

ROMAN MACHUGA

ORCID ID: <https://orcid.org/0000-0002-5333-494X>

roman.machuga@uwm.edu.pl

The Use of Cloud Computing to Organize Group Work in Real Time

Zastosowanie chmur obliczeniowych do organizacji pracy grupowej w czasie rzeczywistym

Keywords: cloud computing; group work; dispersed team; information management; communication

Słowa kluczowe: chmura obliczeniowa; praca grupowa; zespół rozproszony; zarządzanie informacją; komunikacja

JEL code: L86; D83; M15

Introduction

Over the last few years, there has been a rapid development of various information and communication technologies. These have been extended to different areas, including economy, science, transport, health care, sociology, etc. Modern computers and information and communication technologies are used to manage production processes, support decision-making to manage information and information processes, and organize databases and remote work, as well as to operate various offices. Increasingly, different software and services are being used to perform the above-mentioned tasks (platforms) accessed online via the Internet [Machuga, 2017, p. 109].

Nowadays, it is virtually impossible to run any office or organization where such tasks and processes are carried out. Such tasks cover, among others, the collection and drawing up of documentation, preparing reports and financial service operations,

strategic and operational planning (management), designing products, undertakings and operations, handling correspondence, etc.

Moreover, different information processes are conducted in offices, especially processes connected with information management, including generating, gathering and processing (filtration, sorting, grouping) information; storage, sharing and providing access upon request; and interpretation and utilization. The described tasks of office staff and office processes are typical not only of physically existing enterprises but also of virtual organizations. A virtual organization is created due to the application of modern information technologies and global IT systems. As a rule, such an organization has no typical physical construction, i.e. buildings, offices, normative acts, etc. [Niedźwiedzińska, 2003, p. 208]. "(...) a virtual organization is made up of temporarily created network of independent entities joined via electronic computer net (...). Such an organization is large geographically and, for cooperation, it utilizes modern IT technology" [Wallis, 2015, p. 107].

In such an organization, the office work of a team or individual employee is performed remotely. An employee is given access to various documents and files via computer networks pursuant to applicable law (editing or reading only). Obviously, this kind of work has both advantages and disadvantages. For instance, "(...) a remote employee means reduction of costs. The employer does not have to organize a workplace for him on the company's premises or provide equipment" [*Praca zdalna...*, 2018]. There are also benefits from the point of view of an employee: he/she can work at any place, and may save time allocated for commuting, etc. On the other hand, there are also drawbacks to such work. The employer cannot be 100% certain what their employee is busy working on at a specific time. Besides, remote work requires high self-discipline from employees [*Praca zdalna...*, 2018].

It is frequently the case in an organization that there is a need to organize joint work on some kind of document or file. It is then referred to as group work or team work. Every group created possesses features such as, among others, a method of participation and taking decisions, methods of communications, methods of work and an organizational structure. Such groups are created to realize a common objective [*Praca zespołowa...*]. With reference to groups working reportedly, one can say about dispersed teams. Challenges faced by those managing such teams were described in considerable detail in the online publication [*Zarządzanie zespołem...*, 2018].

In virtual organizations, organizing group work (team) is connected with some problems. For example, employees may not always work remotely at the same time, which may result from the fact that some staff members are located in different countries. In this event, companies often send an authentic version of a given document (file) *via* e-mail to all the work performers. Each of them at a given time works on their part of the document and sends it back to the coordinator. Another problem then arises – compiling various parts of the document into one file. Quite often, this is done in an ineffective manner, through "copy and paste". The worst aspect to this approach is the fact that if the need for edition or adjustment of the first version of the

common document arises, it has to be sent back once again to the same employees for further adjustments or corrections. Then, unfortunately, the process of sending back as well as “copy-paste” may be repeated a few times. In such situations, arranging work in real time seems the best solution to the problem.

Yet another problem in the case of remote group work is that of checking the edition of a document (file) by different users, as well as the possibility, when necessary, of restoring its different versions. It is difficult to realize this and, in fact, impossible without using specialized software or website services.

It is at least equally important to organize communication in real time between persons working together on a document (file). There are different ways of providing such communication, including utilizing mobile networks, instant messengers or professional software. These generate additional losses for an enterprise as well as create some difficulty in securing information flow. Cloud computing and the websites it offers might be one possible solution to the above-mentioned problems.

The aim of this paper is to justify the possibilities of the effective application of cloud computing and the websites it offers to group working in real time.

1. Technologies of cloud computing and its current level of use

The concept of cloud computing is very broad; treated by scientists ambiguously, it is often associated directly with the concept of virtualization. There are various definitions of cloud computing. For example: “Cloud computing is an external virtual space where data are recorded” [*Przedsiębiorca w chmurze...*, 2016] or “a service of giving remote access to calculation power of IT devices provided by external entities which is available at request at any time and scaling when required” [*Chmura obliczeniowa – definicja...*, 2014]. All existing and widely used definitions share one feature, i.e. “(...) access to various services, software, computing power, disc space is done remotely (via the Internet)” [Machuga, 2017, p. 110].

At present, technologies and websites offered by cloud computing are utilized by different enterprises, organizations and individual users. They may be used for the following purposes:

- remote use of computer calculation power;
- storage of various information;
- use of professional software in online mode, e.g. accounting, office CRM system;
- access to and dissemination of information to an unlimited number of users in compliance with their individual access rights;
- using e-mail services, calendar, contact management;
- hosting and database service, etc.

The interest in cloud computing and its use in the economy and by individual users is growing year on year. Periodically, different EU institutions conduct research

with the aim of analysing the utilization of cloud computing as well as possible trends in their application and development; for instance, the findings of the main research carried out by the Directorate General for Internal Policies of EU in 2012 (through the Policy Department A: Economic and Scientific Policies) [*Chmury obliczeniowe. Ekspertyza*, 2012]. After two years, other research conducted and published by the European Parliamentary Research Service, revealed a growing interest in cloud computing and its application by companies and individual users in different EU countries [*Potential and Impacts...*, 2014].

The increasing popularity of cloud computing is also proved by the data collected and published on a regular basis by the main providers of statistical information, both in Poland and the European Union – the Main Statistical Office¹ and Eurostat². According to Eurostat data, every year in Poland, the percentage of companies using different cloud computing services is on the rise. In the years 2014–2016, this increase was 1% per year, i.e. 6%–8% (for comparison, in Finland, the same indicator for the same period increased from 51% up to 57%) [*Cloud computing services*, 2017]. In addition, it is worth noting that figures of the Main Statistical Office in Poland show that the percentage of companies using cloud computing services in 2017 increased by another 2% (compared to 2016) and is now at 10% [*Spoleczeństwo informacyjne...*, 2017, p. 2]. According to updated data from Eurostat, the same indicator for Finland in 2017 (compared to 2016) increased by 9% and was as high as 66% [*Cloud computing services*, 2018]. This provides clear evidence that there is increasing interest in the potential of cloud computing services and their practical applications.

Further confirmation of the growth in the interest in cloud computing is the trend identified by Google, which shows an increase in the search for information on “cloud computing” in the years 2008–2018 [*Chmura obliczeniowa – Odkrywaj...*].

Taking into account the above, the application of cloud computing to the organization of group work of office workers is up to date and in line with current trends, and may be an effective solution to the discussed problems.

2. Organizational tools of group work

The problems of team work organization have been around for a long time. They also refer to office work and to joint work with information in the form of documents and files, in particular. These are mostly problems connected with the control of access rights to documents, management of their different versions, simultaneous file edition by different users, synchronization of documents by different employees working with different devices, and communication in real time between cooperating

¹ Main Statistical Office, <http://stat.gov.pl> [access: 9.09.2018].

² Home – Eurostat, <http://ec.europa.eu/eurostat> [access: 9.09.2018].

persons, etc. Along with the possibility of remote group work, in real time, the solution to these problems is an increasingly urgent and significant aspect of management.

To solve these problems, there are different approaches available and applied in companies and organizations; among others, specialized or universal, free of charge or commercial software, local application available *via* the Internet, telecommunication or Internet resources. Each organization selects their most effective or simply available tools for shared work on documents.

The tools that might be used for group work online have been broadly discussed as early as 2011 [Wyroślak, 2011, pp. 53–63]. Since then, the services and their potential as discussed in this paper have changed significantly. For example, the already outdated product Windows Live SkyDrive has been developed and changed into an integrated cloud OneDrive service; a set of Google Documents tools has been modified several times; and HyperOffice³ and Zoho⁴ services have been changed fundamentally. Just as the development of information and communications technologies is rapid, approaches to solutions of management problems are also subject to change, including team work on documents in real time.

At present, the most popular organizational tools of such work are as follows:

- version control systems (files, documents);
- workflow systems;
- applications (packages) online;
- cloud computing.

Version control systems are systems to store and control the access to files, following the modification of documents and their history of changes, work organization in the Distributed Computing Environment (DEC), etc. [Potiopa, 2016]. “Workflow Systems were created to manage effectively business processes” [*System Workflow...*]. Such systems have at their disposal a built-in client of electronic mail, specialized communicator, calendar and the possibility of various comments, which makes the debate and exchange of views on files and other facilities possible [*System pracy grupowej...*].

Modern Internet applications, available online, are currently most often suggested for download as part of the available services offered by cloud computing. At present, the most popular ones are Google Drive, Dropbox, OneDrive and MegaBox. Each of these offer their users a number of various services and applications. They may be free of charge or require payment, depending on their options and the access to specialized services.

The use of cloud computing in the organization of group work in real time will allow the above-mentioned problems to be solved. The characteristic qualities of a large part of cloud computing are, among others, the following:

³ <https://www.hyperoffice.com> [access: 9.09.2018].

⁴ <https://accounts.zoho.com/u/h#home> [access: 9.09.2018].

- “(...) the possibility of remote work independently of the workplace of an employee;
- the possibility of organizing a «virtual office» with no need to have a separate room and the presence of all the employees «under one roof»;
- the solution to the problem of different versions of shared documents that are to be processed by a few employees, automatic updating of implemented changes;
- a wide range of opportunities to manage the access rights of users to information (files) necessary for their work;
- ongoing storage of access to documents and total recording of changes introduced by users” [Machuga, 2016, p. 182].

Apart from the mentioned common features of cloud computing, Google Drive also offers its users the following options for group work in real time:

- providing documents (files) exclusively for registered employees (holding a Google account) – excluding the risk of editing documents by not registered persons;
- providing documents with various access rights (“edit”, “comment” and “display”);
- “visibility” (in colour) for all cooperative employees working on the document online which allows for ongoing document versioning of changes introduced by particular persons;
- recording total history of all the changes in the document and the possibility of returning it in any version since its creation to the owner;
- organizing interactive chat between those working on the document directly in the viewport.

OneDrive cloud actually offers their clients similar possibilities, providing for the provision of files for joint work between Microsoft users. An extra benefit is that OneDrive is wholly integrated with MS Office (starting with the 2013 version).

In the Dropbox service, there is an additional option to manage files, i.e. a possibility of recovering files and version histories⁵ (a cloud stores removed documents that may be displayed at request and recovered when needed). Equally important is the fact that document provision through the Dropbox cloud takes place in any e-mail box, and also in the e-mails of non-registered persons. The fact that files may be made available with the right to edition only in folders with the same authorization, offers an additional way to secure data.

One shared asset of Google Drive, OneDrive and Dropbox is a local application ready to download that may be installed onto an unlimited number of stationary and mobile devices. Its main function is to synchronize selected files with a cloud and other devices. Such applications after installation work at the back, do not need

⁵ In the free version of Dropbox (“Basic”), file recovery is possible within 30 days, and in “Professional” (or “For teams”) versions – within 120 days.

additional activities on the part of an employee. Their main characteristic is that with updates of any file, they display a short message with current information on introduced changes.

Most of the described assets of cloud computing are available even when used free of charge. If the use of cloud services requires payment (“business”, “professional” accounts, etc.), cloud computing offers their users a number of additional possibilities, especially related to group work in real time. These include, among others, additional securing of information from loss, extended time for recovering removed files, unlimited storage space for information and extended technical support, etc.

Conclusions

The following conclusions can be made based on the research:

- the organization of group work with documents in real time is connected with performing various tasks including provision of information, access right management, document versioning and ongoing communication with the team, etc.;
- cloud computing may be used for the effective organization of the remote group work of office workers in real time;
- cloud computing services that require payment offer users additional possibilities in terms of the management of their own information in the cloud.

Further research in this area may involve, e.g. building up a model of information management based on the use of cloud computing, and the identification and analysis of factors influencing the effective applications of cloud computing for information management.

References

- Chmura obliczeniowa – definicja, rodzaje i warstwy*, 2014, <http://sicd.pl/teoria/chmura-obliczeniowa/> [access: 9.09.2018].
- Chmura obliczeniowa – Odkrywaj – Trendy Google*, https://trends.google.pl/trends/explore?-date=2008-07-08%202018-09-07&geo=PL&q=%2Fm%2F02y_9m3 [access: 9.09.2018].
- Chmury obliczeniowe. Ekspertyza*. Dykcja Generalna ds. Polityki Wewnętrznej Unii Europejskiej, Departament Tematyczny A: Polityka Gospodarcza i Naukowa, 2012, [http://www.europarl.europa.eu/RegData/etudes/etudes/join/2012/475104/IPOL-IMCO_ET\(2012\)475104_PL.pdf](http://www.europarl.europa.eu/RegData/etudes/etudes/join/2012/475104/IPOL-IMCO_ET(2012)475104_PL.pdf) [access: 9.09.2018].
- Cloud computing services*, 2017, http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=isoc_cicce_use&lang=en [access: 9.11.2017].
- Cloud computing services*, 2018, http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=isoc_cicce_use&lang=en [access: 9.09.2018].
- Eurostat, <http://ec.europa.eu/eurostat> [access: 9.09.2018].
- <https://www.hyperoffice.com/> [access: 9.09.2018].
- <https://accounts.zoho.com/u/h#home> [access: 9.09.2018].

- Machuga, R., *Możliwości zarządzania informacjami przez wirtualne przestrzenie obliczeniowe*, [in:] E. Skrzypek, G. Grela, M. Hofman (red.), *Powiązania organizacyjne w społeczeństwie sieciowym*, Katedra Zarządzania Jakością i Wiedzą. Wydział Ekonomiczny UMCS, Lublin 2016.
- Machuga, R., *Wykorzystanie chmur obliczeniowych w Polsce i w państwach Unii Europejskiej: analiza porównawcza*, „Informatyka Ekonomiczna” 2017, Vol. 4(46),
DOI: <http://dx.doi.org/10.15611/ie.2017.4.09>.
- Main Statistical Office, <http://stat.gov.pl> [access: 9.09.2018].
- Niedźwiedzińska, H., *Wirtualizacja jako aktualny trend rozwoju biznesu*, „Acta Universitatis Lodzianae. Folia Oeconomica” 2003, Vol. 167, <http://repozytorium.uni.lodz.pl:8080/xmlui/bitstream/handle/11089/7050/201-210.pdf?sequence=1&isallowed=y> [access: 9.09.2018].
- Potential and Impacts of Cloud Computing Services and Social Network Websites*, Science and Technology Options Assessment, January 2014, [http://www.europarl.europa.eu/RegData/etudes/etudes/join/2014/513546/IPOL-JOIN_ET\(2014\)513546_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/etudes/join/2014/513546/IPOL-JOIN_ET(2014)513546_EN.pdf) [access: 9.09.2018].
- Potiopa, P., *Systemy kontroli wersji (VCS) – Git, SVN, CVS, Mercurial, Bazaar – który wybrać?*, 9 July 2016, <https://www.ispro.pl/systemy-kontroli-wersji-vcs-git-svn-cvs-mercurial-bazaar-ktory-wybrac/> [access: 9.09.2018].
- Praca zdalna – jakie są jej wady i zalety?*, 18 January 2018, <https://poradnikprzedsiębiorcy.pl/-praca-zdalna-za-i-przeciw> [access: 20.08.2018].
- Praca zespołowa*, [in:] *Encyklopedia Zarządzania*, https://mfiles.pl/pl/index.php/Praca_zespołowa [access: 20.08.2018].
- Przedsiębiorca w chmurze obliczeniowej*, 29 July 2016, <http://poradnik.wfirma.pl/-przedsiębiorca-w-chmurze-obliczeniowej> [access: 9.09.2018].
- Spoleczeństwo informacyjne w Polsce w 2017 r.* Główny Urząd Statystyczny, Warszawa, 20 October 2017, http://stat.gov.pl/files/gfx/portalinformacyjny/pl/defaultaktualnosci/5497/2/7/1/spoleczenstwo_informacyjne_w_polsce_w_2017.pdf [access: 9.09.2018].
- System pracy grupowej – eDokumenty. Elektroniczny system obiegu dokumentów, workflow i CRM*, <https://edokumenty.eu/zarządzanie-zespołem/> [access: 9.09.2018].
- System Workflow – Elektroniczny obieg dokumentów i optymalizacja procesów biznesowych*, OneClick, <http://www.oneclick-workflow.pl/system-workflow/> [access: 9.09.2018].
- Wallis, A., *E-zarządzanie współczesnym przedsiębiorstwem*, „Acta Universitatis Nicolai Copernici. Zarządzanie” 2015, nr 3, http://apcz.umk.pl/czasopisma/index.php/AUNC_ZARZ/article/view/AUNC_ZARZ.2015.036 [access: 20.08.2018], **DOI: http://dx.doi.org/10.12775/AUNC_ZARZ.2015.036**.
- Wyroślak, K., *Narzędzia umożliwiające pracę nad dokumentami w czasie rzeczywistym w tym m.in. EPUAP. Materiały szkoleniowe do bloku C*, 2011, <https://zasobyip2.ore.edu.pl/pl/publications/download/174> [access: 20.08.2018].
- Zarządzanie zespołem rozproszonym – wyzwania i dobre praktyki*, 27 January 2018, <http://informatyka-wfirmie.pl/systemy-informacyjne/praca-zespołowa/160-zarządzanie-zespołem-rozproszonym-wyzwania-i-dobre-praktyki> [access: 20.08.2018].

Zastosowanie chmur obliczeniowych do organizacji pracy grupowej w czasie rzeczywistym

Celem artykułu było uzasadnienie możliwości efektywnego wykorzystania chmur obliczeniowych i oferowanych przez nie serwisów do organizowania pracy grupowej pracowników biurowych w czasie rzeczywistym. W opracowaniu wskazano zalety zastosowania chmur obliczeniowych w zarządzaniu informacjami, określono obecny stan ich wykorzystania oraz uzasadniono korzyści i możliwości chmur obliczeniowych w organizowaniu pracy z dokumentami w trybie online. We wnioskach zamieszczono możliwe kierunki dalszych badań.

The Use of Cloud Computing to Organize Group Work in Real Time

The purpose of the article was to justify the possibility of the effective use of cloud computing and the services it offers to organize the group work of office workers in real time. The article presented the advantages of using cloud computing to manage information. The current state of their use was determined, and the benefits and possibilities of cloud computing when organizing work with documents online were outlined. The conclusions set out possible directions for further research.