

## SOME MAIN ASPECTS OF MIGRATING DATABASE AND KEY ENTERPRISE APPLICATIONS TO CLOUD

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### **Abstract:**

*The new Internet technologies have opened the way for a new economy, the digital economy, where accessing and using the Internet are the key to a successful business. For that, it is necessary a wide process of business digital transformation which requires a high-power IT infrastructure. There are a number of emerging technologies that can be a solution for the digital transition of any business. So, nowadays, the new trend is that the companies to abandon building or developing their own IT infrastructure, and choose, as a much cheaper alternative, to migrate their key applications and databases in the cloud, using for that the Cloud Computing services through the Internet. But, the process of business digital transformation is not uniform. The aspiration and practical implementation are not in the same rhythm, being a significant gap between them. There are many situations when the migration to the cloud had not registered the expected success because there is no a generally valid practical way for it or for redesigning the business for the digital economy. Even so, most of the enterprises are embarked on a digital transformation, and a fundamental stage of this change involves migrating key enterprises applications and databases to the cloud. However, according to the Eurostat data, there are major gaps between the EU Member States in using cloud technology for hosting enterprises databases, more than a half of them have percentages lower than the European average, even if the European Commission has adopted the Digital Single Market strategy in May 2015 with the aim of „encourages the economy, businesses and the workforce to maximize the benefits of digitalization”. Based on a large literature on the topic, the aim of this paper is to motivate the necessity of cloud migrating the organization databases and data, highlighting the opportunities and advantages gained.*

**Keywords:** Cloud computing services, database, enterprise applications, migration to cloud

**Classification JEL:** L86

### **1. Introduction**

Digital technologies have changed the nowadays businesses and it is a reality for everybody that the present economy must be a digital one. In the Guide to "Next-gen IT infrastructure strategy to guide digital transformation" published by Nettarget Network to guide the digital transformation of organizations, it is emphasized that digital transformation involves a major reinvention of the business, supply chain and workflow, requirements on employees' digital competences, interconnection with customers and its value for each of the stakeholders. Digital transformation is the only way an organization can remain competitive in an ever-changing economic environment generated as IT evolves. Surviving any business, nonprofit, or even public institutions depends on its rapid digital transformation. Organizations should move much faster today, as a result of modern technologies that shape customer expectations. Cloud Computing (CC) is only one of emerging technologies that can be a solution for the digital transition of any business, a technology that facilitates virtual access to IT infrastructure resources, software and hosting of company databases regardless of geography. CC technology allow users to store data and files, or to use software on a server that runs over the internet.

As cloud services are provided online, enterprises must have internet access for using them, and in the same time need a fast and stable connection to the Internet. Even if, 97% of EU enterprises employing 10 persons or more had had Internet access in 2016, with similar shares registered in all Member States, only 21% used cloud computing services. A better situation registered enterprises of large size class (250 employers and more), where the increase in the period from the year 2014 to 2016 is 10%, but the share is still with a low value, under 50%. (See Table 1)

Table no. 1 **Enterprises without financial sector with internet access and buy Cloud Computing services, by, at the level of European Union (28), on the years 2014 and 2016 – (percentages of enterprises)**

| Type of enterprises                              | 2014                             |   | 2016                             |   |
|--|----------------------------------|---|----------------------------------|---|
|  | Enterprises with internet access | Buy cloud computing services used over the internet | Enterprises with internet access | Buy cloud computing services used over the internet |
| Small enterprises (10-49 persons employed)       | 96                               | 17  | 96                               | 19  |
| Medium enterprises (50-249 persons employed)     | 99                               | 24  | 99                               | 29  |
| Large enterprises (250 persons employed or more) | 100                              | 35  | 100                              | 45  |
| All enterprises (10 persons employed or more)    | 97                               | 19  | 97                               | 21  |

Source: Eurostat Database, Internet access [isoc\_ci\_in\_en2] Last update 28.06.2018 and Cloud computing services [isoc\_cicce\_use], Last update 29.01.2018, Extracted by the author on 12.11.2018

Most of the enterprises are embarked on a digital transformation, and a fundamental stage of this change involves migrating in-house software applications, databases, and own data to the cloud. But not all the businesses are ready for that. At the level of the year 2016 face to 2014, there are increased shares for all type of enterprises that reported buying cloud computing, but significant levels had registered only large enterprises (with 250 persons employed or more), both for medium and high cloud computing solutions. This type of enterprises opted for more medium CC solutions, for hosting their e-mail systems, office software, storing files in electronic form, or hosting their enterprise's database.

In the same time, the large enterprises increased the use of the high cloud services to access end-users advanced software as financial/accounting or CRM applications, and more than that, use the CC platforms to run their own applications, that is much important. However, looking at all enterprises, regardless of size, including those of very small size (less than 10 employees), we notice insignificant changes in the acquisition of CC solutions, the percentage of enterprises that opted for such solutions remained very low. (See Table 2)

Table no. 2 **Enterprises without financial sector, by size class and type of bought CC services, at the level of European Union (28), on the years 2014 and 2016 – (percentage of enterprises)**

| Type of enterprises                              | Buy only low CC services (e-mail, office software, storage of files) |      | Buy only medium CC services (e-mail, office software, storage of files, hosting of the enterprise's database) |      | Buy high CC services (accounting software applications, CRM software, computing power) |      |
|--|--|------|---|------|--|------|
|  | 2014   | 2016 | 2014  | 2016 | 2014   | 2016 |
| Small enterprises (10-49 persons employed)       | 6  | 6    | 9   | 9    | 8  | 10   |
| Medium enterprises (50-249 persons employed)     | 8  | 9    | 11  | 13   | 11   | 14   |
| Large enterprises (250 persons employed or more) | 10   | 12   | 15  | 19   | 17   | 23   |
| All enterprises (10 persons employed or more)    | 7  | 7    | 9   | 10   | 9  | 11   |

Source: Eurostat Database, Cloud computing services [isoc\_cicce\_use], Last update 29.01.2018, Extracted by the author on 12.11.2018

The Eurostat data show a increase confidence of companies to store data in the cloud, 12% of European medium enterprises, and 20% of European large enterprises, without financial sector bought hosting for their database (as a CC service) in 2016, with more 2%, respectively 6% than in

the year 2014. But, this means only 9% of total European enterprises 10 persons employed or more) in the year 2016, with only 2% more over than in the year 2014.

Significant increases registered all type of enterprises for storage of files (as a CC service), but can note similar situation for buying computing power to run the enterprise's own software (as a CC service), except large enterprises (See Table 3)

**Table no. 3 Enterprises without financial sector, by size class and type of bought CC services, at the level of European Union (28), on the years 2014 and 2016 – (percentages of enterprises)**

| Type of enterprises                              | Buy hosting for the enterprise's database (as a CC service) |      | Buy storage of files (as a CC service) |      | Buy computing power to run the enterprise's own software (as a CC service) |      |
|--|---|------|--|------|--|------|
|  | 2014  | 2016 | 2014                                   | 2016 | 2014   | 2016 |
| Small enterprises (10-49 persons employed)       | 7   | 8    | 9                                      | 12   | 3  | 4    |
| Medium enterprises (50-249 persons employed)     | 10  | 12   | 13                                     | 17   | 4  | 6    |
| Large enterprises (250 persons employed or more) | 14  | 20   | 18                                     | 28   | 8  | 12   |
| All enterprises (10 persons employed or more)    | 7   | 9    | 10                                     | 13   | 3  | 4    |

Source: Eurostat Database, Cloud computing services [isoc\_cicce\_use], Last update 29.01.2018, Extracted by the author on 12.11.2018

In the 2017 Edition of Digital economy & society in the EU - A browse through our online world in figures is noted: "large EU businesses are twice as likely to use cloud services. Instead of building or expanding their own IT infrastructure, businesses can access computing resources such as cloud services hosted by other parties on the internet". However, Finland and Norway are countries where the percentages of enterprises which bought hosting in the cloud for their databases were 30% in the year 2017, and Danmark registered 28%. Those performances far exceed the European average.

The organizations must look to modernize their mission-critical applications and planned a cloud migration as part of the digital transformation process. But, in many situations, moving the key enterprise applications to the cloud had registered only a limited success, because the practical way of redesigning the business for the digital economy differs significantly depending on the type of organization, the size of the business and their technologies types in terms of web-readiness.

Thus, small and medium-sized economic organizations seem to be advantaged in the adoption and active use of digital technology, part of them being born after the widespread adoption of digital technology are "digital native" and so, fairly easy to convert into a digital-based business model. On the other hand, even if the cloud is the right way to digitalizing a business, for the enterprises with pure legacy systems, unfit for use with nowadays technologies and incompatible with user's needs, the digitalization can be a difficult way.

For the large companies which had already the significant investment on equipment, software, IT specialists, etc. the decision is harder to take, even if, as time passes all these IT infrastructure ages, devaluates, and more than that, are aging physically and morally, necessitating inevitably new investments in its development. Neither Web-enabled platforms have good perspectives, but compared with pure legacy systems, provide some data using.

For making a digital transformation strategy is important to be determined what is the current situation, what is needed, and if there are the resources to will allow materializing it by using the digital-ready technologies, the cloud adoption, and the most important benefits, as flexibility, scalability, automatic updates or economic efficiency, and all of them leading to improve the enterprise productivity being widely described in the last years literature on the topic [1], [2], [3].

## 2. Main aspects of migration in Cloud

Even the time of the data-centers of big companies, that companies which have everything on-premise: data, applications, equipment – nothing leaves the location, passed. As, cloud computing is defined as „a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” [4], it is clear that, besides benefits, there are some disadvantages in using it [5], [6], [7]. However, if the decision of migration in the cloud is opportune, which means that the enterprise is ready for such of technology, and the process of moving data and critical applications is a carefully planned and organized one, the benefits like major flexibility - especially for growing businesses, automatic software updates, disaster recovery, increase collaboration across the employers and teams, avoid a major upfront investment or work from anywhere often outweigh the risks as giving up full control of own data, in time of the responsibility regarding the security and integrity of data, as well as their administration, are shared by the company with the cloud provider.

Cloud offers alternatives to on-premise solutions which are much advantageous for businesses, are distributed as services for which payment is made only on resource use. Moreover, the relational databases, traditional databases, can have a lot of benefits from the moving to the cloud: a better management of data, with a centrally accessible in cloud, a simplified communication and an extensive geographical collaboration, an enhanced performance of IT systems, security and availability of the non-stop service under a total control and not on the last place, optimizing long-term IT costs through an efficient solution that does not involve additional investment [4]. To optimize or digital transform their business, the enterprise must move from on-premises infrastructure and applications to cloud-based storage and applications.

The cloud migration decision can pose problems when is choosing the opportunity or measure the value of cloud migration for the company. Based on a large review, Islam et al. identified three main decision components: *business context, application, and security and privacy*. [8]. The authors consider that business context „determines the cloud portfolio, indicating the chosen cloud model and other necessary parameters to support the migration,„. For that, firstly it is necessary to performing an objective SWOT analysis of the business situation, and a detailed evaluation of the current IT infrastructure, including costs, to identify the optimal way to migrate the data and enterprise applications.

Identifying which applications should be moved in the cloud, is the second main component of the cloud migration decision, because can be a lot of situations when some of them must be left on the enterprise's servers for a better performance, or simply because it cannot be moved. Regarding the application, Islam et al. consider that „before migrating an application to the cloud, it is necessary to understand the application characteristics without using any cloud technologies. Various factors must first be analyzed, such as application type, in-house deployment and application maturity, a determination of the operation of the application in mixed in-house and cloud environments (Cloud-native or Cloud-enabled), along with looking at data storage, programming models, and quality assurance”. In the same time, in their opinion, the third component of the migration decision, respectively security and privacy, seems to be the most important preoccupation because the attacks against cloud infrastructure still represent major provocations [8]. The most important cloud providers offer resources and specific tools for a secure system.

Deciding the optimal type of cloud for the organization is the first step in the business digital transformation, and this must be correlated with its specifically in terms of web-readiness. As the most cost-effective and scalable type of cloud, the public form, is a solution that makes businesses to lose part of its control because data and traffic on the network are shared with other

peer unknown users. From this perspective, the private cloud gives businesses more security and more control of data. But, a private cloud offers limited resources and for that businesses need to supplementary spent on funding the own new hardware resources. In this conditions, with an increasing popularity, the Hybrid cloud seems to be the best solution, because of ensuring private control for the most important data of the enterprise, while the other data, less important, are administrated in the public cloud, less expensive. In particular, each business must to choose the best option for its strategy, especially that there are a various cloud services options, as: Infrastructure as a service (IaaS), Platform as a service (PaaS), and software as a service (SaaS).

Before effective cloud migration, is important to decide what solution is the best one: a single cloud provider or multiple cloud providers [9]. Many businesses are using a combination of cloud computing services looking for efficiency and at the same time an equilibrium between total control of critical data, the functionality of the systems, and lower costs.

When enterprises decide that migrating their databases and key applications to cloud are absolutely necessary, are involves three types of migration: storage migration, cloud migration and application migration. The process of storage migration means „moving data from a location to another, eventually from a format to another, or maybe from an application to another„, while application migration is a „process of moving an application from one environment to another”. Cloud migration are refer to the „process of moving data, application, or other business elements from either an on-premises data center to a cloud or from one cloud to another” [10]. To migrate the on-premises systems, especially the database applications and data, to a cloud, is important to be clear which databases are suitable to migrate, which are the right tools or techniques to be used for an adequate migration plan, and what is the right type of chosen cloud.

But, the real provocation is not to determinate the best option regarding the cloud, but the migration of the database application and data from the legacy systems to the chosen digital solution. Stored in years of using, the old systems contained a lot of data which are not targeted in the migration process because the business no longer needs them. These data must be eliminated from the databases before migration in the cloud. So, the process of data migration involves data profiling, data cleansing, data validation, and the ongoing data quality assurance process in the target system. Regarding the enterprises with systems newer than legacy systems, as Web-enabled platforms considered be a plus, are register problems, too. New models might involve adaptation of mapped data, because of existing the risk of later facing with more complicated issues, and this activity implies IT professionals with hard experience in data migration. Only a certified team can correctly dimension the storage needs, computing power, cloud-ready applications, content delivery, and prioritize migration components correlated with application design and its integration complexity or host operating system. Migrating database is one of the most important and complex stages of a cloud migration, a database being obviously a critical part of any application [11]. For a successful data-migration it is necessary a rigorous plan. The cloud migration planning develops a migration strategy, too.

### 3. Conclusions

It is clear that to survive, businesses must go on the digital transformation way, leaving their old legacy information systems, and adopting the digital-ready technologies. A well-known statement nowadays ”a business is adaptable as its using technology”, must draw manager’s attention, because there are many heightened technologies: mobile, Internet of Things, or artificial intelligence, and their employees and customers alike are expected to use them. More than ever, if consider the saving money to streamlining processes by automating them, small and medium businesses can be competing now with the large companies. Using cloud computing services to the business digital transformation proofed that it is possible. Migration in the cloud is the first step in business digital transformation, a really difficult step for any business, indifferent of the size, field

of activity or technology already implemented. In order to survive, enterprises will necessarily have to replace their old systems because, over time, there is the risk of losing customer fidelity and confidence. It is obvious that such a laborious process involves financial costs that not all companies can assume, and it is the cause of the slow pace of adopting this technology, even for large enterprises, beyond the benefits offered.

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