WIKI TECHNOLOGY – ORIGIN, DEVELOPMENT AND IMPORTANCE

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Abstract: Late 20th century and early 21st century are marked by the emergence and expansion of Wiki technology in the field of informational technologies. The largest ever compiled encyclopedia, Wikipedia, emerged from Wiki technology. Compilation of Wikipedia as the most successful project based on Wiki technology showed true potential of Wiki software. This software is now widely used and imposes itself as a new standard. In addition to Wikipedia, local Wiki Web sites are important as well.

Keywords: Wiki technology, Wikipedia, MediaWiki, free software, history of computer science.

1. History – ideas and preconditions leading to the development of Wiki technology

The origin of Wiki technology and its further development, as well as its increasing importance may be followed since the very beginning. Proper understanding of the origins of this phenomenon requires depiction of its prehistory, that is, technologies and ideas that preceded it and enabled its fast wide-spread popularity. In particular, favorable preconditions need to be stresses, whose fulfillment led to the acceptance of Wiki technology as a world standard among programmers, and, as it turned out, among all other computer users.

Fast spread of personal computers during the 80´s of the 20th century, as well as software and computer network development led to unprecedented utilization of computers and not only for mathematical calculations, but also for text processing in the broadest sense. The role of computers changed; more and more programmers participated in the creation of new concepts, exchanged ideas and cooperated in their realization. All this required more sophisticated and faster exchange of information among people that shared interests or cooperated on joint projects.

A revolutionary break-through in this field was done by Ward Cunningham. In 1994 he programmed software that he named WikiWikiWeb, and installed it on the Web site of his software consulting company on March 25th 1995 (WikiWikiWeb). The idea for developing this kind of Web site software emerged from the application program HyperCard designed for Apple Computers. HyperCard program from 1986 was among the first successful hypermedia systems that existed before Web. It combined database abilities with flexible graphical user interface. In this sense, HyperCard is one of the forerunners of the Wiki technology.

The name of this new software comes from Hawaiian words „*wiki wiki*“, which mean quickly (Wagner 2004), thus conveying its basic idea, the effective communication between programmers, visitors of his Web site. Ward Cunningham heard this words in Honolulu airport and decided to use them to name his new software, although he previously considered naming it „QuickWeb“, which means approximately the same in English (WikiWikiWeb).

Among some of the earlier predecessors of wikis, whose ideas it realized, is memex, a theoretical computer concept of hypertext on microfilm which was designed by Vannevar Bush (1890-1974) in 1945. This concept is considered to be

the oldest predecessor of hypertext and Web in general. Another important advancement in hypertext concept development was ZOG system, developed at the Carnegie Mellon University in 1972. It was a hypertext collaborative database, which became fully functional in 1977.

Memex and ZOG as old predecessors, and HyperCard as a direct role-model, may be considered as concepts whose successor is the current Wiki, in which ideas of its predecessors are incorporated to the widest possible extent.

2. Development of encyclopedia and advantages of Wiki, Wikipedia

Since its origin in 1995, Wiki concept has been related to the Web. In this manner, it made use of all Web advantages, for instance, the existing hypertext environment. Unlike usual text that can be read only sequentially, hypertext enables branching and gives reader an opportunity to continue reading at some different point by simple hyperlink activation, usually with a mouse click. However, Web did not use the advantages of wiki concept and wiki technology immediately.

2.1. Origin of Wikipedia

An important moment for the Wiki technology is January 15th 2001 – the date when Wikipedia's was born. Its founders were Internet entrepreneur Jimmy Wales and doctor of philosophy Larry Sanger. In March 2000 they launched Nupedia, a free encyclopedia that was not based on wiki technology and which could be edited solely by doctors of science. Development of Nupedia failed to give the expected results: in three years of its existence, only 24 articles were finished and 74 were pending (Nupedia). In early January 2001 a programmer, who already used WikiWikiWeb introduced Sanger to this technology. Sanger then proposed to Wales to establish an encyclopedia based on UseModWiki software, which is actually one of several WikiWikiWeb clones (History of Wikipedia). Hence, it is thanks to them that Wikipedia was created on January 15th 2001.

From the very beginning, Wikipedia was conceived as encyclopedia based on the wiki principle, that is, an encyclopedia which could be edited by anyone (Gonzalez-Reinhart 2005). Wikipedia is under GNU Free Documentation License, which in legal sense means that it is an open-type project, whose contents can be freely copied, distributed and modified. Wiki technology is a suitable tool for the realization of free projects, such as Wikipedia, but it need not be used for free sites only

The first version of Wikipedia was in English, and it was soon followed by the version in French, created on May 11th 2001. Shortly afterwards versions in many other languages were created, but English Wikipedia was at the beginning dominant. In January 2002, 90% of articles from all Wikipedias were in English, while in January 2004 their share dropped to 50%, to be further reduced to only 25% in 2007 (History of Wikipedia). Wikipedia in Serbian was created on January 16th 2003.

2.2. Wikipedia contents

According to data from December 2nd 2008, Wikipedia in English contained about 2,643,000 articles while Wikipedia in Serbian contained about 69,000 articles. It is a general encyclopedia with diversified contents. Articles are categorized by topics into subcategories, thus forming a hierarchical structure of Wikipedia contents. The main content categories in Serbian Wikipedia are: arts and culture, geography, history, mathematics, philosophy and religion, humanities, society and biography, technology.

The majority of articles were gradually created through joint effort of many users. A smaller portion of articles was created in cooperation with faculties, whose students prepared their assigned papers in the form of Wiki articles. Some articles were automatically generated from data already in various databases. For instance, numerous articles about inhabited places were imported in this manner. These articles are predominantly

entered by bots, a type of program scripts which will be discussed later. Since in this way usually a larger number of articles are imported simultaneously, the overall procedure was named a mass import.

The number of encyclopedic units represents an indicator of a quantitative progress of Wikipedia. While new articles are being obtained, old one are being improved, therefore, leading to a better quality of Wikipedia.

The problem of the accuracy of information included in Wikipedia is particularly important. Since articles may be edited by anyone, it is necessary to know whether someone reviews and verifies their content and whether information in them is reliable. The project nature does not offer a full guarantee for the accuracy of the found information. Wikipedia's own disclaimer states the following: „Wikipedia may not guarantee validity of the information contained herein". However, in accordance with a survey conducted by the magazine Nature in 2005, the average number of errors per Wikipedia article is insignificantly greater than the average number of errors per article in Britannica, the largest traditional encyclopedia (Giles 2005). If we have in mind that the articles in Wikipedia are longer on average, and that the spotted errors are continuously being corrected, while the errors in hard-copy encyclopedias are not corrected until the next edition, then we can fully appreciate the value of this numerical data. Some proprietary encyclopedias, including Britannica among others, have electronic versions in which the error correction time is shorter.

Wikipedia tends to improve the quality of information by requesting from contributors to include bibliography and reference citations of used sources. Also, one of the basic requests is that information given in an article need to be verifiable. Nevertheless, information from Wikipedia should be used only as an initial source, and not as the only or final source for a claim.

In particular, one can perceive big differenc-es in articles from different Wikipedia. For instance, article „weak plum brandy - *sljivovica*" in Serbian states that the origin of this drink is the region of Serbia and that it is mainly produced in Serbia and Republika Srpska, providing a list of surrounding countries that also produce it (Bulgaria, Croatia, Czech Republic, Slovakia, Slovenia, Macedonia, Poland and Romania). Bosnian Wikipedia states that this is the most popular alcoholic drink in most parts of the Balkans. Slovakian Wikipedia states that this is a drink from former Yugoslavia, for instance, from Bosnia, not mentioning the other countries. Croatian and Slovenian Wikipedia do not have articles under this title, but the former one has an article entitled brandy - *rakija*, where it is stated that its most popular type is *sljivovica*, and stating a list of countries is given where this brandy is manufactured: Bosnia and Herzegovina, Bulgaria, Croatia, Montenegro, Macedonia and Serbia. English Wikipedia states that sljivovica is predominantly manufactured in Czech Republic, Slovenia, Slovakia, Poland, Hungary, Bulgaria, Romania, Croatia and Serbia.

One of the methods for creating the new articles is translation of the existing articles from Wikipedias in other languages. However, after a while, these articles that initially have almost identical content become very different because they are being amended and modified on a daily basis. Due to this reason, alignment of texts contained in different Wikipedia is practically impossible.

2.3. Encyclopedia development concluding with Wiki

Being an encyclopedia, Wikipedia relies on a long history of encyclopedistics reaching far back into the past. Since the very beginning of human written civilization, the systematization of overall human knowledge was needed. One of the oldest preserved encyclopedias is „*Naturalis Historia*" (Latin for „Natural History") by Pliny the Elder from 77 AD. French „Encyclopedia, or a system-

atic dictionary of sciences, arts and crafts" (Fr. *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers*), which included 35 volumes published in period between 1751 and 1780, has a particularly important place in the new age. This encyclopedia had 71,818 articles and 3,129 illustrations, and its editors-in-chief were Denis Diderot and Jean d'Alembert. Numerous respected Frenchmen of the time contributed to this encyclopedia, for instance, Voltaire, Jean-Jacques Rousseau and Charles Montesquieu (Encyclopédie). Among famous encyclopedias of that time is Britannica with its three-volume edition published between 1768 and 1771 (while its 15[th] edition from 1984 has 32 volumes). With development of information technologies, traditional hard-copy encyclopedias are accompanied by electronic encyclopedia and for some of them hard-copy editions is not available anymore. However, apart from this technical difference, methodology of their compilation remained pretty much the same, meaning than a groups of selected individuals participate in their compilation, and it results in rather slow production time. For traditional encyclopedias it is difficult to follow all fast-occurring changes in different areas of science, arts, culture, politics, etc.

It seems that the new age of electronic communication on Internet, when users face a bulk of information coming from different sites, requires encyclopedias of better quality which would encompass and process all this information and keep up with time. This means that it is necessary to include more people in encyclopedia compilation. This is the idea that Wikipedia achieves due to the new wiki software and wiki technology.

Wikipedia originated from an idea to generate and systematize overall human knowledge in one place and to make it freely accessible to all people. Starting from the presumption that each individual has some knowledge and that all people know everything, it can be said that Wikipedia is a global project created by all people for all people. Wikipedia logo is a styled ball reminding of a globe, highlighting thus its nature of a global encyclopedia in different languages. The creation of Wikipedia is a never-ending process, because it is constantly progressing. The acting motto of Wikipedia is „Imagine a world in which every single person is given free access to the sum of all human knowledge – that's what we do".

3. MediaWiki software

From its foundation until early 2002, Wikipedia used UseModWiki when MediaWiki software was designed especially for Wikipedia. MediaWiki was written in PHP language. It is free software under GNU General Public License, meaning that it can be freely distributed and modified. It is used today by Wikipedia in all languages, and by all projects developed within Wikimedia Foundation. Some of the most popular Wiki projects include: Wiktionary, Wikibooks, Wikiquote, Wikisource, Wikispecies, Wikinews, Wikiversity, etc.

In addition to this, MediaWiki software is used by many other Internet sites that are not within Wikimedia Foundation, becoming thus a predominant software representative of Wiki technology. Since it is free software, it is frequently used for exchanging ideas and faster communication by small local communities engaged in joint project (Raman 2006). This was a basic idea of the first Wiki, produced by Ward Cunningham.

MediaWiki software is developed especially for Wikipedia, with an idea to use free software for free encyclopedia. It is still freely developing, and it is being localized in more than hundred languages. Stable version 1.13.2 as of October 2[nd] 2008 (MediaWiki) is currently used. Numerous programmers participate in its development by adding new options. For instance, its localized version for Serbian is improved by page display in both Serbian alphabets – Cyrillic and Latin (Vitas and Krstev 1999). Pages are stored in original script, while clicking on adequate button displays the page in the other script. However,

some parts of the texts are by their nature written only in one alphabet; for instance, Wikipedia remains always only in Latin. These text sections are enclosed in braces - {} - which excludes them from conversion and display them in unmodified form, that is in their original script. Page conversion is performed dynamicaly, on demand. This idea was implemented for the first time for Chinese texts, which can also be written in different manners.

For MediaWiki software localized for Serbian, the option for embedding support for ekavian and ijekavian pronunciation was also under consideration. However, it turned out to be too complicated and difficult to achieve, because it would mean that for every word differently pronounced the form in other pronunciation would have to be provided. The basic advantage of Wiki, its simplicity of usage, would thus be lost. The alternative would be to create a big table listing the equivalent words in Serbian ekavian and ijekavian pronunciation that could be consulted dynamically. However, even though the creation of such a table is possible, it is unknown how many errors due to homographs its usage would yield.

3.1. Some of MediaWiki software properties – simplicity

MediaWiki software is very simple to use. During page editing, text is bracketed with certain tags, similar to HTML, but with simpler syntax.

For instance, if it is necessary to make a hyperlink from a word, it should be bracketed with two square brackets, for instance, [[Ivo Andric]]. Headings are bracketed with two equal signs, for instance, ==Introduction==, and the next embedded level of headings with three equal signs on both sides, etc. The future page appearance may be previewed by simply clicking the „show preview" button.

MediaWiki enables display of multimedia contents, mainly images and sound material which are embedded into articles by using sim-

ple rules of wiki syntax. It is necessary to first send appropriate files to a wiki site for future embedding. All images sent to Wikipedia must be properly marked and with clear copyright status. Sending images with free license is encouraged, whilst rules for material protected by copyright are somewhat stricter.

The largest collection of free material is on Wikimedia Commons, which contains about 3,550,000 files, according to data from December 2nd 2008. These are predominantly images and sound files uploaded by the members of the wiki community under some of the free licenses, as well as images whose copyright expired. These files may be used on all Wikipedias and on other projects developed within Wikimedia.

3.2. Protection of contents

It is particularly important to present all mechanisms for protecting pages in MediaWiki software. These mechanisms enable all benevolent users to contribute to the contents, at the same time preventing misuse and vandalism on articles.

History of all edits is stored for each page. Edit history may help determine when a page was first created and who done it. Also, the list of all page versions is available, giving the time of their creation and name of the responsible creator. It is possible to access each version of the page, and to compare easily any two versions, because software enables simultaneous display of two versions side by side. Users with administrator (sysop) rights who monitor page modifications may restore a page to any previous version. This mechanism of preserving all page versions and possibility to restore any previous page, offers a high level of system protection against vandalism. This is of special importance for fully open wikis that can be modified by anyone, even unregistered visitors.

The best example to illustrate this is Wikipedia itself. As a fully free encyclopedia that anyone can edit, Wikipedia was a target of vandals

which endangered the very concept of Wikipedia and brought its existence into question. However, due to mechanism of preserving a page history with a possibility to restore any previous version, this danger was eliminated, and the system proved to function well in practice.

Another important security mechanism is page locking that prevents their modifications. Pages frequently exposed to vandalism, for instance, articles about political leaders in pre-election period, or articles about religious leaders and founders of religions, as well as about sensitive issues causing severe confrontation between two opposed fractions, may be protected from modification. According to the level of protection there are three types of pages: pages that can be modified by anyone (even unregistered users), pages that can be modified by registered users only and pages that can be modified only by administrators. By default, the level of page protection on Wikipedia is that anyone can modify them, while usually only small number of pages is protected from edits. The higher level of protection refers to pages that can be edited only by registered users, which are not completely new, i.e. time has passed since they have opened their account. The reason for introducing the novelty into MediaWiki software to treat users with newly opened accounts in the same way as unregistered users lies in the fact that account opening procedure is very simple and that vandals could easily avoid this type of page protection by registering. Vandals usually show their nature within the first days after registration and are immediately blocked. Third and the highest level of page protection imply that edits can be performed solely by administrators and it is used for pages that were mostly attacked in the past.

Locking page mechanism protects the current page contents, but since the basic idea of these wiki sites is to promote and develop pages, the page locking mechanism prevents the benevolent users from contributing to the quality of the articles. This problem is resolved with talk pages attached to each Wikipedia article, and on wiki sites in general, which enable opening of a debate about given page in order to give suggestions and reach acceptable formulation through discussion. There is a clear distinction between a talk page for discussing an article and an encyclopedia article. A talk page may be used to suggest a modification of pages that are locked for all users except administrators. Similarly to articles, page history and all previous versions are stored for talk pages. These pages can also be locked if needed, but administrator interventions on talk pages are usually very rare and are mostly related to removing inappropriate, offensive content. Once a talk page develops, its content is usually archived and a hyperlink is established towards archived versions.

Should an individual persist with vandal intrusions on a large number of pages, page locking is not an efficient solution. In this situation, the third level of protection is used: blocking the user. Administrators on Wikipedia and other MediaWiki sites have a right to block a user, that is, an IP address of an individual causing damage to the project. Upon blocking, a reason for it and its duration, which may be indefinite, are stated. Administrator may unblock a user or an IP address prior to the block expiration.

In order to discover vandal intrusions and, in general, to have an insight into site updates, a list of recent changes is maintained. This list provides information about pages that have been modified, and who has modified them and it is chronologically arranged in time descending order. MediaWiki software introduced possibility to patrol pages. Patrol is performed by administrators who verify edited pages and mark them as such. Patrolling right may be assigned to users without administrator status, who earned trust of the community and administrators with their prior work. Marking modification as verified avoids unnecessary double verification of each edit.

All named mechanisms help in maintenance and proper functioning of Wiki sites without endangering basic principle of freedom.

There are Wikis where each visitor can open a new account and others where only administrators can do that. This closed-type wikis usually allow only registered users to edit pages.

3.3. Level of users

Although all those participating in a work related to a Wiki site are equal, there is some sort of user hierarchy. There are: unregistered user, registered user, administrator, bureaucrat and bot.

Some sites require mandatory registration, and some, like Wikipedia registration is not mandatory, but it is recommended, because when users are registered it is easier to follow what type of edits were done and who made them. In addition to this, registration facilitates communication between users. In order to prevent misuse, several days upon registration newly registered users do not have the same rights as registered users.

Administrators have a possibility to delete pages, block users, also to change interface, that is, to modify system messages. Administrators are often selected from more experienced users entrusted by the community. The next level of hierarchy is bureaucrats who, compared to administrators, may assign both administrator and bureaucrat rights.

A word bot is derived from robot and it refers to a program script often usually written in Python language. Their purpose is to perform some systematic tasks, like page categorization, spell checking and similar.

3.4. Namespaces and sub pages

One of important properties of wiki software is namespaces. In addition to main namespace for which no prefix exists, there are other namespaces which depends on particular wiki's requirements. For instance, Wikipedia contains the following name fields: User, File, Wikipedia, Help, MediaWiki, Template, Category and Portal. All of these namespaces have respective talk namespaces, because talk pages are included not only in main namespace, but in other namespaces as well. Full page name, therefore consists of the namespace, followed by a colon :, and then by a page name within this namespace. For instance, Wikipedia:Notability is a page named Notability within the Wikipedia namespace. For each namespace administrators assign certain purpose which facilitates the use of content.

In addition to namespaces, wiki sites may have subpages. They usually have shorter names and a path to a subpage is obtained by adding slash / and a name of the subpage to a page path. Subpages are often used for archiving talk pages, for instance, Talk:Cosmos/1.

3.5. Support for mathematic equations

We can add something about other useful properties of MediaWiki software to the things already mentioned. One of them is a good support to displaying mathematic equations. This is done by integrating a TeX subset for mathematic equations into MediaWiki software (Maric, 2006). Equations and mathematic expressions can be written using standardized syntax well known to mathematicians. For instance, the expression for the area of a circle is written as `<math> P = \pi r^2 </math>`. The tag for mathematic equations is `<math>` within which it is allowed to use TeX notation usually bracketed within $ and $ signs. This extension enables wiki sites to be successfully used for writing mathematical, physics and technical texts, in general, as well as any other texts that contain equations of great complexity, using, for instance, fractions, integrals, square roots and similar.

MediaWiki software is very suitable for adding various extensions. One of the best known extensions is Semantic MediaWiki (Schaffert et al. 2006). Semantic MediaWiki allows semantic text annotation; for instance, in article about Berlin, it can be written: *... is the capital of [[Is capital of::Germany]] ... its population is [[population::3,993,933]]*. This enables semantic search and information processing.

Sites based on MediaWiki, like Wikipedia, are considered to be Web 2.0, i.e. the second generation Web (Aharony 2008).

4. Local wikis

In addition to Wikipedia which became a global phenomenon, there are other types of wikis as well. Local wikis formed by organizations or groups of people engaged in joint work or project are particularly important. These are usually wikis of faculties or some other institutions. Development of local wikis has a huge perspective, because it is foreseen that in near future, this will be a dominant form for any type of joint work, especially as these wikis are defended by different protective mechanisms which makes them accessible only to verified users from the group.

Suggestions were made that in the future sites of local autonomies will be organized in the frame of e-Government on the local wiki principles (Wagner et al., 2006). In addition to organizations and local autonomies, there are also wiki sites categorized by topics. One of the oldest sites of this type in Serbian is a fan site of J.R.R. Tolkien. The number of this type of wiki sites is constantly rising. These wiki sites are not organized on local principles, determined by organization or territory but are rather based on a specific topic. In this sense, they represent specialized encyclopedias as opposed to Wikipedia, which is a general type encyclopedia. This concept is somewhat similar to user groups that were once a popular service on Internet.

One of the important properties of local wikis is that their pages may be exported to Wikipedia. When one page is exported, its edit history is exported with it. In general, import and export of pages is possible between any two wikis if versions of their MediaWiki software are compatible.

5. Importance of wiki

Wikipedia in English is the largest encyclopedia in terms of words (over a billion), characters (over a three and a half billion) and number of articles (over 2 millions). The second largest is Chinese encyclopedia "*Siqu Quanshu*" from 1782, representing a collection of Chinese history books with 800 million words. It is followed by "*Yongle Encyclopedia*", Chinese general encyclopedia from 1403-1408, containing about 330 million words and about 770 million characters. The fourth largest is „*Enciclopedia universal ilustrada europeo-americana*" (also called *Enciclopedia Espasa*) in Spanish from 1933 with about 200 million words, a billion characters and over a million entries. The ninth ranked encyclopedia in terms of volume is Britannica with 44 million words in its printed edition from 2002, whilst its Internet edition has 55 million words. Britannica is the second largest encyclopedia in English, following Wikipedia (Size comparisons.).

The fact that the largest world encyclopedia is written based on wiki principle and that there are many local wikis confirms the social importance of wiki sites and speaks about the effect that wiki technologies have on all other technologies present on the Web.

The whole wiki environment may be roughly divided into three streams: the first is wiki software (for instance, MediaWiki), the second is wiki sites or products (for instance, Wikipedia), and the third is a community of people supporting all of that, and taking care of proper functioning (for Wikipedia and related projects, it is Wikimedia).

Wikimedia Foundation was established on June 20[th] 2003. Its local branches were created shortly afterwards. Wikimedia Serbia and Montenegro was established as fifth local branch on December 3[rd] 2005, subsequently renamed to Wikimedia Serbia.

Wiki technology is an important new technology for both high school and university population (Raman et al. 2005). It is the best possible way for students to understand Web 2.0 (Parker 2007). The use of Wikipedia in education is still an insufficiently studied topic. Students in

Serbia have been thought to use and contribute to Wikipedia by writing their papers in form of Wikipedia articles. In spring of 2007, students of two faculties, Faculty of Philology and Faculty of Physical Chemistry, University of Belgrade wrote for Wikipedia in scope of their regular tasks. The first students in Serbia to write their papers for Wikipedia were students of Faculty of Philology, in scope of the subject "Internet and Web technology" led by Prof. Cvetana Krstev.

6. Conclusion

Wiki technology is one of the latest Internet technologies on which vast number of Internet sites is based. It enables each visitor to the site to contribute to its contents. MediaWiki, written in 2002 for Wikipedia, has special place among other pieces of wiki software. Wikipedia became the largest encyclopedia of our time, foremost due to the wiki concept and MediaWiki software which enabled its realization. In addition to Wikipedia, all other projects within Wikimedia Foundation are based on MediaWiki software as well. Free MediaWiki software is the most popular software for development of wikis, becoming dominant Wiki technology software.

MediaWiki software, localized in over hundred languages and being continuously developed, has a wide range of applications on local wiki sites. In addition to this, it is being used in education to familiarize students with Web 2.0.

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