

**GRADUATE SCHOOL OF SOCIAL SCIENCES**

**MASTER THESIS**

**APPLICATION OF MODERN INFORMATION-  
COMMUNICATION TECHNOLOGIES IN EDUCATION**

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## **ABSTRACT**

### **THE APPLICATION OF MODERN INFORMATION- COMMUNICATION TECHNOLOGIES IN EDUCATION**

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The application of information technology in educational institutions is becoming more often and is making the process of studying and teaching easier.

This paper will indicate from the beginning the effectiveness of information technology and its importance in education.

The first part is describing the routing in computer networks; presenting importance of routing and how it is important in network infrastructure and also in education.

The second part presents the information technology used in Online Education. Also, this part will present installation of Moodle platform for Online Education (distance learning) as one of the most popular platform that is used in Online Education.

The third part will present the complete solution or course called “routing algorithms”.

The aim of this paper is to present the application of information technology in Online Education or E-Learning.

## Özet

Bilişim teknolojileri uygulamaları eğitim kurumlarında sıklıkla kullanılmakta ve öğrenme - öğretme sürecini kolaylaştırmaktadır.

Bu tez, bilişim teknolojilerinin etkinliğini ve eğitimdeki öneminin belirlenmesini hedeflemektedir.

Birinci bölümde bilgisayar ağlarındaki yönlendirme ve yönlendirmenin network altyapısındaki önemi açıklanmaktadır.

İkinci bölümde uzaktan eğitimde bilişim teknolojilerinin kullanımı yorumlanmaktadır. Bu bölümde uzaktan eğitimde kullanılan en yaygın öğretim yönetim programlarından biri olan Moodle kurulumunun nasıl yapıldığı gösterilmektedir.

Üçüncü bölümde yönlendirme algoritması adı verilen diziliminin çözülmesi yer almaktadır.

Bu tez, uzaktan eğitim ve E - öğrenme teknolojileri ve uygulamaları hakkında bilgi vermeyi amaçlamaktadır.

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I would also like to thank to my friend, ElzaMehinagic professor of English language who is using Moodle software application in teaching students and who helped me in creating a new course “Routing Algorithm” inside the Moodle.



Meliha JASAREVIC  
Izmir, 2016

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# 1. Introduction

This paper presents Online Education as one of the learning methods of information technologies and in that way is making easier an educational process. Terms that are most related to this kind of education are explained and presented. Also, in this paper is presented practical use of Web server in process of establishing software infrastructure for Online Education, as completed solution, in other words, complete course “Algorithms for routing”, created inside the Moodle.

Moodle is an application, in other words, software package that has the main role to produce and maintain online courses on the Internet. Name “Moodle” presents an acronym for Modular Object Oriented Dynamic Learning Environment. Moodle is very popular software for distance learning and it is used among more than 200 countries. It is localized in 78 languages. Since Moodle is an open source project, it has a large community of users and extensive documentation. Many users actively participate creation of Moodle by creating new modules, testing of products or giving support to users. This software package has published under the license of GNU Public License, which means that users are allowed to use, copy the code, if they also give permission to others to use the code under the same conditions, that means to not change the original license or protection, they can use the same license for any other work that can be used by Moodle.

Moodle provides professors with computer support while organizing and implementing online courses. The activity within Moodle is creating electronic courses, in other words, creating courses in web format. In order to make courses easier, Moodle allows different activities that support the installation and maintenance of the courses.

This paper describes the conditions of the scientific research field of electronic education. The basic theoretical concepts and practical solutions related to the following areas: learning based on problem set, adaptive learning and mobile education. Also systems for adaptive learning management are describes, as well the most important software solutions for the implementation of these systems. Also, the complete installation procedure has been presented and characteristics of Moodle

platform for Online Education as one of the most popular among the online education systems, then, the realization of a course on Moodle platform has showed, using BigBlueButton module.

The aim of this paper is to present the importance of modern information and communication technologies in the realization of distance learning, in other words in Online Education. In this paper, the most popular Moodle platform is presented for Online Education, as well as the addition of Web configuration system BigBlueButton module.



## 1.1 History of Online Education

Online Education in the Wikipedia mentioned as a method of learning that does not require students to be physically present at a particular place during the semester. This method opens up new opportunities of learning to all students from all countries and all ages and gives them a chance to get diplomas and certificates from almost any online university in the world. When we talk about Online Education, it is often used a series of term: Distance Learning, Distance Training, Distance Education, eLearning (e-Learning), Online Education, Virtual Instruction, Virtual Classroom, Electronic Classroom, Blended Learning...

Online Education started being used long time ago that we thought. Of course, not in a way we used to know, but it had the same principle to overcome physical distance in order to gain knowledge. A pioneer of distance learning was Isaac Pitman. He was an English teacher who developed the system of shorthand. He first applied distance learning with his students in 1840 in England. He was giving them to prescribe messages from Bible and return to him by post. He had communication with students around the country through the postal system and he was equally successful in spreading knowledge. This way of training students, the pioneer of today's distance learning, showed his qualitative, economical and pragmatic side of use, compared to traditional methods. At the beginning of practicing distance learning was spread only through postal system in order to provide the chance of gaining education to people who were unable to attend teaching in traditional schools. In fact, the first stage of development of distance learning is called Correspondence Learning. Women were using this kind of learning, because of exclusion of institutional education program, which was intended only by men, then employed citizens who were in the workplace during the lecturers and those who live too far away from educational centers.

The first half of the twentieth century is remembered by discovery of radio and television that provided new chances in development of new opportunities for distance learning.

New media through which educational program was broadcasted and the audience expanded to unequalled level. With this approach, distance learning gets completely different dimension and becomes inevitable way of learning. The commercialization of the Internet the whole process of distance learning becomes easier, it provided wide range of information for different fields. Also, it gives easier way of using and finding information to the user.

Today, Online Education is developed in that way that is using the advantage of modern technologies. It takes place on the Internet and students can get diploma without even going once to classroom. The advantage of Online Education has led to a revolution in the field of advanced education.

For example:

Classes can take place via streaming, transfer of multimedia content which doesn't require to first download the complete file and then look at it, you can do that while data transfer is in process.

Lecturers can be available in the form of printed materials that are stored as files on the server of the educational worker.

Students can communicate among themselves and with the professor via email, chat and Internet forum.

Assignments can be put in the drop-down menu and tests and exams can be automated and taken online.

Course materials are always available and can be easily updated. Online formats allows flexibility, as well as how to determine to ourselves speed of work and progress.

University of London in 1859 is the first university that offered training for distance learning based on the program they had. Queen Victoria gives a large contribution to this.

Another pioneer in the institutionalization of this kind of education was the University of South Africa, which introduced the Correspondence Education courses in 1946. Education University in the UK, the Open University, in existence since 1969.

A similar opened in 1974, in Germany, the Fern Universitat in Hagen.

Today, around the world there are more than 90 institutions, mostly under the name Open University, based on the long-formed Open University Collage in England, which primarily emphasize the importance of Online Education.



## 1.2 Social and technological conditions of development

Long time ago, the conditions of developing of Online Education were fulfilled, because the man has expressed his curiosity and willingness to broaden scientific horizon. Many schools and universities have been founded and the society stated giving importance to education and the development of technology. There has been increased need for solving scientific problems in society. It was only matter of time when the education will cross the boundary of traditional education. However, because of limited technologies at that time there was not enough possibility to develop distance learning. Only with discovery of new, faster and more powerful ways of transmitting information created conditions for development of Online Education.

In the beginning, there was no advanced technology like computer and Internet and people were using letters, since the post office was the highest form of communication. Progress in the development and implementation occurs with invention of radio and television. It's enabled massive and rapid transmission of information over long geographical distances. In that way the opportunity is given to people to be informed and follow many different scientific accomplishments. It is sure that this kind of progress had great impact on scientists in developing of human civilization. It has to be mentioned that television had better impact in processing

distance learning compared to radio, because of the sound and pictures. Visual presentation gives to audience easier way of absorbing information and making plans how to use their knowledge in practice.

Progress and achievements in various fields of physics, chemistry and electrical engineering have enabled much cheaper production of TV sets, so every family have started having it. In this way huge number of people had access to many information regarding science and social fields

## 2. Research Methodology

### 2.1. Research Subject

The subject of thesis presents an area of Online Education, as well as introducing modern information technologies and communication technologies that have been used in the realization and implementation of online education.

Fist part of thesis presents the basic principles of routing, basic protocols, routing algorithms, application of routing in modern computer networks.

The second part of thesis presents Online Education in general and platforms that are used to implement Online Education, also development of Online Education and its characteristics, as well as practical application. It also provides a detailed view of Moodle as one of the most popular platforms for online education.

In the third part of the thesis the example is given of implemented solutions. Moodle system is installed for Online Education and given an overview of and E-Learning course.

The paper describes the learning management systems, as well as the most important software solutions for the implementation of these systems.

## 2.2. Research Aims and Objectives

The main objective of this paper is to present the purpose of modern information and communication technologies in education. In order to achieve the attended objective, the paper will preliminary examined characteristics of existing Online Education systems, their advantages and disadvantages, as well as the trends and development of these systems.

Also, the goal of this paper is to demonstrate that the exchange of information through Web and e-mail is one of the regularways of communication between student and professor.

The aim of the research, primarily based on scientific facts and findings set out in many papers and publications of experts.

The scientific objective of this paper is research and systematization of knowledge about the technologies used in online education.

The social objective of this paper is research in order to meet practical needs. The research results should be used at University, which has represented Online Education as part of its education system.

## 2.3 Research Methods and Process

During the preparation of this paper certain methodological approaches are used that are typical for the works in the IT field.

According to the aim of this paper, the appropriate methods have been used, inductive-deductive method, analysis and synthesis and method of comparison.

Comparing the Online Education with Traditional Education system uses the method of comparison, while results are showing the benefits of using information

technologies in educational systems. Also, method of synthesis, method of induction and generalizations have been used.

Also, the method of observation and description has been used, to describe principles and algorithms for routing and Internet Protocol.

The research is supported by the findings of international scientific and professional literature and knowledge of other authors who explored the same issue in their books.

## 2.4. Work Structure

This paper is consisted of seven chapters, divided according to the subject that is preceded.

The first chapter explains the basic idea of the paper and the importance of use information technologies in education.

The second chapter includes research methodology that indicates the subject, goals and tasks. This chapter also includes methods and process of research.

The third chapter describes one of the most complex and most important aspects of designing packet switched networks, which refers to the routing.

The fourth chapter represents the importance of these technologies in education. The fact is that information technologies have been used increasingly in educational institutions.

The fifth chapter presents the influence of information technologies as a basis for implementation of Online Education. Also, it is described the process of launching local web server (XAMPP) in order to establish a software infrastructure for Online Education, and one of the ways of starting the installation and configuration of Moodle System for Online Education is presented.



The sixth chapter presents Moodle 2.0. System for Online Education, describes the work environment, parts of Moodle, and course called “Algorithms for routing” is realized for which is used BigBlueButton module.

The seventh chapter provides a brief description of the entire paper work.

### 3. Routing in Modern Computer Networks

Routing is the transfer of packet of information from one network system to another network system. The aim of routing is to constructs for each ending system the table, which contains the path to each destination network and to each router to which the datagram should be sent.

Routing tables can be static and dynamic. However, static table can contain an alternative route in a case that a particular router is not available. Dynamic table is more flexible when it comes to accumulating or error. For instance, if one router stops with work all its neighbors are sending status reports that are enabling routers and stations to update their tables of routing. A similar plan can be used in case of accumulation. Control of accumulation is very important because of disagreements capacity of LAN and WAN.

Routing tables can also be used to assist other services that are mutually related networks, such as security or priority. For instance, a particular networks can be used to download data from a particular security margin. Routing mechanism must ensure that given data security levels that are not authorized to take such information will be prohibited from passing through networks. Another technique of routing is called executive routing. The source station determines the route by stating a consistent set of routers in the datagram. This technique may be useful for security requirements and priorities. In order to obtain track logging, each router is adding its Internet address in the list of addresses in the datagram. This feature is useful in order to test or error elimination.

Nowadays, routing principles involve the use of a route with the longest mask and routing based on the destination address. The new principle of routing, in other words, forwarding traffic based on labels rather than the destination IP address, label is fixed length, which provides shorter processing time, the label is defined in accordance with the needs of routing.

In this part of the paper will be presented the importance of the importance of the contribution of two basic types of routing, static and dynamic routing and explained the use of DV and LS routing protocols.

### 3.1. Previous Research

Routers are an integral part of the Internet and were the subject of discussion of many studies and research. The support in preparing this chapter is provided from theoretical knowledge in the field of communication and information technologies, as well as practical knowledge and research in the field of routing application in everyday life.

Traffic balancing has already proved to be an effective mechanism for increasing the capacity of non-blocking packet networks [14]. The paper investigated and analyzed the practical advantages of routing protocol based on balancing traffic and routing the shortest path, in order to optimize performance non-blocking packet networks.

The great problems which occurs during the optimization routing in package networks tells us the fact that it is extremely hard to predict traffic requirements in the form of traffic intensity between pairs of nodes of source-destination. The increase of share peer-to-peer is contributed particularly from the Internet. It is much easier to estimate the total traffic generated or received at a node of network, in other words, relations between the expected traffic nodes. Therefore, it is important to formulate the linear program for searching of optimal routing as a function of the input-output traffic node. Optimal routing can be easily determinate by a linear program and also determining the optimal coefficients routing requires time, which presents the main problem, also too frequent changes in traffic caused to frequent changes in routing and could lead to a breakdown in communication. Therefore, the concept of adaptive

routing is not useful always. Adopting the so-called routing without memory solves the problem. With this kind of routing, the path or set of paths between two nodes is predetermined. The decision on how the traffic will be routed brings in execution node, regardless of the current state of links and activities of the other nodes in network, but only on the basis of information about the destination where the traffic is going. This way of formulating the problem to optimize routing is applicable in practice, and to the solution of optimization problem and in networks with large numbers of nodes.

Regarding the problem of the development of efficient algorithms for routing of synchronous transmission on the network (ATM), emphasis is placed on practical algorithms that are efficient implementation of distribution. In particular, in line [15] explained the weighted greedy algorithm (GCD), it is an algorithm that uses heuristic for solving problem such that in every stage of choosing the best solution for solving some of mathematical problems, but for some other are not suitable. For most problems, greedy algorithms are usually not successful to find global optimal solution, because they usually do not handle all the basic features. These algorithms are very fast in making decisions that can prevent them from finding the best solution. However, this type of algorithms is useful, because they are able to quickly provide a good approximation of the optimal solution.

If there is prove that the greedy algorithm is finding global optimum for a given class, then the greedy algorithm it is usually used because it is faster than any other optimization methods, such as Prim's algorithm for finding a minimum of a comprehensive tree, Dijkstra's algorithm for finding shortest paths in a graph from the start, algorithm for finding optimal Hafman's tree, and algorithm to solve the problem selection of activities.

When it comes to mobile ad hoc networks (Mobile Ad Hoc Network, MANET), the paper [16] give an overview of typical routing protocol and presented an overview of current research in the field of MANET networks. It points to the problem of achieving credibility MANET simulation, a general simulation model MANET is shown and an overview of the basic tools for simulating the mobility of MANET networks. Special attention was paid to the presentation of characteristic examples of

simulation MANET network approach to the analysis of the results and their interpretation. All simulations were performed using the network simulator NS2.

It can be concluded that the correct choice of routing strategy is of great importance for the performance of telecommunication networks. Specifically, in cases when network technologies and available capacity of links are known in advance, the goal is to achieve high throughput network using available resources, and provide as many outgoing and incoming traffic. Therefore, routing protocols are a set of rules by which routers dynamically share information about paths (routes) where a package should move in order to reach the desired destination. When change has been made in topology of computer networks, the closest router in which change has occurred recorded in its routing table and then routing protocols trigger mechanisms that information about changes in topology forwarded to other devices in the network. In this way routers dynamically update their routing tables. These protocols belonging to the network layer of the OSI reference model.

Due to the properties that the transmission rate is inversely proportional to the intensity of the runs in the network, the fastest way should be to choose the one in which the noise intensity of traffic in the individual branches of the smallest. Problem is equal to the shortest path problem, if traffic intensities is understood as distance.

In general, the shortest path problem is the issue of former information or energy transfer from the source to the destination or between any other two nodes in the network. There are several methods to solve the problem of the shortest path between which the choice will depend on the characteristics of the network.

### 3.2. Routing and Routing Protocols

One of the most complex and most important aspects of designing a network packet switching refers to the routing.

The primary function of the switching network packet consists of accepting packages from the originating station and handing over to the destination station. In order to

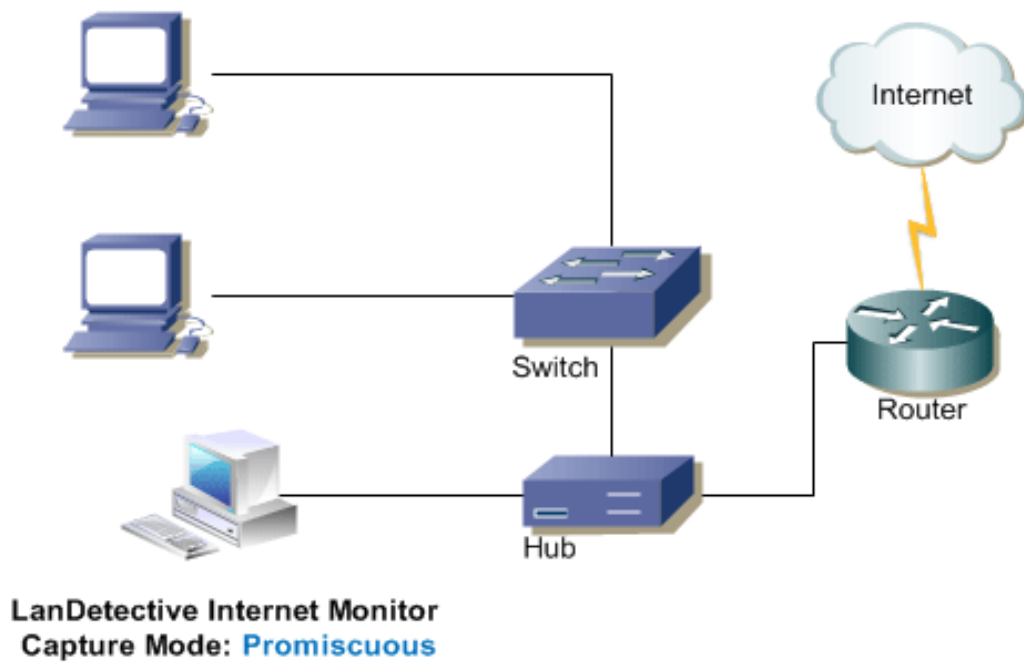
achieve this goal, it is necessary to specify route messages through the network. In general there is more than one way.

Key elements of the routing with switching networks are shown in Table 1.

Table 1. Elements of routing in switching networks

Criterion of performance
<ul style="list-style-type: none"> <li>- Number of flashover- simple criterion is the one which is based on the determination of the minimum flashover in the route (the path that passes through the smallest number of nodes)</li> <li>- Price- refers to the lowest price</li> <li>- Delay- time it takes for a message to arrived from source to destination</li> <li>- Permeability- amount of information that is transmitted</li> </ul>
Time decision
<ul style="list-style-type: none"> <li>- Packages (datagram)</li> <li>- Session (virtual circuits)</li> </ul>
Destination decision
<ul style="list-style-type: none"> <li>- Each node (distributive)</li> <li>- Central node (centralized)</li> <li>- The initial node (source)</li> </ul>

Routing is the process of sending a packet from the source of the network through one or more systems (gateway systems) to destinations in other networks.



Picture 1. Local area networked to the Internet via a router [14]

### 3.2.1. Determination of the path

In order to be able to route packet with information, router or any other device that is responsible for this should have the following key information:

-Address of destination- address to which information should be routed. This data provides the home computer.

-Source of information- from which source the router can find out the path to the desired destination.

-Possible paths- what are possible paths to the desired destination.

-The best paths- the best path to the desired destination.

- Maintenance information of routing and their checking- are the existing paths valid or not.

Information about routing that router receives from its sources are placed in the routing table. Router relies on this table in determining the output port that will be used to forward packets to the destination. The routing table provides information about network that is significant for the routing.

If the router is not directly connected to the destination network, the router has to know and calculates the best possible path to forward packets to them. Routing table is filled in one of the following ways:

- It is manually completed by the network administrator
- It is completed by the dynamic processes that operate within the network

There are also two ways in which the router can forward packets to the network with which is not directly related, they are called static and dynamic paths.

To be able to perform packet routing, the router only needs to know the path to a particular network. Static paths are paths that are defined by network administrators, and to them are explicitly defined route a packet from the source computer to the destination computer. This type of path allows very precise control over the entire process of routing within the network.

Static paths are significant when the network operating system can not determine the path to the destination. In addition, these paths are also used to indicate gateway of last resort. Gateway of last resort is the address for the router to send the packet, which is addressed to network, which is not located in their routing table.

Static path is most often used during routing between the main and stub networks. Sub network, sometimes is used term leaf node, are networks that can be accessed only through one path. In this kind of situation, static paths are used, because it is then the only path that leads to such a network, or out of it. Since these networks leads to only one way, the routers can be configured static routes and thereby avoid the

existence of that part of the network traffic that originates from the routing protocol. It should be mentioned with configuration of static paths provide possibility of connectivity to data connectivity layer that is not directly connected to the router. To obtain the ability to connect from one to the other endpoint, the path must be configured for both directions.

Static paths are configured in the global configuration mode by entering the router's IP ROUTE command. With this command it is also used static parameters, which define additional paths. With static paths it is also possible to manually configure the routing tables. In this way registration remains inside the table as long as the current path. The only exception to this rule is a permanent option as shown in the following example. By activating the option permanent, the path remains in the table even if it's not active anymore. The following IP ROUTE command syntax (for Cisco router) is shown:

```
- ip route network [mask] {interface address} I [distance] [permanent]
```

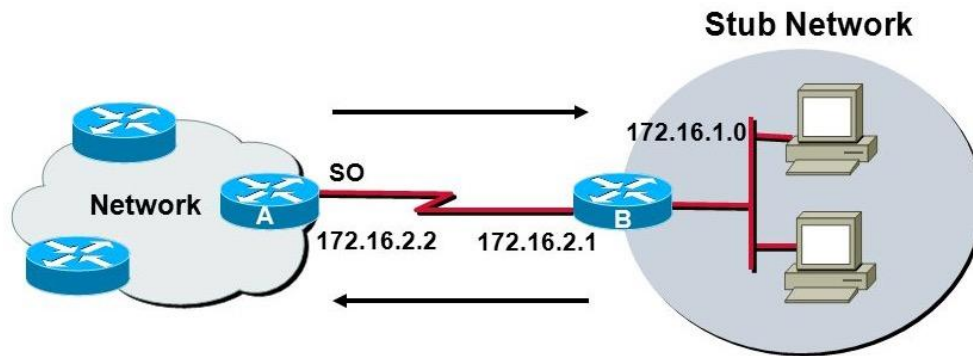
The meaning of IP ROUTE command arguments:

- Network – destination network or subnet
- Mask – the subnet mask
- Address – IP address of the router next jump
- Interface – name of the interface that sends the packet to the destination network
- Distance – this is an optimal parameter that defines the administrative distance
- Permanent – also optimal parameter which indicates that path will not be removed even in the case of the expulsion interface

The following example illustrates the static determination of the orbit:

```
Router (config) #ip route 172.16.1.0.255.255.255.0.172.16.2.1
```





Picture 2. Example of determination of static path [8]

In this case, a static route from Router A to a separate network is configured as follow:

```
Router (config) #ip route 172.16.1.0.255.255.255.0.172.16.2.1
```

The meaning of the parameters of this command:

-ip- command for static routing

- 172.16.1.0. – defines the static path to the destination subnet

- 255.255.255.0. – refers to the subnet mask (8bits in force)

- 172.16.2.1. – IP addresses of the router next leap on the way to the destination

In case of router A, separation of static path to isolated network 172.16.1.0. is appropriate, because this network can be reached only with one path. In order to achieve two-way communication then the path in the opposite direction should be configured.

The default path is a special kind of static paths used in case when path from source to destination is not known, or when the routing table is not possible to store all required information and the necessary paths.

Determination of dynamic path

Although the static path is very helpful in some situations, in case of any change in this kind of network the administrators must reconfigure all routers. Dynamic routing protocols are another way to learn the available path, but with the ability to adapt to changes in the network. In dynamic routing, dissemination and collection of information are in charge of routing protocols. These protocols define a set of rules to abide by the router when communicating with close device (routing protocols determine the paths and maintain routing tables).

The router automatically knows dynamic paths, after the administrator configures the routing protocol that helps in process of determination the paths. Unlike the static path, when the network administrator turns on dynamic routing, routing information of the routing process itself updates automatically each time of a router in the network receives information on the new topology.

### 3.2.2. Routing Protocol

Routers made by different producers need to have some way in order to communicate with each other, for example, to share configuration tables. One type of protocol that involves communication between routers in one entity network is called interior gateway protocols. Every network operation system contains a routing protocol implemented in the operating system.

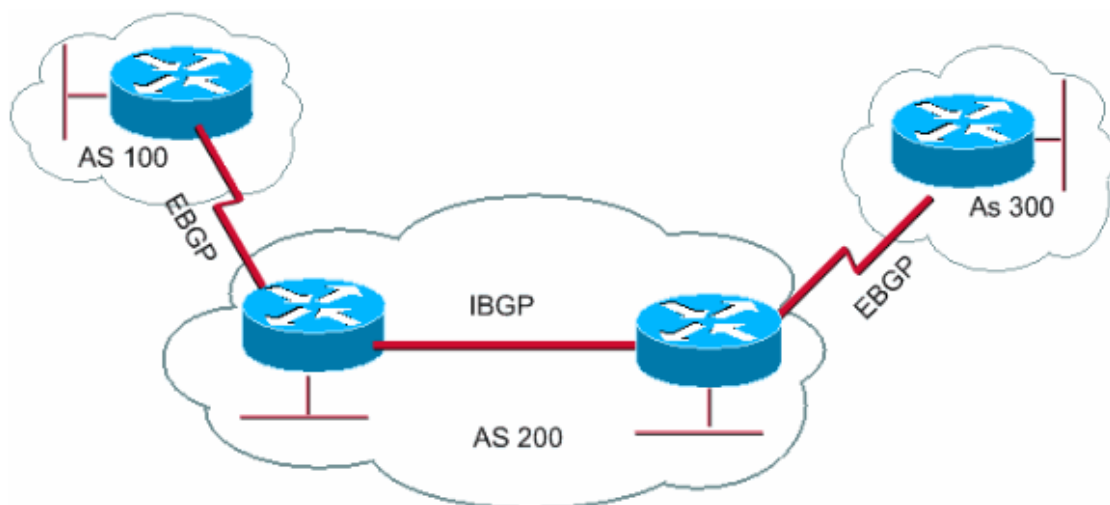
The most common routing protocols in the entity network are:

RIP (routing information protocol) at one time was the most popular protocol, but it was replaced but OSPF (open shortest path first) protocol. The advantage of OSPF is that it has the ability to easily perform the interconnection between the major networks and better updates from RIP.

OSPF is designed to support large networks. Also, it is compatible with sub netting. Messages like “hello” is sent every 30 minutes. Depending on the TOS (Type of Service) field, therefore depends on usage of packet OSPF protocol acts differently. OSPF uses linked algorithm (Link State) that doesn't decides about path only

according to the number of hops, but it takes into account other details that are relevant to the process (transfer time, capacity).

In order to connect multiple networks or autonomous systems, it is used so-called exterior gateway protocols, where multiple routers communicate with each other. Autonomous systems are defined as independent entities, which have their own specific protocols (IGP). This is a collection of networks under a common administrative domain. The most famous is the external protocol BGP (border gateway protocol version 4).

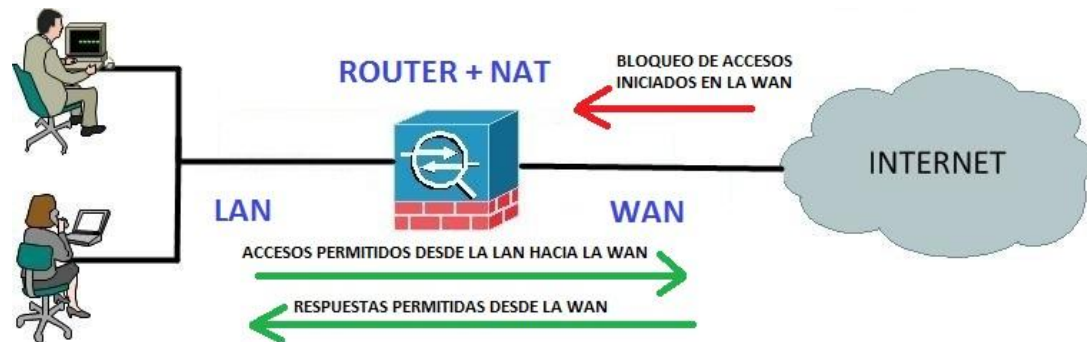


Picture 3. Autonomous systems and external protocol [8]

BGP4 protocol is an external protocol that is used in the global Internet. It uses vector algorithm, but with a few additional changes. Also, BGP4 uses TCP/IP as transport protocol on port 179. While switching the connection, BGP4 system exchange complete copies of routing table, which can be quite large, which causes the BGP4 sessions can last longer. One of the most important functions is the loop, in other words, determination of the orbit in a given autonomous system. Also, what is characteristic of this protocol is that there should be one jump over the boarder of the autonomic system, which means that it needs to know the path to that address. Therefore, the routing table should contain information about one jump out of an autonomous system.

However, in order for router to forward addresses, there must be a way that will lead to this address in a form that is understandable for a man and in a format that computer understands. This process is known as network address translation (NAT),

developed by Cisco. The main identification of computers in networks is its IP address, which consists 32-bit number. A simple calculation shows that the possible existence of a maximum of 4.3 billion IP addresses. Today it is already developed a system that will replace the existing one and it is known as IPv6.



Picture 4. Network Address Translation [8]

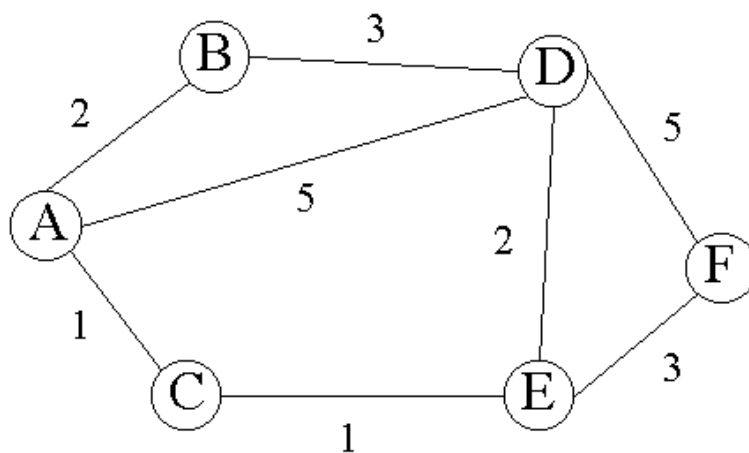
With the help of a NAT, router acts as an agent between the Internet (and other public network) and local (private) network. This means that only one IP address is needed to mark one group of computers. In order to provide a way of not overlapping between IP addresses, an international organization for assigning IP address is determined unregistered IP addresses to the local network can use a router that does not pass away, because they are used only in local networks. In this way, the possibility of conflict is reduced.

### 3.3. Routing Algorithms

Routers necessarily need information about networks in order to make a decision on further forwarding. Comparing destination address with the addresses in the routing tables makes these decisions. Routing system selects the record from the routing table and determines the network mask for the record, then performs a logical AND on this

value and destination address. The resulting value is compared with the addresses of networks in the routing table. If two values are the same means that the destination is available through passages that are defined in this record. If these two values are different, routing system examines the next record in the table. If the entire table is checked and if there is no records that match, usually the result is such that rejects the package and generates a message stating that the destination network is unavailable.

Purpose of the router is not only to forward packets to the given address, but also to determine the best, most efficient and fastest route. When it is said the path, that means jumps (next jump =IP address of long host or router that is directly accessible via Ethernet or serial connection, or some other physical connection), then the time for which the package travels and the cost of such forwarding. Also, for the path using the so-called IP address prefix. IP address prefix is a set of destinations for which the router is valid. Address prefix consists of 0 to 32 bits of significance. For example, the IP address prefix of 128.8.0.0/16 would include any IP destination address in the form of 128.8.H.H.



Picture 5. Illustration of Routing [12]

In order to avoid the introduction of all possible paths in the world, most routers and hosts uses the default path (for example, some routing tables contain only that path). In terms of how the router determines the best route, there are two types of routing algorithm.

Those are:

- Global routing algorithm
- Local routing algorithm

### 3.3.1. LS Algorithms

Routing protocol works based on Link State Routing Protocol that is based on shortest path (Shortest Path First). These protocols are internal routing protocols and they determine the shortest path within the same autonomous system, which according to the size and complexity can be further hierarchically divided into zones.

In LS algorithms, every router has to perform the following actions:

- Identify the routers that are physically connected with it and find its IP addresses. When the router starts, it first sends a welcome package (“hello packet”) through a network. Each router that receives the packet returns to echo of the package. In this way, the router also measures the time it takes a package to reach the destination and return.
- Sending its data over the network to other routers and accepts information about other routers on the network. In this step, all routers share information with each other, so that each router knows the structure and status of the network.
- Using an appropriate algorithm, the router identifies the best path between two nodes in networks. In this step, routers find the best path for each node in the network. An example for this is Dijkstra’s algorithm. In this algorithm, the router drawn graph network based on the information about network condition. This graph shows the locations of routers and their mutual connection. Each connection is marked with a number called the weight or price (cost). This number is a function of time of path of average occupancy network and sometimes simply the number of jumps between nodes. For example, if there are two links between source and destination, the router will choose a path with less weight.

Dijkstra's algorithm is going through the following steps:

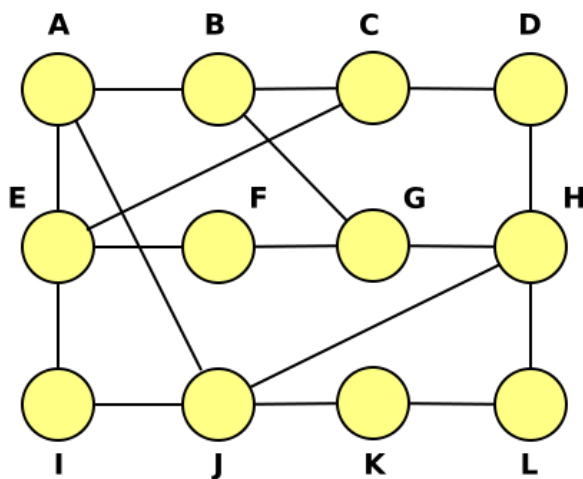
- 1) Router is creating graph network and identifies source and destination nodes, for example, V1 and V2. Then it is creating adjacency matrix. In this matrix, coordinates present weight. For example, matrix [m, n] presents weight between the nodes V1 and V2. If there is no direct link between these two nodes, this weight is defined as infinite.
- 2) Router is creating status record for each node in the network. The record contains three fields:
  - Previous field – This field presents previous node.
  - Field length – The second field presents the sum of the weight of the destinations node.
  - Field label – The last field contains the node status. Each node can have two conditions: permanent or trial.
- 3) The router initializes the parameters of the status record (for all nodes) and determines their length as continuous and their labels on a trial.
- 4) The router sets the T- node. For example, if V1 is the executive T-node, router defines the label as permanent label. When the label is labeled as permanent, it never changes again. In this case, T-node acted as an agent.
- 5) The router improves test records for all test nodes that are directly connected with the original T-node.
- 6) The router looks at all the test nodes and selects the one that is the weight of the smallest node V1. This node becomes the destination T-node.
- 7) If that node is V2 (the intended destination), the router returns to the step number five.
- 8) If the node is V2, the router lists the previous node from the status record until it encounters the V1. This list of nodes shows the best route from node V1 to the node V2.

GRAFICKI PRIKAZ (str.20)

### 3.3.2. DV Algorithms

Routing protocols based on the distance vector (Distance Vector Routing Protocol) include protocols such as RIP, IGRP and EIGRP. The protocols RIP and IGRP operate on the principle of Bellman-Ford algorithm, while the EIGRP advanced on this issue and use DUAL (Diffusing Update Algorithm). As the name says, routers exchange information on the basis of which they find out the distance and direction (or router interface) to some of the remote network, without information on the way to destination network. Exchanging information is carried out by each of the routers periodically transmit the routing table to neighboring routers.

As previously stated, the DV algorithms belong to the local algorithms. DV algorithms are also known as Belman – Ford routing algorithms and Ford – Fulkerson algorithms. In these algorithms, every router has a routing table that shows the best route to each destination. A typical graph and routing table for the router I:



Picture 7. Typical graph of Routing

Table 1. Table of routing for router J

Destination	Weight	Line
A	9	A
B	21	A
C	29	J



D	21	H
E	18	J
F	31	J
G	19	H
H	13	H
I	11	J
J	0	---
K	7	L
L	16	L

As the table shows, if the router J went to send a package to router D, it should send it first to the router H. When a package arrives to the router H, it checks its routing table and decides how to send the package to the router E.

In DV algorithms, every router has to determine the following steps:

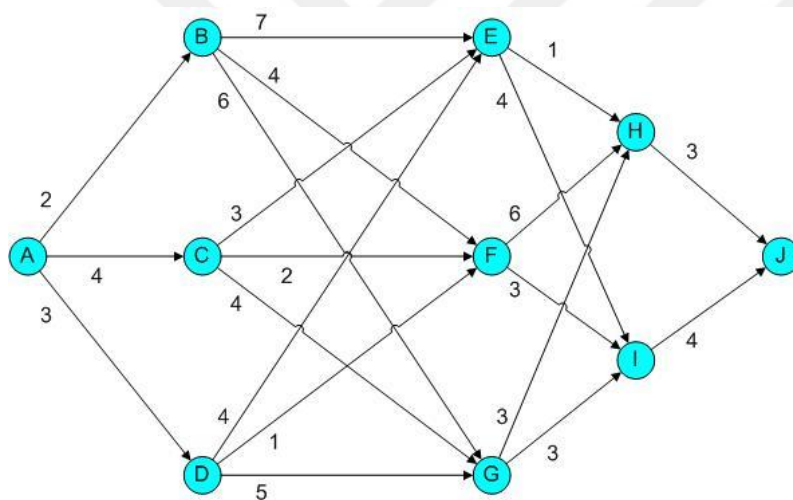
1. It counts the weight of all connections that is directly connected with and it stores the information in its table.
2. In specific period of time, the router sends its table to neighboring routers (not all routers) and receives routing tables of other router.
3. On the basis of information received from neighboring routers, it improves and configures its table.

Before the routing table is formed, firstly it is formed so-called distance table, where each row contains every possible destination, from the other side, each column contains each directly connected neighboring node.

### 3.3.3. Hierarchical Routing

As it could be seen from before, in both LS and DV algorithms, each router must remember some information about other routers. When the size of the network increases, the number of routers in the network increases. Implicitly, the size of routing table also increases and routers are not able to effectively allocate traffic on the network. In order to avoid this problem, it is used so-called hierarchical routing. This is illustrated by the following example.

DV algorithm is used to find out the best path between two nodes. In this case, each node in the network must remember routing table with 17 entities. The typical graph of the network and routing table for the router A is illustrated.



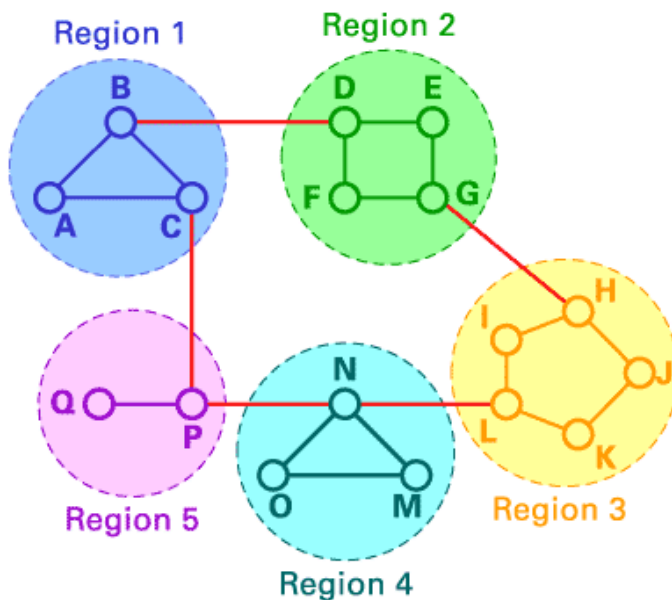
Picture 8. Example of DV algorithm in searching of paths between 2 nodes

Table 2. Table of routing for router A

Destination	Line	Weight
A	---	---
B	B	2
C	C	2
D	B	3
E	B	4

F	B	4
G	B	5
H	B	6
I	C	6
J	C	7
K	C	6
L	C	5
M	C	5
N	C	4
O	C	5
P	C	3
Q	C	4

Routers are classified into groups in hierarchical routing, and these kinds of classifications are known as regions. Each router has the information about its own region only and it doesn't have the information about other regions. Routers are keeping only one record in the tables about other regions. For example, the network is divided into five regions:



Picture 9. Example of division networks into 5 regions

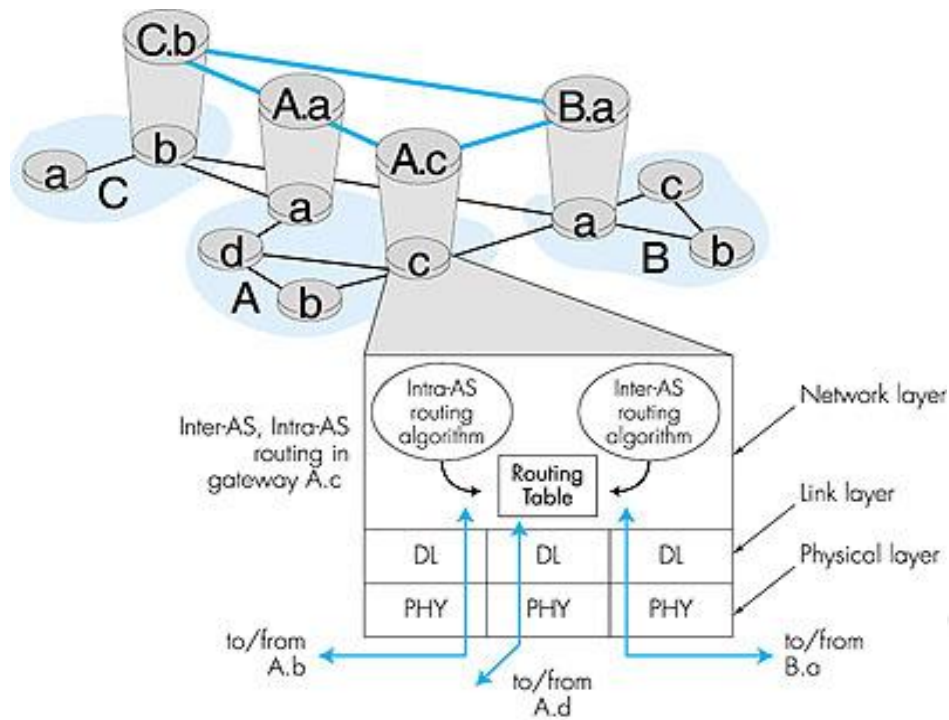
Table 3. Regions in hierarchical routing

Destination	Line	Weight
A	---	---
B	B	2
C	C	2
Region 2	D	3
Region 3	E	3
Region 4	E	4
Region 5	E	5

If router A wants to send a package to any other router in region 2 (C, D or E) it sends it to router B, and so on. As it can be seen, in this kind of routing, tables can be summarized which increases the efficiency of the network. The previous example presents the hierarchical routing in two levels. It can be used for three or four routing levels.

During the routing in three levels, the network is divided into certain number of clusters. Each group is created of a certain number of regions, and each region consists of a certain number of routers. Hierarchical routing is mostly applied to the Internet, and it contains several protocols.

The following example illustrates the application of hierarchical routing with the networks that make more autonomous systems. It can be distinguished between intra-AS (inside an autonomous system) routing and inter-AS (routing among autonomous systems).



Picture 10. Hierarchical routing with autonomous systems [13]

### 3.4. Research Results

Previous studies conducted in this area were mainly based on algorithms for routing. From the previous studies it can be concluded that the routers need the information about networks in order to make a decision about further forwarding. Comparing destination addresses with the addresses in the routing tables makes these decisions. Purpose of the router is not only to forward packets to the given address, but also to determine the best and the most efficient route.

Having in mind the current research problem choosing the appropriate dynamic routing protocol in IP networks and the impact on network performance, this paper analyzes the factors of importance for its solution and it was proposed, based on the results obtained by applying the appropriate simulation models, a possible approach for modeling the BGPv4 and OSPFv2 dynamic routing protocol in IP networks, then

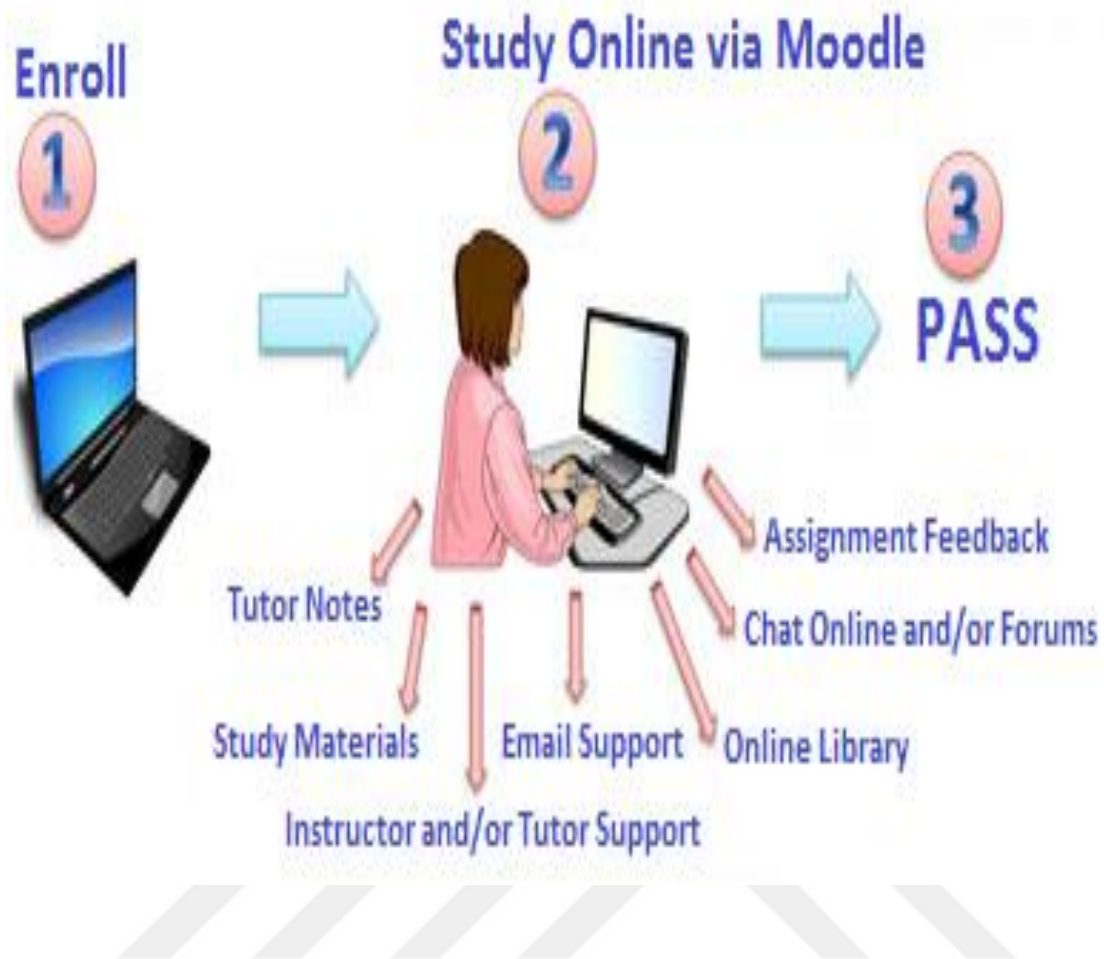
presented the performance of BGPv4 and OSPFv2 dynamic routing protocol and an analysis of the results obtained.

In this sense, a model for the simulation and performance testing BGPv4 and OSPFv2 dynamic routing protocol is a useful tool for network topology designers, applications operators or those who are trying to choose the routing protocol in conditions when they have the information such as network topology and the traffic nature.

Research subject in this part of the paper is to solve complex routing problems, which are presented in practice when it comes to serving a limited number of well-known locations from one or more depots, the presence of certain restrictions in term of requests for services and available resources, considering the last two decades are applicable technologies based on elements of geographic information systems and modern methods of routing.

#### 4. The Role of Information Technologies in Education

Online Education can be defined as a way of learning through information technologies, and also implementing educational system with the help of information technologies. Today is well known that term online education refers to educational process that is implemented through ICT.



Picture 11. Process of Online Education [40]

Online Education can be also described as enrichment of traditional educational system, by visualizing of specific topics through projector and computer. The use of new media (Educational Software) is making easier connection between traditional and modern education. Introducing Online Education is a complex process, which requires knowledge in order to avoid presenting and using an Online Education as one of the additional part of Traditional Education.

The first educational TV shows, movies, audiocassettes have been appeared in the twentieth century. The new pedagogical models and standards started being created and implemented. With the using of computer and designing of computer software provides the usage of dynamic presentations in the classrooms.

The real revolution started by developing of the World Wide Web. With development of a global computer network creates conditions for new ways of learning. For example, the Internet provides an opportunity for communication between students and professors who are using one of the network servers. Distance learning is often identified with Online Education. In order to avoid this kind of wrong interpretation, there are teams of experts who are in charge to make a clear difference between these terms and they create courses in cooperation with the mentor who is a link between course percipients and content. Online Classroom has good communication software and simple instructions for using technology. Online Education has meaningful support also in different processes of learning.

The next chapter presents Online Education in using modern information and communication technologies; also, it is shown the installation of Moodle system for learning in distance, as one of the most popular systems for Online Education and also the Algorithm for routing is presented inside the Moodle.

## 5. Online Education

In this part of paper the Online Education is described and presented the way of learning that is using information technologies in education. Also, the main terms related to the Online Education are explained. Practical way of using Web server in process of establishing software infrastructure for Online Education is also explained.

Online Education can be defined as a process of getting knowledge and skills through information technologies and using appropriate applications in another words, using programs that are designed for it. These applications and processes include studying through web, computers in digital classrooms and material is going through the Internet.

Introduction of Online Education doesn't mean rejection of the existing traditional education, but this can only improve existing educational material, in other words, its modernization.



Methods of sharing content used in Online Education are:

- Word documents, Adobe Acrobat downloads, etc.;
- Web contents (HTML, Shockwave, JAVA, etc.);
- Real Video, MP3 audio, NetShow;
- Authorized content of lessons in the form called executive courses

In order to make Online Education possible, the class material has to be shared through Internet or Intranet. Creating web page with training material, which the user can download, could do that. In addition, the complex system of Online Education requires a whole range of components such as:

- The registration process – creating a unique password (identification number) for each user in the process of Online Education, allowing users' access to the system;
- Control activities – giving users ability the possibility to access those contents and functions that are useful for them in the learning process and this ensures recording and monitoring all the activities within the system;
- An environment that supports learning – enabling users to communicate with each other, participate in class and ask questions to their instructors / professors;
- Testing and evaluation – measuring the success in acquiring knowledge and skills;
- Monitoring the process and creating database management and administration with the possibility of making various reports -recording all activities related to learning process, which will be used later for many other reports.

Electronic learning is present more than ten years as a learning that is made easier by the use of modern technology devices. Such devices include computers, CD-ROMs, digital TV, laptop and pocket computer and mobile phones. Communication technology enables the use of the Internet, email, discussion groups, and system for collaboration learning. Online education is used for distance learning through the

Internet network, and can be considered as component as component of flexible learning. When learning is distributed through mobile devices such as mobile phones, laptops and pocket computers, then the learning is called M-learning. M- learning and online learning are two subsets of E-learning. All three types belong to the set of distance learning. Unlike distance learning, learning in the classroom (face – to – face) contact provides students and professors, and it can be called also contact learning. In practice, each of these types of learning combined with classroom learning is providing a mixture, which is called flexible learning.

## 5.1. Previous Research

In recent years, intensive studies have been realized in the field of Online Education system for distance learning, adaptive education and edutainment. The concept of distance learning and the use of the global network in the organization and implementation of the educational process are increasing significantly. Constant development of information and communication technologies leads to a change in the way the content is delivered to students.

In papers [18] and [19] is developed approach to the creation of adaptive Online Education courses. The developed method is based on adaptive Felder Silverman model of learning styles for the adaptation of courses in Moodle Online Education. The basic requirements and steps are defined in the process of adaptation. By applying the method of business intelligence the typical groups of students are determined and their characteristics. Students within the system for the Online Education laboratory for Online Business are classified in the observed groups. The process of creating the adaptive courses is presented through Moodle system. The syllabus is implemented for mandatory courses for undergraduate studies and a comparative analysis is completed for the results of students who attended adaptive and not adaptive courses. The analyses and results are completed and conclusions have been made about efficiency, effectiveness and applicability of the developed methods of adjustment of electronic courses.

Regarding the integration of mobile educational services in system of electronic education, in papers [20], [21] and [22] the concepts and technologies of mobile education are analyzed. The advantages, disadvantages and limitations of the mobile education have been systematized. Model for introduction of the mobile education system and its integration with Online Education has been created and applied. The proposed model is based on a bladed learning concept. Applications of mobile education are presented, also the way of their integration through the Moodle system for learning management. The analyses of the collected data are accomplished. Also, conclusions are performed about the way of introduction and use of mobile educational service.

In the paper [23] is proposed solution for learning simulation of discrete events via web. Web application FONWebGPSS is developed, which is later integrated into a system for learning management in the Moodle. The paper presents the architecture of applications, user interface, functionality, and the method of integration with a learning management system. Examples of using this application for simulation of system with discrete events are presented.

It can be concluded that the model of portal for adaptive Online Education, offers the possibility of integrating the various components and services of Online Education, services for adaptation, services for course management and learning materials, services for collaboration and communication of the students in education, services for reporting and mobile services. Model and services of portal for adaptive Online Education support modern standards in the field of projecting and development of Online Education system (SCROM, IE, LTSC), and in that way it provides interoperability.

## 5.2. Software for Online Education

While software designers are trying to focus on course and material delivery, from the other side, educational institutions are demanding a wide area of educational services. Online Education systems such as Moodle offer solutions for learning focused on the student and built on socio-constructive pedagogy. Here, students build their knowledge through discussions, also improving their skills.

Technology progress has enabled the creation of better solutions for collaborative learning on the Web. Asynchronous activities use technologies such as blog, wiki, and discussions groups, and allow participants to work together when the timing is appropriate for them. Synchronous activities occur with all participants together at the same time, such as chat sessions, virtual classrooms or conferences.

### 5.2.1. WiZiQ

WiZiQ is an online platform for distance learning, which provides a free virtual classroom, environment for professor to provide online instructions and to teach students in real time. Professors can also create a profile, manage schedules, maintain access to the material, managing the library content, sending Power Point presentations and PDF files.

**WiZiQ** beta  
 education.online

[Home](#)   [Learn](#) ▾   [Teach](#) ▾   [My Network](#) ▾   [My Stuff](#) ▾

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**Schedule a Class**

\*Title:

[Schedule for Right now](#) (Updated)  
MM/DD/YYYY

\*Date:

Ex. 8:30 AM or 4 PM

\*Time:  [EST \(Edit Time Zone\)](#)

Please enter keywords separated by comma

Keywords:

**Who can Attend:**
  
 Anyone (Public) Public Classes can be scheduled by teachers only.
  
Please [verify your email address](#) to schedule a public class
  
 Only whom I Invite (Private)

**Record this Class:**
  
 Yes
   
 No

**Set Class Fee:**  Max \$999 USD/Attendee

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[Add more information about yourself and your class](#)

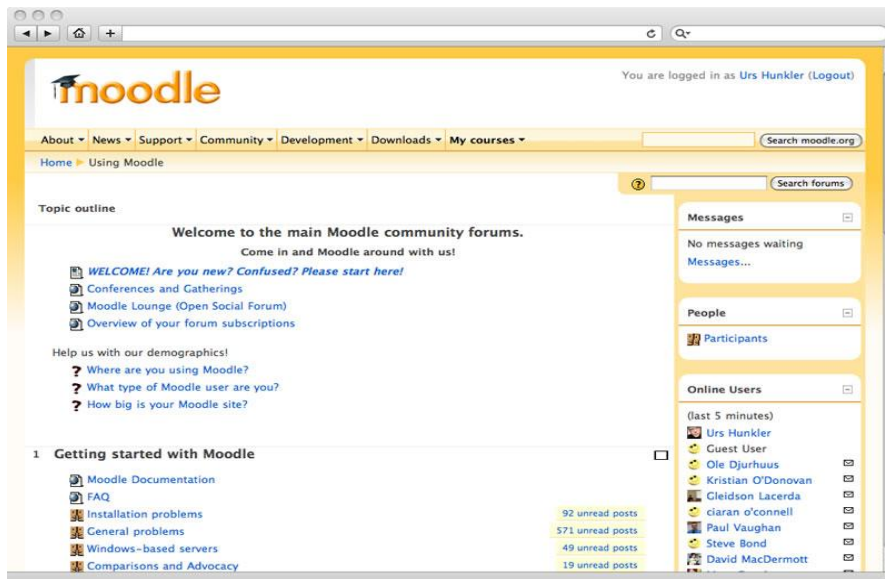
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Picture 13. WiZiQ Live Class

### 5.2.2. Moodle

Moodle (Modular Object-Oriented Dynamic Learning Environment) is one of the most popular and most widely used open source systems for online learning management (Learning Management System-LMS). This is an online application that is installed on the server, and it can be accessed from any computer network via a web browser.

According to data from April 2015, there are 1.000 plugins for Moodle with over 7 million downloads.



Picture 14. Administration Moodle

### 5.2.3. ATutor

ATutor is the open source platform developed to support education systems. It is based on the web and it provides managing educational material. While creating this solution its creators were thinking about a need that the product should be easy for users to use. It provides administrators with easy installation, developers who want to add new functionality allows easy integration, and end-users, professors and students provides with a simply interface for setting course materials, its distribution and exchange, and learning in a very adaptive, dynamic environment. Like most products for these purposes, ATutor also supports major standards in this area.



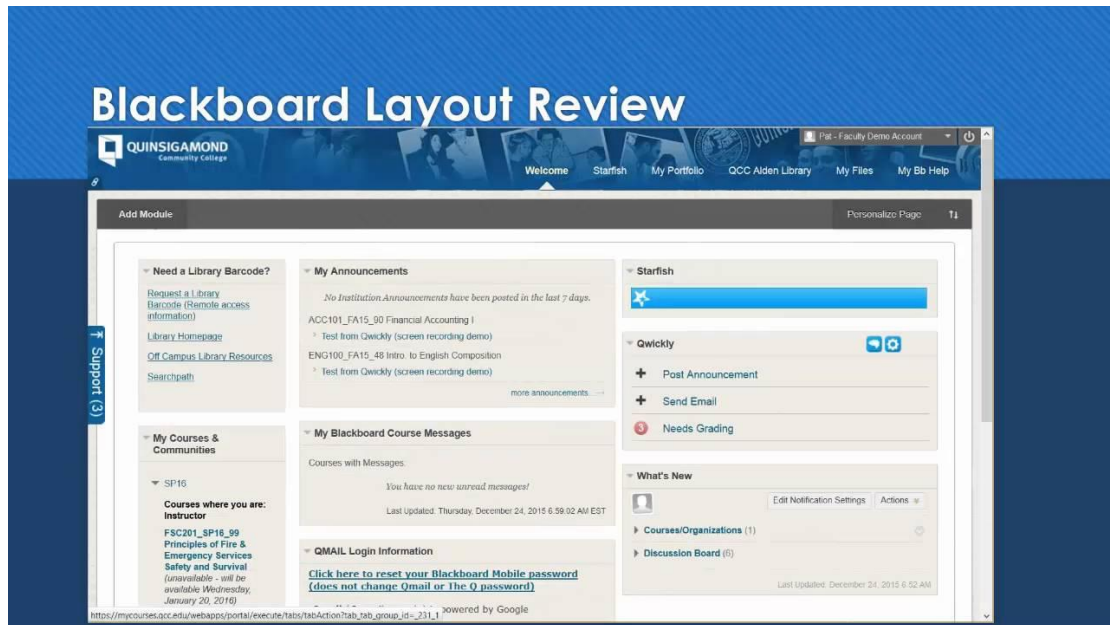
Picture 15.ATutorLayout

The product is free documented by its developers. Also, there is a possibility that users share their experience with other members by leaving comments on the forum site. ATutor allows members to exchange messages through the internal email accounts, which improves communication between participants in the learning process.

#### 5.2.4. Blackboard

Blackboard unlike the previous presented tool is not an open source solution. In order to add the new functionality, Blackboard Blocks can be used. It is installed in over two thousand academic institutions. Three key areas of platforms are emphasized that include a variety of tools that make easier the management and use of the material. These areas present the following: management of class materials, communication and evaluation.

Blackboard is a very good solution and the user interface is very likeable, but the fact that it cannot be used for free, it often makes potential users to use a different, free platform. In the developing of this platform the standards are met IMS, SIF (Schools Interoperability Framework), SCORM, and NLN (The National Learning Network).

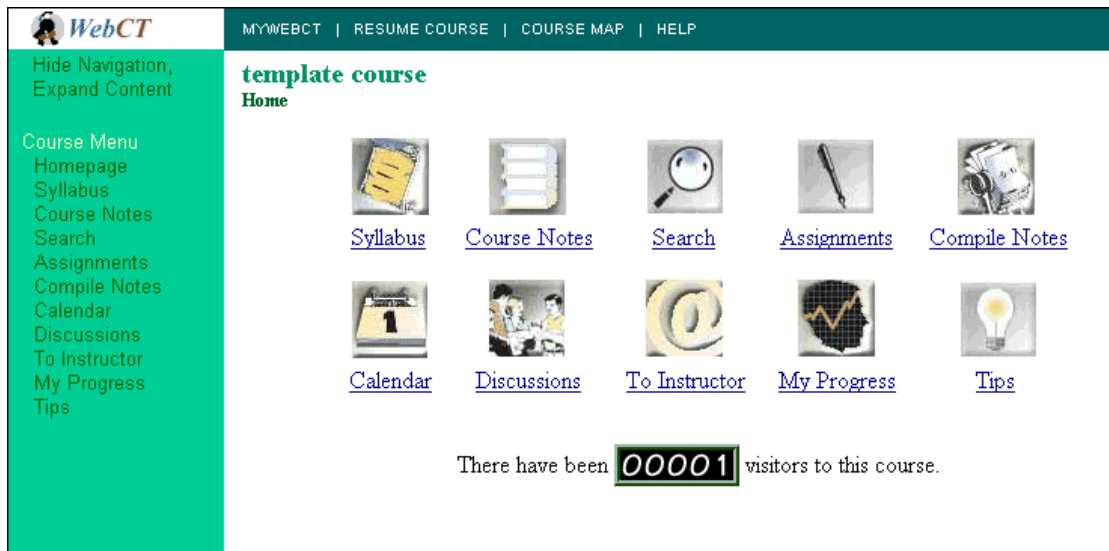


Picture 16. Blackboard Layout

### 5.2.5. WebCT (Web Course Tool)

WebCT is a very widespread commercial LMS, which took over the Blackboard and develop its range of products.





Picture 17. WebCT Course Layout

WebCT is programming tool, which is used for maintenance of distance classes (if professor and student are not at the same place) or as a supplement to the traditional classes and traditional education. Also, multimedia features are used that WebCT and Internet technologies allow. WebCT is developed at the University of British Columbia in 1995. The people who were working in computer department on the University led by Murray W. Goldberg developed it. In it's beginning the WebCT was developed for the needs of the University, in order to provide professors with easier way of posting materials on the Internet.

Each student always performs the preparation of the exams in WebCT individually, but all students need to be well prepared for the exam. Using WebCT the entire course can be hold through this platform. Access to WebCT is authorized and each professor and student has their own username and password to access the WebCT.

WebCT provide the following services:

- Enrichment of traditional course with multimedia elements (sound, pictures, Internet, links, additional information, etc.);

- The assessment of each student tests and assignments online (it is possible to take the exams at different time);
- Self-estimates of knowledge for students;
- Creating of index and vocabulary of important terms from lessons;
- Integration of existing Internet recourses in the course;
- Communication between students and professors through forums and chat.

## 5.2.6. Oracle

Oracle integrated solution, possess all the options of modern LMS and its grate advantage is one of the most reliable databases.

Oracle has the most complete and best range of software and hardware. With thousands of top-quality products, Oracle is ideal base for IT strategy of any organization.



Picture 19. Oracle Home Page

### 5.3. Application of Moodle at universities in Serbia and in the world

Activities related to Online Education in Serbia were initiated through personal interests and international connections between university researches interested in different forms of technology based on the Internet that have been applied to education.

Of course, at the beginning this idea was led by enthusiasts who wanted to promote the Online Education through courses that were presented at their universities. They have introduced a system for managing Online Education (LMS) such as Moodle, in their areas and gradually started to attract more and more attention. In recent years, several programs of studies for distance learning was developed and accredited at some universities in Serbia. However, QA (Quality Assurance) procedures and practices in these cases are in various stages of progress.

Considering that University of Belgrade is the largest university in Serbia, only one study was officially accredited. There are also a number of departments that offer materials through Moodle, but also for some courses and course administration.

Many other universities in Belgrade offer online courses. Very often, these courses are provided by Online Education enthusiasts, professors who believe that the Online Education is providing additional support for their courses, conduct them. A good example is Medical University, where they have four online courses on BSc level, three mixed courses on MSc level, and two blended courses on PhD level. However, Medical University was not adopting Online Education strategy. Only enthusiastic professor are developing their online courses and mixed courses through international projects and donations. It is important that this school provide training for their professors to achieve a high level of computer knowledge in order to have Online Education as widely adopted learning method.

There is a good example of setting course online at University of Nis of Electronics in Serbia. They use Moodle to offer their courses, and they are in the process of

unification of their previous individual offers. All courses are presented by following the same form and the structure of the form is providing information for students. This is definitely a good QA approach. At the level of the entire University has not adopted a unified approach. In many other departments, it is difficult to figure out which specific LMS is used only for searching their website.

The beginning and development of Online Education in USA belongs to universities. How it started developing from the beginning, Chris Curran presented it in studies “Strategies for E-learning in Universities”. Academics are among the first who have used email and World Wide Web, primarily to support their research, access to information and communicating with their associates, and later as a complement to the teaching students.

As a result, many of strategies that are used today in traditional universities come from the first, usually modest projects and initiative of particular professors. Many of these applications have included little more than creating scripts and other teaching materials available online, some professors moved forward, using Online Technology to communicate with their students, to access external recourses, and teaching courses based on the web. Usually, the professors who have been working at universities of informatics have developed many of the first programs, which is a strong synergy between research and teaching.

Athabasca University is a leader in distance learning and Online Education. The courses are offered using the Moodle platform, which offers a variety of flexible ways to communicate attending these courses; the experience is gained with current technologies through experimental and social software systems.

Harvard offers more than 100 options of distance learning, including the Moodle. For Online lectures, streaming videos are used with standard Internet browser software. Video and slides appear on the scree. The video and command is displayed on the left side of the screen and lecture material is on the right.

Queensland University has a coordinate approach in supporting Online Education using Electronic Course Profile System (ECPS) and Blackboard Learn platform.

These systems through university support ITS (Information Technology Service) and Ask-IT (Library). The Learning Place uses blackboard, a learning management system allows students:

- To learn online, in their own place at their own tempo and time;
- To choose from a range of online courses for learning;
- To develop their own online learning course;
- Safe and motivational online learning environment.

## 5.4. Installation and administration of Moodle

Moodle is one of the most popular and most widely used open source system for managing Online Education. It's an online application that is installed on the server, and is accessed from any computer network via a web browser.

System requirements:

- Hardware; The space on disk- Minimum 160 MB of free space is recommended, and more depending on the stored material for classes memory; Minimum-256 MB, and it is recommended 1 GB.
- Software; Web server is needed (Apache), database (My SQL) and PHP.

### 5.4.2. Types of installation packages

Two large groups of Moodle installation packages are:

- Standard Moodle Distribution
- Complete Install Packages (Moodle + Apache + MySQL + PHP)

Standard Moodle Distribution is a group of distribution, which contains only Moodle application, without Web server, PHP and database, which is needed to be previously independent installation, either individually or using of any finished package, such as XAMPP. Inside of this group of distribution are different versions of applications,

such as Latest Release, Latest Stable Branch or Beta of next release. Users are advised to use Latest Stable branch package.

Complete Install Package is a group of distributions, which inside of itself contain, besides Moodle, everything necessary to install and environment in which Moodle as a typical Web application can work. MS Windows operating system installation packages XAMPP, which contains Apache Web server, MySQL, PHP and Perl, but there are also packages for installation on Macintosh computers, such a package is possible to run without installation practices, which means that Moodle will not change the settings system on the computer, such as changing files, installation services, etc.

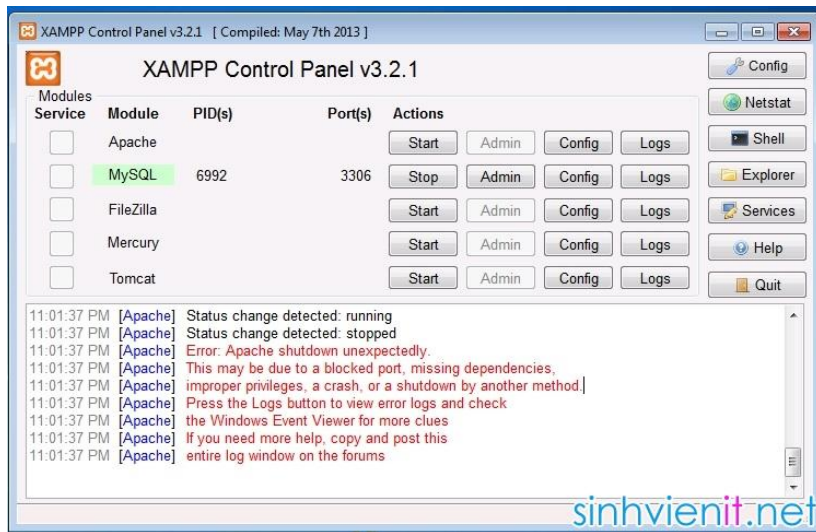
Moodle Download page contains a base module and accessories (Modules and Plugins) and over 65 translation Moodle packages, including packages for installations.

#### 5.4.2. Installation of web server and database

Before installation, it is important to note that Moodle is web application and it can not be run by opening with some of files (.exe), but it needs a web server (Apache, IIS...), database (MySQL, PostgreSQL...) and PHP. If Moodle is installed on a personal computer, although only Moodle files are on disk, in order to come to an application, there is a need to connect to a computer, in another words, with local host with IP address 127.0.0.1.

In this part of paper it is presented installation of using XAMPP Moodle package. The installation is required to download on local computer, and unzip the folder as desired. Inside of unzipped directory is XAMPP system. Before first running of XAMPP, it is necessary to run the file setup\_xampp.bat, which is located in the extracted folder, in order to execute the basic settings of XAMPP.

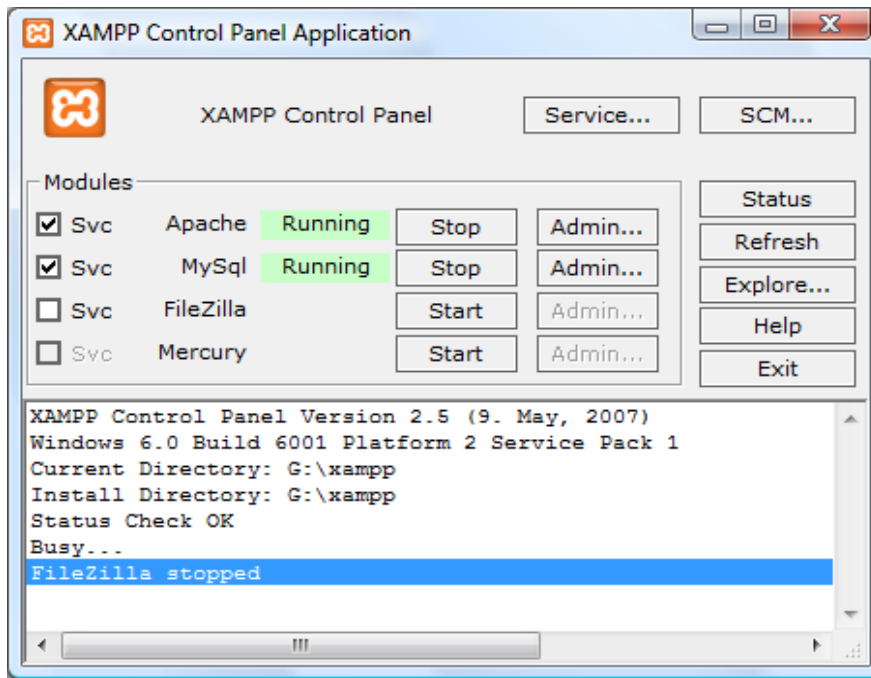
The easiest way to run the web server and MySQL database is the running of XAMPP control panel, which is run by selecting file xampp-control.exe.



Picture 20. XAMPP control panel

In order to use Moodle, the Apache and MySQL servers have to be run by selecting Start. If the user wants the mentioned web server and database to be automatically run with each running of operation system, the SVC (service) needs to be chosen from the left side module's name.

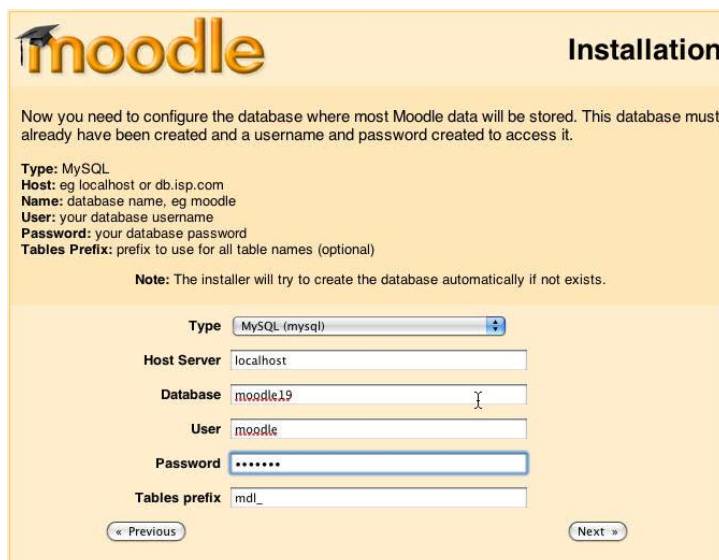
The following picture presents the final look of XAMPP Control Panel, with modules turn on.



Picture 21. Running modules of Web server and databases

### 5.4.3. Installation of Moodle

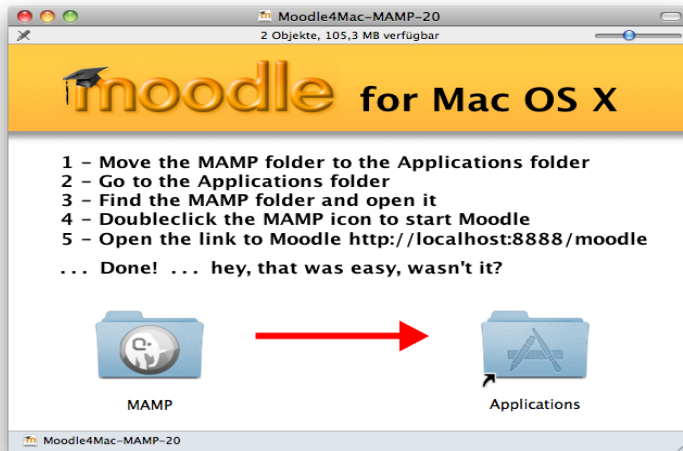
The installation process begins to access of web page <http://moodle.com/> from which the latest version of the program can be downloaded.



Picture 22. Installation Site for program

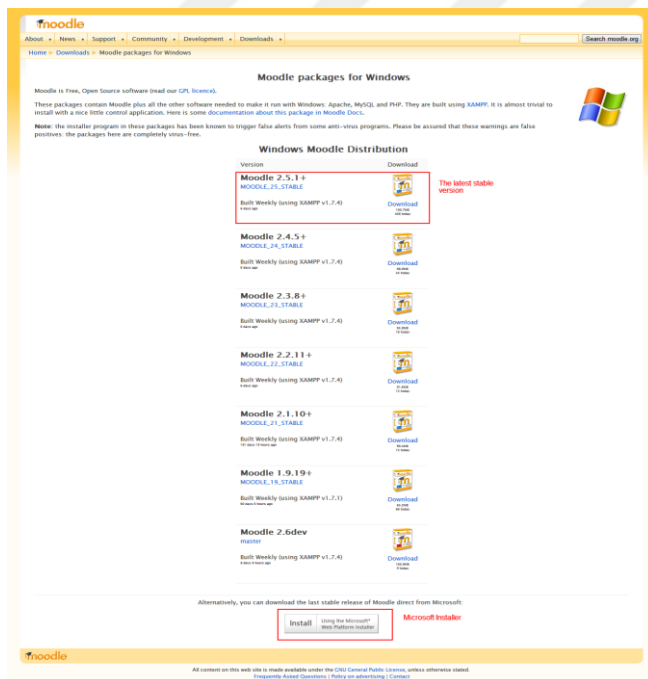


The next step is to choose the operating system from the download page.



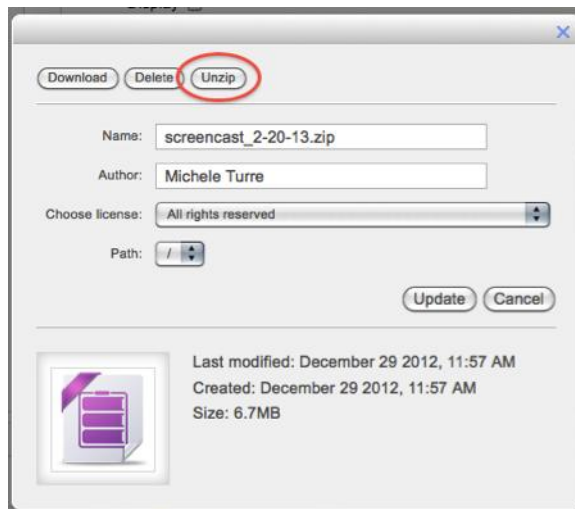
Picture 23. Choosing operating system

The next step is to choose one of the following versions. The best is to choose the last stable version.



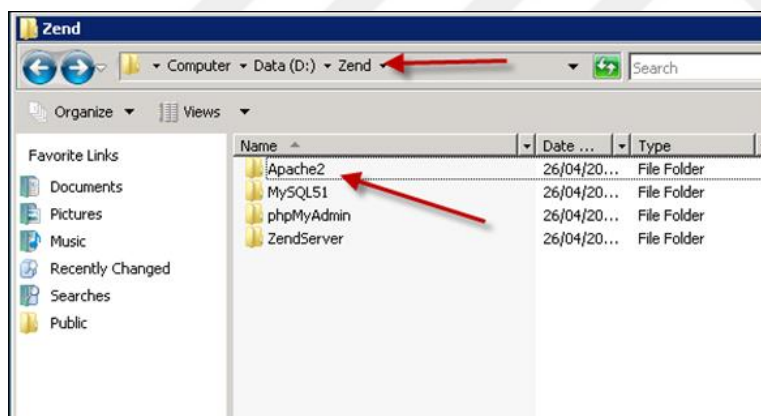
Picture 24. Choosing the last version

Because the file is in .zip format it is necessary before the installation starts to unpack it in to the folder.



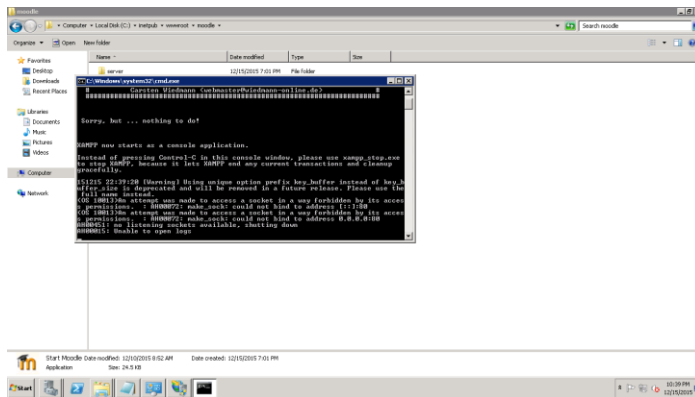
Picture 25. Unpacking zip archive

This version has easier way of installation process because everything is solved by starting a completed file.



Picture 26. Running instalation

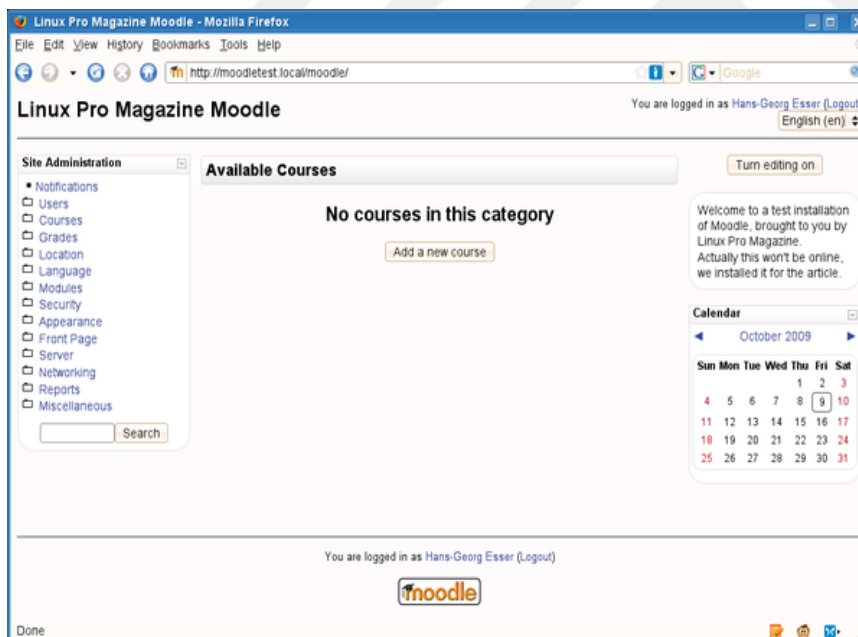
This file runs the Apache web server that is required for the rest of the installation. If the software AdAware is running, it will block the process of the process b2e.exe and server will not start.



Picture. 27. Running Web Server

In order for installation to be continued web browser has to be run and check for the address <http://localhost/> and signed in to the local Apache web server.

At the end of the installation the home page is displayed of a newly installed LMS.



Picture 28. Program Installed

#### 5.4.4. Moodle Administration

In order to administrate Moodle, there is a need for member to be register as a user with administration rights. After user is logged in, on the left side of the screen will

appear Administration block, which is used for using the administration system. Options for administration are classified into categories Notifications, Users, Courses, Reviews, Locations, etc. Clicking on any of these options it gives sub-options or it is directed to pages for arranging parameters.

In this block, the look and language of interface can be modified, new modules and blocks can be added into the system, maintenance of user accounts and courses, etc. It is desirable to examine the options of this block in order to be better acquired with the Moodle's possibilities.

Administrative block of the course is different from the administrative block of portal. In it is possible to adjust only parameters related to the course.

The short description of user options for the administration block is given here:

## Users

User input, the way of their registration, and their assignment to users is done in the administrative part of the interface, called Users. It contains three forms:

- Authentication – in which rules are set for each type of registration to the Moodle.
- Accounts – in which adding and editing user account is done manually.
- Authorization – in which the roles are created in the system and assigned to the specific user. Here it can be used already predefined roles or new ones can be created.

By selecting the option Add Users in the option Accounts, user can create a user account manually whereby the user should be assigned a username and password.

There are several ways of authentication, such as LDAP, POP3, IMAP or NNTP servers, using external bases and so on. For each user can be set to receive automatic email message, the interface language, and many other parameters, also many data can be entered related to the user. In order to add more users at once, the action called

set up users should be chosen. For that way of adding, it is necessary to create text file under special rules listed on the site of Moodle documentation.

## Language

User interface of Moodle portal can be multilingual. The user may be allowed to choose the language in which they will work. However, multilingualism does not apply to the content of the portal itself. The administrator of the portal can edit the translation by using the option called Language editing. In this way changed translations are stored in separate folder in order to avoid changing the original translation files. Adding and removing languages is performed via the Language Packs.

## Modules

A very important feature that allows adjusting of all original modules and adding a new modules as a Moodle application, and their current exclusion and inclusion. The modules are divided into three groups:

- Activities –all activities related to the portal (for example: forum, vocabulary, test, blog).
- Blocks visible segments with some of the content on the website (for example: the currently active users, Search, Calendar)
- Filters - widgets that allow certain types of text to be displayed on the screen in a different way. Simply by activating TEX filters it is possible to write complex mathematical terms using the notation TEX. Also, it is possible to use censorship words defined by list.

The icon for turning on and switching off the module (blocks and activities) is located next to the name of the module.

## Security

This is the page, which is referring to the security of Moodle platform in general. Among other things, it can be adjusted antivirus checks of all facilities that are places on the site. Detailed explanations of the all options can be found in the documentations of the Moodle website.

## Appearance

For many editors of Moodle portal, this set of options will be probably the most interesting. Here is possible to change and adjust the look of portal, calendar, the way of displaying HTML editor, and more parameters related to the displaying of the portal. It is even possible to assign different look to each course.

## Home Page

The home page of portal is easy to edit independently from courses and user can add activities and facilities. However, it is suggested from the very begging that to organize content of materials inside the courses, and to use home page to only present what is inside of the course. Here also, the roles of the users can be managed on the home page.

## Server

All settings related to the web server, database server, or PHP are on this page. This section is preliminary intended for system administrator and requires knowing how settings operate and other servers.

## Networking

This part is particularly important if there are multiple networked servers that are placed into a single portal. Adjustments are preliminarily related to the administration system that are exposes the scope of the Moodle administration.

## Reports

In this part reports are given about registrations on system, problems of system process, backup copies, statistics about using of certain course or activities, also in this part test of the system can be done.

## 5.5. Modules

One of the most important characteristics of Moodle is its extent. There are a huge variety of activities that can be added in the Moodle, and those activities are shaped in so-called modules. With the addition of the modules it makes easier the creation of mathematic formulas or make easier posting of lesson in chemistry with module, which enables writing of chemical formula. There are modules that enable the delivery of tests on student's mobile phones, inserting a flash file, creating multiple copies of courses and many other functions. Each of the modules is additionally installed. It should be noted that not all modules are appropriate for a new version of Moodle, some are written for older versions of Moodle.

As it mentioned above, Moodle has many different modules for different purposes. Although most of the modules work without any problems, it is recommended to read the instruction before the installation and use some of the formulas, because it could happen that the module doesn't work well in that system, or may have limited function. Of course, before any installation it is important to check whether the module is written for Moodle version that is in use. Moodle has many different modules for different purposes; one of them is video conferencing.

Video conferencing represents a transfer of images and sounds in relatively real time between two locations. In this way it is possible to accomplish at the same time video communication between several users at different locations. Video conferencing is used in business for a very long time. Now they find their use in the educational system, and in many other areas. In all educational systems (face – to – face, hybrid, and distance learning), this technology has the potential to recruit students and improve learning. When we talk about Online Education, video conferencing is a form of synchronous communication in which the recording and transmitting the

professor's talk and simultaneously transmits and displays the students in a remote area.

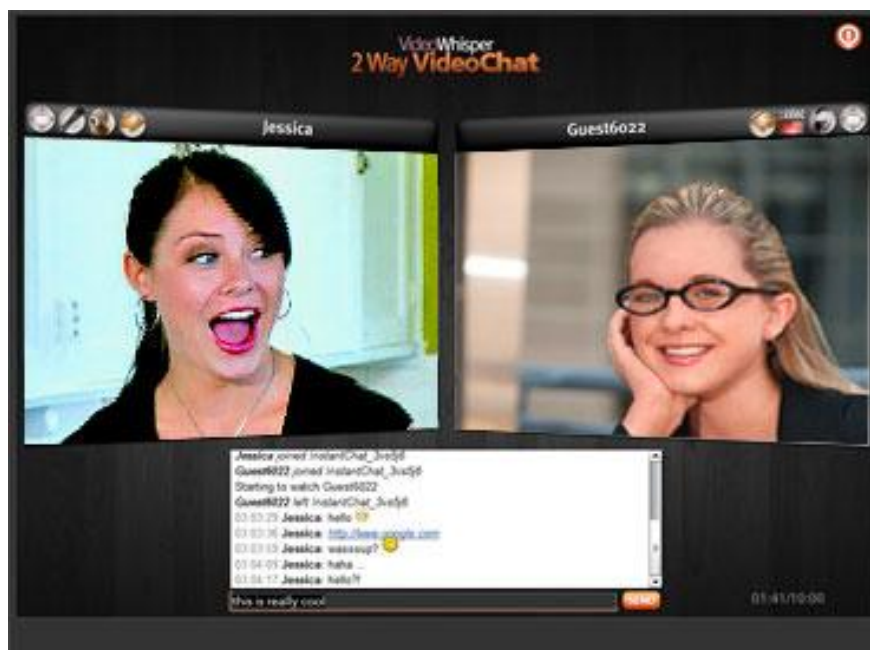
### 5.5.1. Two Way Video Chat

Two Way Video Chat [24] is a web-based software that is used as a supplement to Moodle to build a live interactive virtual LMS.

Two Way Video Chat is P2P highly defined communication software designed for 1 to 1 online videoconference. This solution is easy to adjust the implementation of face-to-face meetings without leaving the office or home. This is the easiest and most-effective way of meeting.

Two Way Video Chat editions integrate Moodle as activities of modules, which gives option to add private video chat rooms to courses as activities, for example: for grading the student.

It is recommendable to use this module with new version of Moodle.



Picture 29. Two Way Video Chat Window



## 5.5.2. Adobe Connect Pro

Adobe Connect Pro [25] is developed in collaboration with Remote – Learner and Adobe Inc. developing team. It is designed to simplify the use of synchronous events within Moodle.

This module allows users to create Adobe Connect Pro meetings by adding activities and names of meetings, URL, start time, end time, public and private settings of meetings.

This is also support for Moodle groups so that users who are part of the group can join the meetings of their Moodle group.

Any user who creates or joins the meetings will have created an account on Adobe Connect server and they will automatically use HTTP headers for authentication.

This module creates three roles: Adobe Connect hosts, presenters and participants, who need to maintain the role of the Adobe Connect server. Users can be assigned some of the roles through Moodle, which will be relevant to the Adobe Connect server when they join.



Picture 30. Adobe Connect Pro Window

### 5.5.3. AMVONET Room

AMVONET module [26] provides access to AMVONET functions such as:

- Audio and Video Web Conferencing;
- Each user can attach, exchange and cooperate through the PowerPoint and PDF files, videos, white tables and more;
- Divide the screen with tools comments;
- Public and private correspondence;
- A real-time system response and integration of Moodle quizzes;
- Sharing files including integration with Moodle course;
- Recording sessions;
- Edit video;
- Creating interactive points in order to record interactive sessions;
- Creating files SCROM and AMVONET videos.



Picture 31. AMVONET Room Module

### 5.5.4. Skype Module

Skype module allows interaction between all professors and students in the process. AmrHourani group creates this module.

## Characteristics of Skype module:

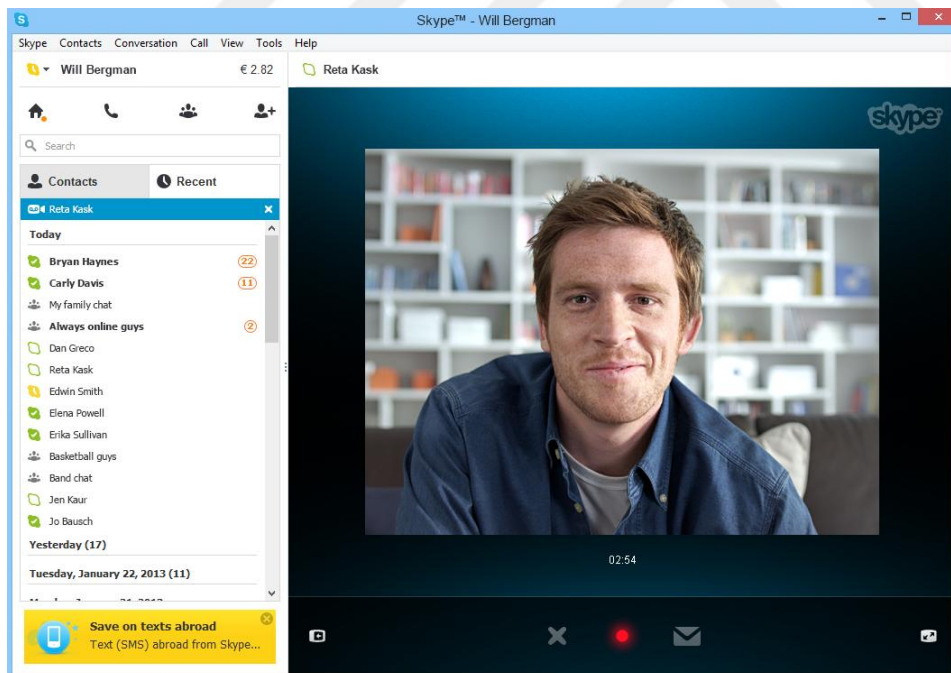
### 1) Two types of interactions between participants:

- Professor – professor;
- Professor /student – professor.

### 2) Options:

- Video calls;
- Sending files;
- Chat;
- Sending SMS.

Users should have their Skype Ids. The module works the best when the activity is inside the course, because it uses role-based assignments of professors and students.



Picture 32. Skype Module

### 5.5.5. BigBlueButton

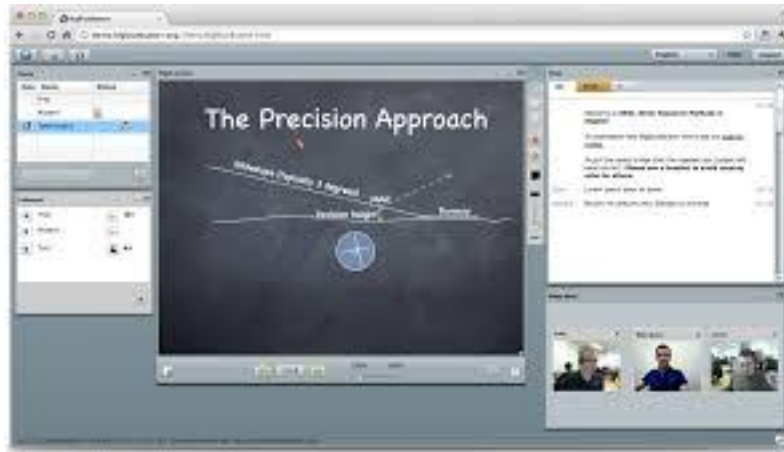
BigBlueButton is Open Source Web configuration system built on more than fourteen open source components, which combined present an integrated software solution that runs on Mac, Linux, and Windows systems.

The characteristics of this module are:

- The ability to create a private “room”;
- “Room” may have one or more moderators (trainers);
- Number of participants who are listening and are active in the debate is limited by the properties of server;
- It is possible to post presentation and draw\write on it;
- Audio\video\connections;
- Text chat;
- Private messages and
- Desktop sharing.

Note:

- A headset have to be used in case of planning of actively participate in the voice discussion, because of the problems with echoes;
- A presentation that is planned to be posted, it is the best to previously export to PDF (PDF format will be converted to flash view);
- Moderator may exclude participants who make noise\echo so that they can be permitted to talk only when they “raise their hand” (virtually).



Picture 33. BigBlueButton

### 5.5.6. WiZiQ Live Class

WiZiQ Live Class [28] module allows users of Moodle to distribute and provide online classes. WiZiQ virtual classroom is based on the Web and it is equipped with tools for real-time collaboration, such as live, 2-way audio and video communication, table for writing and sharing content (.doc, .docx, .pdf, .xsl, .xlsx, .ppt, .pptx, .pps, .ppsx, .swf, .flv and YouTube video ).

In order to download this module from the website: [www. Wiziq.com](http://www.Wiziq.com) it only requires a free user account. The installation of this module is very simple.

After its download, the copy of code folders for blocks is needed and activities and their folders: \* Copy wiziqlive folder, into/home/myMoodle/public\_html/moodle/blocks,\*Copy'wiziq'into/home/myMoodle/public\_html/moodle/mod.

After installation, new activity function, WiZiQ Live Class begins to show in the Moodle system. Administrators and professors generally use this module in order to create new classes and their courses, of course, as any other activities.

## 5.6. Research results

In last few years, many different studies in the field of online education have led to the development of quality systems personalization. Users of online education are classified as heterogeneous groups, which are distinguished by different characteristics. While importance of online education is increasing, adjustment of educational content and activities to the individual user is one of the most common problems that are taken into consideration.

The primary objective of this research is to indicate the procedures for initiating a local web server (XAMP) in order to establish a software infrastructure for online education.

The explanations are presented to specific examples that are used as practical guidance for successful using of Moodle application. This paper presented one aspect of working with Web server and to the regime of the local web server (XAMP) on Windows-platform.

Platforms for Online Education are successful in the implementation of Online Education or provide a low level of adaptively. Personalized courses that are adjusted according to users are making learning process better.

Many studies present the problems in education in system of Online Education, that are related to lack of integrated information, poor adaption of teaching materials and universal access for all students, regardless of their personal references. Student of Online Education courses expect the same level of quality of lectures and interaction as well as in traditional education. From the other side, the personalized systems of Online Education are based on adaptive hypermedia, based on knowledge of the user-student, which provides adaptive content to their needs.

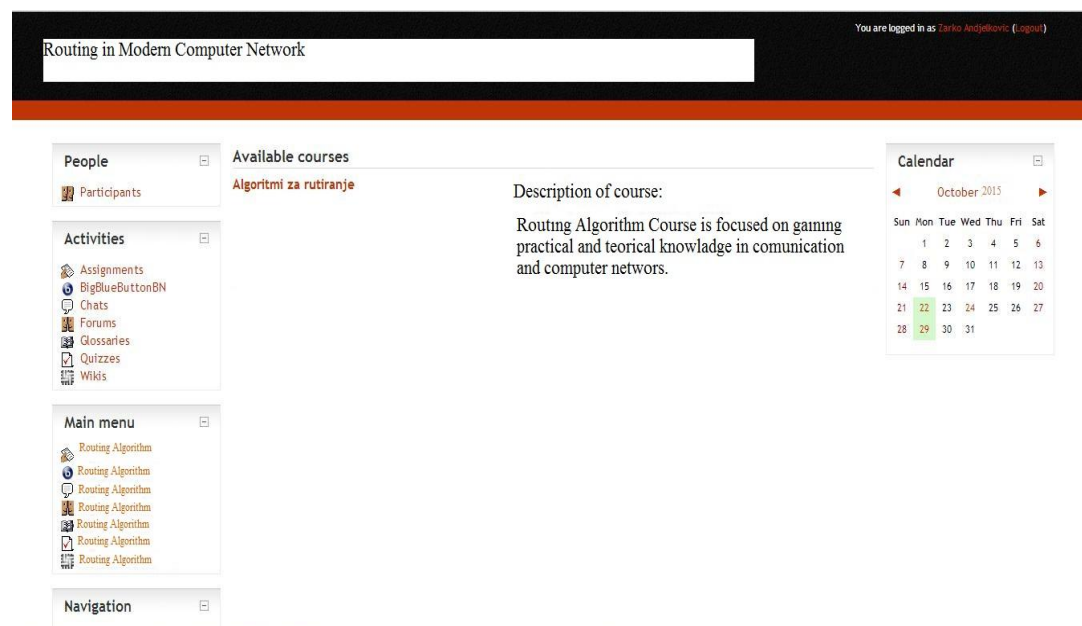
The main objective in the development of tools for personalized learning system is the electronic support for professors to develop adaptive and non-adaptive courses. These activities should be focused on activates, and guided by pedagogy, not technology.

## 6. Course Realization

This chapter describes the important parts of Moodle screen, such as central part and blocks of Moodle. Some more important blocks are containing description and instruction for use. Also, in this section provides a detailed description of activity and function of icons, and it is realized the course called Algorithm for Routing.

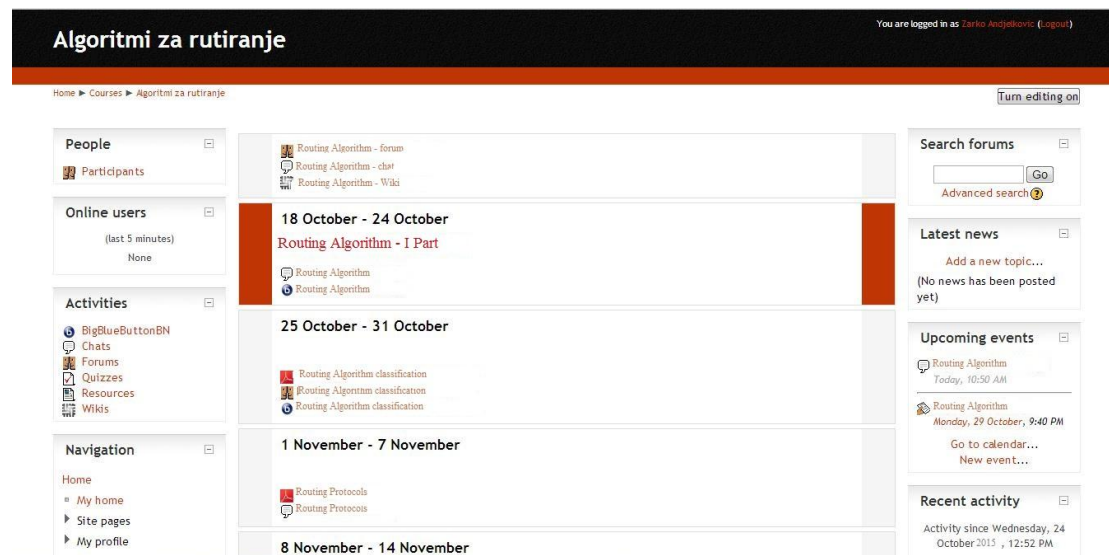
### 6.1. Work Environment

The main part of the window is divided into three parts. In the central part, themes are located. In parts of the window on the left and right sides, blocks are located. The window of Moodle is structured in the form of three columns. The left side contains several menus that are used for access to certain activities that are grouped. These include: a group of students, the group of activities included in to program, links for personal administration and so on. The right column contains the latest news and upcoming activities, calendar and other announcements. Central, widest column is used to display the contents of the course.



Picture 34. Course Description

The class name is shown in the top left corner of the webpage. Below the title is the exact path throughout the course. All the parts are separate and each part is a link to a previous level.



Picture 35. Home page

Link logout, which is located in the top right corner, is used to check out the course.

Button for editing (turn editing on) is used to change the mode. When editing is active then within each course home option add appears as well as a collection of icons that are used for modification. Also, it should be noted that the professor should be careful with icon, which is the shape of the eye. This icon marks parts that students can see. Content, which is located next to the button open eye, is visible to students. In case that eye is not opened, the content is not visible to students.

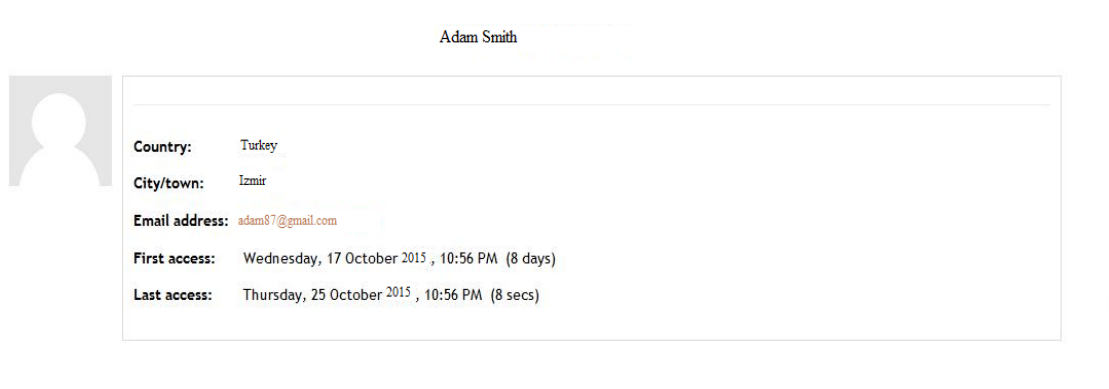
The course is consisted of global activities, such as:

- Forum – where students can discuss the topics that are related to the course;
- Chat – which is available at any moment and enables communication between students and between professor and students in real time;



- Wiki – enables users of course to work together on creating the content Wiki page related to the course;

With click on name of the user, it can be seen profile page with basic information about user of course.



Picture 36. Profile page

## 6.2. Blocks

Parts of the screen in the terminology of Moodle system are called blocks. Blocks are arranged right and left around the central part of the screen with themes. They are adjusted to the particular course, and here will be presented some of the possible outlooks of all blocks. Each course does not have to contain all the blocks. When editing is on, professor is able to choose which blocks will be part of the course, and which not.



Picture 37. Global course activities

The course also contains some of the blocks, whose selection can achieve better interaction with the participants of the course.

- People – allows the fast way of knowing that are the participants of the course.

This block represents a link to a list of all the participants of the course. That list gives the possibility of profile review of each participant.

-Online users- the users that are currently online



Picture 38. Online Users

This block shows the users, which are currently online, and their name represents the link, which guides to their profile, where the basic information about user can be seen.

- Activities – enables fast links to course's resource.

This part presents all the activities that are available in course. That means, it is going to be different from course to course.

- Search Forum – enables the simple way to make a forum research.

This part of screen enables research of texts in forum inside the course, so all the textual parts that are previously entered can be found. As it can be seen on the picture, there is a possibility of Advanced Search, which provides the possibility of phrase

definition, words that are not allowed to be in the text, time period in which words have to be entered, or name of text author in which particular words can be found.

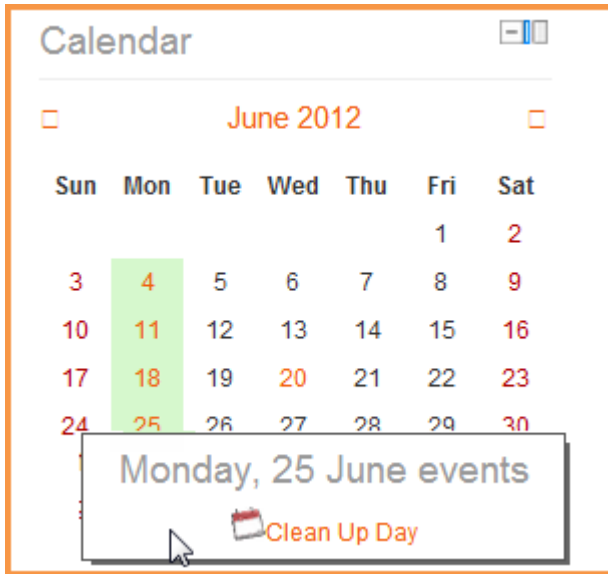
- Latest News –Last correspondence that is made on forum.

This block presents briefly the last news about course, the information about who wrote the comment, comment title, date and time when the comment is written. Clicking on the link more directs to the complete comments, and link Older Topics directs to older written comments.

- Upcoming Events – This block represents a reminder of the events that follow, the date when it will happen. Also, it includes access to the calendar and the ability to define a new event that will be recorded on this list.

This part of the screen presents the events that follow, the date when it will happen. Also, it has access to the calendar, and the ability to define a new event that will be recorded on this list. It depends on lecturer how many events will be listed and what period will be presented. This part of the screen is different from course to course.

- Calendar – shows all the important events that follow, clearly marked with the colors of the types of activities.



Picture 39. Calendar block

As the title and picture says, this part of the screen provides the functionality of the calendar. It serves as a reminder to students. Contains marked dates that contain an event related to the course. Events are added to the calendar based on the rate for a particular group.

In this case when there are dates of completing the forum or quiz, they are automatically added to the calendar. It gives the view of future and past events using arrows left and right. Current date is framed with black frame, and the dates that are related to an event are colored with differently for that date.

Clicking on the date it opens the event, which is, related to that date, as well as detailed description. Using block called Following Event can do adding an event to the calendar. While creating an event, calendar needs to be visible for students.

### 6.3. Other Activities

In addition to new lessons can be also added some other activities: a new assignment, quiz, selection, survey, forum or blog.

The forum module provides discussion about raised topics in modes of professor, news, and open for all or separately; there is ability to manage the duration, the right of access to the forum as well as the inclusion of assessment. This activity is important because the forums take the largest part of the debate and discussion.

Quiz – module for work with quizzes, allows the professor to create database with the questions that shape test in a form of a quiz. There is a possibility of importing, exporting, and storing question within quiz.

During creation, the name of quiz is formed, also time of duration and time of the period when it is possible to access to solution (for example from 01.09 to 01.11) and time for answer (for example, 10 minutes). During resolving quiz the stopwatch is showed which used to measure the time remaining.

The creator also decides how many times the user can access the quiz, also if the solution of quiz is going to be with password, are the solutions will be shown at the end of the quiz, and what is the maximum number of points. After that, questions are added within the chosen category.

The following questions are available:

- Multiple Choice;
- True/False;
- Short Answer;
- Matching;
- Embedded Answer;
- Random Short Answer Matching;
- Calculating;
- Essay;

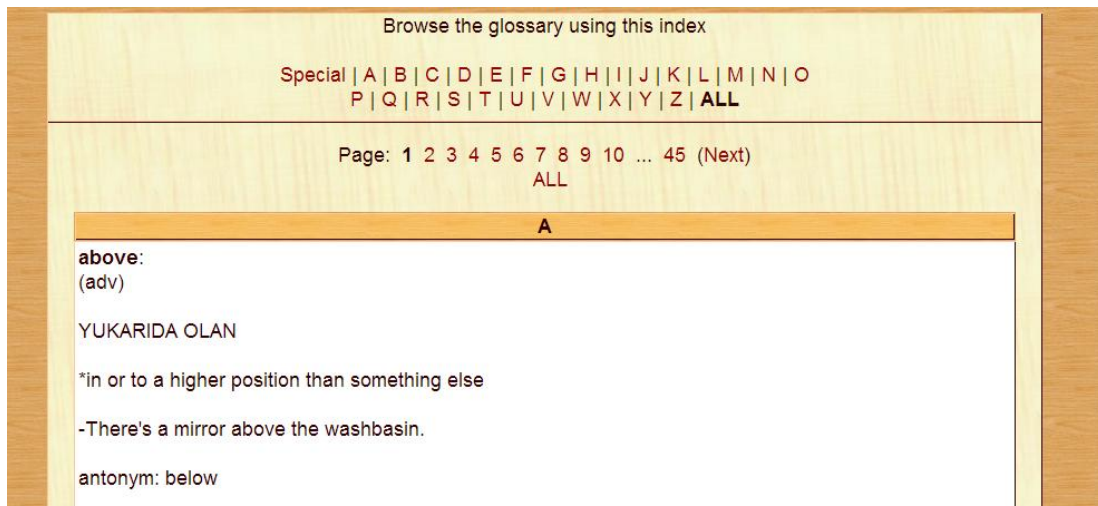
- Numerical questions.

During continuous software development this list of questions is expanding. After adding questions quiz have to be recorded. Pressing on “Save this whole quiz” can do this.

Assignments Module – enables improving assignments to students. Types of assignments are “offline” or “upload” assignment. Assignment needs to be taken out of Moodle when the activity is “offline”. Student can see a description of the assignment, but cannot upload the solution of the assignments on Moodle. Also, it is possible for students to see only their own grades regarding a particular assignment. Student is uploading the solutions of assignments on Moodle. The file can be of any type: Word document, zip or any other type of file. The assignment grade can be written textually or numerically. It is also necessary to indicate the maximum grade and deadline until which the assignments need to be completed.

Exercises Module – provides students with practical assignment. That could be writing an essay, report, or preparing presentation, etc. Before uploading of assignment students are marking it. If it is needed, the professor can ask for correction and re-submission of the task. The final grade is based on the correctness of the assignment as well as the ability of student to evaluate their work.

Glossaries Module –this activity allows professors to create a list as the dictionary with definitions, which can be later searched by various criteria. There is a possibility also to post the links in the lessons that lead to the explanations of a particular term in the dictionary.



Picture 40. Glossaries

Chats Module – enables easy and simple textual communication. It is possible to set up a chat to always repast at the same time, with a free, public access, or to start at any time.

It is useful to apply the chat as well as consultation between students and professors. The module contains a number of management options and re-views the contents.

Surveys Module – adds the survey of Moodle in the course. Users are interviewed in order to improve the quality of Moodle. The answers of surveyed users do not affect their grade, as there is no write answer to the questions. There are several types of surveys which results are visible on the Web site in the form of table graph.

Workshop Module –is an activity of mutual assessment activities with a number of different options. It allows participants mutual project evaluation and as evaluation of projects in several ways. Also, there is a possibility of managing the collection and distribution of previously listed estimates.

Choices Module – can be beneficial to vote on matters of interest to the professor or to the course. Lecturer asks the questions and determines a few possible answers.

Wiki Module – enables participants to collectively edit, modify content of a page, while the old versions are never deleted and it can be restored.

SCORM/AICC Packages present a set of web content satisfying standards of SCORM and AICC for teaching facilities. They include web pages, images, JavaScript programs, Flash animations, and others that browsers can support. Package Module enables upload and inclusion of arbitrary SCORM or AICC package as part of the course.

Labels Module – is not the real activity, it just provides inserting of text and graphs among the activities on the course page.

Resources Module – under this module are all the resources that professors use to explain or display materials. Documents, links, web pages and references can be added. It enables representation of electronic content of arbitrary format (doc, ppt, flash, video, audio...).

## 6.4. Creation of New Course



In order to create a new course it is needed to have particular privileges. System administrator decides what privileges are needed. Beside system administrator, the new course can create also creators who also can be lecturers. Users who have privilege being professor have to be related to some of course or they can be related to more courses. It doesn't exist professor who is not related with some course.

After successfully installed Moodle application for Online Education, the course is created which is called "Algorithm for routing". This course lasts 16 weeks, and it is consisted of two parts. Both parts consist lectures in PDF format, also consists activities such as chat, forum, BigBlueButton.






**18 October - 24 October**


Routing Algorithm - I Part

-  Routing Algorithm
-  Routing Algorithm



**25 October - 31 October**

-  Classification of Routing Algorithm
-  Classification of Routing Algorithm
-  Classification of Routing Algorithm



**1 November - 7 November**

















-  Routing Protocols
-  Routing Protocols

**8 November - 14 November**

-  Optimal Routing Principle
-  Optimal Routing Principle

**15 November - 21 November**

-  Routing in packet-switching networks
-  Routing in packet-switching networks

<p><b>22 November - 28 November</b></p> <p> Algorithm of shortest way   Algorithm of shortest way</p>
<p><b>29 November - 5 December</b></p> <p>I Midterm</p> <p> Routing Algorithm - I Part</p>
<p><b>6 December - 12 December</b></p> <p>HOLIDAY</p>
<p><b>13 December - 19 December</b></p> <p>Routing Algorithm - II Part</p> <p> Flooding   Flooding</p>
<p><b>20 December - 26 December</b></p> <p> Mainstream Routing   Mainstream Routing</p>
<p><b>27 December - 2 January</b></p> <p> DV - Protocol   DV - Protocol</p>
<p><b>3 January - 9 January</b></p> <p> LS - Protocol   LS - Protocol</p>
<p><b>10 January - 16 January</b></p> <p> Hierarchical Routing</p>
<p><b>17 January - 23 January</b></p> <p> Broadcast and Multicast routing   Broadcast and Multicast Routing</p>
<p><b>24 January - 30 January</b></p> <p>II MIDTERM</p> <p> Routing Algorithm - II Part</p>
<p><b>31 January - 6 February</b></p> <p>FINAL EXAM</p> <p> Assignment</p>

Picture 41. Organization of course

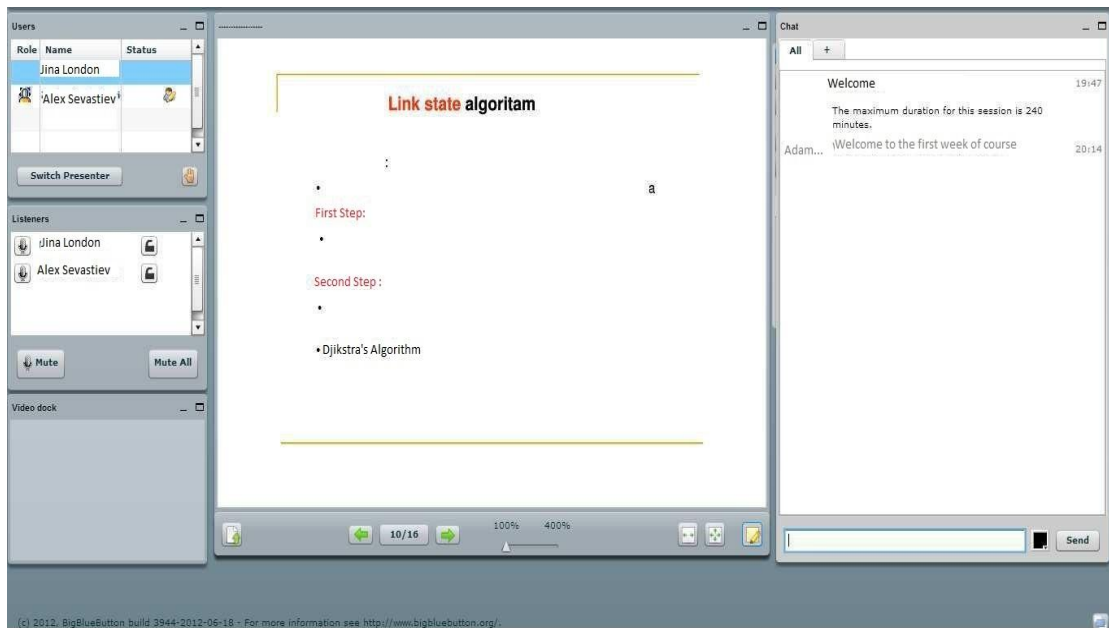
Also, after finishing lecture topic, some of the chapters contain BigBlueButton that provides interactive communication and complete cooperation between professor and student of course, as participants among themselves.

## 6.5. Big Blue Button – Web conference system

The vision of BigBlueButton campaign is to provide on simple and free way creating Web videoconference. While web conference are very important for business people and students, focus of BigBlueButton campaign is to make the best possible system for web conferencing for business people and Online Education users for free.

BigBlueButton is Open Source Web conference system developed on more than fourteen open component, which combined form integrate software solution that works on Mac, Linux, or Windows computers.

BigBlueButton is developing platform with open code, and international community programmers and users actively develop it.



Picture 42. BigBlueButton Work Space

### 6.5.1. Blocs of BigBlueButton

Blocks are located on left and right around central part of screen with themes. They are adjusted to the specific course, and here some of them will be presented.

-Users – Users that are online currently.



Picture 43. Users Block

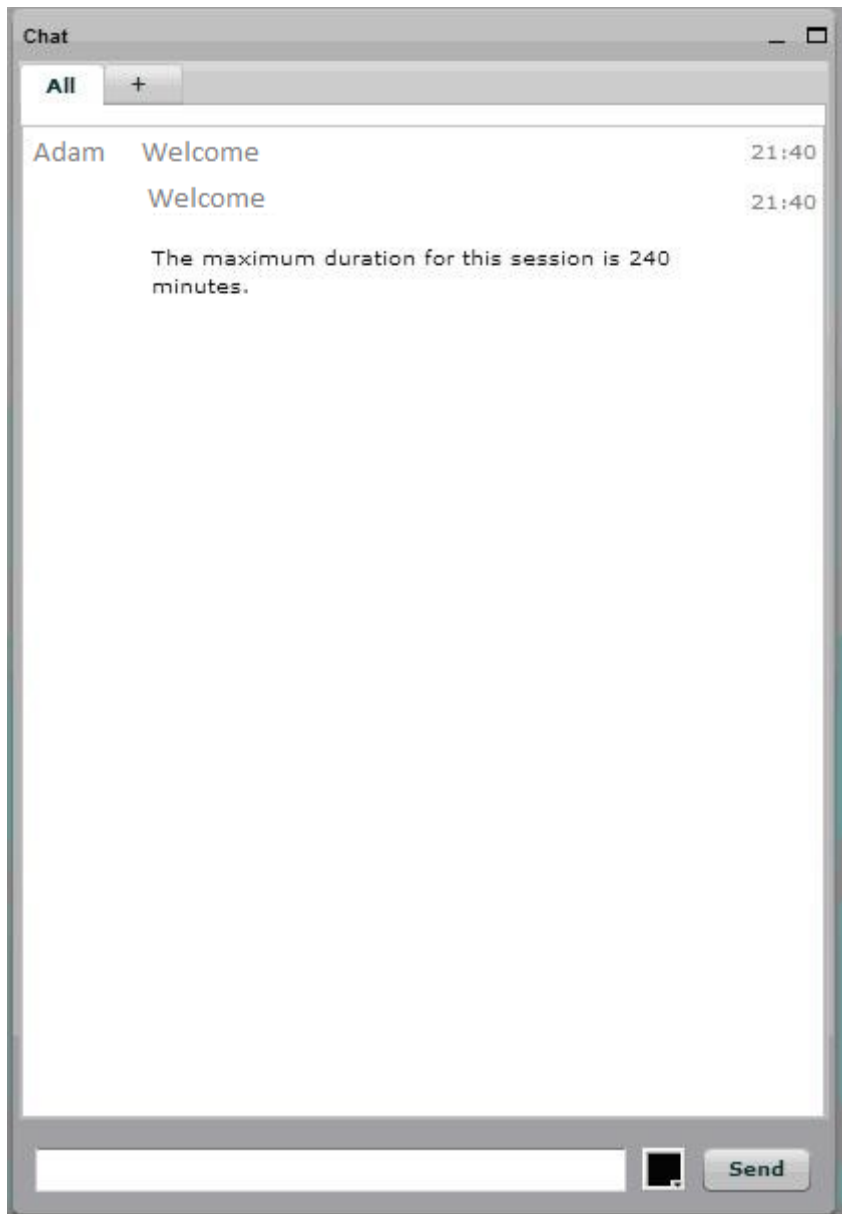
- Listeners – Presents the current listener, which is online. Moderator can exclude the users who are making noise, echo, and let them talk only when is necessary.



Picture 44. Listeners Block

This window block presents names of active conference members. Users can disable video and sound, and they can use it only when is needed.

- Chat – During the lecture, members can write to each other or discuss about the topic related to the course.

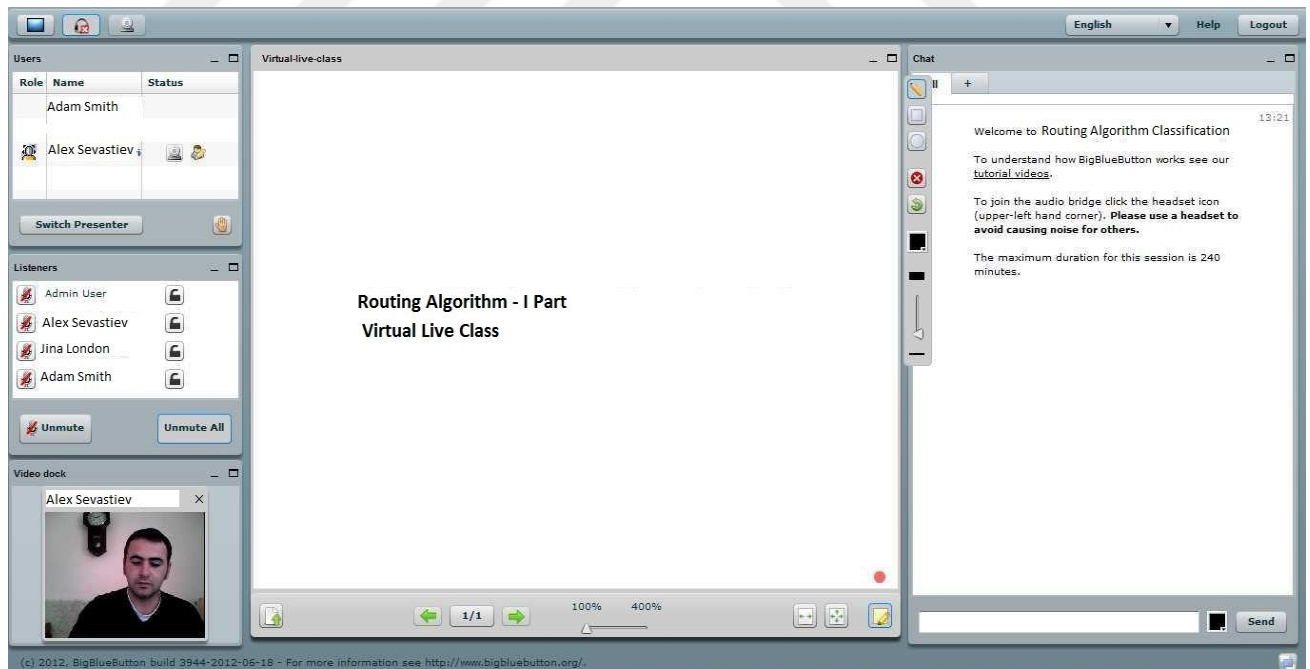


Picture 45. Chat Block

Chat block is used for exchange the messages among members in conference. In this block many questions can be asked and many topic can be discussed. All the information and messages will be visible to all members. Also, private messages can be exchanged that are going to be visible only for few members. There is an option to adjust font, choose language of communication or set automatic translation (Auto Translate).

From the left side the list with students who are attending the course can be seen, and with left click with mouse users are provided to use microphone or camera and also pencil for writing on whiteboard. In the middle workspace is located, which can be whiteboard, document that is uploaded from local computer, video file or some page from the Internet that should be shared with members.

The main part of the lectures is held throughout the workspace. Moderator can add presentations, documents, photos, etc. Presentation that is shared needs to be export to PDF format first.



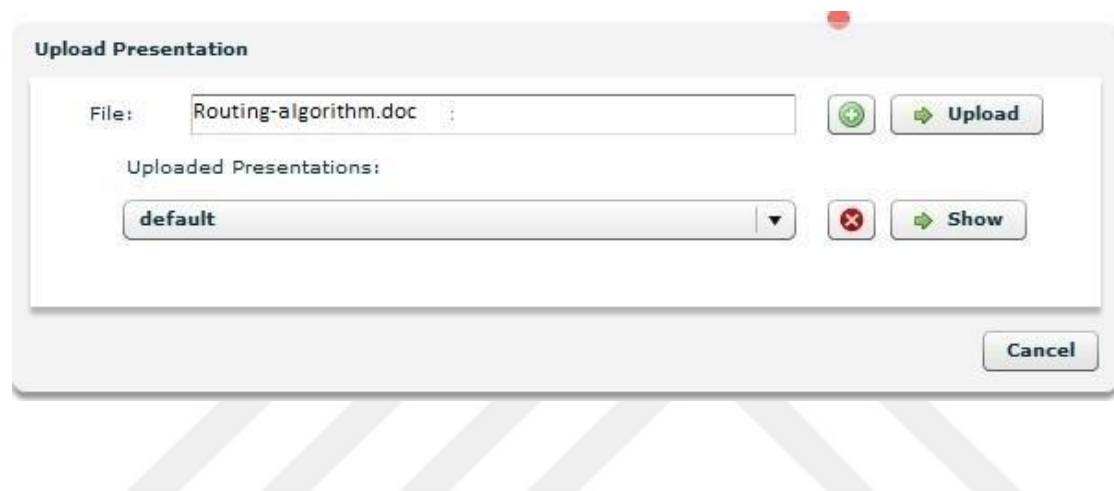
Picture 46. BigBlueButton Virtual Classroom

During lecture, chat can be used, which is located on the right side. Chat is very important option in virtual classrooms, because sometimes this can be only way of

return information (if members don't hear well among themselves), especially if there is more than one member.

From the left side of the workplace toolbar is located, such as tools for marking, pencil, text, eraser, etc.

Considering presentations work, in order to access the presentation or any other document, it is needed to click on left down side of the window "Presentations".



Picture 47. Window for posting the presentations

After converting the document, (some time is needed, depends on number of slides) it will be shown for the members of conference.

In order to access Videoconference there is no some special web browser request, it can be used Internet Explorer, Mozilla Firefox, Google Chrome, etc. This system provides technical information such as:

- Internet address;
- Phone number and e-mail address in order to student contact the moderator;
- Parameters and authorizations.

Participating into Videoconference requests from member to possess headset and microphone. For accessing to conference for desktop, the speakers and microphone are not recommended, because they can make an echo.



Moderator can share desktop, enable members to discuss and use video camera.

Before setting, audio device needs to be check if an operating system is properly identified and whether the parameters for sound are set. To connect with audio devices it is needed to press the button with headset in the top left corner.

After completing the lectures, each chapter contains a test of knowledge in the form of a quiz with multiple-choice questions.

The image shows a screenshot of a quiz interface with two questions. Each question is presented in a light blue box with a sidebar on the left containing question details and actions.

**Question 1**  
Not yet answered  
Marked out of 1.00  
Flag question  
Edit question

Routing protocol works based on link state based on:

Select one:

- a. Dijkstra's algorithm
- b. OSPF protocol
- c. DV algorithm

**Question 2**  
Not yet answered  
Marked out of 1.00  
Flag question  
Edit question

Routing protocol based on the distance vector does not include the following protocol:

Select one:

- a. IGRP
- b. SPF
- c. Rip
- d. EIGRP

**Question 3**  
Not yet answered  
Marked out of 1.00  
Flag question  
Edit question

The default routing table builds:

Select one:

- a. IP
- b. ARP
- c. TCP/IP
- d. TCP
- e. UDP

**Question 4**  
Not yet answered  
Marked out of 1.00  
Flag question  
Edit question

Routing table does not contain:

Select one:

- a. Gateway
- b. MAC address
- c. IP address
- d. Masc
- e. Interface

Picture 48. Test

After finishing the test, pressing on button “Next”, the window appears, which informs how many questions are done, in other words, are the all questions answered.

<b>Started on</b>	Thursday, 25 October 2012, 2:15 PM
<b>State</b>	Finished
<b>Completed on</b>	Thursday, 25 October 2012, 2:23 PM
<b>Time taken</b>	7 mins 39 secs
<b>Marks</b>	4.00/4.00
<b>Grade</b>	100.00 out of a maximum of 100.00

**Question 1**  
Correct  
Mark 1.00 out of 1.00  
Flag question  
Edit question

Routing protocol works based on link state:

Select one:

- a. Dijkstra's algorithm ✓
- b. OSPF Protocol
- c. DV algorithm

The correct answer is: Dijkstra's Algorithm

**Question 2**  
Correct  
Mark 1.00 out of 1.00  
Flag question  
Edit question

Routing protocol based on distance vector does not include the following protocol:

Select one:

- a. EIGRP
- b. SPF ✓
- c. IGRP
- d. Rip

The correct answer is: SPF

**Question 3**  
Correct  
Mark 1.00 out of 1.00  
Flag question  
Edit question

Default routing table builds:

Select one:

- a. ARP
- b. IP ✓
- c. TCP/IP
- d. UDP
- e. TCP

The correct answer is: IP

**Question 4**  
Correct  
Mark 1.00 out of 1.00  
Flag question  
Edit question

Routing table does not include:

Select one:



- a. IP address
- b. MAC address
- c. Interface ✓
- d. Mask
- e. Gateway

The correct answer is: Interface

Picture 49. Results of the test

Considering the evaluation, Moodle is recording results of students who are part of the course, by categories that professors created. In block Administration, it is

possible to choose option Grade and have the total points of midterm exams, and also from the points from the projects for all students. Many different options can be choose in order to get these data.

	First name / Surname	Email address	State	Started on	Completed	Time taken	Grade/100.00	Q. 1 /25.00	Q. 2 /25.00	Q. 3 /25.00	Q. 4 /25.00
<input type="checkbox"/>	 <b>Jina London</b> Review attempt	jina.london@gmail.com	Finished	25 October 2012 7:06 PM	25 October 2012 7:07 PM	54 secs	100.00	25.00 ✓	25.00 ✓	25.00 ✓	25.00 ✓
<input type="checkbox"/>	 <b>Alex Sevastiev</b> Review attempt	a.sevastiev@gmail.com	Finished	25 October 2012 10:40 PM	25 October 2012 10:41 PM	25 secs	50.00	0.00 ✗	25.00 ✓	25.00 ✓	0.00 ✗
<b>Overall average</b>							<b>75.00 (2)</b>	12.50 (2)	25.00 (2)	25.00 (2)	12.50 (2)

Picture 50. Grades of the students

Moodle system remembers the results of student's works, according to all categories crated by professors. In this example on the picture, the evaluation is presented throughout the categories theories and practical part, which Moodle remembers throughout the points and percentages. It is possible to sort the percentages from exams throughout many different categories, and recording the results in the local media in text format or in Microsoft Excel format.

It is not allowed that everyone has access to assignment solutions. The screen viewed from the perspective of professor provides the ability to vies as when the students solve the quiz and when students attend a course.

The course is designed to provide a simple way of learning aboutprotocols and routing algorithms. This course can be applied in various universities, which are

having in their educational system master degree program. Duration of course is 16 weeks, divided into sections (weeks), which introduces students with the subject.

Students will learn about the different types of protocols and routing algorithms, their characteristics and purposes. After finishing the course, students will be able to perform optimal routing packets throughout the network by using the heuristic and met heuristic algorithms, also they will be able to analyze decision-making in computer systems, and develop mathematical models in computer networks. The best students will solve routing problems on networks while different conditions and in real time, and will successfully apply systems to support decision-making and solving various problems in routing packets.

We are witnessing the rapid development of the society in which computers are having very important role. In this way, it is very important to have computer knowledge, in order of successful work in field of information technology.

## 7. Conclusion

Information technologies are more used in education every day. In a last few years we have been noticed the growth of usage of information technologies in education. All educational institutions are using Online Education in some way. Also, companies are using this kind of educating their coworkers in order to improve their work ethic and knowledge.

Using the information technologies, the whole system of teaching have been improved throughout dynamic development of educational institutions, and it is much more then combining information technologies and traditional education.

The very important roles in this process are having multimedia technologies that are presenting integration of text, picture, sound, and voice inside the one environment.

It can be concluded that with implementing of information technologies and new software solutions in education, provides better personalization, appreciating differences between users and possibility of developing personal abilities and skills.

This paper presents the advantage of Online Education compared to Traditional way of education, by using Internet and information technologies. In this paper one of these technologies is realized and it is presented the platform for providing the conditions for this way of education, with highlighting the Moodle, which is the main part of the paper.

The system for Online Education is presented in the paper and advantages and possibilities of this kind of gaining the education. The way of using it is presented and especially the video conferencing is offered as one of the most important partby using this software for Online Education.

In the paper course called “Algorithm for routing” is realized and created inside the Moodle system for Online Education. Different types of tasks indicate possible way of interaction between student and application for learning.

This paper has a goal to inspire the professors at universities to present their lectures to students throughout new and more interesting way. With pleasant graphical surrounding with plenty of multimedia interactive elements, it is possible to motivate student for independent studies and also to test their gained knowledge. Presented tasks in Moodle system can be used to create new interactive tasks, which is the topic for the new researcher of this field.



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