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OTP as a Service in the Cloud Allows for Authentication of Multiple Services

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Annotation: Users no longer trust traditional password-based authentication methods since so many online services now interact with one another. Credentials obtained online are often used to reclaim additional credentials, and sophisticated assaults often target the weakest of a large number of available credentials. One-time passwords and a two-factor authentication mechanism appear to be a natural improvement over traditional username/password schemes, thus researchers are looking into them. The OTP verifier is deployed to the cloud in this manuscript to facilitate its use by cloud service providers. OTP providers can outsource their OTP deployments to the cloud and cloud customers can activate their accounts on the OTP provider across many cloud services when the OTP verifier is hosted in the cloud as a service. This lets them take advantage of multiple cloud services without having to juggle multiple OTP accounts. Alternatively, OTP service provision prevents novice SMEs from overspending on OTP provisioning hardware, software, and staff. This paper presents the architecture necessary to create a trustworthy OTP provider in the cloud, one that respects users' right to privacy. The OTP provider registration, activation, and authentication processes for cloud users are examined. We define and evaluate the privacy and security implications of the suggested architecture. With these assumptions in place, attacks from unknown sources, user profiles with unlinkable features, inquisitive service providers, and OTP verifiers are all thwarted. The analysis ensures the reliability and validity of the proposed solution, which places the OTP supplier in the cloud.

Keywords: OTP, Cloud, Authentication, Multiple Services, Hardware, Software, Modern Security Measures.

Introduction

The primary objective of this work is to provide a trustworthy OTP provider in the cloud that can be used to delegate the use of the second authentication factor [1]. A common type of multi-factor authentication is two-factor authentication [2-4]. The goal of this proposed architecture is to make it easier for smaller and medium-sized organisations to implement an OTP solution for their own authentication needs [5-12]. Many social, tailored, or opportunistic assaults can compromise current authentication techniques such as the traditional knowledge factor [13]. It's also quite pricey to make the switch from antiquated infrastructure to modern security measures [14-17].

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Volume: 5 Issue: 4 | April 2023

Expertise, possession, and inherence are three methods that can be used for user authentication [18]. As its name implies, the know-how requirement for identity verification demands for some sort of information that a user should be familiar with [19-21]. Common activities like entering login information fall within this category. This approach assumes the username is known to the public and the password is known only to the user. Providing they only have the password for the relevant software, authentication is foolproof. However, as our experiences in the real world have taught us, passwords aren't always easy to keep safe, and the human mind isn't great at juggling a lot of different passwords for different services [22-27]. In 2-factor authentication, one of the most popular possession components is the use of one-time passwords (OTPs), which can authenticate owners by having them verify their possession of a pre-shared advantage. Token-based authentication (TFA) is a common type of multi-factor authentication (MFA) [28]. Training data will consist of the well-known username and password combination [29-31]. Since this is the most widely used method of authentication, it is included in and made available by nearly every TFA implementation. Multi-factor authentication for end-users and the cloud has been implemented using this proposed approach [32-35].

The suggested approach allows businesses to save money on the OTP-based TFA transition from the employee training, hardware, and software points of view [36-39]. Users may also easily manage many accounts in one spot, albeit with profiles that aren't particularly appealing. Many cloud service providers may find it easier to use OTP in large quantities if they are able to outsource the service to the cloud, where they can avoid making costly upfront investments [40]. The proposed method works well as a two-factor authentication security mechanism and comes with a wide variety of settings to tweak [41-47]. Regular password management, credential management, and other similar features are just the beginning of what user profiles on user devices can be used for [48].

Literature Survey

In this research, we offer a unique challenge/response-based OTP mutual authentication technique. Users and servers exchange hashes of random sub-passwords generated by the technique. The approach generates generally independent OTPs by executing modular algebraic operations on two or more randomly generated sub-passwords [49-53]. Used sub-passwords are rotated out and replaced with fresh ones using a random permutation mechanism. Numerous one-time passwords (OTPs) can be generated from tens of randomly generated sub-passwords. A microprocessor installed at the client terminal can handle all the data storage and processing. Simultaneously, the scheme can offer adequate protection for common uses [60-65].

Twenty years of study haven't solved the problem of creating a reliable anonymous two-factor authentication solution. The designers must contend with a lengthy wish list of features and strict security requirements [66-71]. While several solutions have been presented, most fall short in either meeting all necessary security standards or providing all necessary functionality. Without addressing the underlying question of whether or not we are limited in our ability to develop a "ideal" scheme that achieves all the required aims, scholars typically work around this unsatisfactory scenario in the hopes of a fresh suggestion [72-75]. According to our findings, it is impossible to achieve some objectives using the standard adversarial paradigm. To the best of our knowledge, this research is the first step toward elucidating the underlying evaluation metric for anonymous two-factor authentication, which we expect will lead to the improved design of anonymous two-factor protocols that provide suitable trade-offs among usability, security, and privacy [76-81].

Compared to other forms of authentication, such as those based on goods or knowledge, biometrics authentication has various advantages [82-87]. Employee ID cards are commonly accepted as proof of identity in the traditional sense. The same password may be used for years by a big group of coworkers without needing to be changed. One of biometrics authentication's main benefits is that it is both unreliable and easy to use. However, there are specific security risks unique to biometrics that must be taken into account while using such systems. Brute-force assaults against biometrics systems are discussed, however the majority of these dangers arise from the system's reliance

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Volume: 5 Issue: 4 | April 2023

on digital signals and the necessity of extra input devices. All pattern recognition systems have their share of problems. We now add "chameleons" to the list, which also includes "wolves" and "lambs." When enrolling with biometrics, users must submit an image of a private body portion, which raises privacy concerns [88-95].

We take a look at the issue of acoustic reverberations from keyboards. We introduce a unique technique that can recover up to 96% of typed characters from a 10-minute audio recording of a user typing English text on a keyboard. A labelled training recording is unnecessary [96-99]. The recognizer bootstrapped in this manner is so advanced that it can decipher passwords and other forms of random text. In our experiments,90 percent of 5-character random passwords using only letters can be generated in fewer than 20 attempts by an adversary; 80 percent of 10-character passwords can be formed in fewer than 75 attempts. To rebuild text from sound recordings without labelled training data, our attack leverages the statistical restrictions of the underlying content, the English language [100]. Cestrum features, Hidden Markov Models, linear classification, and feedback-based incremental learning are only some of the typical machine learning and speech recognition approaches that are employed in this attack [101-105].

Cryptographic methods of authentication have many potential applications. This paper presents authentication protocols that rely on one-time passwords, which are more secure than the more usual fixed passwords. Leslie Lampard suggested utilising one-way functions to obtain one-time passwords in his paper Password Authentication using Insecure Communication [106-111]. These tasks frequently employ cryptographic hash functions due to their ease of use. After discussing the drawbacks of using hash functions, a more versatile one-time password system will be obtained by employing functions on groups of composite numbers [112-119].

Proposed Model

The suggested approach allows businesses to save money on the OTP-based TFA transition from the employee training, hardware, and software points of view. Users may also easily manage many accounts in one spot, albeit with profiles that aren't particularly appealing [120-123]. Many cloud service providers may find it easier to use OTP in large quantities if they are able to outsource the service to the cloud, where they can avoid making costly upfront investments. The proposed method works well as a two-factor authentication security mechanism and comes with a wide variety of settings to tweak [124-129]. Regular password management, credential management, and other similar features are just the beginning of what user profiles on user devices can be used for [130].

Credentials obtained online are often used to reclaim additional credentials, and sophisticated assaults often target the weakest of a large number of available credentials. The ability to withstand DoS assaults, corrupt insiders, third-party access, and OTP replay/liven attacks, among other threats, is essential. The old method of logging in using a username and password is now obsolete [131-135].

In this section, requests from owners with varying levels of security will be owned by cloud proprietors. Owners of cloud storage services will check user credentials and validate the scanned documents phase. They will abandon computer user requests if they cannot find relevant paperwork and accurate information [136-141]. If the user's request is approved by the cloud, a unique user ID will be generated and sent to them through email. Consumption may be eligible to make use of lengthy special criteria based on consumer protection choice. If his security is high, he is free to use any of the basic protections available to him. Both software and hardware components of this system are required for development [142].

The software products' needs are laid out in technical detail in the requirements specification. In the first phase of requirements analysis, you document the features, capabilities, and constraints that your software system must meet [143-151]. User, operational, and administrative use cases are also provided in the requirements. The software requirements specification describes the software project in great detail, including its scope, characteristics, and objectives. This document details the project's intended users, interface, and necessary gear

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Volume: 5 Issue: 4 | April 2023

and software. It describes the project from the perspective of the client, the team, and the target audience [152-159].

Tomcat provides an environment for Java code to execute in tandem with a web server by implementing the Sun Microsystems servlet and Java Server Pages specifications [160]. It's possible to alter its settings by modifying its configuration files, which are typically written in XML format. Tomcat is a standalone web server in addition to having its own built-in HTTP server.

Design is the process of specifying a system's structure, parts, modules, interfaces, and data in order to meet those needs. The design documents the system's architecture, its functions, and the modules that make it up. In what follows, you'll find specifics on how each of the four models is constructed [161-166].

In-depth process definition and a bird's-eye view of the model's operations are provided by the system architecture [167].

Refining the designs, specs, and estimations are all part of the detailed design process. For easier comprehension of the modules' features, they are diagrammatically described [168].

The Case in Point A diagram is a graphical representation of the players, their goals, and the dependencies between use cases that make up a system.

There are two sections to a use case diagram:

Example of Use: Use cases, typically represented by a horizontal ellipse, outline a set of steps that benefit a user in some measurable way.

An actor is any entity outside of the system that participates in or influences any aspect of the system's behaviour (fig.1).

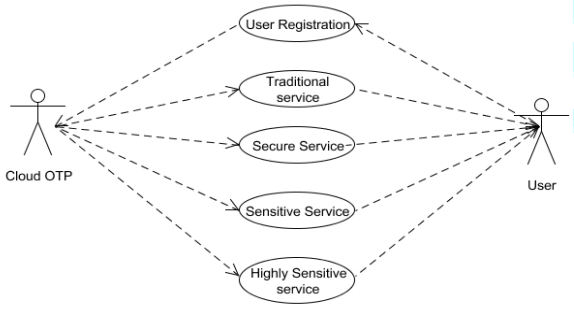

Fig. 1: Use Case Diagram

An example of an interaction diagram, a Sequence diagram illustrates the sequential execution of many operations. Message Sequence diagrams, also known as event diagrams, event scene diagrams, and timing diagrams, are where this concept first appeared [169-171].

Class diagrams in the Unified Modelling Language are a sort of static structural diagram that show the classes, attributes, operations (or methods), and interactions between objects that make up a system's structure [172-175].

Workflows can be represented graphically using activity diagrams, which allow for branching, iteration, and concurrent processing of a series of activities and actions. A control flow is depicted in an activity diagram [176].

The connection and cooperation between software components are depicted in UML Collaboration Diagrams. In order for them to work, there must first be established use cases, system operation contracts, and domain models.

https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071
Volume: 5 Issue: 4 | April 2023

The collaboration diagram shows how classes and objects communicate with one another through the exchange of messages [177-181].

Result and Discussion

Credentials obtained online are often used to reclaim additional credentials, and sophisticated assaults often target the weakest of a large number of available credentials [182-184]. The ability to withstand DoS assaults, corrupt insiders, third-party access, and OTP replay/liven attacks, among other threats, is essential [185-189]. The suggested approach allows businesses to save money on the OTP-based TFA transition from the employee training, hardware, and software points of view. Users may also easily manage many accounts in one spot, albeit with profiles that aren't particularly appealing. Many cloud service providers may find it easier to use OTP in large quantities if they are able to outsource the service to the cloud, where they can avoid making costly upfront investments [190]. The proposed method works well as a two-factor authentication security mechanism and comes with a wide variety of settings to tweak. Regular password management, credential management, and other similar features are just the beginning of what user profiles on user devices can be used for [191-194].

In this section, the user must sign up for a cloud account by entering certain personal information. After a user registers, loud creates a unique token based on the user's information and gives it to the user via email. After receiving the token via email, the user will wish to enter it to verify his identity [195]. If he enters an invalid token, his information will not be saved to the cloud. If a valid token is entered, the user is presented with a menu from which to select various securities. The next step in the security process is for the user to verify their identity using a captcha and a cloud OTP.

In this section, cloud operators will field requests from customers using a wide range of security settings. The cloud service providers will check the user information and the documents one by one. If they cannot locate the necessary paperwork and information, they will reject the user's request. In the event that the cloud service provider grants the request, the user will be issued a unique UID. Depending on the user's chosen level of security, they may be able to make use of the system for the designated applications.

In this section, the user will open a bank account and deposit the funds into the account. The user's mobile phone number will only be used once during the registration process of a chat app with traditional security, and the cloud will only verify the user once using the classic cloud OTP service. When using a chat app, we can open individual messages and read them by touching on them. In addition, we can send a voice message by transcribing audio into text.

The virtual supermarket is a safe OTP service for online food shopping. Users can browse available products, add selected items to their shopping carts, and discard unwanted items. Users also have the option to modify the quantity of items in their shopping basket. Both modern and time-tested commerce standards are supported by this e-commerce platform. All purchases will require your approval. NEFT Transaction is a secure OTP service software that can instantaneously transfer funds to a recipient's bank account. The current account balance can also be viewed. This stringent safety provides access to all the benefits of a reliable, standard OTP service. Every time a user logs in, he will be prompted to give his consent or not. The Bank app features a feature dubbed "online bank account creation," which allows the user to provide KYC information without physically visiting a branch. If he already has a highly secure cloud account, he can simply submit his cloud service and user UID to the bank and import all of his data. OTP can be obtained by the user if he provides specifics. All of your KYC information will be transferred into the banking app once you've completed the OTP process.

Hashed or Hash-based Message Authentication Code is the acronym for the HMAC algorithm. It is the product of research into cryptographic hash functions, which led to the development of a MAC. Since HMAC employs the Hashing idea twice, it is extremely resistant to cryptanalysis attempts. HMAC is more secure than any other

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Volume: 5 Issue: 4 | April 2023

authentication code since it combines the advantages of Hashing and MAC. HMAC is required to be used for IP security as of the publication of RFC 2104.

TOMCAT 7.0 and MYSQL 5.0 are used in the studies. Toolbox, which is included in TOMCAT, is used to carry out the computations. User credentials for accessing an environment built using the proposed system, as well as a sample one-time password built to test the computation response, can be entered in the login screenshot. When the OTP was used with the Cloud Application, access was preplanned along with security terms and the output image. The data is then trained using a common strategy across all methods. Some data is saved for use in training, while the rest is used to put theories to the test. Therefore, the outcome agrees with the predicted one, and the desired level of security is attained in comparison to the baseline model.

Conclusion

Small and medium-sized enterprises, as well as individual users, can benefit from cloud-based OTP services by making the switch from a username/password authentication strategy to an OTP-based two-factor authentication plan. The security and privacy concerns associated with moving the OTP application to the cloud have been taken under serious consideration. Imperfections that can be achieved are discussed, as are the consequences of doing so. There has been talk about preventative measures and reasonable solutions. Note that the proposed architecture doesn't address the issues with learning vulnerability or wondering strikes that plague conventional username/password combinations. On the other hand, these problems will emerge if another component of standard authentication is implemented. This is standard practise because conflicts stemming from human dynamics are notoriously tricky to prevent. The attack model and a realistic scenario for its application are established. The necessary safeguards for a standard OTP provision in the cloud are specified.

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