HPC Visualization with EnSight

Beijing
2010.10.27

Aric Meyer
Marketing Director, Asia & Pacific
CEI
Computational Engineering International, Inc.

- Founded in 1994 out of Cray Research
- Headquarters in Raleigh, North Carolina, USA
  - Offices in Germany, Japan, China, Detroit, Houston
  - Distributors around the world
- Financially strong, stable, and growing

Dedication to cutting-edge visualization
Select CEI Major Accounts

- Ford
- Volkswagen
- Dodge
- Honda
- Caterpillar
- Whirlpool
- PSA Peugeot Citroën
- GM
- Mercedes-Benz
- John Deere
- P&G
- GE
- Renault
- Snecma
- Sandia National Laboratories
- Los Alamos National Laboratory
- NASA
- Airbus
- Boeing
- Voith
- United Technologies
- Oak Ridge National Laboratory

Managed by UT Battelle for the Department of Energy
### A Brief History of CEI HPC Visualization

<table>
<thead>
<tr>
<th>Date</th>
<th>Headline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999.02</td>
<td>CEI's EnSight Software Visualizes Model Containing More than One-Billion Cells</td>
</tr>
<tr>
<td>2000.08</td>
<td>CEI Signs $1.8 Million ASCI Contract to Accelerate Visualization</td>
</tr>
<tr>
<td>2000.08</td>
<td>CEI's EnSight Gold Software Visualizes Model Containing 11.5 Billion Cells</td>
</tr>
<tr>
<td>2000.09</td>
<td>CEI Wins $1.4 Million ASCI Contract to Apply Beowulf Cluster for Advanced Visualization</td>
</tr>
<tr>
<td>2004.08</td>
<td>EnSight selected as application viewset for industry-standard SPECviewperf benchmark</td>
</tr>
<tr>
<td>2005.04</td>
<td>CEI becomes first high-end viz vendor to support 64-bit Windows computing</td>
</tr>
<tr>
<td>2005.08</td>
<td>CEI uses commodity clusters at LLNL to shatter world graphics rendering record</td>
</tr>
<tr>
<td>2006.06</td>
<td>Linux Networx Sets Visualization World Record By Tripling Previous Rendering Rate</td>
</tr>
</tbody>
</table>
About Computer-Aided Engineering

Typical work flow:

**CAD**
(Computer-Aided Design)

**CAE**
(Computer-Aided Engineering)
‘Virtual testing’

**Pre-Processing**
• Converting from CAD
• Preparing the simulation

**Solving**
• Running the simulation

**Post-Processing**
• Visualizing the results
• Extract meaningful info
• **EnSight**

• General visualization and post-processing software for scientific and engineering simulation data

• Used for CFD, FEA, EM, DEM, MBD, multiphysics, ...

• Largest number of features

• Excellent at large data
Parallel Processing

- CPU threading for shared-memory parallel (SMP)
- Handles partitioned data for distributed-memory parallel (DMP)
- Distributed rendering for multiple displays or extremely large data
- Compatible with remote visualization
Remote Visualization

• Powerful CPU
• Large RAM
• Access to data

EnSight Server

Efficient: minimal data transfer over the network

SSH or RSH

Remote Visualization

• Client-Server capability give access to data anywhere in the world

• Server runs remotely to access the data

• Client runs locally to the user

• Stable, fast, and transparent to the user

• Easy setup

EnSight Client

• Powerful CPU
• Large RAM
• Access to data

• Good graphics hardware
• User interface
Batch, scripting, and extensions

• EnSight is fully scriptable in Python or EnSight command language
• Scripts can run automatically in batch, including output of images and animations
• Python extensibility:
  • User-defined tools
  • User-defined menus
  • User-defined GUIs
• C/C++ extensibility:
  • Math functions
  • Readers for data import
  • Writers for data export
Other Advantages of EnSight

• Many interfaces, up to 16 datasets simultaneously
• Powerful free multi-platform 3D viewer
• High output quality, customizable view
• Strong animation capabilities
• Can be a standard post-processing solution
EnSight 9.2

Release in November 2010

“HPC release”

Primarily contains features requested by our HPC customers
What’s New in 9.2?

• Launching in HPC environments
  • Users shouldn’t have to set $CEI_HOME or modify their $PATH environment variables
  • Better support for running EnSight components in network environments
  • Better support for batch queuing systems
  • Site customized launch configuration, ssh, port forwarding, etc.

• Don’t bother most users
• Make significantly better for users that need it
What’s New in 9.2?

- Client-Server Launcher
  - Easy
  - Faster
  - No memorization
  - Random ports
  - Switch from Standalone
  - Future?
    - SOS? DR?
    - PowerWalls?
What’s New in 9.2?

• Compositing of geometry with annotations
  • Can manipulate annotations, legends, and plots at high frame rates independent of EnSight mode – redraw annotation plane then composite with geometry buffer

Pick Buffer contains an object type identifier plus an ID

Geometry

Pick Buffer

RGBZ Buffer

Composite

Overlays
What’s New in 9.2?

• Touch-n-go enhancements to Click-n-go
  • Touch-n-go - simply move the mouse on top of objects
    • Handles (all of them) will appear

Move mouse to object – handles appear

• Handle display required **no** redraw of scene (just a overlay redraw + composite)
• Manipulation of the handles required **no** redraw of scene
• Parts do not have touch-n-go handles – still need click-n-go
• Preferences exist to turn on/off touch-n-go for various object types
What’s New in 9.2?

• Anti-aliasing filters
  • Many new features prevented multi-sampled visuals
    • “jaggies” are back in 9.0-9.1
  • 9.2 adds multi-sampled visuals via “shaders”
    • done in the graphics hardware
    • smooth out the images during interactive
  • Does not effect batch rendering or saving images
    • these are already anti-aliased

• Variables for vortex identification
  • Gamma 1 and 2 scalars on clip planes
  • PSA
EnSight 10.0

Release in Q2 2011

New GUI

Main feature is a new, modern GUI made in Qt
Coming Q2 2011 – EnSight 10.0

New GUI built with PyQt

- Modern look and feel
- Consolidation of Win, Mac, and Linux
- Use of Drag and Drop
- Native File Open dialog (when running stand-alone)
- Dock, resize, and move GUI panels
- Right click on objects in graphics window
- Right click on GUI items

- Existing users will require no training

- Part list from EnSight CFD with additional enhancements
  - Sorting, hierarchical views, use of metadata
EnSight 10

- April 2011 Target Date!
- With not-yet-determined feature enhancements
  - Report Generation
  - Plotting Enhancements
  - Volume Rendering options
  - N-faced element memory and performance
  - Instruments
  - Units
  - Selection by arbitrary polygon
  - LIC (Line Integral Convolution)
Thank you!

For the second part of my talk I will show a few slides from a presentation by our largest customer:

Los Alamos National Laboratory