Unreal Engine 4 Introduction

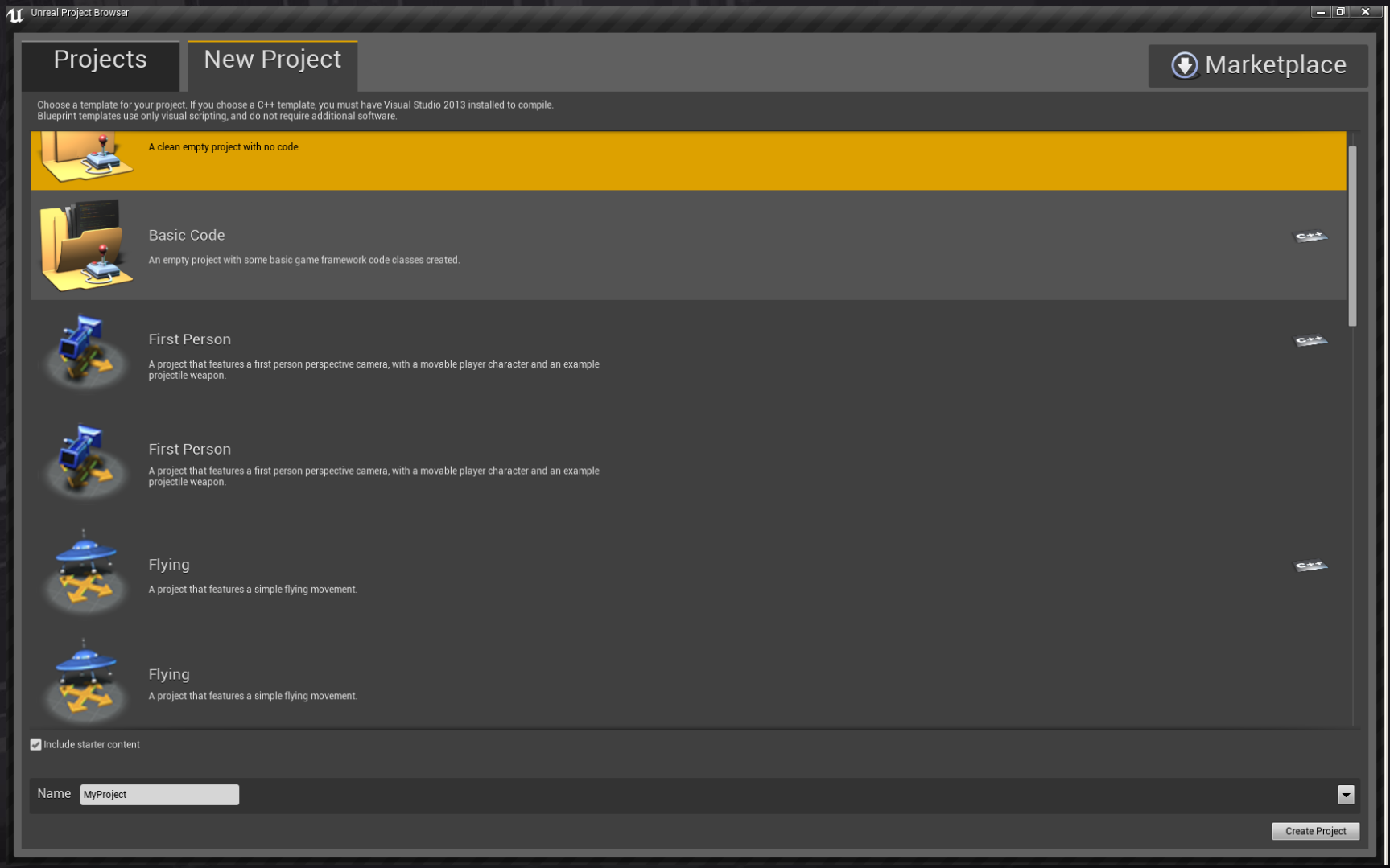
Agenda

- Unreal Engine evolution
  - Project setup
  - Game logic creation tools
  - UI creation tools
  - Automation
  - Physically based materials
- Mobile development with UE4
  - Performance tiers
  - General performance guidelines
  - Content creation notes

Project Setup

- UE3
  - Copy and paste template project
  - .INI hell
  - Lot of manual changes in source code to setup custom project
- UE4
  - Simple project wizard
    - Allow to create project from template depending on game genre
  - Separate directory with all project-related code and content
  - Simple settings managing interface for Editor or Project
    - Easy to tweak global or/and platform specific project settings

Project Wizard



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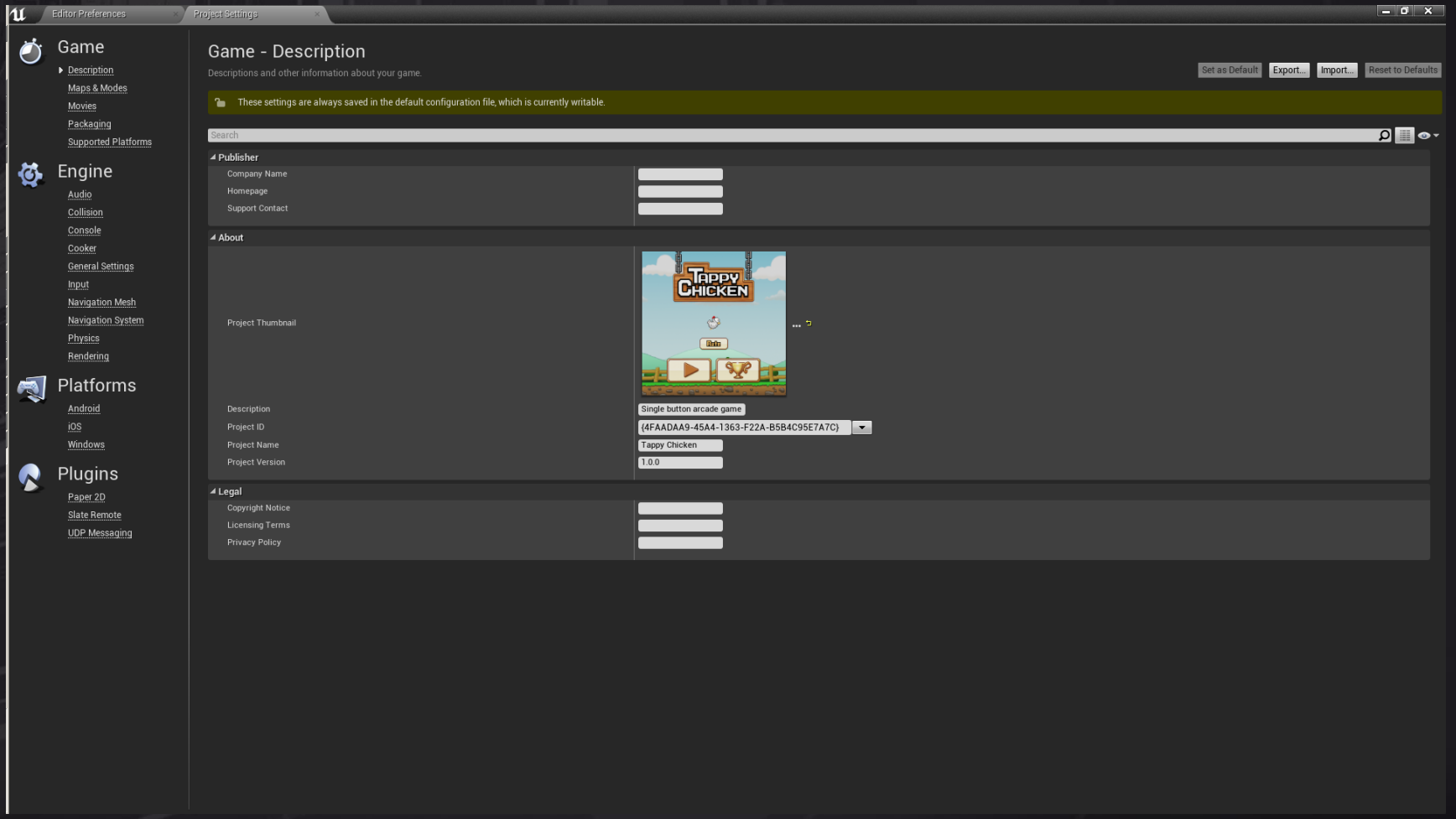
Project Settings



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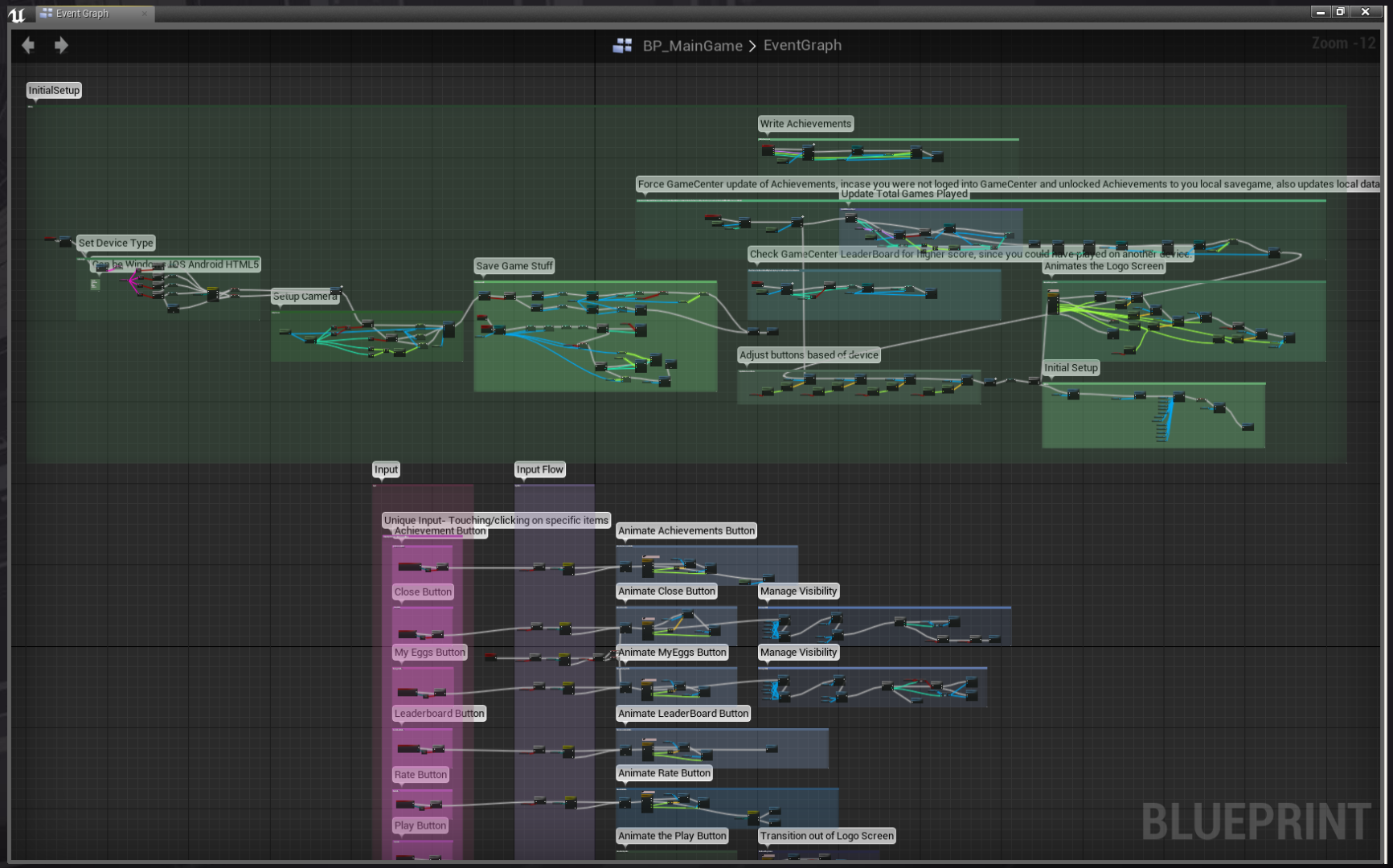
Game Logic Creation (UE3)

- C++ (for full license holders)
  - Was great to have when implementing performance critical gameplay features
  - Was necessary when dealing with low-level systems such as (Animation, Rendering, Physics)
- Unreal Script
  - Java-based language for creating game logic
  - Gives a possibility to implement complex game logic without changes in C++ code
  - Fast iteration times comparing to C++
  - Nearly 10 times slower than C++
- Unreal Kismet
  - Graph-based system for creating high-level game logic
  - Required support from programmers/scripters who deal with Unreal Script
  - Debug was painful

Game Logic Creation (UE4)

- C++
  - Provide low-level control over gameplay aspects
  - Allow to extend basic classes from Gameplay Framework
  - Still optional depending on game project complexity
- Blueprint
  - Derived from Kismet but more powerful and complete
  - Serve many of the same purposes that Unreal Script handled
    - Extending classes
    - Storing and modifying default properties
    - Managing subobject (e.g. Components) instancing for classes
  - Has its own visual debugger

Blueprint Example 1/3



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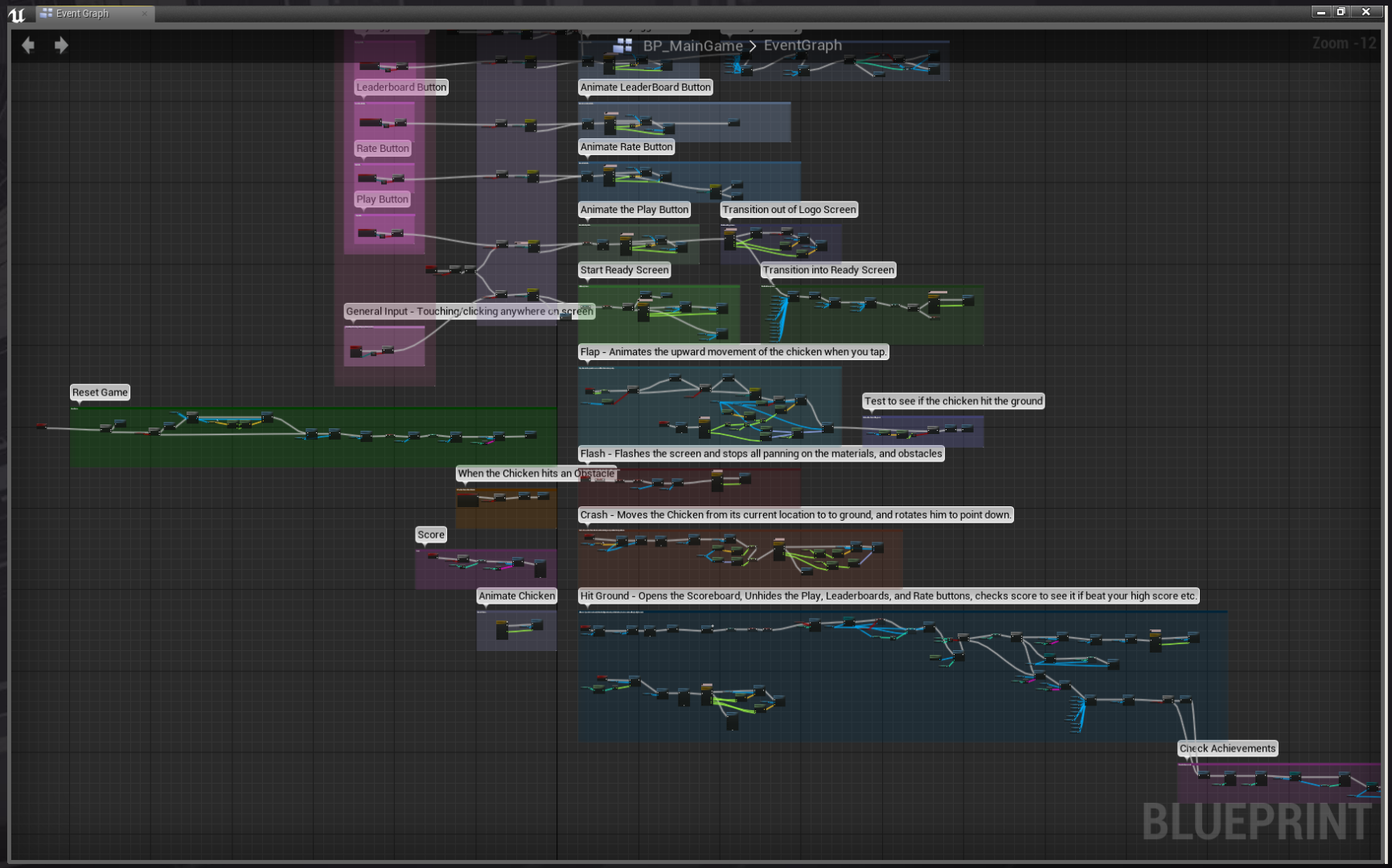
Blueprint Example 2/3



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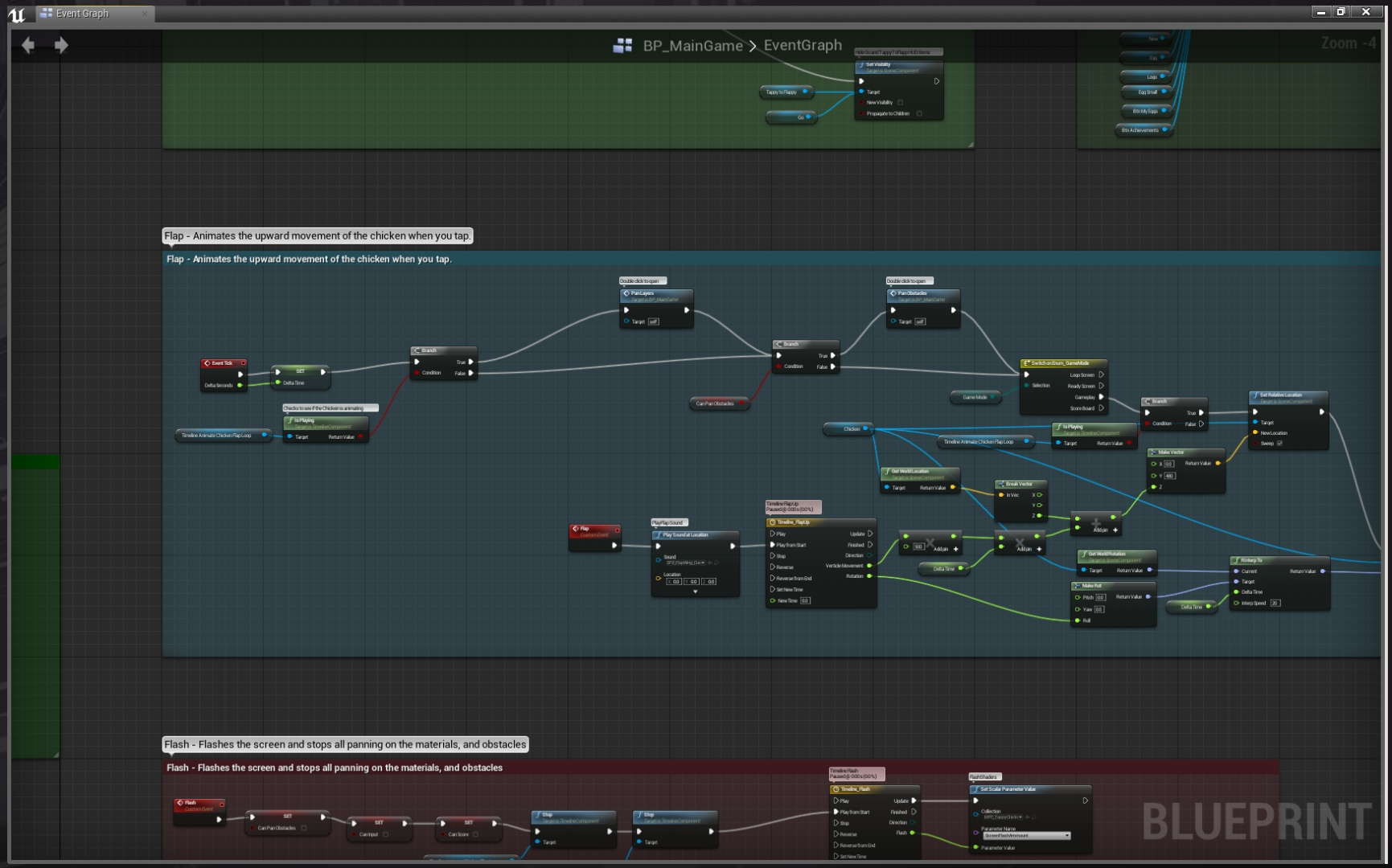
Blueprint Example 3/3



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UI Creation Tools

- UE3 – Multiple tools/technologies for similar problems
  - Scaleform for creating ingame UI
  - Custom UI framework for creating UI for mobile platforms
  - The Editor's UI is built using Windows-based frameworks
- UE4 - Completely new UI system called Slate
  - Fully platform-agnostic UI system
  - Used to create Unreal Editor's UI
  - Can be used to create ingame UI
  - Key features
    - Easy to design, layout and style components
    - Easy to create and iterate on UIs

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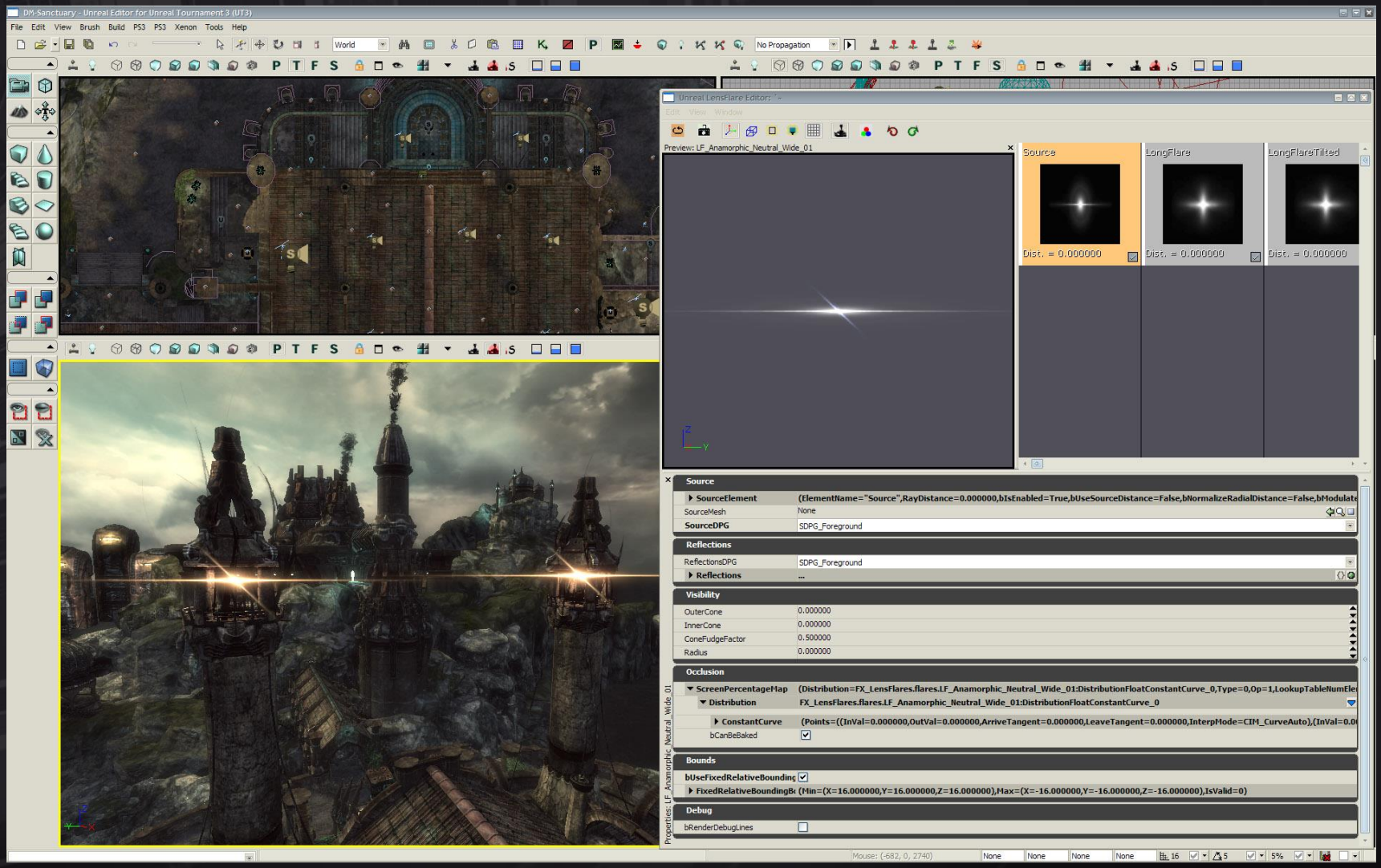
Unreal Editor 3 Interface



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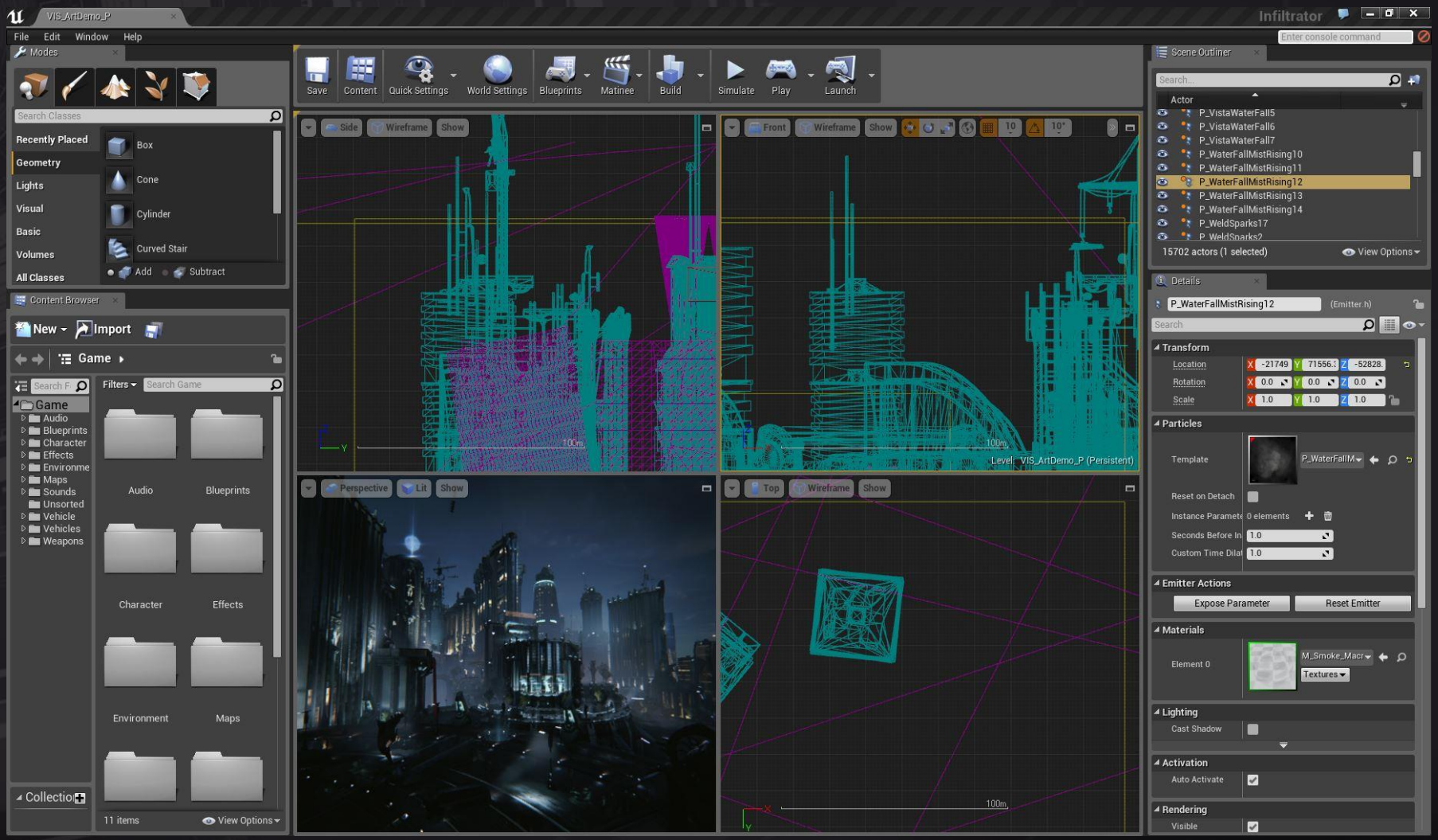
Unreal Editor 4 Interface



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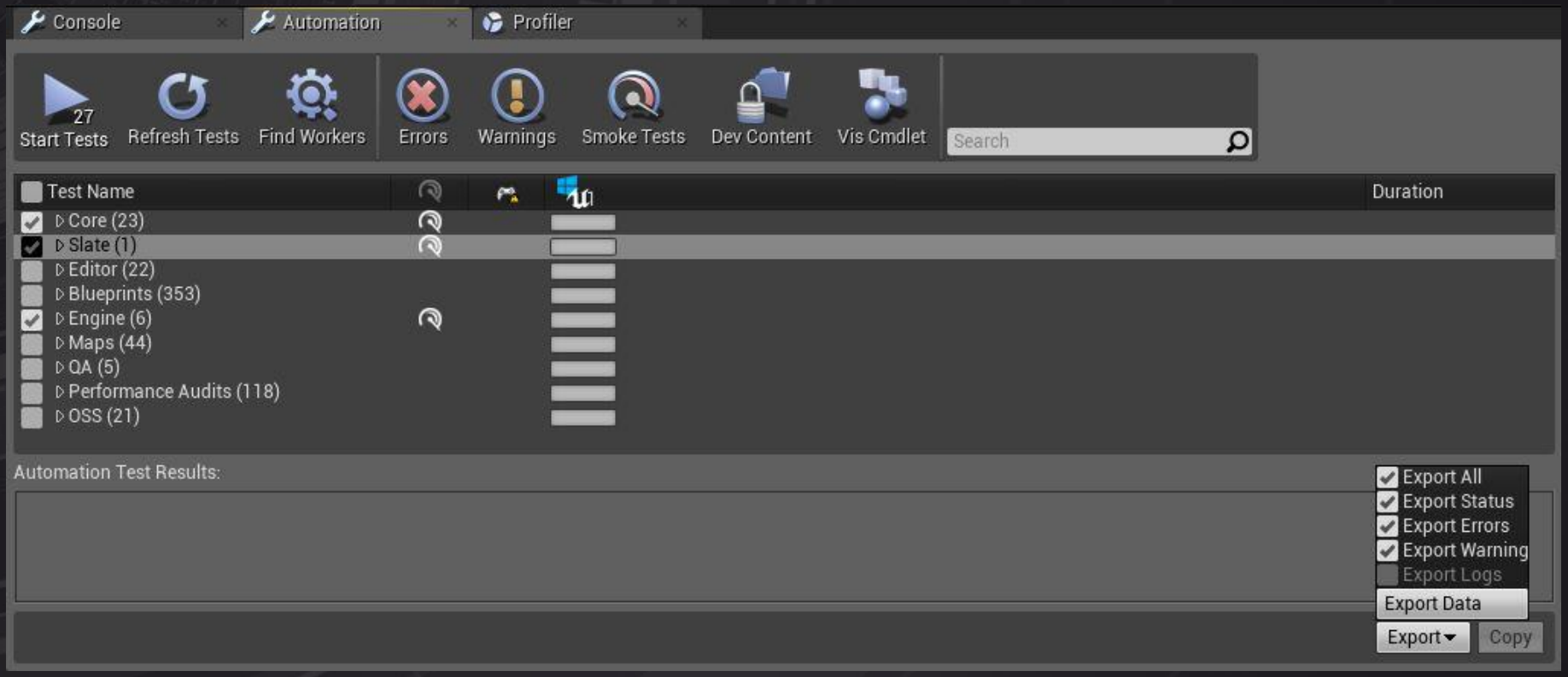
Automation System

- Completely new system comparing to UE3
- Provides the ability to perform Unit/Feature testing
  - Unit tests : API-level verification tests
  - Feature tests : System-level verification
    - In-game stats, changing resolution, taking screenshot works
  - Content stress tests
    - Loading all maps, recompiling all blueprints, recompiling all shaders
  - Smoke tests: Unit tests which runs every time in the editor and are considered to be very fast
- Screenshot-based tests
  - Mostly for testing rendering-related errors

Automation Framework Example 1/2



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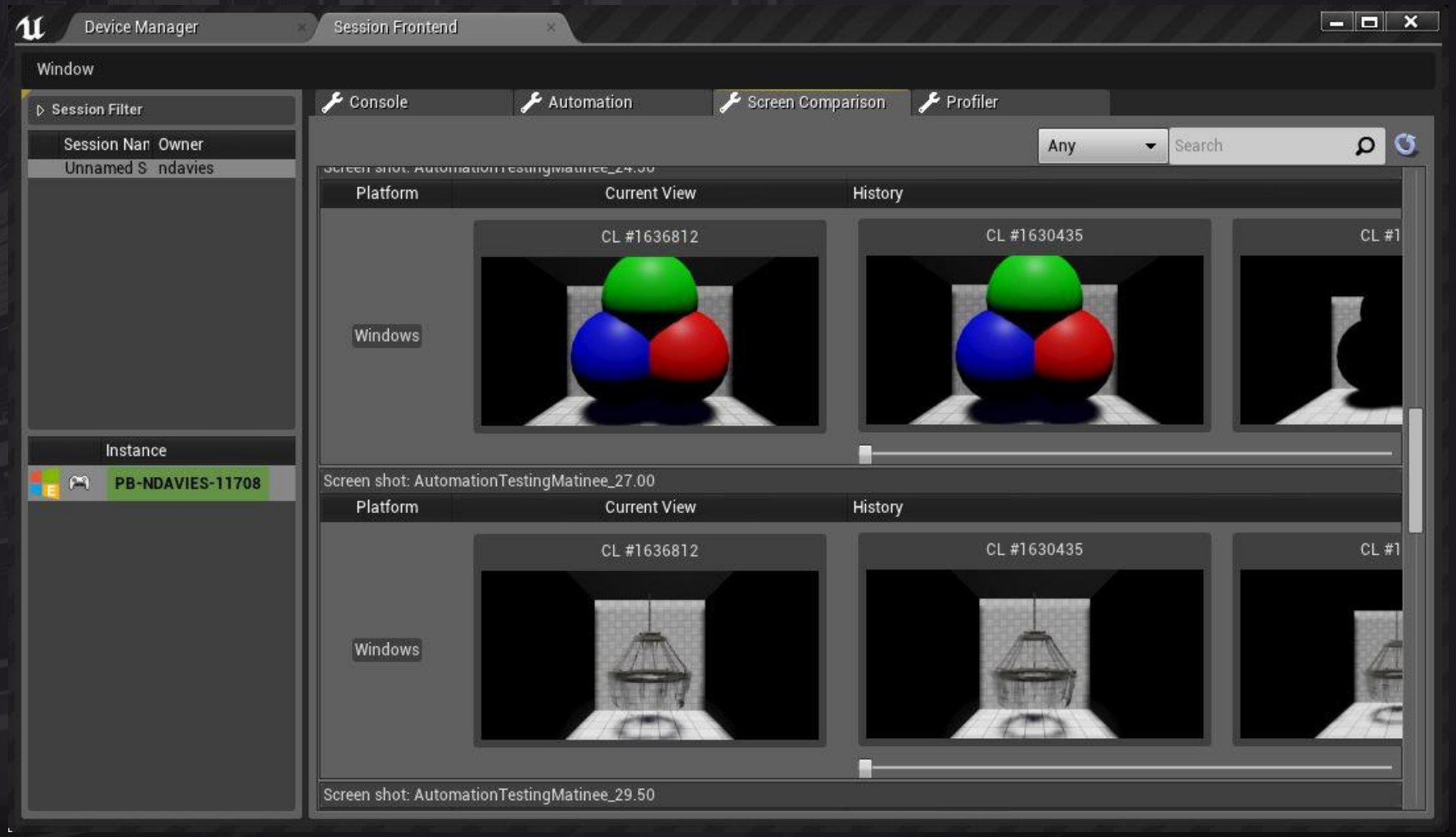
Automation Framework Example 2/2



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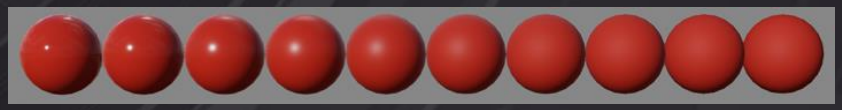
Physically Based Materials

- New Physically Based Shading model
  - Approximates what light does, not what we intuitively think it does
  - Result – more accurate and natural looking
  - Simple properties
    - Base Color
    - Specular
    - Roughness



    - Metallic

  - Values for that properties could be measured in real-world materials
  - Material blending/layering is simple
  - Hard to create physically implausible materials

Mobile Development with UE4

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Supported Platforms

- Unreal 4 was developed targeting high-end PCs and next-gen consoles
  - But supports both iOS and Android platforms
  - Android support is still in its early stages
    - Full list of supported devices could be found on wiki
  - All tested devices are grouped in feature tiers
    - Example of classifying iOS devices by performance tiers

Device	LDR	Basic Lighting	Full HDR	Full HDR w/ Sun
iPhone4	Non-Retina	Unsupported	Unsupported	Unsupported
iPhone4S	Retina	Non-Retina	Unsupported	Unsupported
iPhone5	Retina	Retina	Non-Retina	Unsupported
iPhone5S	Retina	Retina	Retina	Retina

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Performance Tiers

- LDR (The highest performance tier supported in UE4)
  - No lighting, no postprocess
- Basic Lighting
  - Static lighting and precomputed GI features are available
  - Full HDR pipeline with access to some postprocess features like tonemapping
- Full HDR Lighting
  - Realistic specular reflections on surfaces with support for varying roughness
  - Full support of normal mapped surfaces
- Full HDR Lighting with per-pixel lighting from the Sun
  - Same as prev. tier, but per-pixel diffuse and specular lighting

General Performance Guideline

- Use post process features only with high-end devices
  - Bloom/DOF is enabled by default (as on PC) Try to disable
    - Such features can easily cost 60+ ms
  - Always profile your game on target devices before considering to use PP feature
- Control scene complexity
  - Careful control over DIP count (< 700) and triangles count (< 500k)
    - The areas with poor occlusion are going to be the biggest challenge
  - PVS still helps
    - Take care of proper setup visibility volumes and built visibility before run on device
- Double check materials
  - Try to simplify. Fewer instructions and texture lookups is better
  - Use independent texture fetches. (UVs in pixel shader shouldn't be changed)

Content Creation Guideline

- Materials
  - Only 5 texture samplers are allowed due to HW limitations
  - Translucent and Masked Materials are extremely expensive. It is recommended that you use opaque Materials wherever possible
  - Several features like Tessellation and Refraction and Subsurface Scattering shading model are not available
  - Only Default and Unlit shading models are available
- Textures limitations
  - Maximum texture size 2048x2048
    - PVR compressor limitation
  - Dimension must be a power of 2
    - Memory usage became more efficient on mobile devices
- Mesh limitations
  - <= 65k vertices per model
  - <= 75 bones per skeletal mesh

Bonus Slide : Documentation

- Full documentation available online
- In-editor tutorials
  - Useful to start working with Unreal tools from scratch
- Samples Library
  - Game samples available online for free
    - Huge source to start Unreal discovering
    - Samples are connected with online documentation
  - Content Example Sample
    - Represents an approach to learn
    - Each level represents a number of stands each of which has its own example asset and doc reference

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