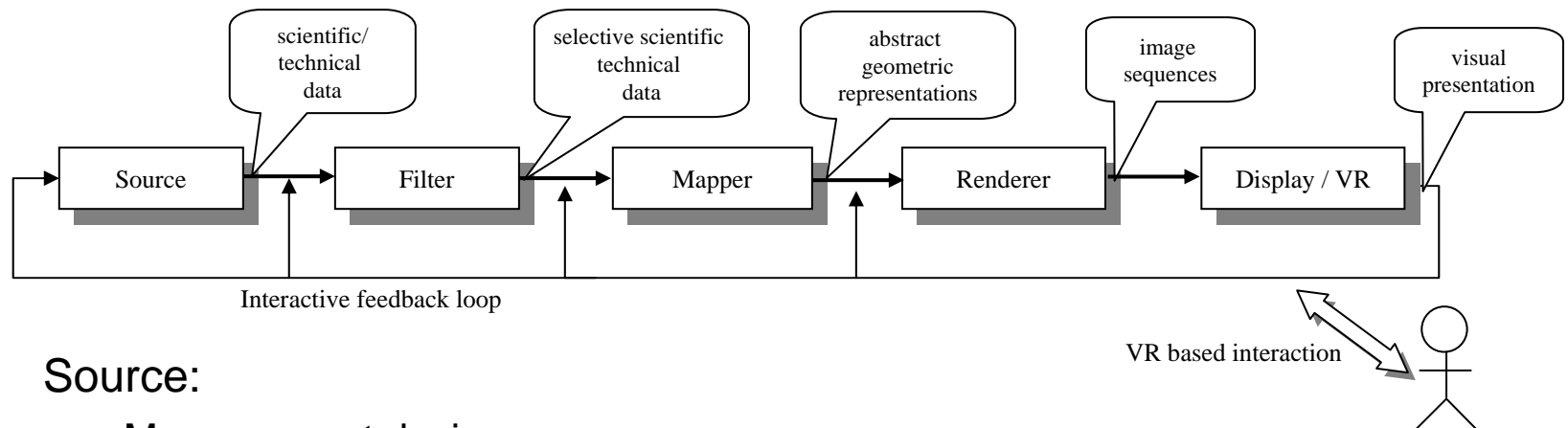

Distributed, Interactive Visualization, Feature Detection and Collaboration

Prof. Dr. Ulrich Lang
Center for Applied Informatics Cologne
Computing Center
University of Cologne

LOFAR-Workshop, 15.-16. December 2005, Jülich

The Visualization Process Chain



- **Source:**
 - Measurement device
 - Computer simulation
 - Storage device
- **Filter:** Select or sample data, generate derived data, correct outliers
- **Mapping:** Convert data into Abstract Visual Objects (AVOs)
- **Rendering:** Conversion of original content into image sequences
 - E.q. 3D scene + lighting and camera position into image
 - E.q. applying color transfer functions
- **Display:** Collection of image sequences and display with VCR interaction

Purposes of Scientific Visualization

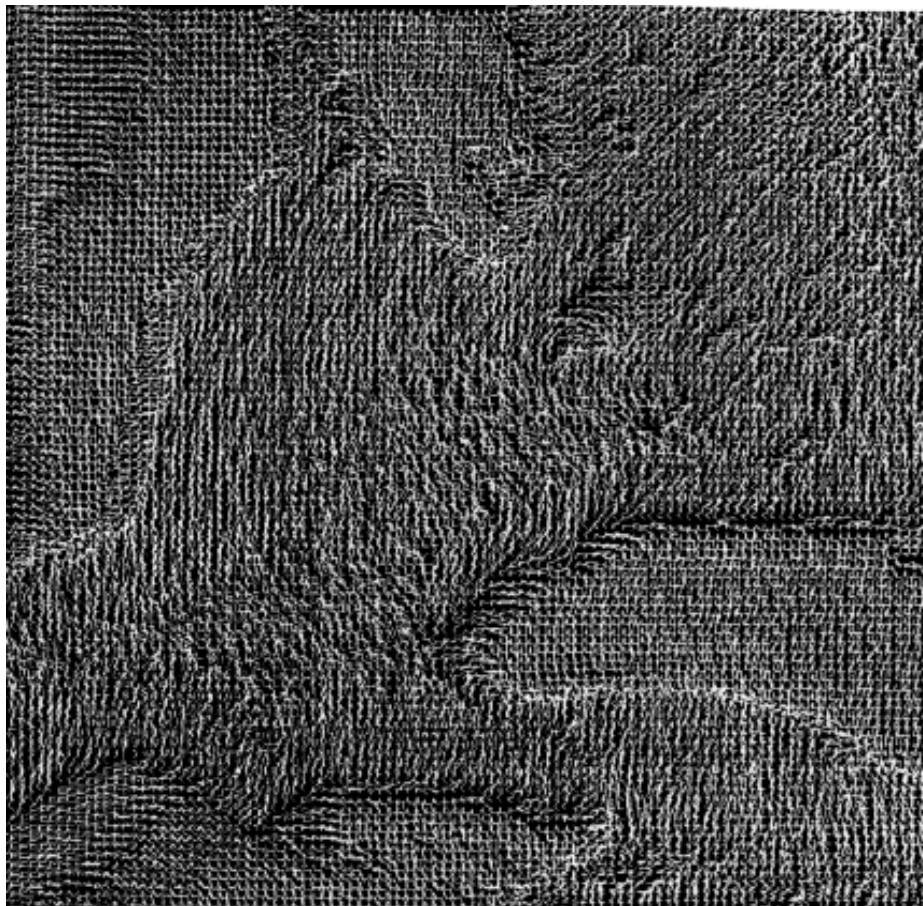
- Exploratory visualization (interactive, detect the unforeseen)
 - Browsing of large data volumes
 - Drill down: detailed analysis of specific effects
 - Feature detection & extraction
- Production visualization (batch, document the foreseen)
- Illustrative visualization
 - Compact presentation of results following an analysis process
 - Guide viewers to certain conclusions
 - Support for educational processes
- Communication/Collaboration oriented Visualization
 - Two or multi way process
 - Involvement of multiple scientists
 - Potentially distributed locations

Exploratory Visualization: Browsing

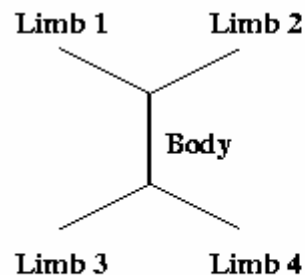
- Pattern/texture map based visual representations
 - Compaction process to map original information into spatial patterns
 - Map multiple data sets defined on same grid onto replicated small spatial structures
 - Animate having time as an orthogonal independent variable
- Use human perception capabilities to detect
 - large scale structures in fine grain patterns
 - motion structures in time dependent evolving patterns
- Requires easy switching between browsing and in depth visualization

Exploratory Visualization: Browsing

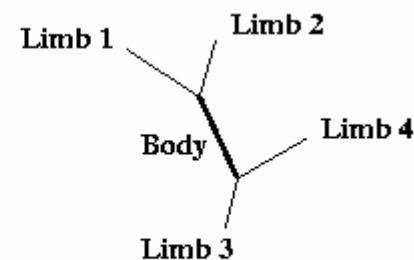
- Browsing example:



5-dim. Imagedata from the great lake region
(G. Grinstein, U. Lowell, Mass.)



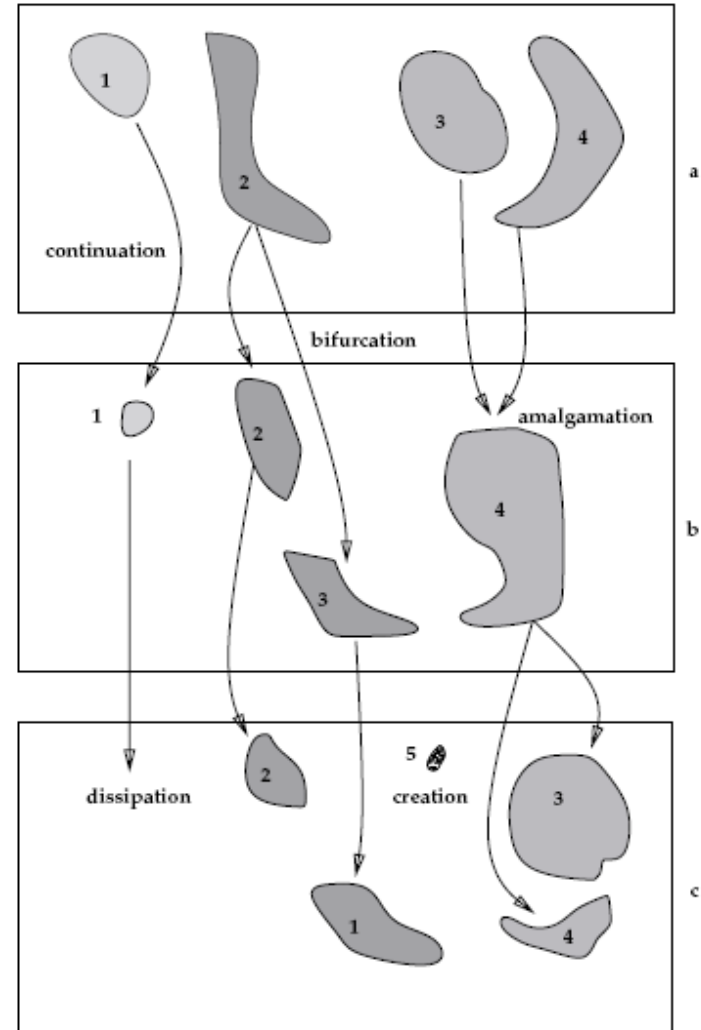
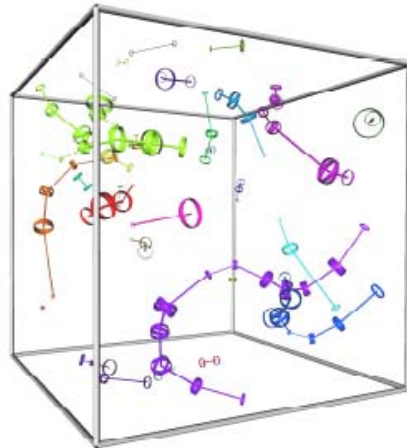
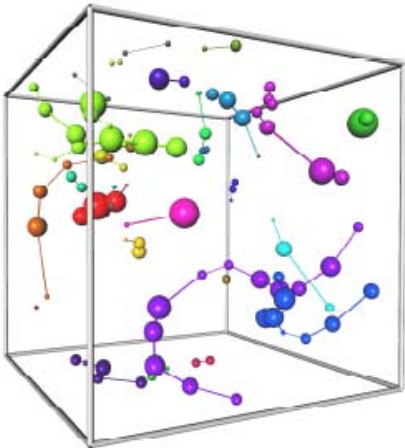
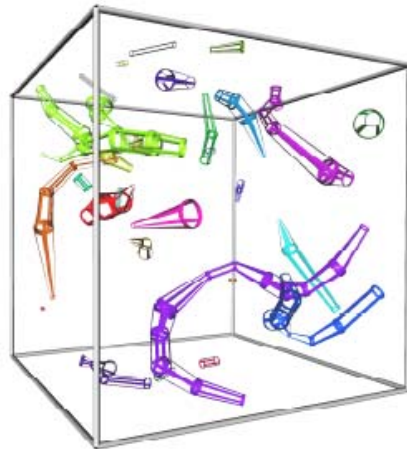
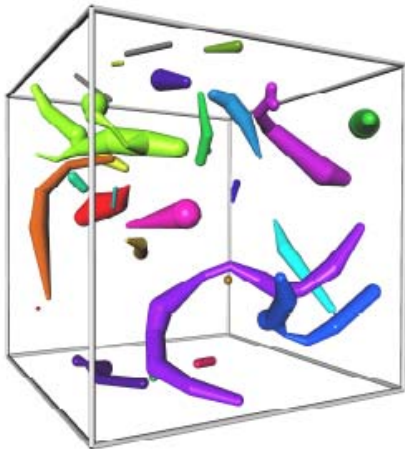
Theoretical icon



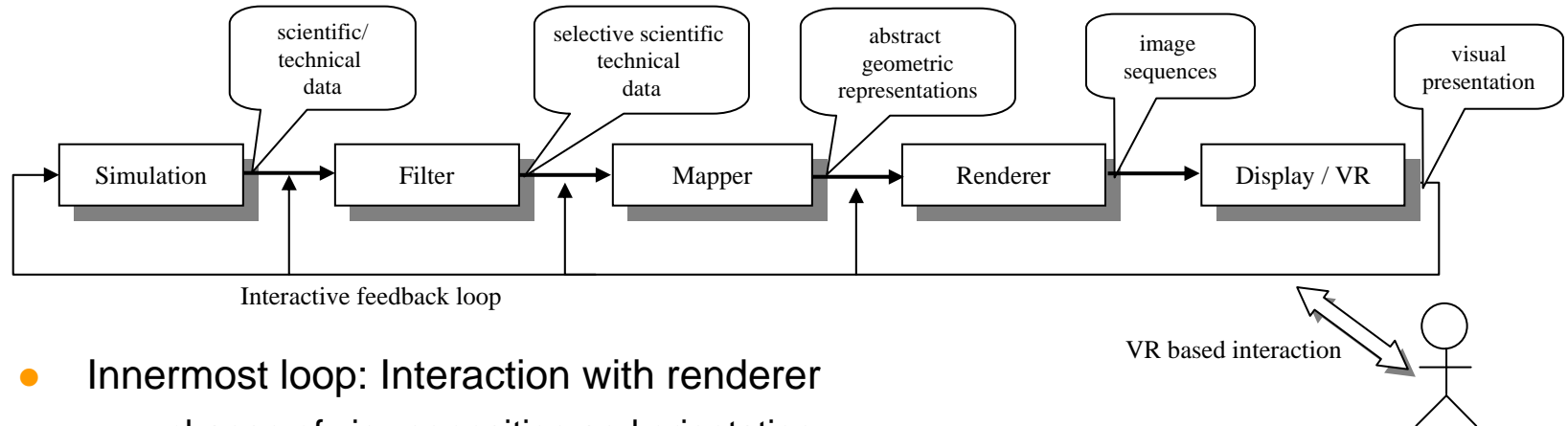
Sample icon

Exploratory Visualization: Feature Tracking

- Frits Post (Delft University, NL)



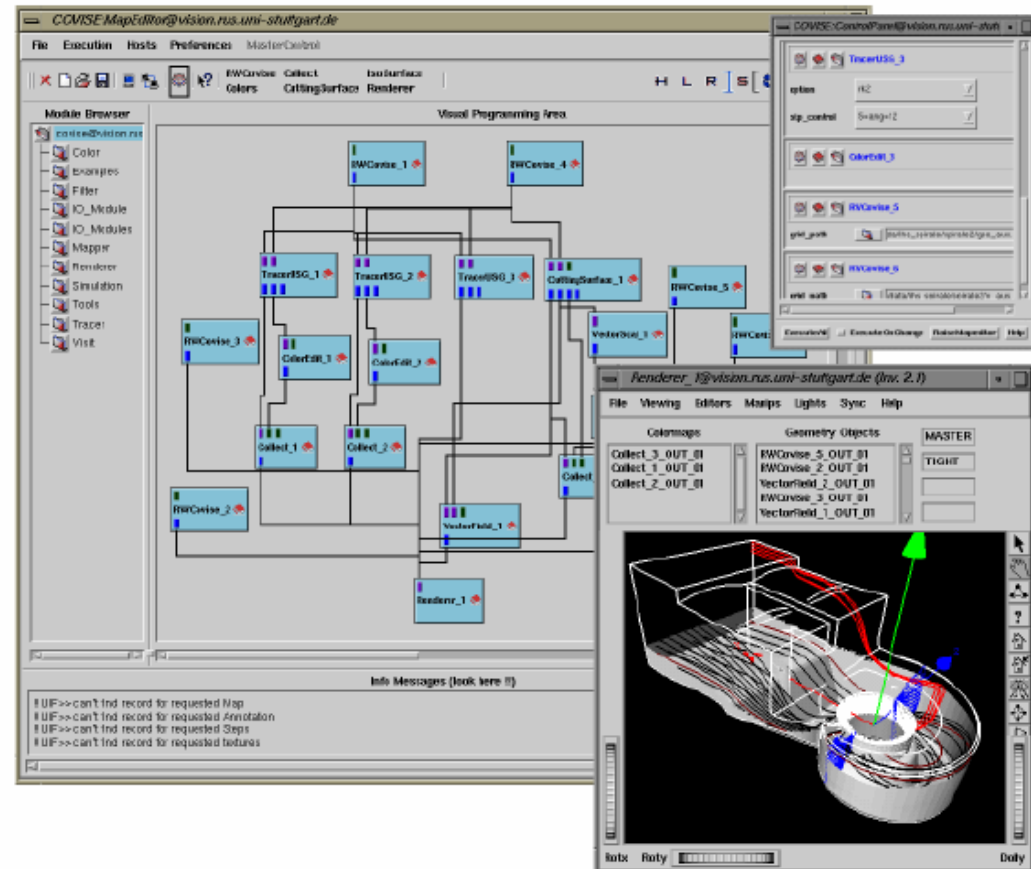
Interaction and feedback loops



- Innermost loop: Interaction with renderer
 - change of viewer position and orientation
 - zooming in and out/scaling the world
- Mapper loop: Interaction with visualization methods
 - Initiate new feature detection parameters
 - Move cutting planes
- Filter loop: Interaction with extraction methods
 - Spatial or data dependent extraction
- Simulation loop: Interact with simulation model
 - Change initial or boundary conditions
 - Change bounding geometry

COllaborative VIualization and SImulation Environment

- Modular distributed multiprocess environment
- Online coupling of simulation & visualization
- Visual programming using data flow network paradigm
- Easy extendibility via new modules or new data types
- Scalable from desktop to Virtual Environments
- Optimized for efficient HPC and network usage
- Supports collaborative working

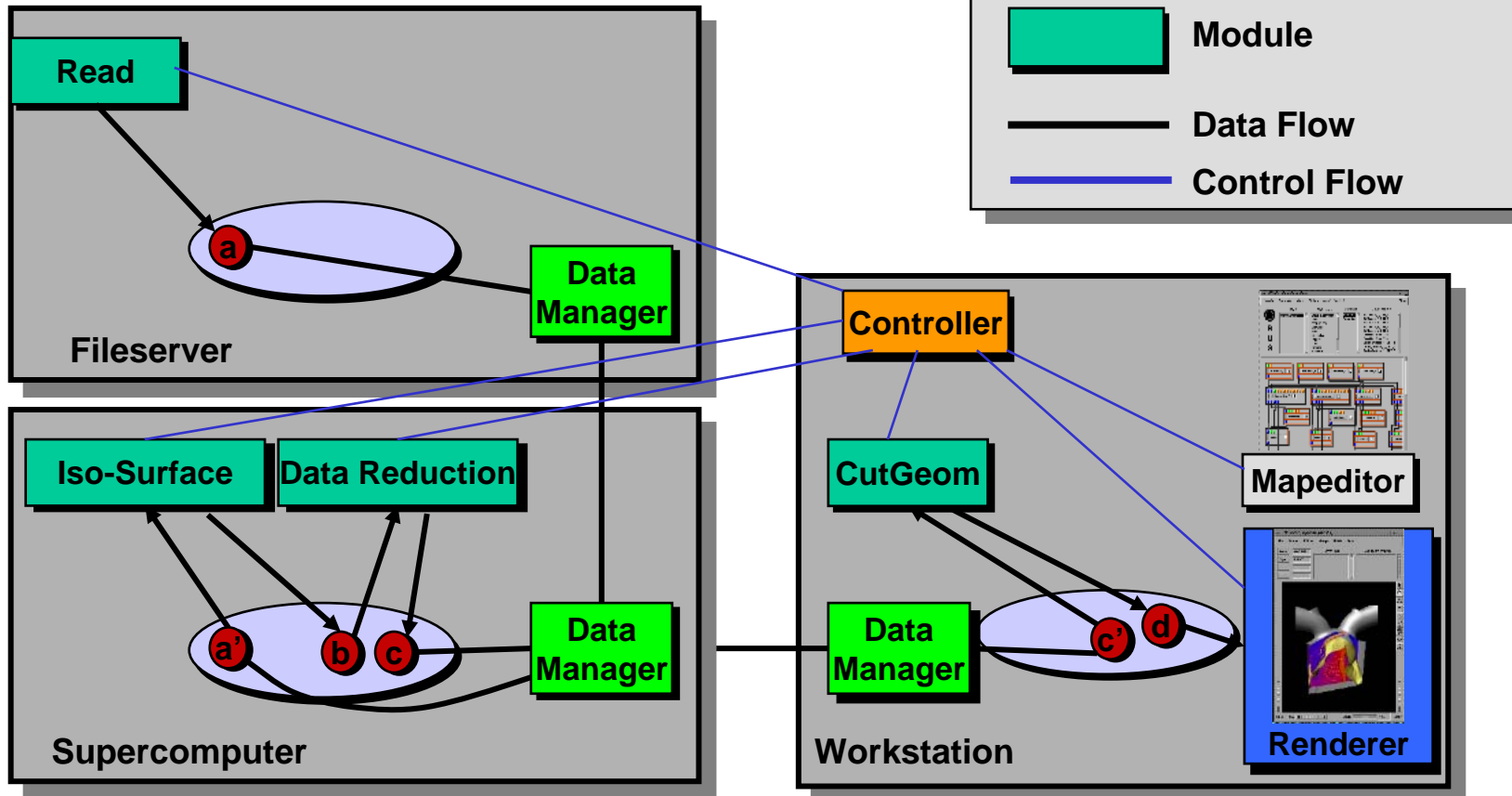


Analysis of fluid flow in an water power plant

COVISE development: HLRS & Uni Köln

COVISE Processing Chains

- Central control process
- Separated control and data flow
- Distributed data management



Remote Collaborative Visualization

<http://www.escience.cam.ac.uk/andrew/cosmogrid/html/main.html>



and

Remote Collaborative Visualization

Welcome to the website of the project for the National Cosmology Grid, based at the Cambridge eScience centre, within the Department of Applied Maths and Theoretical Physics at the University of Cambridge.

Since the beginning of 2002, the National Cosmology Grid has linked the COSMOS supercomputer (housed in DAMTP) with servers at consortium sites in the Institute of Astronomy, the Cavendish Laboratory and throughout the UK (Imperial College and the Universities of Manchester, Oxford, Portsmouth and Sussex). This project will demonstrate the capability of grid technology in the management and visualization of cosmological data sets over local and trans-national networks. A key goal is to implement and assist in the development of real-time remote and collaborative visualization tools with the US National Center for Supercomputing Applications (NCSA) and our industrial partner, SGI.



[Home](#) [About](#) [COSMOS](#) [Cosmogrid](#) [Visualization](#) [News](#) [Software](#) [People](#) [Reports](#) [Links](#)

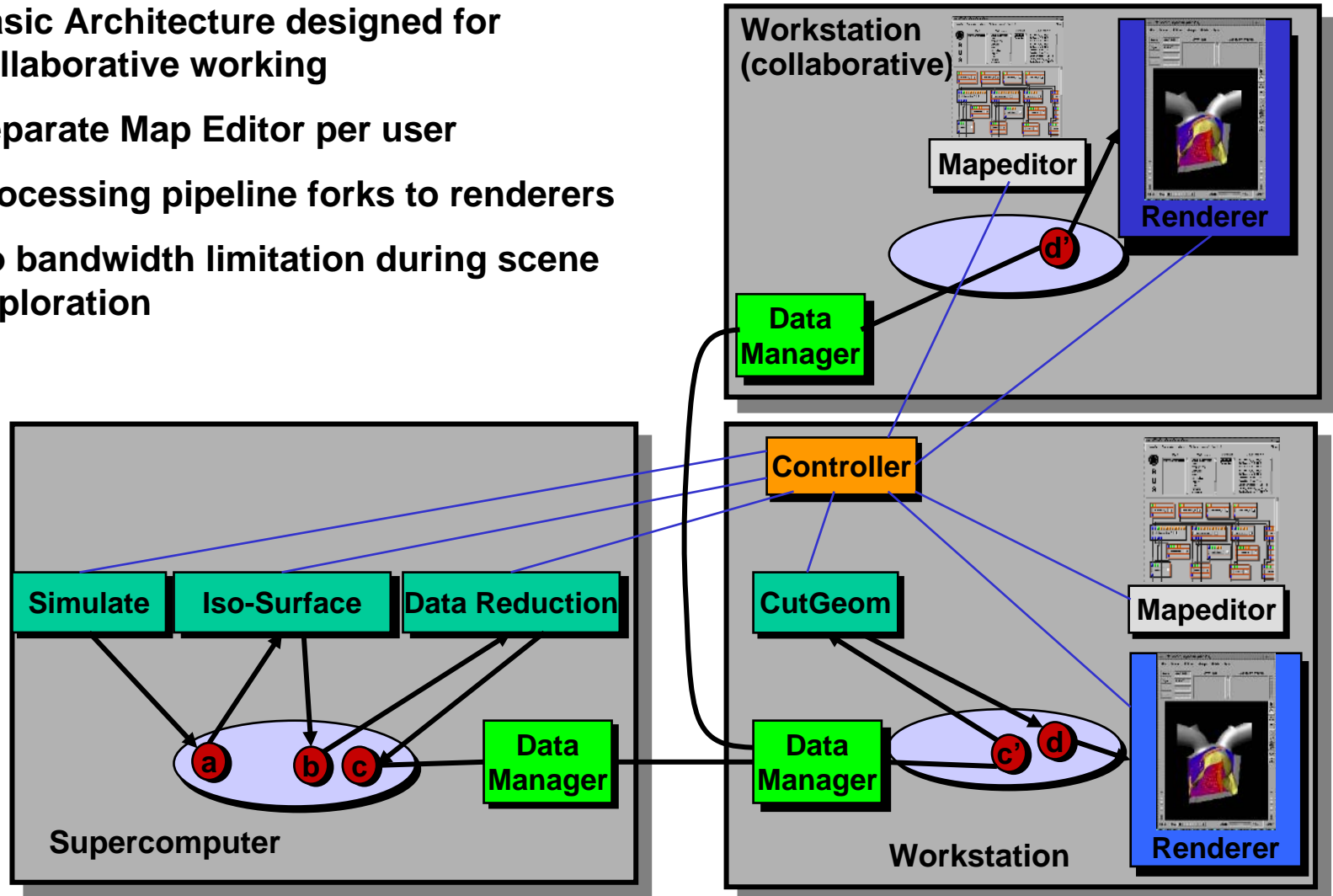
Group Collaboration: Access Grid



www.access.org

COVISE Collaborative Working Architecture

- Basic Architecture designed for collaborative working
- Separate Map Editor per user
- Processing pipeline forks to renderers
- No bandwidth limitation during scene exploration

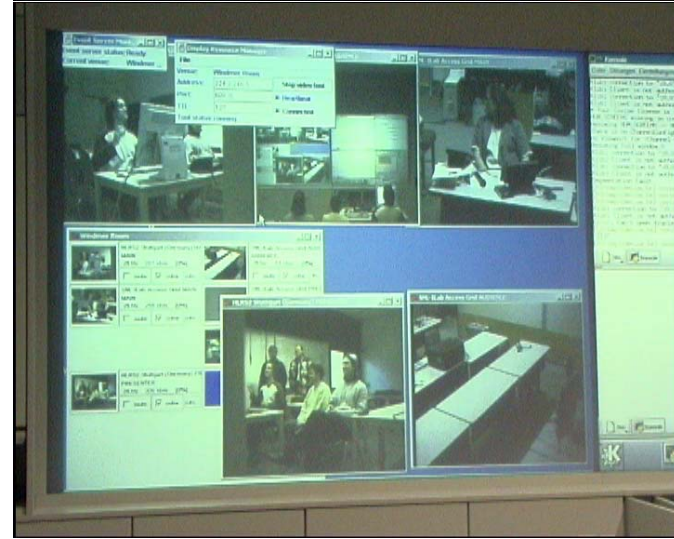


Collaboration Usage for Scientific Discussions

- Cooperation between centres, research organisations and institutes:
 - HLRS, Manchester, Jülich, Salt Lake City, Albuquerque, Argonne

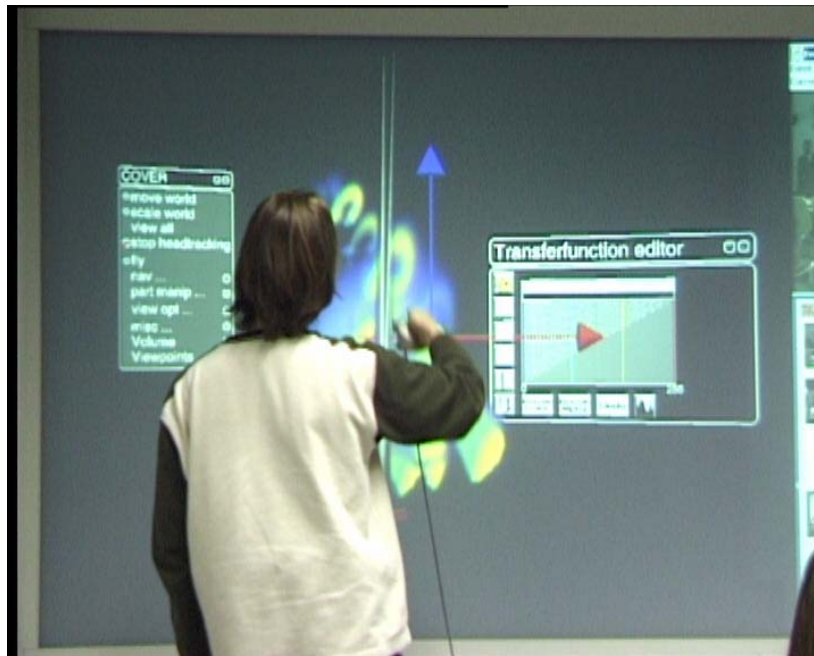


HLRS: Virtual Reality/Accessgrid enabled Seminar Room



COVISE/Accessgrid Integration

- Application enabled Accessgrid
 - Implementation of an Accessgrid compatible Venue Server that initiates applications consistently for groups



HLRS (Stuttgart <-> SNL (Albuquerque))

