

**MODERN TOOLS FOR APPLICATION DEVELOPMENT
AND SOFTWARE BASE OF SERBIAN ENTERPRISE
INFORMATION SYSTEMS**

UDC 681.3.06:65.01 (497.11)

Slavoljub Milovanović

The Faculty of Economics, University of Nis, Yugoslavia

E-mail: smilovan@orion.eknfak.ni.ac.yu

Abstract. *Application software is one of the most important elements of any information system. The most recent trend in the field of the software is, undoubtedly, migration of classic applications from centralized computer architectures to network or distributed architectures. This migration, as well as dynamic business environment of an enterprise, need new methods, technique and application development tools. In contrast to classic applications, distributed applications are characterized by their flexibility and adaptability and they are created by modern development tools. Basic types and characteristics of the tools are dealt with in the paper and software base of Serbian enterprises and modes of the base creation are given at the end.*

1. INTRODUCTION

Products short lifetime and very strong competition characterize the environment in which modern enterprise operates. That is why prime objectives of modern enterprises are fast launching of new products to market, product quality improvement and securing better service for customers. They all arouse new challenges for information specialists, who must, in a short period of time, develop applications, as a support to changeable business needs.

In addition to business, there are technological requirements for applications functionality and easy use, as well. That leads to increase of complexity and size of software projects, long period of time required for software development and high software maintenance costs. Besides, the programs should function not only in isolation but in integrated environment with the other programs as well, the ones that the other firms have developed and in various hardware and network configurations made by different manufacturers. Big and complex IS, geographically distributed data processing and constant

requirements for IS flexibility make the need for complete change of the way the applications are comprehended, developed and maintained.

Software that provides competitive advantage to an enterprise is composed of many general and specialized parts (software components). Some of the parts can be bought in the market but the software firm later adapts the parts to specific needs, while some bought parts have been adapted by enterprise information specialists.

The only software that is distributed and based on object-oriented technology, can meet enterprise changeable business needs. Various client/server (C/S) tools types can be used in these applications development. Quality as well as possibility of carrying out business task successfully, will depend, on the choice of appropriate C/S tools applications. The paper should help to all those who make decisions on C/S choice. Therefore, the second part of the paper deals with various classifications of C/S tools, and in addition, for each type of tools, the business and technical needs it meets most successfully are given.

Serbian enterprises undoubtedly lag behind in use of the newest modern technique in application development. It is useful, therefore, to see what the software base of Serbian enterprises IS is like and how the applications develop, and it is the topic of the third part of the paper. Software base analysis and the way of application development would help Serbian enterprises to see the problems in the field and find out appropriate solutions.

2. C/S TOOLS CHARACTERISTICS

When developers analyze C/S tools, they must study problems which should be solved, apropos goals which should be realized by application development. Therefore, there are:

1. Tactical tools for tactical goals realization, 2. strategic tools for realization of departmental/workgroup strategic goals and 3. Strategic tools for enterprise goals realization.

1. Tactical tools. Enterprise often needs an application for short-term goals realization. For example, enterprise should accomplish pilot test for influence measurement of a new product on market, before the product introduction. When a product has designed to be awhile on the market, the application must be developed rapidly and then canceled. Such applications could be developed by client-based tools.

2. Departmental/workgroup strategic tools. Many departmental applications have greater strategic importance than some enterprise applications. Departmental/workgroup applications have two forms: 1. data-driven applications (the most popular today) and 2. conversation-driven applications. Data-driven applications are designed for access to server databases. The second type applications have access to subjective data from various sources. For example, Lotus Notes and E-mail-based applications belong to this type of applications.

More and more tools will belong to that group of departmental/workgroup strategic tools in the years to come.

3. Enterprise strategic tools. The tools will be dominant in projects of classical mainframe-based applications replacement with network-based C/S applications. Three types of the tools will be important: C/S vertical software oriented to solving specific mis-

sions (accounting, manufacturing, financial and human resources); tools tied to relational databases management systems; high-end tools designed to build database-independent, large-scale systems from scratch.

When developers decided if application is tactical or strategic, then they can solve some technical issues. These technical issues include role of graphical presentation services; development and deployment of complex logic; role of server-based development and the evolution to balanced C/S computing. From that technical characteristics aspect, we may identify following types of C/S tools: 1. client-centric graphical tools, 2. sever-based tools and 3. balanced C/S tools.

1. Client-centric graphical tools. The most of tools on the market are noteworthy for the way they create data-entry and retrieval screens. Intent of the tools is all application logic implementation on the client (for example, Windows-based tools). They will be useful if the application is designed to ease user manipulation of data from a server database. These C/S development tools are characterized by graphical user interface (GUI) and they are efficiently used for report generation and database query which increase end-user productivity.

When users choose the tools, the most important features are: 1. application quality (speed and efficiency of application, consistency of application); 2. support (quality of vendor's support, responsiveness of vendor's service); 3. programming (ease of programming, robustness of programming language, flexibility of programming language, speed of programming); 4. compatibility (compatibility with operating environment, compatibility with development methodology, working with multiple operating environment); 5. ease of use (accessibility of user interface, learning/training time, ease of installation, documentation); 6. price (acquisition and support costs, value for the dollar).

The best tools according to this features are: 1. Microsoft Visual Basic, 2. Gupta SQLWindows, 3. Power soft Power builder. These types of C/S tools work well in development of tactical and small departmental/workgroup applications. However, the next type of tools are recommended for larger projects.

2. Sever-based tools. These tools lack possibility for graphical screen creation in PC style. However, they have scalability for development of applications based on sever. The tools are appropriate for development of medium size workgroup applications. Many of these tools are redesigned to better serve GUI clients.

3. Balanced C/S tools. The latest tool generation is designed an attempt to use the best features of clients and servers: graphical development environment of clients and possibility to store application logic and data on the most appropriate platform, apropos server (a feature known as partitioning). The example of such tool is Uniface Version 5.2. from Uniface Corp.

Tools from that category enable high-end applications development, which comprise whole enterprise and great number of users. The tools intent is to assure the best characteristics of CASE tools and sophisticated programming languages, so programmers don't have to use third generation languages (3GL). Therefore, the tools assure built-in data dictionaries, databases for stored business rules, diagramming tools and the like. Many of that tools also provide application programming interfaces (API) so third-party tools can be integrated. Many server-based tools will start to traverse in that category.

Generally, we may identify two C/S tool generations on the base of previous classification. First-generation tools are client-centric and they solve tactical enterprise problems

while second-generation tools are balanced and they support departmental, workgroup and enterprise strategic goals realization.

Respecting short-range goals which the first-generation tools realize, they are used for rapid application development (RAD). Regardless do the fact that the tools are good from GUI aspect, they cannot solve complex issues considering business (application) logic and data management. Only the second-generation tools can solve the issues, as you could see in figure 1.

Almost all first-generation tools integrate GUI programming code with application logic, so all the logic must be the client. If the application within logic includes data access, then scalability which follows from moving that logic to the server becomes almost impossible. This integration also requires all data transferring across the network between client and server, resulting in a network bottleneck.

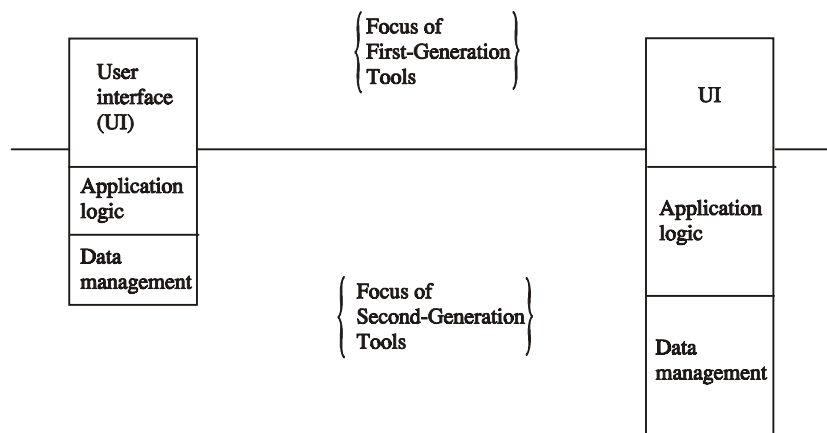


Fig. 1. Focus of first and second-generation C/S tools

In order to develop more complex and greater C/S applications by first-generation tools, programmers must use 3GLs and SQL extensions from various software firms. Fat client syndrome emerges in that situation. The syndrome emerges when desktop system has too much application logic so the system performance is getting low.

Due to 3GLs and SQL extensions, first-generation C/S tools force programmers and users to develop applications in which data management logic is tied to one particular database. If the application needs to access some other database, application logic must be modified. It is difficult to add complex application logic, because there is no modularity in application development. These problems are also solved by second-generation C/S tools, as you can see in figure 2.

The second-generation C/S tools solve complex problems considering GUI, business logic and data management, and also solve problems considering various hardware and network platforms, various databases and increasing number of users. However, the greatest benefit from these tools is the development of flexible distributed applications which have the feature of adaptability. The adaptability is consistent with continual changes in many modern enterprise business aspects.

Nobody can predict how much business conditions will change and become more complex. Many of this changes are infrastructure: entry in new distribution channels, mergers and acquisitions or new partnership forms.

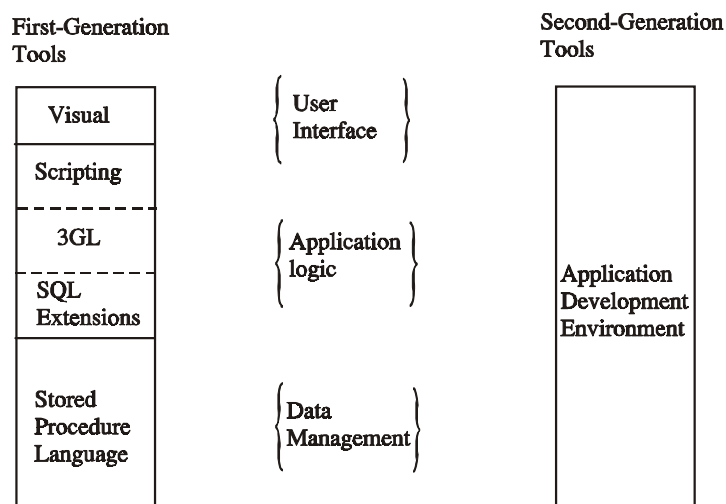


Fig. 2. Integrated enterprise application development environment

An enterprise may increase its size twice or three times and according to that change its organization structure can be changed. A top management may distribute responsibilities for various business aspects to business units across the world and later restore much centralized management structure. Therefore, an enterprise should combine business planning with second-generation C/S technology in order to assure flexible application development.

The second-generation C/S tools should be comprehensive and adaptive. Comprehensiveness is related to application development environment creation, which cover the entire application life cycle of design, development and deployment. In each phase of the life cycle, the development environment should allow a developer to use a single skill set rather than forcing the developer to work with a variety of products that may not work well together in the future (see figure 2).

Adaptability of the development environment is related to changes in business requirements as well as to changes in user interface, databases, computer networks and operating systems, as it is presented in figure 3. The adaptive environment abstracts or hides technical infrastructure complexity so developers can be oriented to a business problem instead of technologies that are subject to change.

General characteristic of C/S development tools is that they are getting more sophisticated and increase their possibilities. C/S tools market is in the early phase, so developers should pay attention to the best tool selection. C/S tools selected today maybe cannot suit to future business needs and users must take into consideration that fact while developing their first C/S applications. Next C/S tool generations will more and more get features of object-oriented technology, which will provide flexibility and modularity in application

development from the components. These components can be reused for the other application development. Developers should not believe that one tool would solve all application development problems so they should consider several various tools. They always should consider the new tools in order to get ready for inevitable technology changes.

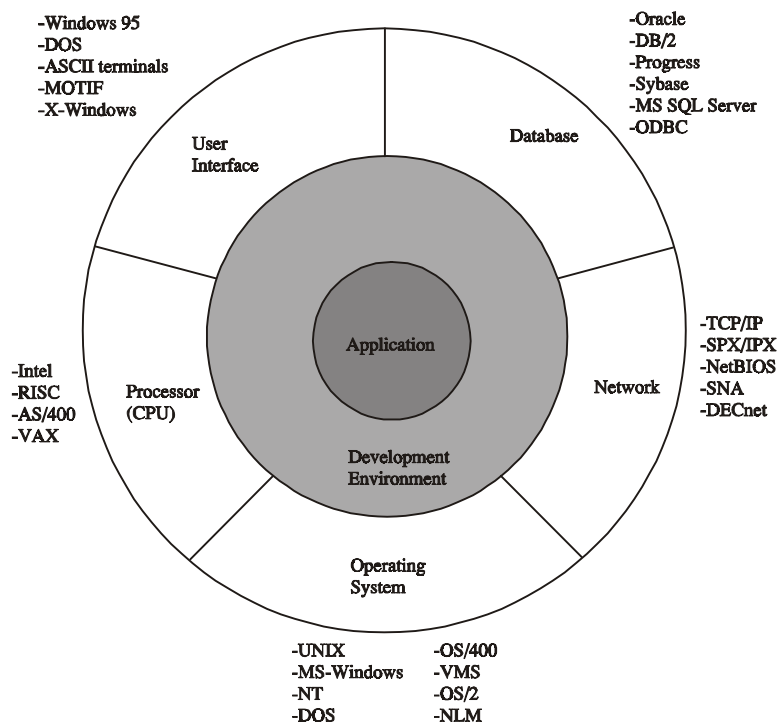


Fig. 3. Complexity of enterprise development environment

3. SOFTWARE BASE OF SERBIAN ENTERPRISES

Information about software base of Serbian enterprises is obtained by empirical research. 30 enterprises, mostly socially owned ones (29 and 1 private enterprise) are dealt with in this research. 20 enterprises are taken from the production sector and 10 from no production. Producing enterprises are taken from different industries: food-processing industry, tobacco industry, textile industry, rubber industry, chemical industry, mechanical industry and electronic industry. As for non-producing enterprises 6 banks are involved in the research, 3 public enterprises, and 1 commercial enterprise. Data are collected by personal interview method. It was a no structured interview with the information function executives.

The empirical research results show that none of the scanned enterprises implemented newest application development information technologies (object-oriented programming and C/S tools). The most of applications (75%) is created in some 3GL. COBOL is used very often (61% of the scanned enterprises use COBOL), after COBOL, PL1 follows

(18% of the scanned enterprises), FORTRAN (14% of the scanned enterprises) and RPG/2 (7% of the scanned enterprises). The most of scanned enterprises (75%) which use 3GLs belong to the category of greater enterprises. These enterprises implemented their first IS on classical minicomputer systems about 20 years ago. These systems remained in these enterprises until today, besides eventually adding PCs.

All the nominated programming languages belong to the procedural language category. It is difficult for users to learn and adopt the languages because users must follow rigorous formal procedure when they develop an application. For this reason, users in the enterprises let information specialists generate standard, regular reports and poorly use IS for ad hoc report generation.

Ease of application development and use is one of the primary criteria for programming language selection. Majority of Serbian enterprises obviously have not taken into consideration these criteria, because 57% of the scanned enterprises use only 3GLs for application development. Application development in procedural languages lasts long and users in the enterprises don't understand all IS features. Moreover, it is difficult for users to understand IS specifications because a long time period elapses from the specifications determination to IS test. (Sometimes several months elapse from the first application analyses to the application characteristics presentation through the test results).

Information function executives in some of the scanned enterprises have understood the need for increasing productivity in application development. They have adopted new methods for application software development: report generators and query languages. The research results show that 18% of the scanned enterprises use the new application development methods beside procedural languages. However, these enterprises use 3GLs for application development as a primary method. It could be said that the enterprises belong to the large enterprise category. These enterprises have recognized all 3GL disadvantages, but due to impossibility old IS do full replacement, the enterprises implemented this hybrid solution.

Some of the scanned enterprises (11%) use network database query languages (for example, IDS2 and IDA databases). It can hardly be said that these enterprises adopted modern application development methods. Enterprises in developed countries abandon network databases or redesign (convert) these databases into relational databases wherever it is possible. These databases are implemented on old Bull Honeywell minicomputers and it may be said that it is a closed application architecture, which does not have the interface with many modern architectures.

Enterprises in developed countries already long use the fourth generation languages (4GLs) or nonprocedural languages as a primary application development method. American enterprises, which started, IS implementation a couple decades ago also have the old applications created by some 3GL (most often COBOL). However, these enterprises practice redesigning these applications into C/S applications, and data organized in the old files redesign into relational database structures. Serbian enterprises almost don't implement such projects. Only 15% of the scanned enterprises are entirely replacing old applications with C/S applications based on relational databases. They have not used the redesigning method by which the old applications could be gradually spanned with to the new hardware platform and data structure. The enterprises started projects from the beginning and lost investment in old IS.

Serbian enterprises, which started their first, IS implementation several years ago are in the best situation. These enterprises could use modern application development methods avoiding problems considering old, inflexible, centralized and monolithic applications. The enterprises (18% of scanned) are adopted nonprocedural SQL which represent the world standard in relational databases application development. The enterprises mostly belong to the smaller enterprises category. Regardless it is easy to use SQL, it is not accepted by users in the enterprises because it requires certain knowledge degree about a particular application and database structure. However, users in the enterprises need training and good documentation.

Enterprises of developed countries have the practice of purchasing completed software application whenever it is possible. Exception is specific application needs relate to particular industry or enterprise. The needs can be satisfied by internal developed applications. However, in the great number of scanned enterprises (43%) still the most application needs have been satisfied by internal application development. 32% of the scanned enterprises combine internal application development with completed applications purchasing, however internal application development is dominated. Only 25% of the scanned enterprises decide upon for purchasing the greatest number of applications.

The most of applications developed in the scanned enterprises belong to the financial and accounting applications group. Regarding that financial and accounting function has standard information needs for many enterprises and various industries, the needs could be satisfied by already developed applications, which can be found in the market. Namely, Serbian market has the great number of microcomputer and network applications, which are relatively cheap and easier to use than COBOL applications.

The great number of scanned enterprises (20%) which do not have not enough human resources for substantive application development decided to purchase all the needed applications. Even some of the scanned enterprises having the resources comprehended that substantive application development is much expensive solution, which cannot satisfy information needs on timely manner. Often, information needs change before application is finished, due to long time development.

Microcomputer software packages are very poorly used by the scanned enterprises. 30% of the scanned enterprises almost don't use the packages and that is a very great, percent, whereas the packages are prevalent in the developed countries. This condition is reasonable where minicomputers with 3GLs applications are prevailing.

4. CONCLUSION

The most recent trend in the field of software is, undoubtedly, migration of classic applications from centralized computer architectures to network or distributed architectures. This migration, as well as dynamic business environment of an enterprise, need new methods, technique and application development tools. Serbian enterprises undoubtedly lag behind in the use of the newest modern technique in application development. Careful recording of software base in the concrete enterprise would make it possible to identify those business fields in which C/S applications could be implemented first. It is obvious that it should be started with tactical applications, which are to be developed by the first C/S tools generation. Only after Serbian enterprise information specialists master the first

generation of C/S technology, the development of strategic C/S applications of certain department, workgroups or the whole enterprise should be thought about. In that sense, market of C/S tools of the second generation should be followed and researched, for it is in its beginning phase of development that is characterized by great dynamics.

REFERENCES

1. Hurwitz, J., *Fitting the Tool to the Job*, Computer world (CW), July 25, 1994., pp 99.
2. Burden, K., *Buyers' Scorecard: Microsoft Visual Basic' Application Quality Wins Users Over*, CW, July 25, 1994., pp 101.
3. Hurwitz Consulting Group, Inc., *Navigating around the Client/Server Iceberg*, Special Advertising Supplement in CW, August 7, 1995.
4. Hurwitz, J. *The Wall*, CW, July 25, 1994., pp 92.
5. Milovanovic, S. *Conception and Function of Enterprise Distributed Management Information System*, PhD Thesis, The Faculty of Economics, University of Nis, 1998.

SAVREMENI ALATI ZA RAZVOJ APLIKACIJA I SOFTVERSKA OSNOVA INFORMACIONIH SISTEMA SRPSKIH PREDUZEĆA

Slavoljub Milovanović

Aplikativni softver je jedan od najvažnijih elemenata svakog informacionog sistema (IS). Za razliku od klasičnih aplikacija, distribuirane aplikacije se odlikuju fleksibilnošću i adaptibilnošću i kreiraju se uz pomoć savremenih razvojnih alata. U ovom radu su date osnovne vrste i karakteristike tih alata, da bi se na kraju prikazala softverska osnova naših preduzeća i načini kreiranja te osnove.