

WWW-access to Resources Corporative GIS ISC SB RAS

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Abstract

In Russia for the first time, within the framework of the complex project of informatisations of science and education, supported RFBR and Ministry of science RF, in the scale Academcity and adjoining to him founding Irkutsk regional scientifically-educational complex (IRSEC), created fiber-optic network with maximum reception capacity 100 Mb/s. and on its base integrated information-computing system ICS SB RAS and other founding an IRSEC with output in Russia and foreign global networks, provided output in Internet. Designed software WWW access to removed by data base on the base of global networks and with using the technologies Active-X and OLE ensuring building corporative Intranet network. As a toolbox for processing cartographic information is used GIS MapInfo installed on GIS-server. Using a given approach ensures a possibility of integration of portioned information resources.

1. Introduction

Until recently the geoinformation systems (GIS) were used only for professional activity narrow around of the persons - cartographers, geologists etc., and for organization working GIS of a place tens to thousands of dollars - cost of the equipment and software are necessary. In the last years the situation with application GIS has changed by a radical image: instead of expensive workstations all are used more often PC, a wide circulation have received inexpensive GIS for the decision special of problems.

On the data of the company Dataquest volume of the software GIS for personal computers by 2000 will exceed 1,4 billion dollars. Taking into account the tendency of de-

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velopment the Internet, which is the basic source of the information all over the world, the integration of GIS-technologies and Internet-technologies represents a doubtless urgency [1,2]. Such integration assumes application of architecture distributed systems processed the information with elements "client-server". The term "client-server" means such architecture of a program complex, in which its functional parts cooperate under the circuit "question - answer". If to consider two cooperating parts of this complex, one of them (client) carries out active function (initiates inquiries), and other (server) is passive on them answers. In accordance with development of system, the roles can vary. For example, some program block will simultaneously carry out functions server in relation to one block and customer in relation to other, in sense of an opportunity of elements in different moment of time to change the active function on passive and on the contrary. The given architecture allows optimum to use hardware (GIS-server, scanner, plotter) and software (GIS MapInfo, GIS ARC/INFO etc.) maintenance. For realization of the offered approach binding program components on Delphi v.3.0 were developed. In GIS-center ISC SB RAS the being available cleanly license software is based on a platform of operating systems Windows, therefore at development of architecture of construction of system of removed access to the specified resources the decisions of firm Microsoft were considered only. We shall briefly consider development of technologies of an exchange between the applications, offered firm Microsoft.

2. The review of technologies of interaction of the Windows-applications

1. DDE (Dynamic Data Exchange) - dynamic exchange of the data.

It successfully realized, till now widely used, technology of a low level of a dynamic exchange by the data. In essence, DDE represents model of asynchronous interaction of Windows-processes (applications), with using of which the application to apply the channel of an exchange by the data with DDE-server, being on the same machine. By other words, after an establishment of communication (connection) the causing party transfers an inquiry and expects return of results, that significantly complicates its use, as it is necessary to take into account probability of infringement of connec-

tion, time-outs and other errors, which application should distinguish and to correct. Complexity of use DDE has compelled Microsoft to search for various ways of its improvement - so the specification DDEML was offered, but it has appeared insufficiently. It was necessary to give the incorporated decision more high level for integration of the applications (component). As such decision technology OLE (Object Linking and Embedding) v.1.0 was offered - linkage and introduction of objects. The mechanism of linkage provides connection of a component with object, which reference on it is underlined only; the mechanism of introduction places to a component in object, where a place for its storage etc is allocated. Using DDE protocol as the base mechanism of the communications, on the one hand OLE allows make active built - in object in the document. That is to receive the compound document, on the other hand it has inherited many problems of the asynchronous protocol (established connections were easily broken, for example, in result of change of a route of access to a file of connected object etc.). A following stage in development OLE of technologies has become publication OLE v.2.0, the specification was widespread among the developers at the end of 1993 - beginning 1994. In addition to "to linkage and introduction" of objects it has defined set of system means. That are switching on Uniform Data Transfer (expansion of the protocols of an exchange by the data), Structured Storage (way of a constant storage, hierarchically enclosed objects) and OLE Automation ("Automation") (interfaces of the applications, used by other applications and languages of the scripts). However the important peculiarity OLE v.2.0 is transition from DDE to COM.

2. COM - Common Object Model or otherwise model of components objects.

Usually the application consists of one monolithic binary file generated by the compiler, and it remains constant, until will be compiled and new version, taking into account changes in operating systems, equipment and functional needs(requirements) of the users, is put. At modern rates of development of industry of programming "static" of the application processes of creation of program systems significantly slow down. One of the decisions of this problem is, to break the monolithic application on separate parts or components. In accordance with development of technology the components, making the application, can be replaced new. The application is not more static, it gradually evolution, - the initial components are replaced new. From existing components easily to create absolutely new applications. The component is similar to the mini-application: it is delivered to the user as binary code, compiled and ready to use. To break the monolithic application on components, powerful tool is necessary which is COM. COM models defines, how to create dynamically interconnected components and customers, to guarantee an opportunity of joint work and establishes the standard for specific architecture of construction of the object applications.

With increase of productivity and common importance of networks needs for the applications, consisting of components placed in a network is increased. The component architecture helps to simplify process of development of the similar distributed applications. Use of the given architecture allows to the developer or to create the applications in view of a configuration of a network, for example, in GIS-center ISC SB RAS is allocated server and clients, or without the account of accommodation of components are determined.

There are the various variants of switching a component with use of the interface. Using the interface COM, switching of components directly is provided. The given interface, includes a set of functions, which are realized by components, and are used by the customers, i.e. it is certain structure in memory, containing a file of the indexes on function. Other approach, ensuring large flexibility of linkage of components, refers to as "Automation". "Automation" facilitates to interpretive languages and macrolanguages access to components COM, and also facilitates a spelling of such components in these languages. Peculiarity of "Automation" is an emphasis on check of types during fulfilment. This way of switching a component is used with many firm applications Microsoft. Means "Automation" allow organizing the hierarchical structure of objects - methods and properties can return the indexes on interfaces of other components. "Automation" can be considered as the standard mechanism, through which object can set the properties, methods and types, and to give to them access as through methods of the standard interface IDispatch, and methods of usual interfaces. "Automation" is uplevel above COM. A component COM, the realizing this interface, refers to as "server of Automation". The customer COM, cooperating with "server of Automation" through the interface IDispatch, refers to as "by the Controller of Automation". The customers do not cause function server directly, instead of it they use the functions - members of the interface for an implicit call of functions "server of Automation". The interface IDispatch gives the customers and components a new way of dialogue among themselves. Instead of granting several own specific interfaces for access to the services, the component can supply access to these services through one standard interface IDispatch.

OLE v.2.0 has given the user additional opportunities: the objects built - in the document of steel now to be made active "on a place", and they can be edited with the help of the own menu and tool lines, such opportunity is very convenient for the end users. By a following step in development of technology of interaction of the applications, development of technology of allocated objects, ensuring realization of component architecture within the framework of global networks, was.

3. DCOM (Distributed COM) - common model of distributed objects, on definition "excluding" realization of the interface from a point of performance.

The technology DCOM provides association of information resources, equipment, program systems, interaction between

ÑÓÄÄ, GIS, other applications and opportunity of access to them through World Wide Web. The detailed description of organization of WWW-access to the cartographical information of GIS-centre ISC SB RAS (fig. 1) is shown in [3].

In April, 1996 Microsoft has accepted in sphere of the interests environment World Wide Web and has entered into the using the term ActiveX, called to display a new direction in strategy of issue of program products of firm.

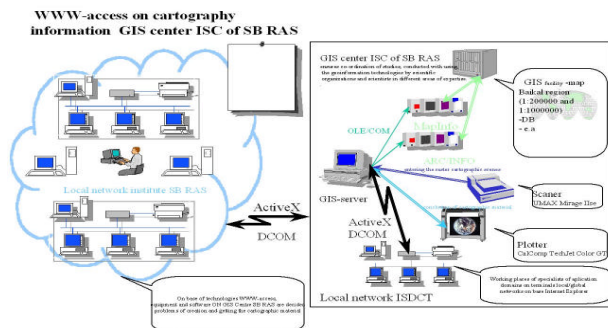


Figure 1. The Structure of WWW-access to the Cartographical Information GIS-centre ISC SB RAS

4. ActiveX - specialized set of means, constructed on the base COM, and problems intended for the decisions, connected with World Wide Web and corporate networks (intranets).

In essence, the term ActiveX has replaced the term OLE, as the majority of means used ActiveX already existed up to this time, and the realization was introduced in Microsoft Internet Explorer.

We shall notice that the COM specification is a basis of such technologies, as OLE and ActiveX. This technologies there are only two versions of realizations of the specified above services, constructed on their base, wonderfully “sticking together” objects not dependent on an arrangement, portable between various platforms and not limited in a choice used of the programming languages.

3.Opportunities of API-interfaces GIS

The base software of desktop geographical information systems in GIS-centre ISC SB RAS is MapInfo v4.1 and ARC/INFO v7.1.2. GIS-server represents the computer with base operating system MS Windows/NT and set of the software for creation, display, editing of cards, libraries for organization of access of the customers as ActiveX of components, ðï ïññîàà of region in formats 1:200,000, 1:1000000. The client place - the browser of standard HTML-pages. At processing he of main page server GIS starts the program, supporting the interactive interface to the software server.

Specified above tool GIS give the following opportunities:

GIS MapInfo (version 4.5 and is higher) provides as work in a local network on technology “client-server” and use it in quality server OLE/COM/DCOM of objects (“Integrated Cartography”) with interfaces to languages MS Visual Basic, MS Visual C ++, Delphi v.3;

“Integrated Cartography” is a mechanism, when elements GIS MapInfo (window of a Card, Report, Legends, etc.) are integrated in the user application, providing the developers by simple methods of access to opportunities MapInfo from the user applications (linkage of components). GIS ARC/INFO (version 7.1.2 and is higher) - Open Development Environment (ODE) which allows to the developers to address to functional opportunities ARC/INFO from other applied programs through specially created interfaces.

ODE represents a set of libraries with one library for each standard module. ODE gives access to functional opportunities ARC/INFO as a set of the subroutines and functions. ODE supports the same teams and functions, which are accessible in traditional modules ARCDIT, ARCPLOT, ARC GRID, and also through a command line ARC/INFO. Version ODE for Windows/NT includes a OLE-environment for each dynamically connected library (DLL). In result we have three managers of an element ActiveX (ActiveX Controls) and two server of objects COM. ActiveX Controls include means of work with cards: ARCDIT (Arcdit.ocx), ARCPLOT (Arcplot.ocx) and ARC GRID (Grid.ocx). Server of objects COM include library of a functional level ARC (Arc.dll) and level of a line file (Strings.dll), which return the information for environment of development. ActiveX Controls are located in the applied program for reception of access to functional opportunities: ARCDIT, ARCPLOT and ARC GRID.

Further, realization of WWW-access to resources GIS MapInfo on the basis the interface IDispatch and method CreateOleObject for organization of access to methods “Server of Automation” on technology COM is shown.

As functions GIS API MapInfo the technology OLE gives an opportunity only of local work, for the decision of the given problem it is necessary to enter an intermediate link (“ProgramA”) (fig. 2).

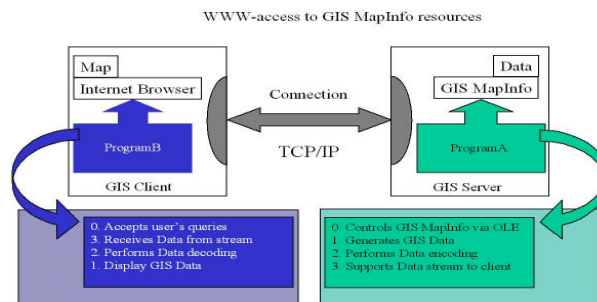


Figure 2. The Structurally-functional scheme of WWW-access to Resources GIS MapInfo

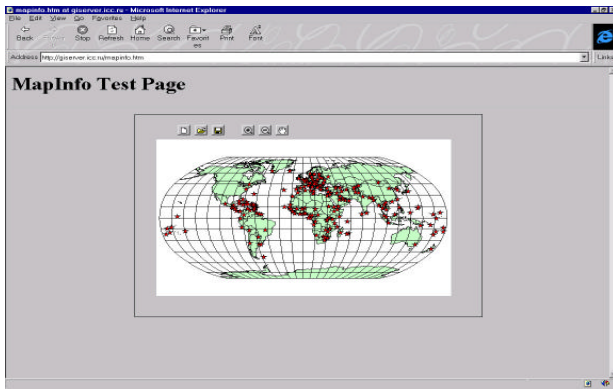


Figure 3. The Screen form of the interface of the user

Which is established on one machine with GIS MapInfo, and on the one hand, can locally to cooperate with GIS MapInfo, and with other, under protocol TCP/IP - with the removed customers (“by the Program(-s)B”). As already it was marked earlier, GIS MapInfo the decision of a put problem is “server of Automation”, and only due to this probably. Further, we shall consider, how there is the OLE-management and as described system as a whole works: ProgramB (we shall be repeated, is at the client) causes methods ProgramA (is on GIS-server), which in turn causes methods MapInfo. All graphic data GIS MapInfo are removed in submission and controllable window of ProgramA. The specificity of a problem assumes, that for determined classes of the images, for reduction of the size, the image is converted in GIF (Graphic Interchange Format) format with use of a method “XOR” and flow (TStream) is transferred ProgramB(client). By use in ProgramB of keys of management, removed methods ProgramB are caused which generates teams for a window GIS MapInfo (in the field of a card it is coordinates of the cursor of the mouse and used working tool, etc. We shall consider on stages an offered method.

The start GIS MapInfo in a background mode occurs by a call of function CreateOleObject (),

```
Var MapInfo: Variant;
MapInfo: = CreateOleObject ('MapInfo.Application')
```

Where MapInfo.Application is the name GIS MapInfo, registered in the register Windows. The given function returns the interface IDispatch, with the help of which it is possible to address with GIS MapInfo.

For maintenance of interception of management of dialogue windows and messages GIS MapInfo a team GIS MapInfo - “Set Next Document Parent” (more in detail, description and terminology see the chapter “Integrated Cartography” in the Developer’s Guide) is used: MapInfo.Do ('Set Next Document Parent' + sWinHand + ' Style 1 ').

Where, sWinHand - unique number (HWND) window, which follows in this case occurs. I.e. after a call of this command all graphic data

MapInfo will be deduced in a window with HWND=sWinHand.

For example, Opening the new table occurs as follows:

```
MapInfo.Do ('Open Table' + ' ' ++ c:\MapInfo\Data\World\world.tab '++ ' ' + 'Interactive Map From world');
```

Increase of scale of a card: MapInfo.RunMenuCommand (1705), etc.

The received card is deduced in:

```
TMapForm = Class (TForm)
Var
  MapForm: TMapForm;
Further, it is necessary to keep the image as a graphic image GIF:
Var
  BitMap: TBitmap; // can keep in memory the graphic data in a format BMP (i.e. the information is remembered about each point) and to keep them on other carriers of the information, in a flow, in Clipboard etc.
RSource, RDestination: TRect;
BitMap: = TBitmap.Create;
Try
  With MapForm do
    Begin
      RSource: = Rect (0,0, Width, Height);
      RDestination: = Rect (0,0, Width, Height);
      BitMap.Width: = Width;
      BitMap.Height: = Height;
    End;
    BitMap.Canvas.CopyRect (RDestination, MapForm.Canvas, Rsource);
  Finally
End;
SaveToStreamSingle (Stream, // a flow in which is kept in GIF
BitMap, // initial BitMap
True, // GIF through a line?
True, // to change color of a background?
MapForm.color // If yes, by this color
);
To pack an image into a flow, for transfer to the customer:
Var MyStream: TStream;
BitMap.SaveToStream (MyStream);
To send a flow to the customer
Var
  NMStrm1: TNMStrm;
```

NMStrm1. PostIt (MyStream);

The customer, by accepting a flow MyStream: TStream, makes its unpacking and display:

Var

Gif: TGifImage;

BitMap: TBitmap;

Gif: = TGifImage.Create (nil);

BitMap: = TBitmap.Create;

Gif.LoadFomStream (MyStream);

BitMap.assign (Gif);

MapImage.picture.Assign (BitMap);

Further, the customer makes a decision on necessity of an inquiry of a new portion of the data, and the circle becomes isolated.

We shall describe in more detail interaction ProgramA with ProgramB within the framework of offered technology:

For these purposes is used of a component of system Delphi-TSocketConnection (). Its main properties are: Address - IP-address of the computer, on which is established server, with which it is necessary to communicate; ServerGUID - unique identifier ProgramA, kept in the register Windows.

The method TsocketConnection.DoConnect() establishes connection with server, and after it, probably, to cause methods ProgramA from the customer, using property TsocketConnection.AppServer which interface on connection with ProgramA returns and through it now it is possible to cause methods ProgramA as follows:

SocketConnection.AppServer. <Name of the Method ProgrammA>.

The client application is an element ActiveX, built in Internet-browser and working under its management. The insert of the client application in HTML-document use tag-“Object”. For example:

```
< OBJECT
      Classid= " clsid: 7BB8C785-3CFF-11D2-AB42-243204C10000
"
      Codebase= "NameForm" *version=1,0,0,0 >
</OBJECT >
```

We shall notice that the appropriate functional opportunities of a component MapInfo are requested during fulfilment (technology of late or dynamic linkage). The late linkage is the most powerful and flexible, but slow, as against early and ID-linkage, technological method of dynamic interaction of program modules for an exchange of functional opportunities.

4. Conclusion

To advantages of the offered approach it is necessary to attribute the fact, that the used level of integration of used components has an opportunity of scaling. The increase of amount of the users does not influence functional opportuni-

ties of a program product, by use of technology OLE there is no necessity in a spelling of the special software for interaction between DBMS, GIS and applied programs. The basic problem at realization of the given system is maintenance of necessary speed, and also some limitation, connected to use in quality of a server platform of the operating system Windows/NT, arises necessity of significant expansion of resources GIS-server, and in quality the client place of operating system Windows95,98/NT with Internet Explorer-browser. Also it is necessary to note, that work with ActiveX - elements supports only Microsoft Internet Explorer-browser v.3.0 and above. For other browsers the given technology is developed and is tested.

All above stated allows speaking about perspective of the used approaches in the present. In future further expansion of use of components “of black boxes”, allowing to one program is planned to operate fulfilment other by means of installation/reading of properties of objects and call of their methods, while the market of the specified systems free of the similar decisions and standards.

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