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Dual Scripting in a Virtual Reality Engine. Embedding Python in XVR

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In this talk we present the embedding of Python inside the eXtreme Virtual Reality (XVR) Engine. XVR is an advanced and lightweight system for the development of Virtual Reality applications both for the Web and for 3D Immersive systems.

This system has been extensively used in European Projects for the construction of high quality 3D graphic applications enhanced with VR devices. XVR applications are written in the S3D scripting language and compiled into a bytecode representation executed by the XVR Virtual Machine. The scripting language and the virtual machine are specialized and optimized for the manipulation of 3D entities and efficient object oriented programming.

The XVR system allows to develop and deploy 3D application easily by asking the developer only to write the core rendering loop and place the application in a Web page. The XVR Engine provides natively a set of classes for creating Virtual Reality applications ranging from 3D graphics (both high level classes and low level OpenGL functions), 3D sound and physics. Moreover it is possible to extend such features with external native modules providing the support for new devices, simulation engines or rendering techniques. At runtime the external modules are loaded and their classes integrated in the system namespace.

PYXVR is a XVR extension that allows to embed a Python script inside a XVR application or, putting it in another way, write a Virtual Reality application using the XVR Engine features. Typically the XVR application loads the PYXVR extension, executes the scripts and invokes Python in response to the rendering (OnFrame) and animation (OnTimer) events of the XVR Engine.

The result is a dual script environment in which the two scripting engines cooperate for providing the best of the two worlds. The Python scripts are able to access all the functions and classes defined by XVR (both scripted and native), while the XVR script accesses the Python scripts through the eval and callback functions

There are some advantages to using Python inside a XVR application. First there is the possibility of modifying and extending the application using the script, because the XVR application is completely defined at compilation time. Then there is the possibility of using the Python libraries and multi-threading for enhancing the XVR application. Despite the advantages there are some drawbacks that should be taken into account. First there is the aspect of security. XVR applications are typically executed in the Web Browser and the XVR classes respect the security requirements of this environment. The PYXVR extension allows the unrestricted import of modules and for this reason it is currently limited to local XVR applications. The second disadvantage of PYXVR for 3D Web application is the weight of the Python engine whose core shared library is in the order of one megabyte, a size that is equivalent to the whole XVR engine comprising the Virtual Reality features. With regards to the execution speed, the S3D scripts are faster than the Python ones in managing objects and external entities because during the

off-line compilation of the script all the names and functions are known and encoded in the byte-code. The simpler type space of S3D provides also additional optimizations when dealing with 3D entities.

The talk discusses the overall PYXVR extension, the aspects of integration between the two environments, the multi-threaded features and finally a performance evaluation of this solution.

Concluding, the PYXVR extension presented in this talk can be used by XVR developers for enhancing their XVR applications and at the same time by Python developers for the fast prototyping of Virtual Reality applications.

Information about XVR can be found at http://www.vrmedia.it
More information on PYXVR will be shortly provided on:
http://wiki.vrmedia.it/index.php?title=PYXVR

Summary

eXtreme Virtual Reality (XVR) is a system for the development of Virtual Reality applications based on a specialized scripting language and Virtual Machine. In this talk we discuss the PYXVR extension for XVR that allows to enhance XVR applications using Python for providing more flexibility or accessing existing Python libraries.

The result is a Dual Scripting environment in which the two virtual machine cooperates.

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