

# Computer Graphics Practice

Lecture 01

Dept. of Game Software  
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# Plan

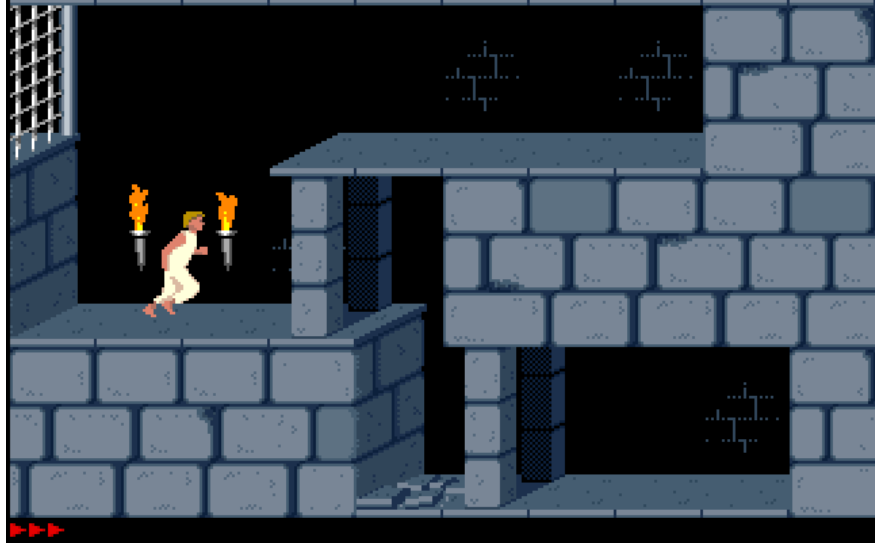
- What is a Game?
- Game Programming
- Game Engine: Rendering
- DirectX SDK



# What is a Game?

- As a general term
  - Board games, card games, video games, war games, etc...
- Video game [Wikipedia]
  - An electronic game that involves **interaction** with a **user interface** to generate visual feedback on a 2D or 3D **video display** device
- Technical term
  - Soft real-time interactive agent-based computer simulation
    - Real(imaginary) world is modeled mathematically, but it is a simulation (or approximation) because it is too complex.
    - Agent-based means multiple agents are interacting.
    - Interactive because it is temporal simulations or dynamic.
    - Soft Real-time because most video games present their stories and respond to player input in real-time.

# What is a Game?



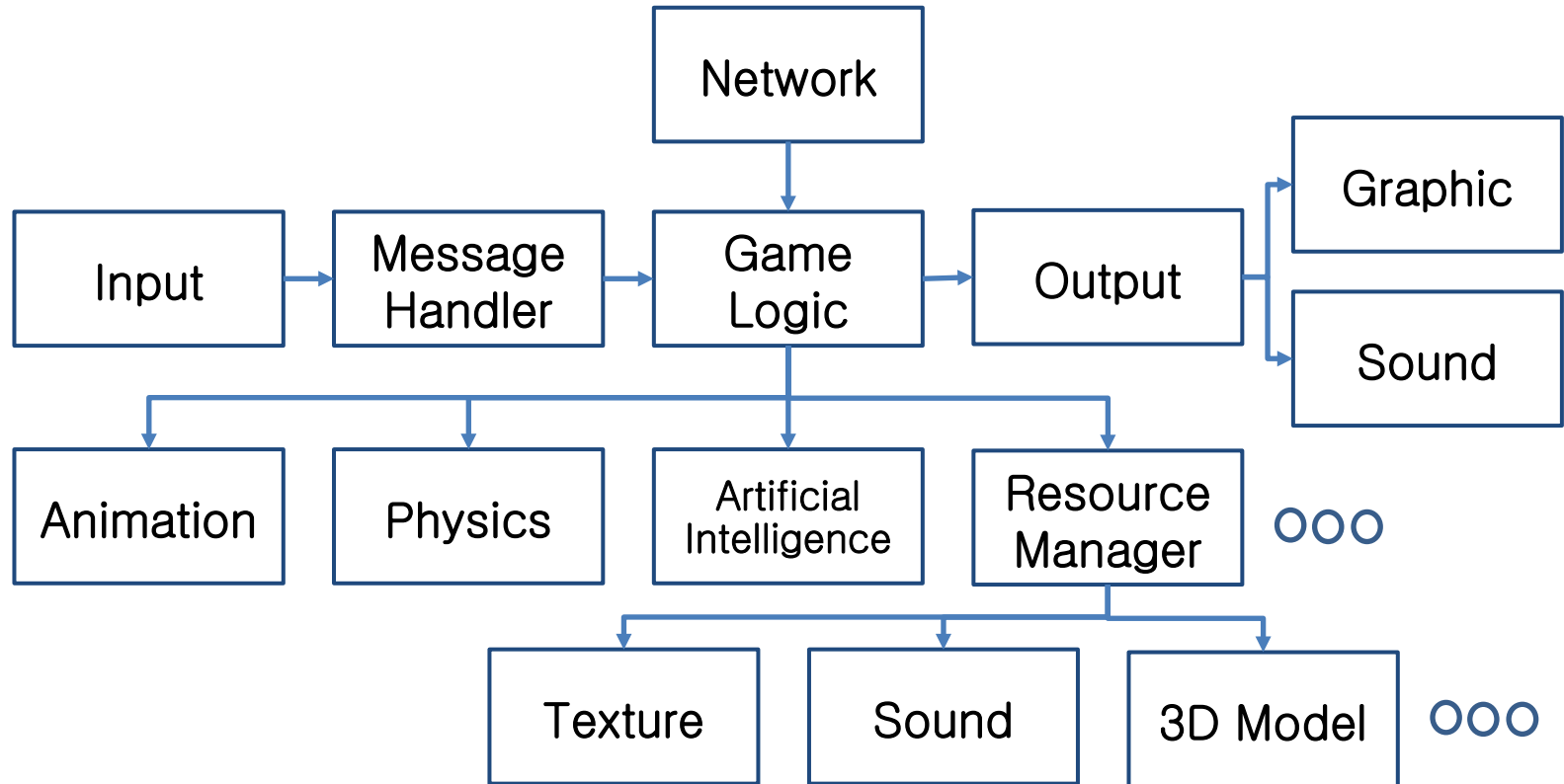
# Game Programming

- 3D Game Programming
  - Basics in computer graphics: video display, output primitives, geometric transformations, object representations, etc.
  - 3D math: vectors, matrix, geometry, etc.
  - Data structure: array, linked list, object(class), tree, graph, etc.
  - Object-oriented programming: C/C++, DirectX APIs



# Game Programming

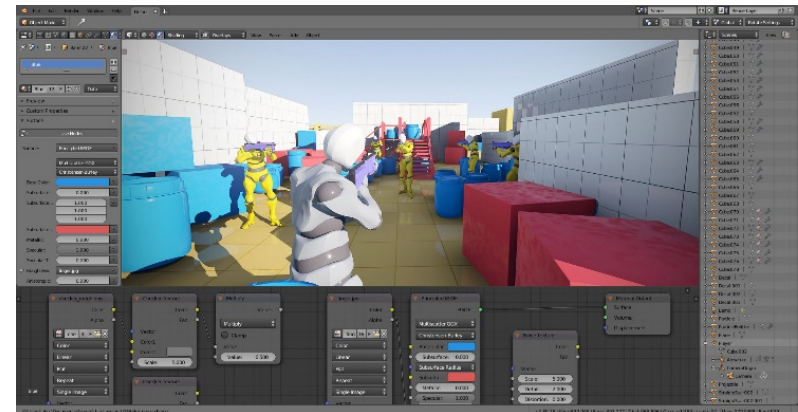
- Game structure





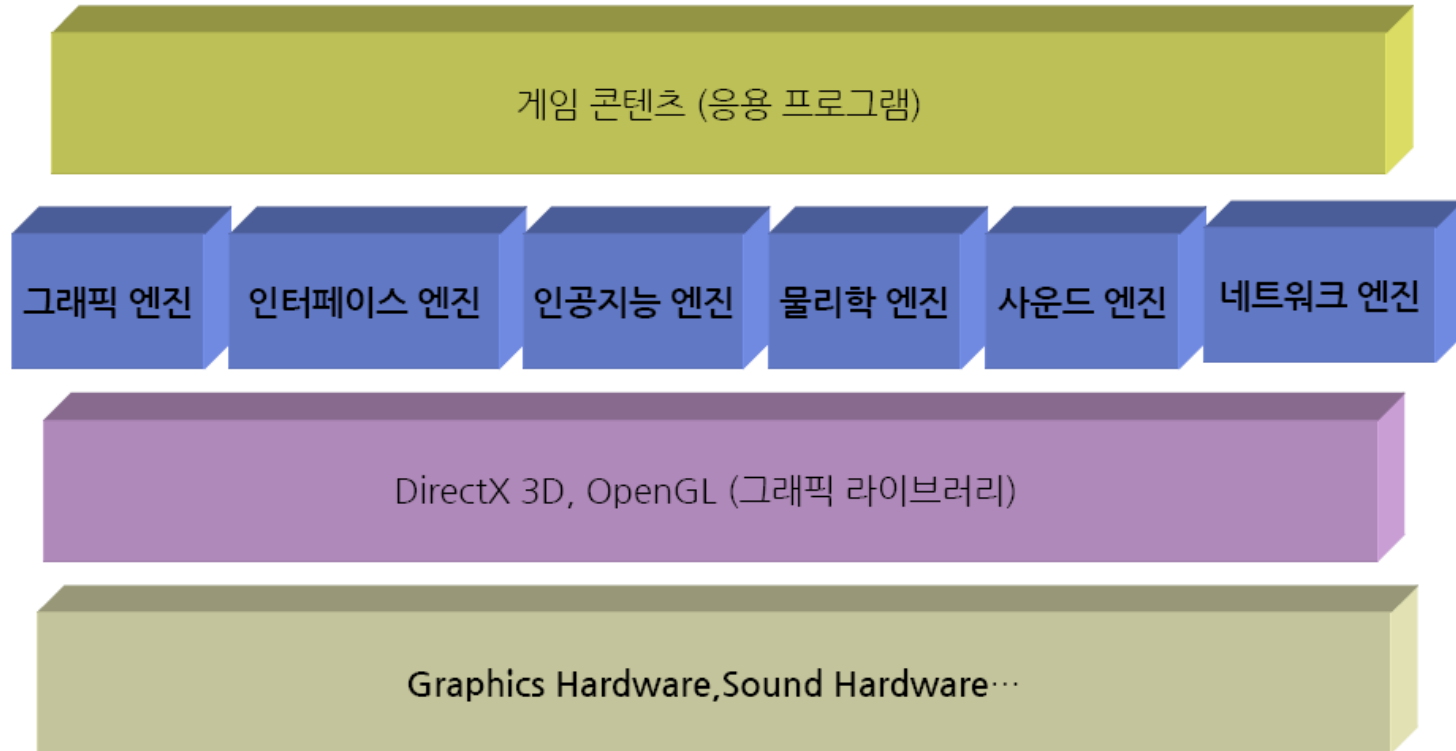
# Game Engine

- Purpose
  - Managing the data and artistic content of the game, and deciding what draw on the computer screen and how to draw it [D.H. Eberly]
- Components
  - Software-development environment to construct games through engine components: **rendering**, physics, sound, animation, A.I., networking, memory management, etc.
  - A set of software library and tools
    - Library: application programming interface (API), data structure, etc.
    - Tool: exporter, converter, viewer, editor, etc.



# Game Engine

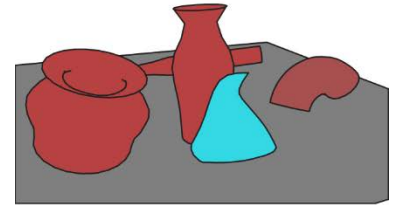
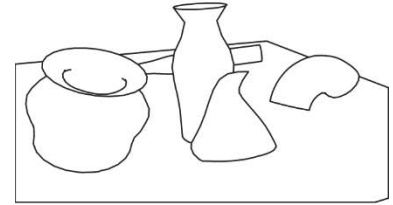
- Middleware





# Game Engine: Rendering

- Rendering (Image Synthesis) [Wikipedia]
  - Automatic process of generating a photorealistic or non-photorealistic image from a 2D or 3D model
- Rendering features
  - Illumination model (Direct/Indirect)
  - Shading
  - Texture mapping
  - Bump (Normal) mapping
  - Shadows (Hard/Soft)
  - Etc.



# Game Engine: Rendering

- Graphics (Rendering) pipeline
  - The process of transforming 3D models stored in a scene file into the 2D displays along a rendering device (GPU)
  - Low-level APIs: DirectX, OpenGL, Vulkan
- Low-level vs High-level (Scene Graph) APIs
  - Low-level: Faster in performance, detailed controls
  - High-level: Faster in production, easy controls
- Relationship with 3D graphics tool
  - Should support the resources created by an artist
  - e.g. FBX file format exported by 3D Max or Maya

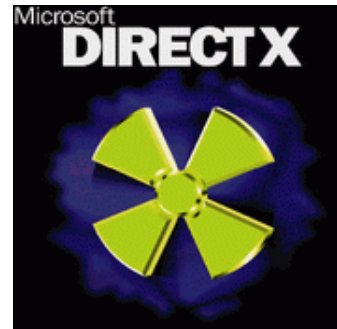
Microsoft®  
**DirectX**®

**OpenGL**®

**Vulkan**™

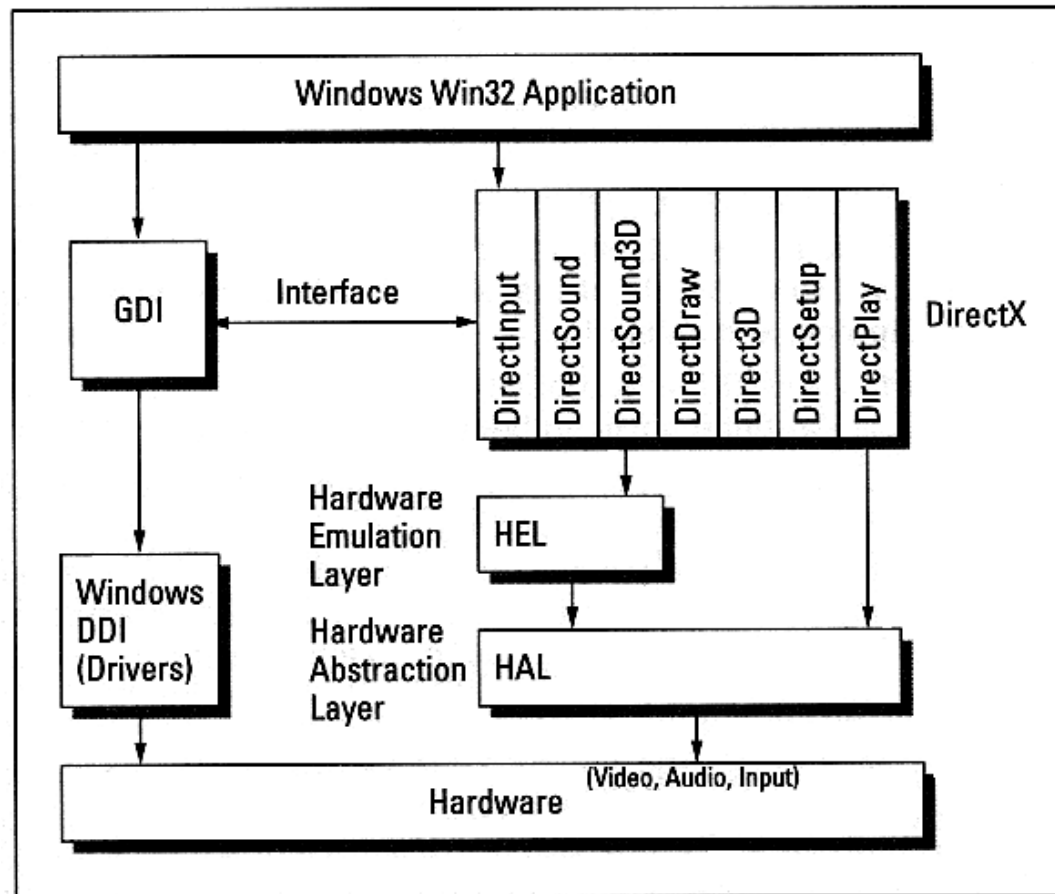
# DirectX SDK

- Microsoft DirectX SDK [Wikipedia]
  - A collection of application programming interfaces (API) for handling tasks related to multimedia, especially game programming and video, on MS platforms.
  - X for **Direct3D**, DirectDraw, DirectSound, DirectInput, etc.
  - Software development kit (SDK): runtime libraries, documents, tutorial examples, sample resources, tools, etc.
  - Versions: 1.0~12.0 (1995~2019)
- Direct3D
  - Part of DirectX
  - Microsoft only
  - COM(C++)-based
  - More popular in game industry
- OpenGL
  - Graphics only
  - Platform-independent
  - C-based
  - Not as popular as Direct3D



# DirectX SDK

- Architecture



Q & A