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Efficacy of Data Security in Managing the Database of SIMMAG 3D System

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Abstract

The basis of functioning of the systems from different industries are reliable data. They can be both input parameters for operation of individual modules and representation of their work results. Due to multitude of functions performed by these systems, number of necessary parameters is very big. The most convenient form for their storage and processing are database with implemented management system. This article presents how to manage database on example of IT system supporting area of logistics – SIMMAG 3D, prepared within framework of a project funded by the NCBR under the Program for Applied Research (PBS3). The aim of system is modeling of warehouse facilities in 3D, their visualization, spatial planning and evaluation of processes occurring in them, as well as placement of objects in logistics network. SIMMAG 3D system has modular structure and each module gets values from database. The flow of data between its elements was discussed. During flow of data can occur risk of access to them by unauthorized entities. This article analyzes database of SIMMAG 3D system in terms of data security against unauthorized access.

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1. Introduction

Nowadays, there is need to take many important decisions and often in very short period of time [7]. In order to minimize risk of error, which can have more or less serious consequences, there are building systems that support decision-making [9–12, 17]. Their use allows for identification of the problem and using a series of input data for selection of variant, which from the viewpoint of various criteria will be the best.

Because of the size of considered problems, it is necessary to take into account a number of input data, which come from different subject areas. The most appropriate place to support them are database [4]. In databases data are collected according to strict rules and then using systems to manage databases are processed. The database is therefore one of the elements of the IT system [1, 6].

One of decision support systems in the logistics industry is SIMMAG 3D developed within the project funded by the NCBR (The National Centre for Research and Development) under the Program for Applied Research (PBS3). The aim of system is to support modeling and visualization of warehouse facilities in 3D. To the basic functions of SIMMAG 3D system, we can include: modeling of warehouse facilities in 3D, designing of warehouse facilities in 3D, visualization of warehouse processes in 3D optimal placement of objects in the logistics network, designing of supply chains in different planes, shaping and dimensioning of warehouse facilities, scheduling process, internal transport, multi-criteria evaluation of proposed solutions, simulation of the flow of materials in different functional areas of warehouse facilities. For its appropriate work it is required number of input data [18], which are collected and processed according to specific rules.

The article presents how to manage database implemented in IT systems. The flow of data between their elements were discussed. The example of IT system supporting area of logistics – SIMMAG 3D, prepared within the framework of project funded by the NCBR under the Program for Applied Research (PBS3) were indicated. The system has modular structure and each module gets values from database. In addition, analysis of SIMMAG 3D system database in terms of data security against unauthorized access were performed.

2. Database management in IT systems

In each IT system, data are important element. They can be divided into two groups. The first group are input data for operation of individual system components. The second group are data resulting from work of these components, which in addition to resulting function can be used as input data to selected module. Because of the size of some problems, the amount of data can be quite large. To provide a comprehensive data service they are collected and processed in a database. Scheme of a typical IT system is shown in Fig. 1.
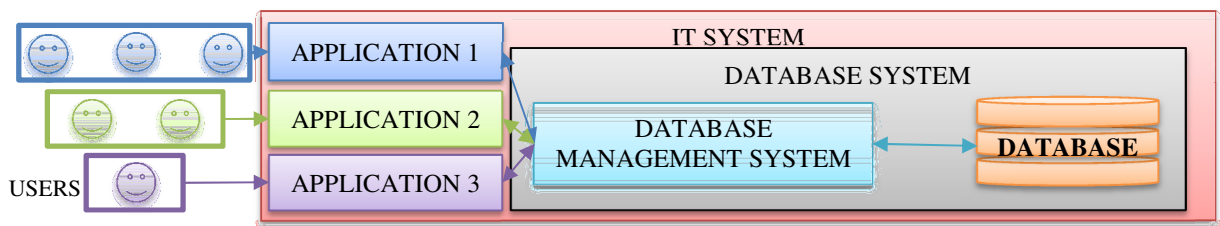

Fig. 1. Scheme of a typical IT system.

In Fig. 1 it can be seen database system [14], which consists of database (DB) and database management system (DBMS). As mentioned above, database is the media on which data describing the reality are stored according to strict rules [2]. For correct storage and gathering of data is responsible DBMS [16]. It allows for [5]: data management, ensuring data integrity and security, their disaster recovery, access to collections by many users at the same time, giving access privileges for particular types of users and optimization of database.

Database system is one of the IT system subsystems, in which should be mentioned client applications allow for access to the database through the management system. The flow of data between database and applications can be

two-sided, because for action each of them may be needed input parameters and as a result of action may arise values which can be stored in a database. Users get access to the database through applications, which are part of IT system.

It should be emphasized that data stored in database are stable and independent from application [3] (data are not part of application, but are stored on separate media). Databases can handle data which are very complex (can come from different areas and connected to each other by respective relationships can characterize complex system). DBMS must ensure accuracy and robustness of database, its efficient processing and access of many users at the same time.

3. Modular structure of SIMMAG 3D system and effectiveness of data exchange

As mentioned above SIMMAG 3D system is designed to support modeling of warehouse facilities in 3D. The system will allow for preparation of warehouse facility model in 3D, its visualization, planning and evaluation of processes in it, as well as placement of facility in logistics network. Structure of SIMMAG 3D system includes three modules: optimization and simulation module, 3D visualization module, database.

User access to each module of the program is done through graphical user interface. On it there are buttons that allow on access to various simulators, which will be developed within the project SIMMAG 3D and visualizer. It is assumed that in context of optimization and simulation module user will be able to use following components:

- simulator for facilities locating and supply chains designing [15], which will allow to determine optimal location for designed facility and locate it in supply chain,
- simulator for shaping and dimensioning of warehouse facilities [19], which will allow for the spatial configuration of various areas in the facility and their dimensioning,
- simulator for scheduling of internal transport process [13], which will allow for the distribution of tasks in time and determination of their starting moments,
- simulator of multi-criteria evaluation of variants which using analytical methods will allow to select the most beneficial one,
- simulator of material flow in functional areas of object, which will allow to make distribution of freight flow in each functional area and conducting analysis.

Data which are needed for action above mentioned simulators will be stored in the internal database [8], to which will be included editor of data (data can be edit), data importer (in order to make import data to it) and data generator (in absence of relevant data they will be able to generate). Database in addition to the function of data storage, will play also a power function in appropriate data. This is the first component of the database for SIMMAG 3D system.

3D visualization module of SIMMAG 3D system will offer for user ability to: analyzes and selection of characteristics (user can select individual characteristic values, change their value and perform analysis) modeling facilities and their graphic design (it will be able to build a warehouse facility with ready-made elements using their graphic representation).

The module for 3D visualization of warehouse facilities will use database developed under the project SIMMAG 3D in terms of data about facility and its configuration, in terms of equipment catalogues and libraries of objects in 3D. Database in addition will be supplemented with data from the WMS (Warehouse Management System) in field of basic data, data on orders and inventories, determining the schedule, configuration of space, process and storage units.

4. Analysis of database for SIMMAG 3D system in terms of data security

It is clear that it is impossible to fully secure the database, and even the best protection has its drawbacks. It should be emphasized that influence on the security degree has the specificity of the system, which is SIMMAG3D. This system is less exposed on hacking attacks (than e.g. in the case of banks), while it must be protected against loss and destruction of data. Therefore, the action which must be taken and security policy shall be appropriate to the risks. The diagram shown in Fig. 2 shows potentially dangerous areas in the system.

In the figure 2 were highlighted 4 main places in the database with highest risk of undesirable events occurrence, among them should be indicated:

1) Input to the database through the database management system (VPN + DBMS) or direct access to the server (DBMS). Entrance this is reserved for the system administrator. Among the main risks should be indicated unauthorized access or unskillful management database (eg. functions and procedures damage).

2 & 3) Entrance to the database within the program (via the GUI – Graphical User Interface). Due to the two separate modules (admittedly integrated), there are two interfaces to access the database. From the program, user has access to selected resources, viewing, editing and creating new records. The most serious threats include unauthorized access, incorrect use of the system (incorrect entries to the database), theft of data by the user.

4) Other impacts on database. At this point, the impact relates to other factors affecting the database. One can identify such as: physical damage to the server or drives (data loss), hackers attacks (theft, loss of data).
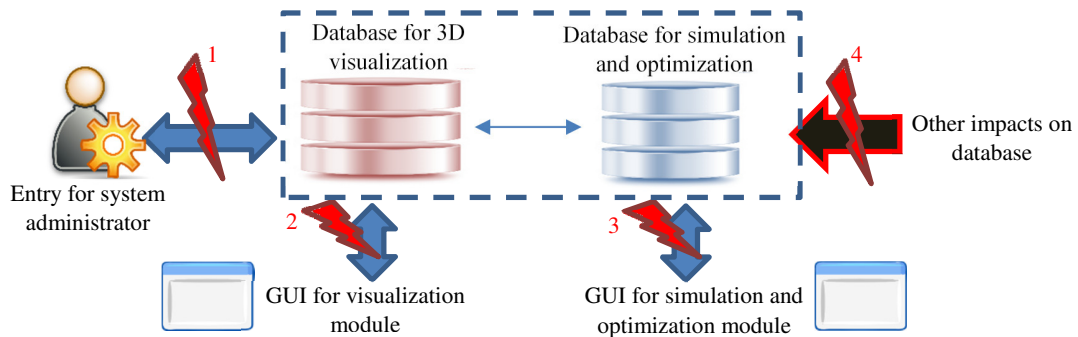

Fig. 2. Areas in the SIMMAG3D with the highest security risk.

In connection with the identification of critical places it was possible to recognize examples of types of threats (most important from the point of view of the SIMMAG3D), the place of occurrence and the preventing solutions. Schematically it was shown in Fig. 3.
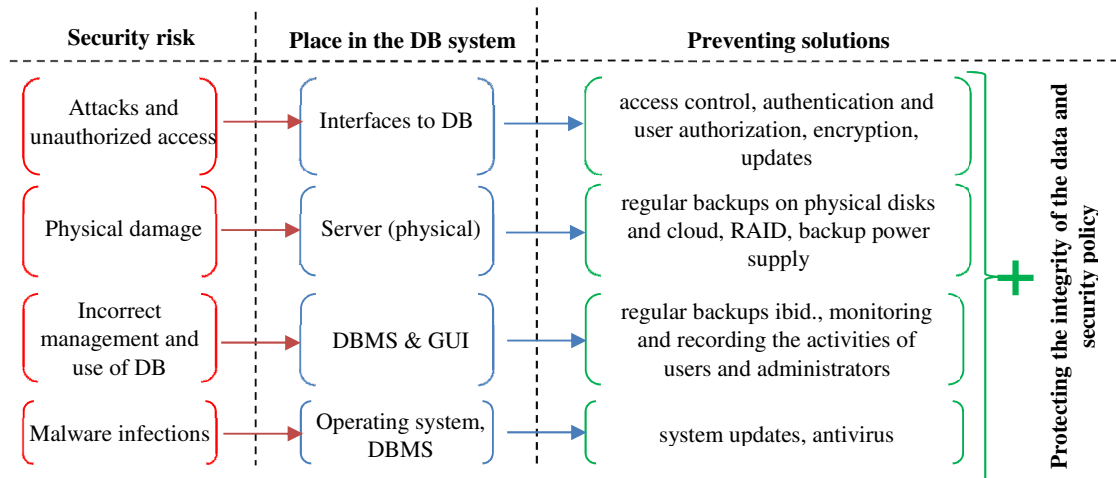

Fig. 3. Examples of risks in the system SIMMAG3D and protection methods.

The database for system SIMMAG 3D has been prepared in such a way that all users can use the same database at the same time. It was made in network technology in client-server architecture using Microsoft SQL Server

database management system. In connection with utilization of such technology (and threats as outlined earlier), will be implemented solutions preventing access to the data in SIMMAG 3D system such as:

- adequate protection of database running in the network from external hacker attacks,
- application of cryptography for encrypting of connections,
- regular updating of database management software,
- regular updating of IT system and database management system, by which there is possible to access to the database,
- authorizing the limited use of implemented database for IT system users,
- recording the movements and operations performed by individual users in the database,
- minimizing the database functionality to reduce the number of places where it is possible unauthorized access to the data,
- securing of place, where are data storage in the database either from physical damage as well as in terms of software,
- securing of data in the database through periodic backup of media.

5. Summary and conclusions

The basis of systems functioning from different industries: engineering, economic, administrative, business and other are reliable data. They can be both input parameters to the operation of individual modules and a result of their work. Due to the multitude of functions performed by these systems, the number of necessary parameters is very big. The most convenient form for their storage and processing are database with implemented management system.

This solution has been implemented in the SIMMAG 3D system for modeling and visualization in three dimensions of warehouse facilities being the result of project funded by the NCBR under the Program for Applied Research (PBS3). This system has a modular structure and between each module and database is two-way flow of data. Moreover, the system is powered on data from WMS – Warehouse Management System. The essential problem from the point of view of data is their protection against unauthorized access. The types of security depend on the technology in which database has been prepared. The article discusses the actions that should be taken to protect the data.

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