CS230
Game Implementation Techniques

Lecture 2

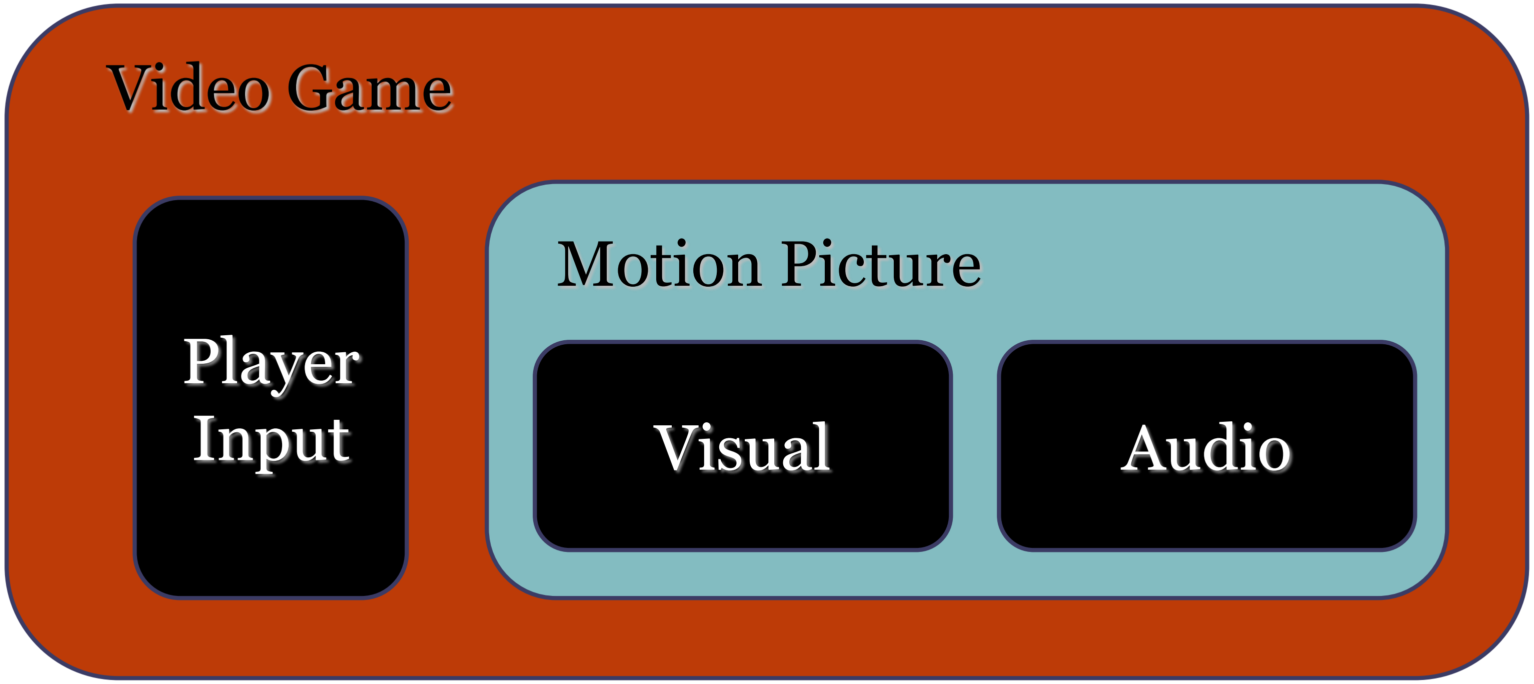
Questions?

- Resolution
- CRT
- Refresh rate & Frame Rate
- Vertical Sync
- LCD Monitors

Overview

- Game Engine
- Game Engine Components
  - System Components
  - Game Logic Components

What is a Game?



It's like a movie … with interaction!!!

Simulation VS Games

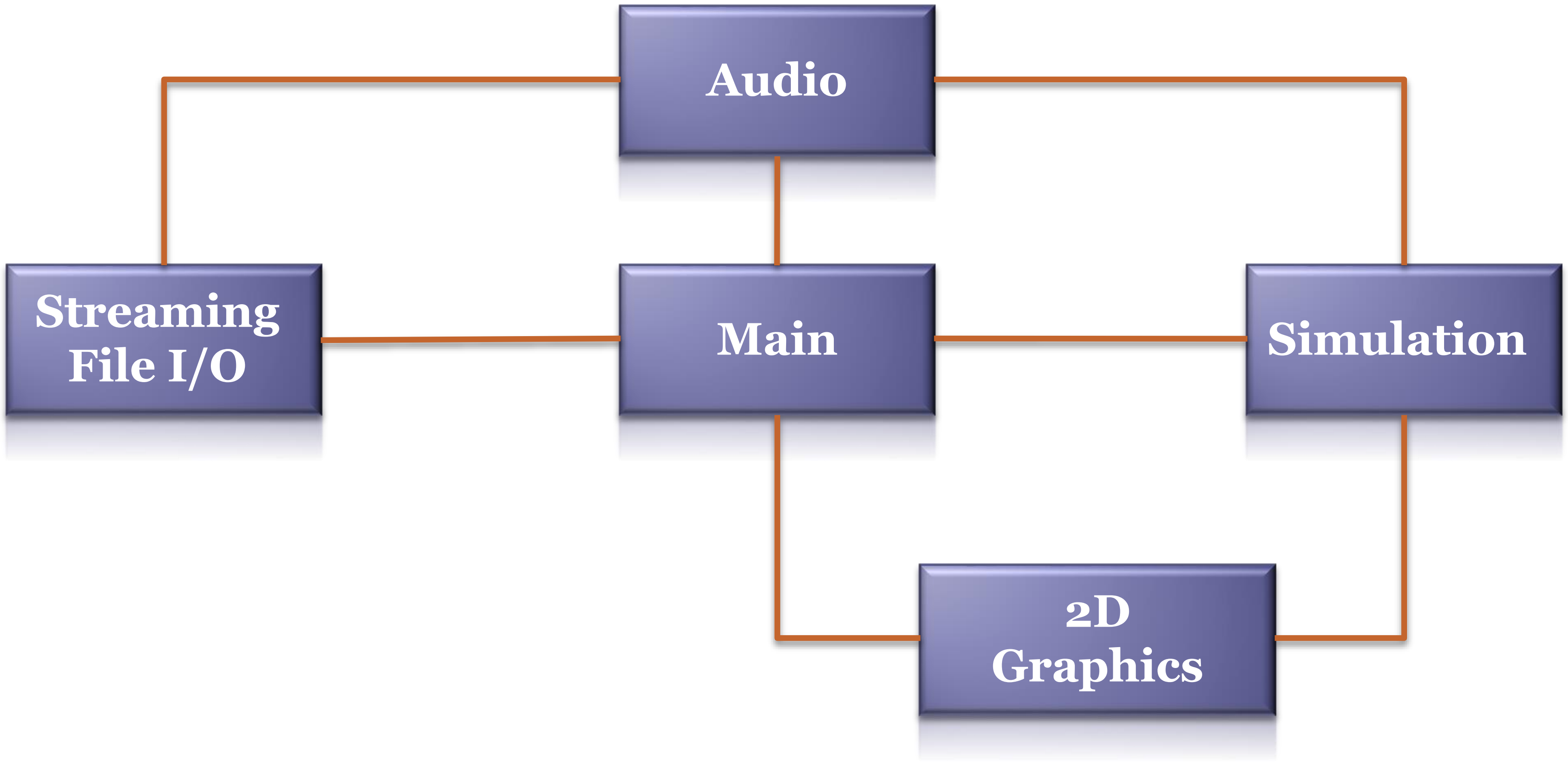
- Scientific representation of a real phenomenon
- For computational purposes

- Artistically simplified representation of a phenomenon
- For educational or entertainment purposes

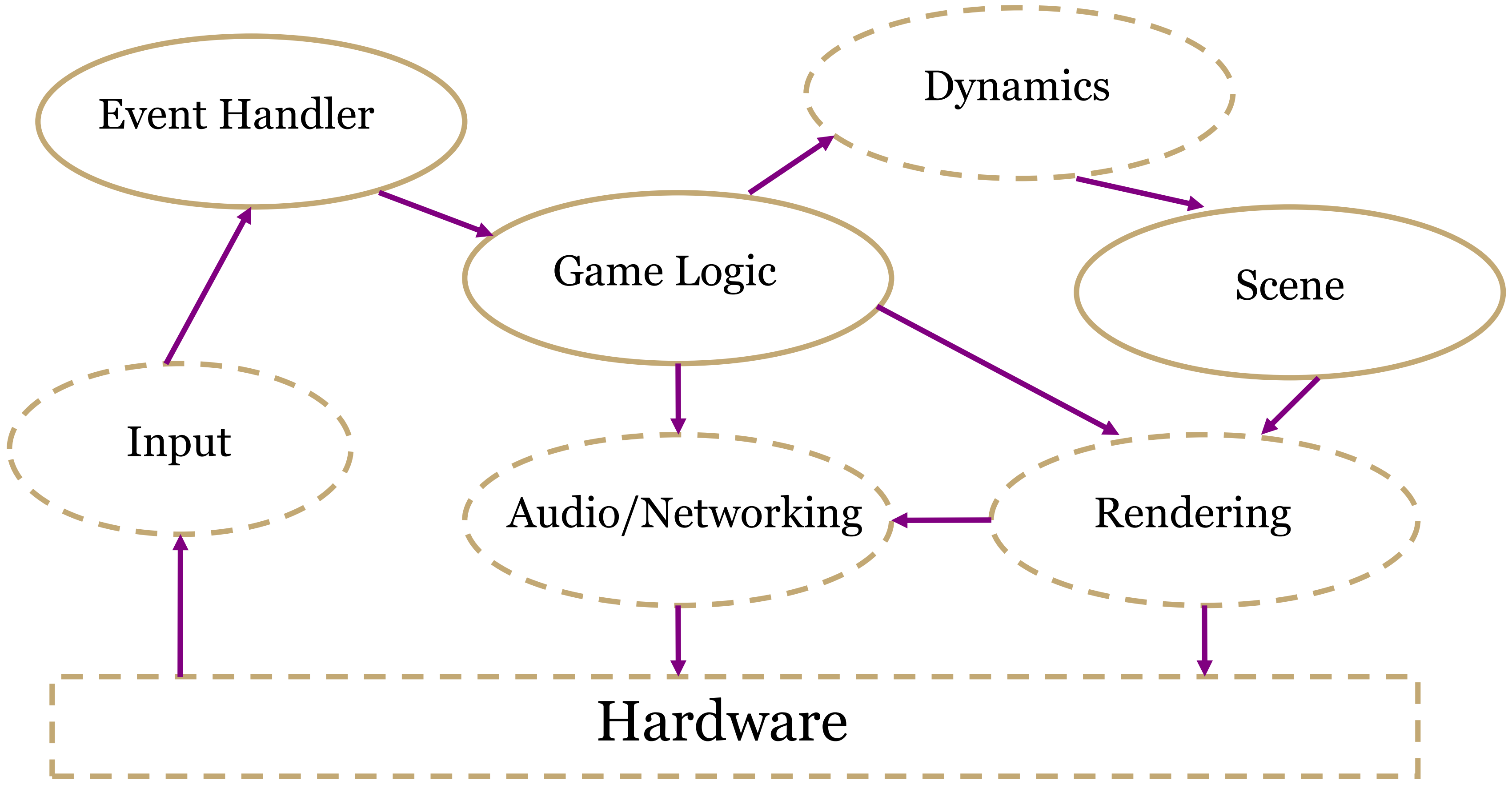
What is a Game Engine?

- It's the operating system of games
- Software system that enables game developers to build games without concerning themselves with system's internal structure

Structure of a Simple 2D Game Engine



Structure of a Game Engine



Game Engines

- A game engine includes all elements in schematic that have no effect on game content
  - Reusable elements indicated by dashed ovals
- In practice, most game engines are tuned to a particular content style.

  Example:

  An engine tuned for flight simulators may not be appropriate for games that take place in tunnels and dungeons.

Overview

- Game Engine
- Game Engine Components
    - System Components
    - Game Logic Components

Game Engine Components

- System component is responsible for isolating the game logic component from communicating with the hardware directly.
- The isolation makes it easier to port the game to another platform
- Subcomponents should belong entirely to either one of the main components.

System Components (1/2)

- The system's subcomponents are:
  - Frame Rate Controller
  - Memory Manager
  - File Manager
  - Graphics Manager
  - Audio Manager
  - Input Manager

System Components (2/2)

- Subcomponents dealing with the hardware should be initialized at the very beginning of the application.
- If any initialization fails, the application should quit.
- Upon exiting the application all the devices that were allocated should be released.

Frame Rate Controller

- Has two primary jobs:
  - To ensure a consistent frame rate for the current game state and decide when the frame buffer should be swapped
  - Tracks useful information:
    - Number of frames since the game started
    - Number of frames since the game state started
    - How much time the last frame used (in seconds)

Memory Manager

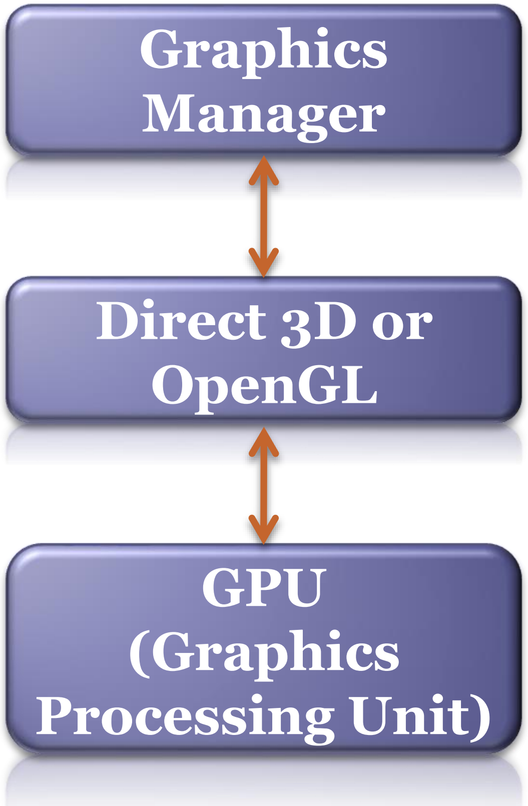
- Features that a memory manager should have:
  - Optimized memory allocation/deallocation for the game
  - Hierarchical memory heap
  - Easy way to track memory usage
  - Simpler way to track memory leaks
  - Runtime memory de-fragmentation

File Manager

- Features that a file manager should have:
  - Background file loading
  - Decompress data during load time
  - Automatic file sharing
- File managers run on a different thread

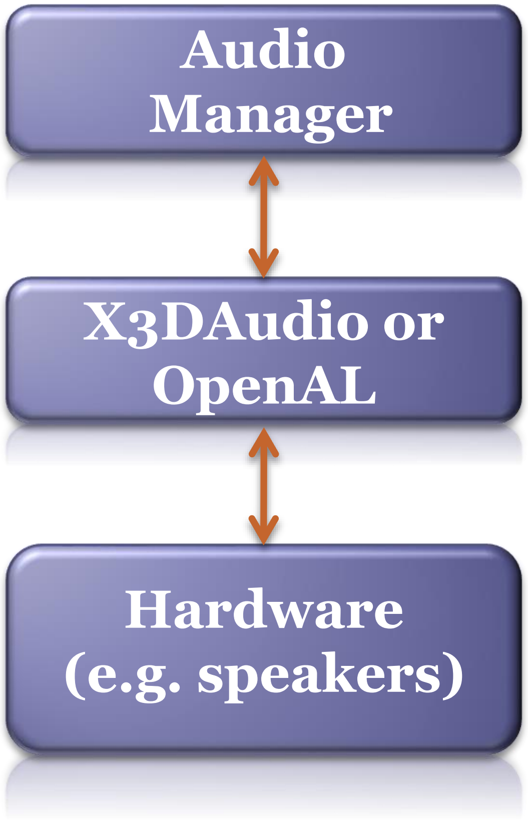
Graphics Manager

- A layer on top of the graphics hardware



Audio Manager

- Deals with the sound hardware



Input Manager

- The input manager keeps track, among other things:
  - Current pressed keys
  - Newly pressed keys
  - Newly released keys
  - A history of pressed keys

Game Logic Components

- The game logic's subcomponents are:
  - Game State Manager
  - Simulation Manager
  - Collision Detection Manager
  - Object Manager
  - Environment Manager
  - Camera System

Game State Manager (GSM) (1/2)

- A game is always in a state. A game could be in "Main Menu", in "Level 1", in "Loading screen"…
- The GSM is responsible for game state switching, the game loop and the frame rate controller.
- Each state is associated with a set of functions that manages that state's cycle.

Game State Manager (GSM) (2/2)

- The cycle functions are:
  - Load
  - Initialize
  - Update
  - Draw
  - Free
  - Unload

Simulation Manager

- It’s the physics component of the engine
- Deals with the kinematics and dynamics of the game objects

Collision Detection Manager

- Takes care of the objects' impact and their collision updates
- Collision systems might be written from simple mathematical intersection functionalities to a complex partitioned collision sections
    - Quadtree
    - Octree
    - BSP Tree
    - Etc…

Object Manager

- Objects that are "Alive" are managed by the object manager that is responsible for:
  - Loading game objects and initialize them
  - Create and remove object instances
  - Updating objects
  - Sending object's data to the graphics manager

Environment Manager

- The environment manager deals with static objects.
- Static objects are objects that the user does not interact with directly

Camera System

- Sounds very simple, yet, a bad camera could practically turn a perfectly good game into horrible game.

- There are four parameters commonly used to control the camera
  - CamPosition
  - CamTarget
  - CamUp
  - CamFOV