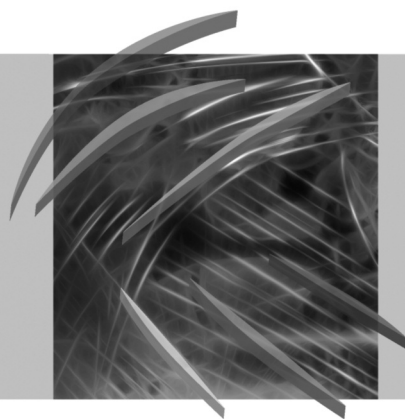


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PROPERTIES OF CLOUD COMPUTING FOR SMALL AND MEDIUM SIZED ENTERPRISES

Abstract: Development of new information technologies (IT) should meet user's needs and additionally be innovative enough to attract particular users. In the case of small and medium sized enterprises (SMEs), information technologies should support very different facilities of this group of users but in a very effective way. Undoubtedly, enterprises representing SMEs have specific features and expectations that are essential in acceptance of new solutions in IT. The aim of the paper is to discuss these properties and needs which are the basis for showing utility of cloud computing (CC) as a technology addressed to SMEs. In the most important part of the paper crucial offerings and features of CC are discussed and confronted with SMEs expectation.

Keywords: cloud computing, small and medium sized enterprise, IT features, SMEs requirements.

1. Introduction

New information technologies should create better and better possibilities of meeting changing needs of a potential user. On the other hand, modern computer infrastructure can be seen as a set of facilities for resolving almost all problems with information processing in an effective way. In common understanding *cloud computing* can be identified with a service over the Internet on a utility basis. There are several texts stressing usability of CC in SMEs (for example: [Cattedu, Hogben 2009], [eUKhost 2011] or [Hope-Baillie 2011]), but the authors consider rather global concepts than particular user's views.

The aim of this paper is an investigation of the crucial properties of CC that are useful in SMEs sector. Basically, cloud computing was intentionally prepared rather for small enterprises but in reality there are certain obstacles and even fears in implementation of this technology especially when identifying and comparing to grid computing (see: [Owoc, Hauke 2009]). The paper is divided into four sections. In the first one general characteristic of SMEs is presented, stressing their unique features. The second part is devoted to the demonstration of main assumptions of CC includ-

ing: goals, models and crucial properties. In the next, very important section, expectations of users coming from SMEs sector are discussed with regard to CC offerings. The last section presents concluding remarks arising from the paper.

2. Essential expectations of small and medium sized enterprises

Small businesses are common in many countries and it seems to be obvious that companies representing this group need an active communications network to perform their activities. In modern economy small and medium sized enterprises play a very significant role – in Europe about 99 % companies, according to many elaborated surveys, are qualified to this sector. Relatively clearly defined are criteria of diversification the discussed sector of enterprises. Therefore, headcount (less than 250), turnover (≤ 50 million €) or balance sheet total (≤ 43 million €) are considered to qualify enterprise as medium sized and smaller values presented above for small and micro companies [Recommendation 2003].

In common understanding a small business can be activated at a very low cost and on a part-time basis. Regarding usability of specific IT, we should be conscious of crucial properties of a small business and as a consequence – requirements of enterprises qualified as SMEs. Let us discuss properties of such companies underlying these features (compare: [Nicolescu 2009] or [*Policy Brief...* 2011]) that are strictly tied to IT offerings.

The first one can be defined as **reactiveness**. This property denotes the fast response of a company to the market needs. In other words, a company is able to prepare new products or services when signals appear from outside about customer's expectations. This feature can be fulfilled if monitoring of the market is effective and a particular company has capabilities to generate new solutions. IT supports monitoring tasks as well as analyzing of company productiveness.

The second property can be labelled as **high typological diversity**. This feature means that the discussed companies cover almost all sectors of global and national economy. In some sectors these enterprises have 100% of market share and on the other hand it is difficult to find a sector where SMEs do not act. Therefore, these companies represent many branches and IT products should be very highly customized to assure efficient information services.

The next widely recognized feature of SMEs is **high flexibility**. This feature allows for changing of main parameters of the SMEs system at relatively short time. The main decisive factors essential in achieving high flexibility relate to: small quantity of resources and relatively small volume of activities, high capacity of perception of the exogenous by managers and high capacity of decision and action. There is a big challenge to support frequently changing information needs in such conditions.

The last essential feature refers to **low labour cost**. There is a big competition on the market in all sectors so companies try to reduce costs of their services mostly via rationalization of the production and overhead expenses. Costs of IT services should

be also taken into account in cost cutting especially for SMEs, where there is limited computer infrastructure.

The mentioned properties of SMEs create real impact on IT solutions offered by computer science market. One can define the following groups of expectations from the discussed companies:

- **Functional** – covering set of tasks supporting managerial decisions at three basic levels: operational, tactic and strategic by specialized software. There are many management information systems developed especially for SMEs that embrace all necessary functions but solutions and range can differ.
- **Technological** – where details referring to data and information processing are defined. This sort of challenge includes data models, used algorithms, methods of communication, security, and many others. In the case of SMEs implemented technologies have great impact on user's satisfaction.
- **Economical** – very important aspect of IT implementation considering solution effectiveness, costs and benefits calculation, but also easiness of software implementation. In particular for small and medium companies the aspect is critical because of resource shortage.
- The mentioned expectations can be considered in the last part of the paper in cloud computing context.

3. General assumptions of cloud computing

Cloud computing appeared as a market term to express new features and speciality of this relatively new technology based on Internet resources. According to Sosinsky [2011], "Cloud computing refers to applications and services that run on a distributed network using virtualized resources and accessed by common Internet protocols and networking standards". Therefore, CC is a model of applications and services used via Internet and basically involves a number of different capabilities: application servers, storage servers, platform services and management services. Each of these capabilities plays a role in defining cloud computing. In the marketplace, providers of cloud computing generally offer these four different capabilities.

Facilities available via CC are strictly determined by properties of this technology. Generally speaking, one can identify two primary concepts and several properties which can be termed as secondary. All these CC features are important for different users including SMEs (some of these features correspond to company challenges). Two concepts essential in "cloud" environment are abstraction and virtualization (compare: [Sosinsky 2011]).

Abstraction means that in CC details of system implementation are not specified in advance (for example, unknown are locations of data storage and administration of systems is in some way outsourced).

Virtualization consists in pooling and sharing resources of computer systems. Parts of system infrastructure can be provisioned as needed from available computer

infrastructure and resources are scalable in a smart way. Therefore, an essence of CC relies on abstraction based on the notion of pooling physical resources and presenting them as a virtual resource.

Secondary features of CC are more disputable and include at least the following characteristics (compare: [Sosinsky 2011]): scalability, availability, flexibility, measurability, efficiency, effectiveness, low costs of services, low barrier to entry and security.

Scalability – using CC a user has access to unlimited resources of the whole computer infrastructure. Therefore, companies do not need to plan additional resources assuming growth of volume data processing. Available infrastructure can be gradually extended according to user's requirements.

Flexibility – in some way this is a feature of CC that supports the previous one. It is the ability to use resources in the optimal way. Particular components of computer infrastructure can be set more efficiently.

Availability – migration of some IT resources to CC create more mobile data and information processing. Workers of companies can do their tasks in any place. Development of a company (creation of new positions for example) does not cause problems with access to the global infrastructure. In fact, a user can have an access to computer infrastructure on demand.

Measurability – there are several elaborated methods of service measuring (for example using time units, number of performed transactions or calculation capacity of a database). This way adequate options for payment for the delivered services can be implemented.

Efficiency – can be defined as a result of scalability and flexibility mentioned before. Usage of CC model allows for access to almost unlimited computer infrastructure. This is very convenient situation for users with not very stable and dynamically changed requirements for computing.

Low costs of services – using CC model a user covers expenses exactly for delivered services. There is no need to invest in expensive computer infrastructure or to keep a specialist responsible for computer centre administration (see also: [*Cost-Benefit Analysis...* 2011]).

Low barrier to entry – (sometimes called easiness of implementation) preparation of CC services for a particular user seems to be relatively easy after properly defined agreement. Companies get fast access to applications and services at low cost without special installation of software, configuration servers, etc.

Security – the most “sensitive” and disputable feature of CC. Theoretically all potential problems should disappear (all necessary tasks are performed by specialized partner). No doubts, problems with database recovery should be served professionally, however, a risk of data losing or data leaking can occur.

Presented above properties of CC approach are essential in different cloud computing models. There are several models addressed to potential users. Therefore, scientists separate two distinct sets of models (compare [Sosinsky 2011]): **deployment**

models – referring to the placement and management of CC infrastructure, and **service** models – consisting of specific types of services available via CC infrastructure.

Deployment models (manner in which computer infrastructure is deployed) can be divided into: **public** cloud, **private** cloud, **hybrid** cloud, and **community** cloud according to availability for particular users (compare: [Owoc, Hauke 2010]). **Service** models are represented as: Infrastructure as a Service, Platform as a Service and Software as a Service where the mentioned categories are taken into account as a critical resource for a user.

There is great number of solutions addressed to different companies where some of all models are implemented. Significant number of companies with CC models belongs to SMEs sector. In the next section the discussion about small and medium sized enterprises challenges and CC approach are presented.

4. Usability of CC properties for SMEs

Implementation of Cloud Computing in SMEs sector seems to be obvious and effective decision. As a matter of fact entrepreneurs should be convinced of the value of this solution (see: [Wilson 2011]). There are many actual important challenges coming from SMEs and managers can react on them in different ways differ. On the other hand, particular properties of CC approach can be more or less important for managers in different ways. A synthesis of usability of CC properties for SMEs is presented in Table 1.

Table 1. SMEs expectations vs Cloud Computing properties

Challenges	Expectations of small and medium sized enterprises	Cloud Computing features
Functional	High typological diversity High flexibility	Scalability Availability Flexibility
Technological	Reactiveness Effectiveness Security	Flexibility Efficiency Scalability Security
Economical	Low labour costs	Measurability Low costs of services Low barrier to entry

Basic challenges are defined in the left column. Contents (in terms of company's expectations defined earlier) is a bit disputable, namely some expectations can be connected to more than one challenge. Anyway all three challenges (functional, technological and economical) reflect main streams of IT development.

All mentioned earlier expectations of SMEs are located in the second column. From the functional point of view two of them seem to be crucial: typological di-

versity (therefore services offered by contractors should cover many areas) and high flexibility (as the need of changing company profiles). Potential “answers” referring to functional challenges are presented in the last column. One of the CC features exactly meets company’s requirements: flexibility which allows for changing applications and/or services in the case of some changes in an enterprise. Scalability and availability are crucial also from the functional point of view. Both features serve different enterprises in terms of company’s range and nature of its activities. A good example of applications in this area is CRM systems which offer many functional services supporting sale (see: [*SalesCloud*]).

Expectations representing technological challenge are more rooted in data and information processing. Reactiveness important in SMEs requires delivering necessary information that can be achieved via flexibility offered in CC. Effectiveness of SMEs can be achieved using CC technology via efficient solutions and scalability present in this technology. The last technological aspect security has as before exactly this feature available in CC approach. All the mentioned expectations are available via specialized platforms using different devices (compare: [*TouchCloud*]).

The last challenge (economical) is strictly tied to cost aspects in company expectation but refers also to some management tasks essential in SMEs. Natural tendency of cutting costs is supported by three properties present in CC approach. Starting from measurability we may fulfil the defined expectation including low costs of services and from the managerial point of view – low barrier to entry. Very promising offerings referring to economical aspects are available at [*DataCloud*].

Summing up, all features of CC technology meet small and medium sized enterprises’ requirements. Therefore managers should be convinced of rationale of CC technology in the SMEs sector. It is important to stress that applications cover almost full *functionality* (Accounts and Contact, Analytics and Forecasting, Approvals and Workflow, etc.), use the most advanced *technology* and represent very *economical* approach (see: [Sosinsky 2011]).

5. Conclusions

The main findings of this paper can be formulated as follows (compare: [*Accounting web* 2011] or [*SimplyIT Hybrid... 2011*]):

- Small and medium sized enterprises as a big player on the market have special features and their requirements addressed to IT sector are relatively specific,
- CC technology offers relatively new opportunities for different users and some features are prepared exactly for SMEs,
- All defined SMEs expectations can be fulfilled with adequate CC technology features.

In further research adequacy of SMEs requirements and offerings of cloud computing should be identified.

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WŁASNOŚCI *CLOUD COMPUTING* ISTOTNE DLA MAŁYCH I ŚREDNICH PRZEDSIĘBIORSTW

Streszczenie: Rozwój nowych technologii informacyjnych powinien być konfrontowany z potrzebami użytkowników, a także być na tyle innowacyjny, aby ich przekonywać do tych rozwiązań. W przypadku małych i średnich przedsiębiorstw (MŚP) technologie informacyjne powinny wspomagać zadania różnych użytkowników w efektywny sposób. Niewątpliwie firmy reprezentujące MŚP wyróżniają się dość specyficznymi cechami i formułują swoje odrębne oczekiwania, istotne w akceptacji rozwiązań przygotowywanych w sektorze IT. Dyskusja o własnościach i potrzebach stanowi podstawę pokazania użyteczności przetwarzania w chmurze jako technologii adresowanej do MŚP. W najważniejszej części artykułu kluczowe cechy *cloud computing* są konfrontowane z oczekiwaniami małych i średnich przedsiębiorstw.