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7-1 Lighting

5CM503 Virtual Environment Development

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Lighting

Light the way.

What is the purpose of lighting?

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- First and foremost, we need to see what we are doing.
- But it also has additional functions beyond this.
- The way a scene is lit can completely change its perception and communicate information to the player.

THE LEGEND OF
ZELDA
BREATH OF THE WILD

So, what do we need to do?

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- As programmers, we can set the general appearance of the lighting.
  - Artists can come and fine-tune after us.

- We are not expected to be experts, but we must know how it works.
  - Particularly when we are using light to guide and inform our player.

Lumen

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"Lumen is Unreal Engine 5's fully dynamic global illumination and reflections system that is designed for next-generation consoles, and it is the default global illumination and reflections system."

- This system will do a significant amount of the heavy lifting for us.

- You will find that artists will mostly switch it off due to the performance overhead incurred by using it.

How does light work?

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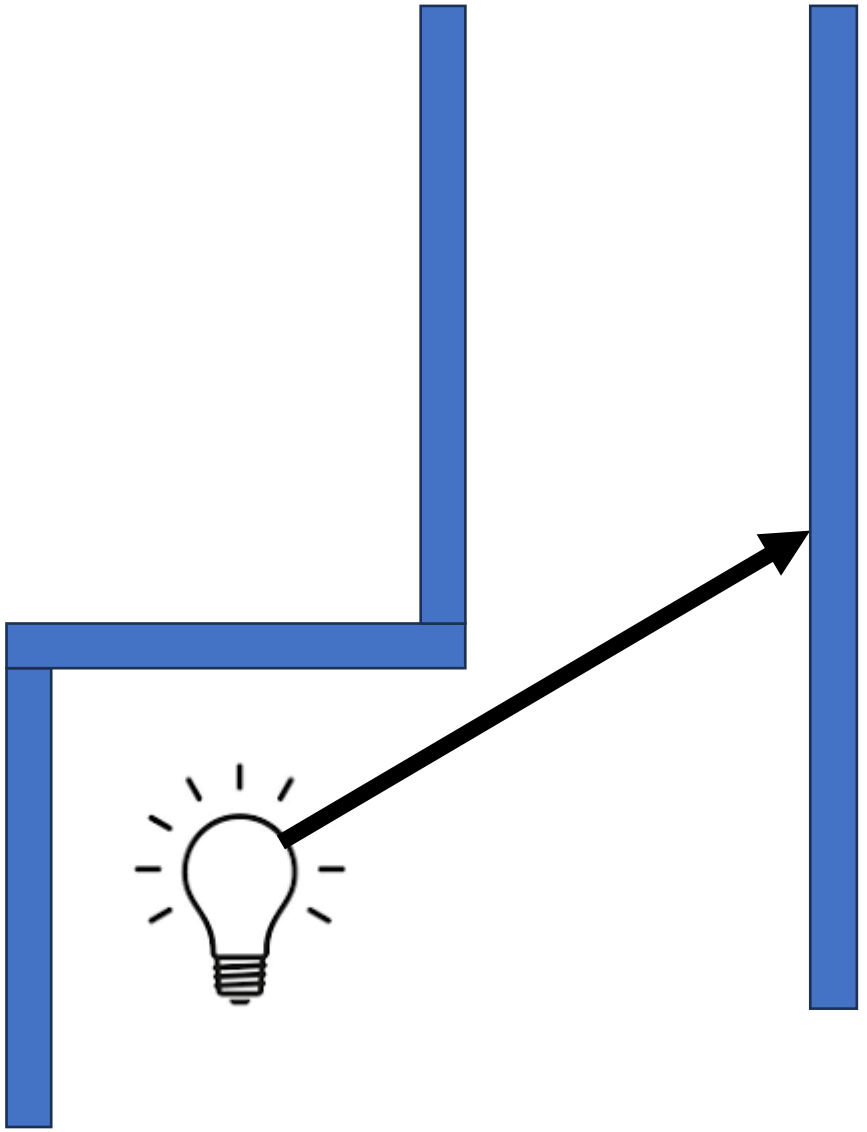
- A game scene has one or more light sources.
  - Light sources emit light into the scene.

- The engine calculates which surfaces of which models are illuminated by that light.
  - Surfaces that have illumination are bright. Those that do not are dark.

Direct illumination

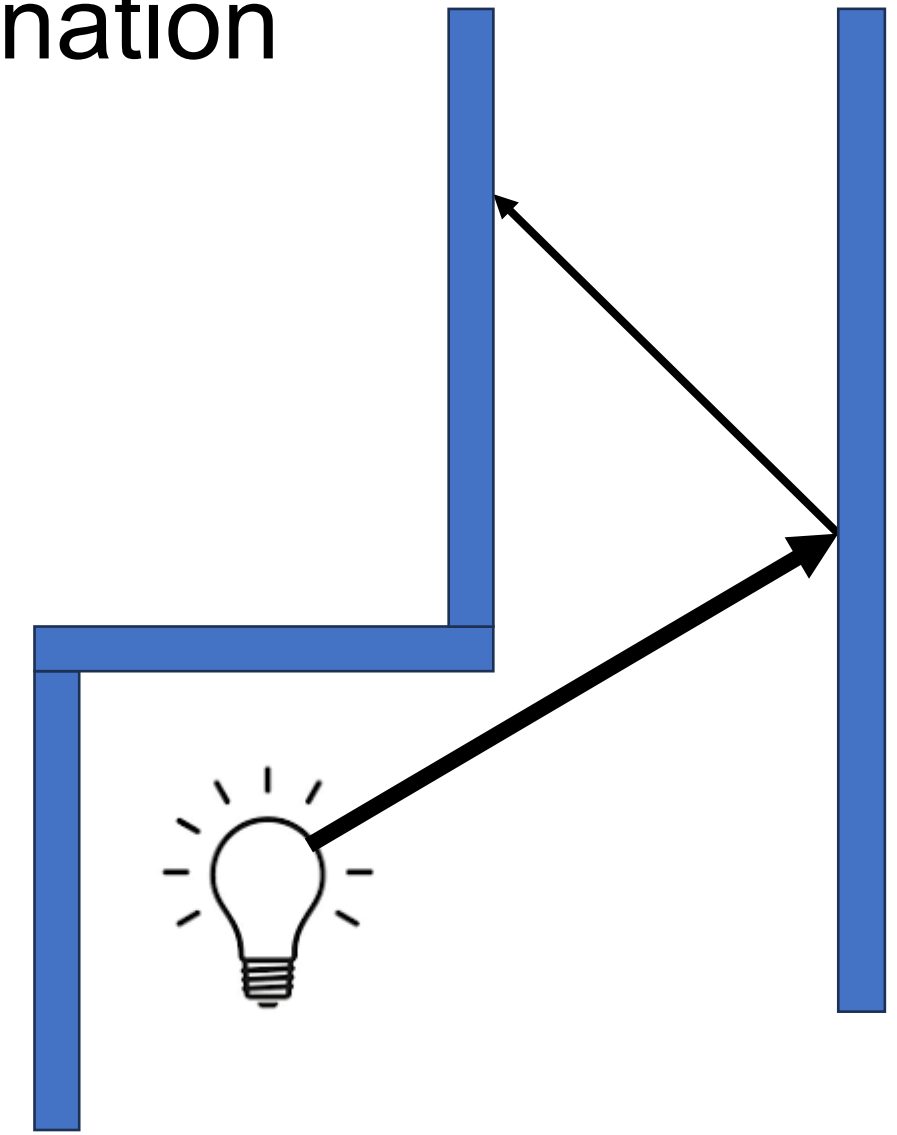
- A light source directly illuminates a surface that covers.



Global / Indirect illumination

- Light bounces from the surface into the environment.

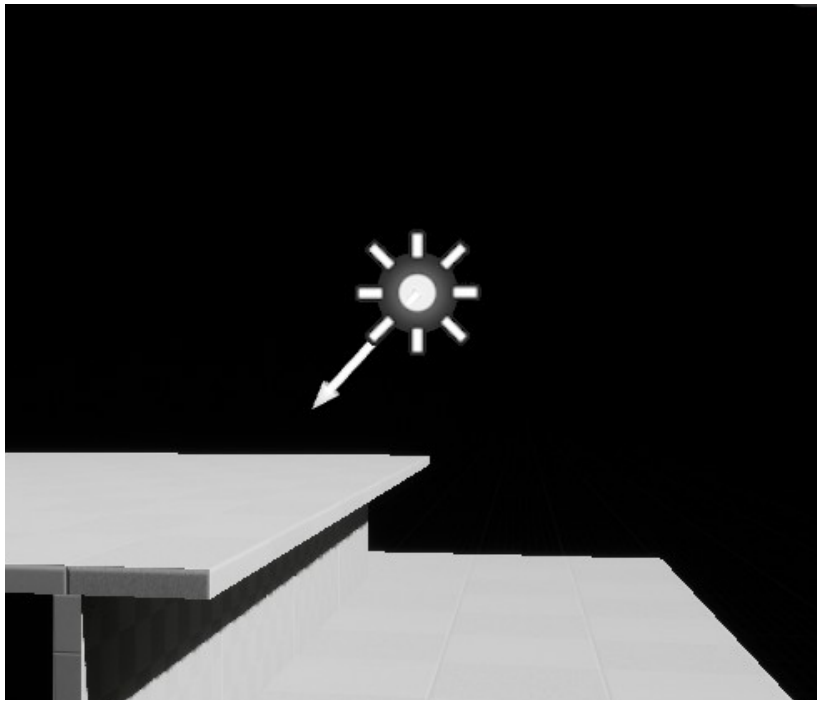
- Intensity, direction and colour are influenced by the surface struck



Directional light

- A light source at an infinite distance applies uniform directional light to the scene.

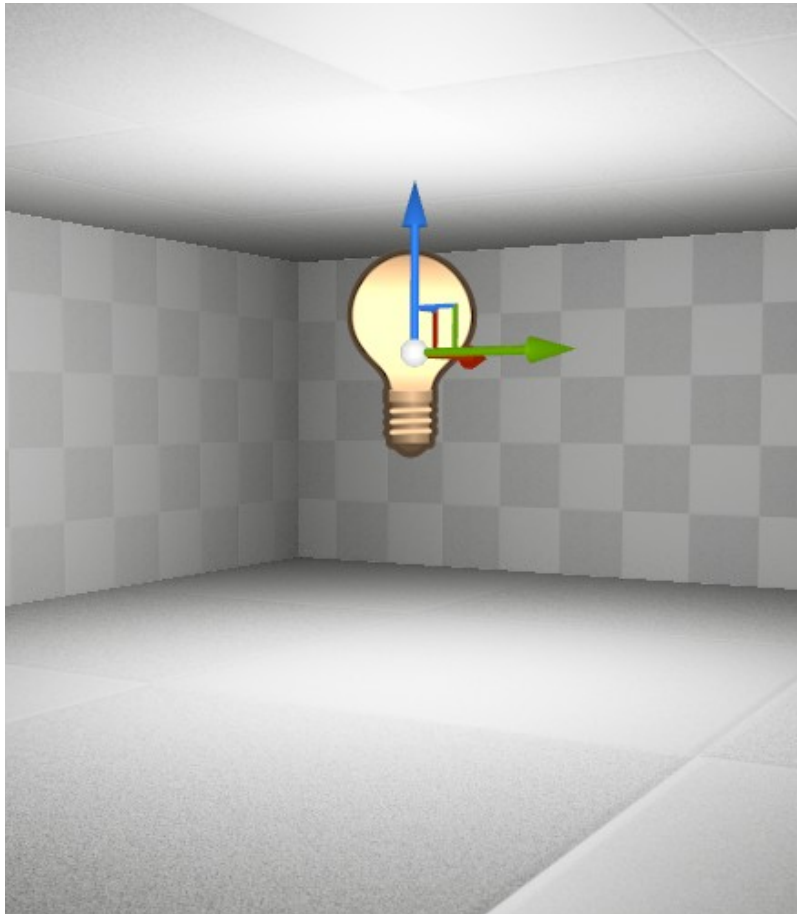
- A light that illuminates the whole level from a specific direction.



Point Light

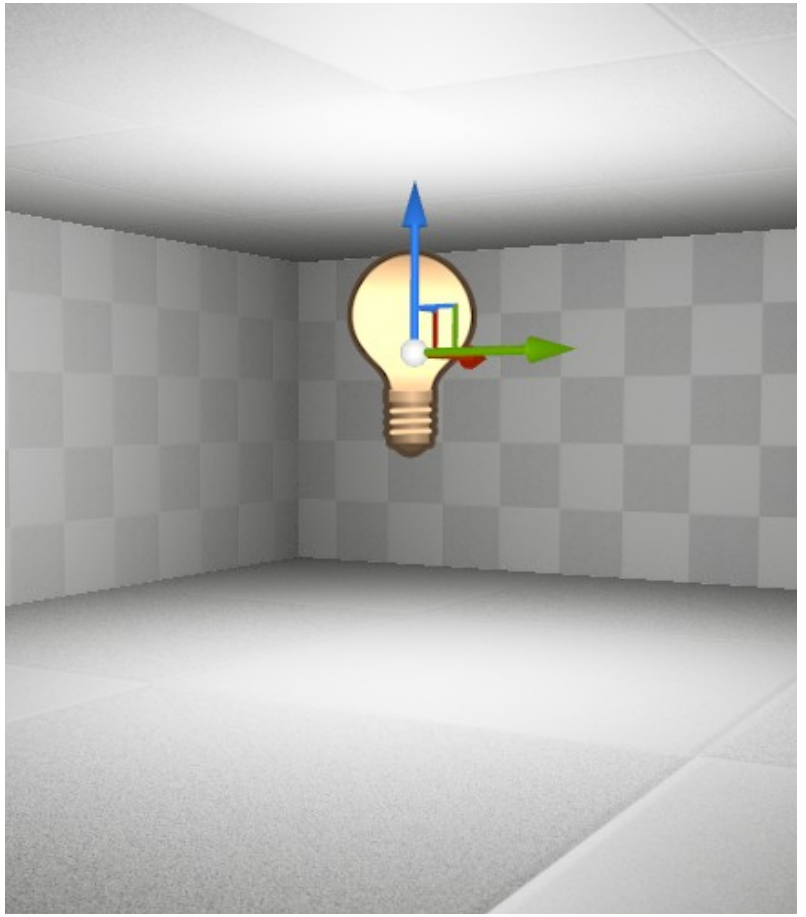
- Emits light equally in all directions.

- Essentially a light bulb.



Point Light

- Emits light equally in all directions.
- Essentially a light bulb.
    - It’s actually 6 spotlights welded together but shhhh….

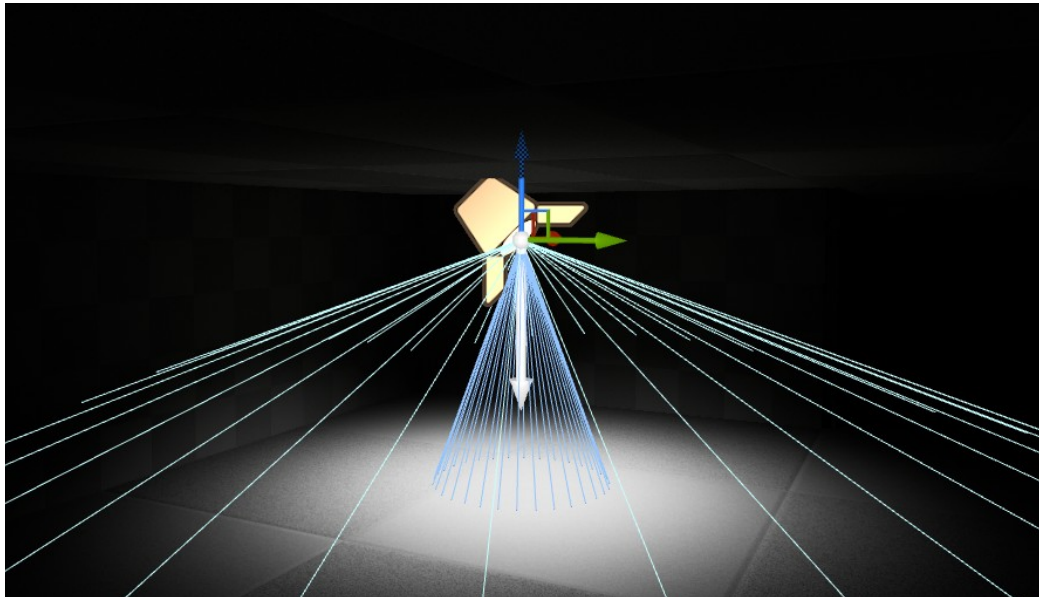


Spotlight

- Emits light in a focused cone.

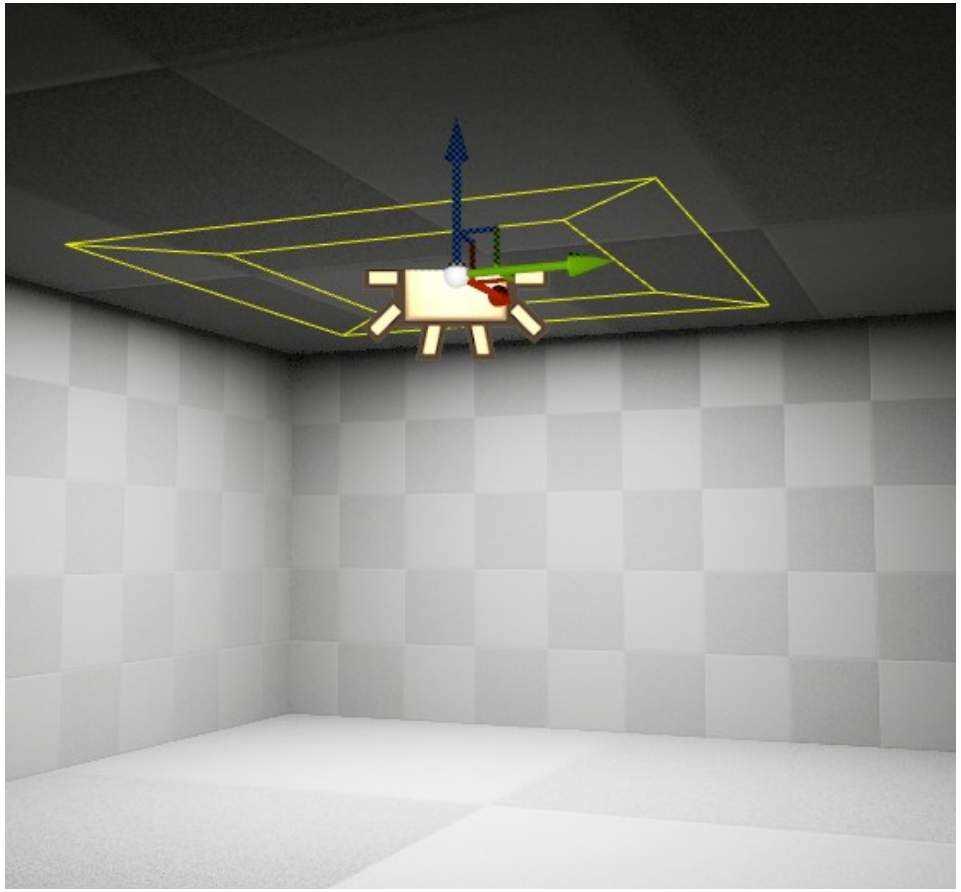
- Like a spotlight in a theatre.

- Actually made up of two cones
  - In the inner cone, everything inside is illuminated to maximum brightness for the light.
  - Falloff in the area between the outer and inner cones.



Rect Light

- Emits light from a rectangular plane into a scene
- Florescent lighting
- Barn door angles narrow or widen the spread of the light



Light Mobility

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- Static lights are basically free (at runtime) but cannot be altered in anyway during runtime.
  - Quality is influenced the lightmap resolution.

- Stationary lights provide the highest fidelity but are much more expensive than Static lights.
  - Max 4 overlapping
  - Can only change parameters such as intensity and colour.

- Moveable lights can change most parameters (including rotation and position) giving the greatest flexibility.
  - But they are entirely calculated at runtime, incurring the greatest performance cost.

https://techarthub.com/lighting-companion-light-mobility-in-unreal-engine/#:~:text=Unlike%20lights%20with%20Static%20mobility,mask%2Fanimate%20the%20projected%20light

Intensity

- Brightness!

- How bright a light is.

- Does not change the range of the light.

- Measured in Lumens.
  - 1700 lumens = 100-watt lightbulb.
  - 1 lumen = 1 candela (cd) = roughly the light of 1 candle

Attenuation Radius

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- Sets the reach of the light

- Maximum reach of the light.
  - Falloff effects the rate of dimming towards the maximum extent.
  - Bigger lights get expensive quickly! Use large dynamic lights sparingly!

- Not to be confused with source radius and length.
  - These change the size of the source of the light effecting specular highlights.

Light colour

- Changes the colour of the light.

- Additive pallet
  - Red + Green = Yellow.

Sky light

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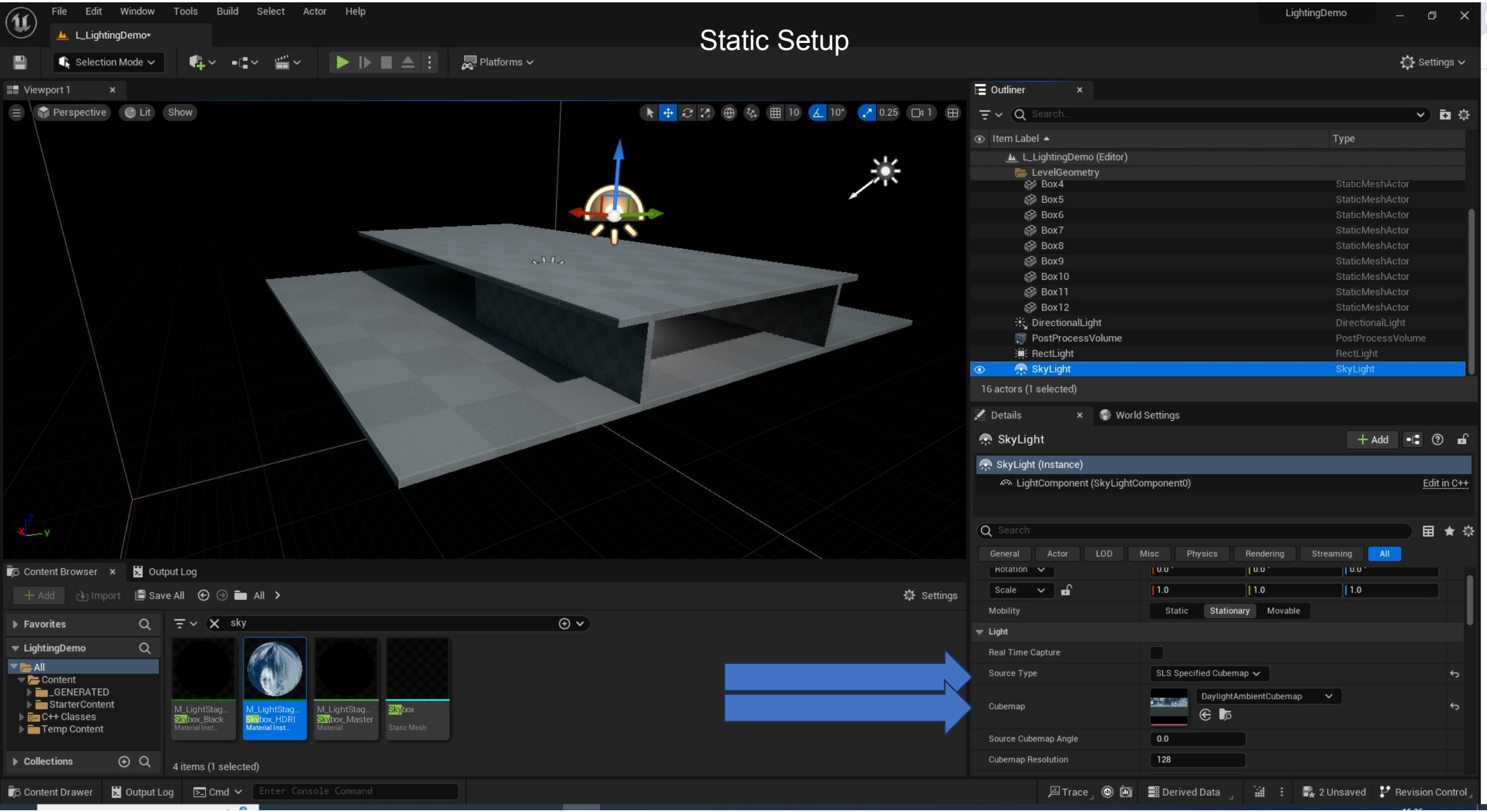
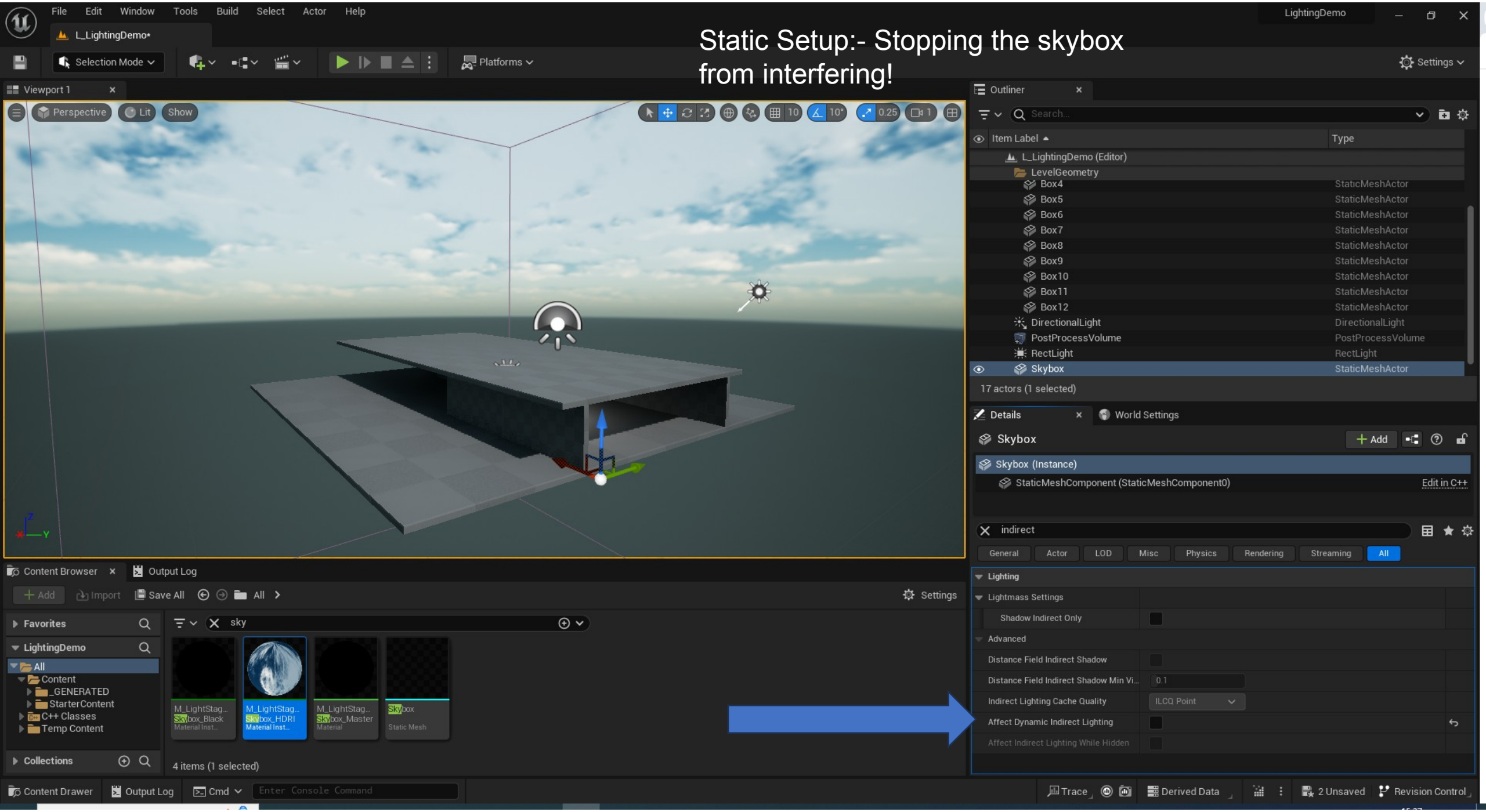
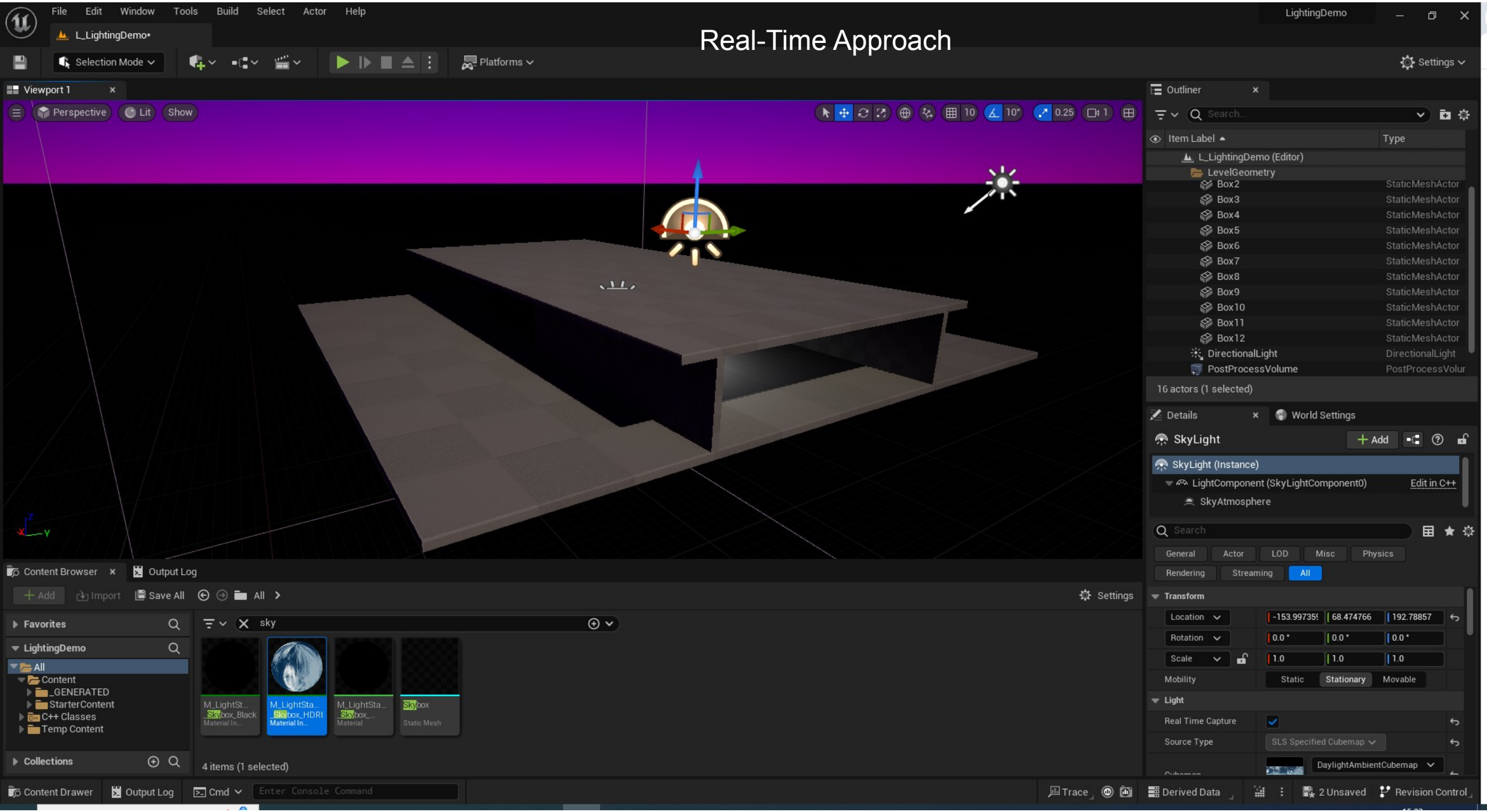
- Apply lighting from distant parts of the level to illuminate the scene.
- Light that comes from the sky.
- Very complex to set up correctly, requires much fine tuning to get it right.

Static Setup



Static Setup:- Stopping the skybox from interfering!



Real-Time Approach