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IMPROVING SERVICE QUALITY MANAGEMENT BASED ON CALL CENTER MONITORING SOLUTION

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Annotation. The presented paper investigates common call center challenges ranging from management to software and agents. Service quality is a complex and multifaceted construction that has a major impact on customer acquisition, retention and loyalty. Because there are a few different factors that influence service quality, call center managers must know what they are before they can work to optimize them. As an important part of any business is communication, both within the organization and with customers and clients, a feature-rich, advanced Private Branch Exchange (PBX) phone system is of great benefit. Call Centers are one of the most commonly used implementations of PBX systems in businesses of any type, shape and size. We suggest an efficient and secure solution for collecting, processing, storing, analyzing and visualizing data from call centers. The proposed approach is driven by applying the type of IP PBX engine based on Asterisk. AWS cloud hosted clustering approaches and load balancing system algorithms have been studied in order to mitigate progressively growing load indicators as we add more customers and thus real data sources to the system. The ELK Stack has been chosen as the optimal approach: it is open source and covers a need in the log management and analytics space. The proposed solution will help to automate the call flow process, where it is necessary, based on the analysis of the collected call centers data. The monitoring results obtained along with the particular call center structure knowledges gives us an opportunity for improving call strategies such as ACDs and IVRs, filling agent's knowledge gaps, eliminating the absence of well-defined practices of call handling, etc. It also eliminates the need to hire additional staff or outsource call centers to share the load.

Keywords: Asterisk, call center monitoring, data, ELK stack, IP PBX engine, REST API, module, service quality management.

Introduction

Companies often introduce new products to maintain competitiveness. However, it is the service quality and the resulting customer satisfaction that are decisive for long-term business success. Service quality management encompasses a variety of procedures to assess the quality of services according to customer expectations. Moreover, companies profit from the additional benefit of getting to know their target audiences much better along the way. Lastly, continuous service quality management enables companies to identify and reduce sources of errors and customer complaints. Service quality is a complex and multifaceted construction that has a major impact on customer acquisition, retention, and loyalty. Because there are a few different factors that influence service quality, call center managers must know what they are before they can work to optimize them. Any imaginable goods or service provider in any sphere of business or public activity relies on call centers to a certain degree – they help build partner-customer relationships, provide technical assistance, and even save lives.

Problem statement

As an important part of any business is communication, both within the organization and with customers and clients, a feature-rich, advanced Private Branch Exchange (PBX) phone system is of great benefit. Today, PBX solutions have undergone a mini-revolution of their own. You might come across “cloud PBX” or “virtual PBX” systems, which are basically PBX systems that tacked on the ability to use the Internet to make calls. This technology is called VoIP (Voice over Internet Protocol). An IP PBX is a communication device that uses VoIP to establish connectivity to public telephone

networks. IP PBX supervises calls across its private network. IP PBX phone systems place and receive calls over VoIP and convert analog signals to digital signals.

Call Centers are one of the most commonly used implementations of PBX systems in businesses of any type, shape and size. A call center is a centralized department to which phone calls from current and potential customers are directed. Call centers can handle inbound and/or outbound calls, and be located either within a company or outsourced to another company that specializes in handling calls [1, 2].

Agents in an inbound call center may handle calls from current or potential customers regarding accounts management, scheduling, technical support, complaints, queries about products or services, or intent to purchase from the company. In an outbound call center, an agent makes calls on behalf of the company or client for tasks, including lead generation, telemarketing, customer retention, fundraising, surveying, collecting debts or scheduling appointments. To maximize efficiencies, calls are usually made with an automated dialer and then transferred to an available agent via an IVR (Interactive Voice Response) system once a connection with a person is established. The first factor that influences service quality in the call center is the degree of accessibility of the agents. This construction is positively correlated with the service quality: the more it accessible, the higher the service quality is. The degree of accessibility of a team takes into account the items shown in Fig. 1.

Measuring call center QoS (Quality of Service) and efficiency is not straightforward [4]. Multiple studies are needed to be conducted to identify the main factors and metrics on which the overall customer satisfaction depends: served versus answered call ratio; time in queue; time on hold; first call resolution ratio; amount of callbacks and transfers; average call length, etc. [5].

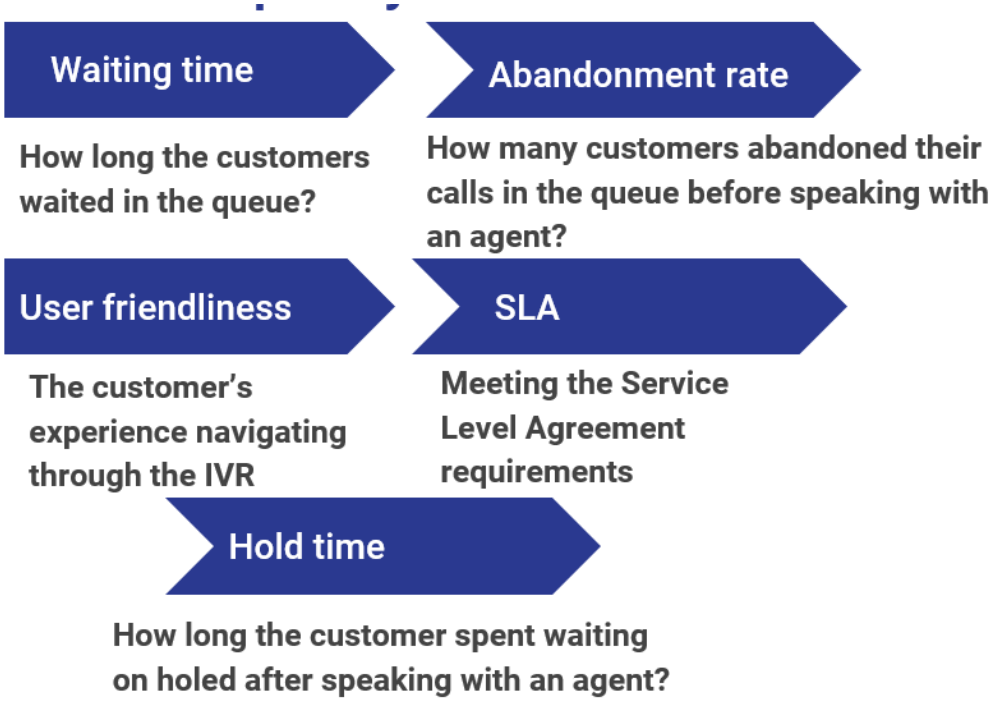

Fig. 1. Call center quality assurance components.

While there are worldwide recognized studies and implemented approaches, the way of acquiring data from call centers is usually very unique, as it needs to match the set of tools and phone system used. Designing and assembling a solution to reliably collect, process, store, and analyze this data will improve communication and increase efficiency.

Call center monitoring solution for service quality management system

The proposed solution (Fig. 2) is driven by applying the type of IP PBX engine based on Asterisk. Asterisk is an IP PBX system used by companies of all sizes to improve their communication, including Google, Yahoo, IBM, etc. Asterisk is a Linux-based open source platform that enables Linux administrators, developers, and power users to set up a private VoIP system in an enterprise. Asterisk is more customizable than other telephony platforms, with features like voicemail and call queues built into the software.

The ELK Stack has been chosen as the most optimal approach: it is open source and fulfills a need in the log management and analytics space. A combination of Elasticsearch, Logstash and Kibana provides great scalability and load management, and is an amazing toolkit for very diversified customer needs in terms of types of data pulled, building graphs and visualizations, scheduled reports, etc. [3].

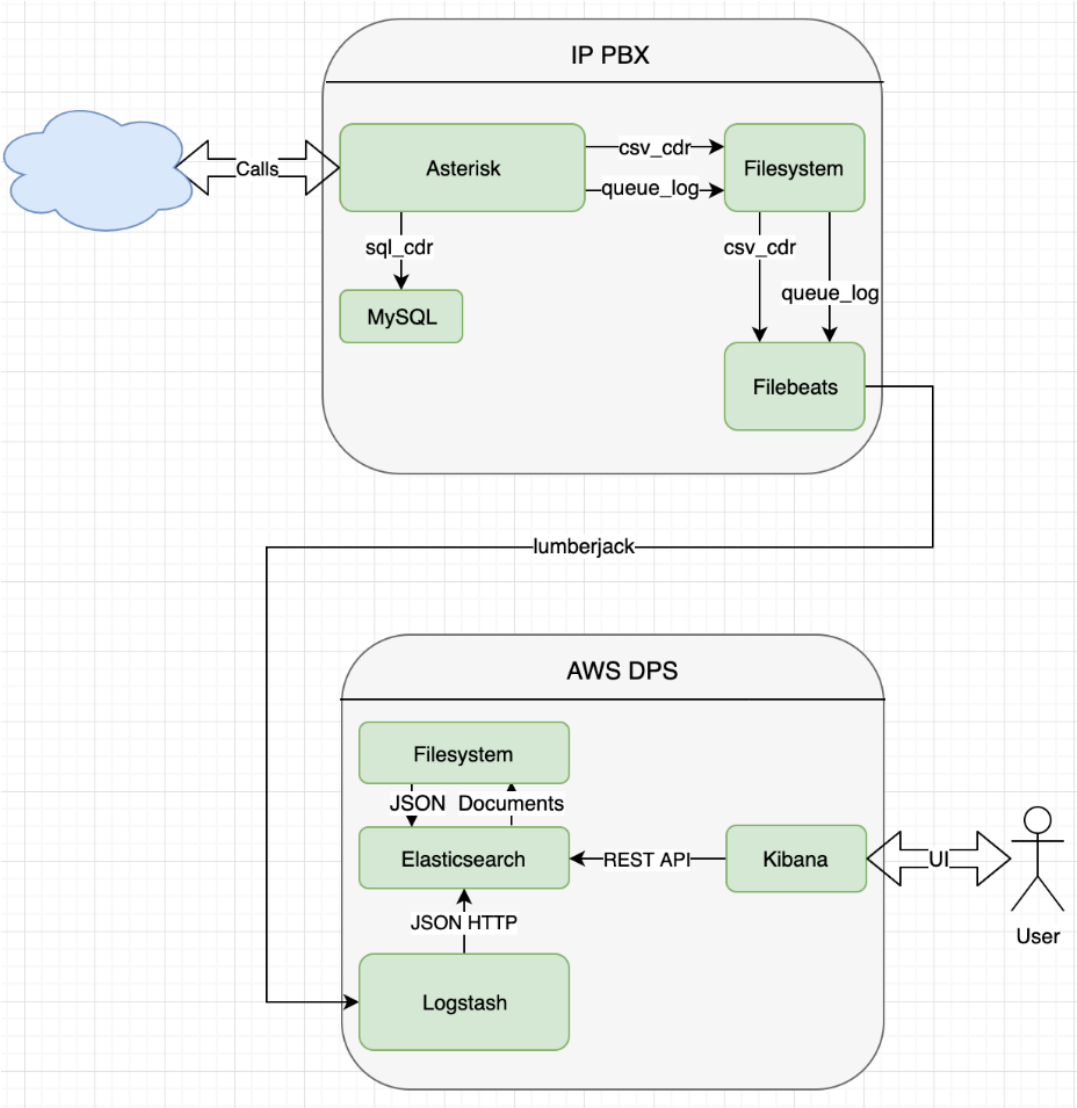

Fig. 2. Call center monitoring solution overview scheme.

Collecting call data and storing it in the filesystem is performed using the Asterisk's default logger module [4]. We are collecting two different types of data: the first one is queue-log data and the second one is CDR (Call Data Records) csv-data. In order to properly manage ACD (Average Call Duration) queues, it is important to be able to

keep track of details of call setups and teardowns in much greater detail than traditional call detail records provide. In order to support this, extensive and detailed tracing of every queued call is stored in the queue log.

By default, Asterisk generates CDR records in comma-separated text files. Detailed records can be partially configured on a channel basis, and some of the data for IAX (Inter-Asterisk eXchange protocol) and SIP (Session Initiation Protocol) can be determined on the user level. To provide this opportunity, we add a supplemental module and configure the output pattern (defining all the fields and the order in which they need to be stored).

Logstash is the world's most popular log analysis platform and it is responsible for aggregating data from different sources, processing it, and sending it down the pipeline, usually to be directly indexed in Elasticsearch [8]. Logstash can pull data from almost any source using input plugins, apply a wide variety of data transformations and enhancements using filter plugins, and deliver the data to a large number of destinations using output plugins.

Beats is a lightweight Logstash-like tool, whose main and only purpose is to transform data stored in plain text from the filesystem into lumberjack protocol (a protocol specifically designed for transporting data between Logstash instances) compliant with json-like messages to be transported to a Logstash server.

It is decided to move Logstash to a dedicated server as it requires JVM (Java Virtual Machine) to be installed on the machine. The reasons behind the move are as follows. First, it is overload of CPU and RAM, while the goal is to keep PBX instances as small as possible since it is a hosted solution. Second, one centralized scalable cluster is easier to maintain rather than a large number of separate ones. Thus, Filebeat appears to be the best fit-for-purpose here. Filebeat also adds metadata to the message to be used for identification later on, such as a Unix timestamp, PBX domain name, serial number.

Another important part herein is to encrypt data for secure transferring. To resolve this issue, we use authority signed SSLv3 certificates.

Logstash processing job is done by using JVM engine and it is conducted according to a specific set of rules. This set of rules is built knowing the pattern of queue-log and CDR csv-messages coming from the PBX. It is a list of "if-statements" designed to accurately process every message in a way that would make the outcome data most usable by Elastic and Kibana searching capabilities [9].

Elasticsearch is designed to index, store and retrieve messages processed by Logstash into a NoSQL file system (in JSON format). In order to make the data workflow more understandable and accessible to call center senior management, rather than the complex set of REST API requests used by Elasticsearch, Kibana is used in the proposed solution. Kibana provides us with a set of tools for filtering output by fields, ordering data based on our needs, scheduling reports, designing visualizations and graphs, saving search patterns, creating user roles and indexes.

t	host.architecture	x86_64
◑	host.containerized	false
t	host.id	ec2036fcd068be65bda5799c596435ef
t	host.name	ipa
t	host.os.codename	stretch
t	host.os.family	debian
t	host.os.name	Debian GNU/Linux
t	host.os.platform	debian
t	host.os.version	9 (stretch)
t	input.type	log
t	log.file.path	/var/log/callweaver/queue_log
t	message	1560454941|wildixbox-1560454743.591940|1|Local/2005@internalcalls|RINGNOANSWER|30000

Fig. 3. An example of the Logstash results data.

Results and discussion

An example of the Logstash results data (the set of "key:value" pairs) is presented in Figure 3. Figure 4 shows an example of a search based on this data (we query for "*source=queue_log and event=RINGNOANSWER*" for the last 15 minutes) which includes agent ID, queue number and timestamp-data (date and time parts). A visualization of the amount of unanswered calls per 30 seconds in the last 15 minutes is presented in Figure 5.

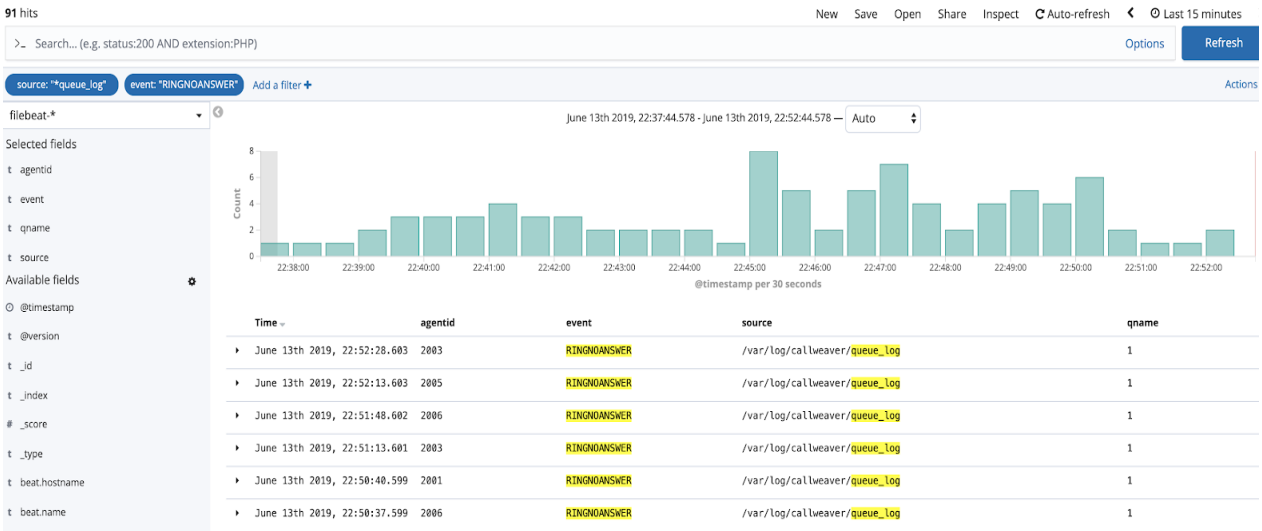

Fig. 4. An example of Kibana search outcomes.

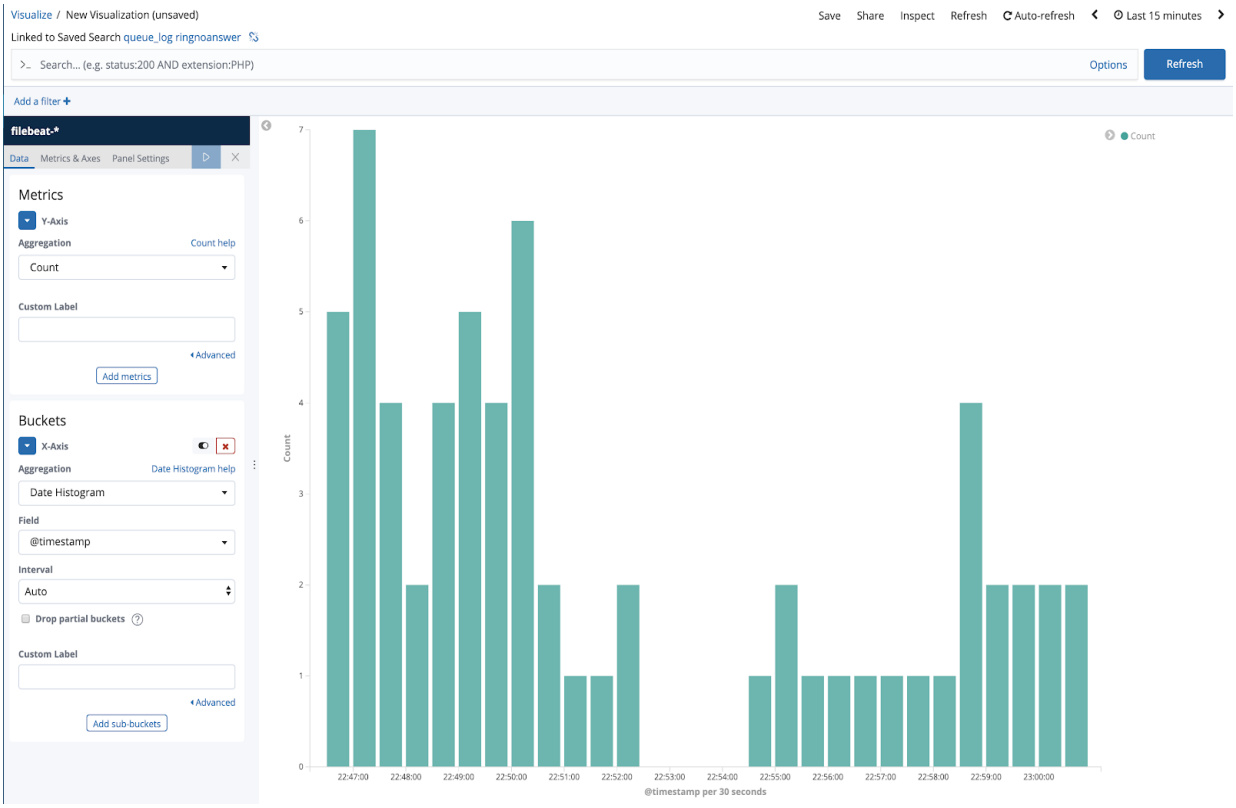

Fig. 5. The monitoring results obtained with visualization based on Kibana outcomes.

We also could create a dashboard off the visualization and export it as a browser widget that can be embedded into a webpage or used as a scheduled report for quick access. The monitoring results obtained along with the particular call center structure knowledges gives us an opportunity for improving call strategies such as ACDs and IVRs, filling agent's knowledge gaps, eliminating the absence of well-defined practices of call handling, etc.

Conclusion

In this paper common call center challenges ranging from management to software and agents are investigated. We have suggested an efficient and secure solution for collecting, processing, storing, analyzing and visualizing queue data outside of IP PBXs. AWS cloud hosted clustering approaches and load balancing system algorithms have been studied in order to mitigate progressively growing load indicators as we add more customers and thus real data sources to the system.

Typically, analytic processes are becoming a slow down as the amount of data a system handles continues to increase. The proposed solution architecture uses the ELK stack to improve these analytic processes. The solution will help to automate the call flow process, where it is necessary, based on the analysis of the collected call centers data. It also eliminates the need to hire additional staff or outsource call centers to share the load.

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