

Draw It or Lose It

# **CS 230 Project Software Design Template**

Version 1.0

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## [Document Revision History](#_grjogdjh5fi8)

| Version | Date | Author | Comments |
| --- | --- | --- | --- |
| 1.0 | 07/20/2025 | Erica Boterf | Initial version of software design |

**Instructions**

Fill in all bracketed information on page one (the cover page), in the Document Revision History table, and below each header. Under each header, remove the bracketed prompt and write your own paragraph response covering the indicated information.

## [Executive Summary](#_sbfa50wo7nsh)

The Gaming Room currently offers the game *Draw It or Lose It* as an Android application. They would like to expand the game to a web-based platform that can run seamlessly across multiple operating systems and devices. This shift will allow the game to reach a wider audience and provide consistent gameplay experiences regardless of the user’s device.

To achieve this, we will develop a web-based distributed application using industry-standard software development practices. The solution will ensure that:

* The game supports multiple teams and players.
* Game and team names are unique for easier identification and user experience.
* Only one active game instance exists in memory at a time, using the Singleton design pattern.
* Efficient management of players and teams through the use of object-oriented principles such as inheritance and encapsulation.

This document outlines the design constraints, domain model, platform evaluations, and recommendations to deliver a robust, scalable, and secure solution.

## Requirements

*The Gaming Room’s primary business and technical requirements include:*

* *Ability to support multiple teams and multiple players per team.*
* *Unique game and team names for clear identification.*
* *Restrict the system to one game instance in memory at any given time.*
* *Ensure compatibility across different operating systems and devices.*
* *Provide secure communication and user data protection.*
* *Enable future scalability for additional features and game modes.*

## [Design Constraints](#_2et92p0)

Developing a web-based, distributed application introduces several constraints:

* **Platform Independence:** The solution must run on multiple operating systems (Windows, Linux, macOS) and mobile devices. This requires web technologies like HTML5, CSS, JavaScript, and a back-end built on a platform-independent framework.
* **Scalability:** The application must support multiple concurrent users without performance issues. This requires load balancing and a scalable server environment.
* **Security:** User data must be protected through encryption and secure APIs. Since the application communicates across networks, data-in-transit security is critical.
* **Latency and Reliability:** Distributed environments can experience network delays or outages. The design should minimize latency and handle disconnections gracefully.
* **Unique Identifiers:** All game, team, and player names must be unique. Implementing the Iterator pattern for searching names before creation will prevent conflicts.
* **Single Instance Limitation:** The Singleton pattern will be implemented for the GameService class to ensure only one game instance exists in memory.

## [System Architecture View](#_ilbxbyevv6b6)

The system will use a **web-based, client-server architecture**. This approach allows players on different platforms—desktop (Windows, macOS, Linux) and mobile devices—to access the game through a web browser without requiring additional installations.

The architecture consists of the following layers:

* **Client Layer (Front-End):**  
  Runs on the user’s device through a standard web browser. It handles user interactions and communicates with the server using HTTPS. The front-end will be built using standard web technologies such as HTML5, CSS, and JavaScript, ensuring cross-platform compatibility.
* **Application Layer (Server-Side):**  
  Deployed on a Linux-based environment for reliability and cost-effectiveness. The server will manage game logic, enforce business rules (e.g., unique names, single game instance), and process all requests from clients. The Singleton pattern will ensure only one game instance runs in memory.
* **Data Layer (Database):**  
  A cloud-hosted relational database (e.g., MySQL or PostgreSQL) will store persistent data such as player information, team details, and game history. This enables scalability and high availability.
* **Communication:**  
  The system uses RESTful APIs over HTTPS to exchange data between clients and the server. This ensures secure and efficient communication.

This layered design promotes scalability, maintainability, and platform independence, making it an ideal choice for a distributed, web-based game application.

## [Domain Model](#_8h2ehzxfam4o)

The UML diagram illustrates the relationships among the core classes:

* **Entity Class (Base Class):** Holds common attributes like id and name. This promotes code reuse and simplifies maintenance.
* **Game Class:** Inherits from Entity. Represents a game instance and maintains a list of teams.
* **Team Class:** Inherits from Entity. Holds a collection of players.
* **Player Class:** Inherits from Entity. Represents individual participants.
* **Inheritance:** Shared attributes are centralized in the Entity class to avoid redundancy.
* **Encapsulation:** Class fields are private, and public getters/setters control access.
* **Polymorphism:** All classes can be handled through the base Entity type when needed.
* **Abstraction:** The design hides implementation details from users while exposing only necessary functionality.

These principles ensure efficiency, maintainability, and scalability in fulfilling client requirements.

**"The Gaming Room UML diagram. The top of the diagram is labeled as com dot gamingroom. Test boxes are placed in two layers. The first layer has three text boxes and the second layer has four of them. In the first layer, the 'ProgramDriver' textbox points to 'SingletonTester' textbox. The 'ProgramDriver' textbox contains the text 'asterisk main round brackets.' The 'SingletonTester' textbox contains the text 'asterisk testSingleton round brackets.' The arrow between these two text boxes are labeled 'open two angle brackets uses close two angle brackets'. In the second layer, there are 'GameService', 'Game', 'Team', and 'Player' text boxes. The 'GameService' textbox has texts arranged in two layers. The first layer contains games colon List open angle bracket Game close angle bracket, nextGamesId colon long, nextPlayer Id colon long, nextTeamId colon long, and service colon GameService. The second layer contains GameService round brackets, getinstance round brackets colon GameService, addGame open parenthesis name colon String close parenthesis colon Game, getGame open parenthesis id colon long close open parenthesis colon Game, getGame open open parenthesis name colon String close open parenthesis colon Game, getGameCount round brackets colon int, getNextPlayerID round brackets colon long, and getNextTeamId round brackets colon long. The 'GameService' box is connected with the 'Game' textbox with a line labeled 'zero dot dt dot asterisk'.  The 'Game' textbox also contains text in two layers. The first layers contains the text teams colon List open angle bracket Team close angle bracket. The second layer has Game open round bracket id colon long comma name colon String close parenthesis, addTeam open parenthesis name colon String close parenthesis Team, toString round brackets colon String. The 'Game' textbox is connected with the 'Team' textbox with a line labeled 'zero dot dt dot asterisk'. The 'Team' textbox also contains text in two layers. The first layers contains the text players colon List open angle bracket Player close angle bracket. The second layer has Team open parenthesis id colon long comma name colon String close parenthesis, addPlayer open parenthesis name colon String close parenthesis colon Player, and toString round brackets colon String. The 'Team' textbox is connected with the 'Player' textbox with a line labeled 'zero dot dt dot asterisk'. It contains the text Player open parenthesis id colon long comma name colon String close parenthesis and toString round brackets colon String. The 'Game', the 'Team, and the 'Player' boxes point to the 'Entity' textbox in first layer. The 'Entity' textbox contains text in two layers. The first layer has the text id colon long and name colon String. The second layer has Entity round brackets, Entity open parenthesis id colon long comma name colon String close parenthesis, getId round brackets colon long, getName round brackets colon String, toString round brackets colon String.**

## [Evaluation](#_2o15spng8stw)

Using your experience to evaluate the characteristics, advantages, and weaknesses of each operating platform (Linux, Mac, and Windows) as well as mobile devices, consider the requirements outlined below and articulate your findings for each. As you complete the table, keep in mind your client’s requirements and look at the situation holistically, as it all has to work together.

In each cell, remove the bracketed prompt and write your own paragraph response covering the indicated information.

| **Development Requirements** | **Mac** | **Linux** | **Windows** | **Mobile Devices** |
| --- | --- | --- | --- | --- |
| **Server Side** | macOS can host web servers but is less common for production use. It offers good security but higher cost. | Linux is the most popular choice for hosting web applications due to stability, open-source nature, and cost-effectiveness. | Windows Server is reliable but requires licensing fees, making it costlier than Linux. | Mobile devices are not suitable as servers due to hardware limitations. |
| **Client Side** | Requires development for Safari compatibility, macOS users expect a polished UI experience. | Linux users typically access via browsers, so no special adjustments beyond standard web compatibility. | Must ensure compatibility with major browsers like Edge and Chrome. | Requires responsive design and possibly mobile-optimized features for touch input. |
| **Development Tools** | Tools: Xcode, IntelliJ IDEA, Java SDK. Languages: Java, HTML, CSS, JS. | Tools: Eclipse, IntelliJ, VS Code. Languages: Java, HTML, CSS, JS. | Tools: Visual Studio, IntelliJ IDEA. Languages: Java, C#, HTML, CSS, JS. | Tools: Android Studio, Xcode (for hybrid apps). Languages: JavaScript frameworks like React or Flutter for cross-platform support. |

Recommendations

Analyze the characteristics of and techniques specific to various systems architectures and make a recommendation to The Gaming Room. Specifically, address the following:

1. **Operating Platform**: Linux is the best option for hosting the server-side application due to its stability, scalability, and low cost. It supports most modern web technologies and integrates well with cloud services.
2. **Operating Systems Architectures**: A 64-bit Linux architecture provides strong performance for web-based applications and ensures support for large-scale deployments.
3. **Storage Management**: A cloud-based relational database such as **MySQL** or **PostgreSQL** is recommended for storing user and game data. These systems offer reliability, backup features, and scalability.
4. **Memory Management**: Linux uses efficient virtual memory management, leveraging paging and caching to optimize performance for web applications. This ensures the application remains responsive even under heavy load.
5. **Distributed Systems and Networks**The application will use a **client-server architecture**. Clients interact with the server through RESTful APIs over HTTPS. Load balancers and redundant servers will ensure uptime even during outages.
6. **Security**:

Security measures include:

* **Encryption:** Use SSL/TLS for secure data transmission.
* **Authentication:** Implement secure login and session management.
* **Data Protection:** Encrypt sensitive data in the database.
* **Firewall and Monitoring:** Regular vulnerability checks and intrusion detection systems