The intention of this document is to describe how to use the **Procedural Terrain Generator (PTG) v2** inside Unreal Engine and all of its settings. All the blueprints reference will be included here too.

The PTG has been created by Víctor Hernández Molpeceres using the [Auburn's Fast Noise Lite](#) library and the [Koderz's Runtime Mesh Component](#). It supports UE4.26 and beyond. For the legacy version of PTG (versions 1.0 to 1.4), please refer to the [legacy documentation](#).

You can see the version notes clicking [here](#).

Introduction

This plugin is an editor code plugin that aims to assist the user by procedurally creating terrains with different shaped (plane, sphere or cube) and populate it with thousands of nature meshes (using HISMs) and actors in just a few seconds, using your own assets. It also provides modifiers and other settings that let you create exceptions on the terrain for certain assets generation. For example, you can use trees and grass assets, but configuring the plugin to avoid locating trees in a defined area or height.

The first thing would be to enable the plugin. Go to **Edit > Plugins > Code Plugins** and enable the ProceduralTerrainGenerator. Then, enable the plugin content visualization through the **View Options** (see the image below).
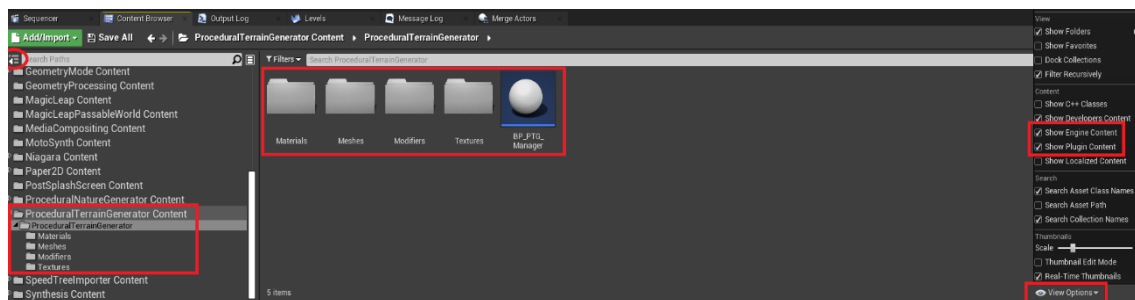
Now that you see the plugins' content, you can drag & drop the **BP_PTG_Manager** actor to your map, and start configuring it. In the details panel you will find all the properties under different categories and all the actions available in editor, as you can see in the next image:
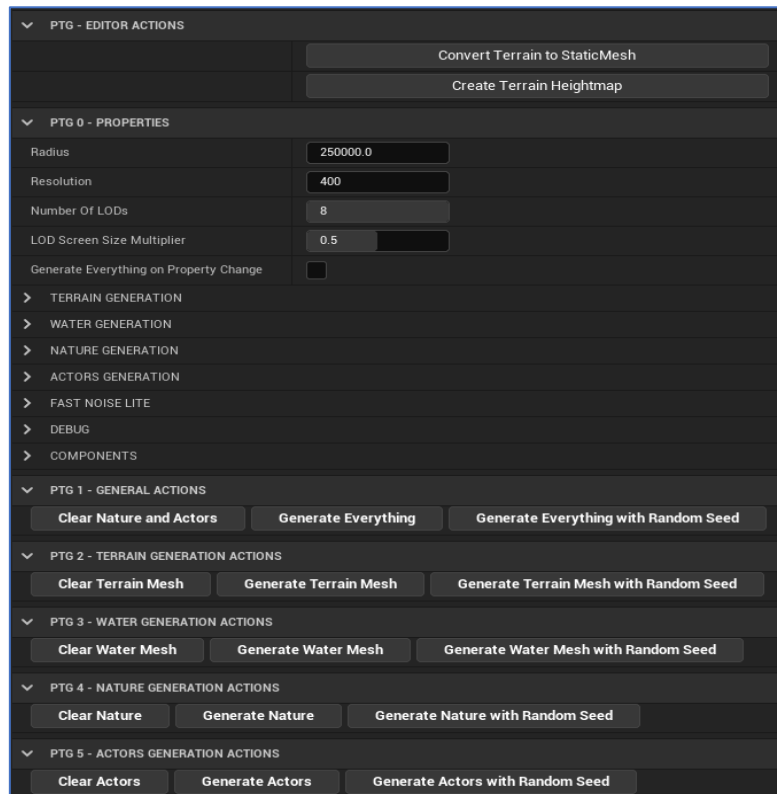
Inside the **Modifiers** folder you will find **BP_BoxModifier** and **BP_SphereModifier**, which can be used in nature and actors' generation to avoid placing some meshes/actors inside or outside those volumes.

It is highly recommended to watch the video tutorials available in YouTube.

PTG Properties

Here you can configure every aspect of the PTG divided in different categories:

General Settings

- Radius - Extension radius of the terrain. It is expressed in centimeters, so a value of 40000 will generate a 400-square-meter on plane terrains or a 400-meter radius on spherical and cubical terrains.
- Resolution - Number of tiles that will be generated on x and y, this means that with a value of 300, the terrain will be divided into 300x300 tiles. Cubical and spherical terrains have 6 faces, so the terrain would have 300x300 tiles on each one.
- Number of LODs - Number of LODs that will be generated for the terrain and water meshes. A Value of 1 means no LODs (only LOD 0 will be generated).
- LOD Screen Size Multiplier - The screen size multiplier applied to each LOD (0.0 - 0.99). The screen size is calculated using this: *Pow(LODScreenSizeMultiplier, LODIndex)*.
- Generate Everything on Property Change - If true, regenerates the corresponding stuff automatically when some property changes.

Terrain generation

- Shape - Describes the shape of the terrain (plane, cube or sphere).
- Use Terrain Tiling - If true, it will add an offset to the noise based on actor location, so the terrain will tile with other generated terrains. Only available on plane terrain shape.
- Noise Input Scale - Making this smaller will "stretch" the noise on the terrain.
- Noise Output Scale - Making this bigger will scale the terrain height.
- Terrain Material - Material used for the terrain mesh.
- Enable Terrain Collision - Whether the generated terrain mesh should have collision or not.
- Lowest Generated Height - Lowest height value of the generated terrain. Not editable, only visible to know the lowest height.
- Highest Generated Height - Highest height value of the generated terrain. Not editable, only visible to know the highest height.

Water generation

- Generate Water - Whether to generate water mesh or not.
- Water Height Generation Type - Type of water height generation. Fixed Height is only available on plane terrain shape.
- Water Seed - Seed used to generate the water mesh height when Water Height Generation Type is Random Percentage using Water Random Height Range Percentages.
- Water Random Height Range Percentages - Range of height percentages where the water will be randomly placed between Lowest Generated Height and Highest Generated Height ONLY when Water Height Generation Type is Random Percentage. For example: Lowest Generated Height = -100, Highest Generated Height = 100 and Water Random Height Range Percentages = (25,75), the water will be placed at a random height between -50 and 50.
- Water Fixed Height Percentage - Percentage of height where the water will be placed between Lowest Generated Height and Highest Generated Height ONLY when Water Height Generation Type is Fixed Percentage. For example: Lowest Generated Height = -

100, Highest Generated Height = 100 and Water Fixed Height Percentage = 75, the water will be placed at a height of 50.

- Water Fixed Height Value - Relative fixed height (Z) value for the water generation ONLY when Water Height Generation Type is Fixed Height.
- Water Material Uses PN Triangles Tessellation - Check this option if the water material uses PN Triangles tessellation mode. WARNING: if this option is checked, an extra calculation time will be added when generating the terrain. Only needed on Procedural Mesh Terrain Element.
- Water Material - Material used for the water mesh.
- Enable Water Collision - Whether the generated water mesh should have collision or not.
- Water Height - Height of the water. Not editable, only visible to know the generated water height.

Nature generation

- Generate Nature - Whether to generate nature meshes or not.
- Bioma Nature - Array of different meshes per bioma. For example, you can set 2 registers for Underwater, one with bush meshes, and other for rocks.
    - Corresponding Bioma - Bioma where the mesh will be randomly placed (earth surface, underwater or both).
    - Cull Distance - Distance (in centimeters) from camera at which each generated instance fades out. A value of 0 means infinite.
    - Meshes - Array of meshes used by PTG to randomly pick each time it adds a bioma element.
    - Min Meshes to Spawn - Minimum nature meshes that will be added on the corresponding bioma.
    - Max Meshes to Spawn - Maximum nature meshes that will be added on the corresponding bioma.
    - Min Max Scale - Min. and max. range to randomly scale each added mesh.
    - Rotation Type – There are 3 types:
        - Random – random Rotation, commonly used on stones, for example.
        - Terrain Shape Normal – Rotation that matches the terrain face normal, commonly used on trees, for example.
        - Mesh Surface Normal – Rotation that matches the normal of the mesh surface where it is placed, commonly used for grass, for example.
    - Seed - Seed used for all the random operations of this bioma nature.
    - Modifiers - Array of shape modifiers to avoid when placing new nature meshes.
    - Use Locations Outside Modifiers - Disable this option to get the inverted result on modifiers (nature meshes will be located only inside of them).
    - Height Percentage Range to Locate Nature Meshes - Height percentage range where nature meshes will be placed.
    - Use Locations Outside Height Range - Enable this option to get the inverted result (nature meshes will be located only out of height range).

Actors' generation

- Generate Actors - Whether to spawn actors or not.
- Bioma Actors - Array of different actors per bioma. For example, you can set 2 registers por earth surface, one with a character, and other with an actor blueprint.

- o Corresponding Bioma - Bioma where the mesh will be randomly placed (earth surface, underwater or both).
- o Cull Distance - Distance (in centimeters) from camera at which each generated actor fades out. A value of 0 means infinite.
- o Actor Class - Class of the actor that will be randomly placed.
- o Min Actors to Spawn - Minimum actors that will be spawned on the corresponding bioma.
- o Max Actors to Spawn - Maximum actors that will be spawned on the corresponding bioma.
- o Seed - Seed used for all the random operations on the actor generation.
- o Modifiers - Array of shape modifiers to avoid when placing new actors.
- o Use Locations Outside Modifiers - Disable this option to get the inverted result on modifiers (actors will be located only inside of them).
- o Height Percentage Range to Locate Actors - Height percentage range where actors will be placed.
- o Use Locations Outside Height Range - Enable this option to get the inverted result (actors will be located only out of height range).

Fast Noise Lite

- Noise Type - Algorithm used to generate the terrain height.
- RotationType3D - Domain rotation type for 3D Noise (Cube or Sphere terrain shapes) and 3D Domain Warp.
- Seed - Seed used for all noise types. Using different seeds will cause the noise output to change.
- Frequency - Frequency for all noise types, except White Noise. Affects how coarse the noise output is.
- Fractal Type - Method for combining octaves in all fractal noise types.
- Fractal Octaves - Octave count for all fractal noise types. The amount of noise layers used to create the fractal.
- Fractal Lacunarity - Octave lacunarity for all fractal noise types. The frequency multiplier between each octave.
- Fractal Gain - Octave gain for all fractal noise types. The relative strength of noise from each layer when compared to the last.
- Fractal Weighted Strength - Octave weighting for all non Domain Warp fractal types. Default value: 0.0. Note: Keep between 0...1 to maintain -1...1 output bounding.
- Fractal Ping Pong Strength - Strength of the fractal ping pong effect.
- Cellular Distance Function - Distance function used in cellular noise calculations. The distance function used to calculate the cell for a given point.
- Cellular Return Type - Return type from cellular noise calculations.
- Cellular Jitter - Maximum distance a cellular point can move from its grid position. Setting this higher than 1 will cause artifacts.
- Domain Warp Type - Warp algorithm.
- Domain Warp Amplitude - Maximum warp distance from original position when using Domain Warp.

Debug

- Show Debug Messages – If enabled, it will show debug info messages on screen and on the output log.

- Debug Messages Time on Screen – Specifies the time debug messages will be on screen.

PTG Actions

Here you can find call-in-editor functions to regenerate different parts of the terrain separately.

General actions
- Generate Everything - Regenerates the terrain, water, nature and actors using the seeds configured in the manager.
- Generate Everything with Random Seed - Calculates random seeds and regenerates the terrain, water, nature and actors.
- Clear Nature and Actors - Removes all nature meshes and actors on the terrain.

Terrain generation actions
- Generate Terrain Mesh – Regenerates the terrain mesh using the seed configured in the manager.
- Generate Terrain Mesh with Random Seed – Calculates a random seed for the terrain mesh and regenerates the mesh.
- Clear Terrain Mesh - Removes the terrain mesh.

Water generation actions
- Generate Water Mesh - Regenerates the water mesh using the seed configured in the manager.
- Generate Water Mesh with Random Seed – Calculates a random seed for the water and regenerates the mesh ONLY if Generate Water is true AND Water Height Generation Type is Random Percentage.
- Clear Water Mesh – Removes the water mesh.

Nature generation actions
- Generate Nature – Regenerates the nature and the actor spawning using the seeds configured in the manager.
- Generate Nature with Random Seed – Calculates a random seed for the bioma nature and regenerates the nature ONLY if Generate Nature is true.
- Clear Nature - Removes all nature meshes on the terrain.

Actors' generation actions
- Generate Actors – Regenerates the actor spawning using the seeds configured in the manager.
- Generate Actors with Random Seed – Calculates a random seed for the bioma actors and regenerates actors ONLY if Generate Actors is true.
- Clear Actors - Removes all actors on the terrain.

Editor actions
- Convert Terrain to Static Mesh - Create a new Static Mesh asset using current geometry from generated terrain mesh. Does not modify instance.
- Create Terrain Heightmap - Create a new .png image using current vertex data from the generated terrain mesh. Only available on Plane terrain shape.

Blueprint reference

The PTG is also blueprint-friendly! All the settings and functions are also exposed to blueprints. Using the keyword "PTG", you will see different categories for all the exposed functions.
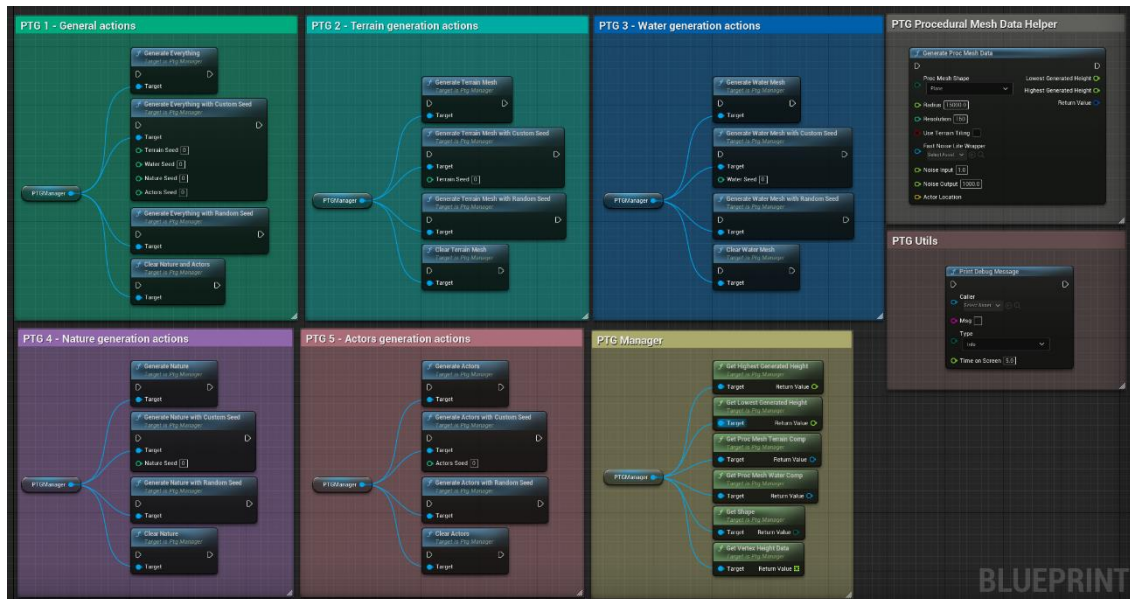
C++

All the code is well-documented and can be used from other source code files in your projects. You can find and analyze it in ProceduralTerrainGenerator\Source\ProceduralTerrainGenerator

Fast Noise Lite library

Fast Noise is an open source noise generation library with a large collection of different noise algorithms. It's used to calculate the noise that will be applied on the terrain height. The original library and all its documentation about noise generation can be found here.

I've constructed a free UE4 plugin using the original Fast Noise Library, it's well documented and also exposed to blueprints. Click here to know more.

Acknowledgements

Thanks to Auburns for creating the incredible Fast Noise Lite library.
Thanks to Koderz for creating the awesome Runtime Mesh Component.
Thanks to my colleagues at Tessera Studios, specially to the great Marcos Neila Muro, who created the PTG logo, saving a poor programmer like me, unable to create a decent not-eye-killer logo. You can find more about Marcos here.
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