Game Engines

Martin Samuelčík

VIS GRAVIS, s.r.o.

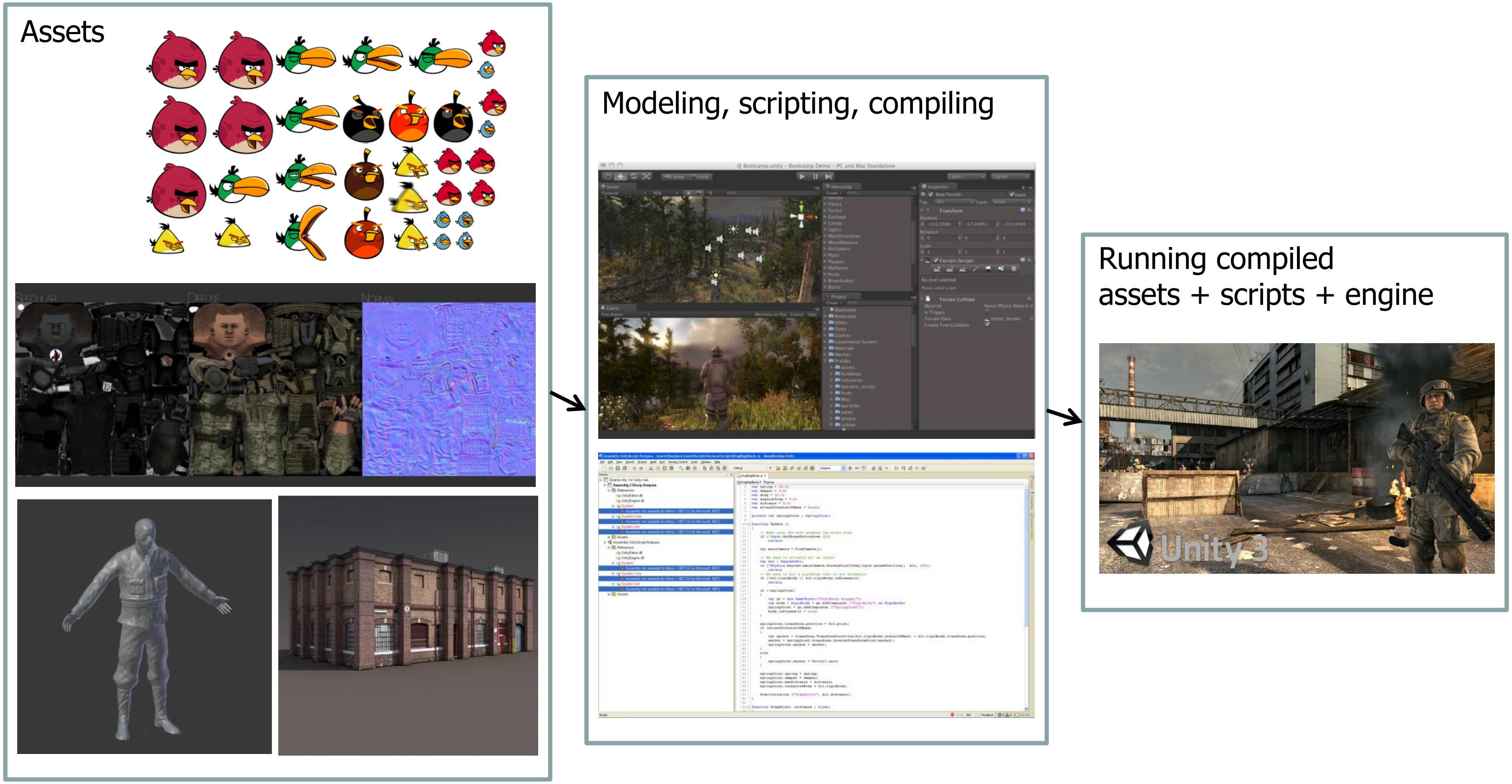
samuelcik@sccg.sk

http://www.sccg.sk/~samuelcik

Game Engine

- Software framework (set of tools, API)
- Creation of video games, interactive presentations, simulations, … (2D, 3D)
- Combining assets (models, sprites, textures, sounds, …) and programs, scripts
- Rapid-development tools (IDE, editors) vs coding everything
- Deployment on many platforms
  - Win, Linux, Mac, Android, iOS, Web, Playstation, XBOX, …

Game Engine



Assets

Modeling, scripting, compiling

Running compiled assets + scripts + engine

Game Engine

- Rendering engine
- Scripting engine
- User input engine
- Audio engine
- Networking engine
- AI engine
- Scene engine

Rendering Engine

- Creating final picture on screen
- Many methods: rasterization, ray-tracing,..
- For interactive application, rendering of one picture < 33ms = 30 FPS
- Usually based on low level APIs – GDI, SDL, OpenGL, DirectX, …
- Accelerated using hardware
- Graphics User Interface, HUD

Scripting Engine

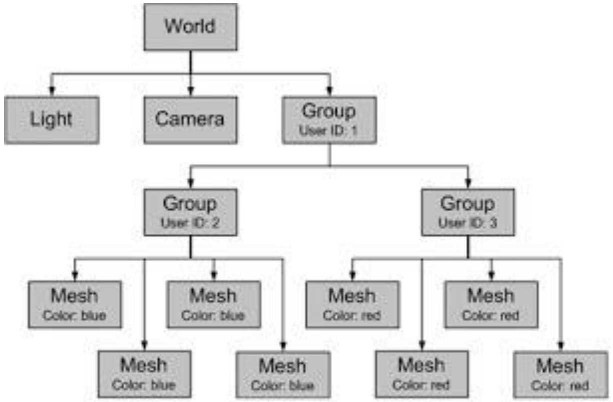
- Adding logic to objects in scene
- Controlling animations, behaviors, artificial intelligence, state changes, graphics effects, GUI, audio execution, ...
- Languages: C, C++, C#, Java, JavaScript, Python, Lua, ...
- Central control of script executions – game consoles

User input Engine

- Detecting input from devices
- Detecting actions or gestures
- Mouse, keyboard, multitouch display, gamepads, Kinect sensor, Wii controllers

Scene Engine

- Representing 2D, 3D scene
- Usually hierarchical structure, scene graph
- Unified rep. of models, lights, cameras – game objects, entities, nodes, actors, …
- Each entity has its own properties, components
  - Important comp: Transform
  - Scale, translation, rotation



Networking Engine

- Downloading, uploading data on web
- Communicating with other instances
- Running as client or server
- Peer-to-peer communication
- Using protocols like UDP, TCP, HTTP

List of Engines

- Proprietary, no source code, big suites of developer tools, many deployment targets
- Unity (http://unity3d.com/)
  - Free for personal use
- Unreal Engine (http://www.unrealengine.com/)
  - Free for personal use
- Cry Engine (http://cryengine.com/)
  - Small monthly fee
- Source 2 (https://developer.valvesoftware.com)
  - Coming in near feature

List of Engines

- Open-source projects, usually without mature IDE, mainly graphics engines, less deployment
- OGRE (http://www.ogre3d.org/)
  - Just graphics engine, many add-ons
- Irrlicht (http://irrlicht.sourceforge.net/)
  - Easy to use engine with lots of features
- OpenSceneGraph (www.openscenegraph.org)
  - 3D graphics toolkit & scene engine
- Blender Game Engine (http://www.blender.org)
  - Component of modeling package

List of Engines

- JavaScript engines using WebGL or HTML5, displaying scenes in web browsers
- Three.js (http://threejs.org/)
  - Simple but usable graphics engine
- BabylonJS (http://www.babylonjs.com/)
  - Full game engine
- Turbulenz (http://biz.turbulenz.com/)
  - Another full game engine
- Construct 2 (https://www.scirra.com/)
  - Mainly for 2D graphics

Resources

- https://unity3d.com/learn/tutorials
- https://wiki.unrealengine.com/Main_Page
- https://docs.unrealengine.com/latest/INT/GettingStarted/FromUnity/
- https://en.wikipedia.org/wiki/List_of_game_engines
- http://www.worldofleveldesign.com/categories/level_design_tutorials/recommended-game-engines.php
- https://html5gameengine.com/
- http://www.html5gamedevs.com/
- http://opengameart.org/
- http://archive3d.net/
- http://www.cgtextures.com/
- http://www.freesound.org/

Lectures

- Simple introduction to one open source game (graphics) engine – OGRE
- Introduction to one proprietary, full IDE game engine – Unity
- Basics of window management, scene management, rendering, materials and shaders, GUI (HUD), scripting, user input, interaction, animations, network communication, physics, deployment

Lecture evaluation

- Implementing 3D interactive presentation project in one game engine
- Based on written specification
- Unity, Unreal Engine, Ogre, Blender, BabylonJS, Turbulenz
- For more info, see http:///www.sccg.sk/~samuelcik/gengines.html

Questions?