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CLOUD COMPUTING AS INFORMATION TECHNOLOGY PROSUMPTION ENVIRONMENT

Introduction

Innovation can be seen as a management activity, which involves focusing on the organization's mission, searching for unique opportunities, determining whether they fit the organization's strategic directions. Innovators are expected to deliver something new − new products, new processes and new designs, which create change in goods as in lifecycles. The creativity in innovations adds value to the individuals and the communities and is based upon perceiving and capturing an opportunity. Tidd and Bessant consider four types of innovations:

1. Product innovation − changes in the products or services that a business organization offers.
2. Process innovation − changes in the ways in which they are created and delivered.
3. Position innovation − changes in the context in which the products and services are introduced.
4. Paradigm innovation − changes in the underlying mental models which frame what the business organization does [TiBe11].

However, this paper focuses on information technology (IT) user as innovator. The paper consists of four subchapters. At first, the innovative role of IT users is discussed. Next, the cloud computing for end-users is presented in the aspects of benefits and limitations. The third subchapter covers the review of software application distributed in clouds for individuals and small business companies. The last part includes the cloud computing architecture model, where the role of end-user is emphasized.

IT user as innovator

IT innovation, as any innovation, demands the co-evolution and co-existence of the information technology invention and the socio-economic activity of any institution. The object of IT innovation does not stand alone, but is set in the cultural and business practices, social values and interests. Innovation research has emphasized the importance of understanding user needs in the process of new product development. However, it is not sufficient to understand or even satisfy existing users, but rather it is necessary to lead existing users and create new user segments. Therefore, companies could be interested in IT user involvement in production or service delivery process. IT users are able to support companies to change their image, reduce research and development costs, differentiate offers, reduce the time to market, facilitate user education, improve market acceptance or even to provide more original and valuable proposals than professional developers. General classification of IT users covers lead users, normal users and user communities [BHvH06]. Lead users are critical to the development and adoption of complex products. They demand innovation ahead of the general market of other users. They face needs that will be the future trends in the market place and they are actively engaged in the innovative process. Normal users could help to provide superior and differentiated services, reduce cycle time, increase acceptance of the new service. Communities are treated as a decentralized virtual design teams, as designers and as a source of innovations.

Users as innovators seek to develop new designs for their own personal usage or (in the case of user firms) internal corporate benefits. They do not anticipate selling goods or services based on their innovations, although they may later go into business as manufacturers. Designing for users and testing by users are the essential characteristics of users as innovators, they may subcontract production and parts supply, but they cannot outsource the innovation's conceptualization and design. Particularly in e-economy, it is visible that focus on users instead of customers is necessary. Users are customers, job candidates, business prospects and partners, brand fans, media agency members and other stakeholders, who interact with a company through digital media and technology. The interactivity is realized in Internet, through mobile applications, a Web site, customer relationship management software, the Facebook page or Twitter account. Usually, users want simplicity of IT solutions and intuitive software applications. When people find something difficult or confusing to use, they do not blame the software producer, but they blame themselves and reject that way of using and cancel the entire experience. Therefore, the companies must work on the im-

provement of usability to provide users an easy products, to satisfy the users with their experiences. User-centric management is a philosophy and approach to business management that puts users first in all decision making [Shap11]. Users benefit from their positive experience that fulfils personal needs and interests. However, there is a risk that the user involvement in the design process will never be properly rewarded and an organization will fail to provide a positive user experience, so the negative consequences can occur such as negative publicity and loss of user engagement. So, only through social interactions, perceived dialogue online and social accessibility and transparency the value can be co-created. Some initiatives have involved professional staff, others build on communities of practitioners and rely on their voluntary work. There are a couple of models of open collaboration.

− user-producer model: centralized model; although real costs can be met with resources other than money, most initiatives need to raise some capital,
− co-production model: equal participation of software application developer and users,
− replacement model: open (i.e. provided by user) content replaces other uses and benefits from cost savings,
− foundation, donation or endowment model, in which funding for the project is provided by external actors,
− segmentation model, in which provider offers value-added services to user segments and charges them for these services,
− conversion model, in which "you give something away for free and then convert the consumer to a paying client",
− membership model, based on fund-raising campaigns or paying members [GKfF11].

For many years, mass production and product customization were business strategies that aimed at fulfilling individual needs quickly and efficiently. However, concepts such as customer orientation, user-centered design, customer segmentation, customer relationship management, user-centric management reveal the importance of the user involvement. The separation of production and consumption cannot imply that consumer is a passive recipient, but they should be considered as creative actors. Consumers can act as resource integrators, when they use their competence, tools, raw materials and sometimes professional services to produce maintenance services, entertainment, meals for themselves. Prosumption implies that buyers manufacture products for their own consumption. Although most contributions in marketing to date have been consistent with the goods-dominant logic view of consumers as passive buyers of what others produce, there is a growing body of challenging this rather limited perspective.

Cloud computing opportunities

The prime revolutionary aspect of cloud computing (CC) is its ability to deploy location-independent services. The main challenge includes managing various infrastructures across multiple organizations consisting of frameworks that now include self-healing, self-monitoring and automatic reconfiguring of mission-critical applications [CAAS10]. CC services compris of three parts:
− basic infrastructure services that frequently provide remote storage, hosting, firewall services, identity services, backup services and so forth,
− platform software including various support functions such as standard libraries, storage, portal servers, development tools,
− service-oriented applications that exist primarily to provide services to users, but are also accessible by other applications or application platforms.

CC users include individuals or organizations who interact through cloud services and provide services on the cloud. They may supply information or non-technical services to their target customer communities for profit or non-profit activities (e.g. online legal consultants or blog authors). These users have an interest to monitor clouds for where their customers are connected. CC services offer the following opportunities:
− service-orientation: CC services are delivered over the Internet; the service components are modular, pluggable, composable, standardized, and loosely coupled,
− resource pooling: service virtualization facilitates shared resources and costs among a large pool of supply chains, it supports a multi-tenancy environment and allows for centralization of infrastructure for lower operational costs,
− centralization vs. federation: cloud configurations can be deployed to a centralized organization or be distributed among different locations that demand a certain degree of collaboration,
− security: CC technology provides infrastructure level oversight of security; although a cloud can enforce stronger endpoint security and better data protection, the sharing environment is vulnerable due to its open nature.

The other benefits of CC cover on-demand self-servicing without the need for interaction with cloud service provider personnel, broad network access to IT resources in the cloud, rapid elasticity and measurement of provided services, low costs of computing, high quality of service, simplified maintenance and upgrading, outsourced IT management, and low barriers to entry.

Cloud computing marketspace for individuals

Current trends in professional life, education and also in leisure time are characterized by increasing change and diversity. The diversity concerns people with different skills, knowledge, cultural background, and cognitive or psychological abilities, as well as diversity related to different tasks, contexts, and areas of work. End users are generally neither skilled nor interested in adopting their systems at the same level as software professionals. However, it is very desirable to empower users to adapt systems at a level of complexity that is appropriate to their individual skills and situations. Today, the focus is on the process of outsourcing to the customer with the help of the Web 2.0. Typical examples cover:
− product configuration, mass customization (e.g. Dell),
− product development, design, idea finding (e.g. Dell Idea Storm),
− innovation and design contests (e.g. Starbucks Idea),
− product rating (e.g. Amazon),
− internet-mediated self-service (e.g. buying rail or airline tickets),
− platforms for user-generated content or user activities (e.g. YouTube, eBay) [RiVo10].

The origins of Web-based consumer-generated content emerged out the rise of so-called Web 2.0. Participatory media formats like blogs, wikis, mashups, multiplayer video games, video hosting and social network sites are all developed out of the interactive and open architecture as well as of social software technologies that allow users to create, remix, and redistribute content traditionally owned and controlled by corporate organizations and the established culture industries. In the new model, prosumption includes iterative and non-linear practices of users and new media exploitation by them allowing them to be simultaneously producers and consumers in the act of creating, re-mixing and redistributing media texts, content, information and knowledge in participatory Web cultures. The new information technologies are expected to create the potential to overcome the traditional division between users and the individuals responsible for developing, operating and maintaining systems. Perhaps, a challenge for the next years will be the development of the computing environments that allow for the transposition from easy-to-use to easy-to-develop interactive software systems.

According to Lieberman et al. end-user development (EUD) can be defined as a set of methods, techniques and tools that allow users, who are acting as non-professional software developers, at some point to create, modify or extend any software artifacts [LPKW06]. Some forms of EUD are well known for years as

developed for commercial software companies e.g. recording macros in word processors, setting up spreadsheets for calculations and defining email filters. However, active users are highly differentiated, so the common categories of them are as follows:

− environment: personal (home) user or worker (corporate, organizational, enterprise) user,
− skill level: novice, semiskilled, expert using specialized software,
− frequency of use: occasional, frequent or extensive,
− software use: word processing, email, accounting, etc.,
− IT education level: basic, intermediate, advanced (i.e. having special software certificate e.g. SPSS),
− relationship: internal user (co-worker), external user (client).

   Clouds satisfy different types of users:

− end users, who mainly use the services of the software as a service (SaaS) layer over a Web browser and basic offerings of the infrastructure as a service (IaaS) layer as for example storage of data resulting from the usage of the SaaS layer,
− business users, who might access all three layers: the IaaS in order to enhance their own infrastructure with additional resources on demand: the platform as a service (PaaS) layer in order to be able to run own applications in a cloud and eventually the SaaS layer in order to take advantage of available applications offered as a service,
− developers and independent software vendors, who develop applications that are supposed to be offered over the SaaS layer of a cloud,
− end-user as a hardware provider; the resources can be specialized hardware dedicated only to run the cloud applications or equipment that is used for other applications, such as desktop computers [SSWo10].

   A private cloud is fully owned by a single company who has total control over the applications run on the infrastructure. A public cloud includes date centre hardware and software run by the third parties, e.g. Google and Amazon which expose their services to customers via the Internet. Through the cloud market, service providers have possibilities to define and customize the software service offers in a personalized way for each user by selecting the most appropriate services from the available repositories. Well known companies, i.e. Amazon, Google, IBM, Salesforce.com offer tools for cloud service developers. There are also a number of smaller companies working in this domain, e.g.:

− 10gen (www.10gen.com), which provides a platform for developers to build scalable web-based applications,

− Cohesive Flexible Technologies (www.cohesiveft.com), which offers the Elastic Server On-Demand virtual server platform,
− Joyent (www.joyent.com), which delivers the Accelerator scalable on-demand infrastructure for web application developers, as well as the Connector suite of easy-to-use web applications for small businesses.

CC applications for personal usage are to improve communications among family members, for example a web-based email service, such as Google's Gmail (mail.google.com), Microsoft Windows Live Hotmail (mail.live.com), and Yahoo!Mail (mail.yahoo.com). Collaborating on schedules is enabled through the use of a web-based calendar, such as Google Calendar (calendar.google.com) or Yahoo! Calendar (calendar.yahoo.com). All what users have to do is to create a public calendar and authorize access for all others within a group or a family. There are a lot of sites available to share family photos, from non-commercial sites like Flickr (www.flickr.com) to sites that sell the prints, such as Shutterfly (www.shutterfly.com). There are sites particularly offered for sport teams, e.g., web-based applications include eteemz (www.eteemz.com), League Athletics (www.leagueathletics.com), League Lineup (www.leaguelineup. com), and TeamSnap (www.teamsnap.com). Salespeople have to deal with lots and lots of contacts. Among the most popular of these applications are BigContacts (www.bigcontacts.com), Highrise (www. highrisehq. com), and the market-leading Salesforce.com. For managing projects, the most popular of these applications include AceProject (www.aceproject.com), Basecamp (www.basecamphq.com), onProject (www.onproject.com), and Project Insight (www.projectinsight.com). For enterprise management support, some of the most popular enterprise-level web-based expense reporting applications include Concur (www.concur.com), ExpensAble (www.expensable.com), ExpensePoint (www.expensepoint.com) and TimeConsultant (www.timeconsultant.com). Some of the popular event management applications include Cvent (www.cvent.com), RegOnline (www.regoline.com), and ViewCentral (www.rmkr.com/viewcentral). The CC software are small packages for communication. Web-based contact management applications enable access to contact information from any computer connected to the Internet. Instead of storing personal contacts on home PC, users can store all their contacts in the cloud, where they can be accessed from home and work. The most popular web-based contact management and CRM system available today is offered by Salesforce.com (www.salesforce.com). For Web-based word processing, Google Docs (docs.google.com) is the most popular web-based word processor available today. In the desktop computing world, the leading database program today is Microsoft Access. None of the major database software devel-

opers currently provide web-based database applications. However, Blist (www.blist.com) proposes easy-to-use database designed for non-technical business people. Dabble DB (www.dabbledb.com) makes it easy to create new databases and add new records. The application called myWebDB (hu.oneteamtech.com/ mywebdb.html) is billed as a do-it-yourself Web 2.0 database application. Sometimes, users need support in the CC software utilization. The common ways to help users include:

− peer support: users frequently look to their colleagues, when they need computer assistance,
− part time user support: hardware and software vendors often provide informal client support during the early stages of product development,
− help desk support as a single point of contact for users in need of technical support, whether they are internal workers or external clients,
− user support centre, known as information centre, which provides a wider range of services than a help desk.

The cloud market analyses allow to aggregate information from various sources (operational, business, social, user feedback), in order to gain knowledge for improving the business terms and conditions for new CC products and business models. The general model of CC architecture is presented in Figure 1. The CC service provider office covers the following functionalities: service management, service cataloguing, service right management, pricing, user profiling, payments, product supporting, analytics and reporting. Product catalogue covers the product specification and is linked to the corresponding services and applications in the service repository. The second repository covers the contracts repository, where the agreements between providers and users for each marketplace transaction are placed. Presented in Figure 1 cloud computing architecture is an information processing model, in which centrally administered computing capabilities are delivered as services, according to the users' needs across the network to a variety of user-facing devices. The users should understand how the services are distributed, and how the service levels and performance indicators are monitored and measured by the providers. They can control access to cloud applications and services and can mediate between different internal and external protocols and standards.

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│ Cloud Users                                                   │
│                                                               │
│  ┌──────────┐  ┌──────────┐  ┌──────────┐  ┌──────────────┐  │
│  │ Service  │  │ Security │  │   User   │  │Service Level │  │
│  │Catalogues│  │Management│  │Self-service│ │ Management   │  │
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│ Cloud Providers                                               │
│  ┌──────────────────────┐  ┌────────────┐  ┌──────────────┐  │
│  │ Service Management   │  │            │  │   Service    │  │
│  └──────────────────────┘  │            │  │ Integration  │  │
│  ┌──────────────────────┐  │   Data,    │  │     and      │  │
│  │  Data as a Service   │  │ Software,  │  │Accessibility │  │
│  └──────────────────────┘  │Platforms,  │  │ Management,  │  │
│  ┌──────────────────────┐  │    and     │  │  Work Load   │  │
│  │ Software as a Service│  │Infrastructure│ │Orchestration │  │
│  └──────────────────────┘  │  Security  │  │  Resource    │  │
│  ┌──────────────────────┐  │ Management │  │ Acquisition  │  │
│  │ Platform as a Service│  │            │  │              │  │
│  └──────────────────────┘  │            │  │              │  │
│  ┌──────────────────────┐  │            │  │              │  │
│  │   Infrastructure     │  │            │  │              │  │
│  │    as a Service      │  │            │  │              │  │
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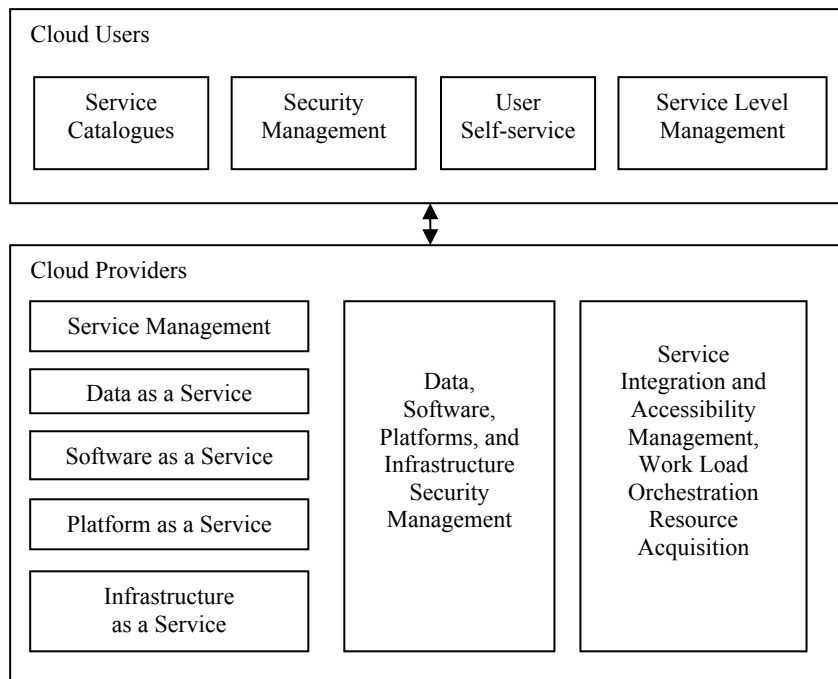
Fig. 1. User in cloud computing architecture

Source: Based on [RaPe11].

In clouds, information and services are programmatically aggregated, acting as building blocks of complex compositions, called service mashups [BBGo11]. That is a new kind of Web-based applications to foster EUD. To shorten the traditional and time-consuming development process, the applications are developed by non-professional programmers, often in a non-formal, iterative way by assembling existing building blocks.

The CC users expect on-demand nearly instant access to resources, therefore, cloud must allow self-service access and the users can request, customize, pay and use services without intervention of human operators (see Figure 1). Cloud services must be priced on a short-term basis allowing users to release resources as soon as they are not needed. In the cloud computing the high activism of users is not only visible in self-sourcing, because lately the term Dev 2.0 is used to describe platforms, that aim to bring user's participation into application development, much as Web 2.0 technologies, such as blogs and social networking [Shro10]. Non-programmers can use Dev 2.0 platforms to create a limited

class of business applications, in nearly the same manner as ordinary users of the Internet were empowered to publish content using Web 2.0 tools, such as blogs and wikis. Lately, many Dev 2.0 platforms have become available from startup companies i.e., Bungee Labs. TrackVia, Caspio, TeamDesk, ZohoCreator, QuickBase, Qrimp, Wold, OutSystems, PerfectForms, Cordys, Iceberg, WorkXpress and WorkLight. Each of these platforms is based on an interpretative and multi-tenant architecture, and allows creation of simple forms-based workflows. Dev 2.0 platforms represent a potential paradigm shift for development of small to medium enterprise applications, and can lead to significant improvements in development productivity for that class of applications.

Conclusion

The idea of Enterprise 2.0 and Dev 2.0 create opportunities for emergence of open innovation, which rely on the capabilities that modern telecommunication networks offer to collaborate at a distance. Open innovation realized by users could be greatly facilitated by providing some structured framework for the end user activities and by agreeing on common purposes and shared set of service expectations.

Acknowledgement

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PRZETWARZANIE W CHMURZE JAKO ŚRODOWISKO PROSUMPCJI TECHNOLOGII INFORMACJI

Streszczenie

Artykuł jest zorientowany na wyeksponowanie użytkownika systemów informatycznych jako innowatora. Składa się z czterech części. Najpierw wyjaśniono innowacyjną rolę użytkownika systemu informatycznego, następnie przedstawiono korzyści i zagrożenia przetwarzania w chmurze w aspekcie użytkownika systemu. Trzecia część zawiera przegląd oprogramowania użytkowego dystrybuowanego w chmurze, a ostatnia − model architektury przetwarzania w chmurze, gdzie rola użytkownika jest szczególnie wyeksponowana.