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THIN CLIENT IN MASSIVE RLS WITH CLOUD APPLICATION

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Abstract: T Many organizations, both large and small, are investigating the potential of thin client architectures for their companies. In general, a thin client is the one which does not have any local storage and we are using this because of their many advantages. Few years ago, we build our own virtualized cloud for REMLABNET and we still are taking benefits of this decision. This item handles with using Cloud computing platform for providing Remote laboratories. This work shows, how it is possible to save money if we use centralized system for more consumers. Every consumer can use access to centralized portal in the Cloud computing from Consortium REMLABNET. Every item is focused on environments of universities, where this cloud is existing, and this is what we want to use for remote labs. This is item from practice knowledge and experiences about system function and managing virtual platform and next construction this proposal.

1 Introduction

IT departments in universities are permanently under pressure to provide high quality services with reduced budget. On the other side, costs of energy for datacentres (DTCs) running and cooling call for radical changes in all universities compared to classic DTCs. Few years ago, we were using a prevailing standard in the decentralization and fractionating of services to several physical devices. This approach is nowadays under severe changes in direction to consolidation of DTCs denoted under cumulative term of virtualization. Virtualization has to offer decrease in energy consumption and increase in system performance without compromise on security of DTCs [1].

The last two decades has seen the rise of the DTC computing practically in every application domain. The move to DTC has been powered by two separate trends. In parallel, functionality and data usually associated with personal computing have moved into the DTC; users continuously interact with remote sites while using local computers, while running intrinsically online applications, such as email, chat or manipulating data, traditionally these are stored locally, such as documents, spreadsheets, videos and photos. In effect, modern architecture is converging towards cloud computing (CC), a paradigm where the whole user activity is funnelled into the large DTC via high-speed networks. Simply speaking, cloud computing is a set of computers, services or infrastructure. Delivering services are meant to reduce the work of consumers every day, as well as service providers and IT specialists. Cloud computing allows more access services as it reduces infrastructure delivery time from weeks to hours and it offers reimbursement for provided sources and services only [2].

Main idea of our work and this paper, is for clients to use new methods on how to provide remote laboratories (RLs) [3]. On the Figure 1, we can see primary idea of this system. On the left side, we can see individual remote laboratories, experiments, with physical HW and SW, connected to our virtualized cloud. Core of our cloud is management system for monitoring, diagnosing and administrating remote laboratories and users, or our clients. This management system is named Remote Laboratory Management System (RLMS) REMLABNET and it is consisted of few modules. For example: diagnostic server, data warehouse and content management system (with schedule and calendar, communication server, etc.) [4].

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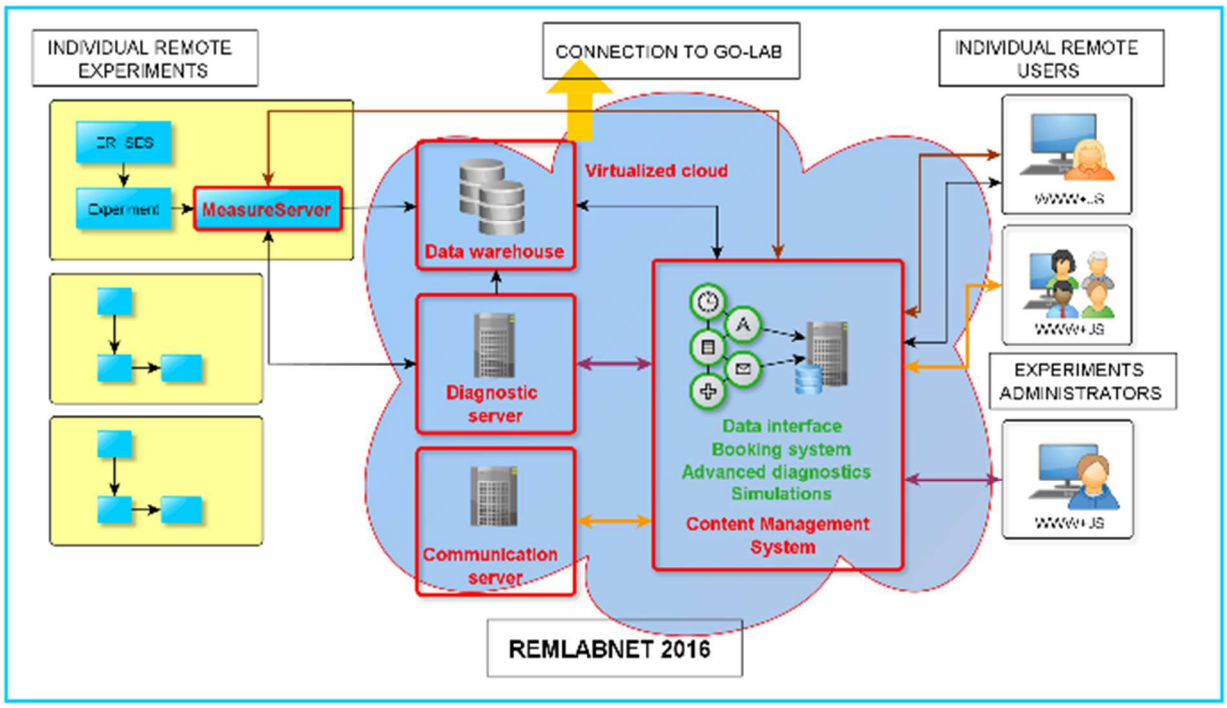

Figure 1 – Block diagram of CC-REMLABNET

2 Cloud computing concept

Of course, our work is primary oriented for remote laboratories, but our idea is to provide remote laboratories like cloud computing service. We were first in the world, who provided remote laboratories via CC technology. A new concept of our CC is figured on the Figure 2, where we can see all interesting parts of this idea.

First, we can see main parts of cloud computing. Each cloud is based on three primary services for use [5]:

IaaS – Infrastructure as a service is a standard service for providing all infrastructures.

PaaS – Platform as a service is a standard service for providing VMs with operating systems.

SaaS – Software as a service is a standard service for providing SW features for consumers.

Virtualized DTC contains physical and virtual servers, which serve a variety of services including web services, file services etc. The advantages of DTC are enabling application isolation from malicious or greedy applications cannot impact other applications co-located on the same physical server. Perhaps the biggest advantage of employing virtualization, is the ability to flexibly remaps physical resources to virtual servers in order to handle workload dynamics.

Server resources in a data centre are multiplexed across multiple applications and each server runs one or more applications. These applications are usually business critical applications with Quality-of-Service (QoS) requirements. The resource allocation needs to not only guarantee that a virtual container always has enough resources to meet its application's performance goals, but also prevent over provisioning in order to reduce cost and allow the concurrent hosting of more applications.

Our other aims are: To construct really stable and dynamically expandable Cloud computing for using remote laboratories. To create VMs and linkage for all parts in cloud, create communication links, virtual network for cloud computing inside, and all needed parts for Cloud computing concept. The goal of our work is new and acute topic of providing a new service for the consumers - completely functioning "Remote laboratory as a service" (RLaaS) [6].

It is very interesting for all clients of the Remote laboratories, because they can find this cloud concept and every remote laboratory. We created Consortium named REMLABNET and this is consortium of the three universities: Trnava University in Trnava (Slovakia), Tomas Bata University in Zlin (Czech Republic) and Charles University in Prague (Czech Republic). REMLABNET portal is on domain name or web site www.remlabnet.eu [7].

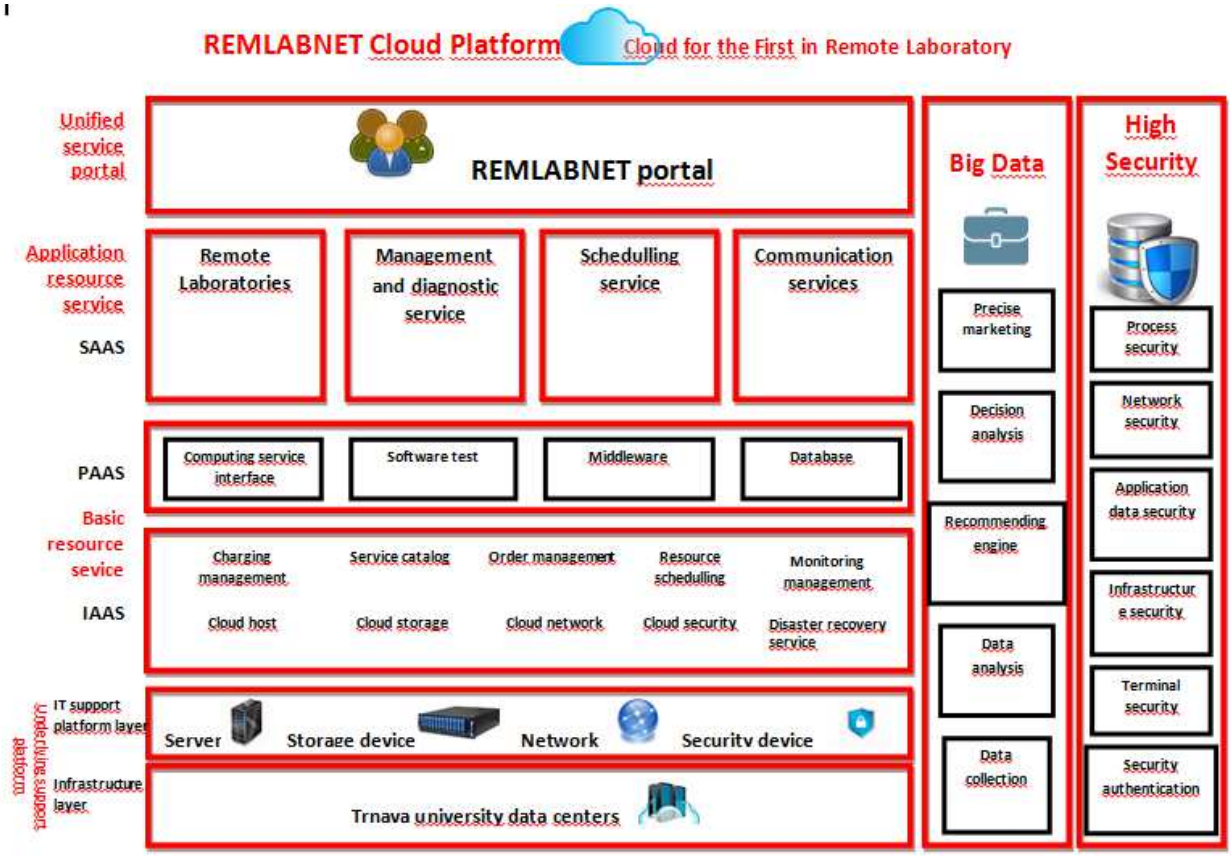

Figure 2 – Cloud computing concept in our Remote laboratory area

3 Thin client in RLs

In the world of client/server architecture, you need to determine, if it will be the client or the server that handles with the bulk of the workload. By client, we mean the application that runs on a personal computer or workstation and relies on a server to perform some operations.

Thick or thin client architecture is actually quite similar (Figure 3). In both cases, you can consider it as being the client application running on a PC, whose function is to send and receive data over the network to the server program. The server would normally communicate that information to the middle-tier software (the backend), which retrieves and stores that information from a database.

A thin client (TC) is a networked computer with few locally stored programs and a heavy dependence on network resources. It may have very limited resources of its own, perhaps operating without auxiliary drives, CD or DVD drives or even software applications.

Typically, a thin client is one of many network computers that share computation needs by using the resources of one server. A thin client often has low cost hardware with few moving parts and can usually function better in a hostile environment than a fat or rich client.
In global, we are talking about two categories:

1. thick client, called sometimes fat client,
2. thin client, where is difference in thin client or zero client (only HW configurations).

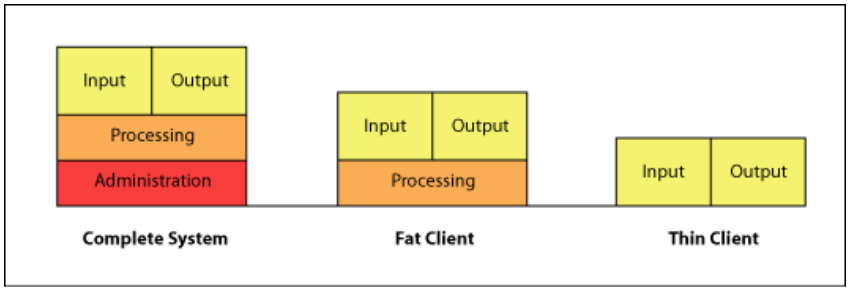

Figure 3 – Thin and Fat Client compared to a complete system [8]

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We are arriving at decision to move to thin clients from local PCs for administration of the laboratories. TCs are sometimes called 'dumb terminals' and can offer a number of advantages:

- Increased security
- Easier upgrades
- Lower cost of ownership
- Reduced energy consumption
- Reliability

If we are looking at individual experiments, we can see these differences between Figure 4 and Figure 5, where we show using traditional PC architecture for laboratories and new concept with TC.

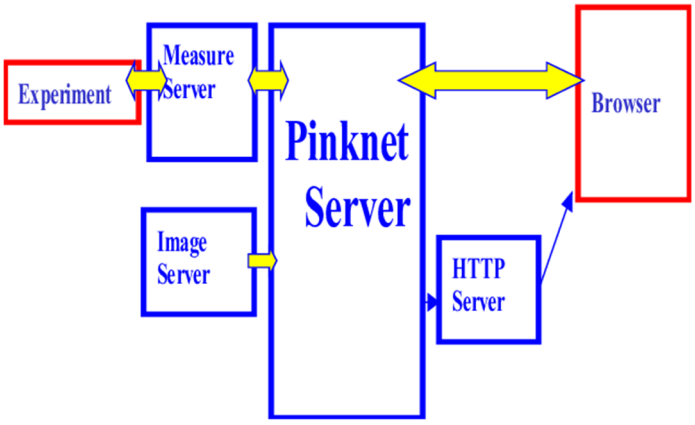

Figure 4 – Schematically representation of the remote experiment setup with Pinknet server and Image Server, Measure Server and HTTP Relay Server [9]

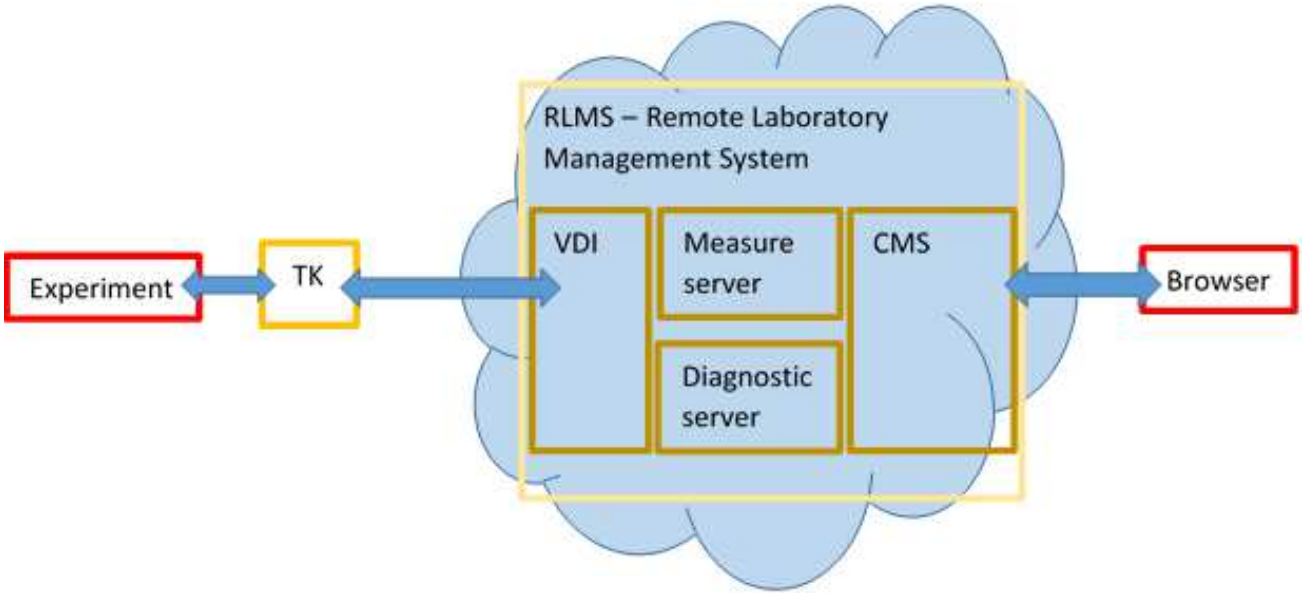

Figure 5 – New schema with using TC

We can see that all SW parts of experiment are moved to Cloud. Every part can start from template and this is good way for easier administration and possibility to connect different HW configuration of RLs to RLMS REMLABNET. In REMLABNET, we are trying two different styles of thin client. First is old system from Oracle SunRay (old Sun Microsystem SunRay) and second is thin client from Huawei. These are shown on Figure 6.

Figure 6 – Thin clients used in REMLABNET

The main architecture of TC in REMLABNET is figured on Figure 7. Every TC is connected to his own virtual machine (VM) via LAN (with separated VLAN) and Virtual desktop connector in REMLABNET named FlexControl. Flexcontrol system is set of SW instances for switching and management VMs. Every TC have allocated just one VM from virtual cloud. This allocation is handled by the MAC address to each TC.

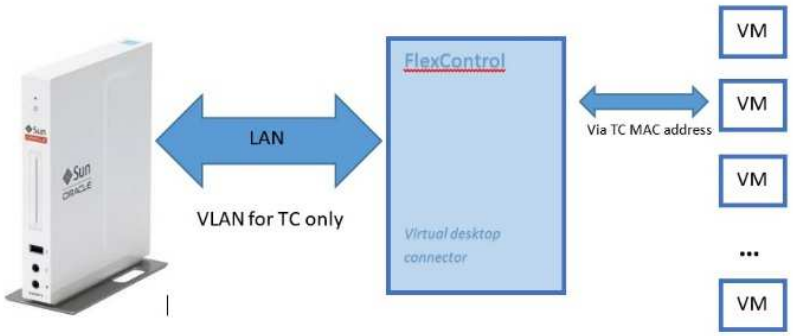

Figure 7 – Architecture of TC in REMLABNET

On each VM for TCs we have installed every needed part like Measure server, diagnostic server, and for some TCs also Image server. HTTP server and others are part of RLMS. FlexControl and VMs are part of virtualized cloud and can be used like cloud service.

4 Conclusions

Our idea of use Cloud computing was attested and discussed with experts in this research part. The way of our work is good and have a big progress. We can provide new service, Remote laboratory as a Service (RLaaS) in our cloud system and we are first to use thin client to communication between main experiment and virtual cloud. Our consumers are primary teachers, students and brainpower of the universities and high schools, but access is possible for all consumers via Internet. This show, how the university network is very overcast for communication and traffic. This claim, that network must be without failure and latency. And be secured too for management and research data protection. Security on the network is very important part, but it is without frame of this paper.

In this paper we showed our idea of construct Cloud computing system with important parts like using thin client. Our work is oriented to save money in education and research if everyone builds their own Remote laboratories. We have connected many laboratories from Zlin University, Trnava University, Charles University and other in the world. Our work is in simple terms „Bring Technology to Service!“.

Acknowledgement

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