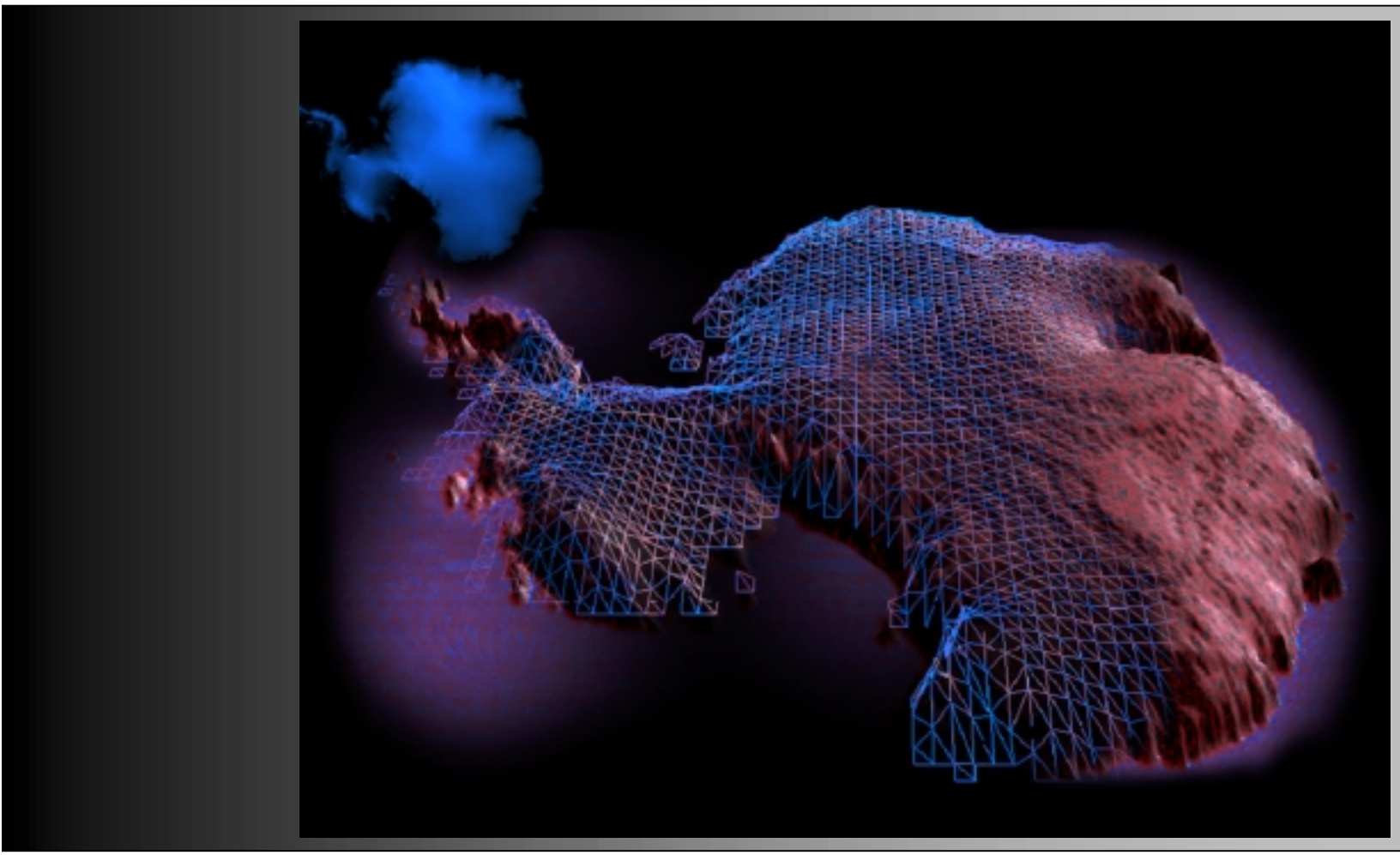
TerraForm3D

Terrain Modeling Software and Beowulf Cluster Maintenance Guide



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Section 1: TerraForm3D Media Output

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Corrective Maintenance

Bugs

No known bugs.

Perfective Maintenance

Upgrades

1. Allow user to set file name and output directory for POV-Ray files instead of auto-generating unique file names. The file name will need to be set by `MediaOutput` for each `PerspectiveView` and `VRML` object using a menu item “Export As...” in `TerraGUI`.
2. Allow user to set exact number of frames to generate for movie frames. Add `user_defined` to `frameRate` enumerated type, add `int num_frames` and method for setting this value to `PerspectiveView` via `MediaOutput's` movie member variable, and give the user a menu item in `TerraGUI` that sets the value.
3. POV-Ray does not efficiently read image data (it reads an entire file into memory). This function should be changed to allow large data files to be read dynamically, only reading in the needed data during any portion of the rendering process. POV-Ray is open source.
4. Link into POV-Ray's libraries so that call to renderer is done as a function call instead of a system call to launch the POV-Ray executable.

Adaptive Maintenance

Migration

Except for the system call to POV-Ray, TerraForm3D has been designed to be system independent. In practice, TerraForm3D can only be compiled and run on systems that can run the GLUT, GLUI, and OpenGL libraries, and POV-Ray software.

For the Flagstaff Field Center USGS personnel, future migration is predicted to move away from the Alpha/True64 workstations towards IBM-compatible and Alpha-based Linux systems. Strong development and testing has been done under Linux as well as Alpha/True64, thus migration towards Linux on either architecture should be a smooth process for TerraForm3D, and mainly dependent on the availability of the required libraries and software, and working through minor compilation errors.

Section 2: TerraForm3D Image Manager

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Corrective Maintenance

Bugs

No known bugs

Perfective Maintenance

Upgrades

ImageManager's **Image** class is an inheritance structure that allows the easy addition of various image file format types. TIFF, BMP, TGA, and other types can be added by creating a child class of Image that overrides the `parseImage()` function with the algorithm for reading a particular file format. **ImageManger** will need the case statement that instantiates the correct child of **Image**.

Adaptive Maintenance

Migration

Except for the system call to POV-Ray, TerraForm3D has been designed to be system independent. In practice, TerraForm3D can only be compiled and run on systems that can run the GLUT, GLUI, and OpenGL libraries, and POV-Ray software.

The only known issue is the Little Endian verses Big Endian architechtures and reading binary file types. The software was designed on Big Endian systems, and has not been tested on Little Endian systems, such as Sun or Macintosh. It is believed that if the user converts his data sets from Big to Little Endian byte order, that ImageManager's binary file stream will work correctly.

Section 3: TerraGUI

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Corrective Maintenance

Bugs

The user interface appears to use excessive CPU time. Solving this problem will require extensive testing and monitoring to locate and resolve the problem.

Perfective Maintenance

Upgrades

The following user tools are recommended for future upgrades to the user interface:

- Save all POV-Ray calls for batch rendering at the end of the session
- Create a batch rendering file to be run from the command line (O/S dependent)
- Load the texture for on screen viewing as an overlay over the terrain
- Allow the output file name to be set by the user

Adaptive Maintenance

Migration

OpenGL was chosen as the 3D language because of its growing acceptance as a system independent standard. Migration to other platforms and operating systems should consider the need for OpenGL support as a factor.

Section 4: Beowulf Cluster

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Corrective Maintenance

Network

- New switch for the network, currently the switch does not have enough bandwidth on the backplane to support all network card going at the full 100 Mbs in full duplex. A Cisco switch such as the Catalyst 2900 would be a good choice. Keep up with the latest network driver, doing this will help ensure that you are getting the most out of your network card. Look at http://cesdis1.gsfc.nasa.gov/linux-web/ for the latest network and beowulf information.

Memory

- More Memory for each of the computers would help with the buffering of information between computers. This would speed up the computation time, and cut down on disk swaping.

CPU's

- Though PVM POV-Ray does load balancing, the act of load balancing hurts the performance of the cluster. If the entire cluster was running at the same speed, this would improve the performance.

Perfective Maintenance

Parallelization of POV-Ray

- PVM POV-Ray currently brings in the entire image on to each of the computers. This is not nessesary. The code found on the CD in /cluster/prototype/parallelization.cpp should be implemented to fix this problem. Instead of running PVM POV-Ray, run the normal POV-Ray on each computer, using this code to divide up the work and to start it using MPI.

Linux software

- Attention must be paid to the current releases of patches for the Linux software and the kernel. These can be both security risks if not patched, and a performance increase of the cluster could be missed. You should subscribe to your Linux distribution's security mailing list and look for the latest kernel update at www.kernelnotes.org.

Adaptive Maintenance

Software Migration

POV-Ray and the Beowulf clustering system are well supported by the Linux community, and do not pose a risk in the future maintenance of the system.

Hardware Migration

OpenGL was chosen as the 3D language because of its growing acceptance as a system independent standard. Hardware upgrades should consider the need for OpenGL support as a factor.