Panda3D: 3D Engine   Wesley Weaver

When looking for a topic to write on in game development, I came across this release of a 3D rendering and game development program called Panda3D, or Platform Agnostic Networked Display Architecture. A massive multiplayer online game called Toontown Online, which was developed by Walt Disney Imagineering VR Studio, was created using this 3D engine.   This program was released as a free software license that allows anyone to download and use and even alter the source code as they want. Since, it is open source this has allowed a large community to work together to improve the engine, from its already short learning curve and rapid development design.

Panda3D is a combination of C/C++ framework and Python-based scripting interface. Python allows programmers to edit their C/C++ code while the program is running, enabling fast development. Panda's features can be extended by using other Python modules to allow programmers to use already created module to add a feature they may want. Here is a feature list from Panda3D's website:

   - Multiple underlying rendering APIs: DirectX/OpenGL

   - Python scripting interface

   - Programming on the fly using interactive scripting in the Python shell

   - Extensibility using Python modules

   - Custom 3D file format, Egg, with exporters for 3D Studio Max and Maya

   - Soft skin animation and a sophisticated actor interface for character animation

- DIRECT Tools for GUI-based scene editing

- Particle Effects API and GUI-based particle panel

- Lighting, fog, and animated textures

- Sound using the FMOD library

- Multithreading, event handling, message passing, and finite state machines

- Functions for interpolation, sequencing, and parallelization

- Modules for magnetic tracking for virtual reality

- Input device interfaces

- Extensive scenegraph manipulation modules

Some of the Panda3D features are built on top of Python as added tools to help in constructing simulations and games. Panda uses a simple Task scheduling system in a single-threaded process in which each Task runs once per frame taking turns for each frame, with "do-later" Tasks put on a priority queue. Events are handled using a global messenger to manage mouse click and keyboard strokes on either the depression or release. These events are used for controlling when responses will be executed and for broadcasting capability through the code. Sequences and Parallels control when intervals for animations, function, etc. will begin. The intervals can be paused, resumed, restarted, and even jumping to a point in an interval. Here is a list of the various interval types from the Python documention on Panda3D:

Lerp Interval – Interval for linearly interpolating NodePaths or functions (position, rotation, scale, color, etc)

- Actor Interval – Interval for playing animations on Actors

- Mopath Interval – Interval for moving an object along a spline motion path

- Sound Interval – Interval for playing back a sound effect

- Particle Interval – Interval for playing back particle effects

- Function Interval – Interval for executing functions

- Wait Interval – Interval that waits for a specified time and is useful for complex sequences

One amazing aspect of Panda3D is that during a simulation, you can redefine a method in use and start it again from the point you stopped at. Panda3D rereads the definition of classes and swaps the old ones with the new, therefore rebinding the new version. There is even special code to swap function pointers, such as events and tasks.

Here are a few examples of what Panda3D has enabled developers to do:

Toontown Online

Above: Screenshots from Toontown Online
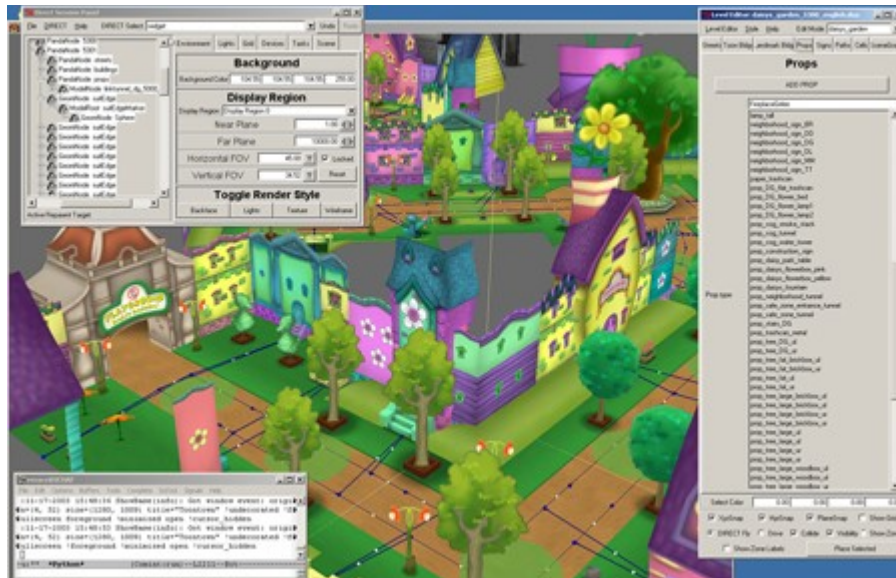
Above: Level Editor and DIRECT Tools for Toontown

Toontown is Disney's massively multiplayer online role playing game (MMORPG) which was built using Panda3D and developed using Python scripting. It is a game that is downloadable and is less than 30 MB compressed. It was named MMORPG of the year by Computer Gaming World in 2003.

Building Virtual Worlds

Entertainment Technology Center has a class called Building Virtual Worlds where teams of 4 to 5 build interactive virtual reality experiences in two or three weeks. They are viewed with Head-Mounted Displays and magnetic tracking. The experience is based in Panda3D and it produces stunning results for the class.

Depending on the game development community and open source movement Panda3D may become the rapid prototyping tool of choice for games and simulations.

Sources

Panda 3D Website, Entertainment Technology Center, Carnegie Mellon University, http://www.etc.cmu.edu/panda3d.

Python Software Foundation Website, 2006, The Panda3D Engine - Python Scripting for Game and Simulation Development, http://www.python.org/pycon/dc2004/papers/29/