A Simultaneous 2D/3D Autostereo Workstation

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Objectives

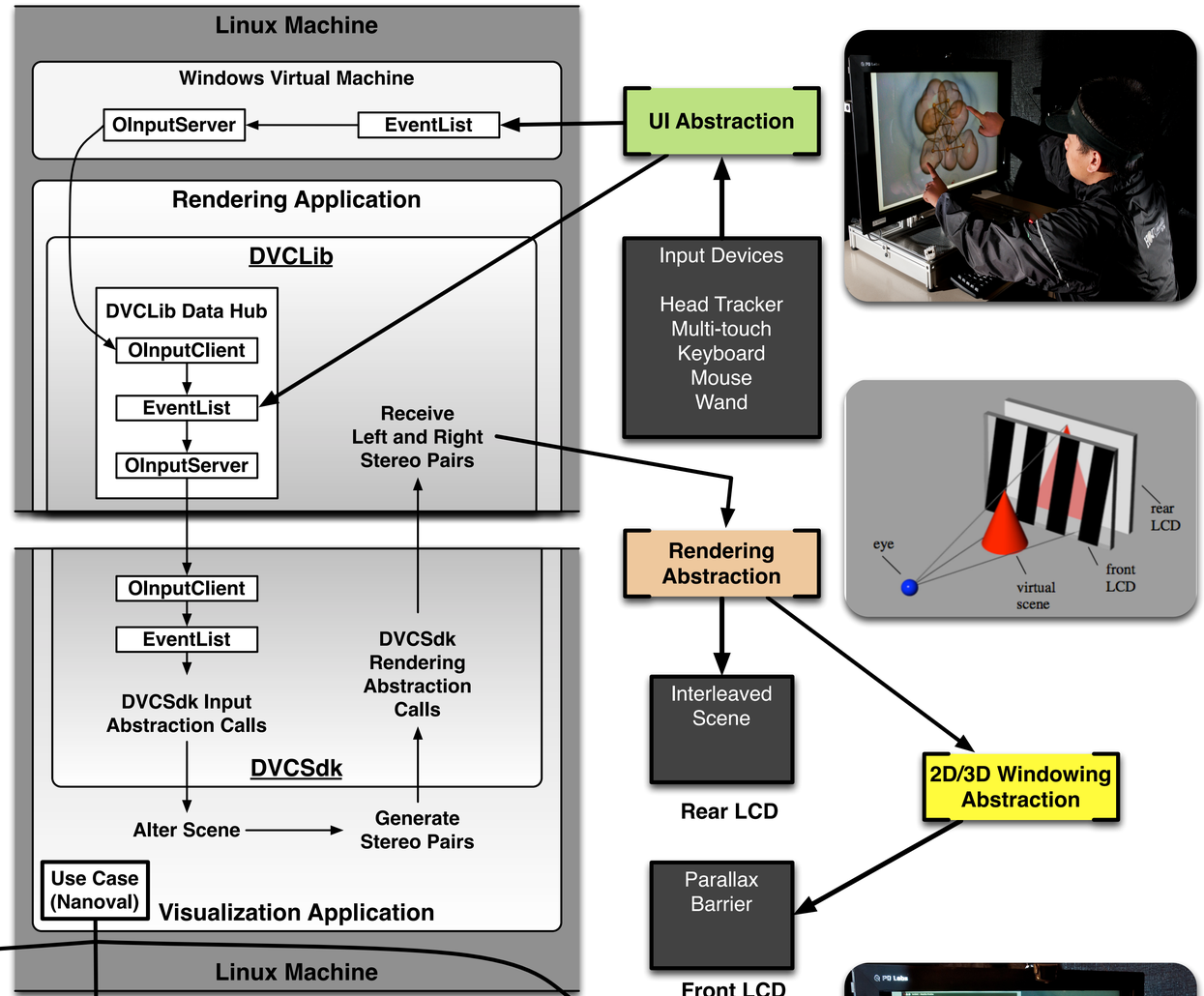
- Deploy a transparent virtual environment that directs the user's focus on the science problem instead of the technology.
- Support existing workflows so that scientists need not give up tools upon which they rely to be productive.
- Design an accessible environment that is always available and requires little or no added effort on the part of users and developers.

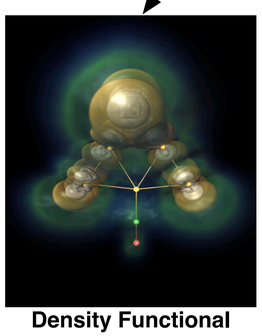
Implementation

- Next generation of the Dynallax: a dynamic parallax barrier autostereoscopy system in a desktop form factor.
- It is driven by a software system called Dynamic View Client (DVC) which consist of two parts:
  - o DVCSdk : A server-side library that enables streaming of stereo image pairs to the client side and interacts with applications to process client input
  - o DVCLib : A client-side library that displays stereo images, supports interaction devices, and provides a simultaneous 2D and 3D workspace.

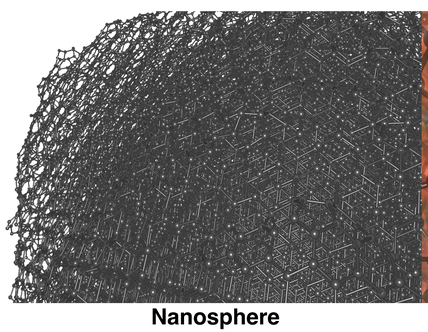
Use Case

- Coupled Dynallax to Nanovol, an interactive visualization tool designed to visualize different aspects of energy research being conducted at Argonne National Laboratory.
- Nanoval handles mixed ball-and-stick and volume rendering for :
  - o Amorphous aluminum oxide nanobowls, which serve as catalyst support structures.
  - o Carbon nanosphere represented as a larger ball-and-stick models with the option of fog and volume rendering to improve depth intuition.
  - o Modeling initial atom geometry prior to optimization in density functional theory (DFT) computation.

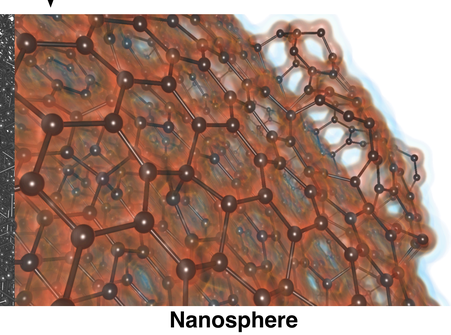




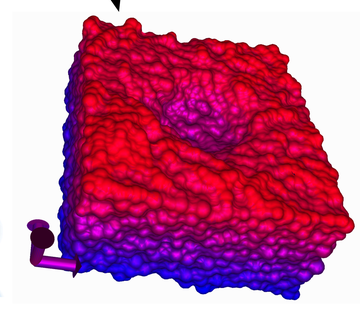
Density Functional Theory Model



Nanosphere fog and volume



Nanosphere ball-and-stick



Nanobowls

UI Abstraction

- UI Abstraction helps users connect to various devices, grab input data, process and repackage the input as a generic event packet and stores them in an EventList.
- Local user input events are abstracted by DVCLib within the rendering application.
- DVCSdk, at the visualization application, uses a thread to continuously poll and accesses the interaction data via streams.
- Wrapping OmegaLib in DVCSdk and DVCLib aided in the abstraction and transferring of user input between the two applications.

Rendering Abstraction

- Rendering Abstraction reduces the complexities of the interleaving and parallax barrier generation within the rendering application.
  - o The visualization application is responsible for taking user input events and head tracker data and using these inputs to modify the scene and rendering a stereo pair.
  - o The pair is simply transmitted to the rendering application for final autostereoscopic interleaving and rendering on the Dynallax device.
- The transfer of the stereo image pairs occurs between DVCSdk and DVCLib via TCP sockets.
- The visualization application can be an existing piece of software such as Paraview or it can be a custom application like Nanovol.

2D/3D Windowing Abstraction

- 2D/3D Windowing Abstraction allows Dynallax to be a simultaneous 3D lens into scientific data and a 2D workstation for everyday tasks such as word processing or web browsing.
- This functionality is possible via a custom X11 window manager that determines and queues the location and size of 2D windows.
- After the GLSL shader renders the parallax barrier a white rectangle is drawn for each window in the queue to "clear" the linescreen.
- The resulting white region is the union of all the 2D windows and the transparent nature of the front LCD allows the user to see the 2D content at full resolution on the rear LCD.

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