

Construction and application of Database architecture for integrated business software purposes

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In order to build an effective database architecture, an appropriate structural model is needed, which is the basis of the integration of a given management information system in business organizations. In the current development, the emphasis is on the optimal management of the information arrays. They, in turn, are accepted as systematized data, which is a prerequisite for the full functioning of the ongoing business processes in the entire business organization. In practice, it would not be possible to build a working software product without its foundation being based on a functional database. There is an active two-way connection between the database and the management software. One is a warehouse for storing large arrays of information, while the other practically manages access to them. All of that is the basis of the modern digitalization of the business sector, which is becoming the most essential tool for achieving the competitiveness of modern companies.

Keywords – business, business, information, management, model.

Изграждане и приложение на архитектурата на база данни за целите на интегриран бизнес софтуер (Владислав А. Филев). За изграждането на архитектурата на база данни, е необходим подходящ структурен модел, който да е в основата на интегрирането на дадена управленска информационна система в бизнес организация. В настоящата разработка акцентът се поставя върху оптималното управление на информационните масиви. Те от своя страна се приемат, като систематизирани данни, което е предпоставка за пълноценното функциониране на протичащите бизнес процеси в цялата бизнес организация. На практика не би било възможно да се изгради работещ софтуерен продукт, без основата му да е базирана на функционална база данни. Налична е активна двупосочна връзка между базата данни и софтуера за управление. Едното е склад за съхранение на големи масиви от информация, а другото на практика управлява достъпа до данните. Всичко това е в основата на съвременната дигитализация на бизнес сектора, която се превръща в най-съществения инструмент за постигане на конкурентоспособност на съвременните компании.

Introduction

The progress of the global process of digitization of business organizations in the modern world is directly related to the effective construction and overall maintenance of full-fledged databases /DB/. Only in this way could a widespread implementation of a business management information system be carried out, for processing, systematizing and storing the daily flows of economic data flowing through companies.

The publication examines the opinion of engineer A. Petkov in "Management Information Systems", as the author of numerous scientific works on that subject. He says that "a key element in building a database is the connection to the DBMS that provides

the real data to export the models to the particular business environment". The works of PhD S. Boyadzhieva "Structure, organization and management of processes in distributed databases" were also studied, as well as of A. Yordan "Applying machine learning classifiers in a Database smart indexing algorithm" and PhD S. Nikolich with "Development and use of information and communication technologies". Each one of them describes the need for proper structuring and construction of a database for the needs of integration into a business information system.

The main goal of the present development is to show the importance of proper architectural structuring of a database for the needs of a modern business organization. Practical models are

demonstrated, considering possibilities for their optimization and upgrading. In the present work, it will be proved that for the development of modern business it is as important to build the database correctly as it is to choose the most suitable software product for the organization.

Importance of Database for integrated business information systems

When reviewing the available literary sources related to the topic of the present development, it is found that the term Database is the name of large-volume arrays of stored information related to the conduct of activities in a given business organization or structure. The object of research in this publication is the databases used for the needs of integrated business information systems. Their application is mainly associated with the storage of a large amount of economically significant information, most often in an electronic /digital/ version. In terms of integrated management business software /in particular ERP Systems/ their application is most distinct in the use of the CRM /Customer Relationship management/ module. This module is implemented as a business strategy that companies use to manage interactions with current and potential enterprise customers. With its help, companies are helped to rationalize their business processes, build sustainable relationships with their customers, increase their sales, improve the quality of their customer service and increase the financial profitability of their company.

The specific information technology on which modern databases are based is applied to the needs of the daily processing of large volumes of information. The individual user could gain access through their personal /work/ computer, and at the business organization level access based on network servers is implemented, the activity being carried out through a suitable software product /business information system/ for software control of the database. The principle of general access to the available economic data in the specific business organization is often applied /obligatory in accordance with the personal rights of each of the employees in order to guarantee corporate security/. Most often in modern business environments, the following indicative situation is observed: the accumulated information from sales is applied to the needs of the marketing department and preparation of the company's market concept. In this way, a closed cycle of data exchange regarding ongoing economic processes in a given enterprise is obtained.

From the data obtained in the market sectors, an

interesting moment is observed, business entities are very likely to reach the following difficulty - when a significant volume of economic data accumulates, which is inherently chaotic and cannot be directly applied to achieve long-term business goals. Then it is necessary to apply a method of processing and systematization, as well as to set appropriate criteria for what type of information to collect and how to arrange it more precisely. This is done to achieve corporate goals and requires serious managerial skills as well as a critical volume of knowledge in terms of data analysis and administration. The structural construction and management of an optimal database is an important element of the proper operational management of any organization. Especially when the set goals are in the direction of market expansion of the trading company and stepping into new markets. In the long term, this challenge for the management apparatus of the company could only be achieved through an integrated business management system based on a reliable database, even more so when it comes to an economic organization with a daily flow of a significant volume of economic information.

With the development of digital information technologies, the databases used have taken a fundamental place in them. The classic definition of a DataBase found in the literature is "a logically connected set that is used to store information in a predetermined format" [1]. Through them, such a type of data storage is achieved so that it is possible to carry out the necessary checks, reports or analyzes at any time. To guarantee the needs of an integrated business information system, Database Management Systems (DBMS) are applied, and several of their varieties are known in practice.

In the following Fig. 1 demonstrates the file upgrade to achieve a complete DB.

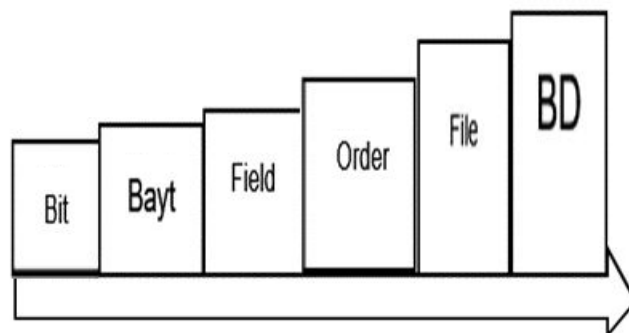


Fig.1. Hierarchy of data separation.

Let us clarify that the term "file" will mean a set of entries made in the same field. The purpose of the

clarification is to be able to build an understanding of the relationship of the file system in the built DB. Several types of file operations are known, the main ones being - arrangement and sorting of information, as well as the ability to search for specific data. From a structural point of view, the file system is organized using three types of physical methods as follows:

- Direct access to the file;
- Sequential file access;
- Access by indexed sequence.

Like any known system, the file system is characterized by certain weaknesses and disadvantages. We can name the main ones among them:

- Ability to duplicate information;
- Implied restrictions on data access;
- Difficulties in processing large data sets;
- Frequent occurrence of problems when maintaining the file system;
- Risk of information loss.

When working with a file structure, it is necessary to know that any change in files necessarily leads to a change in the application itself. Too often a dependency is observed, where a large number of applications are based on the same file system /a typical example is additional applications to an already installed operating system/. Thus, by implementing just one change in the file structure, it is possible to affect a large number of dependent applications. Due to the importance of the above and for the purposes of the issues addressed in this post, a file system diagram is presented. A typical example of the file structure of an Operating System is shown in Fig. 2.

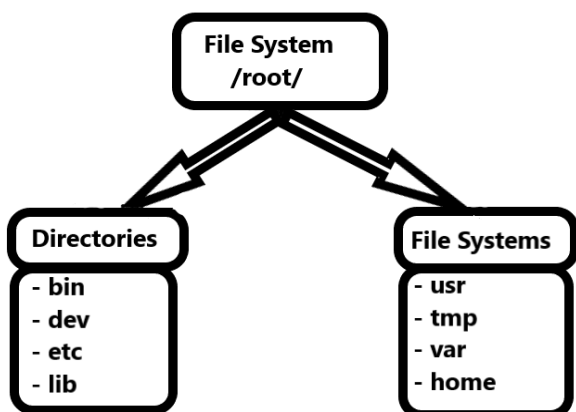


Fig.2. Typical OS file system structure.

In conclusion of what has been said up to this point in the development, the following essential conclusion could be drawn that the databases used to guarantee

the needs of an integrated business information system provide the real opportunity to store, process and analyze large volumes of information, in terms of the activity of a modern business organization in the highly competitive environment surrounding it.

Basic concepts for building databases

Nowadays, it is assumed that the databases used by business organizations are a collection of logically related business information. This volume of data could be of varying volume as well as a relatively high level of complexity in its content. This practically means that the information stored in the database is logically bound, through a predefined structure, so that it can be easily accessed and processed by the relevant users or by the system maintainers. Practically, the combined and available business information is used to serve the interests of a given circle of target users related to the business organization that owns the information database. An appropriate moment of the publication is to adopt a specific definition for the concept of "data" [3], which should be based on the literary sources on the subject. Such a definition is: "a collection of information that has been processed and arranged in a specific way so as to acquire a level of significance for a given user or group of people". When converting existing data into user information, the opposite principle of operation is observed. Their consolidation is carried out according to specific criteria, so that the appropriate business information can be extracted to fulfill the necessary corporate task.

In the practical use of databases, the following term "metadata" is found in the technical literature. According to the definition used, it is a specification of parameters to define available characteristics of already structured data. Metadata can be an indicator to define a data specificity, an adjacent structure or a certain type of access restrictions to already existing data.

It is important to clarify that they are only indicative of the properties of the available data, but are not data in themselves. The application of metadata is when building a database for the needs of a management business information system. Their main contribution is in their role as an adequate indicator of complete and applicable business information about the content, meaning and differences between individual datasets.

The basic concept of building a database aims to prevent the effect of weaknesses in its constituent file system. Specific principles and rules for working with the data arrays available in the database can be found

in the literature. In this way, the very activity of an integrated business information system is optimized and the time to access the available information is improved. Among the main building principles are (SQL, Access and many others). There are three known ways of describing a database for the needs of an information system, which are as follows:

- of a logical point of view - a connection is made through a system for managing the available data;
- of a physical point of view - the material medium on which the data is stored;
- of the point of view of the users - the interface providing the connection between the users and the physical place for storing the available data. Each of the users aims for maximum quick and simplified access to the information he needs.

The concept of building a database of an integrated information system is based on a structure of adjacent schemes and sub-schemes. Their advantages are as follows:

- possibility of sharing the available information between a large number of users at the same time;
- easy access to specific information required by a user of the system;
- optimized access to all available information, by streamlining the database;
- independence of available data from making changes by individual users;
- unified programming language for building the database structure.

Schematically, the processes can be represented as follows in Fig. 3.

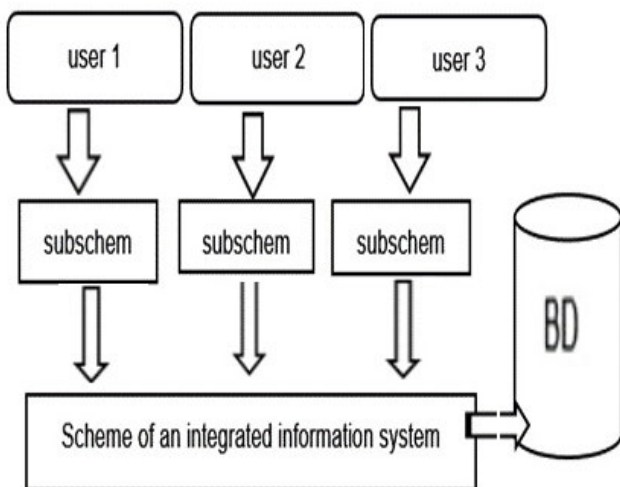


Fig.3. Database construction concept.

The technology used to build the DB architecture has been actively developed since the middle of the 20th century. Various options are being explored and prototypes are being developed to be tested in real conditions. Among the most active companies in this regard, IBM Research stands out. Among the basic reworkings, emphasis is placed on RAID partitions, atomic transaction concepts, structural model variations, and more. Along with this, standards are also being developed for the classification of data in a given database. Examples of that:

- text documents;
- statistical or accounting data;
- bibliographic content of files;
- arrays of data from a production process;
- others.

Whatever the intended purpose for the implementation of the database structure, among the main tasks for its construction is the construction of a conceptual model of the data, which will allow the application and processing of the available flows of information in the specific architecture of the database. This can be achieved through various approaches, among the most widespread being the application of UML /Unified Modeling Language/ diagrams.

Applicable model of building a database to ensure the needs of an integrated business system

Currently applicable databases used to ensure the needs of an integrated business information system are based on specific structural models. The function of these models is to provide comprehensive support for the application of appropriate schemes in the direction of logical construction of a given database. The standard structure is based on a hierarchy where the relationship is "one to many" (a tree can be visually compared, where one walks from a given branch to the base of the tree to access required information). For larger business organizations, it is possible to develop a "network" structure that is a collection of many individual ones. At the moment, the following classic construction models are known:

- Rational database model - /SQL database/ where a large volume of data is stored, through relations. Most often, the user accesses a tabular form of data that is made up of individual fields and records.
- Semantic model of the database - considered to be an upgraded version of the relational model. Here, in addition to the described advantages of the previous model, software programmers are given the opportunity to

adjust the database according to the business model of a specific user company. Thus, the business environment of the enterprise that has integrated an information system is reflected to a much greater extent.

In conclusion, we will say that both of the above-mentioned models have a classic approach to work and provide an opportunity to build a suitable interface, an object-oriented database and model the way of storing the available data.

Approaches to modern Database management

The management process of modern Databases, with integrated business information systems, is carried out by means of a relevant software product /specific computer program/. DBMS (Database Management Systems) is most often applied. In this way, unwanted risks are prevented, such as:

- occurrence of a data integrity problem;
- negative impact on available data from the applied software;
- accumulation of redundant non-functional data.

Each of the implemented DBMS, regardless of the period of creation, is structurally based on the following elements:

- Programming language to define available data;
- A programming language that performs any manipulation with the available data;
- Database Management (DBM) program.

The software for managing the processes in a given database is named with the abbreviation DBM (Database Management). This software product performs the necessary activity of controlling the ongoing processes and the correct storage of data, while working with the available information arrays. In Fig. 4 demonstrates how to build a DBMS.

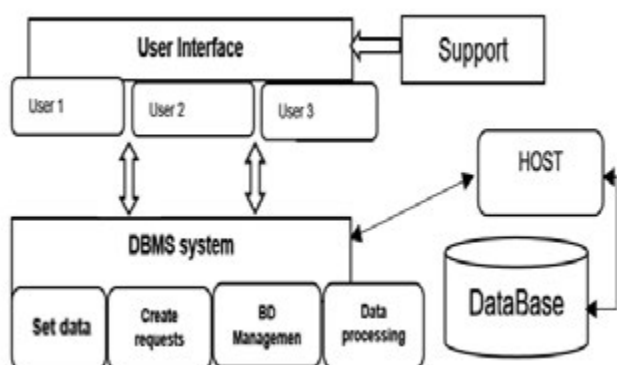


Fig.4. Building a database management system /DBMS type/.

Strengths and weaknesses of applied models and concepts

Applying the model for handling large volumes of data set so far is distinguished by several things. Among them are both strengths and weaknesses. It is important to mention that this is currently the most widely used way of working with a database. Of course, other possible options are encountered in practice, as well as work is being done on building new database architectures to guarantee the needs of an integrated business information system. In the present development, the most distinct advantages and disadvantages are indicated through a generalized analysis.

The advantages known so far include the following:

- Significant reduction of redundant data;
- Data duplication is avoided;
- Fast integration of available data from the DB, through DBMS compared to standard use of a file system;
- Separation between physical storage and logical structuring of available data. Security is ensured through the data independence thus granted;
- Improved management of information flows;
- Create backups and quickly restore data in the event of an adverse event.

Among the main deficiencies identified, the following are currently listed:

- Still high financial cost for acquiring and maintaining the software part;
- Additional costs for conversion of the used data;
- Resource losses in case of problems related to access to the system or temporary and non-functioning;
- High complexity of building network databases;
- High complexity and cumbersome work with hierarchical databases;
- High capital investments to acquire the hardware security of a database.

Conclusion

At the core of modern integrated business information systems is a functional database model. In practice, business management systems are developed to handle large daily flows of information related to the business processes of the organizations. This is actually a permanent activity, therefore their functioning /of the management software system/

would not be possible without a fully developed database structure.

The increasingly active digitization of the economic sphere, both of companies from the home market and the international business sector, has created a prerequisite for extremely "fierce" competition and practically the almost complete neutralization of economic borders. Business process management systems are no longer a priority and requirement only for large corporate giants, but have become an indispensable part of almost every business organization, including even smaller companies that could not afford significant investments for a competing software product.

This publication examines topical issues related to the importance and application of DB to the modern business economic environment on the global stage. A definition of the terminology used in the development is given, citing the literature of recognized experts in the field of business software services. Emphasis is placed on structural engineering concepts and marketable database management systems. The most widely applied models for structuring databases are described and compared, as well as the approaches to their management, by means of software products such as Database Management Systems, are indicated.

About the integration and maintenance of a software product, such as a business management information system, regardless of the size of the organization undertaking the implementation process, a mandatory basis is the construction of a functional and reliable database, as well as the creation of prerequisites for management, control and updating of the contents arrays of data are in it.

In conclusion, of the information provided, it can be summarized that databases for the needs of integrated software are constantly undergoing changes and development. The current direction of development is towards cloud services, optimization of social networks, as well as the new versions of developed software for conducting a comprehensive analysis of ongoing business processes. Among the trends for the development of databases, the increasingly active ERP systems are emerging. They are a key factor for the development of the digitalization of the business sector. It is the

modernized architecture of building large data sets that stands out as a leading factor for the implementation of business management systems. In this report, in addition to specifically formulated challenges, questions are also raised before modern business, the answer to which will be sought in future development and upgrading of information systems. Business organizations that are catching up are facing the most serious difficulties. They will have relatively little time to digitize their activities and optimize their business processes. Inevitably, meeting this challenge requires them to choose a database model as the basis of the software products with which they will conduct their business.

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