

# CASTLE GAME ENGINE

## GAME ENGINE USING X3D AS A SCENE GRAPH



Castle Game Engine is a modern, open-source game engine closely connected with the X3D standard. It uses X3D as a scene graph, and also as it's main 3D and 2D interchange format.

### X3D NODES AS A SCENE GRAPH

Loading any 3D or 2D asset to the engine results in a graph of X3D nodes.

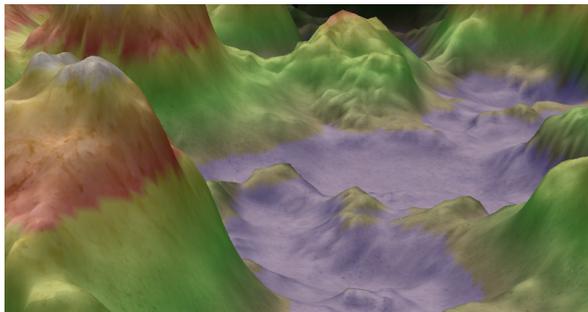
Developer can freely animate and operate on the loaded scene graph, making the content fully dynamic. It can be processed using X3D events or by directly modifying X3D nodes and fields.

X3D worlds can be composed and processed. Many 3D scenes can be combined, and can be **animated or build or modified**. Their behaviour can be coded as scripts (inside X3D) or using powerful object-oriented API in *modern Object Pascal*.

Moreover, many **other data formats** can be loaded and are converted seamlessly to the X3D scene graph. For example, *Spine 2D animations* or *Collada 3D assets*. Everything cooperates in the engine, as it's all a graph of X3D nodes after loading.

### PROCEDURAL GENERATION

Developer can build an X3D graph by code, from scratch or by compositing modeled 3D parts. This allows to generate 3D worlds using a variety of interesting techniques, e.g. generate terrains using a smooth noise, or generate cities using grammar-based procedural generation algorithms.



### STREAMING

As we can load and save any X3D graph (to XML or classic encoding), the developer has the tools to save the 3D world.

### PORTABLE (ANDROID, IOS)

The engine is truly portable, supporting various standalone (Windows, Mac OS X, Linux, etc.) and mobile (Android, iOS) platforms.

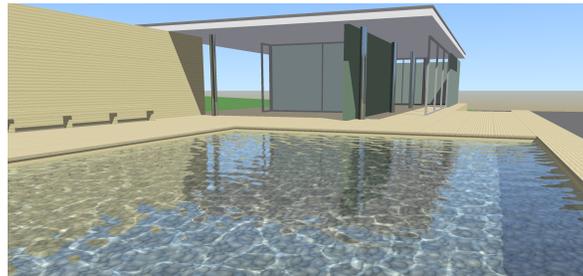


### MODERN GRAPHIC EFFECTS

The engine provides a plethora of modern graphic effects and techniques, like:

- **Bump mapping** (steep parallax mapping with self-shadowing).
- **Shadows** (by shadow maps or shadow volumes).
- **Custom shaders** (by enhancing or overriding engine rendering).
- **Mirrors** (by cubemaps or flat texture reflections).
- **Rendered textures**.
- **Custom viewports**.
- **Screen-space effects** (programmable in a shading language).

Everything is expressed using X3D nodes (with some extensions to the X3D standard). See the documentation of our extensions at our website, and in Michalis Kamburelis papers "*Shadow maps and projective texturing in X3D*" and "*Compositing Shaders in X3D*".



### ACCESSIBLE FOR EVERYONE

The engine is accessible to all content creators, regardless of the tool they prefer — since virtually every 3D tool allows to export it's data to X3D or VRML. For X3D authors, it's trivial to just use X3D to build a 3D or 2D world.

### 3D AND 2D

Just like X3D, the engine is suitable for 2D games as well as 3D.

### INTELLIGENT 3D WORLD

- Comfortable **scene manager** for 2D or 3D game worlds.
- **Movement planning** by waypoints and sectors in 3D.
- Ready to use classes implementing **artificial intelligence**.
- **3D sound**, integrated with **X3D Sound component**.

### ANIMATIONS

- **Interactive** (using standard X3D interpolator mechanisms).
- Humanoid (**H-Anim**) animations supported (skeletal and skinned).
- Can be **baked** making rendering fast (at the cost of memory usage).



### DEVELOPING IN OBJECT PASCAL

The developers can use a full-featured object-oriented API to load and manage the game. The engine is written using modern **Object Pascal** language.

- Modern Object Pascal is probably more similar to Java or modern C++ than to the Pascal you learned in school 30 years ago:)
- Modern hybrid programming language, with everything you expect — units, classes and interfaces system, generics, rich runtime library, tools etc.
- Compiled to native, optimized code.
- Type-safe.
- Portable (thanks to FPC, Free Pascal Compiler). Windows, Mac OS X, Linux, Android, iOS (iPhone, iPad), many more.
- Easily cooperates with other languages.

