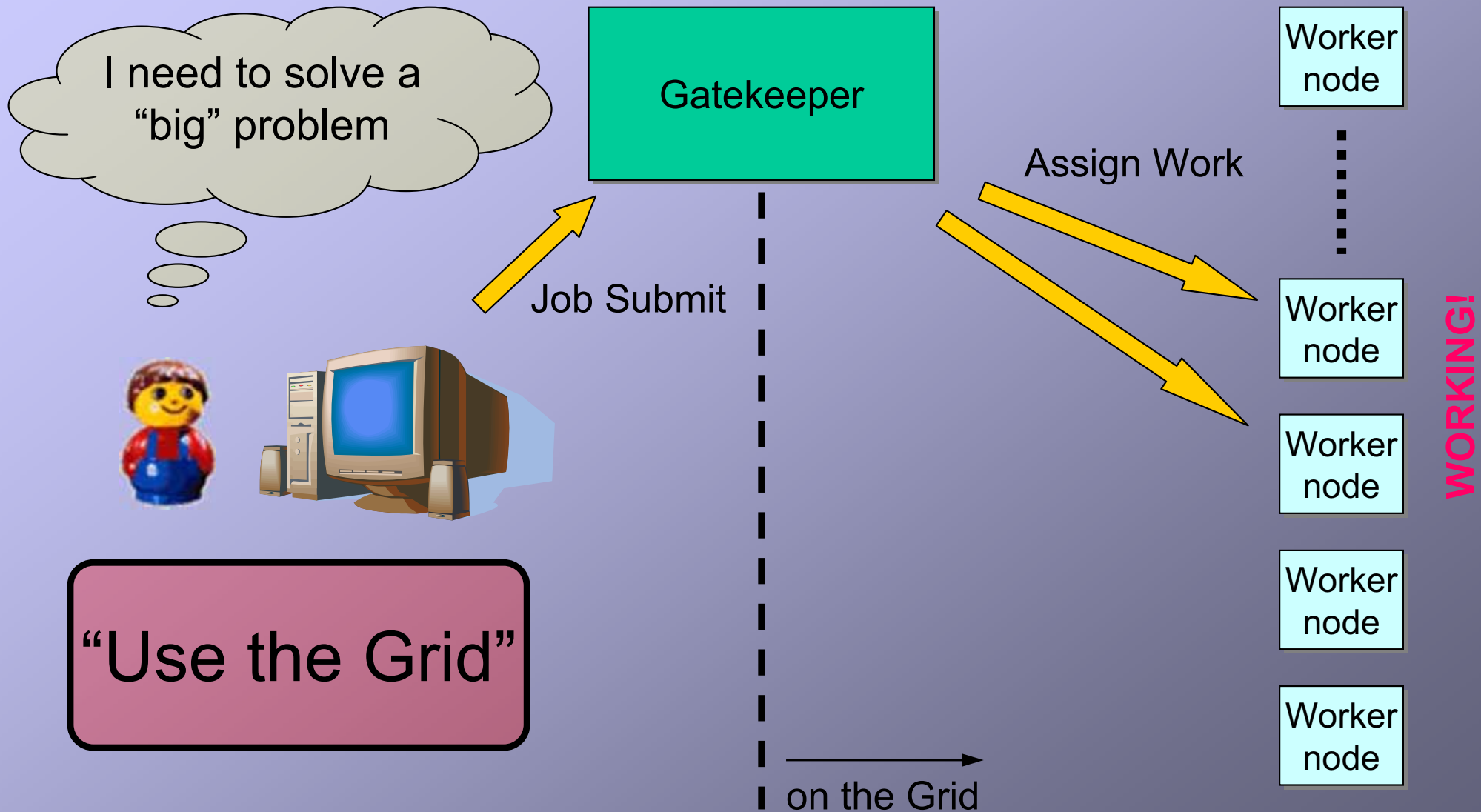


"Putting the User into the Loop"



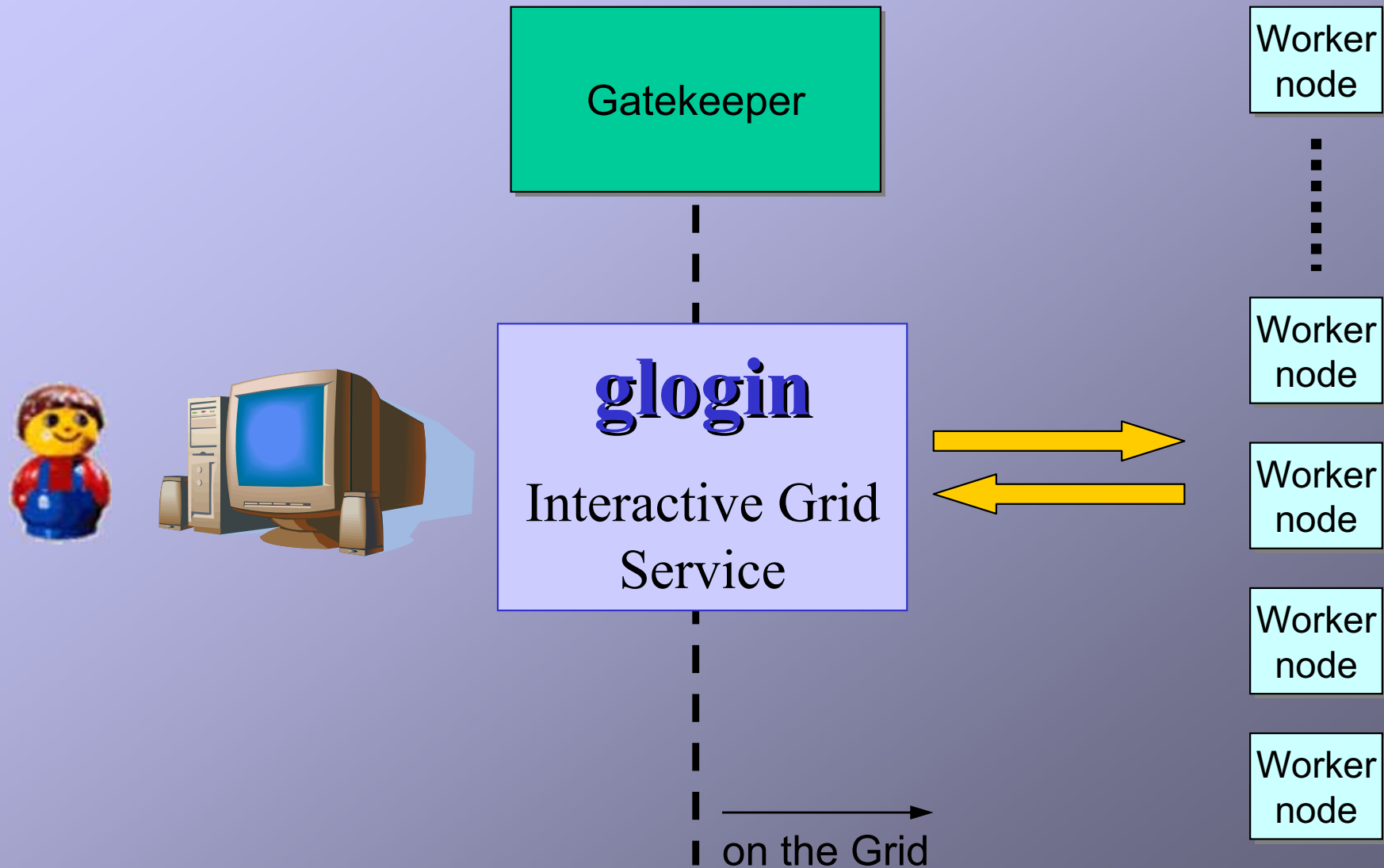


„Into the Grid“





Shell Access



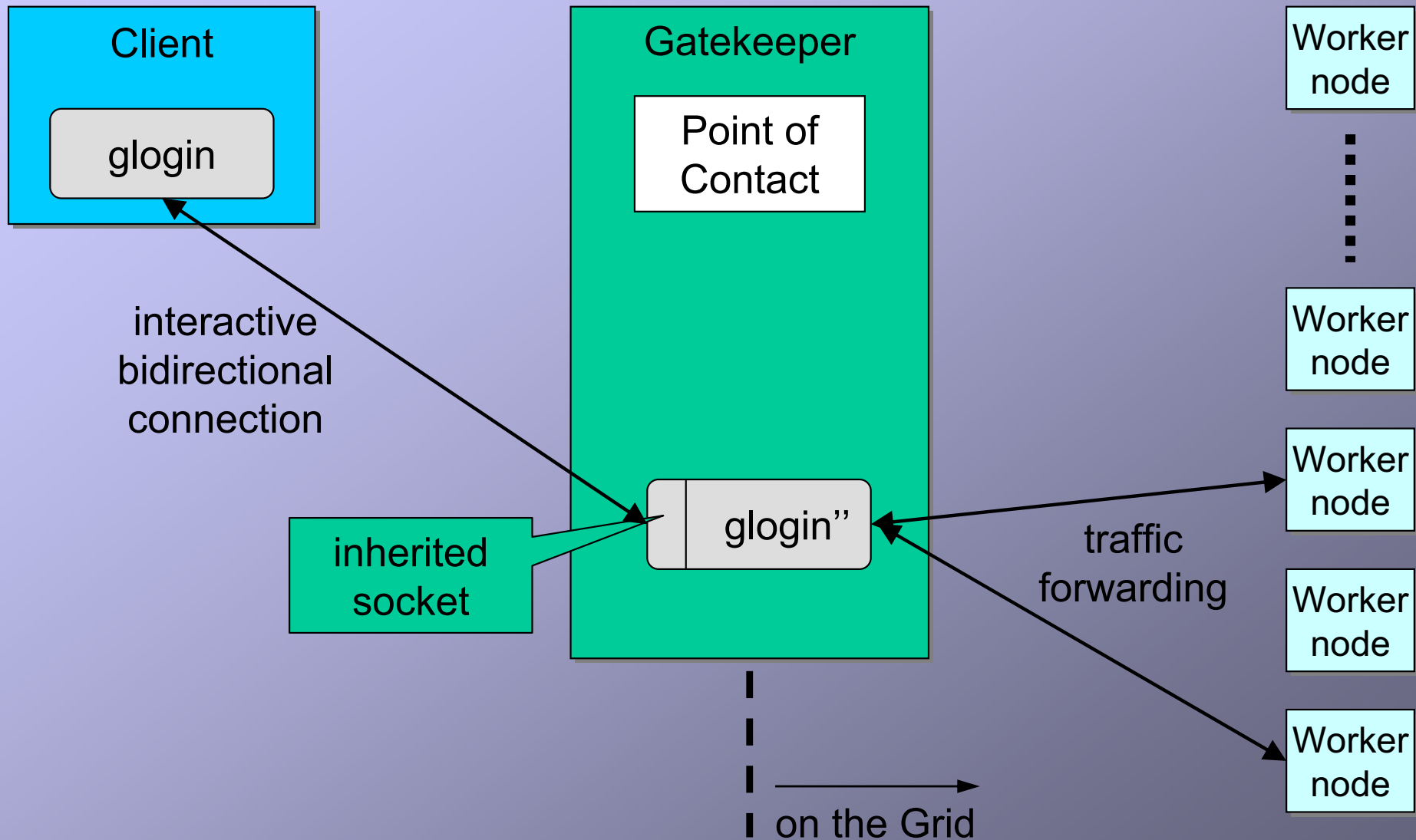


glogin ...

- ... enables online communication between nodes on the Grid and off the Grid
- ... provides shell functionality for access to Grid nodes
- ... is a standard (lightweight) Grid job
- ... is easy to install and use
- ... is secure

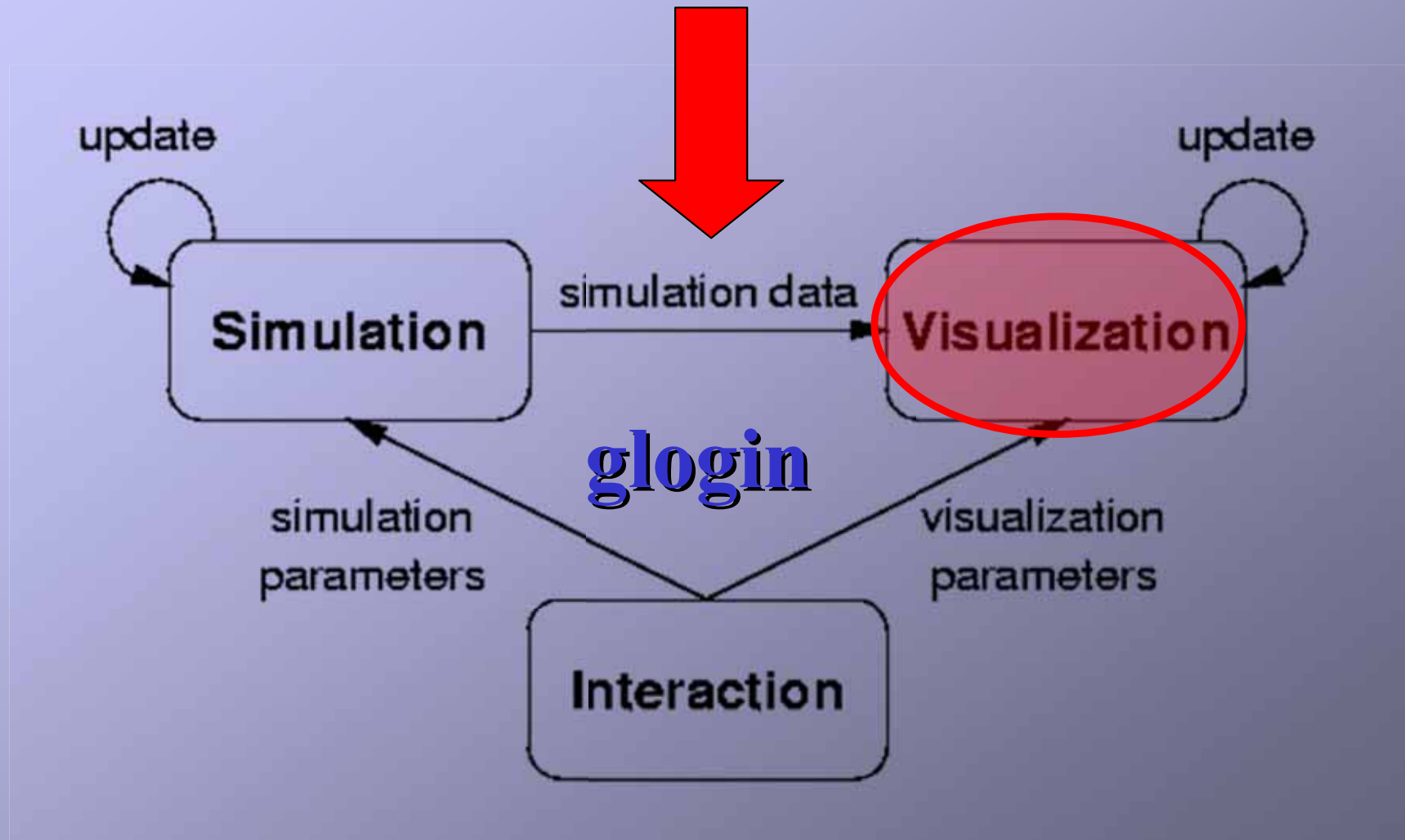


Initialize Connection





"Putting the User into the Loop"





Grid Visualization Kernel

Goal:

Visualization services for the grid

*GVK = „Middleware-Extension
for Visualization“*

GVid – Video Streaming Module of GVK



Objectives of GVK 1/2

Simulation ...

- is decoupled from the visualization (temporal/spatial)
- is running „somewhere on the grid“
- is a „moving target“ in a heterogeneous environment



Objectives of GVK 2/2

Visualization ...

- may be invoked anytime, anywhere, anyhow
- may be invoked by multiple, cooperating people (multiplexing)
- should be as fast/good as possible (via any available network)



Exploitation of the Grid

Side effect:

- Grid delivers computational power which can be used for visualization.
- Parallelization of visualization algorithms
 - Triangle mesh partitioning (Metis)
 - Raytracing parallelization on pixel level
 - Reference image rendering on different nodes
 - ...



"Immediate" Goals of GVK

- Integration of GVK:
 - Interfaces for existing visualization toolkits
 - Visualization on different devices (CAVE, PDA, ...)
- Visualization Pipeline:
 - Setup and processing of visualization data on the grid
- Network Transportation Optimizations:
 - Decrease communication latency
 - Increase system throughput

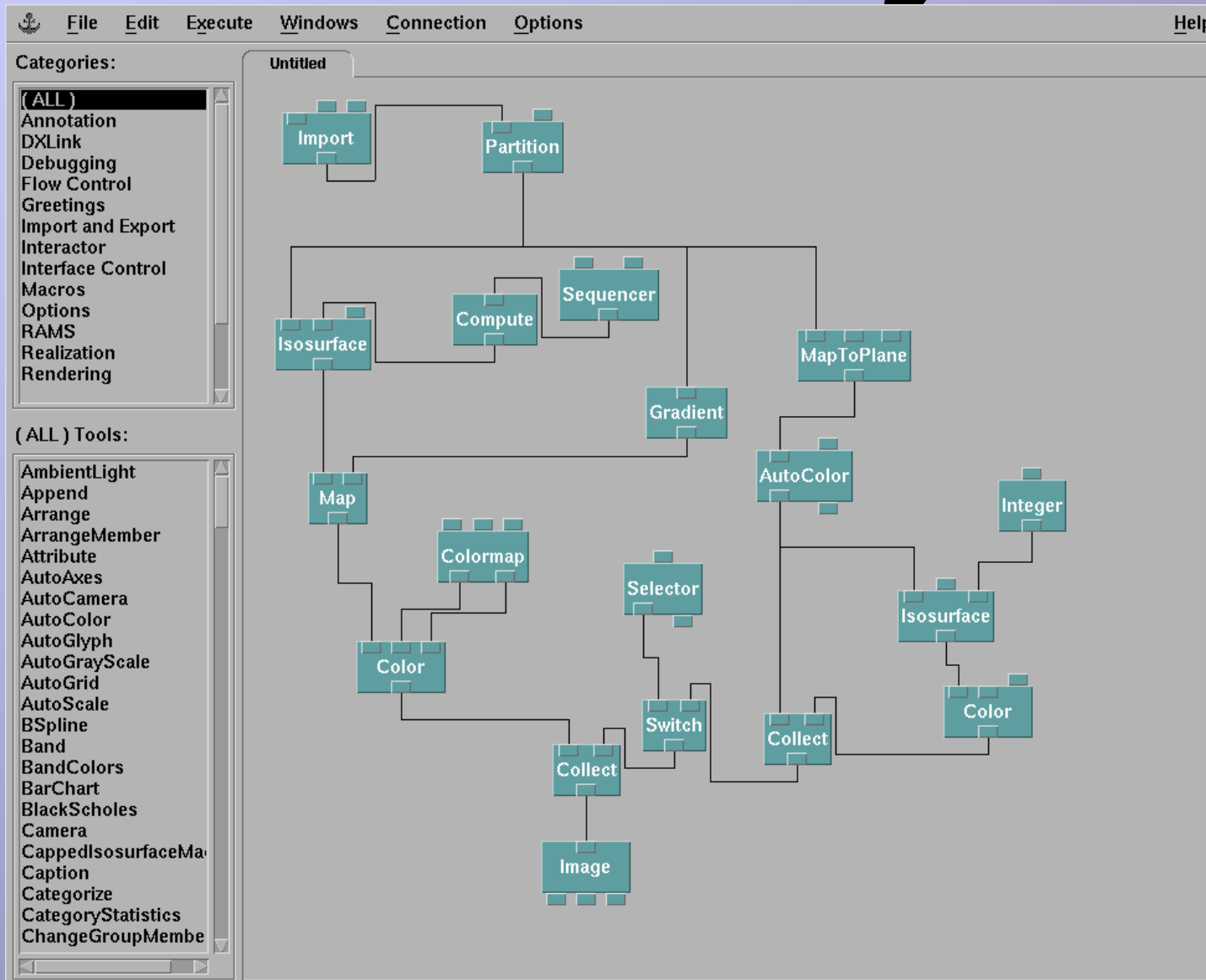


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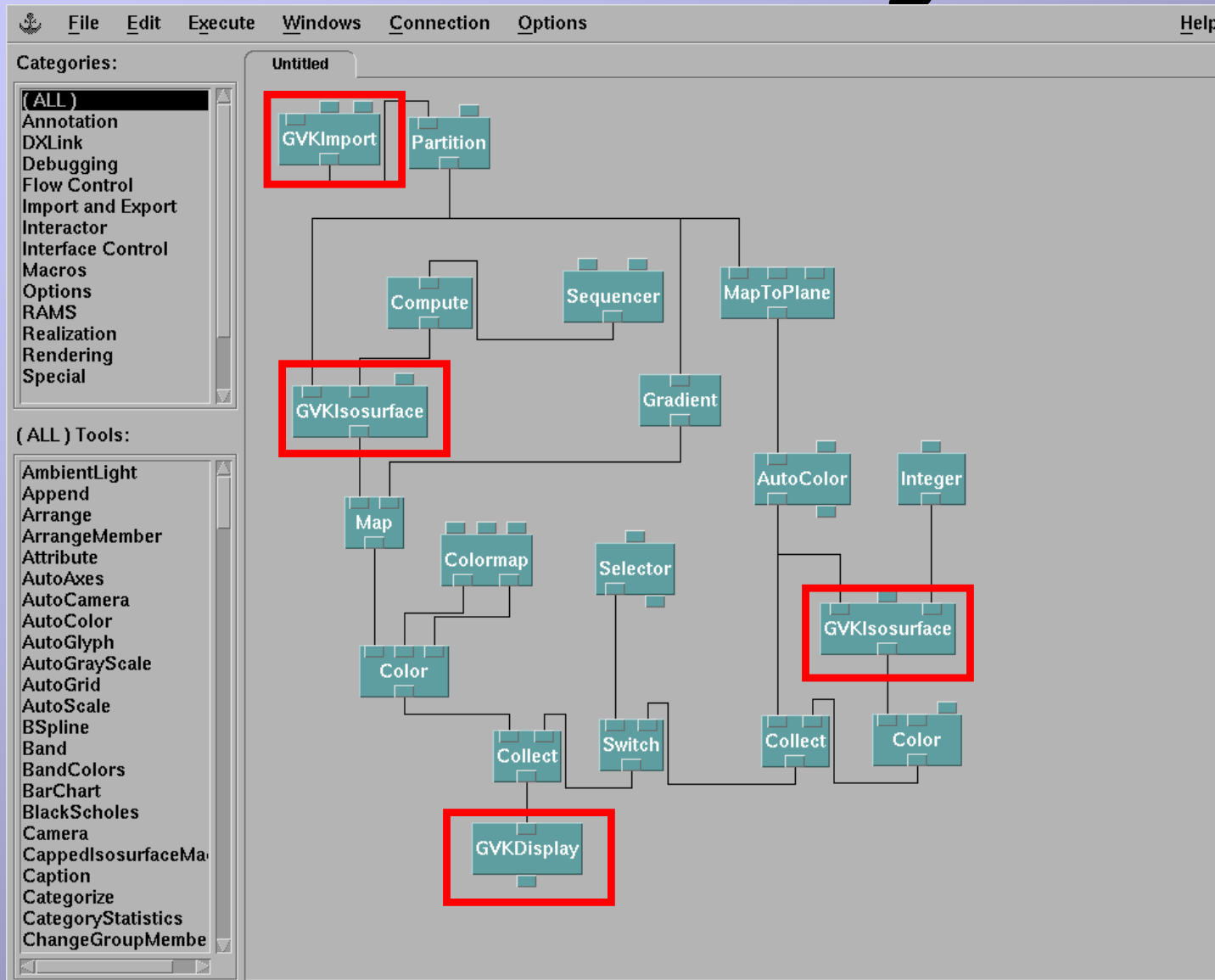
GVK Integration with existing tools



Example
OpenDX
flow graph



GVK Integration with existing tools

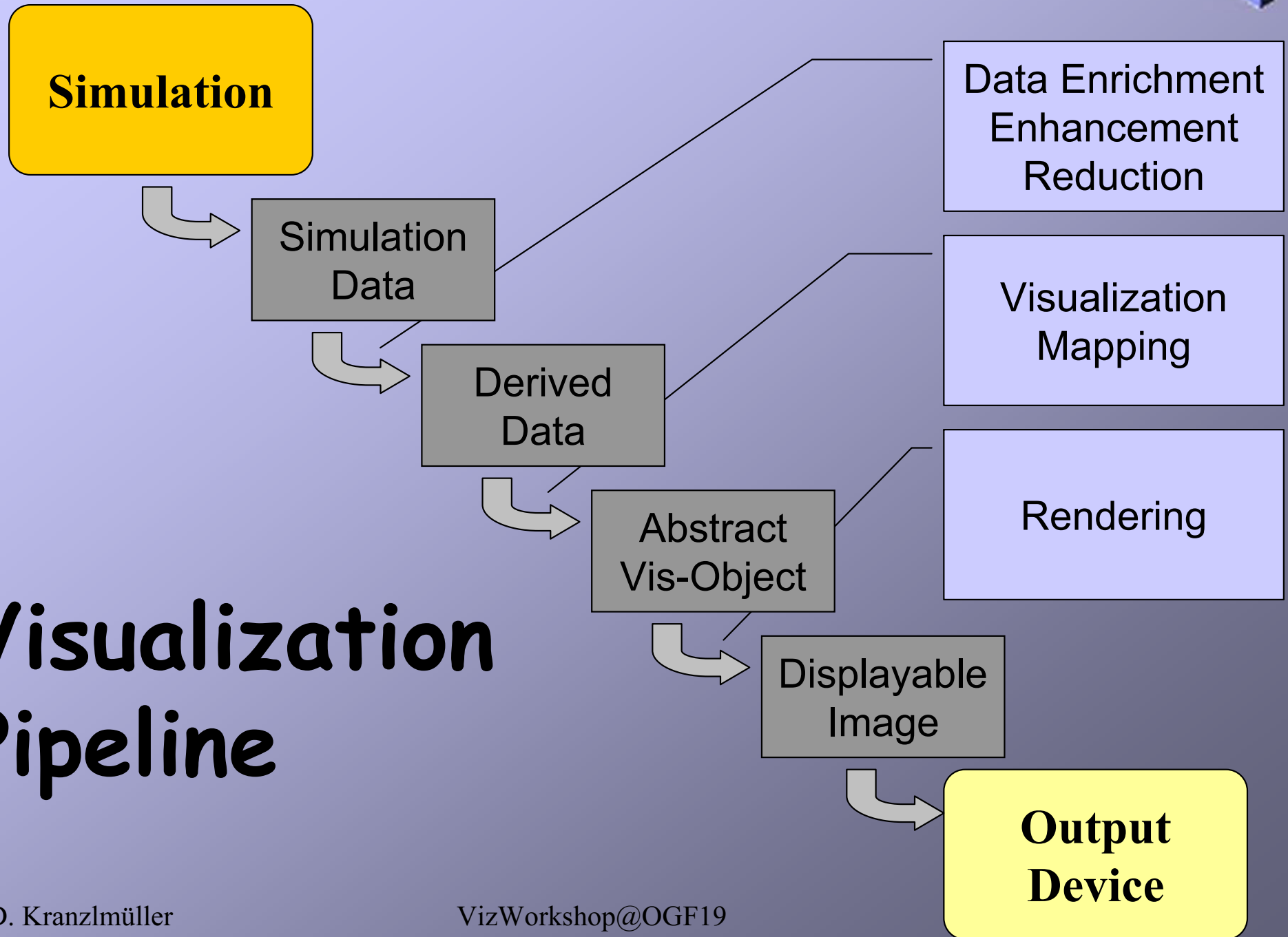


Example
OpenDX
flow graph
using
GVK



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Visualization Pipeline



Visualization Pipeline on the Grid

Simulation

Simulation Data

Derived Data

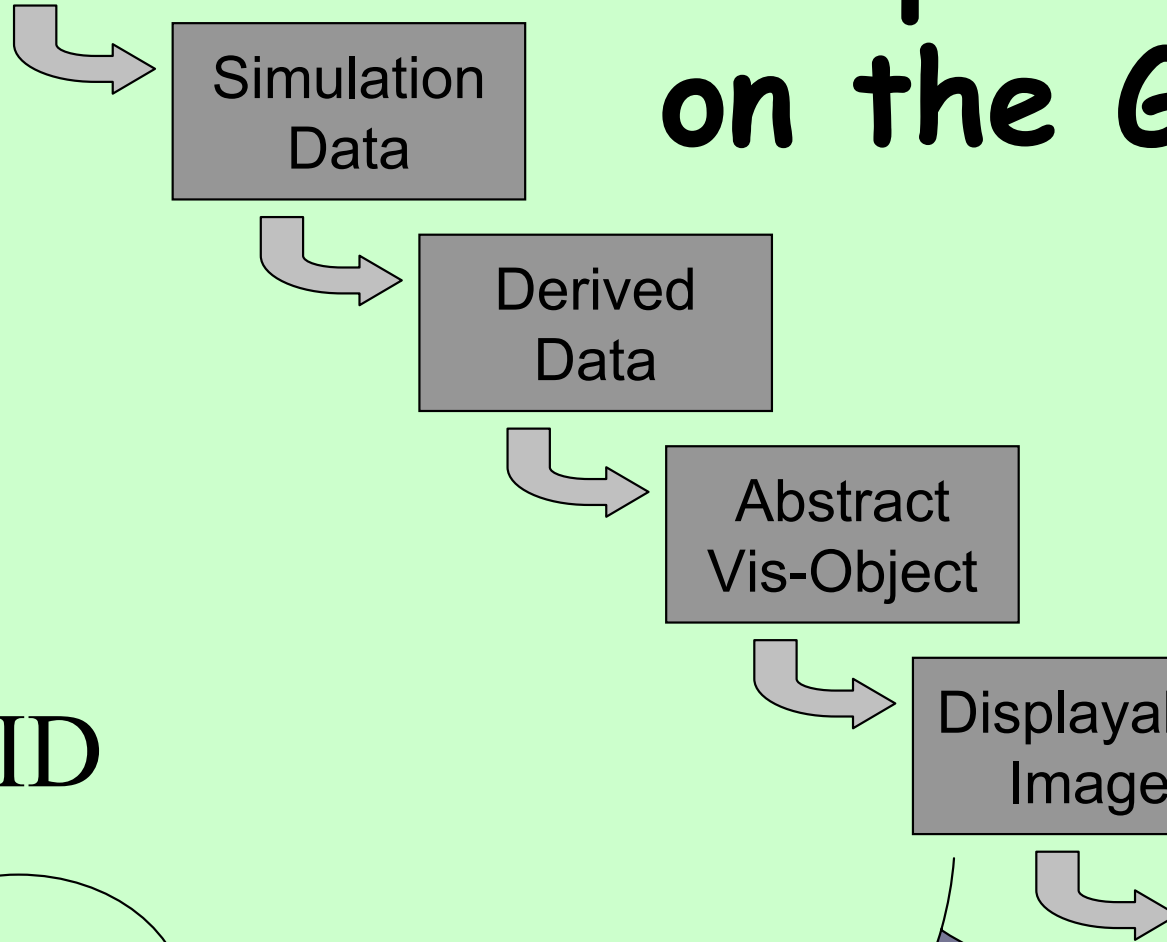
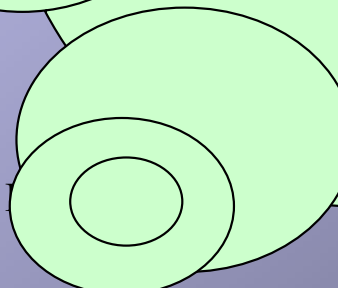
Abstract Vis-Object

Displayable Image

Output Device

GRID

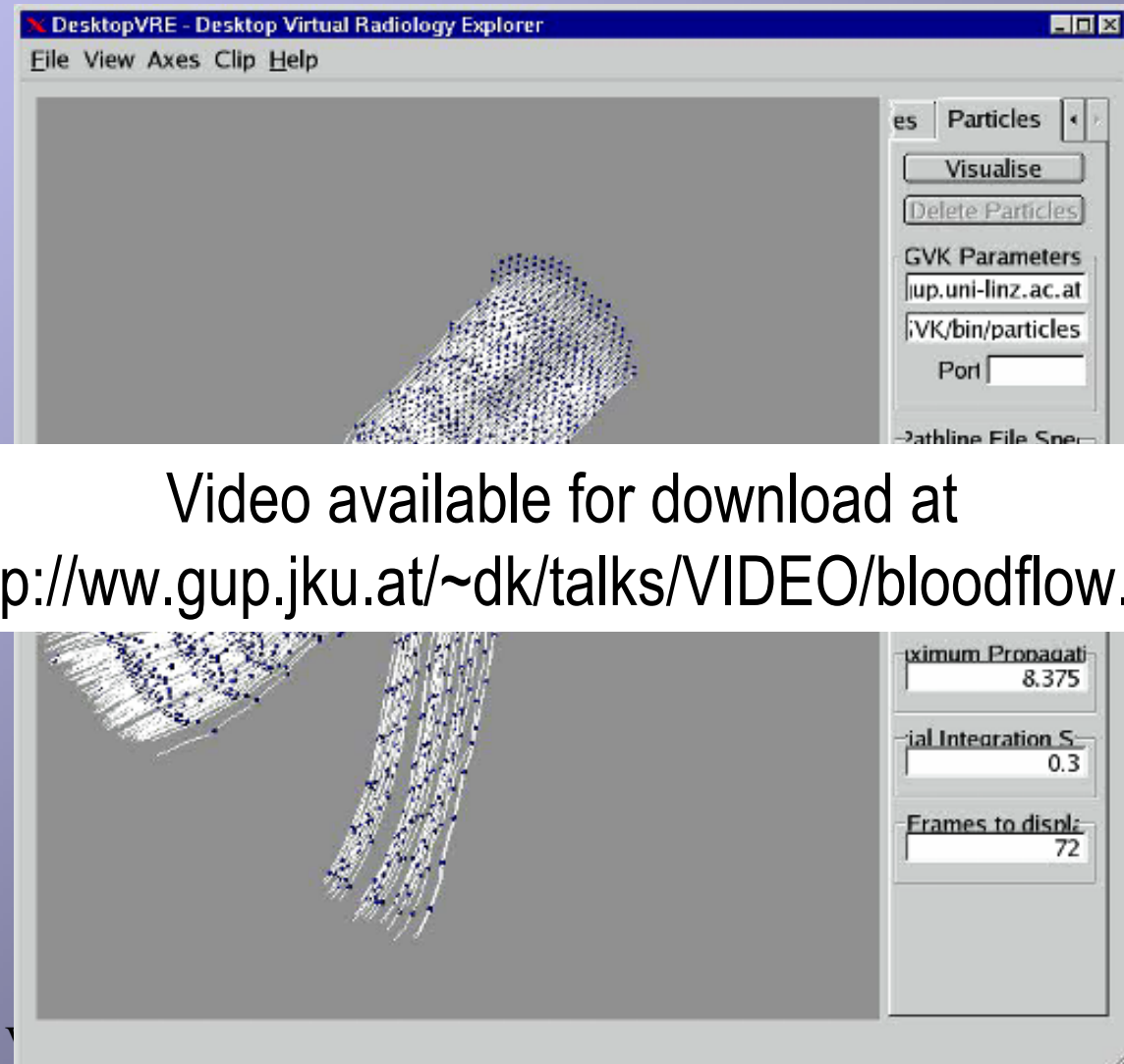
D.





Example: Biomedical Investigation

- **Parallel simulation of blood flow on the Grid**
- **Online visualization of simulation results on the desktop**
- **Interactive steering of simulation**
- **Grid is „invisible“**





GVK Display on different devices

- **Simulation of flooding on the Grid**
- **Visualization of results in the CAVE**
- Grid is „invisible“



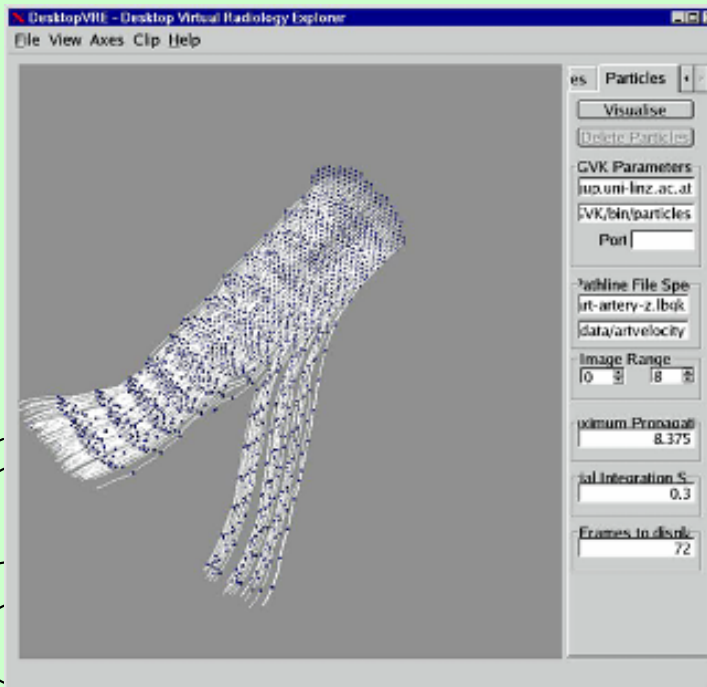
Video available for download at
<http://www.gup.jku.at/~dk/talks/VIDEO/flooding.avi>



Simulation

Simulation
Data

Derived
Data



Abstract
Vis-Object

Displayable
Image

**Output
Device**



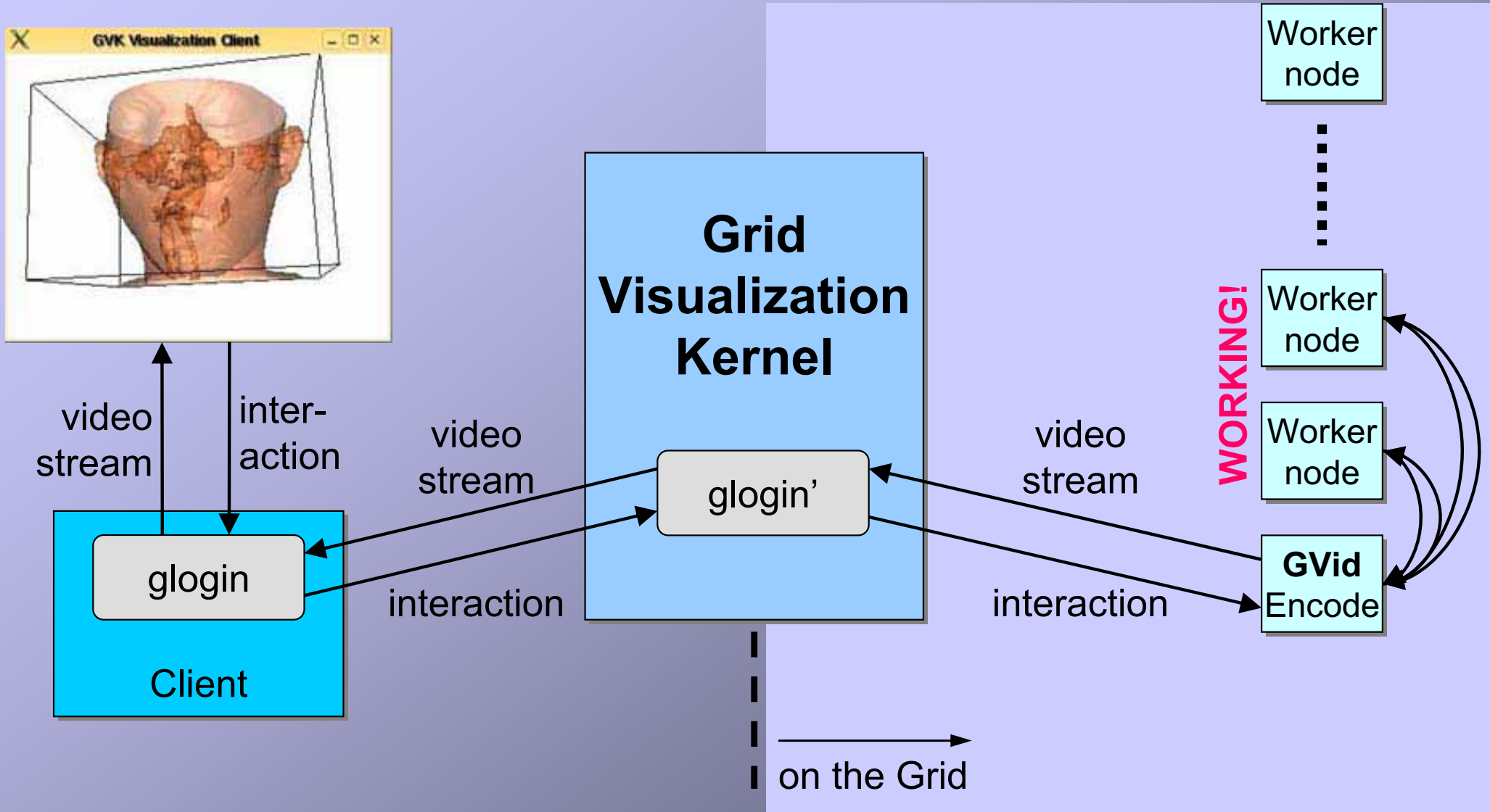
GVK Extension

Grid-enabled **V**ideo streaming

- Generate video stream at data origin using off-screen rendering and video capturing
→ Data remains where it is produced!
- Transport video stream to output device
- Display video stream on output device
- Manage interactive input on output device

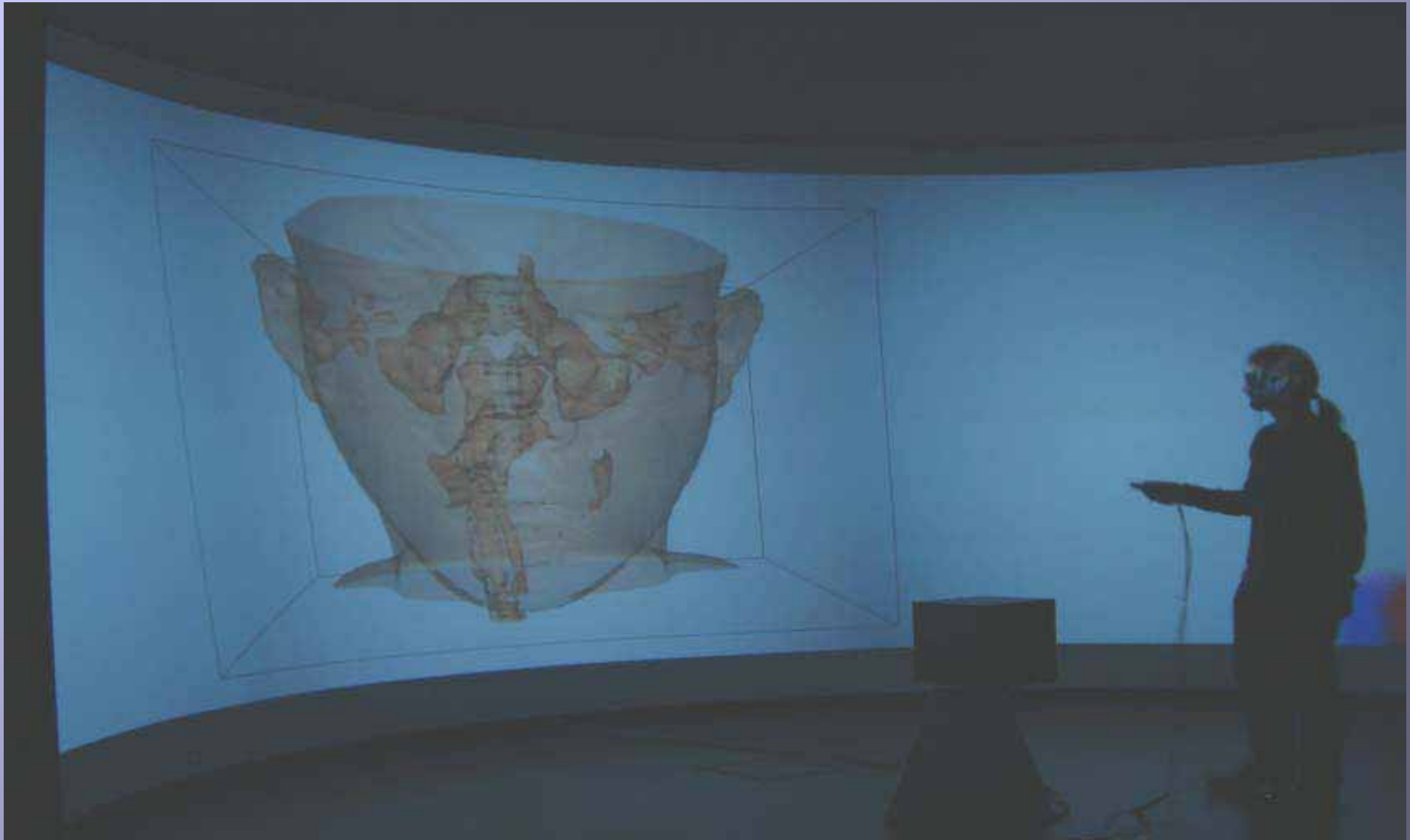


GVid Extension to GVK





Example: GVid



Example: GVid Output Device

Sony Playstation Portable (PSP):

- CPU: MIPS R-4000
- Memory Stick PRO Duo (32 MB-1 GB)
- Wi-Fi (802.11b)
- MPEG-4 Video Codec





GVideo Output on PSP

Video available for download at
http://www.gup.jku.at/~dk/talks/VIDEO/gvid_psp.avi

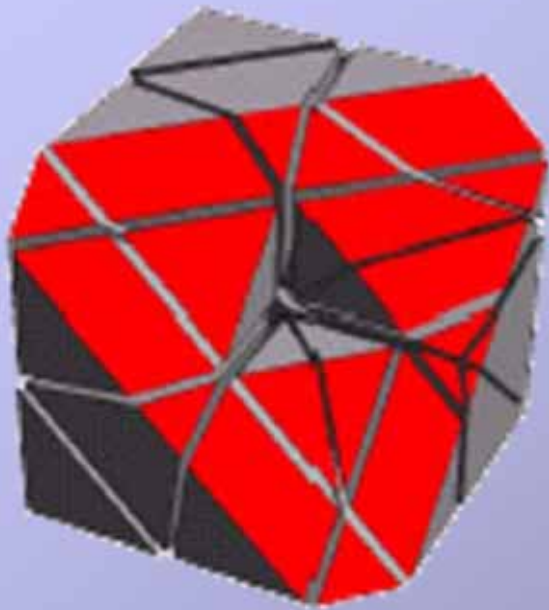


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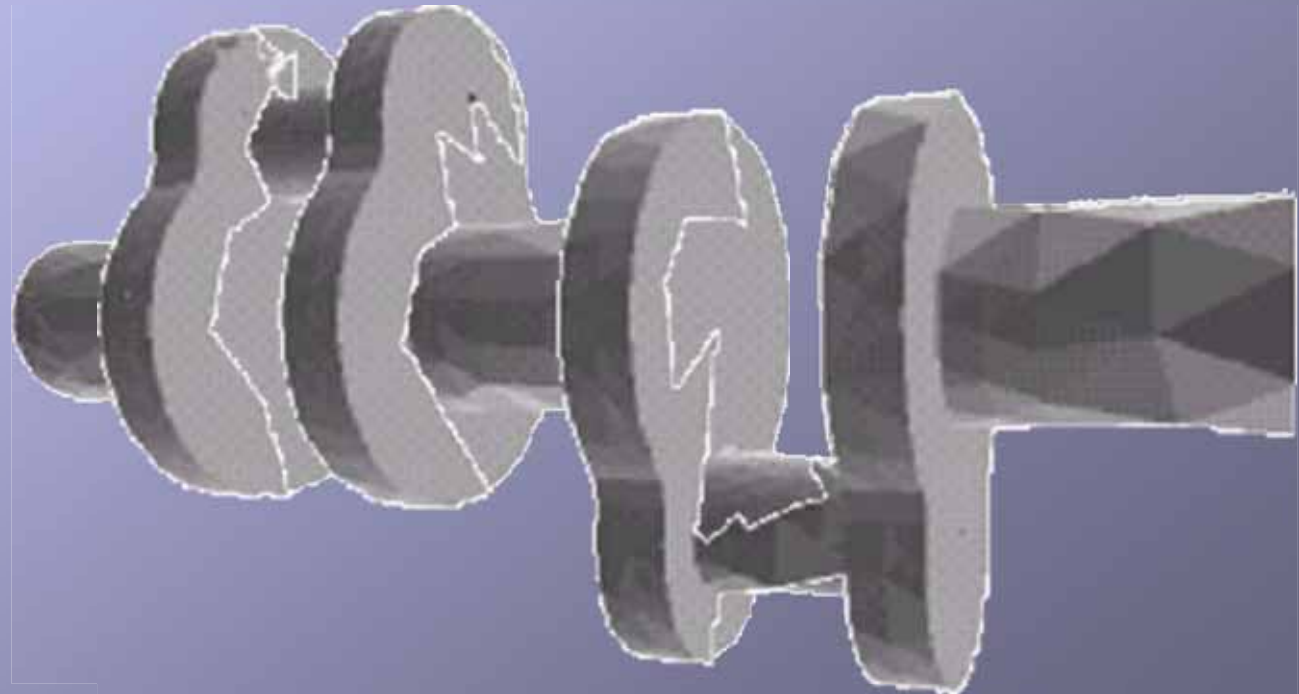
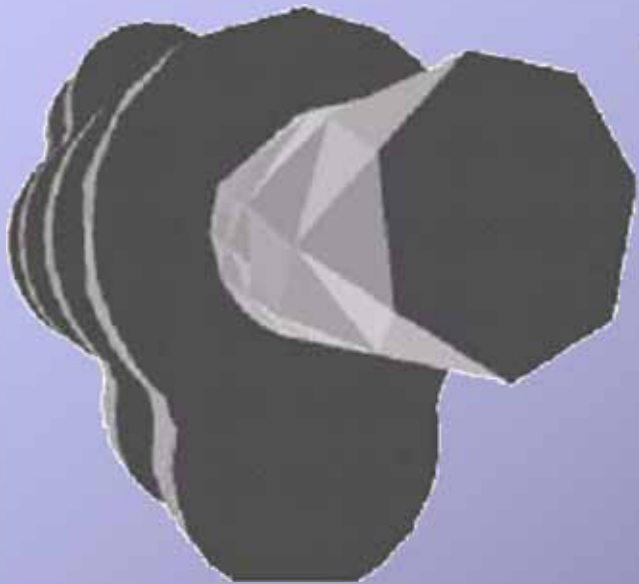
Level-of-Detail



33 tetrahedrons



GVK Reduction of data transport



Occlusion culling



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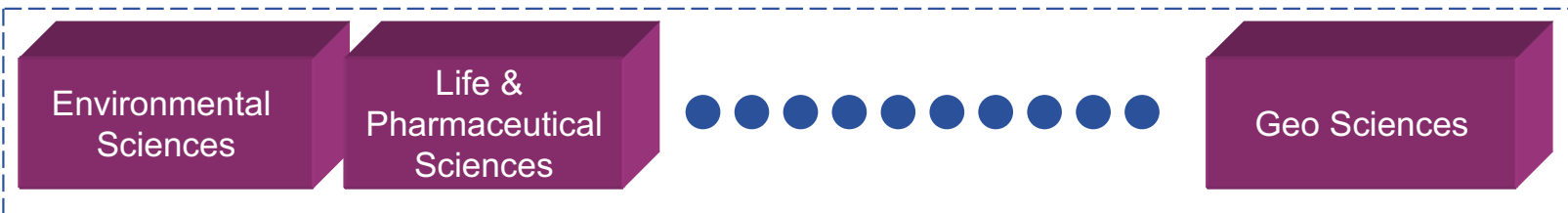
Conclusions

GVK ...

- ... is a grid middleware extension for **interactive visualization**
- ... can be used with different **visualization front-ends** and **output devices**
- ... exploits the grid for **increased performance** and includes various **optimizations**



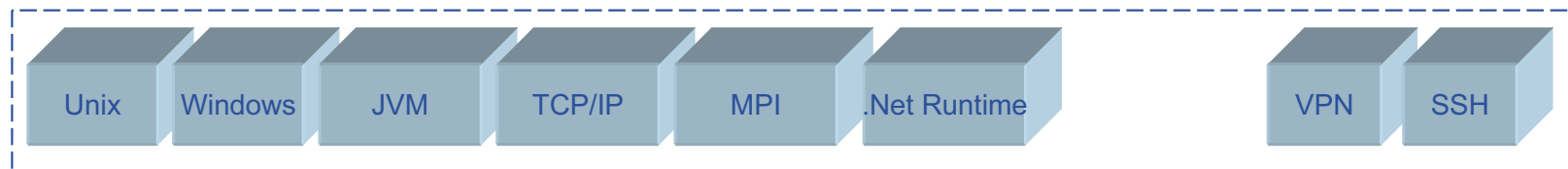
Applications



Middleware

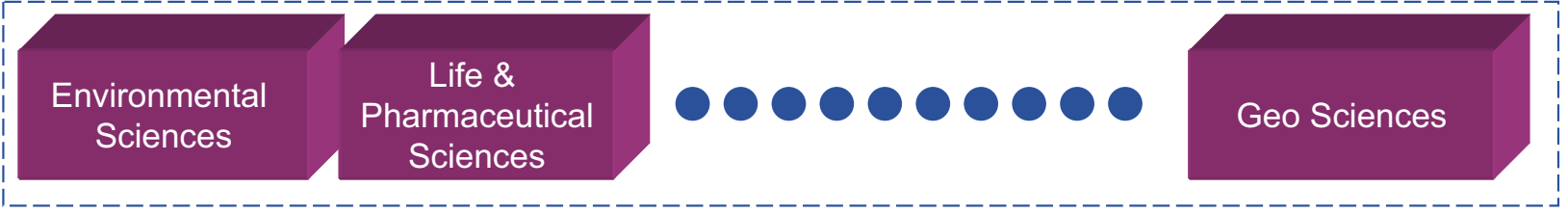


Platform Infrastructure





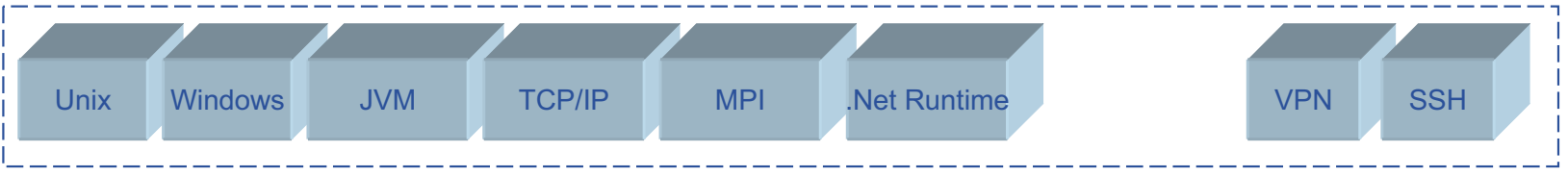
Applications



Middleware

Upper Middleware & Tools

Platform Infrastructure





Conclusions

- Today's grid services provide basic (low-level) functionality for grid applications
- Higher-level grid middleware services are needed for **future applications**:
 - Interactive User Interfaces
 - Visualization Services

→ Increases *demand*
for *novel low-level grid services*, too



GVK Future Work

- Additional application domains
- Additional visualization output devices
- **Adaptive performance optimizations:**
requires dedicated monitoring support
- **Enhanced Interactivity** support
- **Cooperation and Collaboration** support
within Virtual Organizations



Team

Dieter Kranzlmüller,

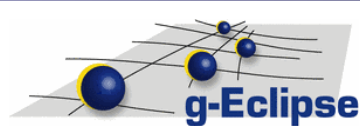
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Paul Heinzlreiter, Herbert Rosmanith,

Hans-Peter Baumgartner, Peter Praxmarer,

Andreas Wasserbauer, Gerhard Kurka,

Jens Volkert



More Information

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