

# The Modern Development Cycle of Citizen Oriented Applications

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**Abstract:** General citizen access to global computer networks' resources is a request of the knowledge society. Applications are created for a huge target group, such as the citizens of a country, citizens fulfilling specific requirements. These computer applications use national databases that should be designed, created and populated. The concept of citizen oriented application is defined in the paper. Different types of citizen oriented applications exist as a consequence of the existence of many classification criteria. The main characteristics of the citizen oriented applications are analyzed. Many differences are found by comparing citizen oriented applications with traditional ones and from these differences arises the need of a modified development cycle. The stages of the citizen oriented applications' development cycle are presented and their particularities are highlighted. The use of national databases is analysed.

**Keywords:** software engineering, development cycle, citizen oriented applications, characteristics, national databases.

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## 1. Citizen Oriented Applications

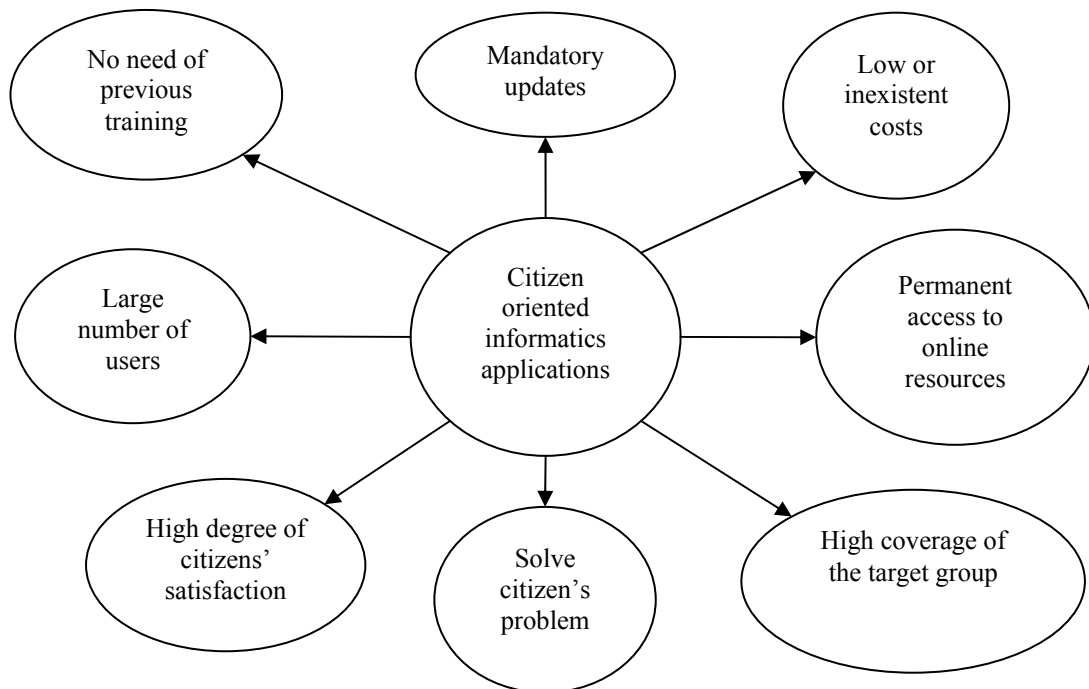
Following the evolution of the knowledge based society, the quality demands for informatics applications grows. The new informatics applications are no longer instruments of organizations for which they were initially created, these applications must be orientated towards citizen satisfaction. Considering the fact that geographical boundaries do not apply in the new society to information streams, the new applications must address a wider segment of users with diverse characteristics and demands [1].

With the evolution of technology, the number of services which migrate from the traditional

form to the online form grows as well. For these specific services an adequate providing form must be found in the online environment, using the proper technologies, guaranteeing the access of large number of users, fast and secure payment services.

All of these factors impose a reevaluation of quality demands of informatics applications in the online environment. Developing the application based on the out-dated quality requirements makes it non-competitive in the new society.

In [2] is considered that in Information Society the web technology offers effective means for sharing ideas and knowledge. Citizen oriented applications are developed



**Figure 1.** Citizen oriented informatics applications' characteristics

for fields such as e-governance, e-administration, e-education, e-banking and not only.

In [3] it is described the practical experience of utilizing simple IT tools in a foresight project aimed at building a vision of the Information Society defined like a Knowledge Society. The citizen oriented applications are encountered in such kind of society. The idea of citizen-oriented applications refers to an effective collaborative system in which people and equipment cooperate in order to achieve certain objectives. This is about Human-Human Interaction and Human-Computer Interaction.

Informatics applications corresponding to the new society are citizen oriented. They have the target group - the citizen, as a central element. COIA are designed for citizens, to solve their problems quickly and achieve the highest degree of satisfaction.

Figure 1 shows the additional characteristics of the citizen oriented informatics applications compared to traditional ones. The higher the degree these characteristics are met, the better the citizen oriented applications' quality is. The reorientation of applications to meet the citizens' needs is required [4].

For the design of the citizen oriented applications the target group is analyzed. The applications' quality characteristics depend

on the target group's members. The users' satisfaction level is a good indicator of the application's final quality. [5]

Citizen oriented applications are realized to solve their problems. Considering that the target group is large and diverse, the citizen oriented applications are very diverse in order to solve a multitude of problems. These applications are classified according to several criteria:

*The interaction criterion* assumes the classification of informatics applications according to the degree in which the users interacts with the applications. Following this principle the applications are divided in: not input data; selections; data input.

An application is efficient if the user ends with the data input in a few iterations and in a very short time. [5].

*The content criterion* realizes the classification of informatics applications regarding the content modifications. Based on this criterion the applications are divided in: fixed content applications; applications whose content is modified by adding; applications with content that changes over time; applications with content changed by addition, update and erasure assume recording of dynamic content.

*The security criterion* divides informatics applications in safe and unsafe applications.

*The cost criterion* assumes the classification of applications considering the fee the users must pay in order to use them. According to this the following are identified: zero cost applications; individual session payment applications; subscription applications; paid applications.

The classification criterion insures an application division considering different criteria which directly regard citizens. The clearer the classification the faster the citizen will choose an application from the set of existing ones.

Citizen oriented informatics applications – COIA must meet the citizen needs and for this purpose they must have the following quality characteristics [6]:

- maneuverability - the capacity to easily manage the application from the outside by the administrator and at the same time to have the capacity to administer the user resources and to have access to complete information about previous transactions;
- availability - the capacity of the applications to run continuously;
- scalability – the capacity to improve performance upon new hardware installation;
- functionality - to the quantity of processing made by the informatics application;
- stability - the capacity of the application to ensure variation proportionality regarding the input volume, processing volume and result complexity;
- controllability - the capacity to have its own adequate messages for each input message given to the user;
- determinism - the characteristic through which for the same input data the same result is outputted not depending on the user;
- reliability - the characteristic of the informatics application to run correctly and completely for all data sets inputted by the users;
- maintainability - the characteristic of informatics applications which enables fast updates at low costs;
- reusability represents the degree in which the application uses already

developed components;

- portability establishes the measure in which the informatics application is independent from the hardware/software platform of the user.

Ensuring high levels of these quality characteristics of citizen oriented informatics applications leads to competitive applications which lead to high levels of user satisfaction. The development cycle for citizen oriented applications differs significantly from the structure of the development cycle of classic applications, because of different pursued objectives and complexity differences.

## 2. Development Cycle's Stages

Citizen oriented distributed informatics applications are the result of a complex process which includes stages characterized by [7]:

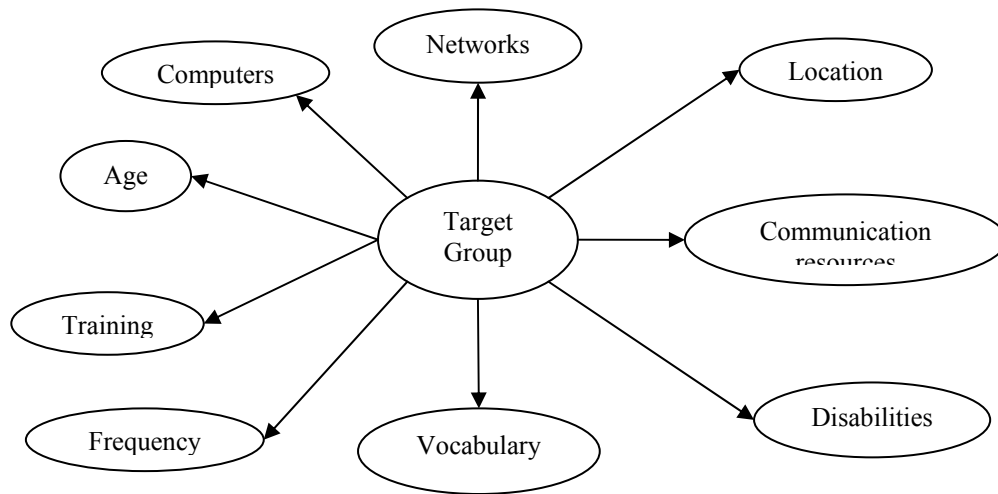
- specific objectives;
- input;
- activities;
- resources;
- techniques, methods, technologies;
- results.

The stages of the citizen oriented informatics application development cycle are different compared to the same stages for classic applications because the focus is set on citizen orientation and the developed application must reflect the needs and preferences of the citizens [8].

**Problem definition stage** assumes specialists with wide experience in knowing the theoretical aspects and mostly the practical ones of the domain the distributed application is interacting with. Defining a problem means: specifying input data and who generates it; building computation formulas and models; identifying algorithms for indicator computation, expression evaluating, optimization, estimation, subset extraction, comparison and graphical representation of aggregated values; establish the presentation form of final results which in fact are most important for satisfying the requests of those that thought of the building the distributed application.

**Establishing the target group** represents the stage through which the person's categories are established, their number is estimated and the persons which will interact with the application in solving problems.

In Figure 2 the main characteristics of a general citizen oriented application's target group are presented. For specific applications additional characteristics must be taken into consideration as these might be indispensable. Characteristics that currently are not of use for the applications but, in the future, might prove very useful at the update of the application, must be considered.



**Figure 2.** Target group's characteristics

**Specification elaboration** is the stage that presumes the existence of high performance specialists with rich experience because specifications must be:

- exact, meaningful and ready to express the demands of the distributed informatics application owner;
- complete which captures the whole range of nuances tied to the exigencies of target group members, totality of input data, computation formulas processing types and totality of final result structures;
- correct; correctness is demonstrated but in most cases must be observed; for this the specifications must contain test data sets, intermediate results and final results;
- deterministic meaning that more development teams undertake these specifications and develop informatics

applications independent from one another, the respective applications must not be significantly different in terms of interface structures and especially as result structure.

**Building the project** represents the stage in which specialists with experience in interpreting specifications and in equal measure code elaboration move to the following stages:

- identifying the processing functions;
- establishing the modules and the connections between them;

- defining data structures and storage data format;
- building matrices of initial data-modules, final result-modules;
- stating the software and hardware necessary resources;
- estimating of the necessary work force;
- elaborating the calendar specific to citizen oriented distributed informatics application development.

A competent team has the capacity to associate the exact needed resources to the application, the whole development process being a process of resource allocation and levelling.

**Code elaboration** is an activity through which a project is materialized and it is completed by developers with a strong grasp on the chosen technology, who possess the capacity to take information from the

specifications such that the written lines of code represent self standing products whose quality is exactly measured.

Code elaboration is a team activity and assumes: the existence of an unique style; using the same programming language; developing the same level of auto documentation; following the degree to which the developed software components fulfil the planned quality requirements; perfecting the content of each procedure.

Code elaboration is the stage that produces what is in reality the software and is undergoing analysis fact that mandates that all the efforts of individuals involved in development process management must be focused here. All the differences between what is established to be developed and what is effectively developed are highlighted in this stage.

**Server uploading** is proceeded by an analysis made by a small group of specialists of the development team, specialists that have a complete image of what the distributed citizen oriented informatics application must be. The received components are analyzed in detail and if they meet the requirements they are taken in and integrated step by step to obtain the application as a whole. Server uploading is the step that allows the behavioural analysis of the application by those who have password access to its resources. To this scope users and passwords are created.

**Technical testing** is proceeded by auto testing. This means that the product already completes the minimum processing required through the specifications [9]. The testers know the objective for which the distributed citizen oriented informatics application is developed. Firstly starting from the test data sets from the specifications the application behaviour is seen. The differences between what must be obtained and what is obtained are signalled. Certitude must exist that the results are correct, complete, consistent, precise and obtained fast by the application [10].

**Sample testing** assumes establishing persons which with specialty assistance move to solving real problems using the distributed application. Sample testing imposes making real time corrections on the components of

the application showing only programming errors, which come from design errors or specification definition errors [11]. Starting from the idea that the user is in the center of the distributed application development activity, sample testing is meant to observe the necessary durations to the user to localize, to enter data, to verify and to make corrections. The application must contain variables that record start and ending moments for interactions as well as storing them in the data base. The quality of the application is given by the duration study, the numbers of runs and the types of errors the users make.

**Documentation elaboration** is an activity left to the end of the developing cycle in an erroneous manner by all the team members. The documentation is built simultaneously with the developing process even if it is not in the final form. Specifications are a form of documentation. Programmers elaborate detailed schemes, notes regarding the sequence generalities, note the auto-testing results and show the flexibility elements they incorporated in the procedures allowing thus an efficient maintenance process. For the testing step specific elements are included in the documentation to show the application's comportment for common problems among users. The documentation includes information regarding the application's performance obtained through the testing process.

**Implementation** assumes the application's installation on the client's server and the configuring for optimum functioning. Before the installation it is necessary to prepare the server to accept the distributed citizen oriented informatics application. For applications that work with databases the database server must be prepared. The application server must support all technologies the citizen oriented application implements and offer sufficient resources so that the users are not forced to wait. After the application's installation on server it is configured to answer the client's requirements and to realize the connection with the database.

**Maintenance** is the process of updating the distributed citizen oriented application to reflect the changes from the economic, social and legislative environment. Each module is

updated depending on necessities so that the sum of changes leads to the total reflection of the reality in the informatics application. Application's modularity facilitates the update process as the team members work in parallel on the modules realizing the updates in a very short time [12]. The distributed citizen oriented application's maintenance process is realized only as long as the costs implied by it are very low and don't justify application's reengineering.

**Software reengineering** assumes the redefining of the application's objective so that quality and performance increase, but the new objective does not differ fundamentally from the original one. The reengineering process takes place when the maintenance costs are very high or when the application can't deal with a large part of the users' requirements. After the reengineering process the distributed citizen oriented informatics application fulfils all the users' requirements, has improved performance and provides new features.

**Removal from service** is a very rarely process as many applications don't get through the maintenance process and the reengineering process. The removal from service is caused by:

- the disappearance of the problem that generated the problem;
- very high maintenance costs;
- the discrepancy between what the application offers and its users' requirements.

Removal from service is similar to the problem of replacing the physically spent equipments, only that in the application's case we talk about moral spent with much deeper effects on the report application-users.

In [13] is defined the non-deterministic software as unavoidable. Its development entails not just new design principles but new computing paradigms. Applications devised in line with the Computing as Interaction paradigm, including above all agent-based and citizen oriented applications, entail at least two interacting agents (the interface agent and its owner), evolving in parallel, autonomously but not independently.

### 3. National Databases

The developed information society involves the creation of databases at national level for the homogeneous treatment of some sets of issues for each citizen.

**The population database** contains information describing in detail the characteristics of people living in a precisely defined area, country, county, city, common. When designing such a database are taking into account the particularities that appear in:

- building the words string for name, surname;
- building the words string for complete describing the parents;
- structuring the unique identification code so that regardless of demographic dynamics, each person should be associated with a unique code;
- elements of spatial localization of the person;
- establishing the elements that define the first record related to the person through time and place of birth;
- defining the elements of training, pre-university education, qualifications;
- information relating to identification documents;
- identification elements on marital status;
- the descendants situation present interest for the succession process;
- elements regarding the criminality;
- elements regarding the individuals properties;
- elements on people occupation.

**The health database** presupposes the existence of data about each individual receiving medical care. The health database must include: the unique identification key; the description of the physical characteristics of the person to be identified if the unique identification key is not available; the description of physiological and anatomical characteristics; the detailed list of diseases from which the person suffers; the list of most likely diseases to affect the person; the detailed list of medications that the person using them; the results of a national set of tests established by experts; complete

descriptions of medical interventions suffered by the person.

If a person needs medical services, the database is consulted and extracted all the information necessary to a quality medical service.

In Figure 3 the way to interact with the health database is showed. The investigator makes data requests from a computer or mobile device to the database. The request is made using the XML language and thus it is redirected towards a server that reads the XML file and does the actual request to the database. The data is sent back to the investigator through XML and its device reads the file and shows the data in a graphical context.

received should not be redundant, overcrowded, so that those who consult that information may find quickly what they are interested in. Data on population are consulted by anyone, not at the atomic level, but at the aggregate level on commons, cities, counties, country.

In [15] it is analyzed the usability of e-learning systems based on augmented reality. For these new e-learning systems to be effective traditional usability evaluation is not enough. Because the usability of a citizen oriented application is a critical feature, the usability evaluation does not ensure a successful adoption of the information technology. The evaluation of citizen oriented applications should go beyond the traditional usability

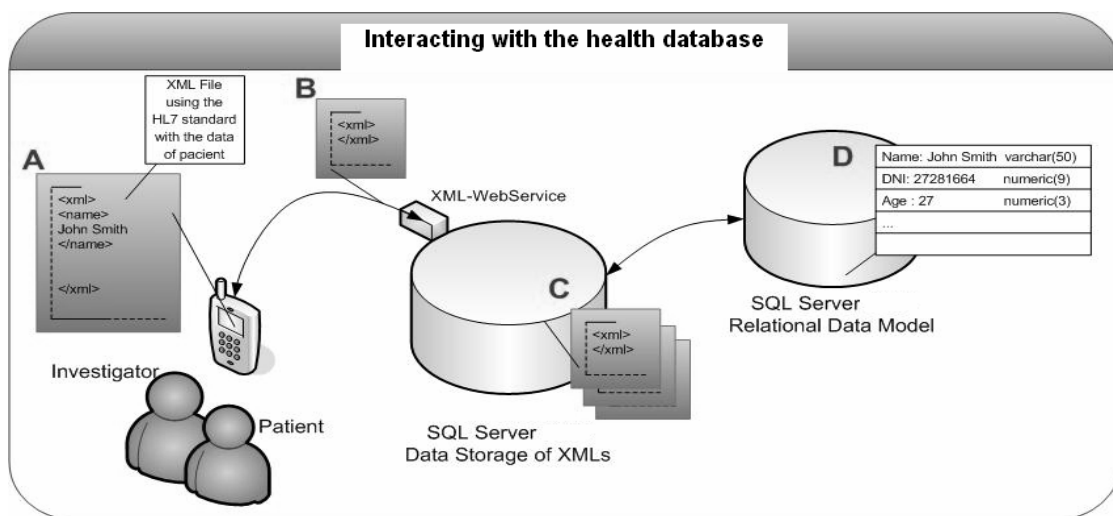


Figure 3. Interacting with the health database [14].

Using national databases should be restricted so that only authorized persons can access them. Some information from national databases are available to all without requiring special authorization. The aggregated indicators at the level of counties, countries are data at which everyone has access. The national databases should provide the whole necessary information at one time, the extensive search process being automatically conducted. When a person is in a special situation of health, by the code number, unique key for national databases in which is stored information about individuals, is searched information in all the databases which have relevant information for the health status of the person, so that the first steps taken to be effective and grounded. The information in the original data set

approach and investigate the user acceptance in order to understand the various factors that influence the intention to use.

#### 4. Conclusions

On-line citizen-oriented applications are accessed by a very large number of inhomogeneous users, which must spend as little time as possible interacting with the application. Major problems arise from entering data errors. The basic idea is that the user should end with the introduction of data in a few iterations [5].

The informatics applications oriented to citizen come to meet the needs of users in the terms of digital economy. These all meet the highest requirements of citizens and the digital economy. For these facts, citizen

oriented applications have special features besides the classical applications. Completion of the highest degree of these features lead to increased satisfaction of the citizens who use them. The criteria for the classification of the applications are diverse and specific to this type of applications. To ensure a high quality to the citizen oriented applications is required making changes in the cycle of development compared with classical applications. In all the stages of the development cycle, the actions are designed to achieve an application that serves primarily the citizen, not the owner. Thorough study of the target group and respecting the requirements of this in other stages of the cycle development ensure obtaining high-quality applications that meet the needs of citizens. To implement citizen oriented applications, data sources are very important. Databases should be constructed to include all information relevant to the field for which they are constructed. The existence of national databases leads to the development of citizen oriented applications in which the degree of automation actions is very high.

## Acknowledgements

This article is a result of the project „Doctoral Program and PhD Students in the education research and innovation triangle”. This project is co funded by European Social Fund through The Sectorial Operational Programme for Human Resources Development 2007-2013, coordinated by The Bucharest Academy of Economic Studies.

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