Large and Cloud-based Software Systems

GOOD GAMES

System Architecture

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Technology
Arts Sciences
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1 Revisions and Responsibilities

revision	date	authors	remarks
	02/05/2019	Whole Group	Planning and task allocating
	13/05/2019	Hoang Trung Hai Pham	Combining all parts and proof reading
	13/05/2019	Le Hoang Long Nguyen	Submission

Table 1: document revisions

author	authorship of / responsible for
Hoang Trung Hai Pham	Chapters 8, 9, 13
Le Hoang Long Nguyen	Chapters 10, 11
Hoang Viet Chu	Chapters 2, 3, 4, 12
Syed Sameer Ul Hasan	Chapters 5, 6, 7

2 Functional Requirements

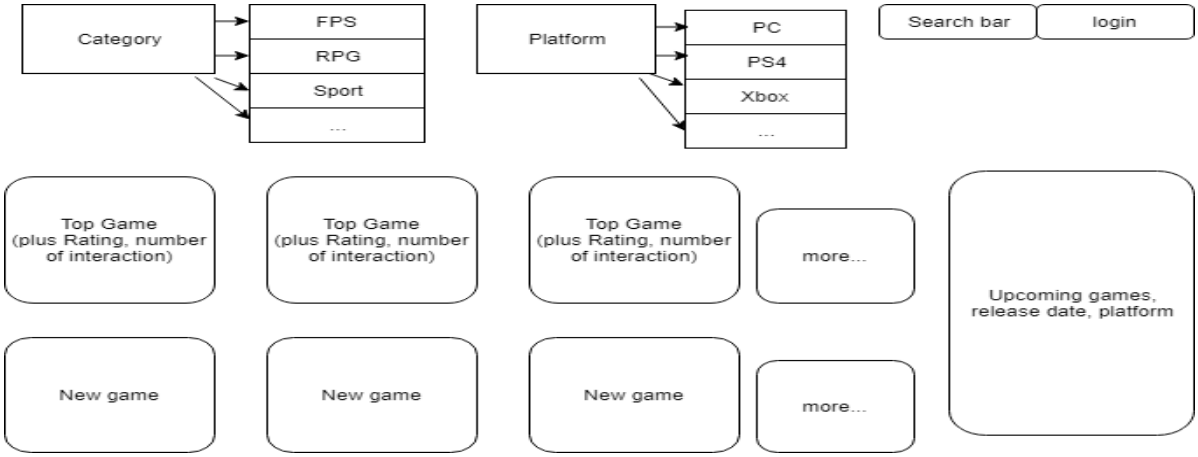


Figure 1: Good Game Homepage

The picture above is Good Game Homepage, which display the main functions of Good Game. There is a Category bar for viewers to pick which type of games they want to see, e.g FPS, RPG... and right next to Category bar is a Platform choice as well. There also is a Search bar to navigate to the specific game the user want to look up for, and a login function in case they want to leave a review or rate a game.
Below that is the appearance of several Top Games, and New Games with their rating and number of interactions.
There is also a table of upcoming games, their release dates and platform specified, which might cause interest to gamers.

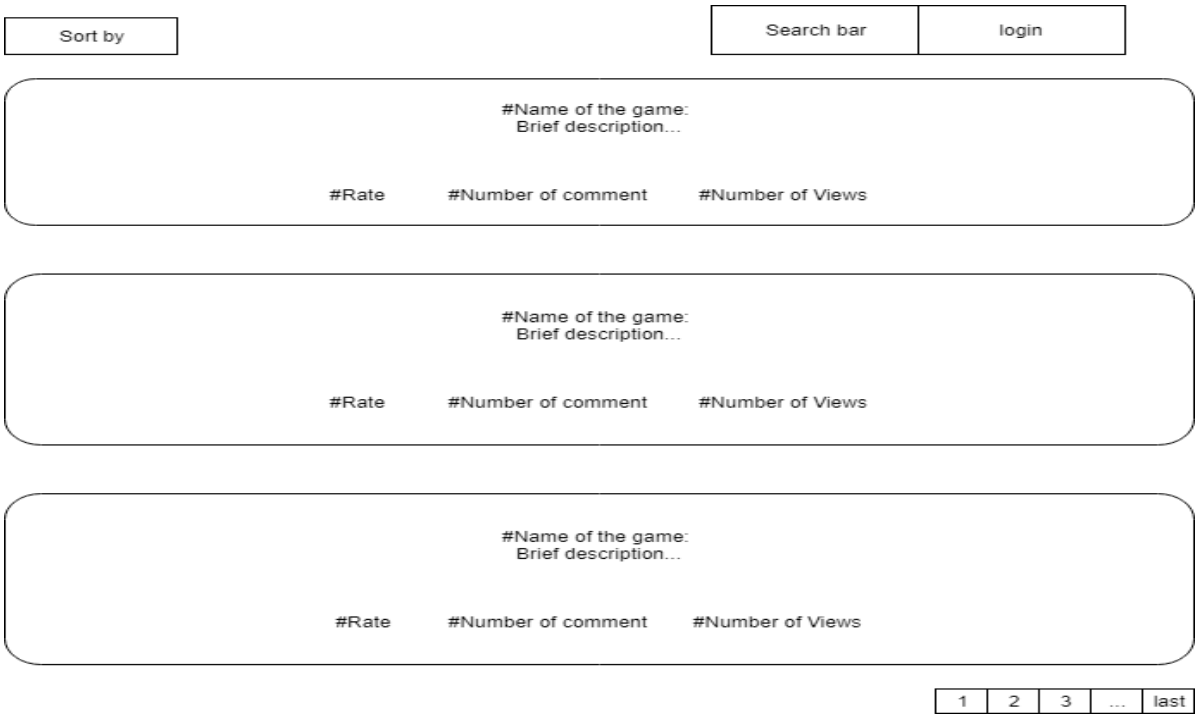


Figure 2: Appearance of each game category

When click onto each category, figure 2 show how the webpage displays the information. There are several games with their brief descriptions, rating, number of comment and number of views displayed on each page. User can sort these information by many options, e.g date, rate, views... User can still use Search bar to navigate to the game they want, or login to leave a comment or rate here.

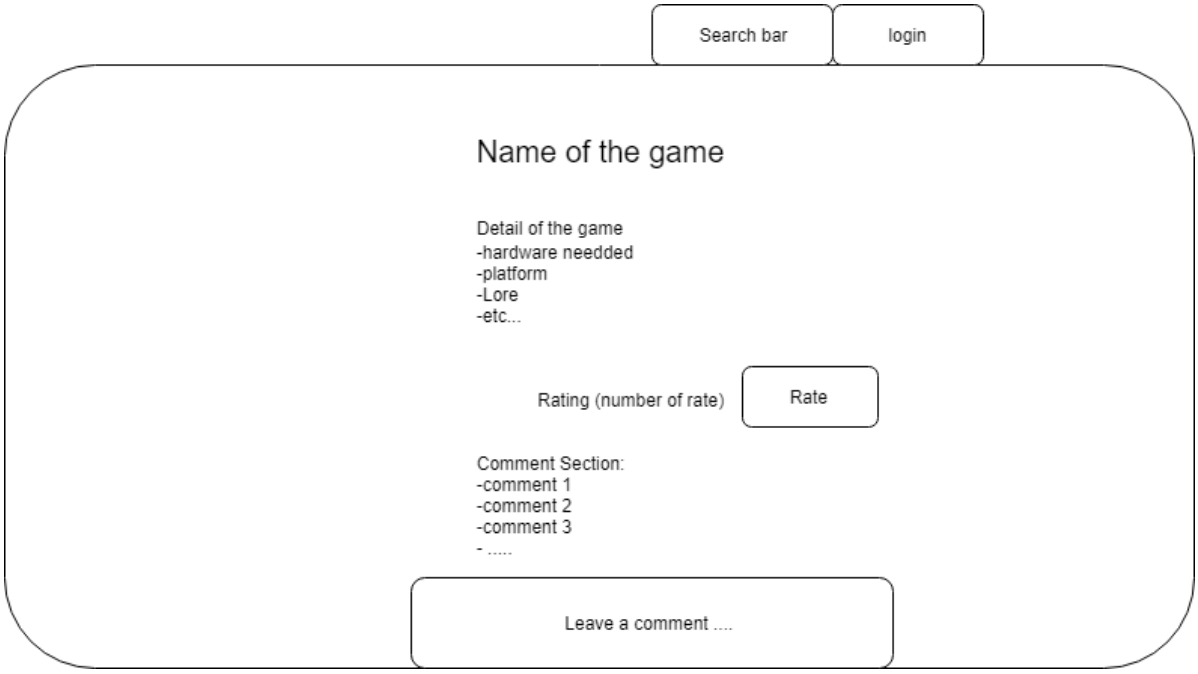


Figure 3: Information displayed for a specific game

When users either click to game on Homepage or in each category, it will navigate to a page that display information of that specific game. These information include Name of the game and more detail information about that, e.g: hardware recommendation, platform, release date, lore ... It will also display the overall rating and number of users that rate the game as well. Below them is the comment section where all the comments are displayed. Users can also login to rate the game, and leave the comment here.

3 Quality Attributes

requirement category	rating	explanation
speed of development	5	Keep track on the speed of development, ensuring everything is in control for a perfect service.
inexpensiveness	3	Good Game runs on Google Cloud server, which means we only pay for what is used, less cost for maintenance and so on...
size of scope	5	Good Game focus on being a trustful source of truthful rate and review for gamers all around the world.
performance		
response time	3	Good response time increases user's experience, but certain time out does not affect the quality of the services.
throughput	1	Not always gamers come to Good Game, mostly only when they either need information for some new game, or give comments, reviews.
capacity	3	To cover all type of games, for all type of Operating System, also handle transactions between nodes.
scalability	5	Effective and efficient, cost saving.
dependability		
availability	5	Good Game is meant to be source for gamers around the world, thus its availability is very important.
reliability	1	The information Good Game provide is one-time request, so the system failure does not affect user's experience once the content is fully downloaded.
resilience	5	This is to support the availability quality, since we do not focus on realibility.
consistency	1	Simply we choose availability over consistency.
maintainability		
operability	5	Ensure high availability, low start-up time is preferred.
simplicity	5	Simplicity is required for an easy integration of newcomer
evolvability	3	Evolvability should not be underestimated in case of future extension, e.g. purchasing, renting games.

requirement category	rating	explanation
security	1	Good Game does not store user's sensitive data.
usability	5	Every system need to be usable and provide good user's experience.

Table 2: Quality attributes

4 Quality Attribute Scenarios

Quality attribute	Portion of scenario	Values
performance	Source of stimulus	End users
	Stimulus	Huge simultaneous requests the same content
	Artifact	System
	Environment	Overloaded mode
	Response	Process stimuli, degraded quality of service
	Response measure	Latency, data loss, throughput
Dependability	Source of stimulus	Internal, External to system
	Stimulus	crash, incorrect timing, incorrect response
	Artifact	storages, processors, channels
	Environment	Degraded operation, repair-mode
	Response	Track/log activities to detect fault, prevent faults to failures, disable event source.
	Response measure	Acceptable downtime, ideally no downtime.
Maintainability	Source of stimulus	Developer, administrator
	Stimulus	Add/change/delete functions, adapt new constraint
	Artifact	Source code, hardware, configuration
	Response	Deploy, test, document
	Response measure	Efficiency, costs in term of money and time, changes.

Quality attribute	Portion of scenario	Values
Security	Source of stimulus	Individual or system with either authenticated or unauthenticated access
	Stimulus	Manipulate data, preventing availability
	Artifact	System data, system service
	Environment	Normal operation mode, access from internet behind firewall, system offline connectivity
	Response	Authenticate users, track/log activities, block access to data/service, notify admin
	Response measure	Duration and number of attacks, damages, Time/effort/resources to prevent, counter-attack

5 Constraints

Constraint	Category	Explanation and rationale
Google Cloud	technical	Due to a partnership between Good Game and Google, it's a matter of fact that Good Game will be operated in GCP. Therefore, GCP's strengths and limits must be considered right from the start.
CICD	organizational	Development processes at Good Game follow a continuous delivery approach. So, the build of Good Game has to be automated and development processes to be set-up appropriately.
Programming language	technical	Which programming languages are going to be used in the development of the project.
Operating system or platforms supported	technical	Whether it works on Windows, Mac, iOS and Android. Or is it a browser based app altogether.
Time	organizational	The amount of time that is available for the project
Costs / Budget	organizational	The amount of money that is available for the project

6 Stakeholders

Stakeholder group	Class	Responsibilities, Interests and Concerns
Enterprise Architect	Latent	Enterprise architecture is in good standing with the top management of Good Game. Their main responsibility and thus concern is to keep the IT landscape free from redundancies. We need to keep an eye on the functional scope of our system as it should not overlap with existing systems.
project manager	Promoter	The project manager is responsible for keeping a project in time, budget and quality, which are his major concerns
product owner	Promoter	The product owner represents the system under development towards the business. He or she is also responsible for maintaining the products requirements. Their main interests and concerns are about the final product and its success. They are often less concerned about time and budget
Backend Developers	Defender	A backend developer focuses on the server side in case of a web application. He or she will normally be having advanced skills in Java and SQL, which are the building blocks of Good Game.
frontend developer	Defender	Frontend developers at Good Game will focus on the implementation of the user interface of a system which is the main platform that the end user will be using. In case of a web application, the frontend developer has advanced skills in technologies like HTML, CSS, Javascript and associated tools and frameworks. Good Game uses extensively uses HTML, CSS and Javascript for its frontend developement.
information security	Latents	At Good Game, the people at the information security department are responsible for implementing safeguards for protecting the system against hacking, copying data or any other compromises. These could be in the form of hacking into the platform and messing up with the user reviews to destroy the image or rating of a competitor.
test manager	Apathic	A test manager keeps track of existing and relevant test cases and their execution w.r.t. to a specific release. The tested performance of the system is then presented to the supervisor.
support	Apathic	The support department solves problems that arise on the customer's side. They will form the support staff for Good Game
Actual Users	Latents	An actual user or an end user is a real person that will be using the Good Game platform. In our scenario, actual users include the people reading and writing reviews and rating the games.

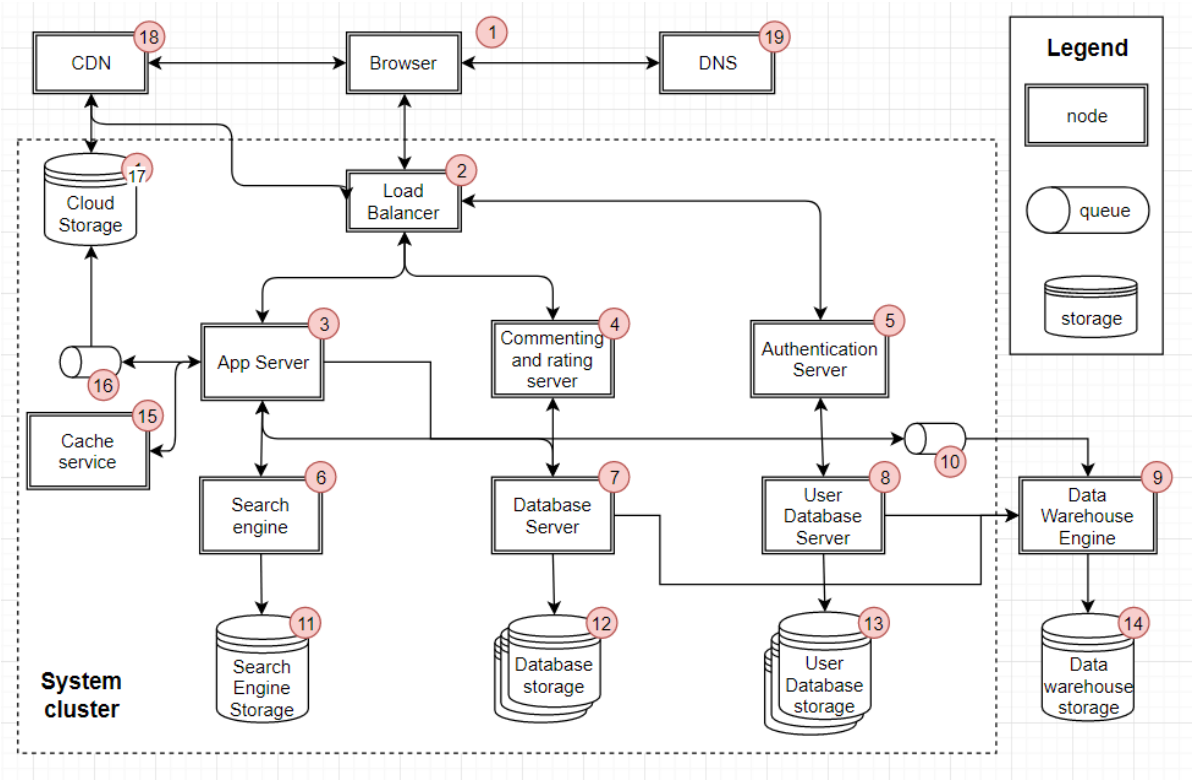
7 Scope and Context

actor/system	explanation
Online Users	These are the actual people who are going to read reviews, rate games and post new reviews of the games.

8 Key Design Decisions

Decision	Category	Explanation and rationale
RESTful API	Technology	Easy to grant access for both browser and non-browser clients.
Responsive web UI	Technology	Reasonably display information on browser either on laptop or on mobile.
Microservice structure	Architectural	Good Games offers lots of services (log in, read and rating) for numerous users. Therefore, each service is developed separately for better performance and maintainability.
Cloud deployment	Architectural	Good Games requires high-level scalability, so cloud is more suitable than self-hosting.
Content Delivery Network	Quality attribute	Good Games offers good response performance for any user around the world.
No 2-step authentication	Quality attribute	Good Games does not store sensitive user data. Thus usability is prefered than security.
No Smartphone App	Organisational	Users rate games occasionally; therefore, dedicated app is not necessary for development.
No Desktop App	Organisational	Similar to above.

9 Deployment View

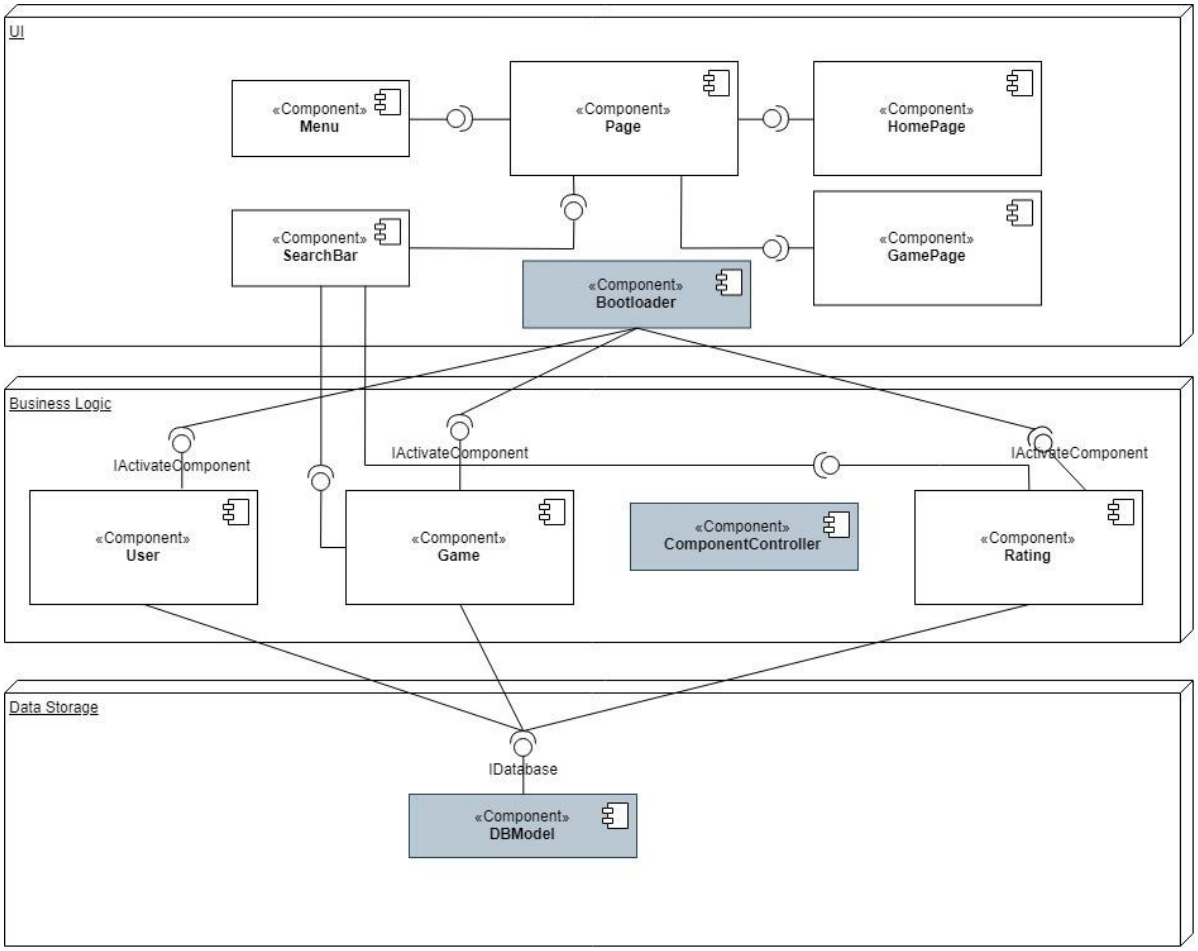


Components	Explanation
DNS 19	Provide the IP that a client should redirect to.
CDN 18	Provide homepage for the nearest clients.
Cloud storage 17	Contain data for CDN nearby, data change is triggered by app server.
Browser 1	Client browser to access Good Games.
Dataflow between browser and load balancer (1 and 2)	Inbound traffic from client is https. Load balancer is the end point of TLS exchange.
Load balancer 2	Distribute the load equally, to mitigate the risk of overloading on each server.
App Server 3	Responsible for the main app to display all games and their reviews. The number of app server could be more than 1 so as to satisfy the demand of scalability.
Cache service 15	Contain frequently accessed data for reducing the response time.
Commenting and rating server 4	Responsible for the Good Games service of commenting and rating.
Authentication server 5	Responsible for authenticate users to grant the ability of commenting and rating.

Components	Explanation
Dataflow between authentication server and user database server (5 and 8)	The connection is encrypted, since it contains users' passwords.
Storage server 6,7,8,9	Reduce the workload for main servers by handling the querying and updating the storage.
Database 11, 12, 13, 14	Store data matching defined model, specified in later parts.
Database 12, 13	Is replicated for the sake of security. Because it contains main data for Good Games's business (i.e. games info, comments and rating, user data).
Data warehouse engine 9	Make use of data of warehouse storage to provide the analysis of the application.

Compared to the model in lecture, a partner system is omitted. Because Good Games handles all stuffs on its own, without either requesting data or using API from external system. Specifically, we obtain games' information by ourshelves, and allow only comment and rating directly in our application, instead of via outsider systems.
In addition, Good Games does not have outbound gateway, since it has no intention to actively contact directly to users, by sending advertising emails, or anything similar.

10 Software Component View



11 Data Schema View

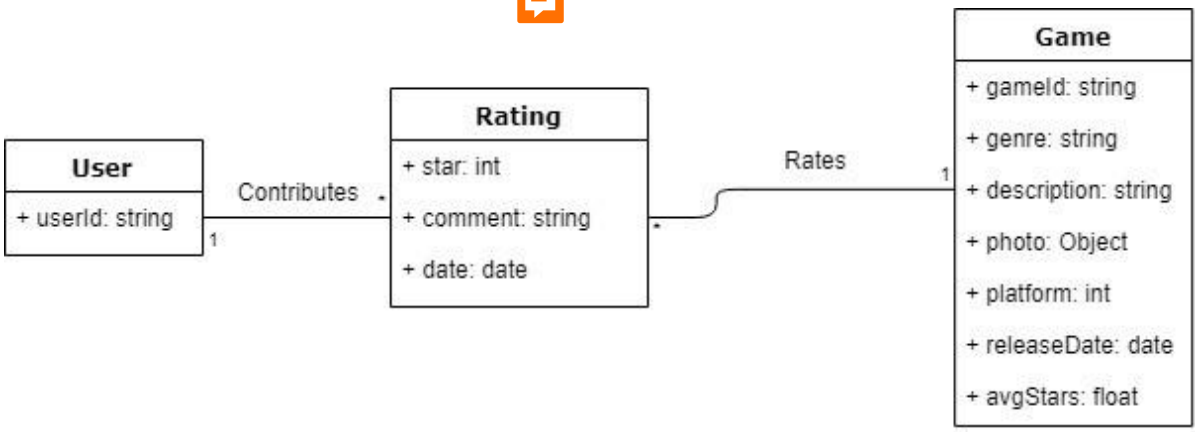
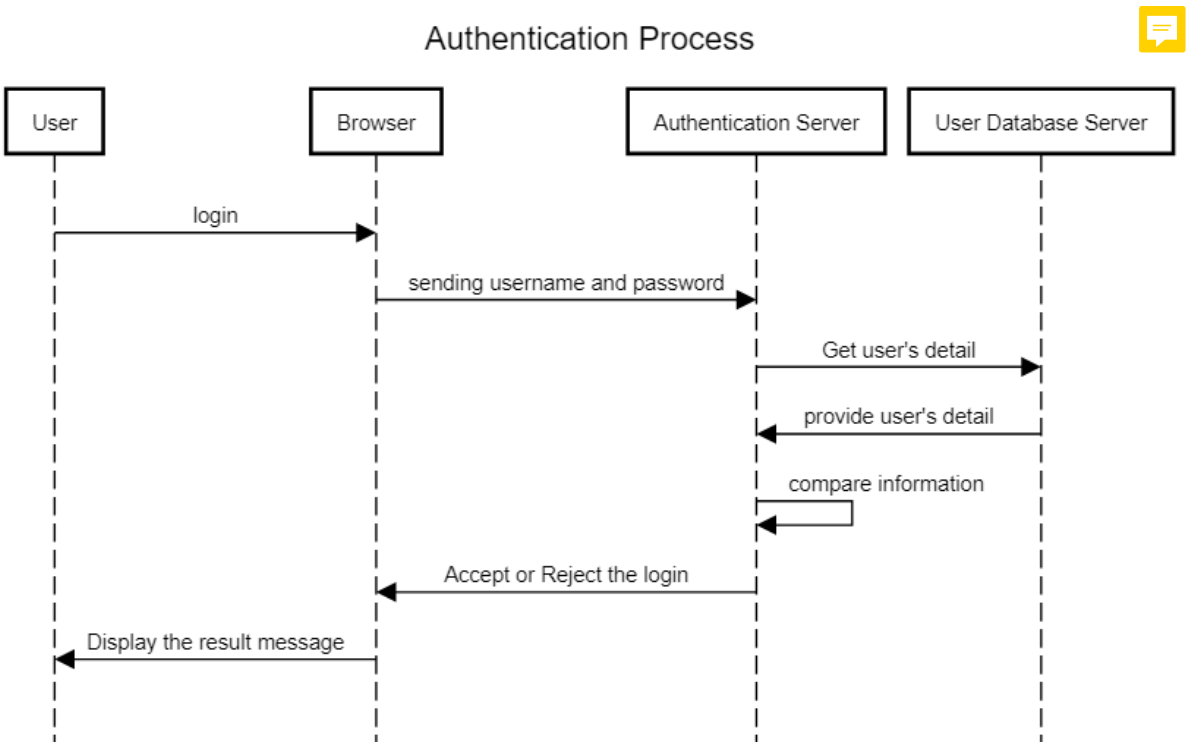
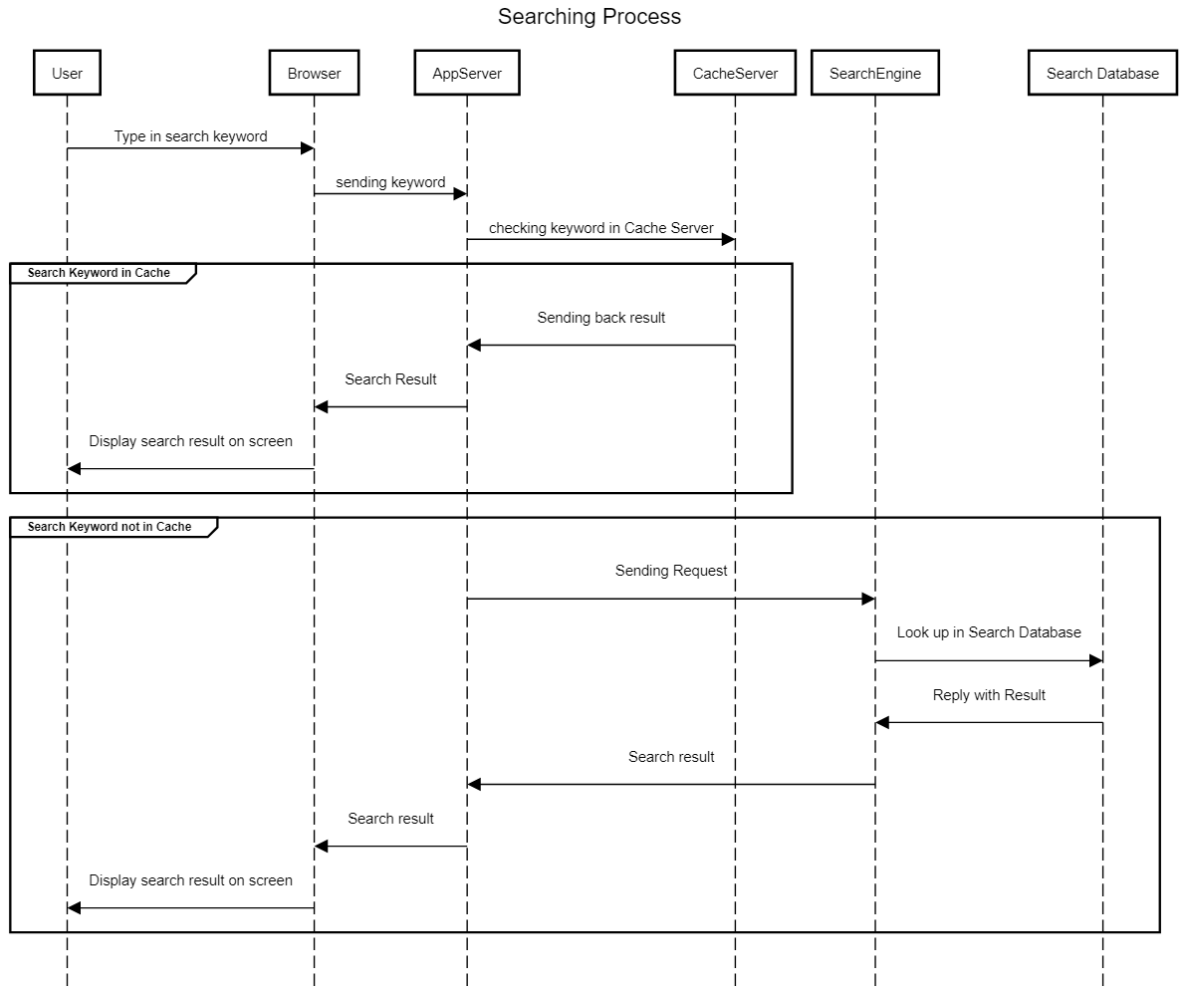


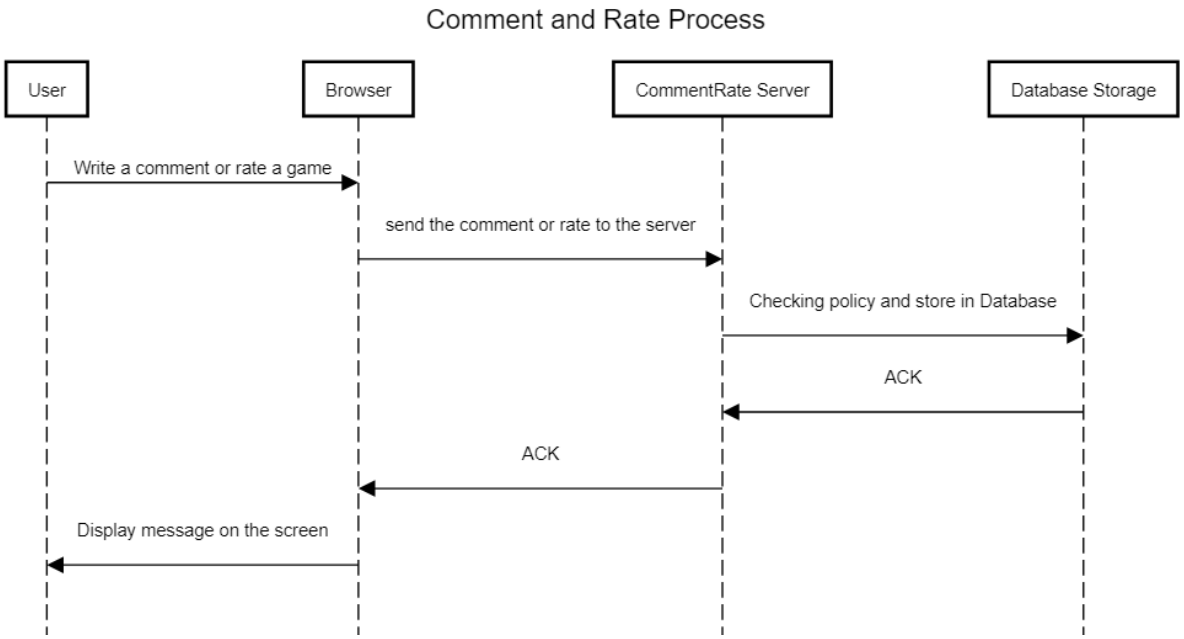
Figure 4. Data schema for Good Game as UML class diagram drawn with draw.io ~~(simplified example 3ame data schema specified in PlantUML (http://plantuml.com)~~

Figure 4 depicts the (simplified) data schema of Good Game. A *rating* is for a single *game* . The *star* is an integer representing the "stars" a user spends in a *rating* and the *comment* is an optional free text comment which the user leaves as a review that supports their star rating. Each *game* might have arbitrarily many ratings. For sorting purpose, each rating saves the date/time at which it was created.

12 Runtime View






Comment and Rate Process
User
Browser
CommentRate Server
Database Storage
Write a comment or rate a game
send the comment or rate to the server
Checking policy and store in Database
ACK
ACK
Display message on the screen

13 Crosscutting Concepts

Crosscutting concept	Category	Explanation and rationale
Build, test, deploy	Development	Using Jenkin, due to its proven quality and its familiarity to team members.
Source code repo	Development	Good Games source code is versioned in a single Git repository hosted on the internal GitLab xyz server.
OAuth 2.0	Security	Good Games should implement OAuth 2.0 and allow login via social network or email.
HTTPS for all pages	Security	To ensure the confidentiality of users' info, all HTTP request and response from and to user must be encapsulated in TLS protocol.
AAA	Security	Rule of AAA should be applied for the sake of good security.
Disaster avoidance	Operation	To avoid unpredictable situation, important database should not be centralised, but allocated around the world.
Disaster mitigation	Operation	Purchase insurance to transfer risk to third party.
User Interface	UX	The design must be attractive, which might lead to some acceptable uncertainty. Because age of users is mostly young.
Internalisation	UX	Multi-language should be implemented, since Good Games is deployed in the scope of globe. At least 3 main languages are shown: English, German, Chinese.
Scrum process	Operation	Good Games development team should work under the Scrum process for the effectiveness.
Clear mission separation	Operation	At the beginning, Good Games must clearly identify task of each department to prevent duplicate work.