Remote Visualization on the AccessGrid

Michael E. Papka

And

Futures Laboratory

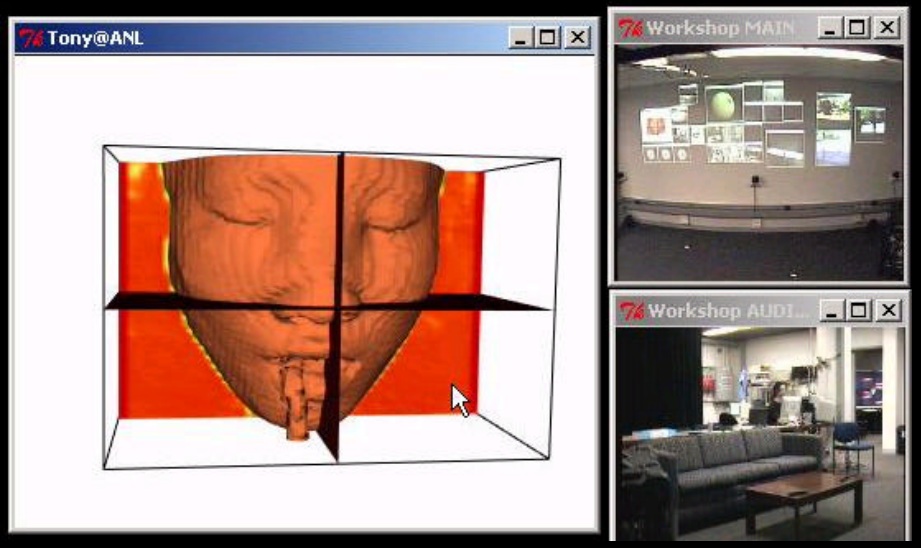
Argonne National Laboratory

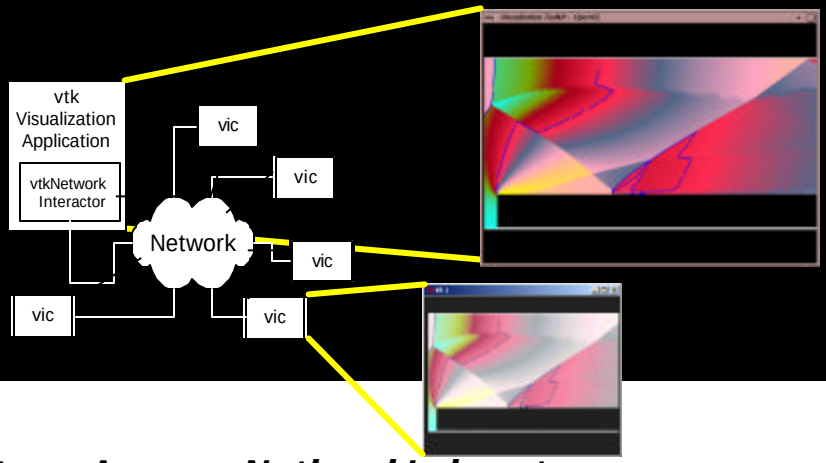
Is visualization needed?

- *Collaboration is:*
  - *More than just talking and looking at slides …*
  - *Exchanging ideas*
  - *Asking questions*
- *What is available?*
  - *AGAVE – Electronic Visualization Laboratory*
  - *vtk/vic – Argonne National Laboratory*
  - *Flatland - University of New Mexico*

vtk / vic on the Access Grid

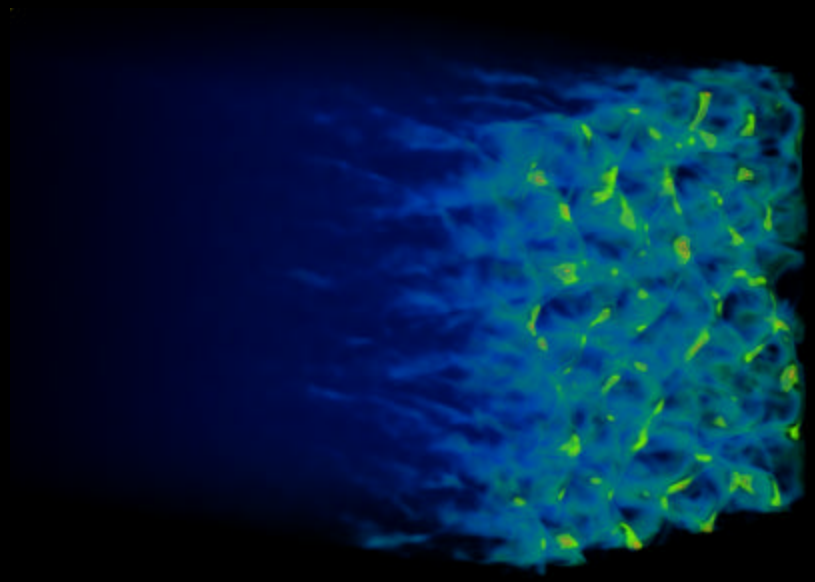
- *Lightweight modifications to vic and vtk to enable wide-area use*
- *vic client*
  - *Patch to allow for keyboard input to vic client*
- *vtk server*
  - *Addition of vtkNetworkInteractor, vtkNetworkRenderer that connect vtk application to the net*
  - *Headless video encoder for putting server output on the net*

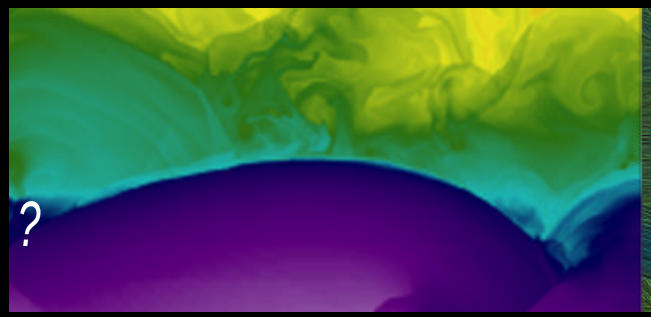


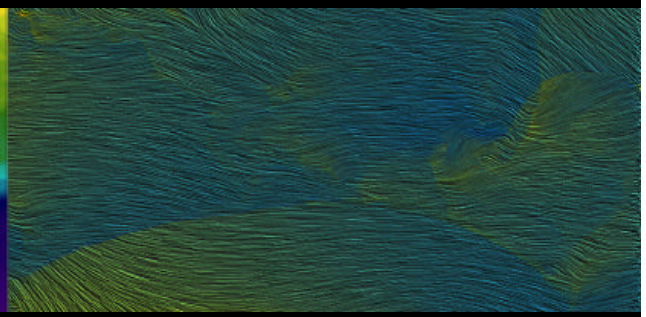


What we need to do?

- *We need get visual content to users*
- *We need to do this in*
  - *Adaptable manner ?*
    - *High Fidelity, low latency*
  - *Reliable ?*
  - *Recordable ?*





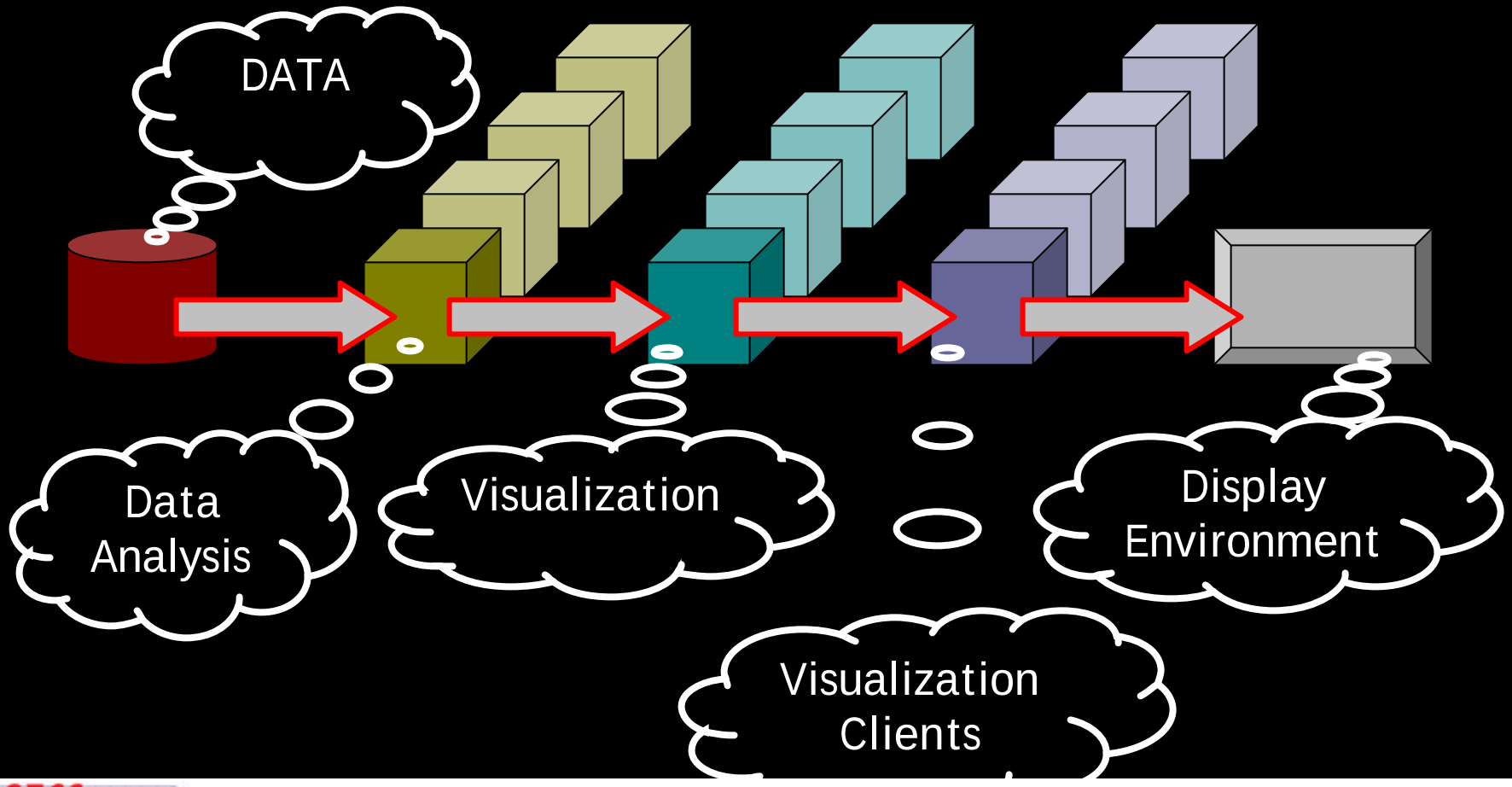


Issues and Requirements

- Issues
  - Pixels versus polygons?
  - Compute /Graphics power
  - Bandwidth / Latency
  - Interaction
  - Multi-modality
- Requirements
  - Portable
  - Lightweight
  - Interactive
  - Multiuser

Corridor One Architecture

Distributing the Visualization Pipeline



Data Servers

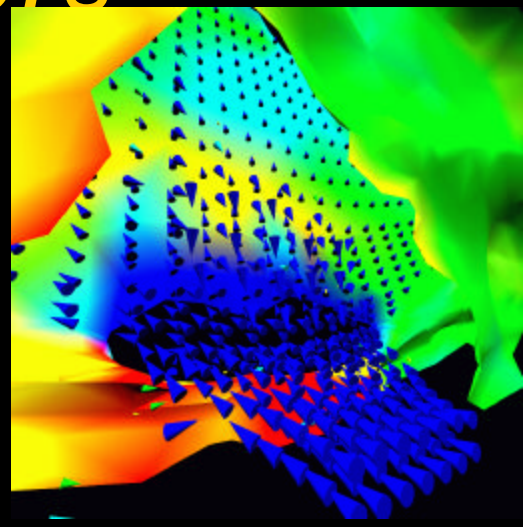
- *Mass Storage*
  - *Large disk farms, tape storage*
- *Instruments*
  - *Experimental beamlines, microscopes, …*
- *Supercomputers*
  - *Real-time simulation output, expensive post processing steps, …*

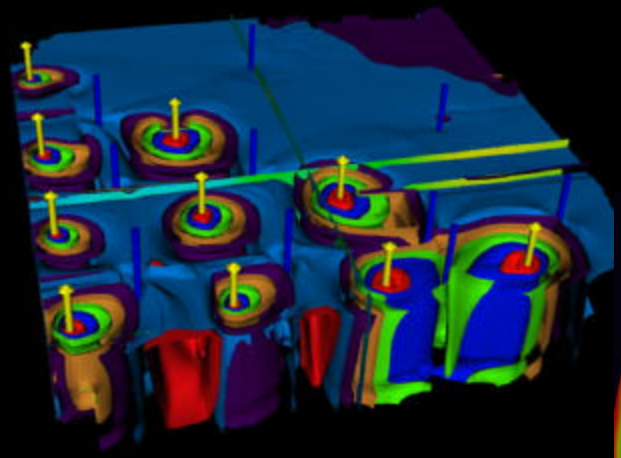
Data Analysis and Manipulation Engines

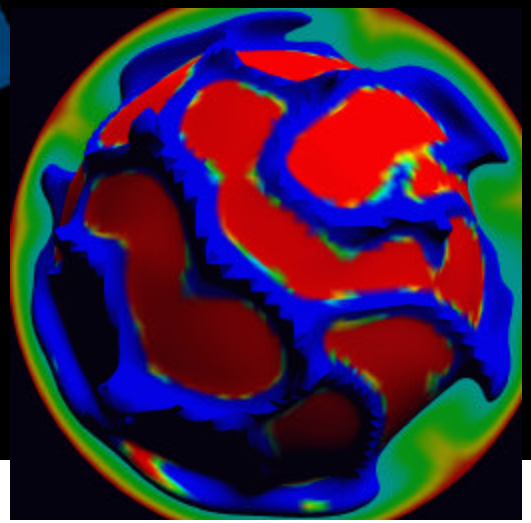
- Transposers
  - Data reorganization
- Manipulation
  - Interpolation
  - Sampling
- Feature Detection

Visualization Servers

- *Parallel & Accelerated Hardware*
- *Volume*
- *Image*
- *Surfaces*
- *Vectors*

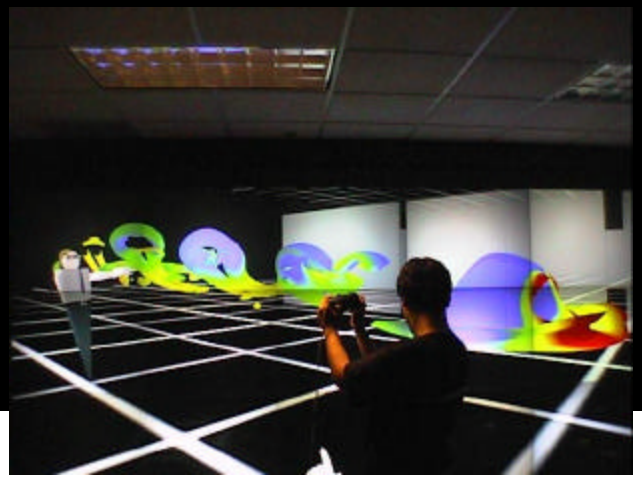


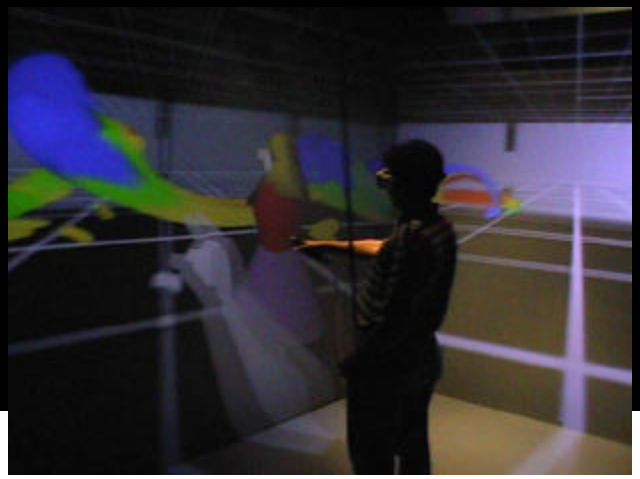




Visualization Clients

- *Lightweight, thin clients*
- *Interfaced with Multiple Display Environments*
- *Collaborative Capabilities*





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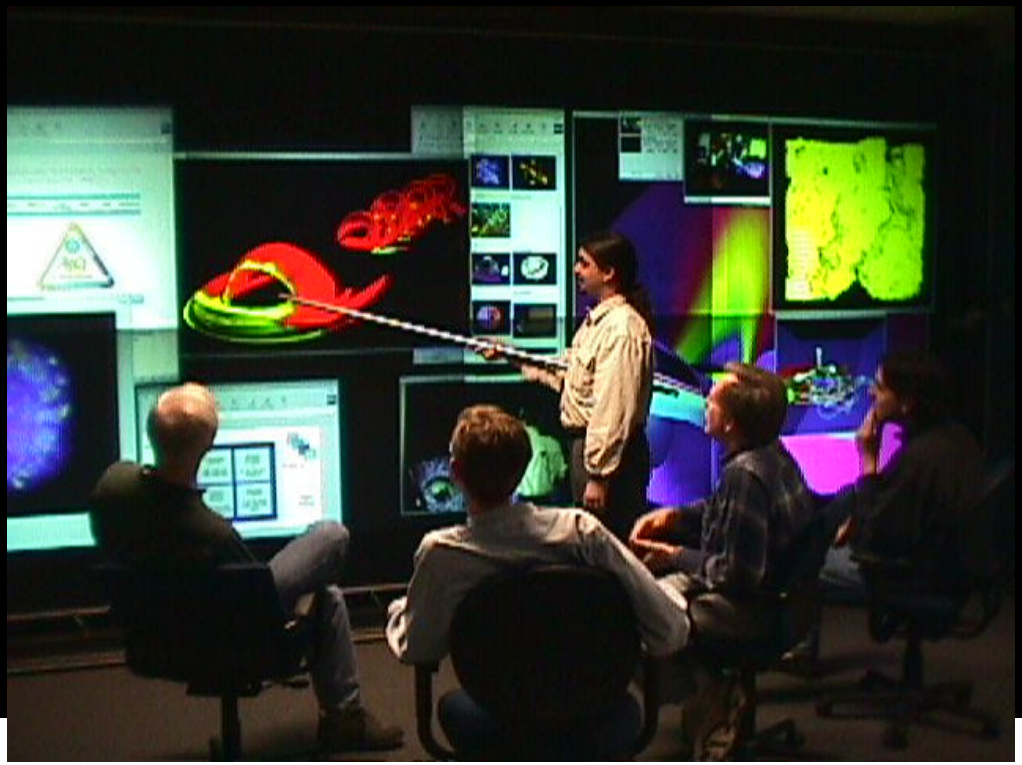
Display Devices and User Environments

- *Large Format*
- *Collaborative*
- *Immersive*



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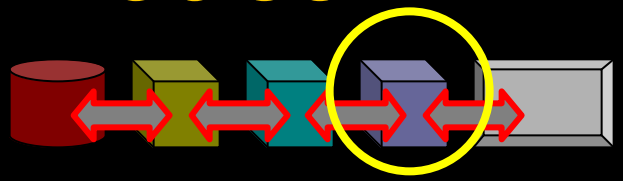
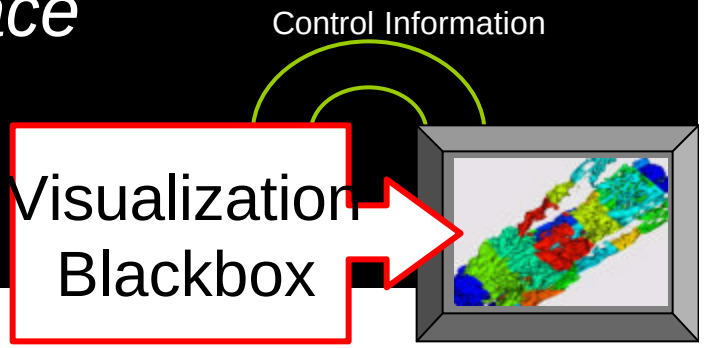
ACCESS GRID
Retreat 2001

Starting at the nodes



- Lightweight client
  - Portable (Will the desktop remain Win based?)
  - Interactive
    - Modes of interaction, floor control
  - Progressive Update
  - Intelligent network interface
    - Interfaced to flow control



Lightweight client at the nodes …

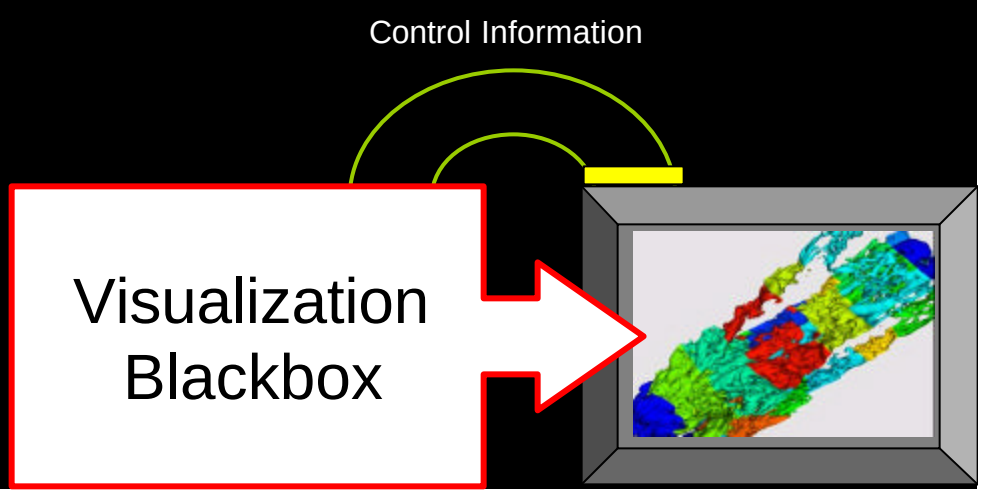
- *Supports both polygonal and video/pixel input*
- *Understand input capabilities*
- *Uses standard interaction methods*
- *Independent of rendering system*
- *Uses collaboration and intelligent layers*

Capability discovery at the nodes …

- Simple library of functions
- Connected to a database
- Database supports
  - Graphics card
    - Color depth, average polygon rate, etc.
  - Network connection
    - Average bandwidth
  - Much Much More …

Intelligent Monitoring at the nodes …

- *Simple library of functions (IM tools)*
- *Connections to:*
  - *Discovery capabilities*
  - *Current OS*
  - *Lightweight client*
  - *Upstream kernels*



Intelligent Monitoring at the nodes …

- *Supports adaptive distribution of data*
- *Maximizes performance*
- *Maximizes interaction*
- *Maintains usability*

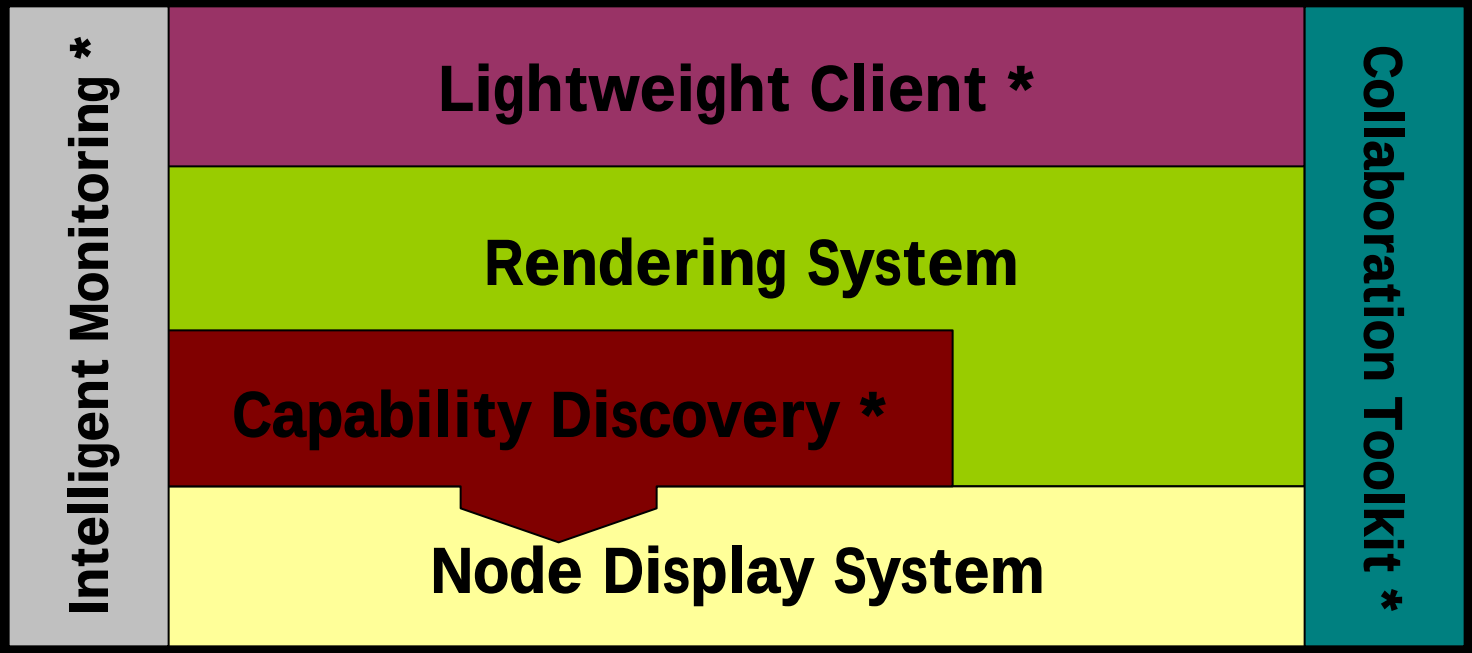
Collaboration toolkit at the nodes …

- *Cross-cutting issue*
- *Beyond the scope of remote visualization*

But

- *Needed for lightweight client*
- *What does it need to provide?*

at the nodes …

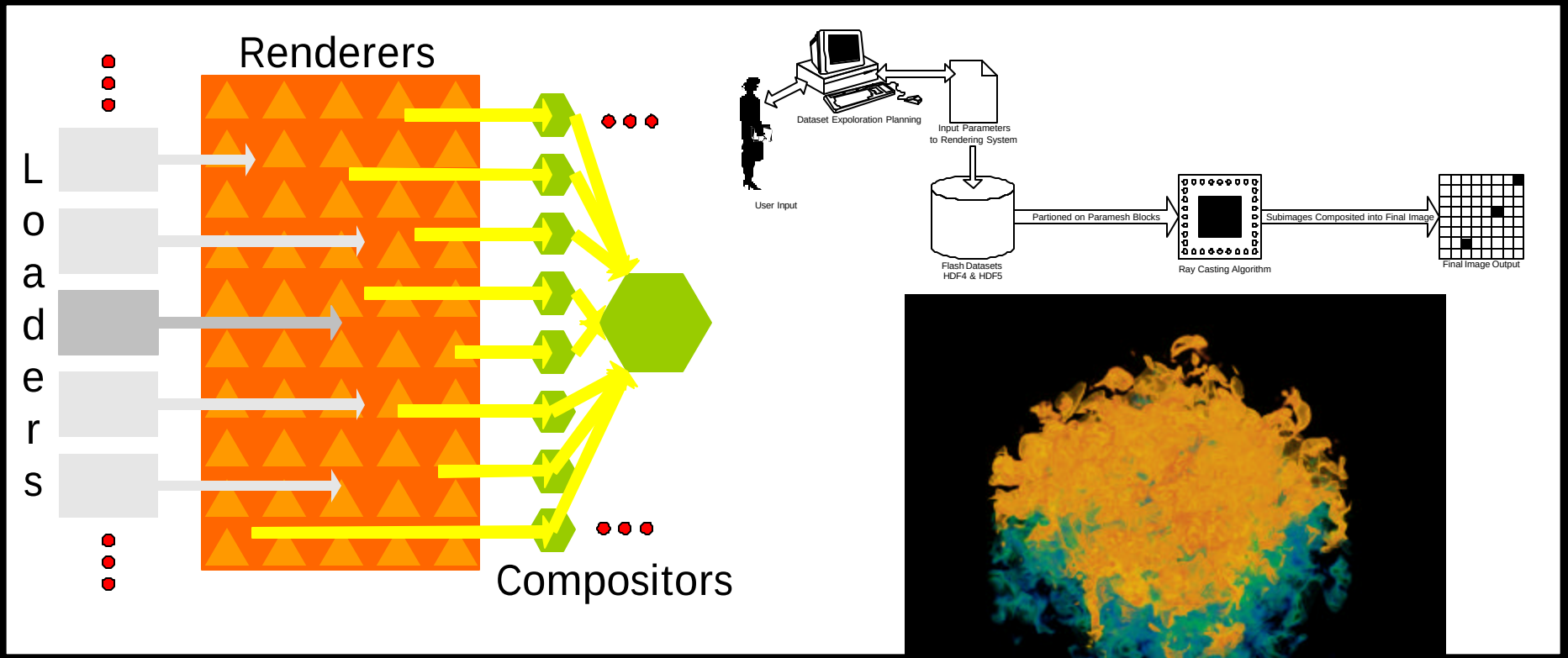
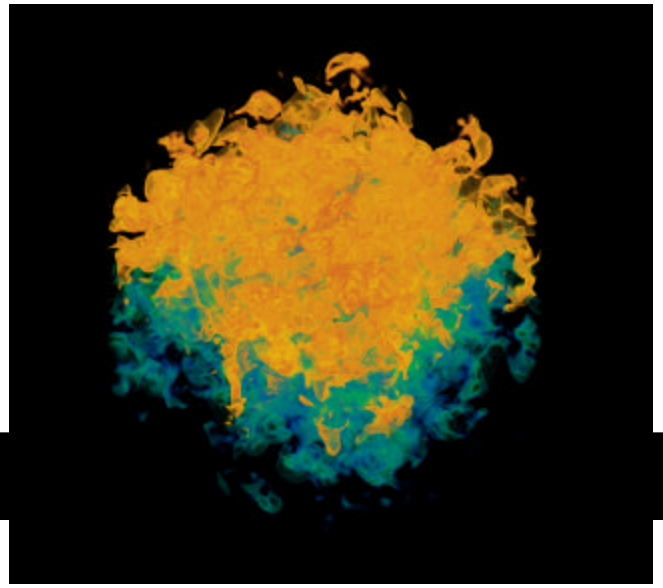


*** Needs to be built**

Conclusion

- *AG remote visualization needs to be capability driven*
- *Open question*

  How are diverse capabilities addressed?

  network, display

Example – Argonne Scalable Volume Render