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ASSIGNMENT 2

Identify a real-world application for both parallel computing and networked systems. Explain how these technologies are used and why they are important in that context.

**Application: Online Multiplayer Games (e.g., PUBG, Fortnite)**

**Use of Parallel Computing in Multiplayer Games**

In online multiplayer games, there are numerous tasks that need to happen simultaneously for a smooth gaming experience. These tasks can include rendering the graphics, managing player movements, calculating physics (like jumping or shooting), and running the game logic (such as calculating health, damage, and effects). These tasks are often computationally intense, and trying to handle all of them on a single processor or core would cause lag, reducing the quality of the game.

**Parallel computing** helps by splitting these tasks into smaller sub-tasks and executing them simultaneously across multiple CPU or GPU cores. This ensures that the game can handle many processes at once, like rendering graphics while calculating the position of objects, and executing physics simulations without delays.

**Example:**

* **In a shooting game**, when a player fires a bullet, different cores can handle different aspects:
  + One core handles the **bullet’s animation** (showing the bullet traveling through the air).
  + Another core checks if the bullet **hits** a target (like another player or object).
  + Another core updates the **player’s health** if the bullet hits the target.

By performing these operations in **parallel**, the game can provide a **smooth and responsive** experience without any noticeable delays or lag, even when multiple actions are happening at once.

**Use of Networked Systems in Multiplayer Games**

**Networked systems** play a crucial role in online multiplayer games because they enable real-time interaction between players, even if they are physically located in different parts of the world. These systems rely on the **internet** or **dedicated game servers** to synchronize actions and data between all players.

In multiplayer games, each player’s device communicates with a **central server** that stores the game state (such as the position of players, actions performed, etc.). This server constantly updates the game world and sends that information back to each player to ensure that everyone is seeing the same game world.

**Example:**

* **If a player throws a grenade**, the following happens through networked systems:
  + The grenade’s action is communicated to the central server.
  + The server sends the updated state (the grenade’s location and movement) to all players who are connected to the game.
  + Every player’s device receives this data in **real-time**, ensuring that all players see the explosion at the same time and place, keeping the gameplay synchronized.

This **real-time communication** allows players to interact with each other instantly, even though they may be far apart geographically.

**Why These Technologies Are Important**

These technologies are crucial for **seamless gameplay** in online multiplayer games. Here’s why:

* **Smooth Gameplay:** Parallel computing ensures that all tasks, such as rendering and game logic, are handled quickly and simultaneously, preventing lag and delays. Without parallel computing, actions like shooting, jumping, or moving might experience delays, making the game frustrating to play.
* **Real-Time Interaction:** Networked systems are the backbone of multiplayer functionality. Without them, players wouldn’t be able to see each other’s actions, make decisions, or interact with the game world in real-time. This technology ensures that the game world is synchronized for every player, regardless of their physical location.
* **Fairness and Fun:** Networked systems also help maintain fairness in the game. Since all players receive the same information about the game world at the same time, everyone is operating on a level playing field. Delays or differences in how players see the game world could lead to unfair advantages or disadvantages.

**Conclusion**

Online multiplayer games like **PUBG**, **Fortnite**, and **Call of Duty** represent one of the most exciting applications of **parallel computing** and **networked systems** in entertainment. Parallel computing enables **efficient, fast processing** of the various tasks that make the game run smoothly, while networked systems ensure that all players are connected and able to interact in real-time.

These technologies allow game developers to create **immersive, exciting experiences** where players can battle it out in virtual worlds, communicate with each other, and enjoy games with friends, regardless of where they are located. Without these technologies, modern online multiplayer games wouldn’t be able to offer the level of performance and interactivity that players expect.