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Serverless E-commerce Recommendation System

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Abstract: *Over the last decade, recommender systems have been widely applied by major e-commerce websites for personalized user experience. However, few efforts have been focused so far on recommender systems architecture. In addition, Big Data technologies present opportunities to create unprecedented business advantage and better service delivery at low cost. The recommender system architecture may vary according to the context in which e-commerce is inserted and with the adopted business settings. Consequently, from smaller to bigger companies, each recommendation system has his individual architecture with distinct implementations, but sharing similar issues. With the rapid development of e-commerce, its information structure is becoming more and more complex, and the amount of information is becoming larger and larger. Users are often lost in massive commodity information, and merchants cannot establish effective customer relationships in massive user information. In order to improve the service level and market competitiveness of Internet commerce, many e-commerce websites begin to introduce cloud computing technology. According to users' purchase records and historical browsing records, they can find the goods they like and recommend them to users. In order to manage massive commodity information and user information more efficiently, this paper proposes a solution to build e-commerce recommendation system on the cloud computing platform to improve the ability of massive data mining and business intelligence analysis, and realise high-performance computing at a lower cost.*

Keywords: E-commerce, cloud computing, system architecture, Recommendation system, Aws

I. INTRODUCTION

Cloud computing is an amazing technology that uses remote servers to help companies store, manage, and secure their data. If you want to offer a product catalog to your customers, you can do it with a cloud-based solution. Recommender systems are used by E-commerce sites to suggest products to their customers. The products can be recommended based on the top overall sellers on a site, based on the demographics of the customer, or based on an analysis of the past buying behaviour of the customer as a prediction for future buying behaviour. Broadly, these techniques are part of personalization on a site, because they help the site adapt itself to each customer. Recommender systems automate personalization on the Web, enabling individual personalization for each customer. Personalization to this extent is one way to realize Pine's ideas on the Web. Thus, Pine would probably agree with Jeff Bezos, CEO of Amazon.com, when he said "If I have 2 million customers on the Web, I should have 2 million stores on the Web."

This paper is based on how we make the better recommendation system as todays recommendation system which provided by the companies like Amazon, Netflix, Facebook, etc. they have some issues in the recommendation system. Like the low processing speed, data do not store securely, anything which cannot interested by the customer that can be give in the recommendation because they do not understand customer need properly. Past data is not store privately and do not understand properly. So, we create the system that it can increase the processing speed and also provide security to the stored past data we can used cloud computing to store the data so it is easily access service provider and also give many services to the user during e-commerce websites that it can used.

With the increasing amount of information, recommendation system has become an indispensable part of every e-commerce platform. In order to improve the service level and market competitiveness of Internet commerce, many e-commerce websites began to introduce data mining technology. According to users' purchase records and historical browsing records, they found products that users like and recommended them to users. As a platform for customers to shop online, e-commerce websites hope to recommend products that may be of interest to customers more accurately by

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using more efficient recommendation technology. Customization, personalization and differentiation have become the core competitiveness of enterprises. The two major trends and challenges of data analysis are: the expansion of data volume and the increasing demand for deep data analysis .E-commerce recommendation system can capture key data from rich data information, tap potential customers for businesses, expand sales scope, and provide product recommendation for old customers and expand user groups .In order to manage massive commodity information and user information more efficiently, this paper proposes a solution to build e-commerce recommendation system on the basic platform of cloud computing, so as to improve the ability of massive data mining and business intelligence analysis, and achieve high-performance computing at a lower cost.We know every company as main goal to give user good experience when it can use their system but if the system is not built properly then it impactson the company to lose user attraction toward the system which effect on the loose of financial cost and also lose their reputation so for this purpose, we create such system that we it gives better result for the recommendation system using cloud computing.

II. OBJECTIVE

Recommender systems are widely used in several different domains for the recommendation of articles, music, movies, and even people. Portals such as Amazon, Netflix and Flipkart etc. use recommender systems to suggest products to their customers. Meanwhile, social networks such as LinkedIn and Facebook use them to suggest new contacts. Recommendation systems are a very popular and effective paradigm in retail business. With a recommendation system, shoppers can find items they like with less effort. Furthermore, they are presented with items they've never thought of buying, but which actually suits their needs. Therefore, as a part of one of our projects for a footwear company, we developed BEterna's customer behaviour analysis platform, which provides clients with customer profiling and recommendation system. In virtual marketplaces, recommendation systems play a similar role, replacing sales assistants in segmenting and recommending products to customers. The major difference is that human sellers are driven by their intuition and experience to investigate a small fraction of the aforementioned variables during a short chat with purchasers.

Recommendation engines, instead, rely on machine learning to process huge customer datasets and consider a broader range of parameters to perform this classification and targeting process. These include browsing behaviour, purchase history, content usage, personal information from user profiles, product reviews, and access devices. Multiply this for each user on a given platform and you'll understand how a recommendation system can get a pretty clear idea of both individual purchasers and the audience as a whole, as well as figuring out underlying sales dynamics that a human observer would struggle to grasp.

III. ARCHITECTURE OF E-COMMERCE RECOMMENDATION SYSTEM

You can implement popular architecture pattern using API Gateway and AWS Lambda as your logic tier. This whitepaper includes the most popular architecture patterns that use AWS Lambda-based logic tiers:

- **Mobile backend** – A mobile application communicates with API Gateway and Lambda to access application data. This pattern can be extended to generic HTTPS clients that don't use serverless AWS resources to host presentation tier resources (such as desktop clients, web server running on EC2, and so fourth).
- **Single-page application** – A single-page application hosted in Amazon S3 and CloudFront communicates with API Gateway and AWS Lambda to access application data.
- **Web application** – The web application is a general-purpose, event-driven, web application back-end that uses AWS Lambda with API Gateway for its business logic. It also uses DynamoDB as its database and Amazon Cognito for user management. All static content is hosted using Amplify.

Today, because of more evolving UI frameworks like Angular, Vue & Ember in JavaScript, UI development has taken a React, shift towards single page from a multi-page approach that was there in the early.

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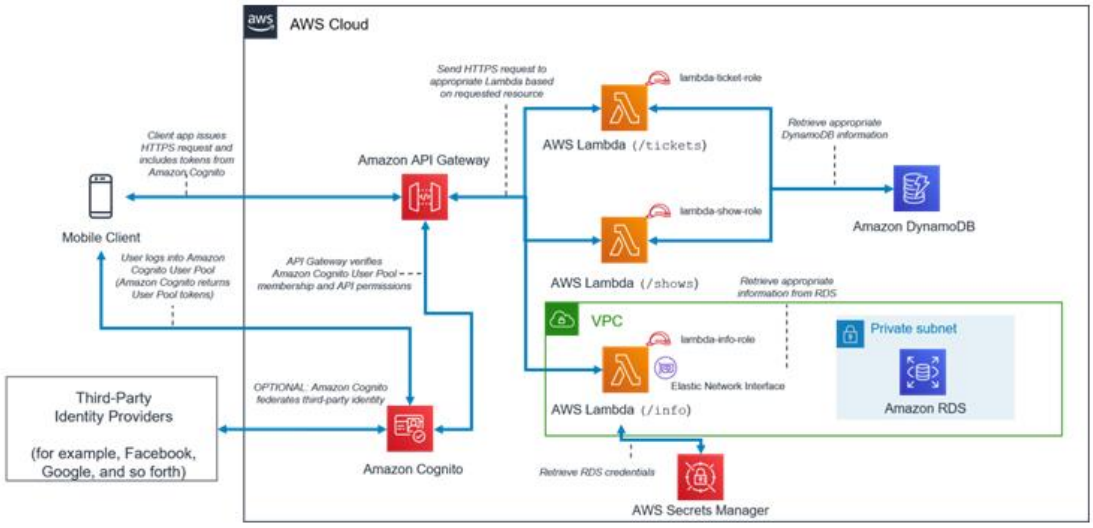

Fig.1. Architecture Pattern for serverless mobile

1.Hosting a single-page app can be done on S3 based bucket system as well.

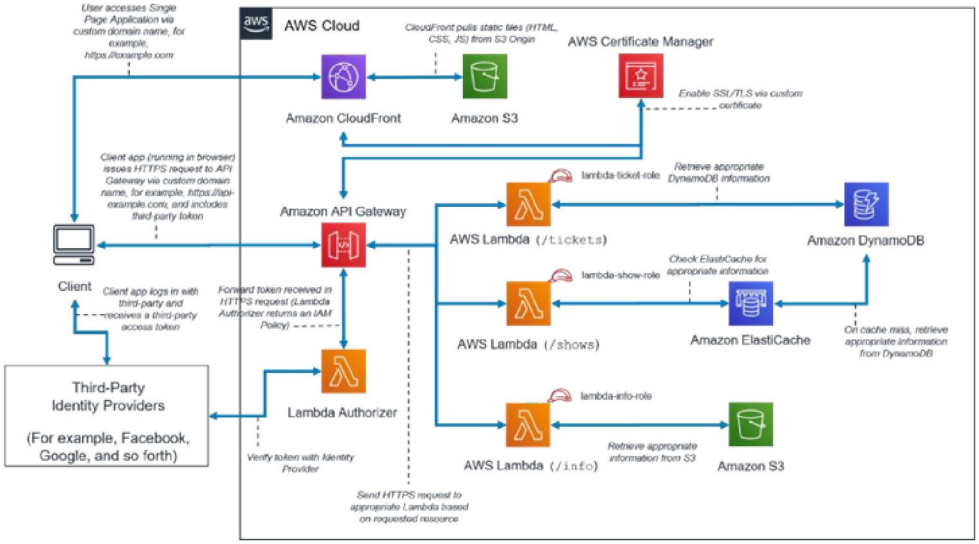

Fig.2. Architecture pattern for single page application

2.You can incorporate Amazon Cognito in the case of multi-page app for making the user view different pages from CloudFront based on his/her access level, whereas in the case of single page app, one can use lambda authorizer as one of the authorizers for verifying the role and access level info.

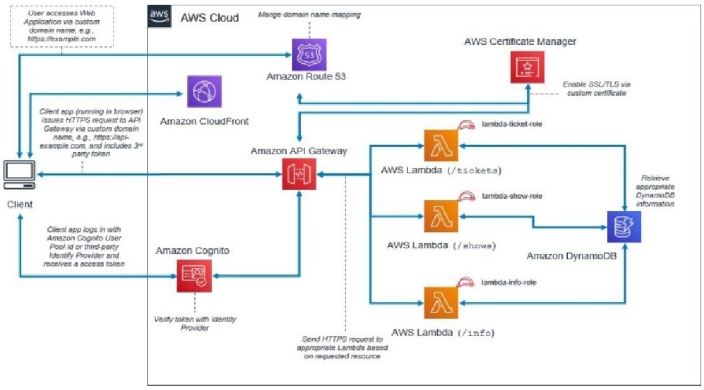

Fig.3. Architecture Pattern for Web Application.

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3.The microservice architecture pattern is not bound to the typical three-tier architecture; however, this popular pattern can realize significant benefits from the use of serverless resources. In this architecture, each of the application components are decoupled and independently deployed and operated. An API created with API Gateway, and functions subsequently launched by AWS Lambda, is all that you need to build a microservice. In general, a microservices environment can introduce the following difficulties: repeated overhead for creating each new microservice, issues with optimizing server density and utilization, complexity of running multiple versions of multiple microservices simultaneously, and proliferation of client-side code requirements to integrate with many separate services.

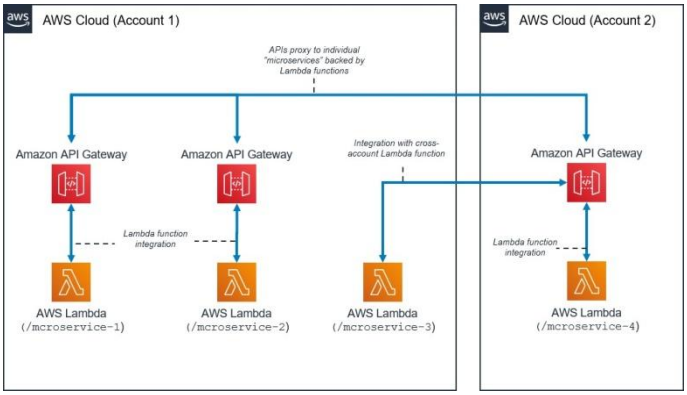

Fig.4. Architectural pattern for microservices with Lambda

When you create microservices using serverless resources, these problems become less difficult to solve and, in some cases, simply disappear. The serverless microservices pattern lowers the barrier for the creation of each subsequent microservice (API Gateway even allows for the cloning of existing APIs, and use of Lambda functions in other accounts). Optimizing server utilization is no longer relevant with this pattern. Finally, API Gateway provides programmatically generated client SDKs in a number of popular languages to reduce integration overhead.

IV. APPLICATION

[1] Helping New and Infrequent Visitors: Broad Recommendation Lists: One of the key challenges for e-commerce sites is to engage visitors –especially new and infrequent visitors – before they leave to visit another site. For sites that list thousands to millions of different products, this challenge is particularly acute; they must not only engage the visitor but also keep him from getting lost and frustrated. Nearly every site visited has some form of broad recommendation list designed to direct customers towards engaging products. These lists typically allow the targeted customer to use current navigation to pull non-personalized suggestions. These include overall best sellers, best sellers in a category, editor and expert recommendations, and other collections of products selected either manually or through simple statistical summarization. In essence, these recommendation lists replace the tabletop displays, endcaps, and large product displays in physical stores. Whichever technique is used, the lists help orient users who might otherwise leave before finding compelling products.

[2] Building Credibility through Community: Customer Comments and Ratings: Retailers in general, and e-retailers in particular, must often overcome an image of low credibility. Customers may feel that the site is interested only in making a sale, and therefore that it will present any "recommendation" or advertising necessary to induce them to make a purchase. While principles of one-to-one marketing suggest that it is in the retailer's interest to serve the interests of the customer, stores must still leap over the credibility hurdle to move towards a one-to-one relationship. One way to do this is to collect reviews and ratings from members of the community at large. These systems use the targeted customer's current navigation to suggest which non-personalized reviews, ratings, and predictions to display passively. By building a "community canter," sites allow customers to communicate with each other and provide each other with advice and feedback on products.

[3] Inviting Customers Back: Notification Services: Stores that know their customers' interests can leverage that information by inviting them back to the store when new products of interest arrive or are discounted. Notification services use keywords provided by the targeted customer and attributes of the items being recommended to push persistent, personalized suggestions and can thereby build stronger customer relationships. Many e-merchants allow

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customers to describe the products they find interesting and then automatically notify them when such products are available. These notification services can provide a great service to the customer, who becomes quickly aware of new products of interest, and can be very effective at bringing customers back to the e-commerce site on a regular basis. The form of the descriptions can vary from a simple keyword or attribute query to a more complex specification that includes price ranges.

[4] Cross-Selling: Product-Associated Recommendations: Suggestive selling is particularly effective when the seller knows the current interests of the buyer. Retailers arrange products to enhance cross-selling by placing complementary items in close proximity. On-line retailers are freed from physical layout and can directly suggest products related to the one a customer is viewing. By using the targeted customer's current navigation as an ephemeral indication of interest, such systems use item-to-item correlation and community purchase history to passively display suggestions to the targeted customer.

[5] Building Long-Term Relationships: Deep Personalization: The goal of most retail businesses is to develop long-term relationships with customers that lead to higher lifetime values and greater competitive barriers. Deep personalization, based on a customer's history of preferences, purchases, or navigation, is the strongest and most difficult type of personalization to implement. Deep personalization is common already in web advertising and is becoming more widely used in e-commerce now that collaborative filtering recommendation engines are readily available. By utilizing collaborative filtering's ability to match the targeted customer's history with histories of other customers, deep personalization is able to generate persistent, personalized suggestions or predictions. Deep personalization builds a customer relationship over time, leveraging the history developed to provide increasingly better recommendations. Unlike notification services that require manual updating, deep personalization updates the user profile whenever the customer interacts with the merchant. Deep personalization systems can use user-to-user correlation, attribute-based systems with a learning module to identify user interests, or a combination of the two.

V. CONCLUSION

E- -commerce has become the most mainstream business model in contemporary society. With the explosive growth of information in the era of big data in e-commerce, personalized recommendation system has attracted more and more attention. E-commerce provides more and more shopping and consumption platforms for people. Using recommendation algorithms such as data mining can recommend products that users like to consumers and improve the turnover rate of E-commerce websites. With the rapid development of internet commercial websites, the total amount of information in commerce system is increasing day by day, and the problem of information overload is becoming more and more serious. Because the recommendation system is based on user behaviour, malicious user behaviour should be filtered. Malicious behaviours include users browsing certain products frequently through programs, creating a large number of user behaviours, or businesses adjusting commodity attributes according to algorithms. The powerful storage, operation and security functions of cloud computing, as well as the ideal mode of resource allocation and sharing, have laid a good foundation for the development of e-commerce recommendation engine, resulting in a brand-new business recommendation mode. In the aspect of data integration, the data analysis middleware layer can be used to import the source data of the business system for analysis, and the data of the business system can also be directly stored in the distributed file system layer for management and access.

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