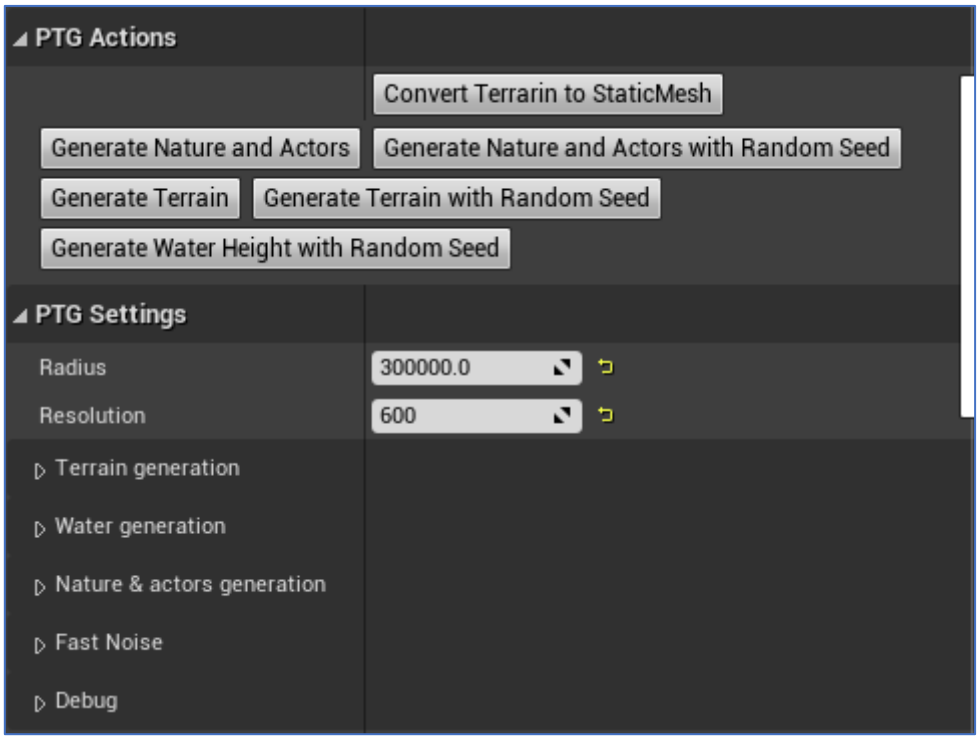
The intention of this document is to describe how to use the **Procedural Terrain Generator (PTG)** inside Unreal Engine and all of its settings. All the blueprints reference will be included here too.

The PTG has been created by Víctor Hernández Molpeceres using the Auburn's Fast Noise library and the Koderz's Runtime Mesh Component. It supports UE4.22 and beyond.

I recommend starting by creating a blueprint inherited from **ProceduralTerrain** class and add a billboard component to it with the image you prefer, to keep it visually localized on the map. Then, in the details panel you will find all the settings under the **PTG Settings** category and all the actions under the **PTG Actions** category, as you can see in the next image:



PTG Settings

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.

Terrain generation

- Shape - Describes the shape of the terrain (plane, cube or sphere).
- Terrain Element - Describes the type of element that will be generated to build the terrain:
    - Procedural Mesh - Generates the terrain with a procedural mesh.
    - Custom Mesh - Generates the terrain using a custom mesh (picked from “Custom Mesh” setting) on each tile. Only available on plane terrain shape.
- Custom Mesh - Static mesh used to build the terrain if “Terrain Element” is set to “Custom Mesh”. Only available on plane terrain shape.
- 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.
- Regenerate Terrain on Property Change - If checked, regenerates the terrain automatically when some setting is changed.
- 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 Uses PN Triangles Tessellation - Check this option if the terrain 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.
- Terrain Material - Material used for the terrain mesh.
- 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.
- Water Height - Height of the water. Not editable, only visible to know the generated water height.

Nature & actors generation

- Generate Nature and Actors - Whether to generate nature meshes and spawn actors or not.
- Bioma Elements - Array of different meshes per bioma. For example, you can set 2 registers por Underwater, one with bush meshes, and other for rocks.
    - Corresponding Bioma - Bioma where the mesh will be randomly placed. You can choose between earth surface or underwater.
    - 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 meshes that will be added on the corresponding bioma.
    - Max Meshes to Spawn - Maximum 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 elements.
- 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.
    - Corresponding Bioma - Bioma where the mesh will be randomly placed. You can choose between earth surface or underwater.
    - Cull Distance - Distance (in centimeters) from camera at which each generated actor fades out. A value of 0 means infinite.
    - Actor Class - Class of the actor that will be randomly placed.

    - Min Actors to Spawn - Minimum actors that will be spawned on the corresponding bioma.
    - Max Actors to Spawn - Maximum actors that will be spawned on the corresponding bioma.
    - Seed - Seed used for all the random operations on the actor generation.

Fast Noise

- Noise Type - Algorithm used to generate the terrain height.
- 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.
- Interpolation - Interpolation method used to smooth between noise values in Value and Perlin Noise. Possible interpolation methods (lowest to highest quality): Linear; Hermite; Quintic.
- 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.
- Cellular Jitter - Maximum distance a cellular point can move from its grid position. Setting this high will make artifacts more common.
- Cellular Distance Function - Distance function used in cellular noise calculations. The distance function used to calculate the cell for a given point. Natural is a blend of Euclidean and Manhattan to give curved cell boundaries.
- Cellular Return Type - Return type from cellular noise calculations.

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

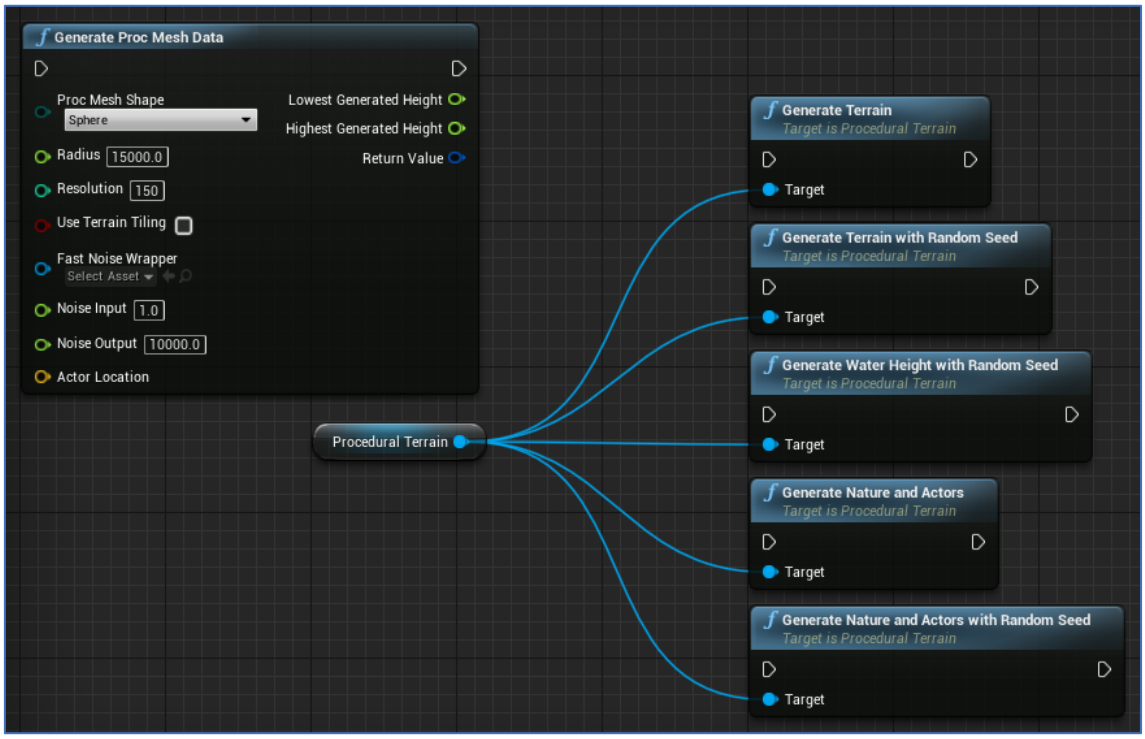
Here you can find 6 call-in-editor functions to regenerate different parts of the terrain.

- Generate Terrain – It will generate the terrain, water, nature and actors using the current seeds.
- Generate Terrain with Random Seed – Same as above, but calculating random seeds (between -1.000.000 and 1.000.000) for every seed variable on the PTG settings, resulting on different terrains every time is clicked.
- Generate Water Height with Random Seed – If “Generate Water” is checked and “Water Fixed Height” is not, generates a random height for the water between the specified range in the “Water Random Height Range Percentages” setting. It creates and sets a new “Water Seed” between -1.000.000 and 1.000.000.

- Generate Nature and Actors – If “Generate Nature and Actors” is checked, and settings for bioma elements/actors has been set, it will add nature to the terrain and spawn actors using the specified seeds and “Nature & actors generation” settings.
- Generate Nature and Actors with Random Seed – Same as above, but creates and sets a new seed (between -1.000.000 and 1.000.000) for every element, resulting in different nature/actor locations every time is clicked.
- Convert Terrain to StaticMesh – 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 for plane terrains.

Blueprint reference

The PTG is also blueprint-friendly! All the settings and functions are also exposed to blueprints. You can find the functions under “Procedural Mesh Data Helper” and “PTG Actions” categories.



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 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, it's well documented and also exposed to blueprints. Click here to know more.

Acknowledgements

Thanks to Auburns for creating the incredible Fast Noise 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.
Thanks also to Andrea Ruggeri to get me the inspiration for coding the terrain tiling support.