

Experience of the Formation of Professional Competence of Students of IT – Specialties

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Abstract—The article describes an approach to build competence in research of Bachelor and Master, which is now an important feature of modern specialist in the field of engineering. We provide an example of methodical teaching methods with the research aspect, including the formulation of the problem, the method of conducting experiments, analysis of the results. Implementation of methods allows the student to better consolidate their knowledge and skills at the same time to get research. Knowledge on the part of the media requires some training in the subject area and teaching methods.

Keywords—Professional competence, its model–specialties, teaching methods, educational technology, decision making.

I. INTRODUCTION

THE modern trend of development and assessment of learning outcomes are closely related to the system of competences obtained a graduate from educational institution. Competence-based approach focuses on the learning process as close as possible to the real professional situations that will meet future specialist. For example, the student - the future IT-specialist, in the process of learning is not only should be acquainted with the subject area of the corresponding course, but also to develop research and analytical skills (competence).

Consider one of the approaches to learning, when the learner formed the competence of independent decision-making in the professional field. Undergraduate and graduate students study various areas of IT-technologies, including the organization of inter-program cooperation based on client-server technology.

II. BRIEF DESCRIPTION OF THE NECESSARY THEORETICAL INFORMATION

As is known, inter-program interaction occurs in most cases in the following technologies: RPC (Remote Procedure Call) and REST (Representational State Transfer) [1], [2]. As is well known implementation of RPC technology includes two components: a protocol for exchange in client-server mode and language object serialization (or structures for non-object RPC). Various implementations of RPC are very different from each other and architecture has differences in their capabilities: some architecture implement SOA, other CORBA or DCOM. The transport layer is used mainly RPC protocols

TCP and UDP. Antipode of RPC style is REST (Representational State Transfer). REST implements standard inter program interaction internet and widespread. Thus the basic principles of REST are the following:

- User agents interact with resources that may be all that can be named and submit. To each resource can be accessed through a unique identifier URI (Uniform Resource Identifier - URI);
- Interaction with the resources (detectable by their unique codes URI) by using a single interface standard commands HTTP (GET, POST, PUT and DELETE). It is also important for the interaction to announce the type of multimedia resource, which is specified by the content-type header HTTP (the well-known media types);
- All the information need to process the request of resource is contained in the query (this eliminates the need for characterizing the state of services);
- Resource contains links to other resources (hypermedia).

RPC feature is the need to perform the procedures for serialization, which is used to transfer objects over the network and to save them to files. For this purpose we write special code that performs serialization and deserialization. Object filled with the necessary data, and then calls the serialization code, resulting in, for example, XML-document [3]. Receiving application creates an object of the same type and calls deserialization code, resulting in a facility with the same data that were the object of the sending application. According to this scheme are serialized objects through SOAP.

The students were tasked - to explore such important characteristic of REST and RPC applications as performance, justify the choice of a particular technology. For this, it is necessary to conduct experiments to evaluate the run-time functionality in various technologies. As a representative of REST is usually considered an application layer protocol HTTP (methods GET, POST), and as a representative of RPC protocol SOAP (method POST (GET method in SOAP is not used)). For the correctness of assessments must meet the following requirements:

- use a single application and system software;
- use one Web server and browser;
- use one programming language that implements the functional (server-side script).

Time spent on packets traveling along the route should not be taken into account, so you need to use either static routes or debug mode type - loop back. Also, for reasons of clarity, it is necessary to enter the same data. As can be seen from Fig. 1,

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the user interface is the same in all cases. To calculate the runtime functionality used browser plug-in Fig. 2 [4], [5]. Runtime transaction consists of the request and response, as well as the transfer request application in all cases a relatively constant value, then the estimate of the run-time functionality can be evaluated by the runtime of the entire transaction. To obtain an estimate rather small sample of 10 transactions, as scatter small. The results of the experiment are shown in Table I.

TABLE I
THE RESULTS OF THE EXPERIMENT

| Transactions | soap | http get | http post |
|------------------|--------|----------|-----------|
| 1 | 515ms | 172 ms | 125 ms |
| 2 | 531 ms | 141 ms | 140 ms |
| 3 | 531 ms | 125 ms | 109 ms |
| 4 | 516 ms | 140 ms | 125 ms |
| 5 | 516 ms | 125 ms | 141 ms |
| 6 | 500 ms | 125 ms | 125 ms |
| 7 | 485 ms | 156 ms | 125 ms |
| 8 | 516 ms | 125 ms | 125 ms |
| 9 | 531 ms | 156 ms | 172 ms |
| 10 | 579 ms | 125 ms | 109 ms |
| Average | 522 ms | 139 ms | 130 ms |
| The multiplicity | 4,02 | 1,07 | 1 |

What conclusions can make the learner as a result of the research?

Analytical results:

- As can be seen from Table I, the average run-time functionality when submitting a request through SOAP 4 times more. Obviously the time spent to perform operations associated with the generation of SOAP-requests and responses, the serialization and deserialization;
- Runtime functionality through SOAP commensurate with through the route to the Internet, as a result, taking into account the possible SOAP-server overload can lead to significant delays perform the requested operation;
- Technology of the organization of inter-program synergies should be chosen with regard to integrated assessments, given the run-time functionality. Obviously, in this case it is advisable to use a style REST.

Note that the choice of a particular technology may affect other requirements and business - conditions: infrastructure constraints, the required level of interoperability, security transactions, the current architecture of the system, etc. These introductory tasks can put a teacher, and in this case the student bases his arguments decision.

Methodical approaches to teaching IT-technologies - visualization and presentation [6]. Next, consider the methodical receptions of teaching students of the technological disciplines of IT-profile. Visualization and presentation of educational material is achieved through the use of programming language constructs operator, service software. As is well known, the study of all disciplines visualization and presentation of educational material greatly increases the assimilation of knowledge to students. We consider the approach, when the study of IT-technology disciplines can apply individual operator designs widespread programming languages such as HTML, service programs. We present, for clarity, the method of studying the application level model TCP / IP. Note that there is knowledge of programming used to study the technology. The examples are built on the principle of simple to complex.

Task 1. Transfer the data server-side script from the command line browser. What method is used? What is the value of environment variables and server QUERY_STRING

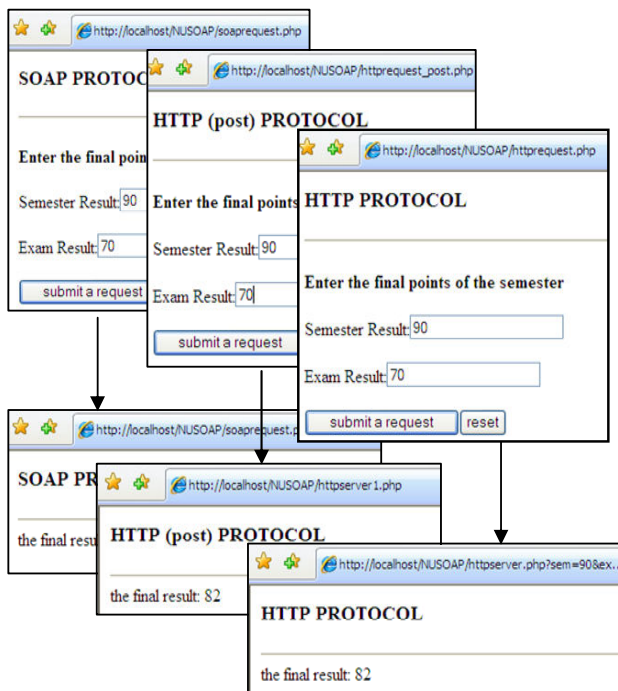


Fig. 1 Dialogs of programs

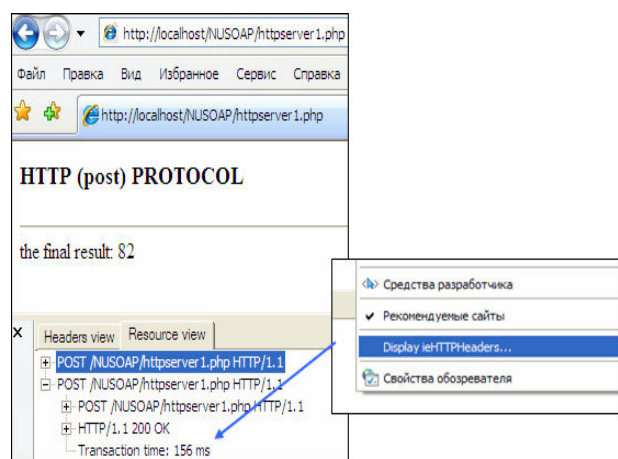


Fig. 2 Dialogs measuring program execution time of transactions

CONTENT_LENGTH? (here designs of operator do not apply).

A possible response:

```
http://localhost/cgi-bin/test.pl?a=b
```

method GET

value QUERY_STRING a=b

value CONTENT_LENGTH empty

Task 2. Transfer data from the server-side script from hyperlinks. What method is used? What is the value of environment variables and server QUERY_STRING CONTENT_LENGTH?

A possible response:

```
<a href="http://localhost/cgi-bin/test.pl?a=b">transfer</a>
```

method GET

value QUERY_STRING a=b

value CONTENT_LENGTH empty

Task 3. To transfer data server-side script by POST method. What is the value of environment variables and server QUERY_STRING CONTENT_LENGTH?

A possible response:

```
<form action="http://localhost/cgi-bin/test.pl"
```

method=post>

```
<input name="a" value=b>
```

```
<input type=submit value="transfer">
```

```
</form>
```

method POST

value QUERY_STRING empty

value CONTENT_LENGTH 3

Task 4. To transfer data to server-side script. Values of server variables QUERY_STRING and CONTENT_LENGTH must not be empty.

A possible response:

```
<form action="http://localhost/cgi-bin/test.pl?a=b"
```

method=post>

```
<input name="a" value="b">
```

```
<input type=submit value="transfer">
```

```
</form>
```

method POST

value QUERY_STRING a=b

value CONTENT_LENGTH 3

Another greater visibility of training can be achieved by applying the program plug-in in our case the plug-in that displays requests and responses of the Protocol HTTP.

We note that these examples are written from the standpoint of programming on the principle of sufficient minimalist because the task is not learning WEB-programming, and in understanding the data transmission technologies at the application level model TCP / IP.

Incrementally solving the above problems, the students receive and perpetuate knowledge of how to pass requests and responses over HTTP, which is a representative model of the application level TCP / IP. What questions of the HTTP protocol clearly displayed in the above examples?

1. When you use the GET request (b) is transferred as part of URL (task 1).
2. When using a hyperlink can only use the method GET (task 2).

3. When using the POST request (b) is transferred in the request body (task 3), the request is passed name = value pairs.

4. Example of 4th Task illustrates the problem of what information transmitted to the server environment variables in QUERY_STRING pair name = value, where value (b) the user data, and CONTENT_LENGTH query length in bytes.

5. Mapping of requests and responses using plugins (Fig. 3) shows clearly to students all the information of protocol headers HTTP.

These tasks can be given to students as individual tasks of independent work. The syntax of HTML language is clear, tag attributes are used as elements of the "building blocks" of understanding technology. Tasks 4 are relatively complex and can be used as an indicator of students mastering the topic "Application layer of the model TCP / IP".

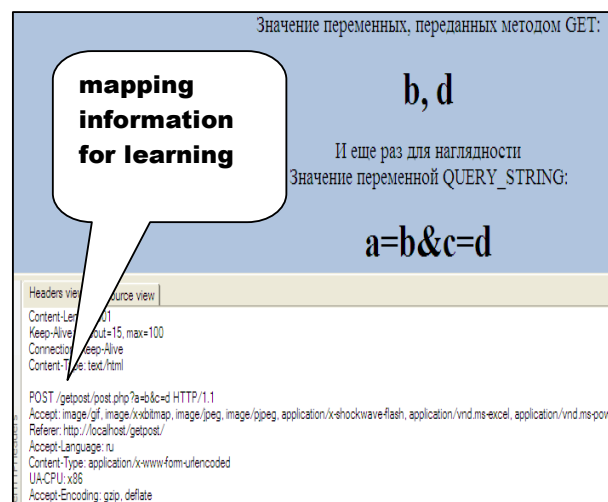


Fig. 3 Application of plug-in to display educational information

And for visualization of educational material can use the Internet. If the audience has, for example interactive electronic whiteboard with a computer connected to the Internet, we can demonstrate the operation of protocols at various levels model of TCP / IP, using the service sites.

Methodical approaches to teaching IT-technologies - creation and support of learning resources.

Feature of modern engineering education system is its intensification. This is due to the need to train a large number of relatively little used as well as new technologies are at the stage of implementation. For this reason, there is a lack of training time and an abundance of topics. One way to overcome these difficulties is the effective use of the information infrastructure of the institution and the use of appropriate teaching methods. One of the modern teaching methods is the use of systems E-learning, the effectiveness of which depends largely on technology creation and support of interactive learning resources.

Constraining factor of the use of E-learning, as a modern and efficient learning technology is the lack of knowledge and

skills on the use of WEB-creation of educational resources by the teacher. Practical and widely used technology E-learning is possible when targeting the "average" user, who does not know the details of information technology. Therefore discussed methods of creating and supporting educational WEB-resources simplified and based on the reduced scheme. This approach compares favorably with complicated, expensive and less flexible systems where such systems administration, persons not involved in the learning process (for example, between the carrier of knowledge and students can be: the knowledge engineer, programmer, web-designer, system administrator, etc.). Teacher himself is a constructor of educational content on the composition and structure of which there are no restrictions. The considered approach allows you to quickly modify and supplement the content of teaching resources carrier of knowledge, which is very important for both sides of the learning process. It is assumed that the interactive training resources can be components of a teacher's personal website or page, and web-resource management is performed by standard procedures available to the user who does not know the intricacies of web-programming. Also, this approach allows us to individualize teaching and methodical content depending on the preferences of a particular teacher. For example, many teachers use their handouts, special tests, etc. There are also no limitations on space-based (placement) of WEB-resources, their scope and style of performance. All this is consistent with the specificity of the teacher, using their individual teaching methods and techniques.

We consider the technological techniques for creating interactive training and support WEB-resources on a few examples. These examples demonstrate the relative simplicity of the technology, and hence its suitability for use by many teachers. We note that for educational purposes, in most cases, you can use relatively simple client-server technology without the use of scripts. This is, firstly simplifies support for an educational WEB- resource, secondly, does not require serious skills of teacher in WEB-programming. Taking this into account technological chain of to create and support educational resources is minimized and all operations are performed by the carrier of knowledge.

Example 1. Training interactive resource - lecture.

This resource is created in the form of a hypertext document with the possibility of checking the knowledge acquired. An interactive element - this is a test of knowledge, realized mini - test on the main issues of educational material. We consider the process of creating such a resource steps.

- 1) Conversion of an electronic version of the training material to the hypertext document (html-file).
- 2) Preparation of the test using the test generation or manual coding.
- 3) Introduction of hyperlinks in hypertext learning material (lectures) or the introduction of the code html-file-test code to html-file-lecture.
- 4) Placing a teaching resource on the server and the hyperlink to the site.

Example 2. Creating interactive multimedia learning resources.

As tools creation of multimedia educational resources, you can use the so-called program of capture images, such as the program "HyperCam2". Consider this process in more detail.

- 1) Definition of scenario of the teaching resource. For example, create video performing practical tasks in a specific discipline.
- 2) Record of all necessary actions according to the scenario.
- 3) Placement of multimedia educational resource on the server and the hyperlink to the site.

Note also that we have a positive experience when students themselves use this technique for the presentation of their work. Progress Report clearly displayed in the form of video, reflecting all stages of implementation of a training assignment.

Example 3. Test control of knowledge.

This task is often solved by the teacher using WEB-resources. In this case, the easiest method is to use software test generation or editing an existing template test. And as you use client technology, it is necessary to prevent the possibility of "spying" codes of correct answers to students. To avoid this, you can use the program ciphering the open source software program such as "HTML Guardian". This resource (interactive test) can also be placed on the site.

III. CONCLUSION

This approach, which implements the competence of self-acceptance solutions with different situations, has been used successfully in the training of bachelors and masters at the Department of Information Technology, Institute of Information Technology and Telecommunications of KazNTU named after K.I.Satpayev.

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