

Design and Implementation of Restful API Using Oauth 2.0 Authentication in Laravel Framework on Marketplace (Case Study: CV. Marvelindo Utama)

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Abstract

CV Marvelindo Utama is an electronics company that sells data packages and other internet-related products, with distribution warehouses and branch outlets across various regions. The company's challenge lies in its manual marketing through WhatsApp. This research aims to address this issue by designing a Supply Chain Management system for the marketplace using REST API and Oauth 2.0 authentication to ensure data security. The Extreme Programming (XP) application development method is used to expedite the development process. This research is expected to help CV Marvelindo Utama face modern technological challenges and improve operational efficiency. Testing results using blackbox and unit testing indicate that the system meets the requirements, with blackbox testing achieving a 100% success rate and unit testing yielding positive results.

Keywords: Blackbox, Extreme Programming, Oauth 2.0, REST API, Supply Chain Management

1. Introduction

In an increasingly competitive industry, distributors must compete fiercely. The key to their success is providing products that meet customer needs on time and cost-efficiently. To excel in the market, the supply chain must be able to offer products at affordable prices, high quality, on-time delivery, and a variety of product choices. [1]. To achieve product availability and competitive selling prices, effective collaboration is needed between retail companies and partners in the supply chain. This collaboration includes inventory management and the exchange of market information useful for business planning. CV. Marvelindo Utama is a company operating in the electronics sector that focuses on selling telecommunications products such as starter cards, data vouchers, and various other products under the auspices of Smartfren. The problems faced by CV. Marvelindo Utama are obstacles in the process of ordering and selling products within the company itself. In the marketing process, it is still done manually, namely via WhatsApp messages, which can cause incorrect information and be less effective. The problems at CV. Marvelindo Utama is currently being resolved by developing a Supply Chain Management (SCM) application for a more modern marketplace section. SCM is the management of the entire series of production processes and activities starting from receiving raw materials from suppliers, the value-added process that converts raw materials into finished products, storing product inventory, to shipping finished products to retailers and consumers [2].

However, in the context of this research, only focuses on the marketing section. With the SCM mobile application, CV. Marvelindo Utama can increase efficiency in distributing their products. The development of this information system is carried out collaboratively, divided between the front-end and back-end. Researchers will focus on the back end of the SCM marketplace application, with special attention to the security of data exchange using the REST API. REST API was chosen because of its simplicity and efficiency of communication between the system and data sources. [3]. By using the REST API, the system can increase the efficiency of communication between systems and data sources which is very important to maintain the protection of data that communicates via the API.

The REST API method that researchers will use is Oauth 2.0. Oauth 2.0 is a protocol that allows users to use various applications to share information and resources securely [4]. By implementing Oauth 2.0 authentication, security in data exchange on the Marvelindo Utama SCM application can be better maintained and it can be ensured that every SCM application user has access according to their role and authority overcomes fraud problems and protects the company's finances.

Researchers use the Extreme Programming (XP) method to improve efficiency, adaptability, and flexibility in software development. [5]. XP covers all areas of software development, not just coding. This approach embraces the entire development process to achieve optimal results. [6]. The advantage of Extreme Programming (XP) lies in its ability to adapt to projects that have dynamic requirements or changing client needs. XP encourages developers to quickly adapt to changes during project development. This flexible approach allows the team to respond efficiently to project dynamics adjust work strategies and focus easily. [7]. Through the XP methodology, researchers can flexibly adjust to needs and changes that arise over time, ensuring that authentication solutions run efficiently and effectively. Compared to Scrum,

XP is more effective for development by small groups, while Scrum is more suitable for large teams of more than 5 people and projects with high complexity that are difficult to predict. [8].

In the research "Design and Implementation of Restful API Using Oauth 2.0 in Laravel on Marketplace" aims to implement Oauth 2.0 authentication on Marvelindo Utama's SCM application. The desired outcome is better control over user access and fraud risk mitigation. XP methodology ensures fast-adaptive authentication solutions, increases marketing efficiency, and maintains Marvelindo Utama's competitiveness.

2. Literature Review

There have been many previous studies on Restful API security with OAuth 2.0 authentication. These studies have shown effective results in protecting data exchange, as well as having a positive impact on maintaining information security. The following are details of some previous studies that are relevant to this study.

First, a study entitled "Implementation of Restful API to Build a Receivables Payment Program Using Oauth 2.0 Authentication" was conducted by Nina Wulandari, Argo Wibowo, and Budi Susanto in 2021 [4]. The study was conducted to implement Oauth 2.0 authentication in the Receivables Payment program.

This study revealed that the implementation of OAuth 2.0 authentication is more profitable than Basic Auth and has a positive impact on server performance in handling requests. From the test results, even though a fairly large number of requests were given, namely 100 users, the server still responded quickly with an average response time of 1.03 seconds.

Second, a study entitled "Implementation of Restful Web Services with OAuth 2.0 Authorization in Parking Payment Systems" was conducted by Indra Kusuma, Ajib Susanto, and Ibnu Utomo Wahyu Mulyono in 2019 [9]. This study presents the results of the implementation in the development of Android-based web service applications with a focus on Oauth 2.0 authorization. Optimization is carried out to improve data transaction security. This study reveals that the use of OAuth 2.0 authentication is more beneficial than standard API authorization such as Basic Auth or API Key. This study includes testing a system that has been well integrated using black-box testing and white-box testing methods. In addition, various validation stages, including client credentials, access tokens, and scopes, have been carried out to ensure appropriate access to the functions provided by the application API by the OAuth 2.0 protocol. After conducting this research, it can be concluded that the use of Oauth 2.0 is safer than standard API authorization methods such as basic-auth API or API Key. Third, a study entitled "Design and Implementation of Oauth 2.0 and PKCE Authentication Systems Based on Extreme Programming (XP)" was conducted by Rahmat Kurniawan in 2022 [10]. The study aims to design and implement authentication using Oauth 2.0 and PKCE in multitenant HMS applications, involving both the server and the client to carry out an authentication process to facilitate the authentication process for each tenant. This study uses the Extreme Programming development method.

The results of the study are that by using Oauth 2.0 authentication, researchers can easily remove the right to access a client without having to change the source code on the client side. This study also proves that the implementation of OAuth 2.0 is much safer when compared to using Basic Auth or API Key. By using Oauth 2.0, clients do not need to create their login system to be able to validate user accounts. Fourth, a study entitled "Implementation of Single Sign-On Using Google Identity, REST and Oauth 2.0 Based on Scrum" was conducted by I Kadek Dendy Senapartha in 2021 [11]. This study aims to implement Single Sign-On using Google Identity, REST, and Oauth 2.0 in the Student Relationship Management (SRM) system using a Scrum-based method to improve the convenience and security of user access to the system. The results of this study are that the SSO implementation has been successfully implemented in the SRM system using the OAuth 2.0 protocol with Google Identity and REST architecture. This implementation makes it easier for Android and web application users to access the system without having to log in repeatedly. The access token refresh mechanism in Oauth 2.0 ensures the validity of user access by periodically checking authentication, authorization, and validity of access tokens. The use of Google Identity services speeds up and simplifies the SSO implementation process in the system, allowing developers to focus on the security of SSO data transmission. The REST architecture with JSON data format accelerates communication between client and server through a simple communication mechanism.

Fifth, a study entitled "Implementation of Single Sign On with Oauth 2.0 for Login Effectiveness" was conducted by Mukrocin, Rohmat Taufiq, and Deskal Dwi Rayananda in 2023[12]. This study aims to increase the effectiveness of user login and make it easier to log in so that you don't have to worry about forgetting your user account or password by using the Single Sign On method from Oauth 2.0. This study uses the Rapid Application Development (RAD) research method. The results of this study are SSO System. The implementation of Oauth 2.0 was successful and made it easier for users to log in to multiple systems with just one account.

3. Method

Extreme Programming (XP) is an approach in software engineering involving an object-oriented process, designed specifically for small to medium-sized teams[13]. This method is very suitable for use in situations where project requirements cannot be clearly defined or often experience rapid change[14]. XP emphasizes flexibility and adaptability in dealing with project dynamics, making it an effective solution for conditions where clarity of project requirements may be difficult to achieve or may change rapidly[15]. Here is a picture of the Extreme Programming method:

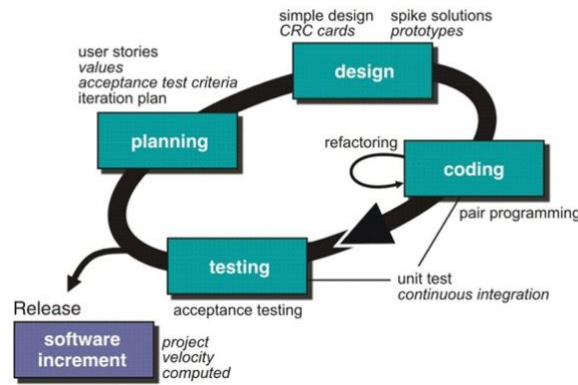


Fig. 1: Extreme Programming [16], [17], [18],[19],[20]

Extreme Programming has 4 stages, namely:

1. Planning; At this stage, researchers together with stakeholders carry out project planning. Researchers determine what features or functions will be developed during the iteration, set priorities, and make estimates of the time needed.
2. Design; The design stage involves developing the structure and architecture of the software. Focus on clarity and simple design, which can be adjusted to changing project needs.
3. Coding; At this stage, researchers begin writing code to implement the planned features or functions. XP emphasizes pair programming and continuous testing to ensure code quality.
4. Testing; Testing in XP is done continuously throughout the development cycle. Testing to ensure that each feature functions as desired and does not result in regression in other parts of the system.
5. Release; At this stage, research is conducted to show the application that has been created for the company that will use the feature.

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4. Page layout

This system applies the Extreme Programming development method, which allows close collaboration between developers and clients for the success of the system. The Extreme Programming method has four main stages: planning, design, coding, and testing. As previously explained, these stages ensure optimal involvement and cooperation between all parties involved.

4.1. Planning

In this research using the Extreme Programming method, there is the use of user stories. The researcher uses the writing format "as a user, I want the system <action> so that <benefit>", as in the following table 1:

Table 1: User Story

Code	User Stories
Story-01	As a user, I want this system to be able to register, login, and logout so that it can help maintain the privacy of the use
Story-02	As a user, I want the system to be able to view profiles so that users can manage information about their profiles
Story-03	As a user, I want this system to be able to see what items are available on the application so that it is easier for users to make purchases
Story-04	As a user, I want the system to be able to display item details and stock so that it is easier for users to see items in detail
Story-05	As a user, I want the system to be able to manage the cart so that it is easier to manage
Story-06	As a user, I want the system to be able to check out the shopping cart so that users can make payments
Story-07	As a user, I want the system to be able to see order history so that users can see what items have been purchased

4.2. Design

At the design stage, user story analysis is carried out which is then described in the form of sequence diagrams and class diagrams.

4.2.1. Sequence Diagram

This design sequence diagram explains how the object behaves by describing the object's access time and the data sent and received by the object. This Sequence Diagram is based on the API endpoint created.

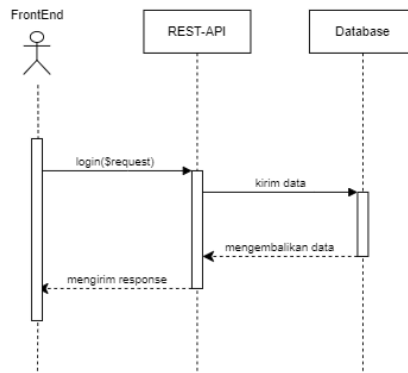


Fig. 2: Login Sequence Diagram

In login, it describes the Actor's activity, namely FrontEnd, where the actor sends a request in the form of a username and password via the REST API. Then after that, the REST API will send data to the database which will later be checked whether the data is correct or not. If the data is correct, the database will return the data via the REST API which will later be returned to the Actor in the form of a response

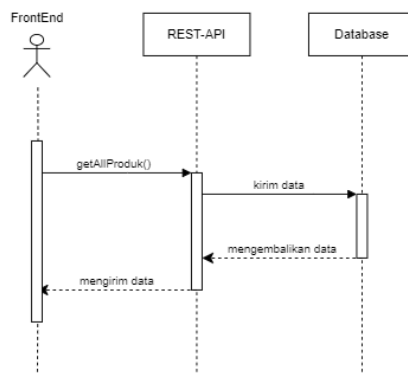


Fig. 3: Product Sequence Diagram

Figure 3 illustrates the actor's activity in requesting to display all products. The actor requests data via the REST API using the getAllProduk function.

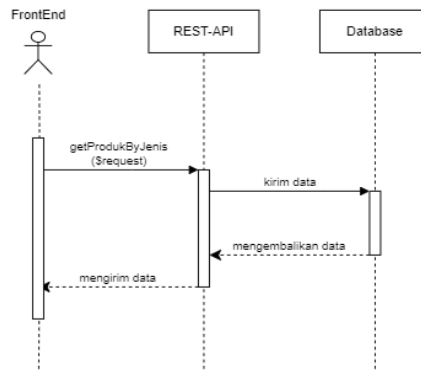


Fig. 4: Product Type Sequence Diagram

Figure 4 illustrates the actor's activity in requesting to display products using a filter per type of item. The actor sends a request with the type of item parameter via the REST API using the getProukByJenis function.

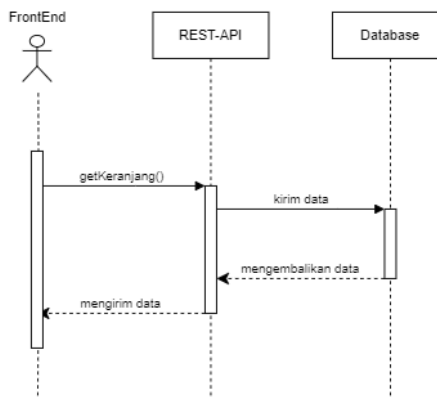


Fig. 5: Sequence Diagram getKeranjang

Figure 5 illustrates the actor's activity in requesting to display the basket. The actor requests data via the REST API using the `getKeranjang` function.

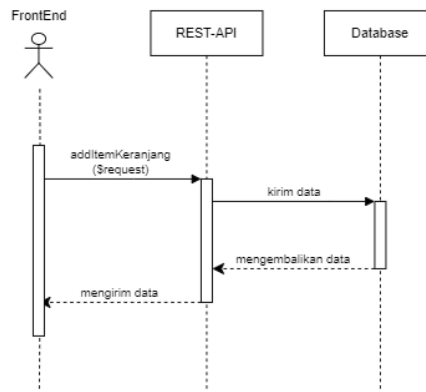


Fig. 6: Sequence Diagram addKeranjang

Figure 6 illustrates the actor's activity in creating data on the basket. The actor sends a request containing the `user_id` and `product_id` using the `addItemKeranjang` function.

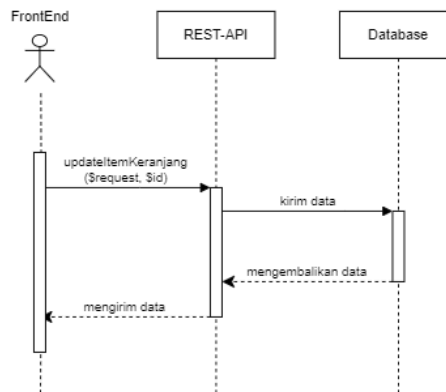


Fig. 7: Sequence Diagram updateKeranjang

Figure 7 illustrates the actor's activity in updating data on the basket. The actor sends a request containing the quantity and uses the product ID parameter to be changed. The actor sends data using the `updateItemKeranjang` function.

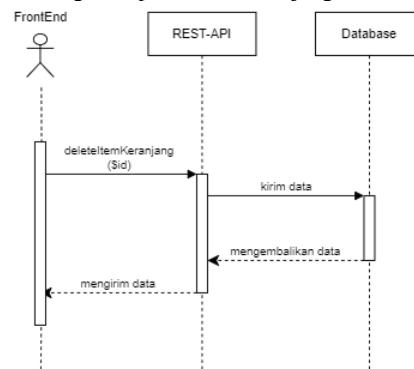


Fig. 8: Sequence Diagram deleteKeranjang

Figure 8 illustrates the actor's activity in deleting data on the basket. The actor sends a request using the product ID parameter to be deleted. The actor sends data using the `deleteItemKeranjang` function.

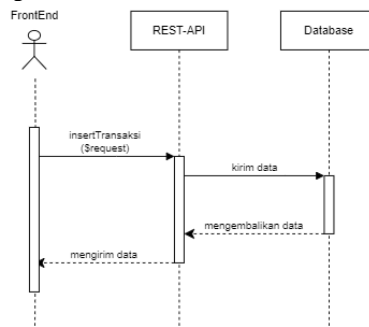


Fig. 9: Sequence Diagram insertTransaksi

Figure 9 illustrates the actor's activity in creating data on a transaction. The actor sends a request containing the outlet, date, payment_type, total, and product. The actor uses the insertTransaksi function.

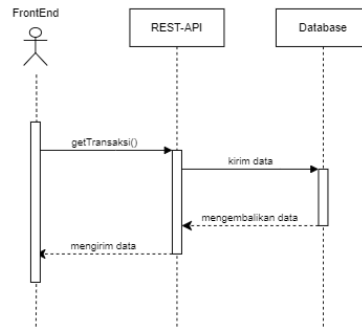


Fig. 10: Sequence Diagram getTransaksi

Figure 10 illustrates the actor's activity in requesting to display all transactions. The actor requests data via the REST API using the getTransaksi function.

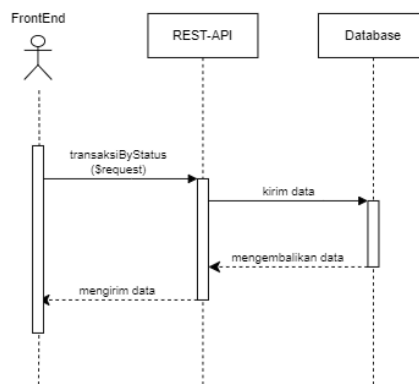


Fig. 11: Sequence Diagram statusTransaksi

Figure 11 illustrates the actor's activity in requesting to display transactions with a status filter. The actor requests data containing the status he wants to see using the getTransaksiByStatus function.

4.2.2. Class Diagram

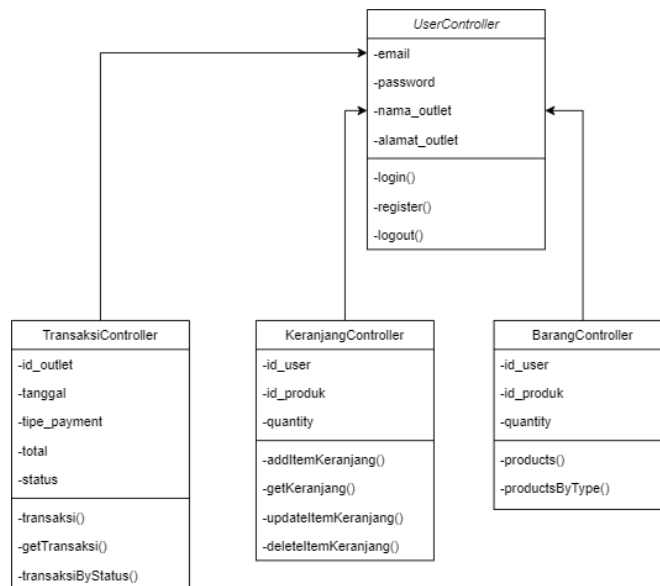


Fig. 12: Design Class Diagram

Figure 12 is a design class diagram that shows the relationship between controllers in the program. There are 4 classes, namely UserController, TransactionController, BasketController, and BarangController. Each class has various attributes and methods depending on its function.

5. Implementation

At this stage, the code development for the REST API begins according to the design that has been made. This process involves several key components. The developer uses the Laravel framework and the PHP programming language that has been selected to write the required code. Then, the modules or components that have been developed are integrated with the database. Furthermore, the initial configuration for the server and database is carried out to ensure the system operates properly. After these stages are met, it produces an accessible API endpoint.

Table 2: API Endpoint

No	Method	URI
1	POST	/register
2	POST	/login
3	POST	/logout
4	GET	/mobile/products
5	GET	/mobile/productsbytype/<id>
6	GET	/mobile/getkeranjang
7	POST	/mobile/additemkeranjang
8	PUT	/mobile/updateitemkeranjang/<id>
9	DELETE	/mobile/deleteitemkeranjang/<id>
10	POST	/mobile/transaksi
11	GET	/mobile/gettransaksi
12	GET	/mobile/transaksibystatus/<id>

6. Testing

Testing using Black Box aims to determine whether the application's functionality is running as expected. The results of the Black Box test obtained a percentage result of 100% for the level of endpoint success. The results can then be seen in detail in Table 3.

Table 3: API Endpoint Testing

No	Method	URI	Scenario	Auth	Params	Body	Output	Result
1	POST	/register	Register new account		email, password, name, address	email, password, name, address	The system successfully saves the inputted data	√
2	POST	/login	Login with email and password		email, password	email, password	If the email and password are correct, the login is successful and the user will get a token, if incorrect, the login fails	√
3	POST	/logout	Logout user by sending user token data to the system				User successfully logs out	√
4	GET	/mobile/products	Call URI with GET method				Successfully displays all items	√
5	GET	/mobile/productsbytype/<id>	Call URI with GET method and item type parameter	Bearer token	jenis_barang		Successfully displays items according to type	√
6	GET	/mobile/getkeranjang	Call URI with GET method	Bearer token			Successfully displays items in the cart	√
7	POST	/mobile/additemkeranjang	Call URI with POST method and fill in the required value	Bearer token	user, product	user, product	Successfully adds items to the cart	√
8	PUT	/mobile/updateitemkeranjang/<id>	Call URI with PUT method and fill in the required value	Bearer token	id_produk		Successfully changes the item data in the cart	√
9	DELETE	/mobile/deleteitemkeranjang/<id>	Call URI with DELETE method and item id parameter	Bearer token	id_produk		Successfully deletes the selected item data in the cart	√
10	POST	/mobile/transaksi	Call URI with POST method and fill in the required value	Bearer token		outlet, date, payment_type, total, product	Successfully checks out the items in the cart	√
11	GET	/mobile/gettransaksi	Call URI with GET method	Bearer token			Successfully displays all transactions that have been made	√
12	GET	/mobile/transaksibystatus/<id>	Call URI with GET method and transaction status parameter	Bearer token	status_transaksi		Successfully displays transactions based on status	√

Then there is testing using Unit Testing to ensure the feature has functioned according to specifications. The Unit Testing test itself can then be seen in Figure 13

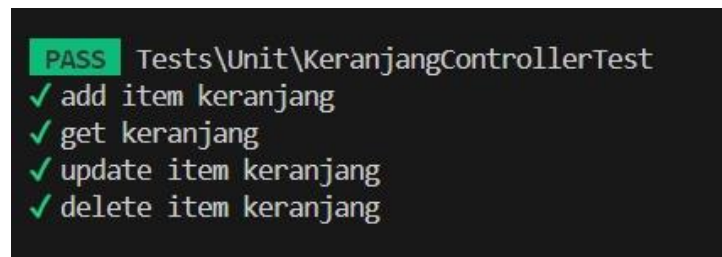


Fig. 13: Unit Testing

Then Oauth 2.0 testing is done with direct access to the protected page. Unit Testing for Oauth 2.0 can then be seen in Figure 14

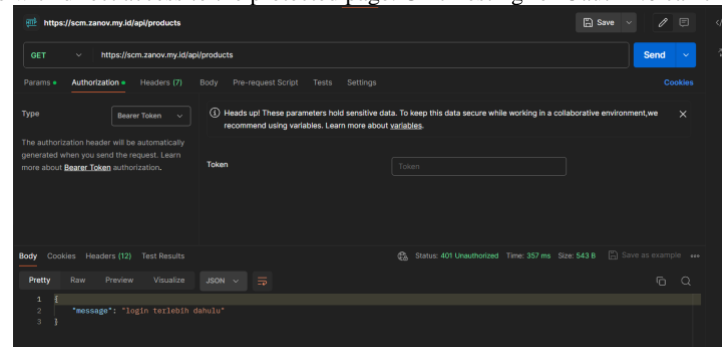


Fig. 14: Design Class Diagram

7. Conclusion

Based on the research that has been done, several conclusions were obtained as follows:

1. The creation of a REST API to support the CV. Marvelindo Utama marketplace application created by the researcher has worked well, users can make purchases and transactions.
2. Authentication security using Oauth 2.0 has been tested using unit testing and black box testing methods, showing valid results and by expectations, namely that all running features are appropriate.
3. Testing using Blackbox showed 100% results in one test and unit testing showed positive results indicating that the system created can meet the needs.

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