T. Salata, K. Gawroński
Uniwersytet Rolniczy w Krakowie

USING UML FORMAT TO CREATING LAND INFORMATION SYSTEMS WITH THE SOIL-AGRICULTURAL MAPS DATA RANGE

В работе представлена концепция создания стандартизированного получения данных для создания почвенно-сельскохозяйственных карт обрабатываемых при помощи систем обработки пространственной информации. Язык программного обеспечения – UML 2.0. Тематический набор данных удовлетворяет всем формальным требованиям. В работе показана схема взаимного воздействия составных частей модели, а также участия логических элементов при сборе, обработке и доступе к этим данным. Работа является попыткой реализации директивы Европейского парламента в 2007 году.

The paper presents the conception of creation of the standarise dataset, from the range of the content of soil-agricultural maps, processed in the spatial information systems. UML 2.0 is the language of the description, used in the software engineering, and the thematic range of the data realize all applied formal requirements. The bilateral interaction of the component pieces and the participation of decission units during the accumulating processing and making accessible this type of the data were also introduced in the work. This article is the trial of the realization of the directive of The European Parliament resolved and received in 2007r

The introduction. The content of the soil-agricultural map includes the categories of data connected with proprieties and the spatial distribution of agricultural places. Thematic categories are differentiated and used especially in agriculture, as also in the different fields of the economy of the space. The data of this type are used by the various kind decission factors: administrative, commercial and social. They are also one of the basic units of the interest wide comprehended the investigative and scientific activity.

Other important matter is the possibility of the write the space, realizes by data contained on soil-agricultural maps in the spatial information systems. The non - standard way of describing tasks placed for created formations is one of the basic shortcomings of the development of informative systems. Using unified format of the description of all units of the systems elements is the solution, as early as conceptional stages, by projecting, realization, implementation, testing and adapting the project.

Aim and the range of the work. The elaboration of the data model accumulated in the computer system which is equal with data range on soil-agricultural maps is the aim of the work. Except this, the dependences among unique units will be described. Identifying processes steering formation, modification and maintenance of the space in the appropriate quality is the next stage. Through processes, is understanding each other determinants in the result which the action follows, and the environment which is the aggregate of rules in the support about which the reaction comes into being.

The thematic range was received a'priori in the work and is equal of the contents of the full soil-agricultural map. In the matter of the study of the data model, the authors limited the investigations to conceptional and logical stages, with the omission of the physical implementation. The notation UML is the used way of the description of tags 2.0 making up the basic tool from the range of the methodology of creating computer systems, the life cycle of the systems, relational database models or also the CASE tools (*Computer-Aided the Software Engineering*).

The qualification of the thematic range. The soil-agricultural map include in her content the following categories of the data:

– the Complexes of the agricultural usefulness of the soils in which is contained the data allowing to attribute soil tags to tillage of chosen plants. The classification to individual categories is bases in the support about following criteria: the proprieties of the soil (type, subtype, species), climatical proprieties, geo-morfological tags and water conditions. The usefulness of soils values to the agricultural uses additionally. They are this, enumerating from the best: three wheaten complexes, three rye, rye-lupin, two cereal-fodder, wheaten mountain and mountain-foot, three numbered to mountain and four appointed as green uses. One complex this soil useless agricultural.

– Types and the subtypes of soils: data relates to the main genetic level, approximate chemical proprieties and physical-chemistry, the equal kind of weathering and similar type of caries (Zawadzki 1999). The subtypes of soils are the data about soils belonging to one type, but possessing the additional factor, not being the main factor decisive about the membership to the definite type, modifying biological, physical, chemical and morphological proprieties (Bednarek and others. 2005)

– The species of soils: that's the data describing mechanical type, assembling soils from the regard on the size of particles (the group of particles is the fraction, however the part individual fractions entering in the type - matter of the soil of this the mechanical type - matter of the soil). We divides soils on following mechanical groups: gravels, loose sands, faintly clay sands, clay sands, dusts, light alluminium, heavy alluminium and loams depending on mechanical type.

– The kinds of soils: data come from the process the qualification the origin and the propriety mother rocks from which the soil arose,

– Additional data characterizing soil-agricultural conditions: the depth of the change of mechanical type, the location of soil strip mine, the presence of river bays, numbering and descriptive data contours and sign mixed rocks.

There is very rich and varied content on the soil-agricultural map. The data comes from various thematic categories, and moreover among exchanged data the relationships we should foresee whose existence while we creating the computer system. Accumulating will be the main task of the database in the standard way as also the assurance of the ruthless cohesion of the data in extreme or exceptional cases.

Canons of applying UML in the process of projecting the systems. The UML language accepts in the practical use the figure of the graphic painting of the projected systems using diagrams related with each other. They possess the possibility of presenting general and detailed models. UML defines two basic units making up his creature: the notation of individual component units used in diagrams and their semantics. The notation do the basic part from the side of the analysis of the system, because UML was just designed to this the aim. However semantics (meta model) plays the basic part generating the code and the passage to the implementation. For the programmes of the software engineering important case is reproducing exactly defined individual fragments, the conversion of patternel was possible to different notation. In distinction from the different, this kind of the proposal, UML is not the methodology of projecting. This is the aggregate of the notions, signs and syntactical rules which can be used in the any methodology. This notation is bases about basic objected notions (Subieta 1999). UML introduces the notions and diagrams which in the foundation have to cover the majority of aspects of modeled systems.

The foundation the relating buildings of the system. On the needs of the stage of the project of the computer system manageress data from the range of spatial information from, three diagrams were used among many enterings in the type of the aggregate of diagrams UML: the diagram of the cases of the use, the diagram of classes and the derivative fine notation UML - the entity relationships diagram .

Example notation for the diagram of the cases of the use looks so, as on figure 1. This graphic performance of the cases of the use, actors and relationships is between them, stepping out in the same category of the computer system. The diagram of the cases of the use do following functions:

– makes possible the analysis of the area of uses,

– allows to the study of the future formation,

– makes up the accessible and comprehensible platform of transport and designers and the users of the formation co-operation,

– the kind of the contract makes up among shareholders, to the range and the functionality of the system,

– makes up basis of testing the function of the system on farther stages of his life (Wrycza, Marcinkowski, Wyrzykowski 2006)

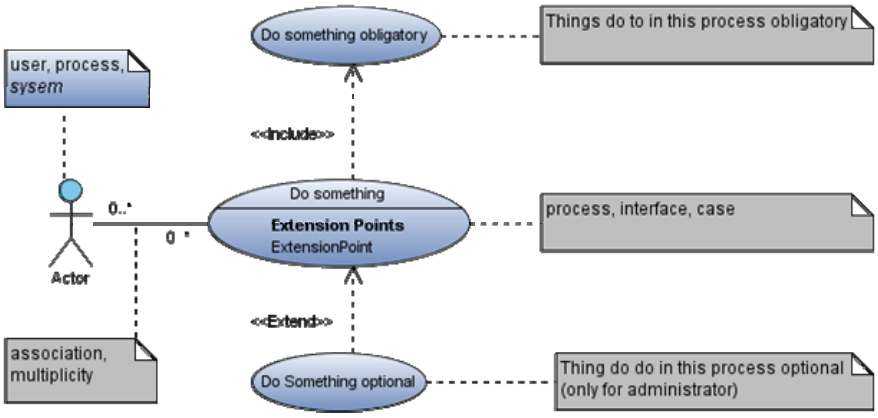
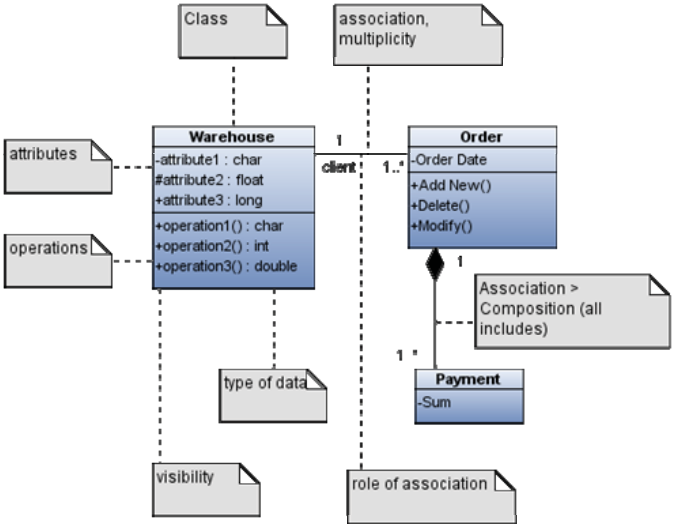


Fig. 1. Example of the diagram of the use case and his main units

The class diagram is the next way of the description of the computer product, being the most often used diagram from among UML. In distinction from the diagram of the use cases, this is the static diagram, describing the structure, dependences, the connection, the methods and heirdom. One word - all this, what we is known from the object-oriented languages of the programming: .NET, JAVA, PHP, C ++ and other. Example of the use of the class diagram and the way of the graphic notation of individual, main units were introduced on figure 2. This offences of the static, declarative units of the objective field and relationships between them.

The object is the basic unit of this diagram. Characterizes the unique identity, therefore there is possible affirm, that the object this the atomic piece of the real world, distinguished from the community of others objects. This also relates to the state, when all objects possess identical values. Object is a unit distinguished from the right of the existence itself, and is not because of the witch descriptive tags. Any object is the authority of the abstract notion, which is a class. The group of objects - the class is characterizes:

– identical structure of the data, that is the attributes,
– identical behavior, that is the operations,
– identical relationships,
– identical meaning in the definite context. (Wrycza, Marcinkowski, Wyrzykowski 2006)



Figs. 2. Example of the diagram of classes with marked main units.

Last patterned uses in the present study, using the notation UML, which is rather derivative unit of this notation - entity relationship diagram. Captures in the structure following units: entities, relationships, attributes and keys, how also the types of the data and multiplicity. This is diagram used in structures relational databases features, but relationships with the object oriented model are clearly visible. Obviously, realization can be prepared by every pattern ERD (Entity Relationship Diagram) using the class diagram, but he does not possess such expression what ERD.

Figure 3 represents the example entity relationship diagram with marked main units.

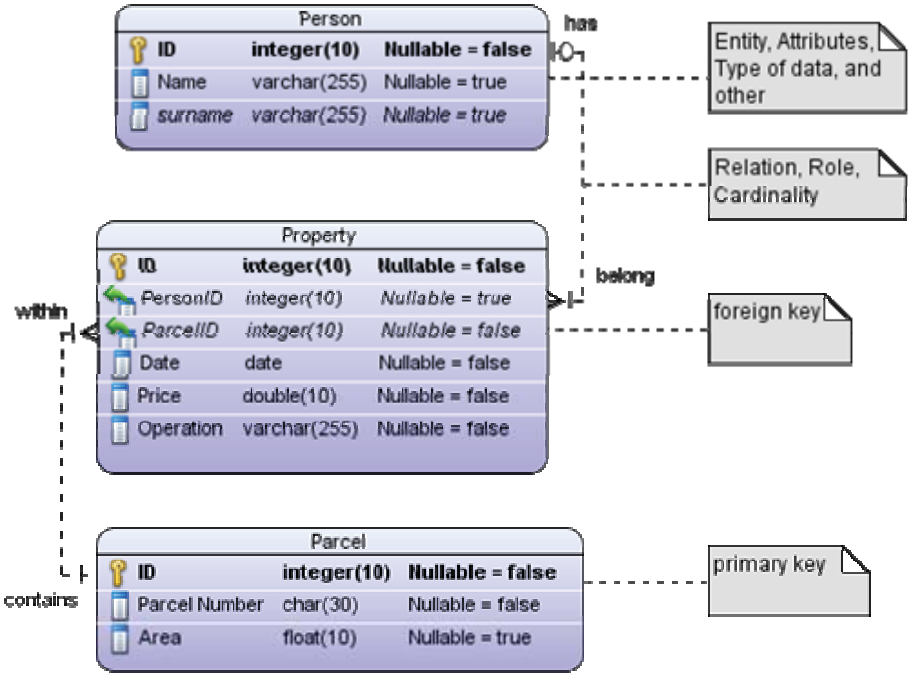


Fig. 3. Example of entity relationship diagram with main units

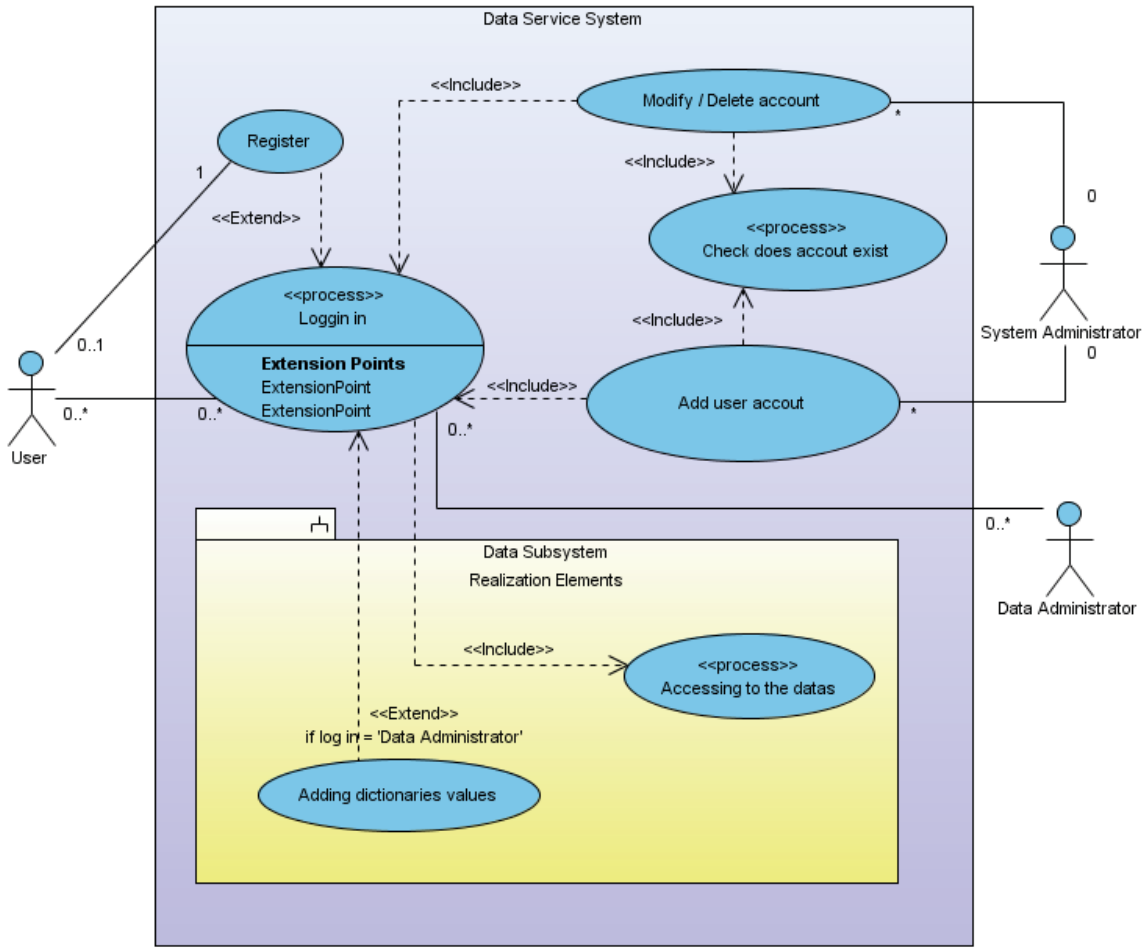
Type of the data describing the kinds of the value, which can be kept in every one from column is represented by field (Elmarsi, Navathe 2005) - that is the file of the atomic values of every attribute.

The building of models: system and given. Received on 14 March 2007 Directive Parliament European and Glad setting up The infrastructure of Spatial Information in European Commonwealth (INSPIRE), put on on the creators of computer systems co-operation in the range of adapting the standards of data and their exchange. This joins with unification of the of the study of the conception of accumulating data, suitable, unified modelling the packets of the data and efficient processing. So, authors part was the study of the spatial data model, in the range of categories used in the process of creating the siol-agricultural map.

The worked out data model and system before the manageress was introduced in the standard way, using notation UML 2.0.

In first stage, visible on figure 4, the case study was applied, in which, the tags of the system manageress were presented in the general way data quoted content.

Introduced patternel in the service system of data three actors being the administrators, and the users of the system. The service system accumulates data information about users accounts and after the execution of successful logging in - user or the administrator of the data receive the access to the data in the suitable range. The assurance of the safety of the data is the basic part of this system by tripping - out the anonymous movement in system and allowing the access to the data only in the indispensable range.



Figs. 4. Use case diagram and the main processes in the worked out system.

The administrator of the system of servicing data subsystem does not possess the access to the data, but administers of properties of accounts only, however the administrator of the data possesses the access to transactional data accumulated in the system, without the dictionary.

The user of the system, in dependence from the level of the privilege, after single - time registering, receives account, what allows the access to the data with tripping - out the dictionaries.

Visible with the word <<*include*>> connection on figure 4 are made in the whole with the process executed obligatory together with the superior process. Therefore, indifferent which users, would like to execute any operation - he will be brought by the system to the interface of logging in, in which he will be verified.

The structure of the data for the described thematic category is presented on figure 5 in the class diagram.

Seven classes being the representatives of the segment of the real world were distinguished on presented figure 5. They answer together the contents of the soil-agricultural map. It should be distinguish two kinds of classes: dictionary classes and proper classes. Dictionary classes are the add-in of proper classes and make up the repository of all accessible values of the proper class. Every dictionary class is the field of the proper class. The classes are joint among themselves, by the help of the conjugation of the association, that is the composition - the obligatory, total relationship, and the aggregation - relationship being the additional developed view of the main class.

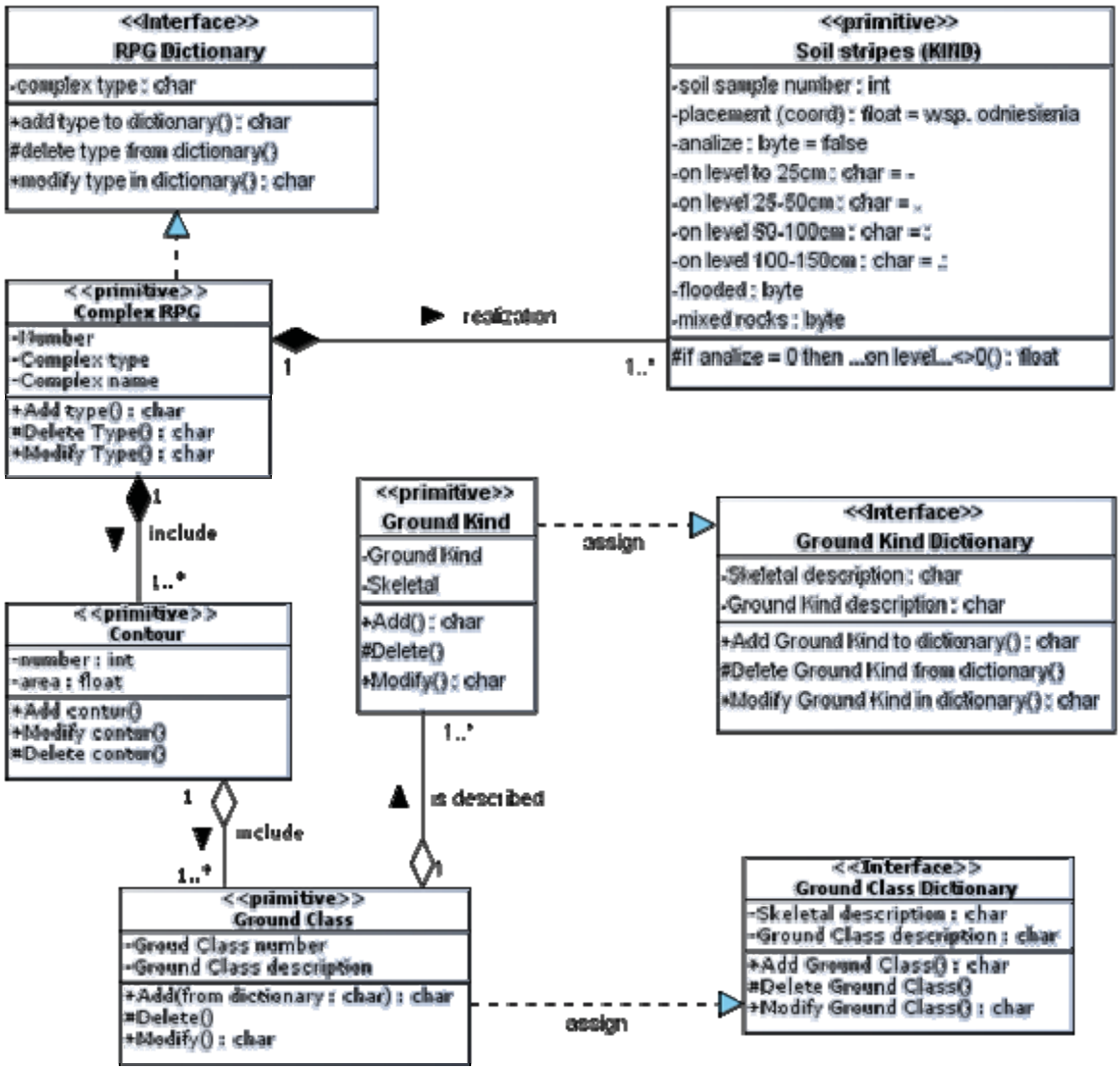


Fig. 5. Class diagram for soil-agricultural data

The soil-agricultural complex is the main class in the project. He possesses attributes, lets on the description all indispensable data visible on soil-agricultural maps. The one or many soil strip mines can be contained in the area of the complex (class Strip mine) and soil contours (class Contour). The Multiplicity of the relationship require existences the most at least the two objects from every class for every association. In the class of the soil contour, we can distinguish the what of the class additional aggregation there is the class of the soil (class Soil Class), and in that class the next aggregation - the Soil Kind (class Soil Kind). Every of the exchanged proper classes of model could function without additional add-ins, but the declaration of dictionary classes operating proper classes is the necessary cut.

Next diagram describing the structure of the project, is entity relationships diagram. That diagram representing dependences between the tables in the databases on the full attributes level. Presented model fulfils Third Normal Form and Boyce-Codd Normal Form. Abandon with the candidate natural keys and replace them one-field artificial keys. Model of relationships is very simple and one ramificated hierarchic tree contains in one-to-many relationship. The figure 6 presents this model.

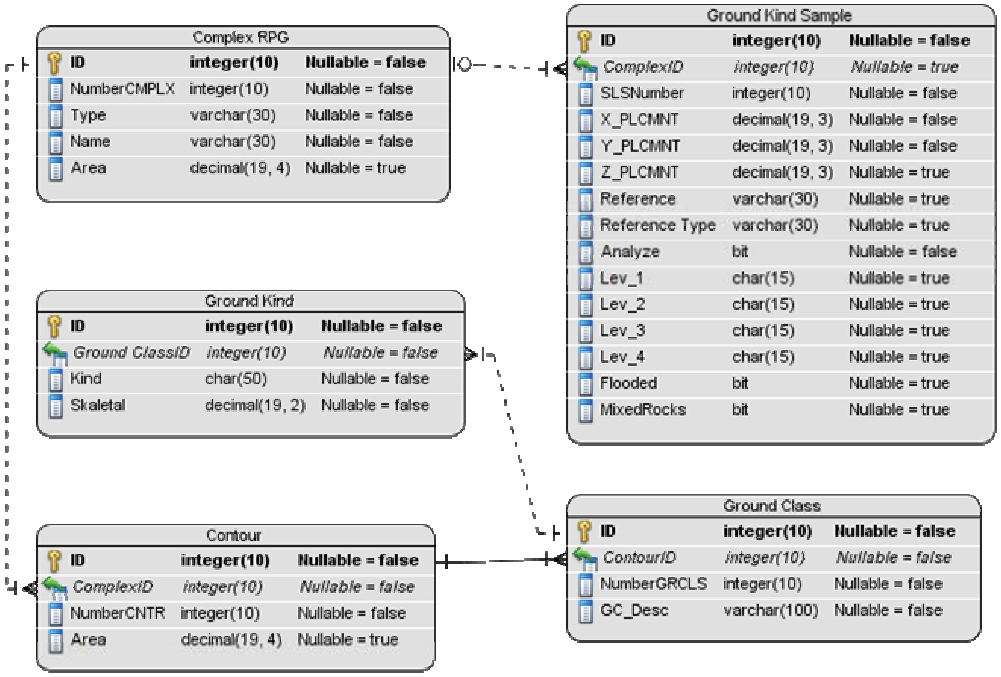


Fig. 6. Entity relationship diagram for worked-out model

Complex RPG was accepted for the main entity, which connected with the relationship about the multiplicity one-to-many from next entities: Contour, Soil Class, Soil Kind. The connection is cascade and affected through the put blockades of One-To-Many multiplicity . The relationship cannot step out Zero-or-One-to-Many, because this brought to the loss of the cohesion of data near the updating of the table Soil Kind, Soil Class, and Contour.

Entity Ground Kind Sample is quite important in model - being the add-in of the class Kind Ground on the class diagram. Makes up additional entity connected with the Complex RPG and not Ground Kind. The obtainment direct and required relationship of soil strip mine is reason of such intervention with the number of the complex. The kind of the soil is defined on the basis of strip mine, but this is holds beyond the system. No significative neither organizational contradiction draws ahead so in this model.

Conclusions. The problems of creating computer systems be subject to in todays' times far-going requirements from the organizational, investigative, formal side and adapted to legal requirements. The environment in which implementations is holds is also not without the meaning. The working of the system cannot break off settled and applied rules, he should throw on valid standards and formats to valid legal adjustments from second side.

The stadarisation should is introduced everyone from stages:

– the study of preliminary foundations of relating tasks realized by the system,

– the description of function and structure,

– methodology and the way of projecting, initiation and testing.

Above mentioned foundations are peaceable with the directive INSPIRE in the range of the data of relating soils, in the case of the numeric studies of derivatives for soil-agricultural maps: the maps of dirt, water retention, water and windy erosion and degradation.

Authors underline the fact of the originality of the conception of the introduced system. The methods which one can use during the creating computer systems are described in the literature quite extensively. There are few concrete solutions in the field of informative systems. According to authors, this publication makes up the contribution to the development of the methodology in the range of creating the spatial information systems.

1. Bednarek R., Dziadowiec H., Pokojska U., Prusinkiewicz Z. 2005. Resources into pedology-Ecological. Warszawa: PWN. 2. Elmarsi R., Navathe S. B. 2005. Fundamentals of database system, Helion, Gliwice. 3. Pilone D., Pitman N. 2007. UML 2.0 Almanach, Wyd. Helion, Gliwice. 4. Zawadzki S (red). 1999. Pedology. PWRiL. 5. Subieta K. 1999. Język UML, V Conference PLOUG, Zakopane. 6. Wrycza S., Marcinkowski B., Wyrzykowski K. 2006 UML 2.0 language in computer systems modelling. Wyd. Helion, Gliwice.

M. Ślusarski
Uniwersytet Rolniczy w Krakowie

METODYKA OPISU JAKOŚCI DANYCH PRZESTRZENNYCH W ASPEKCIE NORM ISO

С целью строительства геоинформационных систем исполняющих ставящиеся перед ними формально - юридические требования. Представлены подробные принципы и методология оценки качества пространственных данных. Одной из основных баз данных местной системы является кадастр недвижимости.
В работе представлены предложения описания качества данных кадастровой системы соответствующей директивам нормы PN-EN-ISO 19113.

In the destination of construction geoinformatics systems meeting requirements put before them is necessary elaboration detailed principles of the assessment methodology of spatial data quality. The cadastre of the real estate is one of basic databases of the local system. This study focuses proposial the description of the quality cadastre data in accordance with guidelines of the norm PN-EN-ISO 19113.

Wprowadzenie. Krajowy system informacji przestrzennej budowany jest w Polsce na trzech zasadniczych poziomach: centralnym, regionalnymi i lokalnym. Poziom centralny to obszar całego kraju, region obejmuje województwo, a zasięg lokalny dotyczy obszaru powiatu.

Tworzony na szczeblu centralnym system geoinformacyjny obejmuje opisywanie zjawisk świata rzeczywistego w skali globalnej (obszar całej Polski). Tworzone bazy danych dotyczą np. mapy topograficznej 1: 500 000, Sozologicznej Mapy Polski lub Krajowej Mapy Hydrologicznej. System regionalny zajmuje się m.in. dystrybucją map topograficznych w skalach od 1:10 000 do 1:100 000 oraz Bazy Danych Topograficznych. Na poziomie lokalnym budowane są bazy danych przestrzennych opisujące m.in. kataster nieruchomości, podstawową mapę kraju (1:500-1:5000) oraz geodezyjną ewidencję sieci uzbrojenia terenu.

Rozwój systemów lokalnych - w skali całego kraju - nie jest jednorodny, szczególnie w odniesieniu do rodzajów baz referencyjnych, jakości gromadzonych danych oraz stosowanych platform sprzętowych i programowych. W celu porównania systemów posiadających odmienną organizację oraz oceny poziomu realizacji zadań jakim służą konieczne jest tworzenie metodyki opisu jakości danych przestrzennych.

Jakość danych jako komponent metadanych. Kompendium infrastruktury danych przestrzennych: The SDI Cookbook (Nebert 2004) definiuje metadane jako dane o danych. W odniesieniu do zbioru danych przestrzennych, metadane zawierają informacje o tym zbiorze.

Definiowane standardy metadanych w swoich zbiorach podstawowych zawierają ocenę jakości danych przestrzennych. Cytowane powyżej kompendium infrastruktury danych przestrzennych (SDI) wyróżnia metadane rozpoznania, które pozwalają na ocenę jakości danych zbioru oraz określenie danych zbioru pod względem wymagań użytkownika. Główne elementy standardu CSDGM (US Federal Geographic Data Committee's Content Standard for Digital Geospatial Metadata) zawierają (wg kolejności ważności) (Longley i in. 2006): podstawową informację o zbiorze danych, informację o jakości danych (ogólna ocena jakości danych w zbiorze), sposób uporządkowania danych przestrzennych w zbiorze i inne.