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A Novel Approach to Privacy Preserving Ranked Multi-Keyword Search Using Multiple Data Owners in Cloud Computing

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ABSTRACT:

With the advent of cloud computing, it has become increasingly popular for data owners to outsource their data to public cloud servers while allowing data users to retrieve this data. For privacy concerns, a secure search over encrypted cloud data has motivated several research works under the single owner model. However, most cloud servers in practice do not just serve one owner; instead, they support multiple owners to share the benefits brought by cloud computing. In this paper, we propose schemes to deal with Privacy preserving Ranked Multi-keyword Search in a Multi-owner model (PRMSM).

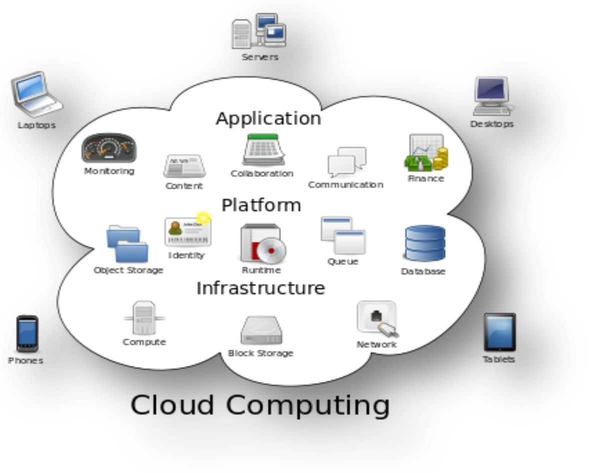
To enable cloud servers to perform secure search without knowing the actual data of both keywords and trapdoors, we systematically construct a novel secure search protocol. To rank the search results and preserve the privacy of relevance scores between keywords and files, we propose a novel Additive Order and Privacy Preserving Function family. To prevent the attackers from eavesdropping secret keys and pretending to be legal data users submitting searches, we propose a novel dynamic secret key generation protocol and a new data user authentication protocol. Furthermore, PRMSM supports efficient data user revocation. Extensive experiments on real-world datasets confirm the efficacy and efficiency of PRMSM.

INTRODUCTION

What is cloud computing?

Cloud computing is the use of computing resources (hardware and software) that are delivered as a service over a network (typically the Internet).

The name comes from the common use of a cloud-shaped symbol as an abstraction for the complex infrastructure it contains in system diagrams. Cloud computing entrusts remote services with a user's data, software and computation. Cloud computing consists of hardware and software resources made available on the Internet as managed third-party services. These services typically provide access to advanced software applications and high-end networks of server computers.



Structure of cloud computing

How Cloud Computing Works?

The goal of cloud computing is to apply traditional supercomputing, or high-performance computing power, normally used by military and research facilities, to perform tens of trillions of computations per second, in consumer-oriented applications such as financial portfolios, to deliver personalized information, to provide data storage or to power large, immersive computer games.

The cloud computing uses networks of large groups of servers typically running low-cost consumer PC technology with specialized connections to spread data-processing chores across them. This shared IT infrastructure contains large pools of systems that are linked together. Often, virtualization techniques are used to maximize the power of cloud computing.

Characteristics and Services Models:

The salient characteristics of cloud computing based on the definitions provided by the National Institute of Standards and Terminology (NIST) are outlined below:

- **On-demand self-service**: A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service's provider.
- **Broad network access**: Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, laptops, and PDAs).
- **Resource pooling**: The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location-independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or data center). Examples of resources include storage, processing, memory, network bandwidth, and virtual machines.
- **Rapid elasticity**: Capabilities can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out and rapidly released to quickly scale in. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be purchased in any quantity at any time.

Measured service: Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be managed, controlled, and reported providing transparency for both the provider and consumer of the utilized service.

EXISTING SYSTEM:

- Secure search over encrypted data has recently attracted the interest of many researchers. Song et al. first define and solve the problem of secure search over encrypted data. They propose the conception of searchable encryption, which is a cryptographic primitive that enables users to perform a keyword-based search on an encrypted dataset, just as on a plaintext dataset. Searchable encryption is further developed.
- Secure search over encrypted cloud data is first defined by Wang et al. and further developed. These researches not only reduce the computation and storage cost for secure keyword search over encrypted cloud data, but also enrich the category of search function, including secure ranked multi-keyword search, fuzzy keyword search, and similarity search.

DISADVANTAGES OF EXISTING SYSTEM:

- Existing schemes are concerned mostly with single or boolean keyword search.
- All the existing schemes are limited to the single-owner model. As a matter of fact, most cloud servers in practice do not just serve one data owner; instead, they often support multiple data owners to share the benefits brought by cloud computing.

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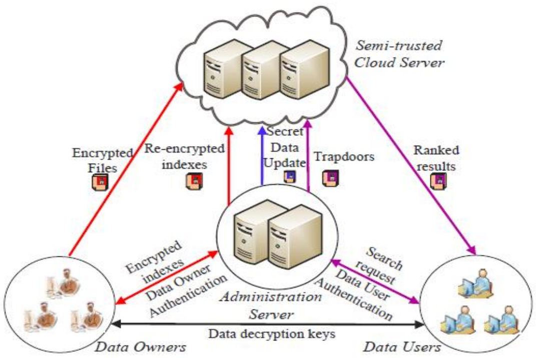
PROPOSED SYSTEM:

- In this paper, we propose PRMSM, a privacy preserving ranked multi-keyword search protocol in a multi-owner cloud model.
- We define a multi-owner model for privacy preserving keyword search over encrypted cloud data.
- We propose an efficient data user authentication protocol, which not only prevents attackers from eavesdropping secret keys and pretending to be illegal data users performing searches, but also enables data user authentication and revocation.
- We systematically construct a novel secure search protocol, which not only enables the cloud server to perform secure ranked keyword search without knowing the actual data of both keywords and trapdoors, but also allows data owners to encrypt keywords with self-chosen keys and allows authenticated data users to query without knowing these keys.
- We propose an Additive Order and Privacy Preserving Function family (AOPPF) which allows data owners to protect the privacy of relevance scores using different functions according to their preference, while still permitting the cloud server to rank the data files accurately.
- We conduct extensive experiments on real-world datasets to confirm the efficacy and efficiency of our proposed schemes.

ADVANTAGES OF PROPOSED SYSTEM:

- The proposed scheme allows multi-keyword search over encrypted files which would be encrypted with different keys for different data owners.
- The proposed scheme allows new data owners to enter this system without affecting other data owners or data users, i.e., the scheme supports data owner scalability in a plug-and-play model.
- The proposed scheme ensures that only authenticated data users can perform correct searches. Moreover, once a data user is revoked, he can no longer perform correct searches over the encrypted cloud data.
- To enable cloud servers to perform secure search without knowing the actual value of both keywords and trapdoors, we systematically construct a novel secure search protocol. As a result, different data owners use different keys to encrypt their files and keywords. Authenticated data users can issue a query without knowing secret keys of these different data owners.
- To rank the search results and preserve the privacy of relevance scores between keywords and files, we propose a new additive order and privacy preserving function family, which helps the cloud server return the most relevant search results to data users without revealing any sensitive information.
- To prevent the attackers from eavesdropping secret keys and pretending to be legal data users submitting searches, we propose a novel dynamic secret key generation protocol and a new data user authentication protocol.

SYSTEM ARCHITECTURE:



IMPLEMENTATION

MODULES:

- System Model
- Data User Authentication
- Illegal Search Detection
- Search over Multi-owner

MODULES DESCRIPTION:

System Model

- ✓ In the first module, we develop the System Model to implement our proposed system. Our System model consists of Admin, users, data owners, and Cloud Servers. Admin provides the accessibility to Data-owners. Initially Data-owner needs to register and admin approves the each data owner request. The respective Password and login credentials will be sent to the Email ID of Data owner.
- ✓ In Users sub-module, Each user has a global identity in the system. A user may be entitled a set of attributes which may come from multiple attribute authorities. The user will receive a secret key associated with its attributes entitled by the corresponding attribute authorities.
- ✓ In data owners sub-module, the proposed scheme should allow new data owners to enter this system without affecting other data owners or data users, i.e., the scheme should support data owner scalability in a plug-and-play model.
- ✓ In Cloud Server sub-module of system model, the owner sends the encrypted data to the cloud server through Admin. They do not rely on the server to do data access control. But, the access control happens inside the cryptography. That is only when the user's attributes satisfy the access policy defined in the cipher text; the user is able to decrypt the ciphertext. Thus, users with different attributes can decrypt different number of content keys and thus obtain different granularities of information from the same data.

Data User Authentication

- ✓ To prevent attackers from pretending to be legal data users performing searches and launching statistical attacks based on the search result, data users must be authenticated before the administration server re-encrypts trapdoors for data users. Traditional authentication methods often follow three steps. First, data requester and data authenticator share a secret key, say, k0. Second, the requester encrypts his personally identifiable information d0 using k0 and sends the encrypted data (d0)k0 to the authenticator. Third, the authenticator decrypts the received data with k0 and authenticates the decrypted data.
- ✓ The key point of a successful authentication is to provide both the dynamically changing secret keys and the historical data of the corresponding data user.

Illegal Search Detection

- ✓ In our scheme, the authentication process is protected by the dynamic secret key and the historical information. We assume that an attacker has successfully eavesdropped the secret key. Then he has to construct the authentication data; if the attacker has not successfully eavesdropped the historical data, e.g., the request counter, the last request time, he cannot construct the correct authentication data. Therefore this illegal action will soon be detected by the administration server.
- ✓ Further, if the attacker has successfully eavesdropped all data of Uj , the attacker can correctly construct the authentication data and pretend himself to be Uj without being detected by the administration server. However, once the legal data user Uj performs his search, since the secret key on the administration server side has changed, there will be contradictory secret keys between the administration server and the legal data user. Therefore, the data user and administration server will soon detect this illegal action.

Search over Multi-owner:

- ✓ The proposed scheme should allow multi-keyword search over encrypted files which would be encrypted with different keys for different data owners. It also needs to allow the cloud server to rank the search results among different data owners and return the top-k results. The cloud server stores all encrypted files and keywords of different data owners.
- ✓ The administration server will also store a secret data on the cloud server. Upon receiving a query

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request, the cloud will search over the data of all these data owners. The cloud processes the search request in two steps. First, the cloud matches the queried keywords from all keywords stored on it, and it gets a candidate file set. Second, the cloud ranks files in the candidate file set and finds the most top-k relevant files. Finally, we apply the proposed scheme to encode the relevance scores and obtain the top-k search results.

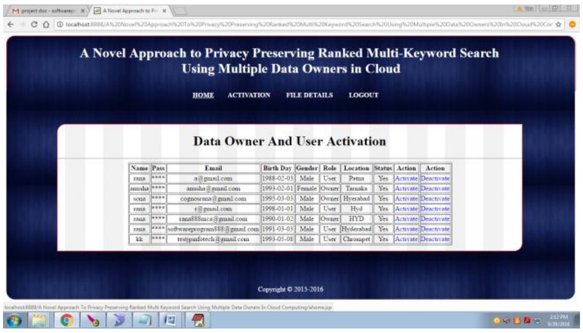
SCREEN SHOTS

Data Owner Login Page:

Registration Form:

Admin Login:

Data Owner and User Activation:



Data Owner Login Page;

Data Owner Home:

CONCLUSION:

In this paper, we explore the problem of secure multi-keyword search for multiple data owners and multiple data users in the cloud computing environment. Different from prior works, our schemes enable authenticated data users to achieve secure, convenient, and efficient searches over multiple data owners' data. To efficiently authenticate data users and detect attackers who steal the secret key and perform illegal searches, we propose a novel dynamic secret key generation protocol and a new data user authentication

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protocol. To enable the cloud server to perform secure search among multiple owners' data encrypted with different secret keys, we systematically construct a novel secure search protocol. To rank the search results and preserve the privacy of relevance scores between keywords and files, we propose a novel Additive Order and Privacy Preserving Function family. Moreover, we show that our approach is computationally efficient, even for large data and keyword sets. As our future work, on one hand, we will consider the problem of secure fuzzy keyword search in a multi-owner paradigm. On the other hand, we plan to implement our scheme on the commercial clouds.

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