Cloud Computing and Windows Azure

G. CARUTASU[1], M. A. BOTEZATU[1], C. BOTEZATU[1]

[1]Faculty of Computer Science for Business Management,Romanian - American University
carutasu.george@profesor.rau.ro,
botezatu.mihai@profesor.rau.ro,
botezatu.cezar@profesor.rau.ro

M. PIRNAU[2]
[2]Faculty of Informatics
Titu Maiorescu University
Bucharest, Romania
mironela.pirnau@utm.ro

Abstract **Cloud computing provides everything like a service, with the aim of offering an infrastructure and an active application platform, which is scalable and efficient in terms of cost for customers. Cloud services are quite abstract without a set of well-defined characteristics and according to user requirements, there are several solutions available on the market of Cloud computing.**

Keywords: Cloud, Virtual Machine, Windows Azure, Data Center

I. INTRODUCTION

Cloud is an abstract, virtual environment where programs and data are stored. In cloud computing power is provided by data centers, which can contain systems for data storage and many servers that have the ability to manage almost any software, and customers pay flexibly according to the resources used, based on a monthly fee. Also in Cloud Computing users do not need to buy software or maintain expensive servers and devices for data storage, this leads to significant reduction of expenses, office space, and internal staff for IT support and increase of data security [1-2]. We can identify that the main components for Cloud Computing are:

- **Clients** defined by terminals or common computers whose benefit are small hardware costs, small IT costs, security, lower power consumption, easy repair and replacement etc;
- **Data centers** consist of collections of servers where subscription applications are hosted. These can rely on a large hall in the same building or a room of servers outside the organization and may contain virtualized servers for which the software can be installed allowing multiple instances of virtual servers that can be used [3-4]. A lot of virtual servers can run on one physical server (multi-tenant).
- **Distributed Servers** that should not be located all in the same location but in disparate geographic locations. In reality if something happens to a site, such as a power failure, the service may be accessed from another site.

Users need an efficient and adaptable infrastructure for the purpose of their business. This involves a non-stop running service, available from anywhere in the world. Data centers can have more destinations such as: transaction processing center; centers for multimedia content delivery [5]; data center to perform complex simulations; data processing operations of enterprise type; data center for regular businesses. Windows Azure appeared in 2009 and contains the following types of Cloud Computing: IaaS (Infrastructure as a Service): is a Cloud model where a provider rents a technological infrastructure, i.e. remote virtual servers, which can replace completely or partly existing IT systems within the company [6-8]. IaaS includes the entire stack of infrastructure resources and facilities (electric power, cooling solutions, etc.) for hosted hardware platforms. IaaS provides a set of APIs that allow forms of management and other types of interaction with infrastructure for consumers. PaaS (Platform as a Service) is that kind of Cloud in which a supplier provides development solutions and application hosting, being used by companies to develop and host solutions on demand or provide services to other companies. IaaS PaaS is created over IaaS adding an extra level of integration with different frameworks of application development. *SaaS (Software as a Service)* represents a model in which a provider offers through web services different applications that make them available to end users. Such services are generally intended to replace user-installed applications on their local systems [1], [9].

A SaaS is built over PaaS, providing a self-contained operating environment used to deliver the entire user's experience, including ERP systems, multimedia applications, accounting software etc [5].

II. TYPES OF CLOUD

A public Cloud provides global services, whereas a private Cloud is a proprietary network or a Data Centre, which provides services to a limited number of people. When a service provider uses **public Cloud** resources to create his own **private Cloud**, the result is called Virtual Private Cloud.

Private Cloud type describes an IT infrastructure designed for exclusive use by a single organization comprising more consumers. A Private Cloud can be compared to a conventional Data Centre - the difference being represented by the applicability of technological solutions in order to optimize available resources and expansion of these resources through small investments, which are made gradually over time. Cloud represents a model of public-owned

infrastructure, administrated and operated by a specialized service provider, a commercial, academic and governmental organization or a combination of these. Within this type of Cloud the modality to access services is via the Internet, and service provider plays an essential role in terms of effective protection of data that are employed in its systems [10-13].

Hybrid Cloud, or the model of "Broker Cloud", describes a cloud infrastructure that represents a combination of two or more distinct Cloud infrastructure (Community Cloud, private or public) [14]. They behave as unique entities but are interconnected by a standardized or proprietary technology, which enables data and application portability on demand (a usage example is balancing resource usage for spikes request). The main aspects and essential facilities for Cloud Computing are: agility that improves users' ability to quickly adapt themselves to cheaper infrastructure resources provided by forecasting technologies; low costs; independence of location and computing device; Multi-Tenancy facilities; Reliability and Scalability. Cloud applications maintenance is much easier because it does not have to be installed on each user's computer. They are easier to administrate and/or upgrade, any change being accessible to customers almost instantly.

Another great advantage of Cloud technology is related to the mobility of accessing data when we need rapid access to critical data.

In Cloud we only need an Internet connection, to access the information stored from any geographic location, at any time, and also to post/transmit information if necessary. Social platforms, store and process Big Date in optimal response time. The database used by SN have big size, leading to the conclusion that their processing must be carried out on efficient computing systems using powerful virtual machines to provide a minimum processing and response time. For example, if a disaster situation arises the need to use critical information posted on a social network, see Twitter, the system that collects the posts to interpret and then process on the bases of analysis of feeling, shall be a Cloud with a strong, efficient and secure Data Centre [15-20]. There are numerous Cloud technology providers.

The European Commission will adopt a strategy for "Harnessing *Cloud* Computing in Europe". The strategy outlines actions to ensure a net gain of 2.5 million new jobs in Europe and an annual increase of 160 billion to EU GDP (around 1%) by 2020. The strategy was designed in 2012 to accelerate and increase C*loud* computing use in economy. Establishing a clear and solid framework for *Cloud*'s adoption by the public sector, will provide international users the security of a reliable access and will make Europe an active pole of innovation in Cloud services matter [21-22]. Adopting reliable *Cloud* solutions by public purchasers could encourage SMEs to adopt this type of solution, too.

III. BENEFITS IN WINDOWS AZURE

Using Windows Azure applications can be developed applications in almost any language and can integrate public applications from Cloud into existing IT environment [23]. Windows Azure includes the following features that enable customers to control access to their data and applications:

- Organizations can synchronize identification data at headquarters with Active Directory from Windows Azure and allows single authentication to simplify user access to their cloud-based applications.
- At any time can be achieved security reports to monitor data access and contribute to risk management.
- Authentication can be done by several methods, which helps to prevent unauthorized access, also providing a mechanism for authentication in addition to password.
- Customers can implement authorization schemes to control users access to resources on the tasks of the role, the level of authorization and permissions approved [24].

If you want to keep a number of local applications on your local servers and move others on cloud then when using "hybrid" approach we can have the necessary flexibility to run your applications and data will be stored locally on the cloud or in a mix of both versions. Microsoft offers solutions such as Office 365 [25], Microsoft Azure and Windows Server. For example, if you intend to host your applications in cloud, Office 365 provides access from anywhere by traditional use, on the desktop and on mobile devices [24]. Moreover, Microsoft Azure offers a fully managed cloud infrastructure to host our business applications and has the ability to quickly install new applications or move them from local servers on cloud, anytime we want. If we do not plan to invest in servers to run applications locally, then we can choose to use a server with built in virtualization capability such as Windows Server 2012 R2, thus having the ability to run multiple applications on the same server. This solution eliminates the extra costs associated to buying a new hardware, IT maintenance services and current bills [6], [9], [24].

Virtualization can also simplify the upgrade process. Even if in the past you used to purchase servers, software or services, "making charges" was the only option [26]. You had to pay directly, in advance, for what you thought you needed, whether it was a larger storage space or a new application by e-mail. Now, cloud technologies offer a better model of payment: a payment on the go [24], see Fig 1.

D11 Standard		D12 Standard		D13 Standard	
2	Cores	4	Cores	8	Cores
14	GB	28	GB	56	GB
4 Data disks		8 Data disks		16 Data disks	
4x500 Max IOPS		8x500 Max IOPS		16x500 Max IOPS	
100 GB Local SSD		200 GB Local SSD		400 GB Local SSD	
Load balancing		Load balancing		Load balancing	
Auto scale		Auto scale		Auto scale	

Figure 1.   Choice of resources(https://azure.microsoft.com/en-us/)

The main types of services brought by Windows Azure are classified as follows:

a.   For computer

- Azure Virtual Machines that allows you install Windows Server or Linux images in Cloud. You can select images from a gallery or you can bring your own customized images of operating system.

- Azure Cloud Services for which you do not have to manage the infrastructure any longer. With Web and Worker roles, you can switch immediately to the development, deployment and management of modern applications.

- Azure Web Sites helps you quickly install Web applications on a scalable and reliable Cloud structure. You can immediately scale resources or number of nodes; or set up automatic scaling as load application requirements.

- Azure Mobile Services Provides a backend in Cloud for Windows Store mobile applications, Windows Phone, Apple iOS, Android or HTML/JavaScript [27].

b.   *Data Services*

- Azure Storage provides storage space for non-relational data structures such as objects or binary files, simple tables, queues or virtual disks.

- Azure SQL Database is a relational database service that allows you to quickly create applications, to expand or scale them in Cloud.

- Azure Backup manages backup copies kept in Cloud with familiar tools in Windows Server 2012, Windows Server 2012 Essentials or System Center 2012 Data Protection Manager.

- Azure Cache is a scalable distributed solution, in-memory, allowing you to build responsive applications of high availability and scalability, providing fast access to data.

- Azure HDInsight is a service bringing Apache Hadoop solution in Cloud. Earn Big Data full value with a Cloud-based platform that manages data of any type and size.

- Hyper-V Recovery Manager helps protect important services; coordinates replication or recovery of virtual machines with a Cloud-based System Center 2012 in a secondary location.

- Azure Media Services provide Cloud solutions for many existing technologies for collection, encoding, format conversion, content protection and streaming live or on-demand.

- Azure Active Directory provides management capabilities of identities and access control for Cloud applications.

- Azure Multi-Factor Authentication helps prevent unauthorized access to Cloud applications or on-premises: adds another level of authentication.

- Azure Service Bus is a messaging infrastructure that is put between applications, enabling them to exchange messages for a better scalability and resilience.

- Notification Hubs is a cross-platform infrastructure of high scalability for sending notifications

- Azure BizTalk Services is a Cloud-based service providing Business-to-Business capabilities (B2B) and Enterprise Application Integration (EAI) for integration of Cloud or hybrid solutions.

- Azure Scheduler allows you to run actions that make HTTP/S calls or send messages in a queue on a settled schedule [25].

- Visual Studio Online provides a Cloud of ALM (Application Lifetime Management) type solution, which cares of code storage with functionality for collaboration and tasks or issues tracking, up to test on uploading or automatic compiling.

- Azure Automation allows you to automatize creation, deployments, monitoring and maintenance of resources using a scalable and reliable engine for execution of workflows.

- Azure Content Delivery Network deliver broadband content to worldwide customers, with low latency and high availability through a robust global network of data centers.

- Azure API Management lets you publish APIs for developers, partners or employees, in a secure and scalable way.

c.   *Network*

- Azure ExpressRoute allows you to create private connections between Azure data centers and infrastructure, which is located on premises or in a colocation environment

- Azure Virtual Network helps us to create VPNs - Virtual Private Networks in Azure and tie safely these VPNs with IT infrastructure.

- Azure Traffic Manager makes load balancing for the traffic coming towards more services hosted on Azure[21].

IV.   VIRTUALIZATION IN WINDOWS AZURE

Virtualization is the most important sector in the field of IT technologies. The current trend in virtualization domain is to install more virtual machines on a physical machine for maximum exploitation of the resources of processor and memory on the life duration of the physical machine. Among virtualization solutions we can include: virtualization at the hardware level (VMware Virtual

Center and ESX, Microsoft Hyper-V and Virtual Server), virtualization at operating level system (Open Source Open VZ, Sun Solaris Containers, HP Secure Resource Partitions), virtualization at the application level (VMware Thinstall, Microsoft SoftGrid, Symantec -Altiris SVS, App Stream, Endeavors), Network virtualization and storage virtualization [26].

Windows Azure enables creating Virtual Machines, offering IaaS (Infrastructure as a Service) so that IT professionals can create and use virtual machines in cloud.

Virtual Machine developed for Windows Azure offers to users the possibility of using a R2 image in Windows Server 2012 system as well as the possibility of running Linux through a virtual machine [21][27-28], as shown in Fig. 2
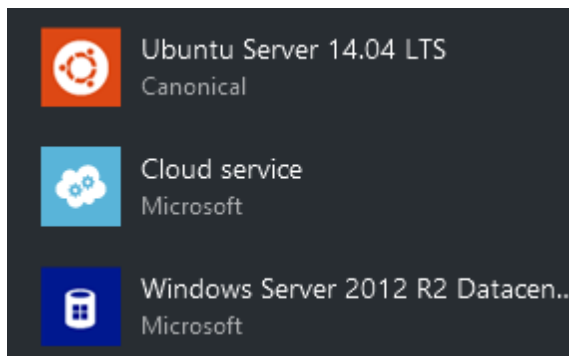

Figure 2.   Contained operating systems

These servers, either Windows or Linux can be accessed via Remote Desktop.

System Center 2012 R2 provides unified management and system administration for Cloud and Microsoft Azure platforms, having also the following capabilities: provision of infrastructure; providing infrastructure; monitoring infrastructure; on-demand service and automation; performance monitoring; service management. System Center 2012 works with Windows Server 2012 to manage a large number of physical machines [28-31]. The virtual machine has a private IP and access to this can only be done through an intermediate machine (Load Balancer), which provides **public** IP (VIP) see Fig 3. At any time is known and monitored the occupancy and load degree of virtual machine used, as can be seen in Fig 4.
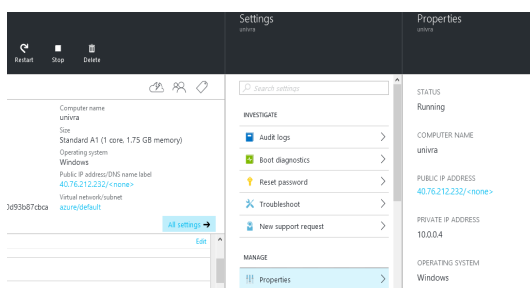

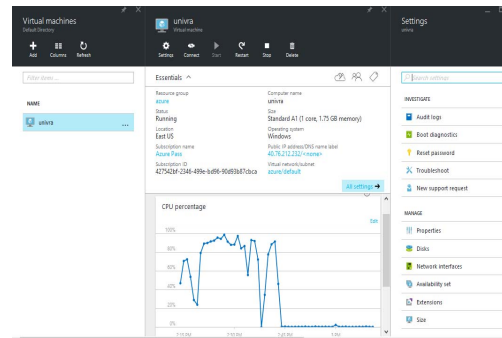Figure 3.   Identifying the IP of virtual machine

Figure 4.   Virtual machine properties

Connecting to virtual created machine is performed based on authentication according to Fig 5. It is very important that the Azure virtual servers to be accessible from anywhere. Windows Azure contains a "preview feature" called VHD Role and allows us to realise virtual machines as in the Amazon or any other hosting virtual machines, either from a predefined template, or with a WHD custom, which then is loaded into cloud [32-34].
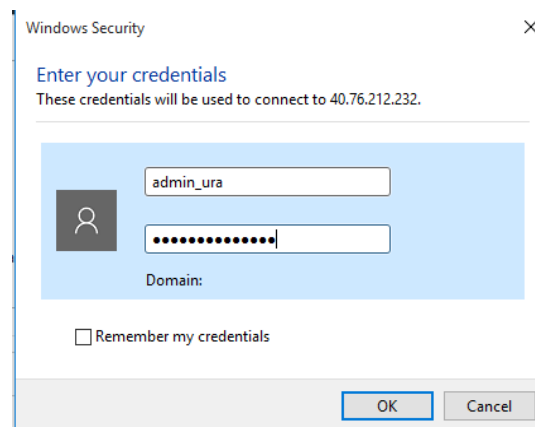

Figure 5.   Connecting to virtual machine

These servers, either Windows or Linux can be accessed via Remote Desktop. Among the highest advantages that virtualization technologies offer the following are most important: the multiple applications and operating systems can run on a single physical system; servers can be centralized in virtual machines; available natural resources are treated as a common part and are controlled within the virtual machine [35].

V.   CONCLUSIONS

A successful implementation of any IT structure depends heavily on choosing and planning of an architecture to meet efficiently the needs of the computer system we want to develop. Maintaining high standards of availability, security and performance in a well-developed regulatory framework will remain the major guiding lines in professional IT services. In order to achieve the desired purpose beneficiaries of cloud should be very careful in choosing a provider. Many of them often assume responsibility for managing the information, but being unable to reach a certain level of service quality may have a major impact on data confidentiality and on operations flows.

REFERENCES

[1] D. Ardagna, G. Casale, M. Ciavotta, J. F. Perez, W. Wang, "Quality-of-Service in cloud computing: modelling techniques and their applications", Journal of Internet Services and Applications, Volume: 5, Issue: 11,pp.1-13,2014.

[2] M. Salam and A. Shawish, "A QoS-oriented inter-cloud federation framework", IEEE Systems Journal, p. 642-643, 2015.

[3] W.Xu, X. Zhu, S. Singhal, Z. Wang(2006)"Predictive control for dynamic resource allocation in enterprise data centers", 10th IEEE/IFIP Network Operations and Management Symposium, 2006,pp. 115-126. doi: 10.1109/NOMS.2006.1687544

[4] T.Ludescher, T. Feilhauer, P. Brezany. (2013) Cloud-Based Code Execution Framework for scientific problem solving environments // Journal of Cloud Computing: Advances, Systems and Applications, vol.2, no. 11.doi:10.1186/2192-113X-2-11

[5] N. L. Căruţaşu, G. Căruţaşu Cloud ERP implementation, FAIMA Business & Management Journal, Vol.4 Issue 1/2016, pp. 31-43, 2016, ISSN 2344-4088.

[6] R. Jennings, Cloud Computing with the Windows Azure Platform, 2009, Wiley Publishing

[7] Henry Li , Introducing Windows Azure, Publisher Apress, 2009, ISBN 978-1-4302-2469-3

[8] S. Krishnan , Programming Windows Azure, O'Reilly Media ISBN: 978-0-596-80197-7

[9] G. Wang and T. Ng, "The impact of virtualization on network performance of amazon ec2 data center", INFOCOM, 2010 Proceedings IEEE, pp. 1-9

[10] J. Yao, S. Chen, C. Wang, D. Levy, and J. Zic.Accountability as a Service for the Cloud. Services Computing, IEEE International Conference on, 2010.

[11] Q. Xing and E. Blaisten-Barojas, A cloud computing system in windows azure platform for data analysis of crystallinematerials, Concurrency and Computation, vol. 25, no. 15, pp.2157–2169, 2013.

[12] S. J. Johnston, N. S.O'Brien, H. G. Lewis, E. E. Hart, A. White and S. J. Cox, Clouds in space:scientific computing using windows azure, Journal of Cloud Computing, vol. 2, article 2, 2013.

[13] M. Popescu, Viorel Ionescu, Building and Using Web Services in Microsoft Technology, Conferinţa Internaţională Educaţie şi Creativitate pentru o Societate Bazată pe Cunoaştere, Section III- Computer Science, Universitatea Titu Maiorescu, Ed. A IX-a, 19-21 noi., 2015, Bucureşti.

[14] http://imtdocs.alberta.ca/NIST_Cloud_Computing_Reference_Architecture.pdf

[15] S. M. Sanchez, "Simulation experiments: better data, not just big data," in Proceedings of the Winter Simulation Conference, pp. 805–816, IEEE Press, Savanah, Ga, USA, December 2014

[16] H.N. Teodorescu, Using analytics and social media for monitoring and mitigation of social disasters. Procedia Engineering 107 (2015), pp. 325-334

[17] H.N. Teodorescu, S.C. Bolea, Analysis of probabilities of specified words' occurrences in SN messages related to catastrophes. 18-th Int. Conf. on System Analysis and Information Technology SAIT 2016, Kyiv, Ukraine, May 30 – June 2, 2016

[18] M. Parashar, "Big data challenges in simulation-based science," in Proceedings of the 6th International Workshop on Data Intensive Distributed Computing (DIDC '14), pp. 1–2, ACM, Vancouver, Canada, June 2014.

[19] X. Wu, X. Zhu, G.-Q. Wu, and W. Ding, "Data mining with big data," IEEE Transactions on Knowledge and Data Engineering, vol. 26, no. 1, pp. 97–107, 2014

[20] Y. Wu and G. Gong, "A fully distributed collection technology for mass simulation data," in Proceedings of the 5th International Conference on Computational and Information Sciences (ICCIS '13), pp. 1679–1683, IEEE, Shiyang, China, June 2013.

[21] http://www.cloudforeurope.eu/documents/10179/15444/D3.1+Standards,+normalisation+and+certifications+associated/fb803b4e-eb78-43be-8369-33297d7d5a2f

[22] D. G. Gordon and T. D. Breaux. Managing multi-jurisdictional requirements in the cloud: towards a computational legal landscape. In Proceedings of the 3rd ACM workshop on Cloud computing security workshop, CCSW '11, pages 83{94, New York, NY, USA, 2011. ACM.

[23] E. Roloff, F. Birck, M. Diener, A. Carissimi, and P. Navaux, "Evaluating high performance computing on the windows azure platform, " in Cloud Computing (CLOUD), 2012 IEEE 5th International Conference on, 2012, pp. 803-810

[24] https://azure.microsoft.com/en-us /

[25] C.S. Calmus, C. Racuciu, MESSAGE ENCRYPTION IN OFFICE 365, Conferinţa Internaţională Educaţie şi Creativitate pentru o Societate Bazată pe Cunoaştere, Section III- Computer Science, Universitatea Titu Maiorescu, Ed. A IX-a, 19-21 noi., 2015, Bucureşti.

[26] R. Nasim and A. Kassler, "Deploying openstack: Virtual infrastructure or dedicated hardware", Computer Software and Applications Conference Workshops (COMPSACW), 2014 IEEE 38th International, pp. 84-89

[27] R. Jennings, Cloud Computing with the Windows Azure Platform, ISBN: 978-0-470-50638-7, Paperback, 360 pages, October 2009

[28] https://azure.microsoft.com/en-us/services/biztalk-services/

[29] G. Shields,The Shortcut Guide to Virtualization and Service Automation, Realtime Publisher, 2008

[30] https://msdn.microsoft.com/en-us/windowsserver2012r2.aspx

[31] X. Song, Y. Ma, and D. Teng, "A load balancing scheme using federate migration based on virtual machines for cloud simulations," Mathematical Problems in Engineering, vol. 2015, Article ID506432, 11 pages, 2015.

[32] E. Cayirci, "Modeling and simulation as a cloud service: a survey," in Proceedings of the Winter Simulation Conference, pp. 389–400, IEEE, Washington, DC, USA, December 2013

[33] J. Li, M. Humphrey, D. Agarwal, K. Jackson, C. van Ingen, and Y. Ryu, "eScience in the cloud: A MODIS satellite data reprojection and reduction pipeline in the Windows Azure platform, " in Parallel Distributed Processing (IPDPS), 2010 IEEE International Symposium on, april 2010, pp. 1 - 10.

[34] E. Pluzhnik, E. Nikulchev, S. Payain. (2014) "Optimal Control of Applications for Hybrid Cloud Services" Proc. 2014 IEEE World Congress on Services (SERVICES 2014)

[35] Z. Hill, J. Li, M. Mao, A. Ruiz-Alvarez, and M. Humphrey, "Early observations on the performance of windows azure, " in Proceedings of the 19th ACM International Symposium on High Performance Distributed Computing, ser. HPDC '10. ACM, 2010, pp. 367-376.