DATA CENTER REMODELING FOR THE INTERNET OF THINGS

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Abstract: *Designing efficient data center is more than ever a challenge for many companies when it comes to meet the requirements of having a greater and extensible computing capacity. It should be stored increasing volumes of data. Applications became increasingly complex. The requirements for running business operations should be very flexible. If we want that ICT infrastructure (**I**nformation **T**echnology & **C**ommunication) to be able to offer, continuosly, high level of services, it is essential to rethink the "robustness" and the need for innovation in data centers. This is true for both servers and storage as well as for the processing power. Companies operating in this field help customers to optimize their data center availability and security by evaluating the energy consumption, cooling capacity and other factors involved in data centers upgrading. The objective is to obtain an optimum in terms of occupied space, most efficient power consumption and most effective cooling in order to achieve a sustainable long term data center operation. The development and modernization explosive data centers as a result to the three major trends existent in the IT (**I**nformation **T**echnology) now: cloud computing, Internet of Things and Big Data [1, 9].*

Keywords: cloud computing, data centers, virtualization, IT infrastructure, integrated management, internet of things

1. INTRODUCTION

In the new era of computing, companies are looking for quick ways to implement cloud computing in order to take the advantage of hybrid environments that maximizes the persectives arising from Big Data and Internet of Things (*IoT*), for providing innovative ways to change the resources [1, 2, 7].

Organizations are forced to go through large volumes of data for a better understanding of the causes and to implementing a quick solution for solving of problems. However, they must predict events and to optimize the way they are managed.

Communications technology underleis of the changes that characterize our life in this period, significantly transforming the way we live, work and interact with each other and then with the world around us. In this constantly changing communication environment, mobile data traffic grows at an exponentially rate, Ericsson Mobility report predicting an increase of 12 times between 2012 and 2018 data traffic.

Increasing the volume of critical data and applications that support real-time decision making, make the adoption of SSDs (***S**olid **S**tate **D**rive*) to be faster and to bring with it an increase in performance of the data center. This adoption, however, has not benefited from sufficient information to centralized management that customers need to effectively manage storage space. The current offering solves this problem by allowing customers at the same time, to combine SSDs with already existing SAN (***S**torage **A**rea **N**etwork*) or DAS (***D**irect **A**ttached **S**torage*) without compromising availability.

Barcelona City currently uses "*Internet of Things*" solutions to provide new services and improved experience. Spanish Town is one of the first in Europe that have developed virtual services for citizens and uses video and collaboration technologies to enable people to interact virtual, remote with the City Hall. However, one of the most intelligent communities in the world connected and implemented IoT solutions in water management, smart parking,

waste management, public transport, which helps the city to save money and improve services provided to citizens.

1.1. Delivering real-time applications in the data centers

Cisco IT has revolutionized the industry by launching the "***A**pplication **C**entric **I**nfrastructure*" (ACI) solution, expanding professional services and providing aa open ecosystem for partners in order to increase business efficiency [3, 7]. With the introduction of ACI, the company offers the first solution for data centers and cloud computing that will provide complete visibility and integrated management for IT resources connected to physical and virtual networks, based on application requirements.

We should discuss about IT industry need to adapt quickly to the "*economy of applications*". Applications became the engine of business, enabling CIOs to deliver new products and services, manage compliance and management level, reduce security risks, and increase business productivity. As millions of new connections create Internet of Things (IoT) that most would experience through applications, focusing on rapid implementation of applications became increasingly important [3, 8]. Thus, the role of communication network as a technology for connecting users, applications and data became critical.

Raised complexity and lack of flexibility of the ICT infrastructure slows the business. Practitioners work in separate and inefficient silos because the technology does not allow the implementation of a unified architectural model. Thus, IT managers do not have a unified view of all the components that affect application performance.

CIOs want to break these silos and unify all IT components - networks, storage facilities, computing solutions, network services, applications, security - and to manage as a single entity and dynamic. The ACI solution cumulates innovations in hardware, software, computers and integrated circuits ASIC (***A**pplication **S**pecific **I**ntegrated **C**ircuit*) network with a dynamic model, responsive applications, built around open APIs (***A**pplication **P**rogramming **I**nterface*), designed to reduce the application deployment time from a few months to a few minutes.

The ACI can achieve this objective by unifying physical and virtual networks, along the appropriate security. It can ensure the compliance and real-time visibility both on the system and for users and applications at unprecedented levels. Innovations in switching at the data center levels provided through the ACI solution, allows the network to quickly respond to the application development teams, delivering a reduction in costs of up to 75% compared with industrial built switches and network virtualization solutions based exclusivelly on software.

The solution is based on industry standards and allow IT industry to meet demand for new applications, adapt and relocate existing IT resources when applications are not used. The ACI accelerate the implementation cycles of the applications for a faster running of the processes in organization and obtaining improved final results.

- Provides a 75% reduction compared to the costs of network virtualization based on software solutions, balancing the existing wiring investments, with the delivery of more effective modular switches through an innovative backplane helping to reduce energy costs and cooling to 15%.

- Accelerate application implementation, improving business agility through a centralized management system of the network profiles of applications, network service automation and open APIs.
- Centralize management policy by simplifying operations due to general control system policy that allows collaboration between teams responsible for applications, security systems, virtualization, processing and storage.
- Investment protection through open protocols, APIs and standards that allow the alignment of networking systems with security services, physical and virtual data processing and storage elements.

2. DATA CENTER – AN IMPORTANT HUB FOR DATA TRAFFIC

Let us ask ourselves the question: How much is 1 Petabyte (PB) of data? One possible answer: 1 PB of data means 50 times the amount of data available in the US Congress Library, or 13 years of HD video transmission. Well, in 2012, in the whole world, peop;e generated 1 PB of data by every 11 seconds!

By now on Facebook is loaded over 300 million picture every day. There are predictions that by 2015, half of the planet will be connected online. The amount of information that occurs already doubles every two years. In 2015 there will be 15 billion connected devices online, mobile data traffic will be over 11 times higher than today, which will mean that by 2015 the cost of energy that we consume will be 27 billion, ie two times higher than at present.

The analysis dedicated to data centers proposes a a radiography of the current situation in Romania, the latest developments and trends in the field and aims to present some fundamental elements that compose a possible strategy planning and procurement of such services by the potential beneficiaries.

2.1. Data Center traffic

Global data center traffic will triple and reach 7.7 ZB (Zetabyte) annually by 2017. It is estimated that cloud traffic, the fastest growing component of the data center traffic will increase from 1.2 in 2012 to 5.3 ZB ZB 2017. An zetabyte terabyte represents a billion of terabytes and 7.7 ZB is equivalent to eight hours of high-definition video streaming online system.

Global data center traffic in 2012 was 2.6 ZB, but it is expected to grow by 25% annually until 2017, when it will exceed 7 ZB, revealed a study [4] for the period 2012-2017 . The study [4] estimated that global cloud traffic will grow faster (at 35%) than the average global data center traffic, given that users and companies are using more and more cloud computing services. Globally, cloud traffic will grow from 46% of the total data center traffic in 2012 to 69% by 2017, representing more than two thirds of traffic the data center.

Approximately 17% of the data center traffic will be fed by end users who access the cloud for web browsing, video streaming, collaborative and connected devices [4]. For the period 2012 - 2017, it was estimated that 7% of the data center traffic will be generated between data centers itself being driven primarily by data replication and system software updates.

The majority (76%) of traffic will remain inside the data center and will be largely generated by data storage, production and development data in a virtualized environment. People around the world will continue to require the ability to access personal content, content business and entertainment content from anywhere (the location), on any device, and each transaction in a virtualized environment and / or in the cloud, can produce effects cascade on the network. Due to this rising trend, we see huge increases in the amount of traffic within the cloud, between and beyond data centers over the next four years.

From a regional perspective, the study [4] predicted that in 2017, the Middle East and Africa will have the highest cloud of traffic growth rate (57%), followed by Asia-Pacific (43%) and Central and Eastern Europe (36%). The study [4] also revealed the trends of workload transition between 2012 and 2017, noting that 2014 will be the first year when the most of work tasks will be moved to the cloud, 51% of these being processed in the cloud, unlike 49% in the traditional IT space.

By 2017, almost two thirds (63%) of work tasks will be processed cloud data centers and only 37% will be processed by traditional data centers, estimated study [4].

3. DATA CENTERS ARE ADAPTING FOR THE INTERNET OF THINGS

From the perspective of IT, the world is currently in the middle of transition from the isolated systems to Internet access devices which can connect and communicate with each other or cloud environments. This new reality is generically called Internet of Things (IoT).

Actual estimates indicate that the amount of data will grow Up to 10x in 2016, while the number of devices connected to the Internet will reach 15 billion by 2015 and 50 billion in 2020. In this context, we can talk about the applicability of IoT a wide range of areas, from retail or distribution of electricity to telecommunications infrastructure.

We can talk about devices and network technologies, the implications for data centers, considerations on cloud computing, big data and security. Recognizing the importance of IoT, Intel announced the creation of a dedicated IoT business unit solution. This entity will be a key point in the company's next strategy.

IoT represents a huge opportunity. The internet was created for communication between people, and most of the data generated today is formed by the interaction with people. The main trend now is that the machines “to talk” to each other, to work smarter together to solve the acute business problems and provide interesting experiences for consumers. IoT devices and new technologies will generate huge volumes of data that must be analyzed efficiently and in the right place, so as to bring business value.

Intel's vision on Internet of Things is based on three pillars: *smart devices*, providing intelligence where it is necessary to secure data collection and filtering; *an intelligent system* - billions of smart devices that share data and supporting safe coexistence with existing and new infrastructure and *end-to-end analytics systems* - solutions ranging from devices to the cloud, providing full value for customers.

When it comes to extract business value from these large volumes of data, then we talk about the need of distributed analytics solutions. We will see a major development in this space, really mature analytics systems for data centers to applying analytics solutions in the network. A real implementation requires distributed analytics solutions both in the network and the data center.

As a novelty, in order to support Internet of Things, Intel's announced the expansion of product families Intel and Intel Atom Quark roadmap, as a starting point in delivering new smart gateway solutions, consisting of hardware and software integrated pre- validated, to be launched in the first quarter of 2014. As well the company also collaborates closely with the industry to accelerate the implementation of IoT, especially in networks.

In conclusion, the field is in full expansion of services and access devices, IoT adding a new dimension; programmable smart and flexible grids being needed, Intel invest today to allow the industry to address the challenges of scalability and network performance and to innovate in the development and delivery of services. Intel's strategy is to redesign the data center architecture, offering products for reducing complexity, space and energy, accelerating the delivery of new services and enabling business transformation through a new approach.

All these new connected devices demands significant involving at the data center level and their infrastructure must respond to this evolution. As these infrastructures will evolve, they will create new opportunities for customers and partners of delivering new services. The appearance of these services will create a high demand for new devices and thus will be born a new spiral.

At the same time, we see that some technologies are still at the beginning. For example, only 6% of large companies make decisions using "*Big Data analytics*", only 9% of sites workload enterprise cloud resides in public cloud and only 8% of midsize companies confirmed that they use HPC (***H**igh **P**erformance **C**omputer*).

From the perspective of the data center in all these areas we see opportunities for improvement. At the same time, other pressures at the data center level come from the service delivery, which are currently require two to three weeks on the market positioning of new services, storage area, where there is a 40% annual growth in data volumes 90% of new data is unstructured and requiring specific management tools (see distribution for Apache Hadoop) and, not least, from the servers, where their use is on average less than 50% despite of virtualization technologies adopted in recent years.

In this context, we intend to see how we can use technology and best practices in large data centers, such as those of Google, Yahoo, or Facebook, to build more effective infrastructure in the corporate IT of traditional organizations. From the above it follows that future data center infrastructure will mean "*Software Defined Infrastructure*", a world where applications define system.

5. CONCLUSIONS

In the study [4] is estimated an three times increase of the global traffic in data centers, which will reach a total volume of 7.7 zettabytes year 2017. Cisco anticipates a 4.5-fold increase of data traffic in the cloud data center.

Thus, approximately 17% of the data center traffic will be generated by end users who access the cloud for web browsing, online transmission of video and use of all devices connected to the network elements that make up the "Internet of Things" [5, 6, 8].

The traffic generated by data centers and cloud computing services to provide access to cloud services for individual users represents another segment. For the period 2012-2017, it is anticipated that approximately 7% of all network traffic will be performed between data centers, as data replication and updates of software and system. Other 76 percent of the traffic

will be generated inside the data center for storage of data in the production and development of a virtualized environment.

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