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New Web approach to aid logistic services

1. INTRODUCTION

Progress in the Web technologies have been giving substantial impact on computing systems addressed to business purposes, also, for the logistic Web based services. One of possible solution for the Web aided services is using so called the Cloud Computing approach, which determines a new, more advanced approach handling the Web services arising from earlier Web technologies, first of all, the grid computing. Grid computing using the defined standards has been adopted mainly in the public systems to compute in integrated on large scale systems the data by defined Web users. Cloud computing was made rather for the private systems where virtualization technology and large data centers have been turned into Web computing of which services can be resold. In such environment the cloud computing users can reduce own systems as computing services can be obtained from the Web on demand.

Cloud computing can be defined as the Internet-based computing where on demand the shared resources, software, and other information are provided to computers of the users, from outside resources like e.g. electricity. Needed applications - the cloud computing services are delivered over the Internet in real time to the users on the base of subscriptions or paying for specified services used. This approach allows extending existing capabilities of information technologies under lower expenses and larger system functionality [1-3].

Usually cloud computing systems used to be divided into three main segments [4-7]:

- Applications
- Platform
- Infrastructure

Each such segment for business purposes defines different products and it is addressed to individuals with different requirements.

For business purposes:

Applications on demand offer the different software services and vary in the price and manner to deliver software to the end users. This distinguish such systems from earlier Web systems offering required applications to the end-users who only purchase from selected Internet servers the access to applications.

Platform segment of cloud computing refers to products that are used to deploy Internet e.g. the platforms of Microsoft, that allow to the users the access to applications from centralized servers.

Infrastructure makes the backbone of cloud computing concept, it assures to the users the infrastructure environments to build own required applications. Via Internet the users maintain data and applications as well as central remote servers

- to use applications without their installations,
- to access the required files at any computer possessing the Internet access.

Advantages of such approach are lower computer system expenses and higher efficiency resulting from the using of centralized storage, memories, data processing and better exploitation of communication channels bandwidth. Cloud Computing can be used as well in computing systems used for the logistic purposes to which below presented presentation will be addressed.

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2. CLOUD COMPUTING WORKING MODELS

Cloud Computing working models are referred to the layers, in which “a cloud client” defines the computer hardware and computer software needed for required applications [3-6]. Mentioned above segments: the Application, Platform, Infrastructure used to be extended on the layers additionally comprising the Client, and Sever segments. While earlier the Internet based services were limited to software and were called Software as a Service (SaaS), the cloud computing comprises not only the software but also the datacenter oriented hardware. Cloud computing can be characterized by the models in which there are determined the layers:

- **application** making the cloud application services called "Software as a Service (SaaS)" with similar meaning as earlier used; required application is delivered over the Internet in the form of the software offered by a given service. Thus the need to install and to run the full application on the customer's own computers is eliminated at simultaneous simplified the system maintenance and support. This corresponds renting the application software,
- **platform** making the cloud platform services, so called "Platform as a Service (PaaS)" being a platform offering computing solution and determining a set of services for given applications. It facilitates deployment of applications without the high expenses purchasing the hardware and software as well as to managing the complex systems. This is equivalent to rent the infrastructure and software tools to build own set of applications,
- **infrastructure** making the cloud infrastructure services, so called "Infrastructure as a Service (IaaS)", to deliver computer infrastructure using the service virtualization platform. Thus, for the service users the fully outsourced services are implemented without the need to purchase the servers, software, and data center space together with network equipment. By this the services are charged only for time when they are used. This is equivalent to rent the service making computing infrastructure,
- **servers** make basic frame of computer hardware together with installed on them the software assuring delivery of cloud services. Main part of such systems usually the multi-core processors and cloud-specific operating systems make.

Under such assumptions the basic cloud computing delivery model can be illustrated as it is shown in fig.2.1

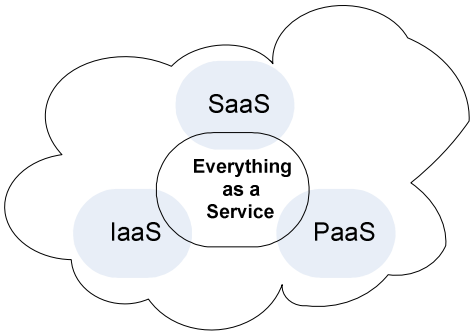

Fig. 2.1 Cloud Computing Service Delivery

The main benefits described by delivery model cloud computing shown in fig.2.1 the costs are, they are spread over all of the users. Unfortunately, the weakness of cloud computing systems is frequently unacceptable level of privacy and security in built by this manner the systems.

Besides delivery models the cloud computing used to be characterized also by so called deployment models. If computing cloud is addressed to the public use in a pay-as-you-go manner, it makes so called the public deployment model of computing. Kind of such model the community models are. An alternative of both these models the private deployment model of cloud computing is, it comprises the internal datacenters systems not to be available to the general public. In other words private cloud makes the internal cloud emulating the cloud computing on private networks guarantying not only required data but also security, corporate governance, and reliability.

Other alternative of deployment models the mixed model is, it comprises in one both public and private models and it is called the hybrid cloud computing model. A hybrid cloud environment consists of multiple internal and external public service providers integrating multiple cloud services.

Putting together specified above cloud computing features and possibilities [8] an integrated model of cloud computing approach can be characterized as it is shown in fig. 2.2.

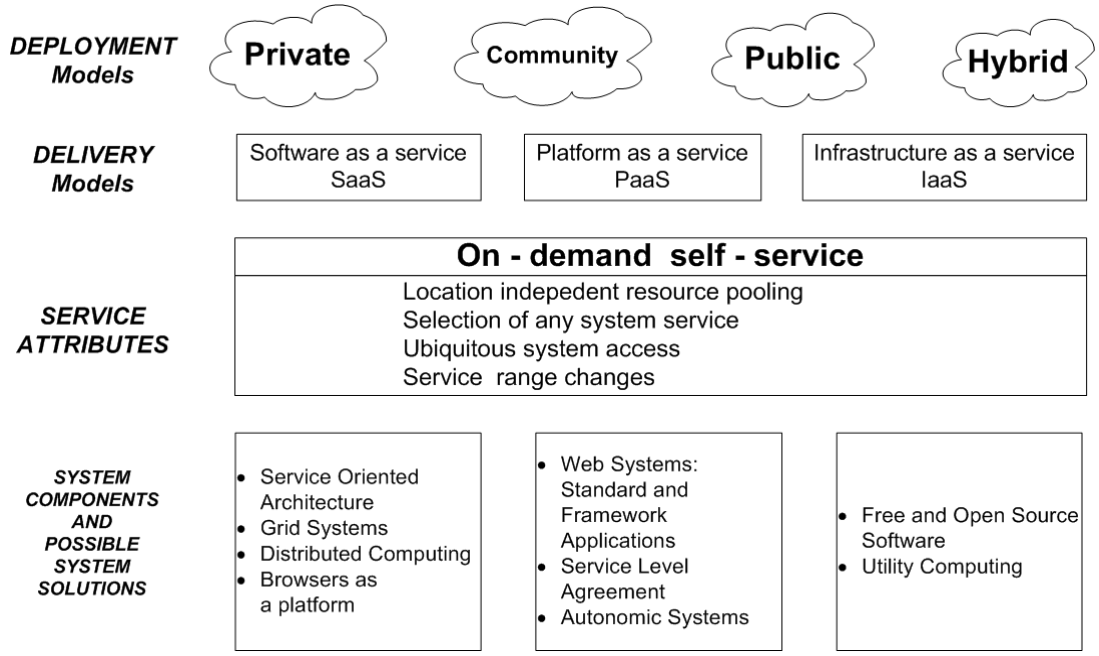

Fig. 2.2. Characteristics of cloud computing principles

As mentioned above basic disadvantage of cloud computing the privacy is: the companies hosting the cloud services can control, and thus, they can monitor, lawfully or unlawfully, all users' business data operations, mainly, stored by them on the host servers. This substantially disturbs the security of business operations and it is issue to delay common adoption of cloud computing systems in practice as to upgrade required security levels the additional security sub-systems have to be built.

Independently from these disadvantages, frequently, the cloud computing seems to be a better way to run businesses than to use the classical computing systems. Reason is a fact that cloud computing allows to the users to focus their attention on deploying more applications, new projects, and innovation without paying attention to technical details of own computing systems. Therefore, a simple idea of cloud computing on demand can have a huge impact on a great number of various businesses as the users :

- can install and configure software required to a given application,
- have unlimited access to needed applications by the use standard network sub-systems,
- have access to system resources independently from localization,
- can increase or decrease the system resources dependently on the needs,
- can pay-per-use just dependently from used computing power, bandwidth of Internet communication channels and data storages.

3. CLOUD COMPUTING IMPACT ON LOGISTIC SERVICES

Business activities in logistics more and more are supported by information technology applications [9]. Challenge of such applications is integration in one system the informatics support. So far, this was classically done by the use systems possessing the access to the Web like the ERP systems. As it was stated above, Cloud Computing offers the support based on significantly widening of the Web applications. In such solution two factors play a key role: reduced system expenses and security of data in Web based systems.

Fortunately, progress of cloud computing allows to optimize the costs and elasticity of the computing systems, in which the data security is improved from system to system. Below, the architecture requirements and component implementations to optimize the cloud computing technology will be presented. This will be done on example the supply chain supported by cloud computing approach.

Primary for these purposes in a given enterprise the services and cloud service providers should be carefully selected to create the Web cloud supply chain system, which meet requirements the composite applications and systems. Typically hybrid, automated, managed deployment model used to be applied. It is supported by adequate type of software making so called the cloud service optimizer referred to a given cloud computing service and business modeling. The model defines the logical, high-level structure and behavior of specified information services in Web. A good example of such implementation makes the Service Oriented Architecture (SOA) determining application assembly, policy and quality-of-service requirements done e.g. by J2EE deployment descriptors. Then, to implement low-level functions for resources managing the abstract containers are used. They meet the IaaS service conditions to support virtual approach through well-defined direct management of physical servers, network devices, storage, etc.

For supply chain management the aim conceptual architecture of cloud computing system is building implementation system blocks, which interacts and shares business information. In the Web this guides to creation the Unified Service Model able to assure data transformation between various systems. Such model is virtually centralized, and covers distributed applications across each information related to the supply chain [10].

Contemporary, supply chains makes the logistics processes which are not only more complex but also more dynamic and distributed. This makes a challenge for logistics planning and control as under such conditions the conventional centralized systems are ineffective due to handling too larger number of objects and associated with them parameters. The useful alternative is autonomous Web based system control of objects participating in logistics processes by the intelligent software agents making frame of cloud computing. To logistics control systems this assures the flexibility and scalability resulting from transient demands.

For supply chain of logistics objects the cloud computing has to be supported by the sub-systems allow to logistics objects their

- identification
- localization
- sensing

by mean the Web processing and communication of related data.

An example can be the intelligent containers [11], they are responsible for planning and scheduling services cross a whole given logistics network. Basic identification the cargo recognition is while the localization and monitoring of loaded goods is accomplished usually by adequate sensor networks working independently from changes of object location and cargo state. By this the intelligent system container is able to be adapted to each logistics changes by mean the intelligent software agents [12]. They allow synchronize each logistics operations with operations of each logistics objects and make hard core of autonomous logistics applications. They are matched to flexible scaling based on parallel manner to handle the software operations in contrary to sequential software operations implemented in traditional logistics control.

In contemporary systems:

Infrastructure as a Service makes the autonomous logistics clouds as from the cloud service providers the users acquire a scalable hardware platform to install own autonomous logistics implementation with system hardware administrated as well by the service provider.

Platform as a Service in autonomous logistics clouds is based on provided software; it covers services by mean a multi-agent platform [13] e.g. PlaSMA [14]. This simplifies agent representative's deployment as the system software platform administration as well is provided by the service provider.

Software as a Service is based on providing the complete implementation of software agents for autonomous control in logistics and administration of the software agents left to the service provider who only must obtain the relevant process information from the user.

Process as a Service makes unique autonomous logistics clouds based on a system platform integrating the logistics service providers to execute at each time the demanded services. The actions of the cloud service provider are similar to well known the fourth-party logistics providing 4PL.

For described the autonomous logistics based on Cloud Computing a predominated issue is integration of logistics with prior existing logistics infrastructures synchronizing real flows material with related data flows. Usually, this is done by adoption of the Internet standards e.g. EPCglobal Framework Architecture [15]. An advantage of such used platform is a fact providing by the service provider the system integration and synchronization of implemented software with logistics process. Disadvantage of such clouds is poor influence of the users on the computing system and logistics infrastructure. Therefore, choosing of cloud service providers should be carefully selected, they should assure the quality of demanded services, acceptable expenses and fair level of security to handle data in outsourcing environment. E.g. software used in optimizing the routes of local trucking.

Presented autonomous logistics system solutions are addressed to implementation in:

- supply chain aided systems,
- mobile resource management
- global trade compliance.

Actually, for logistics purposes the most popular is a SaaS model of cloud implementation available for the service users via Web, it allows to integrate the cloud-based logistics applications with back-office systems using available and ready to use the open software standards e.g. supported by XML language. Usually this is done by the service providers decomposing the full applications into smaller parts possible to be used internally or externally [16].

One of the last logistics and transport SaaS applications the system CarrierNetOnline (CNO) is [17]. A system originally was developed for the logistics industry while now it is used also in manufacturing, retail and wholesale implementations. The CarrierNetOnline (CNO) system still is extended by a new the Web based applications addressed to fundamental supply chain, logistics and transport management applications. They meet requirements of real-time services, mainly addressed to the transport companies for managing and controlling: "in-house", outsourced and sub-contracted logistics operations.

So, CarrierNetOnline Software service system as the Web Based Transport Management System can be assumed as one of the most useful multi-user logistics system operating in the Web 2.0 environment. The system that is not only interactive but also is the system possessing potential to be extended on the other dynamic Web applications.

4. CONCLUSIONS

Cloud computing makes a new approach to handle business computing system by the use of Internet / Web. It allows to be also implemented as autonomous control in logistics based on wide use of intelligent software agents. The cloud services may range from a scalable hardware platform to complete process control by the external cloud service providers playing role of the fourth-party logistics providers. The advantage of autonomous logistics clouds is a fact that users no longer need to invest in own computing infrastructures as the systems solutions are based on low expenses invested in outsourcing systems. Cloud computing are flexible and able to provide the users in changeable applications on demand. However, the basic disadvantage of cloud computing makes the data security on used distributed Web platforms. Therefore till such will be not solved they will make drawbacks of wide implementations of cloud computing in business and transport applications. Taking into account the current state of development of cloud computing systems there can be stated that this approach to handle computing systems can be addressed rather towards middle and small than large enterprises.

Streszczenie

Artykuł prezentuje nowe podejście budowy programowalnych usług w środowisku Web. Dotyczy podejścia zwanego Cloud Computing, które oparta jest na wykorzystaniu software i systemowej infrastruktury z zewnętrznych zasobów od dostarczycieli usług Web. Rozważane w artykule problemy koncentrują się na zasadach Cloud Computing i przykładach ich implementacji w logistyce. Przykłady te dotyczą logistycznych autonomicznych agentów softwarowych wykorzystywanych do kontroli łańcuchów operacji logistycznych poprzez Web.

Słowa kluczowe: programowalne usługi w Web, logistyka.

Nowe podejście wspomagania usług logistycznych w Web

Abstract

The paper presents a new approach to build in the Web environment programmed services for logistic purposes. It is referred to so called the Cloud Computing concept based on the use the system software and system infrastructure to handle logistic services using the systems of Web outsourcing providers who deliver each required software and hardware. The problems considered in the paper are focused on the principles of Cloud Computing approach and examples of its logistic implementations. Shown implementations are addressed mainly to the logistics software autonomous agents used in the control of chain logistic operations by the use of Web.

Key words: Web service programming, logistics.

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