

APPROVED
PARB.00227-02 31 01-AS

SOFTWARE PRODUCT

**GEO INFORMATION SYSTEM «PANORAMA»
(GIS Panorama)**

Description of application

PARB.00227-02 31 01

15 pages

<i>Orig. Inv. No.</i>	
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ANNOTATION

This document contains the operator's guide for the use of software the Geographic information system «Panorama» (GIS Panorama) PARB.00227-02.

GIS Panorama is the universal geoinformation system which have means of creating and editing the digital maps and cities plans, remote sensing data processing, performance of various measurements and calculations, the overlay operations, processing of raster data, means of preparing the graphic documents in electronic and printed form, and also tools for work with databases.

This database of digital vector maps has hierarchical structure. The lower level stores information about individual map objects. The objects can be united in groups, layers and map sheets. The set of one scale and kind maps is the work area - a separate database of digital maps. The description of separate object consists of metric data (terrain coordinates) and semantic data (properties of object). It is including the unique identifier of the object via which the logical communication is carried out with external databases.

The size of the individual database for digital vector maps can have several terabytes (TB). The database update is performed in run mode of the transaction that provides failure recovery and rollback to any number of steps back. The management system supports high performance indexing algorithm data that provides the maximum speed of the search and display of map features on standard hardware.

The interface of management for digital maps allows to request and to change the description of separate objects or their set chosen by set criterion, to display maps with change of scale, structure of displayed data and representation form.

The system is opened to users - it supports various formats of exchange. It is provided by configuring maps classifiers, libraries of symbols. It supports a variety of coordinate systems and map projections. Many of the programs presented as source code in the SDK.

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1 PROGRAM ASSIGNMENT

Geographic information system «Panorama» (GIS Panorama) PARB.00227-02 (hereinafter - GIS Panorama) is the universal geoinformation system designed for collecting spatial data, maintaining spatial databases, creating and updating digital maps and plans, creating information systems for various purposes.

GIS Panorama is the client of network system of processing the spatial data including the server of the spatial data the GIS Server (GIS Server) PARB.00049-02 (hereinafter - GIS Server).

GIS Panorama includes the professional tools for creating and updating digital topographic maps and plans of towns and cities, navigation and other tasks.

Database of digital vector maps has hierarchical structure. The lower level stores information about individual map features. Objects can be united in groups, layers and sheets of maps. A set of maps with the same scale and view is a work area - a separate database of digital maps. The description of the individual object consists of metric data (coordinates on the Earth) and semantic data (object properties), including a unique object identifier that provides a logical link with external databases.

The size of the individual database for digital vector maps can be several terabytes (TB). The database update is performed in run mode of the transaction that provides failure recovery and rollback to any number of steps back. The management system supports high performance algorithm of data indexing that provides the maximum speed of the search and display of map features on standard hardware.

The interface of management for digital maps allows to request and to change the description of separate objects or their set chosen by set criterion, to display maps with change of scale, structure of displayed data and representation form.

The system is opened for users - various formats of an exchange are supported, customizing the maps classifiers and libraries of conventional symbols is provided, various coordinate systems and map projections are supported.

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2 CONDITIONS OF PROGRAM EXECUTION

Recommended requirements to structure of hardware and software:

- processor type Intel Core i5 and more;
- the volume access of operative memory: 8 GB and more;
- free space in one partition of the hard drive for processing spatial data from one TB or more;
- video card to build 3D terrain models with the following parameters: support for OpenGL version 1.4, the amount of universal conveyors (SPU) - 640, memory capacity - 2048 MB, memory bus - 128 bits, texture units (TMU) - 80, ROP units (ROP) - 16, speed SPU - 1085 MHz, cores - 1020 MHz, memory 5400 MHz;
- USB port available for the application;
- screen size of at least 1920 x 1080 pixels;
- the manipulator «mouse»;
- keyboard;
- network card Ethernet capacity of 100 Mbps and more;
- operating system: MS Windows 7 (64-bit) and more.

For work of the GIS Panorama software it is necessary to install the protection key driver for the x64 platform. Installation of this driver of the protection key is located in the folder: «Panorama12\WinKey6».

Before installing the driver, you need to make sure that the Guardant driver of a different version is not already installed. If the specified driver is present on the system, you must uninstall it, then install the current version of the driver.

To check the program correctness of XML (XmlCheck) it is necessary for computer to have MS NET Framework version 3.5 and newer.

To output reports in MS Word format, you must have the MS Word program or Office suite OpenOffice.org Writer on your computer.

The choice of the technical means is connected with the possibility to process a great volume of data. Vector electronic map can contain some thousand sheets of electronic maps. One sheet can contain up to 2 billion objects. The map can be 65 thousand types of objects. Objects can be combined in 255 layers, taking into account the objects localization of more than 1000 layers. The size of a single sheet (the area of the covered area) is not limited.

The volume vector maps can reach several terabytes.

The volume of one raster or matrix map can be up to 1 TB.

GIS Panorama is written in the language C++ ANSI ISO/IEC 9899:1999(E).

To build the GIS Panorama PARB.00227-02 are applied:

- integrated development environment «Borland C++ Builder 6.0»;
- integrated development environment «Embarcadero RAD Studio XE5»;
- a program for creating installers «Smart Install Maker 5.02».

Part of GIS software includes the module panorama64.exe, the set of DLLs and files operational hints with the extension chm. To connect the GIS tasks that are implemented in a separate DLL, there are files ICO in addition that contains the icon of the task (tools). The name of the ICO file matches the corresponding DLL file.

Documentation for GIS users and application developers, including educational materials and a description of the applications is contained in the subdirectory \DOC.

Subdirectory \DATA contains examples of digital maps and classifiers.

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3 TASK DESCRIPTION

GIS Panorama software has modular multitasking structure. All modules are called from the general control shell.

Software includes:

- control shell;
- management system of digital maps;
- service modules.

The control shell is implemented as an executable file panorama64.exe. It is responsible for the user interface (operator work).

The management system of digital maps is implemented as a dynamic library. It performs functions of specialized DBMS of digital maps.

Service modules (converters, editor of the vector image, the module of output to external devices and others) are implemented as dynamic libraries.

The basic content of the GIS Panorama includes more than 100 different applications. The most commonly used application tasks are invoked from the menu «Tools»:

- Map editor;
- Map Computer;
- Sorting;
- View passport;
- Map Navigator;
- Navigator 3D;
- Map Legend;
- Classifier Editor;
- Geodesy Editor;
- GPS-device connect;
- Road net;
- Reference system;
- Raster Editor;
- Preparation to print;
- Custom panels;
- Run application.

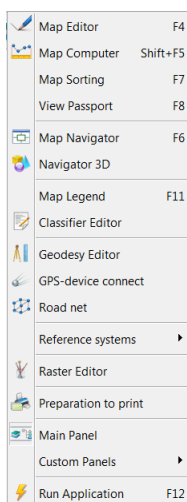


Figure 1 - General view of «Tools» menu

It is possible to call the execution of the application task from the task tree via the menu item «Tools/Run application».

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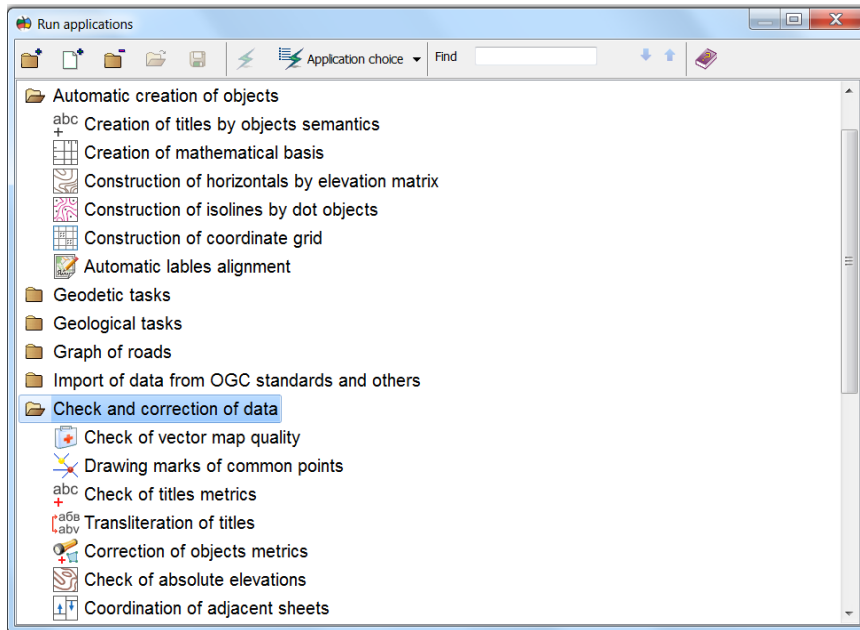


Figure 2 - General view of the dialog for selecting an application task

New application tasks, created on the basis of MAPAPI and PANAPI application interfaces, which are described in the Programmer's Guide, can be added into the tree of application tasks.

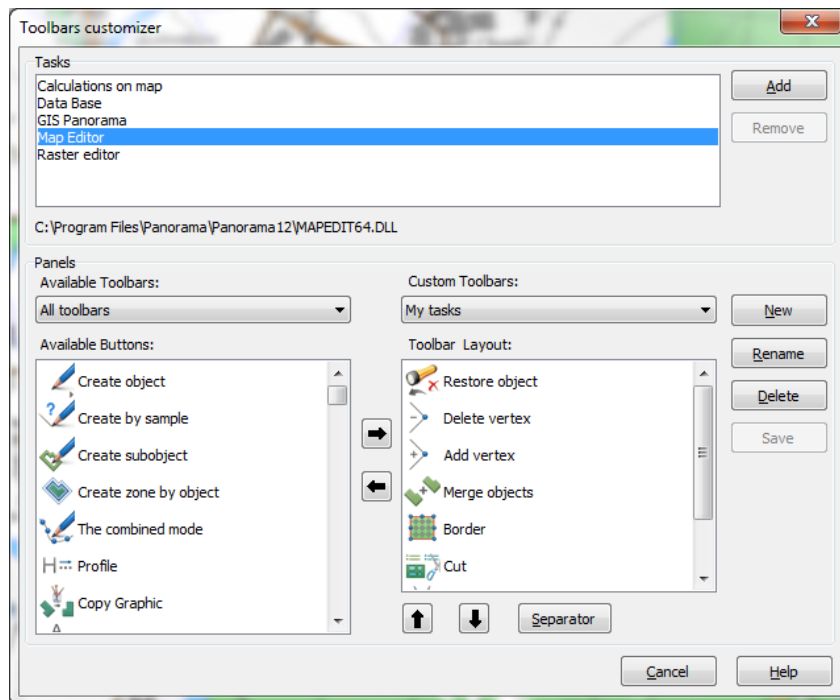


Figure 3 - Customizing user panels with applications

Another way to connect the new applications or their individual modes is to configure custom toolbars. The toolbar can have your name and any set of buttons, recruited from the tasks in basic components of GIS, with the ability to connect libraries of DLL containing new tasks created on the basis of applied interfaces of MAPAPI and PANAPI.

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Figure 4 - User's toolbar

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4 INPUT AND OUTPUT DATA

4.1 Types of processed spatial data

GIS Panorama allows to process the following types of digital cartographical data:

- vector maps in different projections and coordinate systems, including nautical charts, navigation (air), navigation, and others;
- remote sensing data, including satellite images in the optical range, multispectral imagery, laser data, sonar data, and others;
- a regular array of heights, matrixes of qualitative characteristics (covers), TIN-models.

Different types of digital data can be processed together or separately. Digital data can be displayed on graphic displays, be edited, be output on external printers.

To automate the processing of GEODATA obtained from other GIS, and from various web services, GIS Panorama is able to handle dozens of different data formats, including those that are international standards.

Supported classifiers aeronautical information developed in accordance with the recommendations of ICAO (International Civil Aviation Organization) given in the document «Guide to air navigation maps (Doc 8697-AN/889/2). International Civil Aviation Organization».

Nautical charts are generated in accordance with the requirements of the International hydrographic organization IHO (International Hydrographic Organization) standards S57\S52.

In the GIS Panorama it is possible to create the following types of maps:

- the map consisting of a set for nomenclature sheets international graph rules (the standard size) or sheets of any size;
- the map consisting of one sheet the standard or any size;
- the map having any borders (of the whole world, the region, the settlement), changing according to the current structure of objects.

In a map window it is usually opened a multi-sheets map of the area, and over it can be opened maps with arbitrary boundaries and containing a variety of thematic information. Maps with arbitrary boundaries are called the user one. Thematic information depends on the scope of GIS applications. For example: the state of communications, demography, economy, ecology, military and etc.

As the map it can be used a map of any territory, represented by one single sheet. For example: the map region or the map of the country.

Multi-sheet map displays faster than the map that stores objects in one sheet. The division of objects on the sheets does not affect the coordinate accuracy determination of the characteristics of extended objects (rivers, roads), the solution of special problems (transport, navigation).

For sharing digital maps can be used formats SXF, GML, MIF, SHP, DXF, KML, MP, and others.

4.1.1 Vector maps

4.1.1.1 Map contents

Data of digital vector maps have the following logical structure:

- passport data about a map sheet (the scale, a projection, system of coordinates, rectangular and geodetic coordinates of corners of a sheet and so on);
- metric data of map objects (the district coordinate of objects);
- semantic data of the map objects (various properties of objects).

The object of the digital map is set of figures: metrics and semantics. The real object can be corresponded to the object on the map (of the district: the bridge, the river, the building, etc.), group of objects (quarter - group of houses, etc.) or part of object. The object of a difficult configuration can be

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divided into some objects, for example: building porch, separate cases. To some objects of the map there is no compliance: explaining signatures, horizontals, kilometer grid and so on.

Separate objects of the vector map can be logically united on layers, by nature of localization and the signs established by users.

The description of the type objects for vector maps, semantic characteristics (properties, attributes) objects, layers in which objects united, the conventional signs used at display and the printing of the map, is stored in the digital qualifier of the map.

On the digital map can be till 65536 types of objects which can be united in 255 layers and have to 65536 types of the characteristics.

4.1.1.2 *Multisheet map*

Multisheet maps contain sheets of one scale, projection, coordinate system. Data of a single sheet are stored in the following files:

- metrics (coordinates of objects, *.DAT);
- semantics (characteristics of objects, *.SEM);
- help data reference (indexes for fast search of object or its description, *.HDR).

For all sheets of the map the one passport file of MAP format is created. For each sheet in the passport a separate record is contained.

Library of conventional symbols, a list of code objects and their names, description of layers and semantic characteristics are stored in the digital classifier of the RSC format.

The formation of multi-sheet maps can be performed when you import the data of format SXF with the use of the file format of the DIR (see Annex A).

Due to the fact that each sheet of multi-sheet maps physically separated from the other sheets, it can be independently updated, displayed, edited and transmitted from one user to another without affecting the entire multi-sheet maps.

Data files of one multi-sheet maps should be in the same directory. Not recommended in the same directory to host multiple multi-sheet maps.

4.1.1.3 *User map*

The user vector map consists only of one sheet of a map which has no constant sizes. At addition or removal of objects its sizes and location will change. The user map can be displayed together with a vector map of the terrain, and also raster and matrix maps. The same user map can be simultaneously displayed on different maps of the terrain and edited by different users. The results of editing for different users will look the same.

The user map has its own classifier, which does not depend on the terrain classifier.

Together with a single terrain map, any number of different user maps with their classifiers can be displayed at the same time.

Creation, updating and distribution of terrain maps and user maps can be performed independently by different services from different sources.

The exchange of user maps can be performed in the SXF format of binary or text type.

Objects of the user map may not have a connection with the user classifier. Graphic representation of object can be stored in object record that facilitates converting of the data from MIF/MID formats.

Such objects are called graphic objects. The attributive data can be stored in an external relational database. Communication with a database is carried out by unique number of object on a map.

Data about sheet of the user map is stored in the following files:

- map passport (*.SIT);
- metrics (coordinates of objects, *.SDA);
- semantics (attributes of objects, *.SSE);
- reference data (the index entry, *.SHD);

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- graphical data (symbols of graphical objects, *.SGR).

All data onto an arbitrary territory can also be placed in a single file of SITX format.

Library of conventional symbols, list of code objects and their names, description of layers and semantic characteristics are stored in the digital classifier of the RSC format.

4.1.2 Raster data

GIS Panorama allows to display and process different types data of the Earth remote sensing. For example, data of space and air shooting in the optical range, multispectral pictures.

These data can be imported from various formats: Geo TIFF, JPEG, MrSID formats, BMP and others. The Geo TIFF format can be displayed without transformation to the GIS internal format. Other formats will be transformed into the RSW format, having the file structure from several levels and supporting compression of algorithms JPEG and LZW.

The size of one raster image can be up to 1 TB. At the same time together with vector maps it can be opened thousands of rasters.

4.1.3 Matrix data about districts (covering)

GIS Panorama processes matrix data about the districts presented in the MTW, MTQ, MTL formats. Files of the specified formats are additional to data in the SXF format for representation (of different kinds) for district in matrix form.

There are the following types of matrixes of terrain properties:

- matrix of heights;
- matrix of qualities;
- matrix of layers.

Matrixes of heights (MTW) can be constructed according to the vector map. They can contain absolute heights of a land relief or the sum of absolute and relative heights of objects. Matrixes of heights are described in the document PARB.00227-02 99 01_Formats MTW and RSW.

Matrixes of qualities (MTQ) can be received searching the set object types of the map having demanded characteristics. In the matrix are filled with the corresponding weight coefficients those cells which coordinates belong to object. Matrixes of qualities and a matrix of heights have uniform structure.

Formats MTW and MTQ have a tiled structure of several levels, and supports data compression on the original algorithm. The size of a single matrix can be up to 1 TB.

The matrix of layers (MTL) is a regular 3D model of geological bodies (layers of the earth's crust) and contains a regular array of values of absolute heights and capacities of layers.

4.2 Access to data by tools of the GIS Server program

GIS Panorama provides the multiuser access to maps for viewing and editing. But it can open maps not only in a local network in the file-server mode, but also in the Internet in the client-server mode.

As a managing server for accessing maps, the GIS Server SE PARB.00049-02 is used. It provides remote access to vector maps, rasters and matrixes. The connection to the server is made by protocol TCP\IP with using the sockets mechanism.

Between the client and server, binary data - coordinates of objects, attributes, blocks of data for rasters and matrixes - are sent. Therefore, for normal operation, it requires a broadband connection the client and the server, for example, by network Ethernet 100 Mbit\sec.

Placing data on a server provides protection against illegal copying and change. The user chooses to work data on their conventional names (aliases). The list of available data is generated for each user on your user name and password. Vector maps can be opened for viewing or for viewing and editing. Raster and matrix are available only for viewing and performing calculations. Also, all data can be closed or open to copy server - exchange formats to the clipboard or other maps.

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When you first connect to the server in the client program, you must enter the server address - the hostname or IP address of the computer running the GIS Server. The host name can be the name of the computer on the local network. In addition to the address of the server specifies the port number to connect to.

By default, the port number is set to 2047. The computer name can be selected in the dialog «Browse computers» which generates a list of computers in a local network. For remote connection, you must enter its IP address

For connection to another server, you must enter a new address. At one point of time it is possible to connect to a single server.

To access the server, the user at the beginning of the work must enter a user name and a password. After that, the user can select the data in the dialogs «Open maps from GIS Servers» or «Add maps with GIS Servers». If the user will turn to these dialogues before registration or GIS will attempt to open on the server maps which were opened in the last session, the dialog user registration will be opened automatically. The user's password is stored and transmitted in encrypted kind by MD5 algorithm. If the password is lost, it is assigned again by the administrator.

The user can open vector maps, raster or matrix in a separate window or to add to the previously open data. The title of the dialog «Open maps from GIS Server» displays the user name. The dialog contains three tabs - maps, rasters and matrixes. Each bookmark contains a list of relevant data. Each element of the list, for clarity, has a colored icon to indicate access rights - read, edit, copy.

For selecting the required item and clicking «Open», a new window will appear in GIS, containing the selected image data. If the selected data has been already opened in the GIS, then a new window will not be opened. If you open data and error occurred, the screen displays a message containing information about the error.

To add data to the map, it is necessary to choose, in one from the list, the desired item and press «Add» button. It could be selected only custom maps (SIT) to add in the list of maps.

The data placed on the GIS Server is protected from unauthorized reading, editing, copying, printing and spoofing.

When authorizing the user with user name and password, the digest-authorization algorithm is applied to prevent the user from intercepting the user's password when connecting to GIS Server. In this case, it is sent to the Server a random string encoded by the key created on the basis of the user's password. If the result of the string encoding on the client and the server is the same, the authorization is successful.

All data stored on the client computer in the cache for speeding up work is always encoded with a 256-bit key formed from the server key and client key. If the keys have changed when you connect to the data on the server, the cache is automatically cleared and re-filled as you access the data.

It is supported the possibility of autonomous work with data from the cache when communication with GIS Server is lost. If there is no (short-term loss) connection with GIS Server, the data access is automatically switched to the mode «Read Only, Prohibit Printing, Copy Blocking». When the connection is restored, the access is automatically changed to the one that is set for the user on GIS Server, and the data is automatically replicated to the cache in the part of the changed data.

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THE LIST OF SYMBOLS, TERMS AND DEFINITIONS

GDB	-	geospatial data base
BMD	-	base of metadata
GIS	-	geoinformation system
GSI	-	geospatial information
GSD	-	geospatial data
RSE	-	remote sensing of the Earth
ICS	-	information cartographic support
IS	-	information support
CS&HW	-	complex software and hardware
SGSI	-	a set of geospatial information
NS	-	nomenclature sheet
UA	-	unauthorized access
OS	-	operating system
OOD	-	object-oriented data
OOM	-	object-oriented model
OODB	-	object-oriented database
S&HC	-	software and hardware complex
HW&SWS	-	hardware and software system
SWP	-	software package
UDM	-	User Data Models
ST	-	software tools
PECM	-	personal electronic computing machine
WDD	-	working design documentation
TAVP	-	tools of antivirus prevention
TIS	-	Tools of Information Security
DES	-	data exchange system
SSW	-	special software
DBMS	-	database management system
DM	-	digital map
DTM	-	digital topographic map
DPC	-	data processing center
GIS	-	Geographic Information System
GML	-	Geography Markup Language
Attribute	-	The name-value pair contained in the [ISO 19136: 2007] element
Attributive data	-	A piece of data that characterizes the properties of spatial objects (except for information about their spatial location)
Database	-	A collection of data organized in accordance with certain rules and maintained in computer memory, characterizing the current state of a certain domain and used to meet the information needs of the user. The basis of the database is the data model
Basic spatial objects	-	Digital data on the most used objects of the terrain, which differ in the stability of the spatial position in time and serving as a basis for positioning other spatial objects
Geocovering	-	the scheme for the availability of geospatial information, performed in specified conventional symbols
Geoportal	-	A mean for access to distributed network resources of spatial data and geo-services located in the Internet environment
Geoservice	-	The ability of a geoportal user to perform any actions on spatial data
Boundaries	-	A set that contains limitations of some entity [ISO 19136: 2007]

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- The unitary electronic cartographic basis Identification** - A digital cartographic image that is the backbone (substrate) for combining with the image of other spatial data or creating spatial data
- Coordinate data** - The process of assigning a unique value to the attribute of the object that does not coincide with any other value of this attribute from other objects
- Metadata** - A piece of data that characterizes information about the spatial location of objects
- The data model** - Data about the data [ISO 19115: 2003], data describing the content, volume, position in space, quality and other characteristics of spatial data
- The data set** - A fixed system of concepts and rules for representing the structure, state, and dynamics of a problem area in a database
- The object-oriented database** - An identifiable collection of data [ISO 19115: 2003]
- Spatial data** - A database in which data is modeled as object models, including application programs that are controlled by external events. Such database is usually recommended for cases where it is required high-performance processing of data having a complex structure
- The spatial object** - Digital terrain data and geographic and anthropogenic objects located on it, including information on their location, form and properties, presented in the coordinate-time system
- Relational database DBMS** - A digital model for material or abstract object of the real or virtual world, with an indication of the identifier, the nature of the localization, the positioning of the object and its attributive data
- Server (software)** - A database based on a relational data model
- Server (hardware)** - A set of software and linguistic tools for general and special purposes, providing management of the creation and using of databases
- The data dictionary** - Software that receives requests from customers
- The essence of metadata** - A computer dedicated to performing certain service functions
- Schema** - A list of data describing the semantic content and form for the representation of entities and metadata elements, the rules for filling them, as well as a set of possible values for metadata elements [ISO 19115: 2003]
- The metadata element** - A set of metadata elements that describe the same aspect of the data [ISO 19115: 2003]
- Unified resource locator (URL)** - A collection of schema components within a single target namespace [ISO 19136: 2007]
- PHP** - A discrete metadata unit [ISO 19115: 2003]
- WEB-publication** - A standardized string of characters indicating the location of the resource on the Internet [ISO 19115: 2003]
- ISO** - a scripting programming language used for developing web applications
- A form of data representation for display on the Internet
- an international non-governmental organization engaged in the development of international standards and cooperation in the field of standardization

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