

A Social Listening Cloud Service for Referrals and Generate Leads

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Abstract

Huge competition in the market has made it difficult for enterprises to generate leads and acquire new customers. On the other hand, recent technological advancements have made accessing and disseminating information easy. Online social networking systems have been successful in capturing information about users and their social contacts. Such a network allows companies to effectively target the end customers due to intimate knowledge of their preferences and shared needs during social conversations. This paper presents a cloud-based social listening system that leverages such soft data to unfold lead generation. We demonstrate our approach using the Facebook data interface and carry out a socio-temporal analysis of the social interactions captured from customers' social networks and messages exchanged in that network. The proposed setup enables acquiring new customers effectively through referrals by utilizing online social channels.

Key-words: Social Network, Targeted Marketing, Unstructured Data Analytics, Lead Generation, Referral Marketing, Cloud, Asynchronous Processing, HPC.

1. Introduction

Social networking systems are revolutionizing the web, and users are glued to such systems. Enterprises continuously search for technology solutions that can convert users' interests into business benefits [3]. When customers of an enterprise provide access to their social network data, they provide an opportunity to the enterprise to connect, interact and influence customer's friends. We are motivated by this notion to conceptualize a social referral solution.

In a typical social referral scheme, an offer generated by an enterprise is shared by user A to user B through an online mechanism. There may be an incentivizing scheme attached to it where user A will be rewarded when user B connects with the enterprise. Few examples of online referral approaches are as follows:

- After completing an online purchase, the customer may be asked to refer the offer to his/her friends. This offer is a generic one that is targeted towards a large population in general. There may or may not be any reward mechanism associated with it.
- The customer generates a coupon from the mechanism provided by the enterprise, and he/she can share the coupon with contacts through any online means such as blog, forum, email, and social networks. When an online user uses the coupon to get a discount during a transaction, the referrer is rewarded.
- Static widgets are placed in enterprise portals where customers can utilize them to share the offer with their social contacts.

In this paper, we present a cost-effective cloud-based system that leverages cloud services to derive insights from social data and user connections for the referral process. Following are the main objectives of the paper.

- Introduce a novel approach for extracting lead information from social data.
- Efficiently use cloud services to reduce implementation cost and processing time.
- Introduce asynchronous processing of user's social data and auto-scaling to handle the huge load to the system.
- Introduce a schedule-based approach for the flow of newly updated referrals in a cloud-based customer relationship management system(CRM) to social platforms.
- Propose a targeted referral approach to ensure user social network is not spammed.

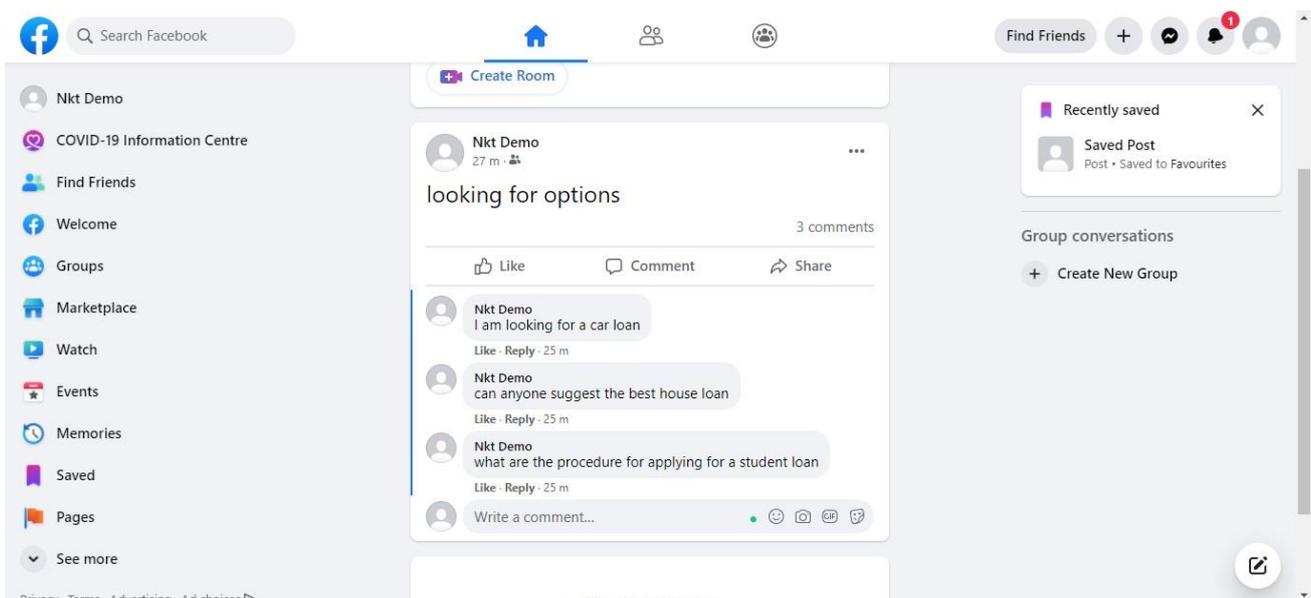
The rest of the paper is organized as follows. Section 2 describes the proposed approach of this work. In Section 3, we cover details of the related work. Section 4 presents the application design of the social referral system. Section 5 covers the application workflows. Section 6 covers the implementation. Section 7 covers the results, and Section 8 concludes the paper.

2. Proposed Approach

The social referral system involves four key entities:

- Third-party social network system such as Facebook.
- Social engagement platform such as web application or mobile application that the organization uses to engage with customers.
- Enterprise customer relationship management(CRM) portal.
- Back-end system that integrates or supports all the above components.

Figure 1 – Screen snap showing status updates in prospect’s Facebook wall



We have implemented this approach for a retail bank that offers services like loans, credit cards, debit cards, and Facebook as the social engagement platform. Figure 1 shows an example of a potential prospective customer looking for services related to what a bank can offer. This section will cover how the user's social posts are converted as an offer to the customer. The step-wise referral enablement process is as follows:

- Customer logs into the social engagement platform such as Netbanking application to perform actions related to his/her account.
- The customer is shown a set of social channels on the Netbanking application and asked to log into the preferred social channel to receive personalized offers and rewards on referrals.

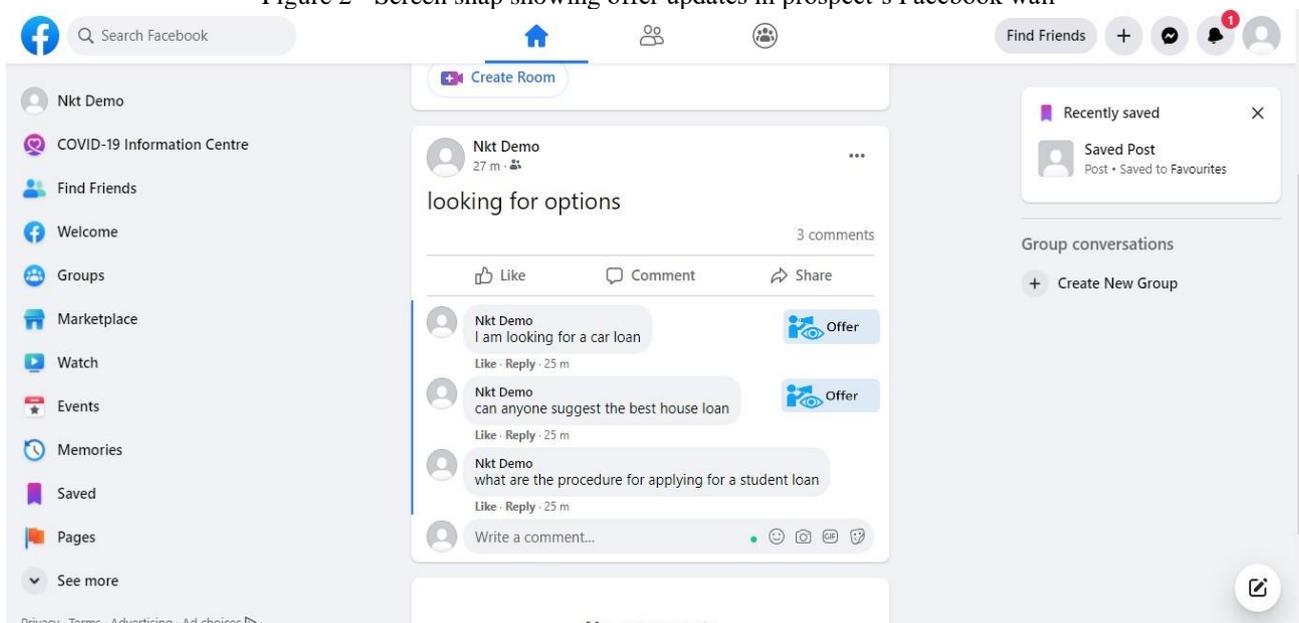
- Customer logs into the social application where the user is requested to authorize the social application to monitor the customer's social network's activities.
- Once necessary permissions are authorized, the customer's social credentials, such as the number of friends, influence in the network, and activeness, are accessed to evaluate the user's eligibility to be a part of the campaign.
- The system retrieves profiles of the customer and her friends from the social networking system. If the user becomes eligible, the system starts listening to the customer's network's activities. The network's activities include updates (conversations), likes, interests, and buzz.
- When activity in the network by a customer or customer's friend is detected, the recommendation engine analyzes the activity context. It classifies to one of the configured sets of products based on relevance (such as home loans, credit cards).
- Product classification works on the structured and unstructured text & derives semantic information from the given data. It can also be configured to consider temporal aspects of activities.
- If the customer's or their friend's activity is classified as a matching one for configured products or services, the system will generate a personalized offer. Information about the friend is retrieved through the customer profile to generate a personalized offer.
- An option is available to generate a manual offer by routing the opportunity information to the CRM system and receiving the offer back from it.
- The customer is asked to recommend the offer to the friend. If multiple customers are connected to the same friend, the customer who has a high social degree of relationship with the friend is considered the conduit.
- On recommending, the offer information is sent to the friend's profile. Options are available to send the offer to the prospect through email.
- Friends can choose to follow the hyperlink sent with the offer and provide the requested information.
- The system captures this information and pushes it as a lead in to the enterprise CRM system.
- Now, the customer is entitled to a reward. The worth of the incentive is based on customer value, the user's past recommendations, and Social factors like social capital and social influence.

Figure 2 shows the prospect customer's Facebook wall where the offers have been published after the referral process has identified the relevant offers and posted them back to the social platform. Clicking on the “Offer” will take the user to the banks' social engagement platform, enabling the user to avail the offer and recommend it to the user's friends.

3. Related Work

The traditional referral mechanisms discussed are not meant to provide personalized offers since they do not have access to user information. Also, the offers are broadcasted without determining whether there is a desire or interest in the prospect for such an offer, resulting in few responses. A significant disadvantage of such a referral system is the ensuing negative reputation as a result of spamming. Very few approaches to discover social referrals exist in the literature.

Figure 2 - Screen snap showing offer updates in prospect’s Facebook wall



Yu and Sing [5] have described a multi-agent system to identify referrals that determine influences in a dynamic social network. This system also finds prospective users in social networks. Chatterjee [1] examined the role of a referrer's activity at social networking website, brand message source, and recipient type on a referrer's decision to recommend a new brand and the prospect's decision to make a referral visit. Cosley et al. [2] describe ways to measure the influence of a user using both a snapshot of the social network data and based on its temporal analysis. Validation of this has been performed in a non-business scenario; therefore, similar schemes may not be directly applicable in the

marketing context of social referral. Westermann et al. [6] describe how an algorithm-based analysis of online conversation in social media can be used for reputation management. Shastri et al. [7] propose techniques for sentimental analysis of users' social media content to understand users' reviews of products and services offered by companies.

4. Application Design

In this section, we present the technical components and the flow of events in the cloud-based solution. Figure 3 displays the different components in the proposed solution. In the current implementation, we have used Facebook as the social media platform.

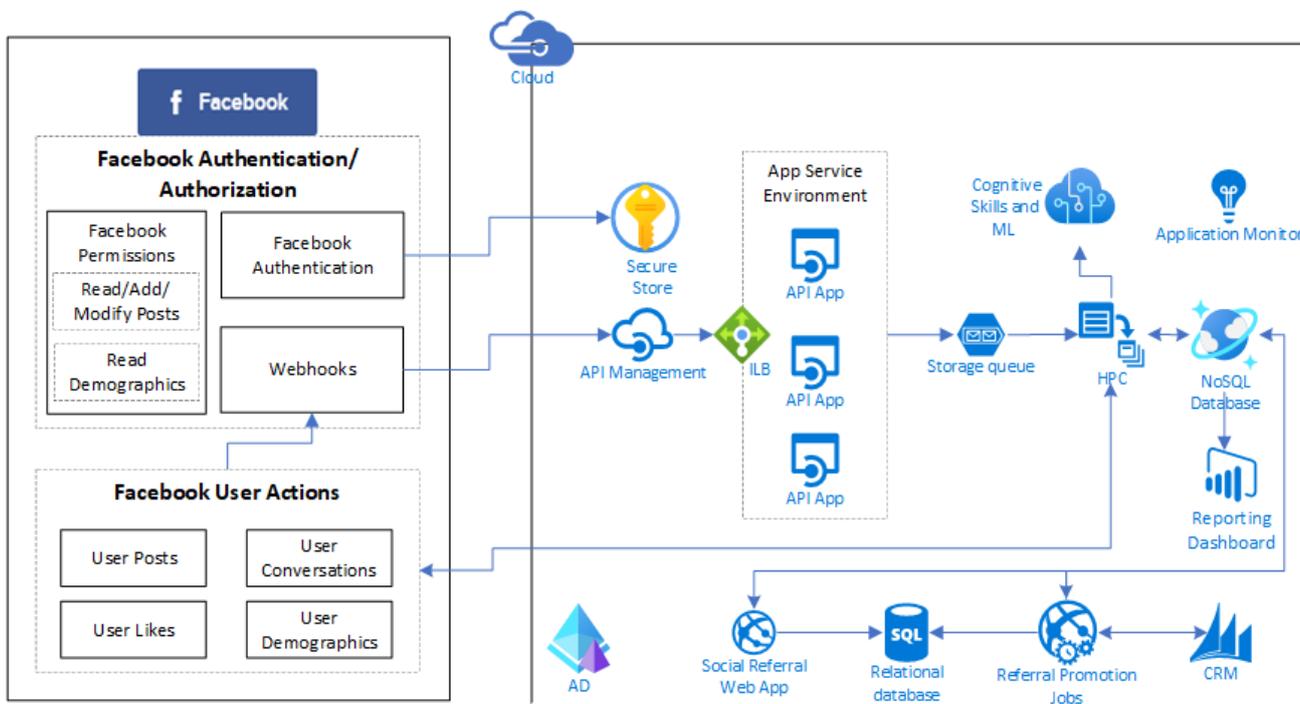
1. Facebook Authentication and Authorization: Facebook exposes out-of-the-box APIs and provides a set of standard development kits (SDK)[7] for interfacing with all the functionalities in Facebook. We have used the following authentication and authorization capabilities of Facebook.

- **Facebook Authentication:** A Facebook app is placed on the organization's Net-Banking site or any customer-facing web application for authentication into Facebook. The authorization token obtained as part of the login process is stored in the cloud's secure store service.
- **Facebook Permissions:** This feature provides granular permission to access, add or update user data in Facebook. The user is requested to permit the app to read or update the following actions on behalf of the user. The consent form for requesting the below permission is shown on the first login.
 - Users posts.
 - User Conversation.
 - Demographic Information.
- **Facebook Webhooks:** Webhooks[8] is a Facebook feature that will help in integrating with a third-party application. This feature enables the third-party application to configure a call-back URL in Facebook triggered when an activity is performed. Webhook performs a POST request to the call-back URL with the information about the Facebook event, such as post messages, likes.

2. Facebook User Actions: Input to the social referral app are the user action types such as posts, likes, conversations, and demographics. This information is passed on to the application using webhooks.

3. Cloud API Management: Cloud API management is a distributed service hosted by cloud providers to manage the lifecycle of APIs exposed as webhooks to the Facebook application. All the updates or additions to Facebook data are sent to the social referral app through the API management service. The API management service monitors these requests and forwards the same to the Web API app. The API management service will ensure that the backend service URLs are not exposed to the external website.

Figure 3 – Application Design



4. Application Service Environment(ASE): ASE is a PaaS(Platform As a Service) service offered by cloud providers to host applications at a high scale. The environment is used to host the REST service that consumes the POST information sent through the webhook functionality of Facebook. ASE is configured with auto-scaling to increase the number of instances of the API app in case there is a huge load from Facebook through webhooks. Auto-scaling is a configuration in cloud services that will enable the service resources to be scaled up or down depending on the load on the system. Scale count is a configuration parameter of auto-scaling which specifies an upper limit to the number of resources added to the service. Scale count is used to limit the total number of resources added to the system as too many resources added to the system will lead to a huge cost to the company.

5. **Storage Queue:** Storage queue is used for asynchronous processing of the POST messages received from Facebook. The API App first receives the webhook request, extracts the updated and added information, and puts it into the storage queue. The message queue stores these messages until the processing application consumes the messages. Storage queue helps reduce the load on the system by asynchronous processing of messages, thus ensuring that the system can be scaled to take any load.
6. **High Process Compute(HPC) Service:** HPC service is a high-process compute platform provided by cloud providers to process the messages in the storage queue. HPC service is used to instantiate compute nodes that process the data in the message queue. The number of nodes in the application is determined by the total number of messages in the queue. As the number of messages in the queue increase, the number of nodes(servers) will increase based on the approximate time taken to process each message. The HPC nodes perform the activities of the recommendation engine, such as triggering the recommendation engine to determine the semantic meaning of social interactions, computing users' social influence, personalized incentives, calculate users' based on likes and comments on users posts, offer generation and rewards based on social behavior, social capital and past referrals. The HPC service will ensure that the time required to calculate all the above information is handled by asynchronous processing of the messages in the message queue and instantiating multiple nodes based on queue length.
7. **NoSQL Database:** NoSQL database is used to store the recommendation information generated by the HPC service, such as successful referrals by the customer, customer social influence value, customer credibility, personalized offers, and personalized incentives.
8. **Reporting Dashboard:** Reporting Dashboard is a SaaS offering provided by the cloud provider for creating reports. The reporting tool is used in our application for creating dashboards used by management teams to assess the effectiveness of the referral system by measuring statistics such as the number of newly added customers and the number of rewards processed.
9. **Scheduled Jobs:** Scheduled jobs are configured using the Web Jobs service. Web Jobs are scheduled jobs that run in ASE and can be triggered on a timely basis. This job trigger scripts to generate periodic reminders to prospects and generates manual offers by routing opportunity information to CRM. Scheduled job handles the referral promotion workflow that has been detailed in Section 5.3.

Figure 4 - Authorization Data Flow



10. Relational Database: Relational Database service is used for creating a database used to monitor and track HPC and Scheduler triggers. It is also used as the backend database for the social referral web application.

11. Social Referral Web Application: Web application exposed to the external user and holds the Facebook App.

12. CRM: SaaS offering from the cloud for managing customer relationship management (CRM).

13. Cloud AD: Cloud AD is a cloud-based identity and access management solution that provides authentication to cloud services.

14. Application Monitor: Application monitor is a performance management service provided by cloud providers for tracking logs, errors, performance metrics of cloud services. Application monitor is used for monitoring the load on the system and take corrective action if necessary.

5. Application Workflow

In this section, we highlight the different workflows that cover the overall functionality of the social referral system. Following are three workflows.

5.1 Authorization Workflow

Authorization workflow is triggered when the user registers for receiving promotion information by entering the credentials in the Facebook app. Figure 4 shows the sequence of steps involved in the workflow. The end goal of this workflow is to register the client for promotional notifications on Facebook and store the security token received from Facebook.

5.2 Social Activity Workflow

Social activity workflow is triggered when the user performs Facebook activities, such as posting a new message, replying to a message, liking a post. Figure 5 shows the sequence of steps involved in the workflow. The end goal of this workflow is to identify the intent of the user action and calculate the recommendation based on the various promotions logged in the customer relationship management tool(CRM).

Figure 5 – Social Activity Work Flow

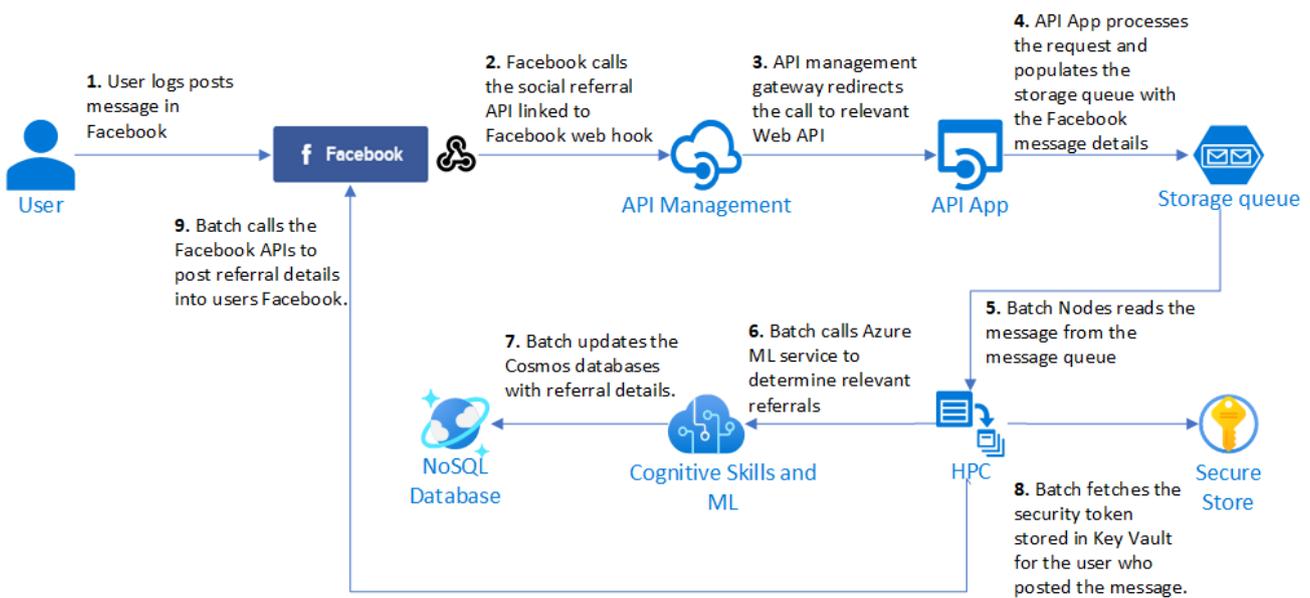
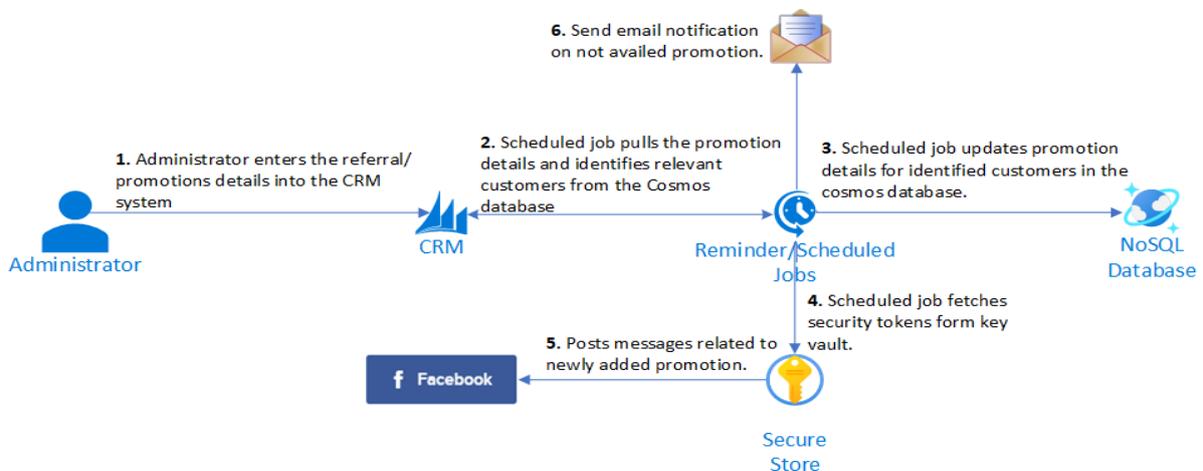


Figure 6 - Referral Promotion Work Flow



5.3 Referral Promotion Workflow

Referral promotion workflow is triggered on a scheduled basis through web jobs. Web job queries the CRM database for newly added promotions. Figure 6 shows the sequence of steps involved in the workflow. The end goal of this workflow is to identify the users for the newly added promotion and post relevant promotions in the user's Facebook account. The referral promotion workflow also takes care of sending reminder mail to users who have not availed of the offer.

6. Implementation View

This section details the cloud services used in the implementation of the cloud services used in the solution. Table 1 shows the mapping between the solution component and corresponding offerings in Azure and AWS.

7. Results & Discussion

In this section, we present the results of the data load generated on the Azure Services. The experiment involved programmatically triggering the creation of Facebook posts. A set of ten offers are loaded into the Dynamics 365 system. The offers are related to a home loan, debit card, credit card, student loan, personnel loan, medical insurance, term insurance, vehicle insurance, shares, and job offers. A multithreaded script is used to generate posts in the Facebook accounts. The posts are generated with sentences related to the offer, such as "I am looking for a car loan," "can anyone suggest the best house loan," "what are the procedure for applying for a student loan. These experiments were targeted to monitor three important critical parts of the overall architecture.

- The ability of the system to handle the load on the system when multiple users are posting messages on Facebook (Refer section 7.2).

Table 1 – Azure and AWS Cloud Services

Cloud Services	Azure[10]	AWS[11]
HPC Service	Azure Batch Service	AWS Batch
NoSQL Database	Azure Cosmos Database	Amazon DynamoDB
Secret store	Azure KeyVault	AWS Secrets Manager
API Management	Azure API Management	API Gateway
AD	Azure Active Directory	Identify and Access Management
Relational Database	Azue SQL Database	RDS
Storage Queue	Queue Storage	Simpe Queue Service
Cognitive Skills and ML	Machine Learning	Sage Maker
Application Monitor	Application Insight	Cloud Watch

- The ability of the system to identify intents related to promotion from the Facebook activity and calculate recommendation which can be posted to users Facebook accounts irrespective of the total number of users generating the messages in Facebook. (Refer section 7.3).
- The ability of the system to monitor newly added promotions in the CRM system and generate promotion posts in the user's Facebook account. The system should be capable of handling any number of users in the system. (Refer section 7.4).

The below section shows the performance of the Azure components.

7.1 Base Metrics

Table 2 shows the average execution time in seconds for all the distinct steps in the referral system. This time was calculated for a single user. It can be observed that most of the time is taken by two activities that are marked in grey. This high time consumption is because of the time involved in loading the models and parsing through the user's records in the cosmos database to arrive at the promotion recommendations for eligible users.

Table 2 - Average Execution Time

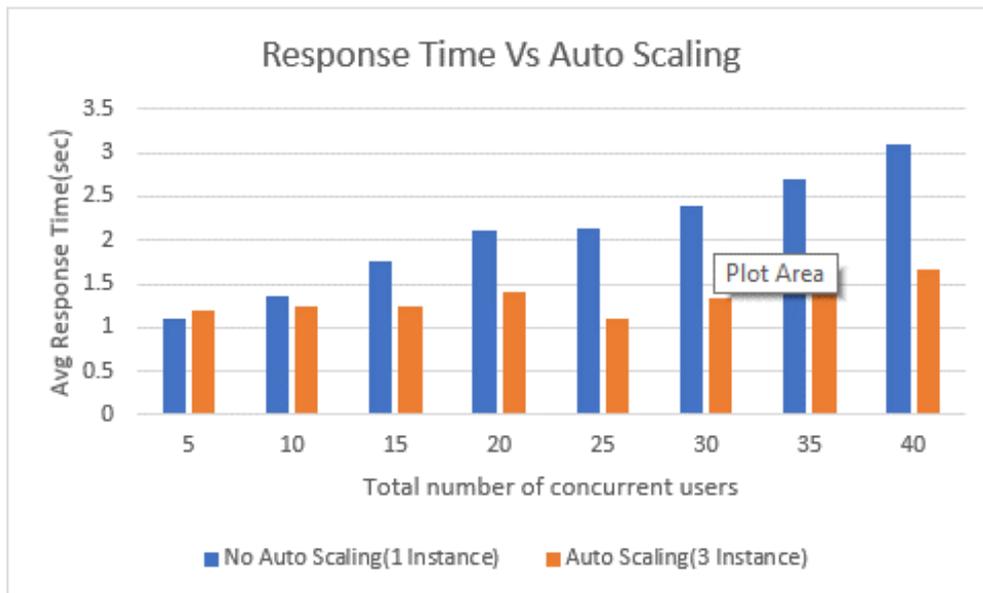
Activity	Avg time taken(sec)
Post messages related to the offers in the Facebook App	0.89
Webhook trigger to POST the updated or added message to Azure Web API	1.34
Determine semantic meaning of POST message	1.98
Computing social influence	2.34
Calculate personalized incentives	5.78
Offer generation and rewards	2.1

7.2 App Service Environment

Figure 7 shows the experimental results of the load test performed on the App Service Environment that hosts the API app configured as a webhook in the Facebook application. The response time of the app service environment was measured with and without autoscaling configured. The maximum scale count for auto-scaling was configured to 3. This experiment involved triggering concurrent scripts that create Facebook posts related to the offer. The number of concurrent requests posting messages related to the offers was steadily increased in steps of 5, and the average response time was measured. Response time is the time taken by any service to return the result. In figure 8, the x-axis indicates the total number of concurrent requests, and the y-axis indicates the time taken by the service to respond. The experiments indicate that the average response time increases when the number

of unique requests increases in a single instance app service plan. In contrast, the response time remains consistent for an app service plan setup with autoscaling. The experiment proves that the system can handle multiple messages posted by multiple users in the Facebook application.

Figure 7 - Avg Response Time in auto scaled ASE



7.3 Azure Batch

Azure Batch is the core of the application as the overall response time, and the successful processing of all the requests triggered through webhooks depend on the Azure batch's configuration. In this section, we replicated the load on the referral system by simulating forty users through a script with an average of 4 Facebook posts per user. Table 3 shows the average response time and the number of compute nodes in the system to process all the requests, and the maximum queue length observed. The maximum number of compute nodes in the experiment was configured to 5. We configured the Azure Batch to use Standard_A8_v2[10] size for the batch nodes. It can be observed from the experimental results that the response time of the referral system can be controlled by the number of Azure batch nodes in the system. In our experiment, the number of nodes was increased by one for every 20 messages if the messages in the message queue are more than 5 for 60 seconds. This experiment proves the ability of the system to handle load on the system when multiple users are performing social activity on Facebook.

Table 3 – Azure Batch Response Time

No of users	Max messages in queue	No of compute nodes in the system.	Avg response time(minutes)
5	14	2	3.17
10	31	3	4.22
15	48	4	4.75
20	65	5	5.07
25	84	5	6.33
30	106	5	7.60
35	123	5	8.87
40	149	5	10.13

7.4 Web Jobs

Web jobs are the key referral system component responsible for ensuring that the newly posted referrals in the CRM system can be communicated to the existing customers depending on their social score and past referrals. Though this is a backend process, the system is configured to address a faster turnaround time. Turnaround time is the time measured between the posting of promotion in Dynamic 365 and the time taken for the notifications to reach end-users. We replicated the load on the referral system by adding three promotions in the Dynamics 365 system and measuring the time required for the promotions to be posted on the user's posts. The promotions are configured to apply to all users irrespective of the social relevance score. Web jobs are configured with a maximum instance count of five. The number of instances is calculated with a simple formula (The total number of users in the system is divided by five). Table 4 shows the average response time observed to process the newly added promotion for all the users in the system. The experiments indicate that the web job component of the referral system and a carefully chosen formulae for determining the instance count of web jobs can handle any number of users and process all newly added promotions in the system.

Table 4 - Promotion Response Time

No of users	No of compute nodes in the system.	Average response time(minutes)
5	1	1.15
10	2	2.30
15	3	3.44
20	4	4.59
25	5	5.74
30	5	6.89
35	5	8.03
40	5	9.18

8. Conclusion

Advancement in technology has enabled people to use social networking sites such as Facebook to engage with others and stay connected with family and friends. These Social networking sites have

enabled users to share textual information, photos, videos to communicate ideas, requirements, and thoughts. Due to the increase in these internet-based social interactions among its customers, banks are interested in exploring marketing venues through these channels. This paper discusses the use of cloud services to develop a fully integrated cloud-based online referral system that automates offer generation and incentivizes over the existing referral methods. It exploits the capabilities of social networks and the data in it throughout the referral process. Intelligence is derived by running analytics on social data of the referrer and the prospect to bring in rich personal data and their related information into the referral system. The bank referral system demonstrated in this paper utilizing cloud services can be configured to make it available for other retail industries. Offers will be generated utilizing the interest profile of the prospect, and thus it is personalized. The trigger for offer comes from the prospect's social network activity which may include an explicit status message or an activity showing an affinity towards the enterprise product or service. Therein the offers are generated based on the need or desire of the prospect. The generated offers are shown to the customer (referrer) in a social application that utilizes the Application Programmers Interface (API) of the social network system to share the offer. The relationship between the customer and the prospect is analyzed and utilized to influence the prospect. Rewards given to the customers on successful referrals can be configured based on their past referrals, social influence, and transaction credibility. The presented system provides a targeted mechanism for new customer acquisitions in a more cost-effective manner. The results section shows how effectively the Azure services can be configured to handle increased load on the referral system. The auto-scaling feature provides an efficient mechanism for controlling costs and handling huge spikes in social messages triggered through social platforms. The authorization mechanism proposed in the solution is efficient as it utilizes existing social media credentials, making integration with social media platforms seamless.

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