Cloud-based Conversational Agents for User Acquisition and Engagement

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Abstract: The benefits of cloud computing have driven different companies from diverse sectors to migrate their products and services to the cloud. In the last decade many businesses have adopted web and mobile applications to offer better customer service as well as used social networks for advertisements and marketing campaigns aiming to acquire, engage and retain their customers. This paper presents a case study combining the areas of chatbots, cloud computing and customer service, acquisition and engagement targeting the gastronomy industry; it evaluates and compares the implementation of a chatbot as a cloud-native application (Platform as a Service) versus one built utilizing an authoring tool (Software as a Service); and it demonstrates how a gastronomic business could attract with ease new customers by interacting with them using chatbots embedded into instant messaging apps.

1 INTRODUCTION

Cloud computing has experienced a significant growth over a short period of time and companies have implemented and/or migrated their products and services to the cloud. With the addition of cognitive services and natural language processing capabilities, cloud providers are currently offering a broad catalog of services that can be used to implement a plethora of intelligent applications such as conversational agents also known as chatbots. In the beginning there was the computer and web interfaces, then smartphones came along and mobile interfaces were introduced. Chatbots are going to revolutionize the software industry likewise web and mobile technologies did. Chatbots are a user interface that is changing the way people interact with machines. Every day people perform simple tasks such as searching for images on a text-based chatbot as well as using voice commands requesting to play one's favorite song or asking for navigation instructions. Whether aware or not, people are already immersed in the era of chatbots. Companies know that to achieve success they must offer excellent customer service in a variety of channels, and chatbots are another way to reach the customers and provide them a 24/7 service. Communicating with customers, showing empathy, being reliable at all times and responsive to their needs are essential to create customer loyalty (Parasuraman et al., 1991).

1.1 Problem Description

Something that has been seen over the years is that technology can improve customer service and gastronomic companies have implemented web systems and mobile apps to achieve this goal. However, most of the times such software brings high costs to the companies as the user interface (front-end) as well as the business logic (back-end) have to be developed, deployed and maintained. In the majority of the cases, gastronomic businesses opt to acquire such software from third parties and thus save some implementation costs. Nowadays people use mobile apps to locate restaurants and check their details to make reservations. Also, users are bound to install distinct apps on their smartphones for ordering pizza, coffee, tacos, the groceries, and the list continues. It can be annoying to create a user profile for each and every app and add the payment method afterwards. It should not be overlooked that smartphones do not have infinity storage and many users have faced the problem of not being able to install apps due to a lack of storage space. In the other hand, chatbots do not need a particular graphic user interface when they get accessed inside messaging apps, thus keeping the same user experience of the platform and messaging app their run on. So, could a gastronomic business improve its customer service by adopting a chatbot in order to acquire customers and keep them engaged?

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1.2 Objectives

Cloud computing and software engineering practices shall be followed to develop two versions of a chatbot: one from scratch deployed as a cloud-native application on a Platform as a Service, and another utilizing a chatbot-building tool (Software as a Service) with the purpose of evaluating the benefits and drawbacks of each approach, and determine which option would be more suitable for a gastronomic business. It shall be analyzed whether it is feasible or not for a gastronomic business to acquire and engage customers by the adoption of a chatbot. This shall be done employing current customer acquisition and engagement techniques in combination of a chatbot implemented for one of the most popular messaging apps. The main functionality of the chatbot shall be to provide relevant information about a gastronomic business, e.g. a restaurant or coffee shop. This information shall be its location, opening hours and the menu.

1.3 Research Statements

In accordance with the foregoing objectives, it is possible to hypothesize that:

1. A restaurant can opt to use chatbots to offer a better customer service providing relevant information such as the menu and opening hours.
2. Customers may get a satisfying experience interacting with a chatbot and getting the needed information promptly. Hence, they are willing to come back and recommend the place to others.
3. A restaurant may acquire new customers and keep them engaged by means of a chatbot.
4. A chatbot deployed on a Platform as a Service may offer better performance and scalability than a chatbot-building tool (Software as a Service).

2 RELATED WORK

Researching about cloud computing, customer service and conversational agents is not new. These fields have been widely discussed over the past decade – in both academic and practitioner literature – due to new methodologies and technologies that have emerged to revolutionize customer service through social networks and conversational agents available day and night thanks to the power and benefits of the cloud. The effectiveness of traditional advertising and the insights generated through business-to-consumer messages on Facebook were analyzed (Vries et al., 2017) in a research for brand-building and customer acquisition attempts. “Can machines think?” was the question that drove Turing to propose a new sort of problem that could be described in terms of a test called the imitation game (Turing, 1950). Turing introduced the idea to develop human-machine interactions in 1950. From 1964 to 1966 Weizenbaum developed a text-based computer program named ELIZA (R. Rising et al., 1978) with which one could establish a conversation in the English language. Since then, conversational agents have continuously been the subject of research and controversial debates concerning moral aspects such as the fear of reducing the value of human interaction and communication, the limitations of dialog systems compared to real natural language interactions between humans, and others. Conversational agents, dialog systems, virtual assistants and chatbots are terms that have been used indistinctly in different papers but referring to the same concept where the basic idea is to establish a conversation with a machine in a dialogical way using natural language. Several researchers (Fadhil, 2018; Brandtzaeg and Flstad, 2017; Shawar and Atwell, 2007) have analyzed how useful chatbots can be and why people use them, finding that the major reasons are productivity, entertainment and curiosity. During 2000s several companies implemented chat services on their websites for customer service using chatbots in order to reduce the costs of having a call center and the benefits of adopting chatbots for live support were evaluated (Braun, 2003). Predictions have been made (Oracle, 2018) stating that 75% of cloud technology suppliers will enrich their current products with artificial intelligence and machine learning capabilities; chatbots will turn out to be highly specialized and with the capacity to learn and collaborate with other chatbots, and by 2020 the dominant part of customer service will be led by chatbots.

3 FUNDAMENTALS

Though there is not a universal definition for customer acquisition, one clear and simple is “the number of newly acquired customers per week” (Vries et al., 2017). Customer service, acquisition and engagement are interrelated areas always in a constant cycle. Customers have to be acquired and companies shall provide them constant quality service; moreover, responding promptly to their needs is a way to maintain them engaged and loyal. Acquisition and engagement techniques vary depending on the target market and segment of customers; thus one technique that works perfectly for one business may not necessarily work for another. Before modern technology and so-

cial networks existed, one technique was used and it is still being used in the present day: words-of-mouth. In the gastronomy industry, it is impossible to advertise the taste of a particular meal or drink, therefore people tend to review online comments about a specific restaurant or to ask directly to friends that have already visited such place. Analyzing online customers' behavior and shopping tendencies by means of artificial intelligence has become a common practice of big companies aiming to build a customer engagement ecosystem (Maslowska et al., 2016).

Chatbots are nothing more than computer programs in charge of performing specific tasks based on user input in the form of a conversation (Galindo Bello, 2018a). Chatbots are a new way to expose software services through a conversational interface (Shevat, 2017). Nevertheless, the chatbot is not to be mistaken as the service itself as it is only the interface to consume the service. In contrast to desktop applications and mobile apps, chatbots are not deployed as native applications of specific platforms. In that sense, chatbots are not installed in mobile messaging apps rather connected to these apps through an application programming interface (API). Figure 1 presents the most common architecture of a chatbot exposing its services to a messaging platform that it is used by messaging clients (apps or browser-based). This type of architecture keeps secure the clients and provides to chatbot developers a clean interface for connecting to the platform. Users may install a messaging app in different operating systems (OS) like iOS or Android, and chatbot developers do not need to worry about the client-side implementation as chatbots are OS-agnostic.

Artificial intelligence (AI) and machine learning (ML) capabilities have been enhanced during the past decades. Often people think that a chatbot is an artificial intelligent program, but that does not hold true for all chatbots. For instance, a chatbot can be implemented to take as an input the name of a city and return the current weather of that city; AI is not required in such case. Most elaborated chatbots can present the menu of a restaurant with rich interactions for each day of the week and grouped by the type of the meal. Though the menu would create chat flows, AI is not required either. Chatbot developers would choose to incorporate AI and ML capabilities depending on the goal of the chatbot.

The process to recognize human speech uses natural language processing (NLP) to derive the user's input (also known as user intent) from the natural language of the user (Shevat, 2017). NLP can be integrated into voice-based and text-based chatbots. Currently, some cloud providers offer cognitive services and they include NLP frameworks and APIs, e.g. IBM Watson Assistant (formerly Watson Conversation). Industry-leading AI powers the underlying natural language models of Watson Assistant[1] which understand users and provides training recommendations for the chatbot on the fly. There are also open source options to add NLP capabilities when developing chatbots, e.g. NLP.js is a general natural language library for Node.js. Visual authoring tools (VAT) can be used to create a chatbot without the need of knowing programming languages and connect it to different messaging platforms. Such tools offered as SaaS may have AI and NLP capabilities and are able to host the chatbots, so the user only needs to worry about the design and specific tasks that the chatbot will perform. Building a chatbot using a VAT, e.g. Chatfuel[2], can be as simple as assembling LEGO blocks.

Chatbots are different from one another in various aspects such as the implementation, e.g. a chatbot for Facebook is not implemented in the same way as one for Telegram. Also, a chatbot may have a single-user focus to serve as a personal assistant or to have a team-focus to be used in chat rooms for a particular task, e.g. a poll bot. Another difference is the way a user may interact with them and currently there are voice-based and text-based chatbots. Well-known voice-based chatbots that are currently present in smartphones are Apple's Siri and Google Assistant. Voice-based chatbots are activated by the user employing a voice command, e.g. "hey Siri", or by pressing a button. Text-based chatbots are usually present in messaging apps such as Facebook Messenger (or Messenger for short), Slack, Telegram and others, and users may start a conversation with a chatbot by writing a text message. At the time of this paper, Messenger is the leading consumer platform for chatbots (Shevat, 2017) and it provides bot-building APIs[3]. A chatbot implemented for Facebook can interact with a user through Messenger (mobile or browser-based), and this implementation connects the chatbot to a page or app inside Facebook using a webhook, which is the Messenger's core bot experience. This webhook resides inside the chatbot's code and it is used to receive and send messages.

Figure 1: Architecture of a messaging platform connected to a chatbot service.

[1]Refer to https://www.ibm.com/cloud/watson-assistant

[2]Refer to https://chatfuel.com

[3]Refer to https://developers.facebook.com/docs/messenger-platform/introduction

4 CHATBOT PROTOTYPES

Experimenting by means of a prototype is the sine qua non of the scientific prototyping method (Galindo Bello, 2018b). Nevertheless, building and deploying a chatbot are not straightforward tasks as it is required to manage the cognitive services of the interface and bind it to an external API and services of the target platform. Moreover, extensibility, scalability and maintenance have to be taken into account while engineering a full-fledged chatbot as it is a comprehensive matter worthy of a book. In order to achieve the objectives of this research, it was chosen Messenger Platform Core set of bot-building APIs. Node.js was chosen to the implement the chatbot's back-end server for handling the allocation of requests (REST API), MongoDB to store the users' data and IBM Cloud (Platform as a Service, PaaS) to deploy the chatbot as a cloud-native application and considering its cognitive services for future work. The chatbot was continuously enhanced until all requirements were incorporated. Rich interactions were added (i.e. buttons, image gallery) and a basic NLP engine was integrated to derive the user intents. Figure 2 shows the architecture of the system where a user sends messages using the Messenger platform (mobile or browser-based). The Facebook's page is linked to the webhook which receives the user's public data and processes all intents. If the user does not exist in the database, his/her information is stored.

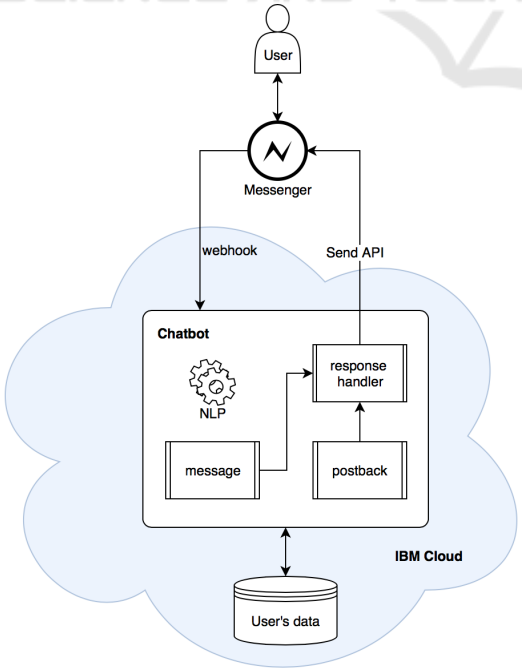

Figure 2: High-level system architecture of the implemented chatbot prototype.

The webhook receives two types of events: messages and postback messages. If the user intent contains only text, the NLP engine derives it and determines the action to be executed by the message module. This module executes the action and prepares the response payload. The response handler takes the payload and sends the response message to the user employing the Messenger's Send API. If the NLP engine cannot determine the action, the message is stored as text in the database for later analysis and the response handler sends a default message. When the user taps a button inside the conversation, the webhook receives a postback event and the postback module prepares the payload of the requested option, passes it to the response handler and the response message is sent to the user.

Once the prototype reached a mature grade and experimentation was conducted, a second prototype was required for the final experiments but utilizing a chatbot authoring tool (Software as a Service, SaaS). Chatfuel was used to jump-start the implementation of a second prototype keeping the same mature grade, quickly integrate AI/NLP capabilities and ease the data collection and analysis. Following the design of the first prototype, creating the second one was straightforward and required zero lines of code. The visual authoring tool was advantageous to quickly create rich interactions and the main menu showing the options in form of a gallery of images with buttons. An option to share the chatbot with other Messenger users was also incorporated.

5 EXPERIMENT AND RESULTS

Attributable to the nature of the system (Messenger chatbot) and its inputs (user intents), black box testing was done following a logic-based technique (cause-effect) where each user intent derives a chatbot action. System and acceptance testing were conducted with the end users and all the functional requirements were tested in both cases.

Aiming to validate the foregoing research statements, experimentation was conducted by testing the chatbot prototypes (PaaS and SaaS implementations) directly with the users in their natural environment, which in this case were customers of the university's canteen (Mensa) chosen randomly. Direct observation plus user feedback helped to detect the flaws of the prototypes. In order to improve usability and user experience, the PaaS prototype was enhanced after each test (iteration) and new users were acquired on each one. The SaaS prototype was utilized during the last iteration.

The chatbot was able to send messages on arbitrary days asking to all the reachable users to kindly respond some questions. Segmentation was done based on the users' data. Table 1 presents the final number of users and main segments. More segments were identified by employing the chatbot to ask questions only to the users that were students and only 71 answered the questions. Only 4 students indicated to have previous experience with chatbots, 59 would use a chatbot to place an order, 3 would use a chatbot to pay for an order and 65 would like to get a free beer. Users were asked about their messaging app preference and how often they are in Messenger finding that WhatsApp is the most used app with a total of 69 users, followed by Telegram with 20 users. None of the users marked Messenger as their most used messaging app, nevertheless they use it sometimes (53 users) or seldom (36 users). Qualitative data did not undergo into content analysis following a particular method; it was primarily gathered by user feedback and utilized to improve user experience and usability of the chatbot prototype. Some data were collected during the experiment at Mensa and other data were provided by the users in the form of text messages using the feedback option of the Messenger chatbot. In total, only 47 users wrote their feedback messages.

Table 1: Segmentation of Users.

Segment	Number of Users
Acquired directly at Mensa	30
Acquired by words of mouth	59
Total reachable users	89
Female / Male	51 / 38
Vegan or vegetarian	14
Enrolled in the university	80

6 EVALUATION & DISCUSSION

This section presents the validation of the hypotheses and evaluation of different parts of the research work. A comparison of the PaaS and SaaS prototypes is done to discuss which approach would be more suitable for a gastronomic business. Facebook and Chatfuel provide analytics tools, graphs and insights activity. Descriptive statistics was used to summarize all the collected data, construct the different graphs and interpret the results.

6.1 Interpretation of the Findings

During the experimentation phase a total of 30 customers were directly acquired and asked to talk with their friends about the idea of using chatbots in restaurants. Advertising was done by creating a Facebook page for the Mensa and following the technique business-to-consumer messages. Words-of-mouth was used to acquire more customers as it has proven to be one of the most effective acquisition techniques (Wangenheim and Bayn, 2007). The final number of customers increased almost 200% in a lapse of four weeks, which can be represented as an average of 22 acquired customers per week. Therefore, it can be stated that both techniques function effectively for customer acquisition as previous studies (Vries et al., 2017; Wangenheim and Bayn, 2007) demonstrated it. There were students without Facebook profiles and others who refused to participate in the experiment due to privacy concerns or just not being interested in chatbots. As it is in any other sector, users are free to choose whether or not they try a product and buy it afterwards. Messenger was not the users' first option for text-based communication notwithstanding that they have Facebook profiles. On average only 65% of all the acquired customers were re-engaged during the experimentation phase.

Gastronomic businesses have used incentives such as giving discount codes or free food if the customers provide their feedback with an online survey. This technique has proven to be effective to retain and engage customers, thus making them to come back to their establishments and consume more. Although the customers (students segment) of this experiment did not receive a free beer as an incentive, 81.2% of them indicated their desire to get it. From the same segment, only 5% indicated having used chatbots before and 73% would be willing to use them as a means to place an order. However, only 3.7% would pay an order using a chatbot due to privacy concerns.

One user asked if the Mensa chatbot could provide also the price and calories of the meals – this would be an added value for certain users. Providing the information that users want and being available at all times by means of a chatbot may help restaurants to improve their customer service and have a more effective channel of communication. This is totally congruent with previous studies (Brandtzaeg and Flstad, 2017; Fadhil, 2018; Shawar and Atwell, 2007) reporting that users employ chatbots when there is an incentive or added value.

6.2 Objectives and Hypotheses

The objective of implementing a chatbot to determine if it would be suitable for a gastronomic business was reached. It was demonstrated that it is feasible for a restaurant to offer services by means of a chatbot and

thus acquire and keep customers engaged. In the last decade restaurants have improved their service and acquired more customers by technological updates such as the adoption of mobile apps and online systems. In a similar way, it is possible to adopt chatbots as another channel of communication and customer service. Furthermore, chatbots can be used for advertising in order to acquire new customers and to create marketing campaigns in social networks and thus keeping engaged the different segments of customers. These facts from the foregoing literature were proved with the implemented chatbot, hence hypothesis 1 and 3 are valid. Previous studies state that technology may improve customer service, quality customer service attracts more customers and happy customers recommend a product or service. Therefore, by implementing a chatbot to offer 24x7 service and providing to the customers the desired information, they may continue visiting a restaurant and recommend it to others; hence hypothesis 2 is valid. The PaaS implementation of the chatbot was designed to be a platform-agnostic application and not depend on a proprietary cloud service; its modules are stateless and run inside containers which can be scaled automatically on demand; a load balancer improves the distribution of workloads and can also be scaled on demand. These capabilities for a better performance and scalability can not be configured in Chatfuel, hence hypothesis 4 is valid.

6.3 Chatbot Implementations

The PaaS prototype evolved until all functional requirements were incorporated and tested with the users. The NLP engine was limited as it does not follow powerful AI algorithms nor has ML capabilities, and in distinct occasions it did not perform properly. On repeated occasions the users wrote messages in German language and the NLP engine was not able to understand the user intents as it was only set for English. For the chatbot menu (options), it was observed that a simpler menu with options as buttons had a better usability than a menu as an image gallery. The quality of the implemented PaaS prototype was evaluated according to the standard ISO/IEC 9126-1, so the user was able to utilize the chatbot (functionality) and received correct information when using the chatbot options (reliability), the chatbot responds immediately to user inputs (efficiency), it is compliant with the system architecture (maintainability) and it can be deployed on any PaaS that supports Node.js applications and NoSQL databases (portability).

The SaaS prototype was implemented in a very short period of time thanks to the drag-and-drop features and all functional requirements were covered. The non-functional requirements were partially addressed as some parts are managed by the chatbot-building tool, i.e. hosting the chatbot, creation of a webhook, HTTPS ports and database. NLP capabilities were integrated using the tool's AI engine, however it was not able to process some user inputs and it also failed to process messages in German as it only understands English. A bug was observed on Messenger running under iOS, Android, some browsers (Safari, Chrome) and it happened randomly; some users were able to write text and others were not. The tool's documentation suggests purchasing a PRO version to solve the bug. Notwithstanding that the authoring tool truly eases the creation of chatbots, its documentation is not extensive and it is not a flexible tool. For instance, it is not possible to broadcast messages only to users celebrating their birthdays because this would require the execution of custom code, but the tool does not have such feature. Furthermore, it is not possible to export the gathered user data neither import data from other chatbot.

Which approach would be more suitable for a gastronomic business? It depends. Several aspects need to be considered such as the approximate number of initial users, who will be in charge of the implementation and maintenance and how fast it is required to go-live. An important aspect to take into account when choosing an approach is the main goal of the chatbot and the type of information that it will provide to the customers. For instance, the Mensa is the type of restaurant that changes its menu every week; this implies changing the pictures of the meals, description, ingredients, prices, calorie information and other details. For this type of restaurants, a PaaS implementation would be more suitable. Also, if there will be active advertising and engagement through notifications and target of segments, the PaaS implementation would be ideal. In the case of a small restaurant or cafeteria with menus maintaining the same products and prices over the year, then the information is static and a chatbot authoring tool would be more suitable, even at no cost when starting with a free version and considering an upgrade depending on the number of users and benefits to receive within the upgrade.

6.4 Business Perspective

Online systems have reduced the stress of making table reservations, waiting in queues at restaurants, placing orders and also making payments. It is then crucial for gastronomic businesses to keep up with technology and continue offering quality service employing different channels – chatbots adoption is one of them. Social networks have tremendously in-

creased their popularity and number of monthly active users over the past years, and it should be used by gastronomic businesses as a strategy to acquire and engage customers. Social networks and chatbots could significantly reduce the costs of traditional advertising, customer service, acquisition and engagement compared to online systems and mobile apps. For instance, a restaurant could employ a chatbot to send messages to all female customers on the International Women's Day inviting them to come and get a free beverage or special discount. This may be a win-win situation because the customers would consume more due to the special celebration. Besides saving implementation costs, gastronomic businesses should not overlook all the benefits of adopting chatbots.

7 CONCLUSION AND FUTURE WORK

In the same way that hardware has evolved from computers to mobile and wearable devices, also software has evolved and continues to do so. Companies continue to migrate their products and services to the cloud; mobile interfaces have become plain, simpler and more usable; and chatbots are becoming a common user interface as well a trend. For better or worse, AI and ML capabilities continue to grow and chatbots will become more intelligent in the next years. Companies have already started to incorporate chatbots within their Facebook business pages, websites and other social networks such as Twitter. Soon chatbots will be an essential part of customer service.

It was demonstrated in this research that users would be willing to try a new trend and use the services of a chatbot when there is added value. In the same way that restaurants use web and mobile apps to offer services, chatbots will also become another channel for communication with the potential benefit of having lower costs of implementation and maintenance compared to web and mobile applications.

Running different modules of the system in containers makes it easy to manage and secure applications independently of the infrastructure that supports them. With this approach, if one module is down (fails), others can continue working while the failed module gets restarted. Cloud-native capabilities such as Serverless allow running dynamic workloads and pay-per-use compute time in milliseconds. As part of the future work, the implemented PaaS chatbot is being redesigned following cloud software engineering principles to migrate it fully to a microservice architecture and thus target more instant messaging apps.

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