

The problem

Once we develop the system that can obtain the questions and the prototype of the Trivial game, the NoGame company decided to develop the same game, but with some modifications. The marketing department of the NoGame has observed that the Trivial game can have a greater impact if it can be used through the Web, where users can connect and play between them.

The previous logic of the game could be reused, but we added a new layer that allows players to connect to the web, create a new game and play with it.

The company also wants that the players will be registered in the web in a very simple way, which allows them to know the historical data. Furthermore, when a user is connected, should be able to know if other users are connected to invite them to participate in a game.

Once the users accept to play a game, it should be in a very similar way that the desktop one. However, it is a web game, so it is possible that a player loses its connection to the web, and leaves it without any notification. The system should deal with these problems.

Given that the company expects to have a big number of users, the architecture must be scalable and offer good answer times to the actions of the connected users.

The company wants that the solution has a separation between the game logic and the user interface so they can experiment with different visualization types. The company is also interested in a web based solution that works in different devices so they expect a solution that follows the responsive design principles and web standards.

It is a prototype, and it is expected a web application that can manage games and players. The game logic, as I said, should be separately of the rest of the application. In the prototype, it is possible to restrict the system so in each game there can only be one player

Methodology

The study of the architecture will follow the Attribute-Driven Design (ADD) (Bass, et al., 2003) and the standard of the SEI (ANSI/IEEE 1471, 2000).

Stakeholders

The first step is to contextualize the problem and identify the stakeholders.

This project will be named "Trivial Game" (TG), so that the context of references and stakeholders can be determined. The client is a company named NoGame.

In this case, the stakeholders are:

- People in charge of NoGame.
- Development team of the TG.

- Players of the TG.
- Privileged users that can access the game stats.

People in charge of NoGame

These are the directors of the corporation, in charge of the budget, from which they allocate funds for the project.

They have to ensure that the project remains with a low cost and that can be ended before the given deadline.

Deployment team

This team will be in charge of developing the system based on the architecture.

Some of their objectives are:

- Low technological intensity of the project, in order to obtain a controlled and predictable development process.
- Profitable project, that is to say, a project that can be developed with the established budget with a rate of profitability that makes it attractive for the development.

Identification of the quality attributes

The following quality attributes have been identified:

- **Availability:**
 - The system must be played any time.
 - The web page in charge of support the game must be available.
- **Modifiability**
 - Easy introduction of new question types and punctuation algorithms.
- **Performance**
 - Since it is a end-user application, the application must ensure that:
 - There is no lag in the Graphical User Interface (GUI).
 - The questions must be loaded from the database at a reasonable speed so that the user doesn't have to wait for them.
 - It works perfectly as a web application.
- **Security**
 - The stats of the game must be accesible only to privileged users.
 - No useres without priveleges can access the stats of the game.
- **Testability**

- The reliability of the system must be easy to test, since it guarantees that the movements of the piece are correctly done.
- The system must take into account that this is a multiplayer web game, so no confusions between users.
- **Usability**
 - The system must provide some ways to ease game playing to handicapped people (for example, tooltips for blind people).
 - The colors used are so different, so colour-blind people should be able to play with it.
- **Reusability**
 - The core game engine must be reusable to develop the same game with different GUIs.
 - As the logic is completely separated from the visual, it could be used with other boards
 - Also, the logic could be used for another game
- **Reliability.**
 - The movements of the piece must be correct.
 - No confusions between the piece of one player and the piece of another player

First approach to the solution

Risks related to the solution

The system has to face certain risks that have to be identified:

- **Guarantee the reliability of the calculations of the movements.** This is related to the reliability attribute.
- **Guarantee no confusions between players:** This is very important. Also related to the reliability attributes
- **Time to end movements calculations.** This is related to the performance attribute. All computers must be able to perform the calculations instantaneously for a good user experience.
- **Knowledge about if a player leave the game, because its connection is lost**
- **Easiness of acceptance by clients' computers.** The system must not impose complex configurations in order to be installed or used and must work in different computers and operating systems.
 - It should be interesting to focus the game to every people, that is, no complex installation and work of the game.

In order to solve the aforementioned tasks, a series of approaches have been proposed:

- **Guarantee the reliability of the calculations of the movements.** Intensive testing must guarantee that all possible movements are correctly calculated.

- **Time to end movement calculations.** A prototype created and tested in different computers showed that any common computer with a processor faster than 1 GHz and more than 512 MB of memory can run the game without any performance issue.
- **Easiness of acceptance by clients' computers.** The configuration required for installation must be minimal. The parameters required for playing the game must also be minimal, being the board size the only required parameter.
- **Well working in the web :** The prototype should work perfectly using the web as the main platform. A user should be able to register and play online.

Impact of the solution

The chosen solution has added new quality attributes, and two new stakeholders: **the players of the TG and the privileged users of the TG.**

These stakeholders have special characteristics, since they have no representatives in the team.

List of stakeholders

CODE	STAKEHOLDER	INTERESTS
ST - 01	People in charge of NoGame	Low development costs: They must ensure that the project is viable for the specified money, and must be done for a given deadline. And make sure that the game is useful as a web game
ST - 02	Development team	Ensure to keep the project controlled. The project must work perfectly for the requirements of the NoGame company.
ST - 03	Players of the Trivial Game	Easiness of use and installation. Reliability in all calculations. Make sure that the trivial works online correctly
ST - 04	Privileged users to the trivial Game	Ease of access to game stats. Reliability of game stats. Quantity of game stats.

List of Quality Attributes

The following list of quality attributes is created based on the previous tasks.

CODE	DESCRIPTION	TYPE OF ATTRIBUTE
AT001	Availability to the system to play alt any time	Availability
AT002	the web page in charge of support the game must be available	Availability
AT003	Scalability of the system, since it may be necessary to eventually change it	Modifiability
AT004	Easy introduction to new question types	Modifiability
AT005	Guarantee a reasonable computation time	Performance
AT006	Guarantee that the GUI has a great responsiveness	Performance
AT007	Questions loading time from the database	Performance
AT008	It works perfectly as a web application	Performance
AT009	Easiness to test the reliability of the system, guaranteeing that all calculations are correctly performed.	Testability
AT010	The system must take into account that this is a multiplayer web game, so no confusions between users	Testability
AT011	Easiness of use	Usability
AT012	Easiness use for handicapped people	Usability
AT013	Reusability of the game logic	Reusability
AT014	Accesibility of the game stats	Security

Quality scenarios

Scenario Number	Source of the stimulus	Stimulus	Environment	Artifact	Response	Response Measure	Affected quality attribute
1	New type of question	Introduce the new question type	Exploitation	System	Include the new question type	The included question type must be available in the game and its visualization has to be correct	AT002

2	Change in the number of players	The number of players has to change	Exploitation	System	Change the number of players.	The game must be able to be played for the decided number of players	AT003
	User click	The user has interacted with the system through the view	Exploitation	View	React to user interaction	The system has to react properly in < 1 ms	
	Questions loading	The system loads the questions from the database.	Exploitation	Questions loader	Load the questions from the database	The questions have to be loaded in < 1 second	
	Need to develop another trivial in another format	The company needs to develop the trivial for other platforms to continue making money	Development	Model	Develop another system reusing the game logic	Another system can be develop using the existing core game engine.	

Attempt to access game stats	A user tries to access the game stats using his account.	Exploitation	Allow access to game stats according to the user's account type.	If the user has an admin / privileged account, he will be able to see the game stats. If not, access is denied.
Easiness of access to game stats	A user tries to access the game stats	Exploitation	Stats module Provide an easy way to access game stats for privileged users	The user can access game stats in a simple way using only his username and password.