CONTENT DISTRIBUTION IN EDUCATION SUPPORT SOFTWARE

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Abstract:

This paper discusses the application of modern information technologies to complement communication between educational institutions and students. Communication is important for development and improvement of the quality of the education system. In place of direct communication, educational institutions sometimes need to make additional educational materials available to students. Information technologies play an important role in distribution of these materials. Students have access to personalised and relevant information at any time, as well as many ways and opportunities to clarify any doubt in a quick, easy and efficient way. This paper explains multiple applications of the educational content distribution. It includes reviews of different web-based services, such as a video distribution platform, a portal designed for scientific research and an application for the Android operating system for delivery of different kinds of content of interest to higher education students.

Keywords:

communication in education, services, content distribution, personalisation, web.

1. INTRODUCTION

Content delivery, especially that of educational materials in higher education is important without question. Modern methods for content delivery or distribution among teachers and students include file sharing over the global computer network - Internet. It is hard to find the exact origin of the idea of content or data delivery and distribution, but important research and development of this topic was done by the United States Advanced Research Projects Agency (ARPA) in 1957. ARPA's primary goal was to perform and examine extensive scientific research and apply it for military purposes. In 1961, Leonard Kleinrock published a paper [1] which proposed the use of packets of data, which would be sent between computers. First steps towards the creation of computer networks capable of exchanging data in this way were made in 1962, when ARPA set itself the task of implementing the concept of data packet transmission. As a result, ARPANET was created in 1969 [2]. This network consisted of four nodes, located at University of California in Los Angeles, Stanford University, California, University of California in Santa Barbara and

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University of Utah. Each node was one computer in each of these universities. By the year 1972, there were a total of 32 nodes [3]. At this time, the first form of private messaging appeared. Today, we call this form of message exchange as e-mail [4]. Not long after the introduction of private mail exchange services on this network, its potential for civil society was recognised. Because of this, this single network was divided into two in 1983. The first remained ARPANET and was reserved for civil use, while the newly formed MILNET was reserved for military use [5]. Even before this time, diversification of use of the original ARPANET resulted in the need for a more robust communication and data exchange protocol. In 1973, a standard for data transfer called TCP/IP protocol was developed [6]. The TCP/IP protocol, especially the method of addressing computers within the network, was crucial for spreading of this network. IP addressing allowed for growing an ever-more complex network. Growing number of interconnections have allowed for new network services to occur [7]. Many of these services allow users to exchange files of different types containing text, images, videos, audio recordings etc. Universities were the first to use the global computer network, now known as the Internet, and they still use it, predominantly for communication, scientific research cooperation and most importantly, as a support tool for their educational work. This paper will focus on Internet based services whose aim is to support education and learning. In this paper, we present use case reports of Internet based services implemented by Singidunum University.

2. THE POTENTIAL OF THE INTERNET FOR CONTENT DISTRIBUTION

In the last decade, the amount of data generated by humanity over the course of a single year continues to grow exponentially [8]. Statistics showed that in the year 2005, all generated content had the size of 150 Exabytes or $1.5 \cdot 10^{20}$ bytes. In 2015 its size was 1700 Exabytes or $1.7 \cdot 10^{21}$ bytes. It is estimated that by the year 2020 all data ever generated will have reached the size of 44 Zettabytes or $4.4 \cdot 10^{22}$ bytes [9].

Along with the growth of the gross amount of data available on the Internet, with the advancement of information technologies, it is more accessible than ever before in the history of humanity and faster than it was ever possible.

To illustrate this, take a look at the list of technologies and the time it took for it to reach a total of 50 million users [10].

- The telephone - 75 years;
- The Radio - 38 years;
- Television - 13 years;
- The Internet - 4 years;
- Facebook - 3 and a half years;
- The iPod - 3 years;
- Angry birds (game) - 35 days.

It is clear that information technology and especially the Internet have great potential for delivering content to a great number of people world-wide. This can be seen through the success of Internet applications such as social networking portals and similar content sharing services.

Personalisation of content delivery in electornic media

Using electronic media to communicate with the target group allows the sender greater efficiency than traditional media [11]. This, as well as the potential of the Internet were recognised by Singidunum University and have helped orient it to modern information technologies. These technologies are applied in providing educational content mainly to its students, as well as for the public, because much of the content is made publicly available free of charge via different web services.

3. CONTEMPORARY CONTENT DISTRIBUTION SERVICES

In this chapter, reviews of different Internet based content distribution services and the method, form and scope of their implementation at Singidunum University are given.

Electronic mail (E-mail)

Electronic mail (e-mail) is a form of data exchange accomplished via computer network communication systems. E-mails were initially used for transfer of text from one person (sender) to one or more recipients. E-mail is exchanged in the form of ASCII encoded text, but other encodings are also possible. Aside from text, e-mails can be used to send any other type of file. Files are sent using the base64 encoding [12], in a specified format within the message body [13], as MIME content [14] [15] [16]. Today, e-mail remains the most popular communication service in business environments [17].

Singidunum University uses e-mail services from two different webmail service providers. The faculty and

the administrative staff use Google Mail services [18]. Students use Microsoft's Outlook 365 Education services [19]. E-mail services are widely used by both the faculty and students. Between 50,000 and 70,000 e-mails are exchanged between students and the faculty.

Electornic payment systems

Electronic payment systems are an important part of contemporary e-commerce systems, such as web shops. The form of electronic commerce systems used today was not known before 1995. After the Amazon Company started its Internet based shop, there has been a steady growth of Internet sites providing this way of shopping [20]. Early sites did not provide a method to order and pay for items on-line. Customers could only make orders which were then processed by the staff. As payment systems have become more secure over the years, their application found way into e-shops [21].

Singidunum University does not have an e-commerce website, but it implements an electronic payment system. This system is currently in the final stages of implementation and will be deployed in April 2017. Students can use this electronic payment system to transfer funds required for exam registration or to request issuing of official documents about their student status etc. Currently, there is no statistics available since the system is yet to enter into service, but it is expected to become popular. This is because the usual method of transferring funds takes one or two business days, depending on the method of payment, while this system will allow for instant transfer of funds on-line, without having to go to the bank or the postal office to initiate cash transfer.

Social networks

Social networks are becoming ever more popular [22]. Many companies are realising that presence on social networks is as important nowadays as presence on the Internet was only a short while ago [23]. The basic idea behind social media is to allow any two people, wherever they may be at the given time, to connect through a chain containing a limited number of intermediaries [24]. Social media helps to connect different individuals and communities [22].

Singidunum University recognises the importance of social networking and presence on social networks. It implements best practices suggested by different sources [25] [26] [27], which are analysed and practically used

by its Internet marketing and public relations team. Currently, the primary social network which Singidunum University uses is Facebook, as it is the most popular social network in the world [28] with over 1.86 billion active users world-wide [29] and nearly 3 million users in Serbia [30].

Implementation of different suggested strategies has resulted in over 137,000 followers of Singidunum University's Facebook page at the time of writing this paper, as well as a total of over 138,000 people who have liked content published by Singidunum University on Facebook.

Services for file Sharing

There are many different implementations of web based services whose aim is to allow users to share files with other users on the Internet. Some services are designed for public access while others require uses to be authenticated [31]. Aside from specialised file sharing services, there are web application platforms that can be adapted for this purpose.

Singidunum University hosts a web service called Course Pages which are used to deliver educational materials for all courses taught at all integrated faculties. These materials include presentations, scripts, additional lesson materials, free electronic publications, etc. Course Pages are created using the Moodle learning platform. It is an open-source integrated system for creating personalised learning environments [32] that offers many features [33]. Main features exploited for the creation of Course Pages are Forum Activities [34] and Folder Resources [35]. The Course Pages were created in 2012 and contain a separate course page for every course taught at the university. Professors are assigned different roles, such as the Teacher and Assistant Teacher role for courses which they teach. All content is publically available for viewing and downloading to students without the need to sign in. These materials are available in read-only form to these users. Each course is divided into three main sections for different content. The first section contains basic information about the course, such as the course syllabus, contact details for the teacher and the teaching assistant, the course schedule and the timetable of important dates etc. Also, it includes two forum sections. The first one is for general notifications that the teacher and the teaching assistant can post and the second is for publishing results of tests, exams and student projects. The second section is reserved for materials from lessons divided into folders containing materials for the first mid-term, the second mid-term, the final exam and for additional materials.

The third section has the same structure as the second, but it is reserved for materials from practical or laboratory lessons. The syllabus article contains information about topics covered by the course, as it is registered in the accreditation documentation approved by the Ministry of education. All materials are publically available, without any restrictions.

Electronic encyclopaedias

An encyclopaedia is defined as a volume or a collection of volumes that attempt to pull together and present the entire knowledge of humankind in one comprehensive work [36]. Encyclopaedias are supposed to be complete compendium of knowledge. Yet, there also exist specialised encyclopaedias, which focus on a particular field or domain [37]. Compared to printed encyclopaedias, electronic encyclopaedias have an advantage of being much easier to update. Instead of periodically printing complementary volumes to update or correct the knowledge assembled in previous volumes of the same collection, electronic encyclopaedias can be instantly updated and can also use hyperlinks to reference other sections, topics, definitions contained within it. As mentioned before, knowledge in encyclopaedias is structured.

However, there are collections of knowledge which is not organised and structured as an encyclopaedia, where a term is defined in a short concise manner. Instead, an entire paper is dedicated to the topic. These kinds of collections cannot be considered encyclopaedias or even specialised encyclopaedias, and they are not proper libraries of documents as well. Singidunum University's Singipedia portal is one of these collections of knowledge, whose name suggests a relation to encyclopaedias, but in reality functions more closely to how libraries do. Singipedia is a web based scientific research portal dedicated to promoting and helping the spread of scientific research via publically providing free access to student theses (bachelor, master and doctoral level), Singidunum University's publications such as books, full-texts of scientific papers presented at scientific conferences organised, supported and sponsored by the University and published in conference proceedings, as well as papers published in the University sponsored and supported scientific journals [38]. There are three major sections of the Singipedia portal, which include the section for the University's textbook publications, the repository of students' theses and the repository of published scientific papers in journals and conferences.

The Books and textbooks (Professional literature) section provides complete electronic editions of textbooks published by the University. Anyone can download electronic copies of these books, free of charge. At the time of writing this paper, there were 242 published books available for download and they have been downloaded a total of 1,084,783 times.

The repository of student theses contains electronic copies of doctoral, master, magister and bachelor theses of the University's students, as well as selected seminar essays of undergraduate students.

Paper category	Number of papers	Number of downloads
Doctoral disertations	149	101.505
Master's theses	1.081	1.195.349
Magister theses	56	64.423
Bachelor theses	128	254.432

Table 1. Student theses number and download statistics

Table 1. shows how many papers were published in each category as well as the total number of downloads of papers from each category.

The repository of scientific papers published in conference proceedings and scientific journals contains papers from eight scientific conferences. Five of those conferences are organised or sponsored by Singidunum University. The Singipedia portal does not allow users to download whole conference proceedings, but only individual papers.

Distribution of video content

Distribution of video content on the Internet is currently mostly associated with web services such as YouTube and Vimeo. However, the first web service that offered hosting of video clips was shareyourworld.com. It started in 1997, but lasted for only four years, when it closed due to costs and bandwidth problems. It worked with a single file format, popular at the time [39]. Videos are a popular format for education on the Internet [40]. Singidunum University has recognised this and has made video lectures available to employed students who cannot always come to classroom lectures. The video platform is called vPLUS. It is directly connected to the University's information system in order to confirm if the authenticated student has delivered proof of employment from

the employer in order to be granted access to recorded video materials. Students from a certain faculty have access to video recordings for all lectures of all courses at their faculty, for both semesters. Video materials are scripted and recorder by teachers and teaching assistants for both the theoretical and practical part of the course. Practical video lessons tend to be longer and more extensive, covering additional materials, while theoretical lessons tend to be shorter and give more of an outline for self-study. Some course materials are made publicly available outside of the vPLUS platform for video content distribution. YouTube is predominantly used in such cases. Teachers can decide on their own if they wish to publish their video lectures publically via YouTube or leave it within the vPLUS platform.

Most videos are recorded in advance in order to be edited and prepared by the IT centre's video editing team. All videos are published minimum three weeks prior to mid-term exams and final exams so that students can have enough time to prepare for tests, exams or to finish their assigned projects on time. The vPLUS platform logs extensive information about the way it is used. From these logs, teachers and the faculty administration can review how frequently and how long certain videos are being watched as well as which student has finished watching certain lessons. This information is not available when services such as YouTube or Vimeo are used, because they cannot track which student has been watching the video. The video editing staff can review watch logs and see at which point a certain video was frequently paused or re-watched. This information can help find problems in the video or in the way a certain part of the lesson was delivered, so that it can be fixed. This approach significantly contributes to the improvement of these teaching materials for current as well as for future generations.

4. CONCLUSION

Given the importance of content distribution in education, it is important to handle it in the correct and efficient manner. Modern information technology helps. In this paper, we have shown that educational institutions can provide good quality learning materials as well as materials for scientific research, such as previous research reports, theses, books, conference and journal articles etc. to students and the general public. By using this approach, educational institutions promote sharing of research and learning materials. However, they also support transparency, which in turn helps increase research quality and the availability of relevant work that will be done

and whose results will be published in the future. This paper explains Singidunum University's implementation of these principles coupled with information technologies to provide functional web services that support education and research.

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