

# THE CREATION OF THE DIGITAL RESOURCE WITH THE AID OF PARALLEL COMPUTING

MERUERT SERIK<sup>1</sup> – JAROSLAV KULTAN<sup>2</sup>  
– NURSAULE KARELKHAN<sup>3</sup>

## Vytvorenie digitálneho zdroja pomocou paralelného výpočtu

**Abstract:** Nowadays, the development of cross-platform applications which work on the different digital platform is a highly attractive topic, which is rising in importance. Another main focus is with the help of parallel computing on the creation of digital resource, which work on the operating system of Windows, Android, IOS, Mac OS X, for the reduction of its loading time. Parallel computing systems are ubiquitous today. From laptops and mobile phones to global-scale compute infrastructures, parallel computing systems drive the world we live in. Although motivated by advances in hardware design, the many-core revolution has a profound impact on engineering software: Only software explicitly dedicated to parallel architectures can fully exploit today's hardware potential and benefit from future gains in hardware performance. Only software engineers who are true experts in parallel computing systems can make an impact on future software (Clemens Grelck, 2018) [1]. In our case it is possible to reduce the initialisation time of the digital resource by using the parallel options of all cores of processors, which is created in Rad Studio XE7. In this article, the methods and efficiency of the digital resource creation are demonstrated by using the parallel computing.

**Keywords:** education, parallel computing, digital resource, cross-platform

**JEL Classification:** C 8, I 23

## 1. Introduction

The development of the computer technology enables to organize a more interesting and efficient training. Using different forms of training, makes it possible to develop the organization of learning process. At the moment, it is

<sup>1</sup> Meruert Serik, Professor, Doctor of Pedagogical Sciences, L.N. Gumilyov Eurasian National University, Kazakhstan; E-mail: serik\_meruerts@mail.ru

<sup>2</sup> Jaroslav Kultán, PhD., University of Economics in Bratislava, Slovak Republic; E-mail: jkultán@gmail.com

<sup>3</sup> Nursuale Karelkhan, L.N. Gumilyov Eurasian National University, Kazakhstan; E-mail: knursaule@mail.ru

more important for the users to use a digital resource with multimedia on the different devices and spend less time for the speed of its initialisation.

On this regard, to develop the digital resource with multimedia, it is necessary to provide its fast initialization, taking into account the lecturer's pedagogical excellence and the special aspects of the subject, using all possibilities of the loading information. To fulfil such requests, it is possible to create digital resource resources using parallel computing in the creating of RadStudio XE7.

The platform RadStudio XE7 is the place for the creation of internally connected applications to the gadgets Windows, Android, iOS, Mac OS X (Figure 1) (Embarcadero, 2017) [2].

The advantage of the application, which is created with the aid of using parallel computing in the creation of RadStudio XE7, even devices (computer, pad, mobile phones) are different, but it is able to work at once parallel, using all possibilities of all cores of their processors.

Figure 1

### Features of the platform RAD Studio XE7



Source:[12].

Get started fast with RadStudio for cross-platform development on Android, iOS, macOS, and Windows. The platforms supported by VCL apps are Win32 and Win64. The platforms supported by cross-platform FMX apps are Android, iOS 32, iOS 64, iOS Simulator, macOS, Win32, and Win64. You can quickly build and deploy a single code base and single UI using FMX to all of these platforms. The Platform Assistant server (named PA server) is a command-line application that can be installed on Windows and OS X. You install the Platform Assistant on a remote system, in the same network as your development system, to let RAD Studio interact with that remote system, so that you can develop cross-platform (multi-device) applications for OS X, iOS, or Win64 (this last from a Win32 development system).

The RTL provides the Parallel Programming Library (PPL), giving your applications the ability to have tasks running in parallel taking advantage of working across multiple CPU devices and computers. The PPL includes a number of advanced features for running tasks, joining tasks, waiting on groups of tasks, etc. to process. For all this, there is a thread pool that self-tunes itself automatically (based on the load on the CPU's) so you do not have to care about creating or managing threads for this purpose. You can use this library by including *System.Threading*. This unit is made up of several features that can be included into new and existing projects. The unit also includes a number of overloaded arguments to make it suitable for C++ as well as Delphi. Using the PPL, your applications can easily:

- Make looping faster with `TParallel.For`.
- Run multiple tasks in parallel using `TTask` and `ITask`.
- Leave a process running focusing on other tasks and then get the result of that process at the point you want. `IFuture` allows you to establish a priority for the running code blocks and still return the results when needed. (Embarcadero, 2017) [2].

To develop the digital resource with multimedia in the creation of RadStudio XE7, it is necessary to understand the function of the setting and to manage of usage the components, properties and signals for creation of e-learning resources.

The RAD Studio XE7 is the one of the suitable programs for the declaration and preparation of the docs on URL. The Rad Studio XE7 fulfils standard possibilities and special functions on the preparation and change of the doc Web. Together with this, it is easy to create electronic tasks, anagrams, tests, crosswords on this setting to strength and check the knowledge of the trainees.

For the creation of the Digital resource for developing RAD Studio XE7, it is needed to learn the function of the setting and be able to use its property

and signals of the components. The program has all possibilities to conduct the training process on the web system.

Creation environment The Studio XE7 series works with C++ or Object Pascal programming languages. Before creating the program, it is possible to create platforms in both environments. During the creation of the program depending at which of languages of the program C++ or Object Pascal you are good; you can work choosing the creation of C++ Builder XE7 or Delphi XE7. In our case, Delphi XE7 is chosen. Afterwards, to demonstrate a practical way of using parallel computing for the creation of RadStudio XE7 in the educational system, we will consider the method of the creation of the digital resource.

## 2. Literature Review

In the course of our research, sources on the topic were analyzed. Analysis of scientific literature and Internet resources show that courses on parallel computing are introduced in higher education in foreign universities; at the same time, there are scientists' researches and works on this topic also in Kazakhstan. The experience of other scientists from different countries was studied, namely the issues of parallel computing in the learning process (Dormido Canto et al., 2007) [4]. In the scientific and pedagogical literature of Kazakhstan (Tseng, 2010) (Tseng, 2010) [5] problems of introduction of parallel computing in the educational process are presented in the works (Serik et al., 2017) [6].

In their works Digital element creation (Hudson, 2010) [7], Education applications (Craig et al., 2009) [8] and Mobile application challenges smart phone and next generation mobile computing (Pei – Ni, 2006) [9] the creation of the education applications was well represented.

One of the tasks of solving this issue is the introduction of special courses in the educational process. In the educational process, in the preparation of future specialists in informational and communicational technologies, including computer science teachers, special courses on the parallel computing and cluster of parallel computing were introduced to improve students' training.

The topic of the creation of the e-learning applications with the aid of parallel computing is one of the chapters of the parallel computing course.

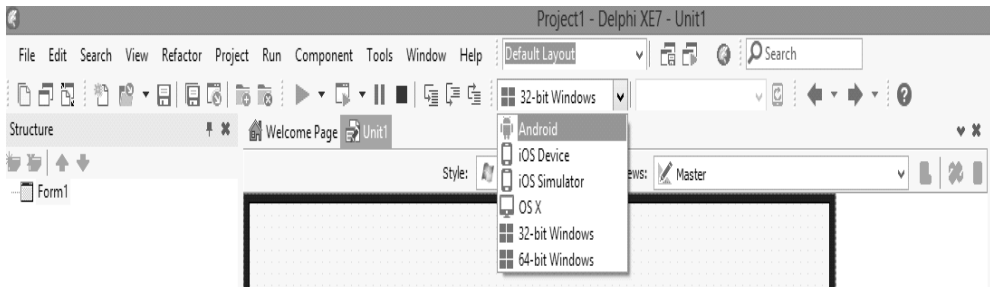
## 3. Previous Work

For the creation of cross-platform application on the setting of Delphi XE7, it will necessary to perform commands *File->New->Multi-Device application ->Delphi*.

The *Blank Application* will be chosen from the appeared window. For the users of the e-learning applications to work on a needed platform, we will choose firstly the type of platform. Further, it is necessary to connect the working device to the program-creating computer. After that, you will choose the type of operating system (<https://habrahabr.ru>) [10] from the panel of tools. In our case it is the Android (see the Figure 2).

Figure 2

### The creation of the cross-platform application on the creation of Rad Studio XE7

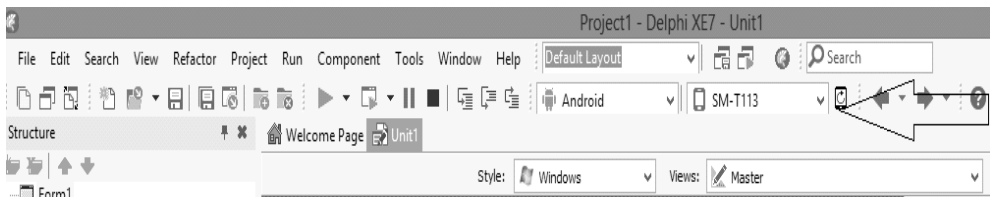


**Source:** Custom processing.

If you accurately connect the necessary equipment to the computer, the name of this equipment appears on the selection panel. If it does not appear, you shall update it choosing the picture of mobile phone with the command *Refresh Device*. In our case the device SM-T113 is ready to create the application (Figure 3).

Figure 3

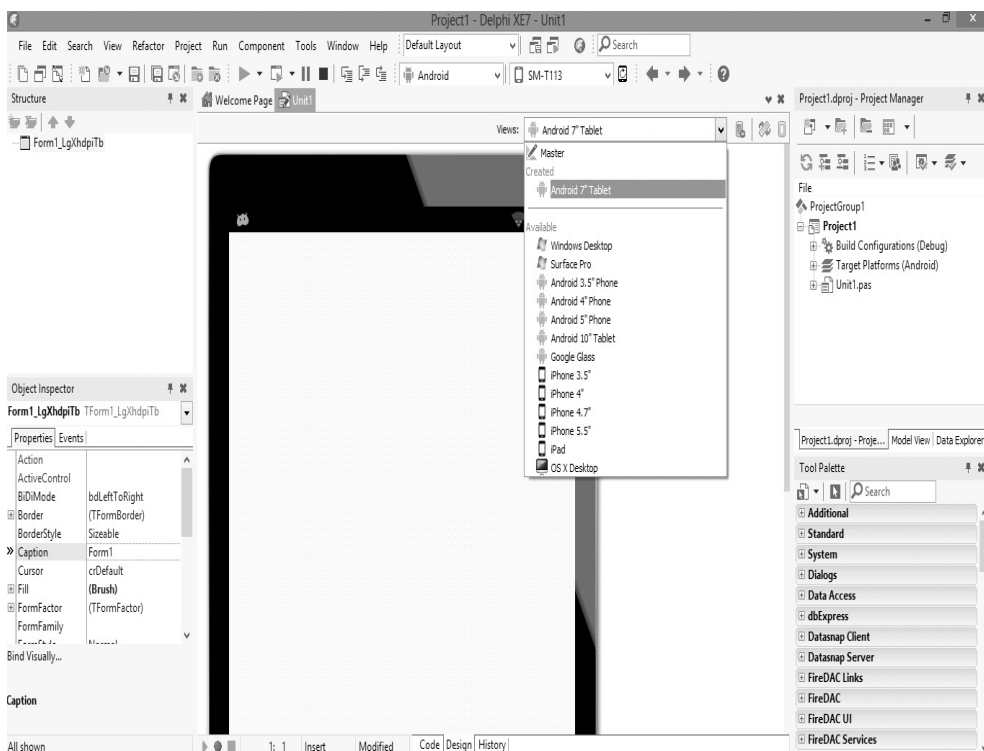
### To choose the model of connected device



**Source:** Custom processing.

The next from the part Style you shall choose the Android, too. To show your device you shall choose the type of your device from the panel Views (see the Figure 4).

Figure 4

**To define the form of necessary device**

**Source:** Custom processing.

Consequently, Rad Studio XE created this way is ready to develop the application for the Android. The digital resource can be connected with the web docs in RAD Studio XE7.

#### 4. Main Part: Solving Tasks

To connect the creating RAD Studio XE7 with the texts of the digital resource with multimedia, it is necessary to prepare new web docs. In our case, there are created the following web docs, as for instance:

- index.htm – main page
- glos.htm – word-book
- lecture.htm –theory
- prak.htm – practice
- video.htm – video courses
- adeb.htm – references.

We can connect these docs with the main page of the digital resource. For this, we will choose the components shown in Table 1, change their properties and write the code of program to their signals.

Table 1

### Properties of the components used

Component	Caption	Consequence of the property	Events
Form1	-	-	OnCreate
WebBrowser1	-	-	-
SpeedButton1-5	Flat	True	-
SpeedButton1	Caption	word-book	OnClick
SpeedButton2	Caption	theory	OnClick
SpeedButton3	Caption	practice	OnClick
SpeedButton4	Caption	video courses	OnClick
SpeedButton5	Caption	references	-
SpeedButton6	Caption	main page	OnClick
SpeedButton7	Caption	control	OnClick
Memo1	Lines-TStrings	to clean (to follow the initialization time when it is used parallel computing)	-
	Visible	False-this is that programmer could follow the time	-

**Source:** Custom processing.

To achieve this, we will put the component Web Browser from the panel of components to the model (forma). Hereinafter \*.html extended files will be opened on this window. Before writing the program code, to the module section, we will write: *ShellApi* is for connecting the component of Web Browser to the Web doc; *System.Threading* is for the parallel computing; *System.Diagnostics* to follow the initialization time. When the main page has been loaded, we write the cods of *OnCreate* signals (Nick Hodges, 2014) [11] using parallel computing.

### ***procedure OpenFile(FileName: string);***

```
var c: array[0..800] of Char;
```

```
begin
```

```
StrPCopy(c,FileName);
```

```
ShellExecute(Application.Handle, 'open', c, nil, nil, SW_NORMAL);
```

```
//to work with web document
```

```
end;
```

*procedure TForm1.FormCreate(Sender: TObject);*

*begin*

*TTask.Run(procedure // parallel computing*

*VarStopwatch: TStopWatch; //time*

*ElapsedSeconds: Double;*

*begin*

*TThread.Synchronize(nil, procedure*

*begin*

*Stopwatch := TStopwatch.StartNew;*

*WebBrowser1.Navigate(z+ 'index.htm');*

*//index.html connect to main page of E- education edition*

*ElapsedSeconds := Stopwatch.ElapsedMilliseconds;*

*Memo1.Lines.Add(Format('initialization in %:2f milliseconds', [Elapsed-Seconds]));*

*end);*

*end);*

*end;*

And for the *OnClick* signals of the button *SpeedButton1* of “Theoretical materials” the following code will be written:

```
WebBrowser1.Navigate (z+ 'lecture.htm');
```

To connect the code of program to the main page, *Navigate* property of the *WebBrowser1* component will be used. Such codes will be written on the signals of *OnClick* of the buttons *SpeedButton2*-*SpeedButton6*. And the verification of knowledge can be automatically realized via a lot of methods. Along with this, it is possible to add video courses, quizzes for checking the knowledge, anagrams, accessible and non-accessible tests to the Digital resource. It creates conditions for the trainees for self-education. In this way, the main page of the Digital resource by using the parallel computing looks as follows (see Figure 5):



Figure 5

Digital resource by the aid of parallel computing



Source: Custom processing.

5. Conclusions

In our case, computational experiments were carried out using the following test infrastructures (see Table 2).

Table 2

Test infrastructure 1

	Test infrastructure 1	Test infrastructure 2	Test infrastructure 3
Processor	Intel Core i5-3210M CPU 2.50GHz	Intel Pentium Dual Core E6600 3.07GHz	Intel Core i3-3210M 2.5 ГГц
Number of cores / threads:	2/4	2	2
RAM	6 GB	4 GB	2 GB
Operating system	Microsoft Windows 8	Microsoft Windows 8	Microsoft Windows 7
Development environment	Embarcadero RAD Studio XE7	Embarcadero RAD Studio XE7	Embarcadero RAD Studio XE7

Source: Custom processing.

The initialization time of the created digital resource without parallel computing: the first digital resource is initialized in 62 milliseconds, and the second digital resource is 113 milliseconds. With parallel computing, the initialization time of the first digital resource was 38 milliseconds, and the initialization time of the second digital resource was 73 milliseconds etc. (Table 3) and (Figure 6).

Table 3

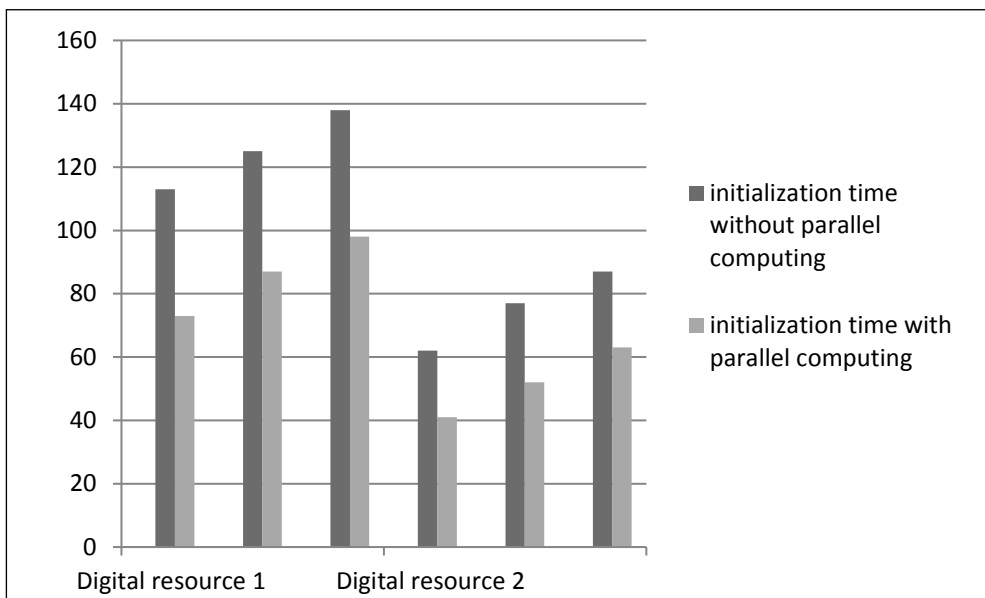
**Initialisation time**

	Test infrastructure	initialization time without parallel computing	initialization time with parallel computing	Acceleration indicators
Digital resource 1	Test infrastructure 1	113	73	0,6460177
	Test infrastructure 2	125	87	0,696
	Test infrastructure 3	138	98	0,71014493
Digital resource 2	Test infrastructure 1	62	41	0,66129032
	Test infrastructure 2	77	52	0,67532468
	Test infrastructure 3	87	63	0,72413793

Source: Custom processing.

Figure 6

**Initialisation time**



Source: Custom processing.

In summary, if the parallel computing is used during the creation of digital resource, then the initialisation time can be reduced according to the number of processor core, in which this application is started. This can be observed

when the digital resource used contains some pictures or animations. For the purpose of developing various digital resources for the users, it is highly efficient to create them using cross-platform program tools with parallel computing. It is very important for the students and undergraduates – the information technologies specialists – to be aware of these possibilities.

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