Chapter XV

Security in Database Systems: State of the Art

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INTRODUCTION

Rapid technological advances in communications, transport, banking, manufacturing, medicine and other fields are demanding more sophisticated information requirements in organizations worldwide. As a result, large quantities of data must be handled, while a high level of security must be maintained in order to ensure information needs are met. The alarming growth in electronic crime is forcing organizations to take a look at how information systems can maintain security while meeting the technological needs of real-time systems in a global market. It is important therefore, that in information systems analysis and design, security requirements are taken into account.

Security is an important quality characteristic as described in the ISO/IEC (International Organization for Standardization/International Electrotechnical Commission) (1999). According to this standard, the main components of internal and external quality are reliability, efficiency, usability, functionality, maintainability and portability. All of these quality factors have several quality sub-factors, viewing security as a quality sub-factor of functionality. This standard defines security in the following way:

"Security is the capacity of the software product to protect data and information so that unauthorized persons or systems cannot read or modify them and so that access is not denied to authorized personnel."

Currently, a technical report is being created (ISO/IEC, 1997), which is dedicated exclusively to managing information system security. The proposed guideline establishes security concepts and models, manages security planning and establishes techniques to choose safeguards appropriate for each case, especially for systems with external connections. This means that organizations for standardization

consider security as an important factor of the information system quality and that they are working hard to establish guidelines so that the software companies build more secure information systems.

Quite frequently, information systems are comprised of information that can be considered sensitive and to which access must be restricted. Often they contain personal information about individuals, which must be specially protected, such as social security numbers, addresses, phone numbers, religious affiliation, sexual preferences and medical data, among others. If this information is used without certain security precautions, individual rights may be violated. The information systems that manage this type of information must be provided with security techniques in order to guarantee that personal rights are not infringed upon.

The use of information technologies is regulated by law, serving mainly to ensure that citizen's rights are upheld. To this end, most countries have established data protection laws, especially when this data is of a personal nature. For instance, in Spain there is the *Personal Data Protection Law* (Ley Orgánica, 1999) and security rules (Real Decreto, 1999), which dictate the security actions that organizations must carry out in order to comply with the law. Information systems that do not guarantee data security will not only be facing fines and penal sanctions for violating laws, but also the negative impact of security breaches (Peso and Ramos, 1998).

As a consequence of the technological changes that are occurring at an ever-increasing pace, there is a great need for security support. Technology has produced the evolution of several fields with special characteristics from a security point of view, requiring important changes in the traditional ways of handling security. Some of these fields are:

a) The progress that the Internet has experienced, and especially the access to databases via the Web, requires secure communications. Information must be safely transmitted.

b) Electronic business, given its dynamic nature, demands the fulfillment of new data security requirements. It is of vital importance to guarantee the security of e-business in order to convert it into another secure and reliable way to do business.

c) The arrival of data warehousing has brought about the necessity to establish new security techniques, owing to architectural problems, of inference, administration and auditing. Also, the use of data recuperation techniques like data mining can lead to privacy problems, provoking new security requirements (Thuraisingham et al., 1997).

All of these factors, including legislative, regulative and technological factors, justify the importance of security in information technologies. In addition, there is the economic perspective of ensuring long-term growth and stability in this technologically driven environment. For instance, Baskerville (1993) confirms that one-fifth of U.S. organizations suffer one or more physical or logical information system disruptions within a three-year time period. The study also concludes that 12% of the U.S. companies were electronic fraud victims, with the average fraud amounting to

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