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CS 230: Operating Platforms

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Draw It or Lose It – Game Design

Draw It or Lose It

Version 3.0

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Document Revision History

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| --- | --- | --- | --- |
| Version | Date | Author | Comments |
| 3.0 | 20/02/2021 | Joshua Fanti | Diagram, description, and client project requirements |

**Executive Summary**

We are Creative Technology Solutions (CTS), a technology consulting firm. Our client, Gaming Room wants a web-based version for its mobile-based video game "Draw It or Lose It". The game has additional features requirements that have to be added to its web-based version that will have a web server backend where the game website will be hosted potentially scaling to serve thousands of clients over the Internet. The game features are described as follows,

* The game will have a backend database or library of images that will serve as clues for a puzzle that the playing teams have to guess.
* It will end up having four one-minute rounds.
* The drawing should be rendered at a steady rate for 30 seconds.
* If a team is unable to guess the puzzle in the designated time, the other teams would be given the chance to guess with 15 seconds time duration.
* The game should be able to be played on multiple Operating System Platforms (Windows, MAC, Linux) as well as on mobile platforms (Android and iOS) in a distributed environment.
* The web-based application should be responsive to cater the mobile users.
* The game should be scalable to thousands of users.
* Teams may be formed having multiple players in real-time.

**Design Constraints**

***Timeline***

It can take anywhere from three months to nine months to develop an Apple iOS app for Draw It or Lose It.

The timeline to develop a “Draw It or Lose It” website (web app) will take around three and half months. It will include three months of discovery, six weeks of design, three weeks of initial development, and two weeks of modifications and testing.

***Budget***

The Apple iOS gaming app cost on average is around 28,000 USD and a gaming web app for "Draw It or Lose It." would cost around 3000 USD. In that respect, an estimated budget of 31,000 USD to USD 40,000 should be designated to develop this project.

***Manpower***

Following the team, technical professionals will be organized.

* ***One Project Manager***: The Project Manager will supervise the project and make sure the project completes in the designated time within the current resources.
* ***One iOS User Interface Designer:*** An Apple iOS mobile interface designer will be engaged.
* ***One Web User Interface Designer:*** A web interface designer will make the web interface more user friendly.
* ***Two Web Developers:***Two web developers will be engaged who will have HTML5, CSS3, JavaScript, PHP, and MySQL in their skillset.
* ***SWIFT Developer:***A SWIFT developer will be appointed to develop the" Draw It or Lose It" version for Apple iPhone. If he knows objective - C, that would be a plus point.
* ***Software Testing Engineer:***A software testing engineer will test all the software and clear it for quality control.

**System Architecture View**

Not Applicable.

**Domain Model**

The UML diagram below shows seven classes. Each class has attributes (also known as variables, properties, or characteristics) in the second field and the third field is the method. The method is a special function that represents an object doing something. Each attribute also has its datatype defined. Take the class Entity, for instance, it has two attributes id and name with "long" and "string" data types. Similarly, the Entity class has Entity(), getid(), getName() methods with their respective datatypes.

When the class "attributes" and "methods" are private that is the other classes cannot access the particular attribute or a method, it is preceded by – sign. On the other hand, if the class attribute or method can be accessed by other classes it is called public, and it is preceded by a + sign.

The relationships between the classes are represented by an arrow sign. The class at which the arrows terminate is called a superclass (or parent class). On the other hand, the class where the arrow originates is called a subclass (or child class). The child class inherits all the attributes and methods of the parent class.

A SingletonTester is used by the Program driver so the arrow displays the word “uses.”

The 0…\* is between the classes that denotes the number of instances from 0 to many. This lets the software scale up as needed for the client. In the following scenario, the class "game" can have from 0 to many instances similarly in terms of team class and player class there can be 0 to many teams or classes.



**Evaluation**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Development Requirements** | **Mac** | **Linux** | **Windows** | **Mobile Devices** |
| **Server Side** | The Mac has good performance. And it's so simple to use, you don't need a technical support team. | Linux based operating systems are powerful and free to use. Web hosting is cheap as compared to the other two. | Windows servers are easy to use but are expensive. As compared to the other two, their web hosting software is slower. | We can use AWS for mobile devices for the best cloud services available. |
| **Client-Side** | Cost and Time for development are more compared to Linux. As developers are not easy to find. | Cost and Time for development are less compared to others given. As developers are easy to find. | Cost and Time for development are more compared to Linux. As developers are not easy to find. | Cost and Time  for development can be an  expensive issue compared to apple. |
| **Development Tools** | XCode will be used as an IDE for developing the app for different iOS, and swift or objective c (older development language) will be used. And, if you are developing for the web, you can use eclipse as an IDE, to develop the application. | Android studio, will be used to develop the application. And, if you are developing for the web, you can use eclipse as an IDE, to develop the application. | Android studio, will be used to develop the application. And, if you are developing for the web, you can use eclipse as an IDE, to develop the application. | The studio will be needed to develop the app. If you are a developer, you can use eclipse as an IDE, to develop the app or we can develop it using the framework |

**Recommendations**

The following are the recommendations.

* **Operating Platform**:

Windows is one of the most important Operating Systems throughout history, its evolution has allowed its core, born from DOS, with a monolithic structure where one program was executed at a time, to improve. The arrival of the graphical interface with windowed applications practically pushed DOS into oblivion. Although many functions are part of today's operating systems, only today DOS is used for console execution where there is more freedom in certain tasks.

With the arrival of Windows NT on servers and PCs, it gave rise to a modular internal structure that has been maintained over time in its design, it has an extensible, portable, adaptable, secure and compatible system with its previous versions. It is a multi-architecture operating system. It is compatible with IA-32/X6, MIPS and DEC Alpha; and later compatibility with PowerPC, Itanium, x64 and ARM was added. The main features of the Windows NT family include Windows Shell, Windows API, Native API, Active Directory, Group Policy, Hardware Abstraction Layer, NTFS, BitLocker, Windows Store, Windows Update and Hyper-V. The modularity allows to adapt to new architectures, we can consider it a suitable system for game development in a secure environment. Internal communication works between processes running in the kernel with system calls, but there are others that through the layers communicate with the message sending protocol. The communication between software platforms are made by sending messages, the protocols established for receiving messages are mechanisms or communication protocols established in the OSI model, establishes the communication standards for all equipment with the same architecture or different architectures.

* **Operating Systems Architectures**:
* In windows: The Windows kernel is categorized as a microkernel, its architecture is hybrid. The operating system kernel sits between the HAL and the Executive and provides multiprocessor synchronization, threads, interrupt dispatching and scheduling, interrupt handling and exception dispatching. The Hardware Abstraction Layer, or HAL, is a layer that sits between the physical hardware of the computer and the rest of the operating system. It was designed to hide hardware differences, the kernel also uses an access control list for file access control protocols, includes a GUI stack in the kernel, maintains a registry to store its configurations, is highly modular and is based on two main layers:
* User mode: it consists of subsystems that can pass requests from to the appropriate kernel mode controllers the Environment subsystem and the Integral subsystem. The environment subsystem was designed to run applications written for different types of operating systems. The Integral subsystem consists of a security subsystem, a terminal service, and a server service. The security subsystem allows or denies access to user accounts based on resource permissions, handles login requests, and initiates authentication.
* **Storage Management**:

There are two types of hard disks, mechanical or HDD and solid state or SSD.

MAIN CHARACTERISTICS

|  |  |  |
| --- | --- | --- |
|  | SSD | HDD |
| CAPACITY | Usually between 256 GB and 4 TB | Usually between 1 and 10 TB |
| CONSUMPTION | Lower power consumption | Higher power consumption |
| COST | Quite a bit more expensive | Much less expensive |
| NOISE | Quieter due to no moving parts | Slightly louder due to moving parts |
| VIBRATION | No vibration due to no moving parts | The spinning of the discs may cause slight vibration |
| FRAGMENTATION | None | May occur |
| DURABILITY | Its cells can be rewritten a limited number of times | With mechanical parts that can be damaged by movements |
| OS START-UP TIME | 7 seconds | 16 seconds |
| DATA TRANSFER | In general, between 200 and 550 MB/s | In general, between 50 and 150 MB/s |
| AFFECTED BY MAGNETISM | No | Magnetism can erase data |

HDDs are storage drives with moving parts and SSDs do not, so they cause less noise and vibration.

One notable difference is speed, as an SSD boots an operating system in less than half the time of a 7200 rpm HDD, and more than triples its data read and write speeds. For example, in some models an HDD reads and writes data at 150 MB/s, and an SSD reads and writes at 545 MB/s and 525 MB/s.

The lifetime of an SSD is directly dependent on the amount of data being written to it, as each cell in a bank of its flash memory can only be written a certain number of times. A study conducted by Tech Report (GEOFF, G., 2014) concluded that a fairly standard SSD disk, could last up to 2.4 Petabytes of data written, which is equivalent to 2457.6 Terabytes, which is more than the 5 years warranty usually offered by manufacturers.

When you need to download a lot of content from the Internet, require large amounts of storage, and have a low budget, the HDD is recommended.

In this project it is recommended that the client and the analysts-programmers of the video game have a faster PC, in which they can edit multimedia content and run the video game; the definitive option is an SSD, since the loading processes will be accelerated.

For servers it is recommended to combine an SSD in the C: drive to install the operating system there and make everything go faster, and an HDD as a secondary drive to store all the heavy files.

* **Memory Management**:

Memory management is one of the mechanisms that the operating system has within its functions. Memory is the physical part that has a storage mechanism for binary numbers that together represent data and information. The mechanisms used avoid that the processes concur towards it in an uncontrolled way, so that the memory actions can be distributed in an organized way avoiding the concurrence of data and the loss of information in some cases. Access to memory in some cases is manual, managed by a specialist programmer, but sometimes it is forgotten to free the used space occupying unnecessary spaces. The best practice is to let it be managed within the operating system through the memory manager. Its job is to keep track of the available memory to enable the processes the requested memory and free the memory in case of terminating the execution. The operating systems, depending on the amount of memory in demand, accesses the secondary memory and uses it as virtual memory, the amount of running processes generates a virtual memory management through the paging mechanism, which is nothing more than using that space of the secondary memory as part of the main memory, virtualizing the execution of the processes in logically shared memory, this mechanism is performed by the MMU, When a process is running and the main memory is not available, the operating system through the memory manager enables part of that virtual memory and the process continues to run as if it were the main memory, for everything to work correctly a series of operations and logical addressing is performed to allow synchronization and execution with the secondary memory as a logical part of the main memory.

* **Distributed Systems and Networks**:

For the game a distributed system is necessary due to the high demand of data and information exchange between players, it is necessary a network with high processing capacity, we consider using a series of servers in Cluster, the advantage of the Cluster management is to have several capabilities for the development of the game, including high availability, the failure of a server will be replaced by another of the same group, these teams are usually configured with the same configuration of software and hardware, the high speed is obtained with the balance of loads, making the servers dispatch requests immediately, also allow scalability, horizontal installation of more Cluster, accepting the increase of more players.

The process would be something like this, a player sends a message to another player, the request reaches the server, the server processes the request, sends one or more messages with the response. The server stores the data sent by each of the players, which allows them to maintain their current status, the server must take care of the players' scores, any inherent data of all players, change of skills, in-game belongings. The servers also perform load balancing, distributing the players among all the servers.

* **Security:**

Security is a must for the game we are developing and is a major issue with video gamers. To ensure security, we need to protect the user’s data and our system. Different database security techniques will be implemented on the website. It includes deploying Secure Socket Layer (SSL) on the gaming site.

To safeguard the data of the web application, the principles of information security, which are authenticity, confidentiality and availability, must be guaranteed. Tools and procedures must be implemented to counteract and protect the information from exposure to threats on the network. This task is the responsibility of the development staff who must implement controls and best practices to protect a site from threats.

There are a number of "layers" to protect data from cyber-attacks, accidents, leaks and others. Among the most important are the following techniques:

Encryption of information. Encryption allows data to be locked in a unique language. It can be applied to databases, websites and communication channels.

To encrypt, an algorithm is used that will alter the data and that can only be decrypted through a private key that will allow access to the owner of the data. The best known algorithms are the AES standard and 3DES, which stands for "Advanced Encryption System", with a high level of data confidentiality.

The three alternatives to quantum computers are:

Cryptography based on hashes: they use secure hash functions, which resist quantum algorithms, where RSA and ECDSA lead the way. Their disadvantage is that they generate relatively long signatures, which limits their usage scenarios. Leighton-Micali Signature Scheme (LMSS) is one of the strongest candidates to replace the aforementioned.

Code-based cryptography: mathematical theory dealing with the laws of information encryption, where the best-studied cryptosystem to date is McEliece's.

Lattice-based cryptography: a discrete set of points in space with the property that the sum of two points of the lattice is also in the lattice. All algorithms require for their resolution an exponential time with the lattice size and it is believed that the same will be true for quantum algorithms.

Overall, data security includes data encryption, tokenization and key management practices.

In this regard, it is recommended that the HTTPS (HyperText Transfer Protocol Secure) internet communication protocol be implemented on the web server, as it protects the integrity and confidentiality of user data between their computers and the website. In order to enable this protocol, an SSL (Secure Sockets Layer) security certificate issued by an accredited Certificate Authority (CA) must be installed to protect users from any man-in-the-middle attacks. It is recommended to configure the certificate with a minimum 2048-bit key. This encrypts the connection and keeps the page secure as it can hide and protect the data sent and received in the browsers.

It is also considered necessary to implement a two-factor authentication method for registration and access to the user portal and platform. This is an extra security measure that often requires, in addition to a password, a code obtained from an application or SMS message. It is also important to guide users to use strong passwords and different passwords periodically, preferably every 90 days.

On the other hand, it is suggested to use network intrusion detection systems (NIDS), which continuously and passively monitor network traffic for anomalous behavior and flag it for review. NIDSs not only block such traffic, but also collect information about it and alert network administrators.

Databases represent the core of the software, therefore they are the most representative target of cybercriminals so a multi-layered defense strategy must be implemented through a database firewall and effective traffic monitoring to identify and assess database vulnerabilities and pinpoint the most sensitive information. A risk plan should be generated as well as a risk mitigation plan, reviewing user privileges and roles. In addition, acquire a monitoring system that performs an automatic blocking in real time upon detection of unauthorized access to the database or in case of security breaches.