

Bid buy sell system using client-server architecture, solution for concurrent users for the website application through optimistic locking and multithreading.

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Abstract- Nowadays, the online web-based auction system has become the extremely popular component in the electronic marketplace. A practical case study will be introduced in this work to highlight the best practices for analyzing and designing a bidding system. The proposed Bid Buy Sell (BBS) - Bidding system was designed and implemented using the UML (to illustrate the architectural model), MySQL and Spring Boot with java programming language. In the proposed BBS, the UML offering several diagrams to enable the new functions to be updated and easily added such as use case, sequence and class diagrams, and user interfaces. The proposed BBS will help the bidders to bid in fast and increase their chances to make a successful bid by suggesting a bid price and help the seller to achieve maximum profit. Along with the tools and method that have been used based on the analysis and implementation of architecture design, the proposed BBS offers excellent advantages for the control of concurrent users through optimistic locking and multithreading.

Keywords: Auction System, Bidding System, Concurrent users, and Unified Modeling Language (UML)

I. INTRODUCTION

In the recent years, the electronic marketplace has been an exponentially grown in usability, size and worth. It is expected that this trend will exaggerate in the upcoming years [1]. Because of the rapidly growing internet environment, the customer can conveniently obtain the products that he/she purchases from the traditional market by online systems. Online platform is a main component of the electronic marketplace that makes use of electronic commerce mechanisms. The idea of our project is like any e-commerce platform in which buying and selling of goods are done. But the core addition will be the system of bidding before buying anything. The products added will be subjected to a certain time frame where users most probably buyers will be allowed to bid on the products and are able to buy the product once the bid time closes or when there are no other bidders. In case of AIT, this platform can be used to sell the used items. More than one person could be interested in the same product, but with this system, there will be a sense of competition as one person bids over another user's bid at the same time and the product value will also increase.

In modern software systems, it is not uncommon to have hundreds or thousands of users independently and concurrently interacting with the [2] resources. We generally want to avoid situations when changes made by one client are overridden by

another one without even knowing. The main architectural challenges that will be addressed is handling multiple concurrent transactions, real-time information updates and handling online payment through secure payment gateways.

We will be using MVC with Client-Server architecture. System backup and recovery will not be handled as there are no long transactions that go in our system. However, we will be storing some instant information in the cache, so that with little interruptions like network connectivity issues users will be able to restore their session data. The application will be using MySQL as a data store. For developing, we are using Java Spring Boot for backend and HTML & CSS for frontend.

Bidding system was designed and implemented using the UML (to illustrate the architectural model). In the proposed BBS, the UML with several diagrams helped to enable the new functions to be updated and easily added such as use case, sequence and class diagrams, and user interfaces.

II. RELATED WORK

To prevent our data integrity from being violated we often use locking mechanisms provided by database engine, or even use abstractions provided by tools like JPA.

Optimistic locking lets every client read and write data with the restriction that just before committing the transaction we need to check whether a particular record has not been modified by someone else in the meantime [2]. This is usually done by adding the current version or last modification timestamp attribute. We need to compare all attributes of an aggregate, while in the locking, we only check if version and aggregate ID are the same. All attributes consistency and version-based consistency both define a pre-condition for the request to be fulfilled.

There is an explicit and standard way of dealing with conditional requests in HTTP protocol. RFC 7232 defines this concept including a set of metadata headers indicating the state of the resource. The ETag [3] or entity tag is part of HTTP, the protocol for the World Wide Web. It is one of several mechanisms that HTTP provides for Web cache validation, which allows a client to make conditional requests. This mechanism allows caches to be more efficient and saves bandwidth, as a Web server does not need to send a full response if the content has not changed. ETag can also be used for optimistic concurrency control [4] to help prevent simultaneous updates of a resource from overwriting each other.

For the request from the users will be considered as the threads and multiple requests will be treated as multithreading. All the threads will be inside a thread pool. A thread pool is a collection of threads on the same machine that operate by continually processing tasks. Logically, a thread pool is associated with a set of task types, and each thread in the pool executes a piece of code that consumes a task, processes it, and dispatches one or more outgoing tasks to a thread pool [5]. This way we can handle the multiple threads to process the requests sent by the client and give back the response according to the requests within its lifespan.

The UML is a language used to specify, visually model [7], and document the artifacts of an Object-Oriented system under development. It denotes several ideas unification from various methods. UML is used in the system design to improve its reusability and maintainability. Object-oriented analysis methods offer class, use case, state chart, sequence, and other diagrammatic notations for modeling [6]. UML has been employed effectively in many projects for modeling different requirements and architectures [7]. With this UML approach, have ease the process of understanding the system and architectures design to be robust for the purpose of controlling concurrent user through sequence diagram.

III. METHODOLOGY

In modern software systems, it common to have hundreds or thousands of users independently and concurrently interacting with the application. Therefore, we generally want to avoid situations when changes made by one client are overridden by another one and to control the concurrent user request or access to application.

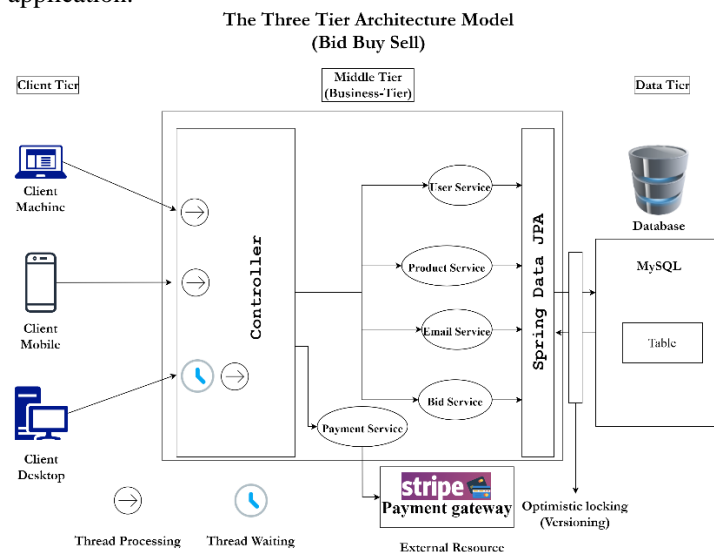


Figure 1. Architecture design

In this Architectural pattern, application consists of 3 hierarchically ordered subsystems or three tiers such as Client Tier, Middle Tier and Data Tier.

The middle Tier or subsystem services data requests between the user interface and the database subsystem.

Three Layer architectural pattern is used for the development of our web app where:

- the Web Browser implements the user interface.
- the Web Server serves requests from the web browser.
- the Database manages and provides access to the persistent data.

Use Case Diagram

The use case diagram is a visualization of a use-case [10, 6-9], i.e., the auction system interaction with the users. In the proposed BBS the use case mainly consists of register case, search product case, add a product case, view product details case, make a bid for product, specify time and price of bidding. Figure 2 shows the use case diagram for the actions that the actors (Seller, Bidder and Admin) can perform in a Bidding system.

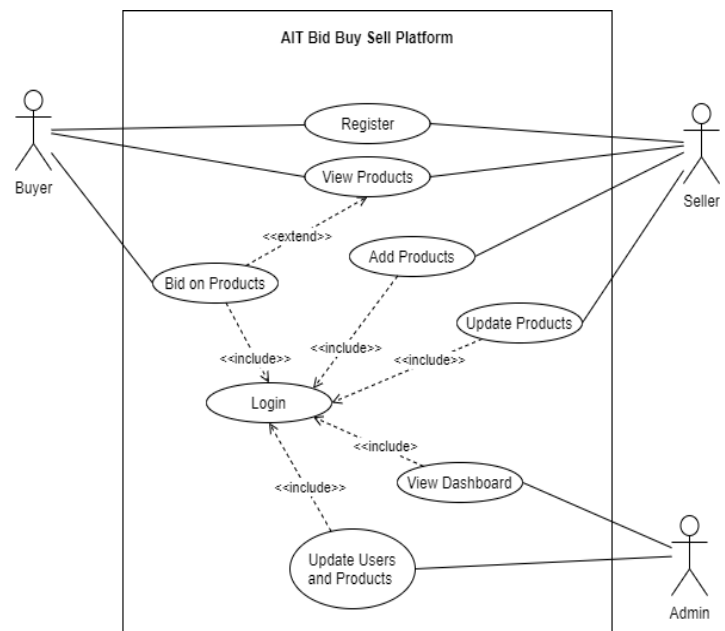


Figure 2. Use case diagram.

Class Diagram

In Object-Oriented analysis and design, the class diagram is the most essential entity. It defines the kinds of objects that are present in the system and describes the static relationships between the system internal classes [10]. The operations and attributes of a class and the constraints that apply to the object's connection can be shown by the class diagram. Figure 3 displays the BBS class diagram. Figure 4 shows the BBS entities, such as product, user and its detail.

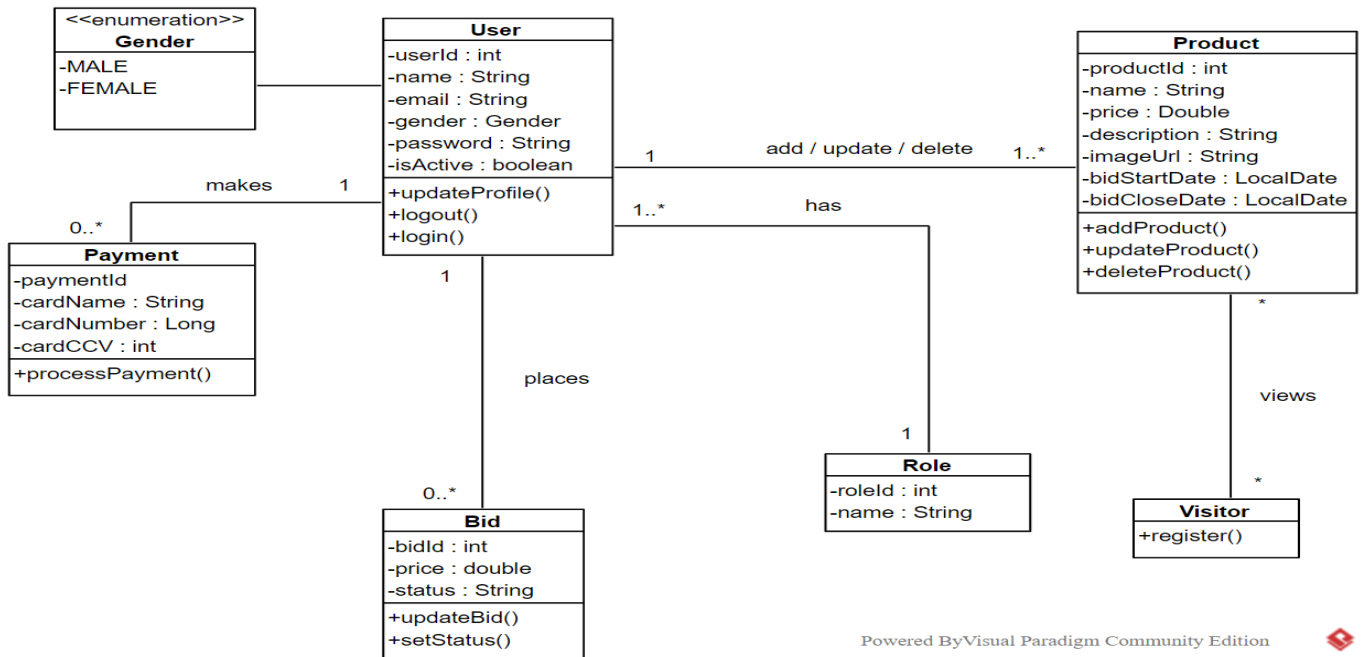


Figure 3. Class diagram

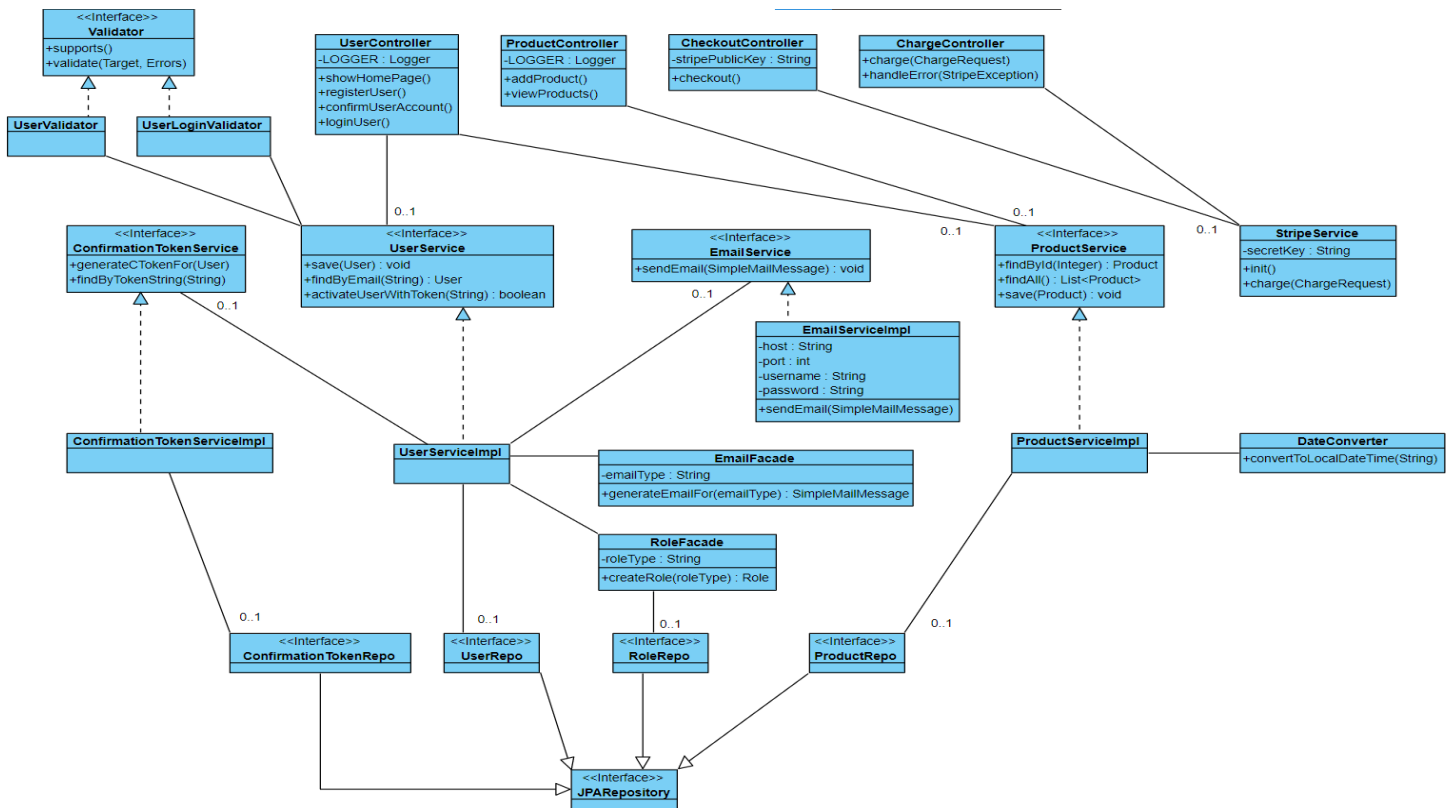


Figure 4. Detailed Class Diagram

Sequence Diagram

A sequence diagram is one of the UML dynamic models [6, 11], and it defines the interaction scene between the objects in time when the use case was executed and highlights the information sending time priority among objects. Usually, the sequence diagram illustrates the single use-case behavior. Figure 5 demonstrates the sequence diagram for the use case ‘Bid on Product’ in the proposed BBS.

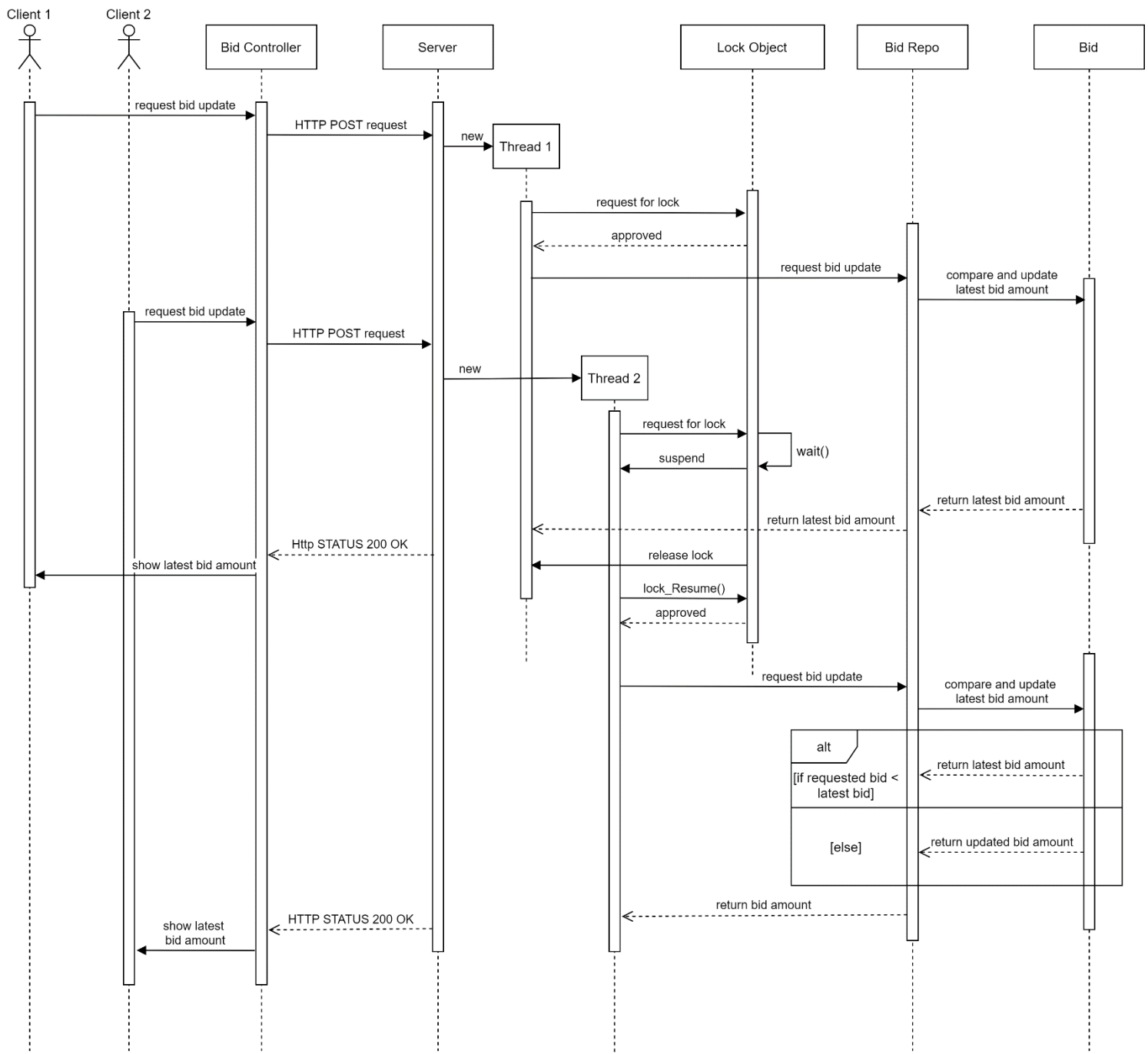


Figure 5. Sequence Diagram of Bid on product

IV. RESULT

In progress, Unit testing and testing report to be included.

V. CONCLUSION

Include finish work and future scope.

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REFERENCES

- [1] Majadi N, Trevathan J and Bergmann N. uAuction: Analysis, Design, and Implementation of a Secure Online Auction System. In Dependable, Autonomic and Secure Computing, 14th Intl Conf on Pervasive Intelligence and Computing, 2nd Intl Conf on Big Data Intelligence and Computing and Cyber Science and Technology Congress (DASC/PiCom/DataCom/CyberSciTech), 2016 IEEE 14th Intl C, pp. 278-285.
- [2] Slota,B. (2020, June 3). Concurrency control in REST API with spring framework. Dzone: Java Zone. Retrieved from <https://dzone.com/articles/concurrency-control-in-rest-api-with-spring-framework>.
- [3] Schworer,C. (2017, March 22). Managing concurrency in a distributed RESTful environment with Spring Boot and Angular 2. NOVATEC. Retrieved from <https://www.novatec-gmbh.de/en/blog/managing-concurrency-in-a-distributed-restful-environment-with-spring-boot-and-angular2/>.
- [4] "Editing the Web – Detecting the Lost Update Problem Using Unreserved Checkout". W3C Note. 10 May 1999.
- [5] Matt Welsh, Steven D. Gribble, Eric A. Brewer, and David Culler, "A Design Framework for Highly Concurrent Systems"
- [6] Dick J, Hull E and Jackson K. Requirements engineering. 2017.
- [7] [62] Bello S I, Bello R O, Babatunde A O, Olugbebi M and Bello B O. A University Examination Web Application Based on Linear-Sequential Life Cycle Model. 2017.
- [8] ALMRASHDEH I A, SAHARI N, ZIN N A M and ALSMADI M. DISTANCE LEARNING MANAGEMENT SYSTEM REQUIREMENTS FROM STUDENT'S PERSPECTIVE. Journal of Theoretical & Applied Information Technology, 2011, 24(1).
- [9] Almarashde I, Althunibat A and Fazidah El N. Developing a Mobile Portal Prototype for E-government Services. Journal of Applied Sciences, 2014, 14: 791-797.
- [10] Rajagopal D and Thilakavalli K. A Study: UML for OOA and OOD. International Journal of Knowledge Content Development & Technology, 2017, 7(2): 5-20
- [11] Karim S, Liawatimena S, Trisetarso A, Abbas B S and Suparta W. Automating functional and structural software size measurement based on XML structure of UML sequence diagram. In Cybernetics and Computational Intelligence (CyberneticsCom), 2017 IEEE International Conference on, pp. 24-28.

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