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Issue Article

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PROBLEMS OF STORING INFORMATION IN BIG DATA

Abstract: *The article demonstrates the issues of storing a large amount of information, since the problem of digital chording is associated with rapid growth in volumes.In ten years, from 2010 to 2020, there has been a 50-fold increase in stored data, more than 90% of which is corporate data. In 2011, the total volume of digital data in the world reached 1 zettabyte, in 2020 the increase in the volume of information was 50 times, which required an increase in the number of servers necessary for its storage by 10 times. According to some forecasts, the increase in the volume of information in the coming years will be more than 20 exabytes, and the problem of storing large amounts of information without Big Data will be inconceivable.*

Key words: *Big Data, information technology, redundant data storage, unstructured data, relational databases.*
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Introduction

The Big Data category includes information that can no longer be processed in traditional ways, including structured data. To work with them, traditional "monolithic" systems have been replaced by new massively parallel solutions.

Information that can be used in the future can be stored.Meanwhile, the cost of storing redundant data varies enormously and is associated not only with losses caused by obvious costs for energy, maintenance and occupied space, but more importantly, with the difficulties of analyzing excessively large amounts of data. To avoid the undesirable consequences of digital chording ("reserve"), it is advisable to get rid of the excess - if some data has not been used for several years, they are most likely not needed; not to arrange isolated data packages, the so-called silo (silo tower); not to accumulate raw and defective data. The problem of digital chording is related to the rapid growth of data volumes. In ten years, from 2010 to 2020, there was a 50-fold increase in stored data, with more than 90% increase in corporate data. However, the increase in the volume of information in the coming years will be more than 20 exabytes, and the issue of storing large amounts of information without Big Data will be unthinkable.

Previously, when the monopoly on data storage belonged to data management systems (DBMS), there was no problem with the use of digital chording. In addition, the structured data that is typically stored in relational databases has been ordered by nature. In the 21st century, unstructured data has become the main source of digital chording. The idea of creating a computer database in its modern sense was proposed in the late fifties by SDC, which is still considered the first software company. The company was state-owned, it developed software for a well-known in computer history project of a control complex designed to monitor airspace called SAGE (Semi-Automatic Ground Environment).

In general, the origins of big data can be classified as follows:

• program-related data sources, whether public or otherwise, such as electronic health records, hospital admissions records, insurance records, bank records, and food banks;

• commercial or operational data sources associated with transactions between two parties, such

as credit card transactions and online transactions (including those conducted using mobile devices);

• data sources associated with the operation of sensor networks, such as data from satellite images, data from road sensors and meteorological data from measuring devices;

• data sources associated with the operation of the recording devices, such as recording data from the mobile telephone network and from the Global Positioning System (GPS);

• data sources related to user behavior, such as Internet search data (for a particular product, service or any other type of information) and web page browsing data;

• data sources related to the expression of opinions by users, such as data from social media comments.

Since then, DBMS have gone through a huge, not without oddities, development path, in which the creation of the theory of relational bases is of particular importance. At the beginning of the second decade of the 21st century, with the advent of clouds and big data, the situation changed - alternative DBMS, such as NoSQL and NewSQL, came to the fore.

A natural question arises - how to replace the DBMS in relation to the new conditions? The answer to it can be the Big Data Platform (BDP). This type of platform should not be confused with similar-sounding platforms - what in marketing is called CDP (Customer Data Platform) user data platforms that serve as databases for CRM (Customer Relationship Management).

From a structural point of view, the DBMS is much simpler than the BDP, because there is homogeneous table storage built on relational principles, and there is data access via SQL. But, in modern conditions of information technology development, the increasing amount of information every year, which is facilitated by the virtualization and automation of many business processes, data digitization has led to problems of storing large amounts of data, and the use of a DBMS could not cope.

In 2011, the total volume of digital data in the world reached 1 zettabyte, which in our usual units is 1 trillion gigabytes, while at the end of 2010 about 7 exabytes (7 billion gigabytes) were accounted for by corporate databases, and 6 exabytes for individuals [1]. Moreover, in 2020 the volume of information increased by 50 times, which required an increase in the number of servers necessary for its storage by 10 times.According to some forecasts, the increase in the volume of information in the coming years will be more than 20 exabytes.

The use of a variety of telecommunications and other devices today generates large amounts of digital information, including the use of GPS technology, the use of social networks, satellites, mobile networks, and so on. Big data, on the one hand, generates a large stream of unstructured information, however, this information can become a valuable source of statistical data if to know how to extract the necessary data from this stream correctly. The potential of big data sources lies in the possibility of obtaining data almost in real time with minimal costs of resources and finances. Although, the application of Big Data technology in statistics has required addressing issues related to methodology, quality, technology, data access, legislation, privacy, governance and funding.

Promising sources of information in the BigData can be:

–mobile telephone network and GPS devices and other recording devices;

–satellite images and other types of geospatial information;

–social networks.

As part of the analysis of mobile network data, it is possible to obtain data on the location of a mobile phone subscriber, and his movement, which can be used in assessing migration, tourist activity of the population, mobility of citizens and other areas. The presence of a telephone in almost every person in the country makes it possible to track information almost in real time, which can provide the most up-to-date information in the field of migration processes.

Satellite data can be used in the preparation, for example, of agricultural statistics, statistics of emergencies and others. The best example which can be used in an argument is that the Australian Bureau of Statistics, as part of the analysis of satellite images, supplemented and partially replaced the practice of surveys conducted to measure agricultural production statistically [3]. Social networks "Twitter", "Facebook", "VKontakte" and others are the source of the largest array of data on people's behavior, interests and movement.Social media is becoming a source of preliminary estimates and reduces the need for statistical surveys, as estimates based on social media data can be obtained more frequently and at a lower cost. To date, Italy and China analyze data from the Internet in general, and social networks, in particular, to assess the situation in the labor market [5].

Big data is currently one of the key drivers for the development of information and communication technologies in the context of high-tech production [6]. The use of Big Data technologies at this time will not be able to solve all the problems of statistics, but it will be able to supplement it, significantly increasing the relevance and accuracy. According to the studies of the UN Statistics Division and the Eurasian Economic Commission of the United Nations, the most interesting areas of application of Big Data technologies in statistics can be demography, social statistics, economic and financial statistics, price statistics. (see Fig. 1)

Application areas of BigData technologies in statistics	%
Demographic and social statistics (including indicators of the subjective well-being of the individual)	44,2
Vital statistics and vital records	11,5
Economic andfinancialstatistics	48,1
Price statistics	38,5
Transport statistics	13,5
Environment statistics	13,5
Tourismstatistics	17,3
Information society / information and communication technology statistics	11,5
Laborstatistics	21,2
Mobility Statistics	19,2

Figure 1. Potential areas of using BigData technologies in statistics [5]

The area of migration and population mobility may also be of interest for statistics using big data. Thus, big data opens up great opportunities in the production of official statistics in general, and in migration statistics in particular. Despite the current problems with the use of big data in practice (problems of obtaining access related to privacy, methodological issues, problems with computing power, etc.), the development of statistics in this direction is inevitable.

Today, in order to develop the use of big data in migration statistics, it is necessary to focus on the development of a specific methodology for assessing migration processes using Big Data technologies and determine what data is needed, how information will be collected, how not to violate the right to privacy of citizens and other related issues [7, 8]. Currently, global Big Data technologies are the key technologies of the future [9].

In downtown New York, thousands of infrared cameras are pointed at the windows of houses - they collect information about when residents fall asleep and wake up, when they turn on the lights, they even know what types of light bulbs they use, they collect information about environmentally harmful emissions from buildings. Sound sensors on traffic lights record the noise level from traffic and house parties.In Chicago, sensors on the streets record data not only on the state of the environment (carbon dioxide concentration, noise level, wind speed), but also on the behavior of pedestrian flows. In Houston, authorities monitor citizens' smartphones to learn about traffic congestion and synchronize traffic lights [9,10]. In Barcelona, analysts commissioned by the authorities study just a huge number of parameters of city life - from economic and demographic indicators to statistics on the use of rented bicycles and congestion of bus routes; computer programs scan messages on social networks about various city events, while sensors on garbage containers help to optimize the work of sanitation services.

This is large business for the world's largest companies - IBM, Microsoft, Cisco Systems, Qualcomm and others. Installing 65 multi-functional sensors in Chicago cost $200 million (the federal government paid) plus large business subsidies, according to the Wall Street Journal. IBM — not just from urban projects, but from big data solutions in general — earned $1.3 billion in 2012, more than any other company in the world. At the same time, this business (especially if we discard the paranoia about total surveillance) is really capable of improving life in cities [4, 12]. Office workers need to scrutinize spreadsheets, dashboards, and reports to gain insight into their organization's activities. Taking into account that employees also receive a huge amount of information via e-mail, at teleconferences and meetings, it is simply amazing how they find time to perform their current duties [7,13].

However, a much more significant effect, both network and at the macro level, is generated not so much by storing as processing and analyzing information, which makes it possible to extract economic value precisely from large volumes of data, the diversity of their types, sources, areas, as well as a high rate of updateand replenishment, and the circle of beneficiaries is not limited exclusively to information and communication companies (ICT companies) [1]. Unprecedented and truly inexhaustible opportunities open up for business entities to make more informed and verified decisions, optimize and improve performance, and create new types of products and services, based on a comprehensive, all-inclusive analysis of situations and problems, forecasting their dynamics and trends, establishing cause-and-effect relationships with factors that were not previously taken into account and identifying the influence of circumstances that were considered insignificant [14].

A similar vision and approaches to handling data, known under the quite predictable name of Big Data, arose quite recently - the very concept of metadata was proposed in 2010 in the United States.

However, the corresponding technologies and solutions are actively promoted by the company to micro-developers and software, for which they form a new capacious market segment. For example, IBM has already invested $12 billion in developments in this area, having opened 6 metadata analysis centers around the world with a total of 4,000 employees [9]. As for the business that is the recipient of the results of this R&D, then, according to SAS, 26% of companies already use Big Data on a systematic basis and note in this regard an increase in efficiency over the past 3 years, while 41% expect an increase in the next 3 years; according to IBM, 28% of subjects have launched pilot projects on metadata analysis, and 47% have a firm intention to implement the relevant technologies [6]. The importance and prospects of Big Data are also recognized by the state as the central institution of economic coordination. Metadata or big data strategies have already been adopted and are being implemented in South Korea, the United States, the United Kingdom and Singapore, which are the largest participants in the global information and communication market. In particular, South Korea was the first in the world in October 2011 to put forward a strategy in the field of Big Data as part of the course towards the formation of e-government, using them to ensure the transparency of the state, develop and strengthen the competitiveness of the economy [7]. At the same time, the strategy itself is the most systematic in comparison with the programs of other countries, covering the whole range of aspects for introducing Big Data into business practice. The UK and Singapore, where special data strategy centers have been established to promote Big Data, are not aimed at developing technologies, but at creating value added through their active use by making information available to a wide range of users [6, 11].

The ever-growing capabilities of processing large volumes of data today are fundamentally changing business processes and the business environment. The use of global Big Data technologies can play a key role in the modern innovative development of the post-industrial economy. Big Data technologies are a completely new development trend, which is confirmed by representatives of the world community [9].

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