Security Design Issues in Distributed Databases
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Abstract: In the rapid growth of networking and information technology expands the business worldwide. As distributed database became more popular, the need for improvement in distributed database management system become even more important. Database provides inbuilt security to manage different levels of data but if we apply overall security from accessing the different levels of user’s data to different levels of users, it will raise the performance complication and also slow down the normal function of the database server. The most important issue is security that may arise and possibly compromise the access control and the integrity of the system. In this paper, we review the most common as well as emerging security mechanism used in distributed database system.

Keywords: Distributed database, distributed database security, distributed database architecture, distributed database retrieval problems, Concurrency control.

I. Introduction
A Distributed database is a collection of databases which are distributed and then stored on multiple computers within a network. An application is able to access simultaneously and modify the data in several databases in a network. The database, link connection allows local users to access data on a remote database. In distributed database system, the major issue is security on data to be accessed at different levels of hierarchy. In a distributed database system, the database is stored on a number of computers. The computers in a distributed system communicate with each other through various communication media such as high-speed networks or telephone lines [1].

A database link connection allow local users to access data on a remote database for establishing these connections, each database in the distributed system must have a unique global database name in the network domain. The Distributed database management system (DDBMS) is a software that permits the management of the distributed database and makes the distribution transparent to the user. The main difference between centralized and distributed database is that the distributed databases are typically geographically separated and are separately administrated between local & global transactions. In a local transaction it access the data only from sites where the transaction originated, whereas in a global transaction on the other hand is one that either access data in a different site from the one at which the transaction was initiated or, accessed data in several different site [2].

II. Distributed Database Security
The databases have been protected from external connections by firewalls or routers on the network outer limits with the database environment existing on the internal network opposed to being located within a demilitarized zone. Additional network security devices that detect and alert on malicious database protocol traffic include intrusion detection systems along with host-based intrusion detection systems [3].

Databases provide many layers and types of information security, typically specified in the data dictionary, including:

a) Access control: Access control is a system which enables an authority to control access to areas and resources in a given physical facility or computer based information system. An access control system, within the field of physical security, is generally seen as the second layer in the security.

b) Authentication: Authentication is the act of establishing or confirming something (or someone) as authentic, that is, the claims made by or about the subject are true.

c) Encryption: In cryptography, encryption is the process of transforming information (referred to as plaintext) using an algorithm (called cipher) to make it unreadable to anyone except those possessing special knowledge, usually referred to as a key Integrity.

III. Distributed Database System
The theory of distributed database came into reality during mid 1970. It was felt that many applications would be distributed in future and therefore the database had to be distributed also. Essentially a distributed database system (DDBS) is a collection of several logically related databases which are physically distributed in different computers or sites over a computer network [4].
While the users of distributed database have the impression that the whole database is local except for the possible communication delay between the sites. This is because a distributed database is a logical union of all the sites and the distribution is hidden from the users. DDDBS is preferred over a non-distributed or centralized database system for various reasons. The design of responsible distributed database system is a key concern for information system. In high band-width network, latency and local processing are the most significant factors in query and update response time. Parallel processing can be used to minimize their effects, particularly if it is considered at design time. It is the judicious replication that enables parallelism to be effectively used. Distributed database design can thus be seen as an optimization problem requiring solutions to various interrelated problems: data fragmentation, data allocation and local optimization. Concurrency Control (CC) is another issue among database system. It permits user to access a distributed database in a multi-programmed fashion which preserving the illusion that each user is executing alone on a dedicated system. Another activity of Concurrency Control (CC) is to "Co-ordinating [5], concurrent accesses to a database in a multi user database management system (DDBMS). There are numbers of algorithms that provides Concurrency control, such as two phase locking, Time stamping, Multi-version timestamp, and Optimistic non-locking mechanism. Various methods provide better concurrency control than other depending on the systems [6].

IV. Distributed database Architecture

The distributed database management system (DDBMS) involves a collection of sites interconnected by a network. Every site run one or, more of the following software modules: a Transaction Manager(TM), a Data Manager (DM) and a concurrency control scheduler or simply scheduler. A site can function as a client, a server or, both in client–server model. A client run only the TM module and a server run only the DM and scheduler module. All server stores a portion of the database. Each data item may be stored at any server or, redundantly at several servers. Figure -1 shows the system architecture for the client server model. The user's interact with the DDBMS by executing transactions, which are on line queries or, application programmes. TMs supervise interaction between transaction and database. The TM at the site where the transaction originated is called the initiating TM. The indicating TM receives operations issued by a transaction, and forwards them to the appropriate schedulers. The goal of a scheduler is to order operations so that the resulting execution is correct. DMS manages the actual database by executing operations, and are responsible for recovery from failures. Transactions communicate with TMs which communicate with schedulers, DMs and it manages data. Architecturally, a DDBS consists of a set of query sites and a non-empty set of data sites. Data sites have data storage capability which the query sites do not. The latter only run the user interface in order to facilitate data access at data site. The problem of distributed query processing is to decide on a strategy for executing each query over the network in the most cost-effective way [7].

![Architecture of a Distributed Database](image)

**Figure 1: Architecture of a Distributed Database (DM Data manager TM Transaction manager)**

V. Security tools emerging in Distributed Database System:

The emerging security tools used in distributed database system are data warehouses and data mining system, collaborative computing system, distributed object system and the web. The major issues here are ensuring that security is maintained in building a data warehouse from the backend database systems and also enforcing appropriate access control technique when retrieving the data from warehouse. For example, security policies of the different data sources that from the warehouse have to be integrated to form a policy for the warehouse. This is not a straight forward task, as one has to maintain security rules during the transformation, then the warehouse security policy has to be enforced. In addition, the warehouse has to be audited. Ultimately, the...
retrieval problem also becomes as issue here. For example the warehouse may store average salaries. A user can access average salaries and then deduce the individual salaries in the data sources, which may be sensitive and therefore, the inference problem could become an issue for the warehouse. To date, little work has been reported on security for the data warehouse as well as the retrieval problem for the warehouse. This is an area that needs much research intension.

In data mining system it is being extended to function in a distributed environment. This system is called distributed data mining system & has received very little attention. Other emerging technologies that have evolved in some way from distributed database are called collaborative computing system, distributed object management system and the web. Much of the work on securing distributed database can be applied to securing collaborative computing system, through distributed object systems security, there is a lot of work by the object management group’s security special interest group. Presently there has been much work on securing the web as well. The main issue here is ensuring that the databases, the operating systems, the applications, web servers, the client and the network are not only secure, but are also securely integrated [8].

VI. Conclusion

The distributed database systems are getting popular day by day. Several organizations are now deploying distributed database system. In this paper we introduce the different aspects related to distributed database such as database system concept, distributed database architecture, design of distributed database and also some security issues including multi level security in distributed database system. We also, describe the most common mechanism of discretionary security and stated the emerging security used in distributed system tools. We also believe that there is much scope for further research and experimentation on these issues.

References

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