

VIP-PERSONNEL FOR TELECOMMUNICATIONS

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Abstract. *In the article the new nonconventional technology of preparation of the experts of high qualification for telecommunications is considered. The experience of teaching of discipline “Informatics” on Faculty of Telecommunication systems in National Aviation University is generalized. The following idea develops: the modern VIP-expert in telecommunications should know and be able to simulate telecommunication systems and protocols in systems of fast designing by methods of the Object- guided programming. In the article the new elements of new technology are considered – they are: the formation of knowledge and skills on modeling the telecommunication protocols, training is exclusively on the examples (projects), teaching of lectures by analogy to a method of descending designing. It is marked, that it is necessary to supplement the usual comments of the texts, photo and video from electronic lectures on a multimedia projector by start and performance of the simulating programs on the computer.*

Keywords: computer science; designing; experts; modeling; programming; technology; telecommunication; telecommunication protocols; training; VIP.

1. Introduction

On the nature the modern telecommunication systems are computer networks with complex hierarchical organization of the telecommunication protocols. Therefore in system of knowledge and skills of the experts on telecommunications on the first place on a priority there is a knowledge of the telecommunication protocols, skill to simulate telecommunication systems and networks. In other words important there is on a priority not so much knowledge of transfer electrical signals, radio signals, circuitry etc., how many knowledge of computer networks from within, that is at a level of processes, algorithms and protocols. There is a problem: what and how to teach the experts for modern telecommunications? What qualities should have the VIP-expert in this area?

The analysis of the educational and working educational telecommunications programs in Universities of Ukraine shows, that the students frequently learn to programming not the telecommunication protocols and systems, they learn the unpretentious functions in languages such as Pascal, C, which basically are not suitable for fast designing and modeling of telecommunication objects.

The purpose of this article was to analyse experience of preparation of the experts on telecommunications, to formulate principles and to describe new technology of training of the experts of high qualification (VIP-experts).

2. Discipline “Informatics” in system of preparation of the VIP-personnel on telecommunications

In the National Aviation University in Institute of Air Navigation on a direction of preparation of the experts of “Telecommunication” (6.050903) there is only one discipline in the program of preparation is a discipline “Informatics”, which allows to generate necessary knowledge and skills - to create models of telecommunication systems and protocols. What basic parameters educational and worker of the educational programs on “Informatics”? So, there are semester 1,2, only 288 hours, including lectures 69 hours, laboratory employment (occupations) – 87 hours. In the first semester there are three modules, in the second semester there are two modules, and one of them is a course’s work.

The modules have the following names:

N 1 “Information, algorithm, computer, operating systems”;

N 2 “Application programs. Editors, databases, Internet”;

N 3 “Technologies of programming. Example of the visual, modular and structural programming in Borland C ++ Builder 6”;

N 4 “The Object-oriented programming. Examples of construction of new Class by an inheritance. Polymorphism”;

N 5 “Course's work”.

So, in discipline there are two modules (N 3-4), where the modern technologies of programming are considered:

– modular programming,

- structural programming,
- Object-oriented programming (in environment of fast designing of the programs).

3. Features of discipline “Informatics”

What features of discipline “Informatics”?

The first feature - lectures are conducted in audience with a multimedia projector in “on-line” mode - the comments of the texts, photo and video are combining with simulating programs on the computer.

The second feature - that the technologies of programming are considered extremely on concrete examples (projects); in discipline “Informatics” there are four projects.

The third feature – lectures are expounded from whole to details and not from simple to complex (traditional method, as in [Reisdorf, Henderson 2003; Arhangelskii 2003]).

The fourth feature - only interesting bright not trivial objects are modeling, for example, modeling of flight of the plane, work MP3- player, of modeling of an exchange of the messages between processes in a network etc.

And now we shall consider separately, in details each project. In total them in a discipline - four. Now about each project in detail.

4. The project 1 Example of modular programming “Force of a current”

The idea of technology of modular programming is wonderfully stated in [Informatics...2005]. The essence of technology that all algorithm is broken into separate steps (modules). Thus each module has only one point of an input and only one point of an output.

In modular programming [Informatics...2005] the text of the program represents a linear sequence of the operators of giving, cycle and conditional operators. In such a way it is possible to decide (solve) not so complex (difficult) tasks and to make the programs containing a little bit (some several hundreds of lines) of a code. After that the clearness of the initial text sharply falls that the general (common) structure of algorithm is lost behind the concrete operators of language which is carrying out too detailed, elementary actions.

Used in discipline “Informatics” the first example is borrowed from [Reisdorf, Henderson 2003] and is named as “Force of a current”. The example is made out as the first project in environment of fast designing of the programs “Borland C++ Builder 6”.

5. The project 2 Example of structural descending programming of “Estimation”

The idea of technology of structural programming also is wonderfully stated in [Informatics...2005]. Essence of technology that the structure of the program should reflect structure of a soluble task, that the algorithm of the decision was clearly seen from the initial text. For this purpose it is necessary to have means for creation of the program not only with the help of three simple operators, but also with the help of means more precisely reflecting concrete structure of algorithm. With this purpose the concept of the subroutine is entered (the subroutine - set of the operators who are carrying out the necessary action and not dependent from other parts of an initial code).

The program is broken into set of the fine subroutines (occupying up to 50 operators - critical threshold for fast understanding of the purpose of the subroutine), each of which carries out one of actions stipulated by the initial task. Combining these subroutines, it is possible to form final algorithm of the simple operators. It turns out, that the subroutines are the new operators or operations of language determined by the programmer.

Descending designing. The presence of the subroutines allows to conduct designing and development of the appendix from above downwards - such approach refers to as descending designing. Some subroutines deciding the most global tasks (for example at first are allocated the initialization of the data, body and end), then each of these modules is detailed at lower level, being broken in turn on small number of other subroutines, and so occurs so long as all task will not appear realized. Such approach is convenient by that allows the man constantly to think at a subject level, not falling up to the concrete operators and variable.

Used in discipline “Informatics” the second example is borrowed from [Informatics...2005] and is named as “Estimations”. The example is made out as the second project in environment of fast designing of the programs “Borland C++ Builder 6”.

6. The project 3 Example of object-oriented programming “A Component of the programmer”

In the third project the idea of object-oriented programming is considered.

Concept of object. Agrees [Informatics...2005] real objects of the environmental world have three base characteristics: they have a set of properties, are capable by different methods to change these properties and to react to events arising as in the

environmental world, and inside the object. In such kind in the programming languages concept of object as sets of properties (structures given, characteristic for this object), methods of their processing (subroutines of change of properties) and events also is realized, to which the given object can react and which result, as a rule, in change of properties of object.

Class. The objects can have identical structure and differ only by meanings of properties. In such cases in the program is created new type based on uniform structure of object (by analogy, how the new types for structures of the data) are created. It refers to as a class, and each concrete object having structure of this class, refers to as a copy of a class.

The description of a new class. The description of a new class is similar to the description of new structure of the data, only to fields (properties) the methods - subroutine are added. The class is a type of the data, same, as any other base or complex type. On its basis it is possible to describe concrete objects (copies of classes).

The object-oriented programming is based on three key concepts - encapsulation, inheritance and polymorphism. The association of the data with methods in one type (class) refers to as encapsulation. Besides association, encapsulation allows to limit access to the data of objects and realization of methods of classes. In result the programmers have an opportunity of use of ready classes in the appendices on a basis only of descriptions of these classes.

The *inheritance* allows to create new classes, reusing an available initial code and not spending time for its copying.

Used in discipline "Informatics" the third example is borrowed from [Illustrated...2005] and the component of the programmer was named as "A Component of the programmer". The example is made out as the third project in environment of fast designing of the programs "Borland C++ Builder 6".

7. The project 4 Example of creation of a new class by inheritance "Hierarchy of classes of planes"

In the fourth project is considered mechanisms of inheritance and replacement.

Agrees [Reisdorf, Henderson 2003] by one of the most powerful properties of classes in C++ is the opportunity of their expansion by inheritance.

The *inheritance* is a creation of a new class by addition of the new members to an already existing class. The class, by which the new members are

added, refers to as a base class, and again created class - derivative class.

In [Reisdorf, Henderson 2003] a class Airplane is considered as an example. Though, as is known, between civil and military aircraft there are large distinctions, for representation of the military plane it is possible to create a new class MilitaryPlane on the basis of a class Airplane, having added to it the new members.

MilitaryPlane includes everything, that contains Airplane, and also some additional elements. It is necessary to pay attention to the first line of definition of a class. The colon after a name of a class specifies to the compiler, that the given class is derivative from other class. The colon is followed by a name of a base class.

In the fourth project the key word virtual is used. It specifies, that the given function is virtual.

The virtual function is a function, which will be caused automatically, if in a derivative class there is a function with the same name.

The replacement of function of a base class refers to as a function of a derivative class by replacement of function. That there was a replacement, the function of a derivative class should in accuracy coincide with function of a base class. Differently, the types of returned meanings names of functions and lists of parameters should be identical.

In [Reisdorf, Henderson 2003] the example of creation of hierarchy of classes of planes by inheritance is shown. From this figure it is visible, that the class of planes with a name F16 is derivative from a class Military Fighter. At the end, F16 occurs from Airplane, as the class Airplane is base for all other classes.

8. Course's work

By the fifth module of discipline "Informatics" is course's work in 2nd a semester. On performance of course's work 36 hours of independent work of the student are allocated.

The course's work and its protection finishes a discipline. At performance of work the student is obliged to reach aerial acrobatics in development of knowledge and skills on "Informatics", technologies of programming and modeling of telecommunication systems. What should become result of course's work?

It is offered to each student on a choice the individual project from CD-ROM [Kultin 2005].

Each project is submitted in a separate folder. Each such folder contains all initial texts of the programs, and also available project, constructed on them, (that is .exe - file).

The student can open any folder, start the ready appendix and estimate its work. The liked project the student announces to the teacher. Thus a copy of a base class for each student is defined individually.

On the second step of course designing the student formulates and asserts distinctive properties and methods of a new class, which should be created on the basis of a base class by inheritance.

9. Conclusions

The considered technology of training and preparation of the experts for telecommunications has shown the viability and high efficiency. Has proved to be true, that the used technology of training allows to carry out revolutionary changes in knowledge and skills of the experts on telecommunications by training to modeling of telecommunication systems and protocols. It has justified itself experience of training extremely on examples. There was not any theory in a separation from the concrete projects. Lectures are conducted in audience with a multimedia projector in “on-line” mode - the comments of the texts, photo and video

are combining with simulating programs on the computer. There was an effective idea of descending training (from object as a whole - to details). It has proved to be true, what exactly the development of the interesting complex (difficult) appendices causes in the student alive interest and strong motivation. It has appeared, that the modeling of the telecommunication protocols, such as Ethernet, IP, UDP, TCP etc. is quite accessible to the students.

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Розглянуто нову нетрадиційну технологію підготовки спеціалістів високої кваліфікації. Показано, що сучасний VIP-спеціаліст з телекомунікацій повинен знати та вміти моделювати телекомунікаційні системи та протоколи в системах швидкого проектування методами об'єктно-орієнтованого програмування. Викладено нові елементи нової технології навчання. Зазначено, що звичайні коментарі текстів, фото та відео з електронних лекцій на мультимедійному проекторі слід доповнювати запуском та виконанням моделюючих програм на комп'ютері.

Ключові слова: інформатика; моделювання; навчання; програмування; проектування; протоколи; телекомунікації; технологія; фахівці; VIP.

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Рассмотрена новая нетрадиционная технология подготовки специалистов высокой квалификации. Показано, что современный VIP-специалист по телекоммуникациям должен знать и уметь моделировать телекоммуникационные системы и протоколы в системах быстрого проектирования методами объектно-ориентированного программирования. Изложены новые элементы новой технологии обучения. Отмечено, что обычные комментарии текстов, фото и видео из электронных лекций на мультимедийном проекторе следует дополнять запуском и выполнением моделирующих программ на компьютере.

Ключевые слова: информатика; моделирование; обучение; программирование; проектирование; протоколы; специалисты; телекоммуникации; технология; VIP.

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