Euronet Lab
A Cloud Based Laboratory Environment

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Abstract - **A large number of virtual and remote labs connected to the internet is already available nowadays. However, they usually are isolated and independent systems, unable to cooperate and complement each other. This lack of interconnection and interoperability leads, consequently, to the duplication of efforts in order to develop what could be easily shared and reused. Therefore, the integration of different platforms can speed up the development of virtual labs and downsize the barriers of using complementary systems that would represent an unachievable development task.**

In this paper one presents a proposal for the implementation of an open system that will be able to integrate different virtual lab platforms and components by interconnecting them and establishing communication mechanisms that will support understanding and agreement between heterogeneous systems.

When one tries to interconnect systems developed on geographically distant places, often using different languages and different cultures, obstacles may arise.

In this paper we present a proposal for a new system that allows users to do exactly this; to interconnect several virtual and remote labs through the internet, and to perform tests using components of several of these systems even if they are physically separated from each other.

Keywords- e-learning; virtual-labs; remote laboratory; cloud-enviroment; remote labs cloud; euronet-lab;

I. INTRODUCTION

V-labs are very useful systems because they allow the users connected to the internet to use several labs as remote labs. However, nowadays v-labs are typically independent working isolated and without any cooperation between them.

If it was possible to connect several laboratories in various places like universities, enterprises and other institutions, this improvement would be a great advantage. Working this way, all the users connected to the network could have access and share all the laboratories and experiences available on the different locations.

So will be desirable that we find a way to connect all the v-labs, and allow also to all the users can connect to all the resources available in the network.

To reach this kind of cooperation and level of connection is necessary that all v-labs system "speak" the same language.

To achieve this objectiv is necessary that all the systems use the type of syntax and semantics. Only following this procedure will be possible putting all the systems cooperate between them.

This paper presents this new paradigm and concept of virtual and remote laboratory that will allow any user, all over the world to build a laboratorial experience anywhere in the world using virtual components that are created with an instance of a component and can be obtained from any server connected to this v-labs network that we propose to build. We call this network: "Euronet Lab" as show in Fig.1.

To propose a wide system like Euronet Lab [1], that is completely supported by Remote and Virtual laboratories, it's necessary to build a new structure support informatics and new philosophy of work.

It's necessary to build and create a new kind of work tool that allows to build a new environment for the use and run of v-labs in Internet.

It's also necessary to build a new kind of virtual lab that defines a new concept of learning object. This kind of object must be "scorm compatible", because this object will be used in e-learning environment, so it should be a RLO – Reusable Learning Object.

To reach this goal we need to define and use a new paradigm that allows to define a new philosophy of work that permit us to build, and use virtual and remote labs not individually, but integrated in a large network, where every user can schedule, prepare and realize is own experiments and laboratories available on this proposed network.

A new paradigm implies that the set of practices defined for a scientific discipline or a scientific "modus operandi" will de redefined in several areas. So is necessary to think, project and implement the necessary logistic and technical means to put this new kind of virtual lab in perfect working conditions.

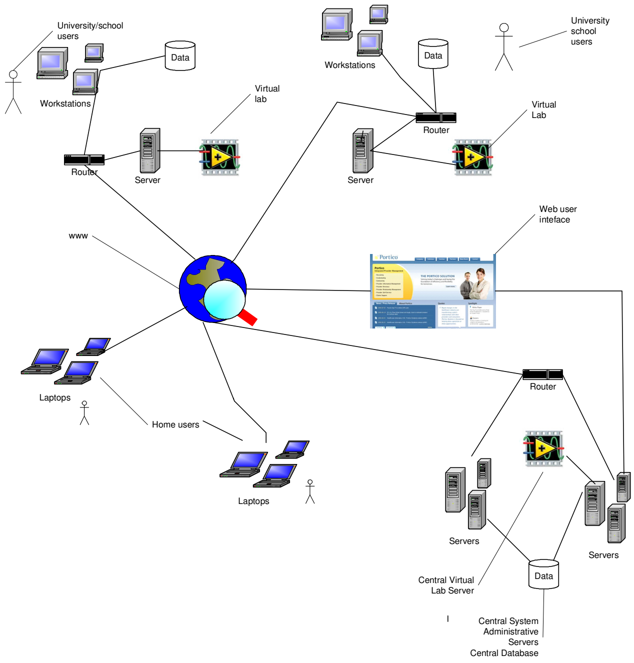

Figure 1. Proposed Euronet Lab Network

For this particular case is important to think how this is possible to create several instances of the same real event. A possible solution for this issue is the use of an Ontology, because this option allow to us to define in a very detailed way all the characteristics and features of a component, that is used as an instance of a virtual laboratory.

To reach this goal we need to define and use a new paradigm that allows us a new philosophy to define, build and use virtual and remote labs not individually, but in a network.

In this paper we present this new paradigm and concept of virtual and remote laboratory that will allow any user, all over the world to build a laboratorial experience using virtual components that are created as an instance of a component and can be obtained from any server connected to this Euronet Lab network.

To permit the use of all the elements, and all its instances, is necessary to have a very strong and consistent database of elements and components to use in all the experiences.

So we argue in this paper that the best solution for this issue is the use of an Ontology.

The Ontology is a science that studies explicit formal specifications of the terms in the domain and relations among them. [4] Is the best system and tool to present all this components and elements described in a very detailed way.

Also due to the nature of this system that can be accessed from anywhere, in a way where the user don't care from where he makes the access, or even where the v-lab and is components are hosted physically. So for the user they simply are located in a "Cloud" [5], somewhere in the Internet. So this paper shows also that the best solution for this kind of environment is in fact the "Cloud Environment".

So two main concepts will be used in the solution proposed by us to this network; an Ontology, and a a "Cloud" environment.

A so called Cloud environment is a very suitable solution for this system because in our particular case exists several different physical systems connected to several servers in different geographic places and naturally different countries, and all system is considerate as a cloud by the users, because the user is connected to an interface where he can choose the lab that wants to use, but is not important to know where the chosen lab is physically hosted.

So… all the search, building and use of the virtual lab will be easier if the user sees him (the v-lab) inside a cloud where the environment to access all the labs require the same actions and procedures.

Because its own conception, technical, economic and user experience characteristics, [6] the cloud computing systems and philosophy of work is spread out very fast today to several solutions and environments where is not necessary to know the geographical location of the servers. Examples of that system are the G-mail system and Amazon Web Services.

Very large areas of science and several application fields see the cloud competing as a solution to several problems and challenges.

In this paper we discuss that in the remote and virtual labs area, cloud computing is very suitable and indicated to this kind of environment where a good example can be the Euronet Lab network and system that we propose, because in the cloud computing environment all the applications and services remain always available in a web platform, that can be accessed anywhere through a web browser[1].

In this paper we make a presentation and we present a justification of the main technical reasons that conduct us to choose the cloud computing as a solution, to the proposed Euronet Lab Environment.

Euronet Lab wants to be a open system where any student can search and schedule a experience, without worrying about where that experience is effectively taking place.

Also will be possible to the teachers upload experiences that is students and other persons and institutions can use, in the same way [1].

So to build and put this system at work and service is necessary to follow the next steps [1]

1. Implement and test the network infrastructure.
2. Install and configure several interface environments
3. Create an Ontology Database that allow us to define and classify all the elements and components used in the experiences.
4. Create a Database for users, institutions and experiences that allow to everybody make is own schedule to the experience that they want to run.
5. Build a system/Database that as the Philosophy of a Virtual Closet where the user can get all the elements/components to the experiences they want to

run, using the elements of the Virtual Closet and his instances, according to the defined Ontology.

6. This 3 system-basic Databases (Users, Ontology and Virtual Closet) can be allocated in a Cloud Computing service such as E2C from Amazon Web services [8]. It`s necessary to create ,build and configure this connection between E2C and the Euronet Lab System.

   This is another “Cloud Computing” element that we propose to use in this system.

   Having efficient databases with the organization show in Fig. 2, and fast access to them, will be a main component of all the system, so the use of specialized services like E2C from Amazon Web Services, it seems to be a good strategy. A little diagram of the database system proposed is show in Fig. 2.

7. Build an application, as a front office in web environment that allow the students to login and schedule, and realize the experiences and labs, anywhere in the cloud.

   This application must permit also an activ dialog and feedback between the students and the teachers.

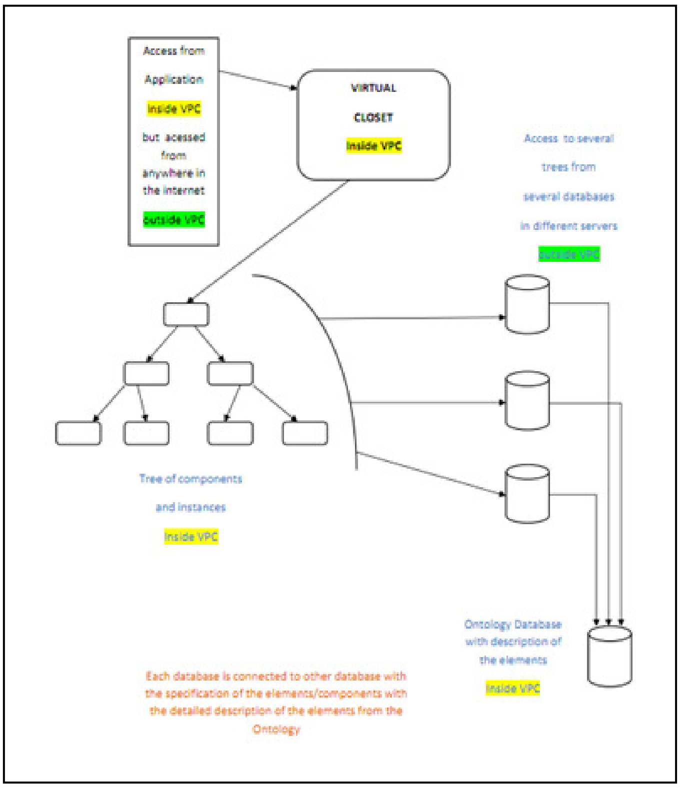

Figure 2. Database proposed system using E2C from Amazon Web services

8. Build a e-learning pedagogical and theorethical support contents for example in video and other multimedia type of content that constitutes a support for the proposed Labs in Euronet Lab Network.
9. Make the integration of the e-learning contents in a search and login system that may be used by all the users connected to the Euronet Lab network.
10. Start-up of the system based on a test server supplying a prototype system and an online tuition of this use.

With this proposal, teachers will be able to use the system as a complement to their tuition maximizing the learning process as all types of information regarding a certain subject, and will be available on this environment, being present as hypertext, animations, videos, virtual Labs and simulations. These materials will be organized in a constructivist and collaboration perspective.

A Constructivist Perspective analyzes and advocates a different teaching methodology from the traditional teaching methodology [9], aiming the effectiveness of the students’ learning process.

On the distance courses perspective, its access from different universities and institutes cooperating as partners will enrich the resources and knowledge, which in turn will allow students to access a vast set of techniques and methodologies to construct their customized knowledge.

But why we propose the use of a “Cloud Computing” environment ? What are our main reasons ?

II. CLOUD COMPUTING

Cloud Computing consists in the utilization of memory and storage capabilities in sharing servers, that are all connected through internet, with a network infrastructure [5].

The Data Storage is done in services, that can be accessed from anywhere in the world, anytime, and where everything works in a web environment, without need of any specific software installation. Examples of this type of network is show in Fig. 3.

All the access to programs, services and files is done remotely by web environment, using the internet as communication infrastructure.

From anywhere you can access informations, files and programs, you only must any have a computer with access to the internet.

With this kind of working philosophy, several characteristics will be possible to reach in this type of environment, so we can say that the advantages are:

- Agility
- Low cost
- Device and location independently

- Multi-tenancy
- High reliability
- Security
- Sustainability

The "clouds" work like a large pool of virtualized resources, that offers also a large pool of others characteristics and benefits like as indicates L.M. Vaquero in "A break in the clouds: towards a cloud definition" [10].

So we can say that more benefits of the use of the Cloud environment are:

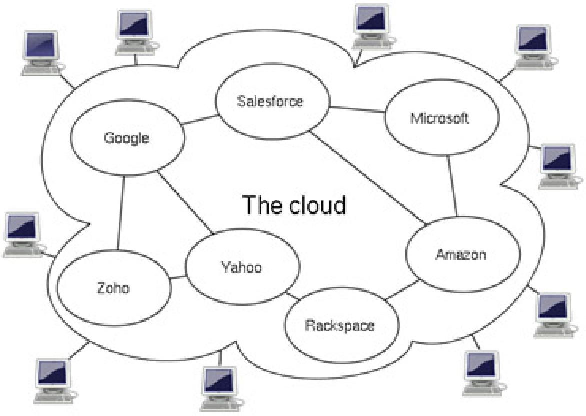

Figure 3. Database proposed system using E2C from Amazon Web services

- User friendliness
- Virtualization
- Internet centred system
- Variety of resources
- Automatic adaptation
- Scalability
- Optimization
- Pay – per – use (when aplicable)
- Service level Agreements

The main characteristic of Cloud Computing is that, this kind of platform provides services to users without knowing much about the infrastructure behind [5]:
Examples of this kind of structure are:

- Amazon E2C,
- George App Engine
- Microsoft Services

The Cloud environment can be classified in the main categories [5]:

Infrastructure as service: is the delivery of huge computing resources such as the capacity of processing, storage and network.

> *Taking storage as a example, when a user use the storage service of cloud computing, he just pay the consuming part without buying any disks or even knowing about the location or the data he deals with.*

Platform as a Service: generally abstracts the infrastructures and supports a set of application program interface to cloud applications.

> *It is the middle bridge between hardware and application.*

Software as a Service: aims at replacing the applications running on PC.

The great advantage is there is no need to install any software in your computer if you use SaaS.
Instead of buying the software at a relative higher price, you just follow the Pay – per – use pattern which can reduce your total cost.
The concept of SaaS is attractive and same software runs well as cloud computing, but the eventual delay of the networks is a very important point to take in consideration.

III. CLOUD COMPUTING VS GRID COMPUTING

Grid computing [11] is a structure formed by a network where all the computers are not in the same place, but distributed. In this structure they exist several components, not only computers, they can be peripherical, switches, instruments and data storage systems.
These resources may be owned by different organizations.
Grid computing links separate computers to make a large infrastructure, using temporary idle resources.
The main goal of grid computing, like a normal electrical network, is to provide, to the user, access to the resources they need, in the correct time they need.
Really the grids address two distincted, but always related goals; providing remote access to is assets, and aggregating processing power, using several computers and processors.
The main and the most important resource included in a grid is a computer with a powerfull processor, but the grid also includes sensors, date-storage systems, applications and other resources. [11]
The Grid itself provides a series of distributed computing resources trough LAN or WAN. From the point of view of the terminal user of application, he sees the grid as a super virtual computer, but in fact grid computing is a method that uses several distributed (more small) computers, to simulate a main-frame.

It includes locations, storage, processing capacity, from distributed processors.
Grid computing requires the use of computing that can be divided, and form out pieces of a program as one large system image to a great number of computers. One positive feature about grid is that have redundant nodes, so if one fails, the other one support the functions and applications.
Grid structure allows to divide a huge task in several small tasks independent ones from the others, and they let every one of them make "is work".
This may even any node fails and doesn´t return result, it doesn´t matter, is task can be addressed and reassigned to other nodes, so the all process, will not be effected.

In Grid Computing, through is resources have been pooled, it looks like a huge resource pool from outside. But from the point of view of the user that has submitted a special task, for him it doesn´t matter and he don´t know which of the nodes, will complete is task. [11]
What he needs to do is to submit his job to the grid according to a special style, and then when he will look to the job and find a idle physical node, send out the job until he will be finished. [11]
It´s possible in grid to realize parallel job processing, and the user as to prepare the algorithm himself and send them to the different physical nodes, what is not indicated to Euronet Lab Network like explained above, because the concept and the philosophy of instances taken by each component.
For a fast characterization of these two kinds of computing, we can resume it in the following table: [5]

Characteristic	Cloud Computing	Grid Computing
Service oriented	yes	yes
Loose coupling	yes	Not totally
Fault tolerance	yes	Not totally
Business Model	yes	No
Erase use	yes	Not totally
TCP/IP based	yes	Not totally
High security network	Medium	Medium
Virtualization	yes	Not totally

Like it was said in the last point, cloud computing put normal computers "together" and for the user, normally in a web browser environment, this service appears as a "super computer". A very well know example of this is the Google Services.
Of course this is not true! Really Google, Amazon and other cloud services as a big number of computers and powerful servers, connected all together but to the normal web user they appears to be a "super computer".
Of course the user doesn´t know where is located the computer that solves is service or request; this is main "top point" of Cloud Computing philosophy.
So a user can get the services from a full infrastructure that seems to be a "super-super-computer" in the Internet. [5]
Like was told also in the last chapter Cloud Computing is divided in four main categories:

- IaaS - Internet as a service, internet based services such as storage and databases.
- PaaS - Platform as a service, this type of service offers to the user a partial or full application development environment, where all users connected to the cloud can have access.
- SaaS - Software as a service- This kind of cloud service offers a complete application such as a Enterprise Resource Management.
- IaaS - Internet Access Services, this consists in create virtual data storage and applications for several users like Amazon Web Services E2C, and this environment can be divided in two types of resources; public and private.

Of course the main advantage of cloud computing is the hill cut in expenses, because the users don´t need to buy big mainframes and specially they don´t need to acquire expensive software, and licensing.
Of course also, this kind of computing system only works if this network has very good and fast connections between the computers and to the internet and also is necessary to guarantee a quick switching and routing processes of data to permit that everything works fine and fast. [5]
We can say that cloud computing is the development of distributing computing and grid computing, this is the "business realizations" of all these conceptions.[5]
We can say also that the basic principle of cloud computing is to distribute the computing tasks to many distributed computers as possible, connected to the cloud, not local computers or remote servers.
As an advantage [5] "Cloud computing can make enterprise pay attention to the application, and access the computers and storage system according to its requirement".
Another big advantage is that if you store your data in "the cloud", end if the cloud is spread out by a large number of computers and servers, you never lose your data because in all the cloud exists redundant systems to backups and protect the data, for example RAID arrays in several servers.
Just like grid computing will make a huge resource pool, grouping all the resources.
Cloud all the computers can be updated automatically through a deployment process and the user doesn´t not need to worry with data updates. Cloud computing will extend the application of hardware and software, and will change the application model in terms of software and hardware.

From the point of view of the user, the hardware or the software that is not need in this moment to himself, can be available to other users in a form of virtual resources accessed to the cloud. This is a big improvement of efficiency to the user to meet the necessary level of requirements and allow to decrease very strongly the management cost of this data system.

All these resources aren´t available and are limited inside the enterprise, so the system can be extended in form of hardware

and software all over the internet, with several connection points. [5]
So we can conclude that the Cloud Computing allows to the user allocate resources according to the needs and also increase automatically theses resources.
We think, from the point of view of control, that the cloud will look at IT resources as a resource pool.
Different physical nodes will be divided in different resource pool parts and components, according to the particular needs of the process.
So this computing model as several advantages and huge potential over the computer model in traditional database.
When you use Cloud Computing in any case it means that you are going to pass to others (the managers of the cloud) to do some part of the job that you have no advantage in to do.

An example is, in the Euronet Lab, the database of users, ontology and virtual closet, can be located with great advantage in the Amazon Web Services- E2C.

IV. WHY TO CHOOSE CLOUD COMPUTING

We can say and defend that Cloud Computing is a good solution to Euronet Lab because the philosophy of work in Euronet Lab is very similar with all the systems that today use Cloud Computing.
First; a general resource that must be accessible all over the Internet, and any user, student, teacher or administrative can access Euronet Lab from everywhere since they are connected to the internet.
The user doesn´t need to know where the resources are, since they can access them.
Any user can make a lab experience anywhere, without worrying where is the service or the experience he/she wants reach to, is locally hosted.
So this is the main characteristic of Cloud Computing, the user is not worried where the service or resource that he needs is allocated in the cloud. He only knows that this resource is in the cloud. The Euronet Lab is a system/structure that has all the characteristics supported by cloud environment [1]:

- Flexibility and Agility
- Low Cost or even three access
- Device and location independency
- Redundancy if a part of the system fails
- High reliability
- High level of scalability
- High level of security
- High level of sustainability
- User friendliness, a web front office interface will be created to all the user environments; teacher, student, administrative, guest, etc

Another possible solution to consider is the Grid Computing, but in our case we think that the solution of cloud computing is more appropriate for the Euronet Lab Network that grid computing because the hardware systems that are necessary are less, and more cheap.

Also the Cloud Computing as the great advantage of the enormous degree of flexibility and scalability of the network, that we need in Euronet Lab Network..

In this network every node can be connected to a different physical system, so this results in a different kind of nodes, what is not appropriate for this Euronet Lab Network, because the technical needs and features of each kind of device connected to each node are different.

Another problem is the parallel job processing that is allowed by the grid computing system, in laboratory applications. This is not applicable because each connection can belong to different instances, and very probably to different users, so they can originate erroneous data transmission, because can belong to another user and process. This means that this paralell processing can originate that one user receives (by mistake) the data from the v-lab operated by other user.

This system presents a very high level of scalability because, everybody can access the resources and especially because every teacher or even user can participate in the system by a constructive way making upload of new experiences and lab environments.
Of course it must exist a administrator or a moderator of the system, because it´s necessary someone with high knowledge of that particular technical area to approve (or not) the exercise or experience that is proposed to the system and he must see if all is correct in the proposed lab/experience.
The high level of sustainability is reached because this system avoid a large number of voyages between several countries and locations what is very positive for the environment of the Earth.
High reliability is reached because in a Cloud Computing Environment they exist several nodes, data links and computers, that allow to all the system works even if some nodes, or some part of the system fails.
For this case-study we propose that as Cloud Computing Environment, will be used the Amazon Web Services (E2C) supported by Amazon Web Servers.
In the following points we present in a more detailed mode what are the advantages of choosing that environment (AWS Amazon) , especially as database support:We can put in the cloud the Ontology Database server because this database as a hugh amount of information; describing all the components and all the instances of the elements existing in the Virtual Closet. This allow to us also to save money and resources don´t buying the servers and web interface for scheduling experiences. So we can put these virtual servers in the cloud of AWS services from Amazon.
To this system work correctly we must establish a VPC between our system with V-Lab servers (for example Labview Web servers) and the virtual servers installed in the AWS VPC – Virtual Private Cloud.

How this works, how can we build this system?

Following the instructions of Amazon [12] we must establish a VPC connection, between our systems and the VPC from Amazon AWS facilities.

First is important to define some concepts about this kind of mixed architecture between our system and the virtual servers of our VPC from Amazon Web Services:

How does Amazon VPC works and for this propose? How can this system been used ? [12]

Perhaps the main idea will be divide the resources between our physical network and the virtual space that we must rent and build in AWS Amazon Web Services.
So in "our own network" we let stay all the systems directly connect to v-labs.
So, "our own network" that also will be a "cloud", but a "WAN Cloud" really distributed by several servers with all the servers connected to several virtual labs, and spread all along the world, by all the institutions participating in the network.

To build a VPC network in AWS Cloud, Amazon proposes to us the following steps, showing in the next Fig. 4 [12]:

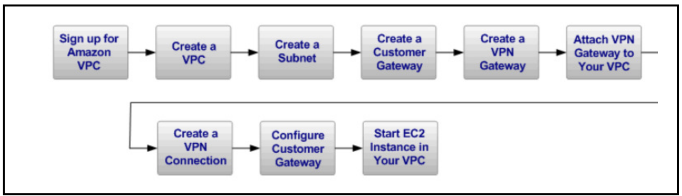

Figure 4. Steps to create a VPC by Amazon E2C

Following the steps described by Amazon AWS we must do the next actions step-by-step…

1. Sign up for Amazon VPC and create a account
2. Create and configure a VPC in AWS environment
3. Create a Subnet inside the VPC that we have create
4. Create a costumer gateway to establish a connection between "our local or WAN network endpoint" and the VPN
5. Create a VPN gateway at endpoint at AWS services at the VPC environment in Amazon Webspace to establish a connection between the VPN and the VPC environment in Amazon Webspace
6. After this we must attach the VPN gateway to the VPC that we have created and make the proper configuration in Amazon Webspace
7. Create a VPN connection between "our local or WAN network" and the VPC in Amazon Webspace
8. Configure the the costumer gateway at "our side"
9. Finally, after all the logical infrastructure built we launch and run an instance in the VPC that we have done the proper configuration at Amazon Webspace

To put our systems at work we must split our systems between "our network" and the AWS VPC network:
At the VPC provided by Amazon we can put there the so called "Central Database Servers":

- The Ontology Database
- The User`s Database (teachers and students)
- The Schedule Database (scheduling of experiences by the students)

All this databases can use as database system manager the SQL server, or even My SQL Server for a Linux enviroment. The "virtual closet" from the v-labs should remain in AWS environment with logical connections to the V-labs servers in our "client WAN". These logical connections pass through the VPN between the V-lab server and the Ontology Database in our AWS VPC.

Like we can see in Fig.2, all the v-lab servers remain in "our own WAN", spread by all the institutions that are connected with EuroNetLab.
All them are connected with the Ontology Database and the "virtual closet".
So to build the system is necessary first to establish a VPN connection between our network and the VPC at AWS.
Even before defining the VPN it`s necessary redefine the VPC that is one endpoint .
Following the instructions of AWS; we must defining a VPC inside Amazon Web Services [12]
To define a VPC the first thing to do is define the "IP Address Space" of the VPC.
This is made when we make the configuration of our VPC. This creates a Primate Network completely separated from any other network; even separated from the Internet at a packet-routing level, so in level 3 from Model OSI from ISO.
The VPN that we create has two endpoints; the customer gateway, that is the point where the VPN connects with the client gateway and the other endpoint, at *AWS Amazon Web services cloud* that is the called VPN Gateway.
The internal interface of the "Customer Gateway" should be connected to the client data center which can be a either a physical machine or a software appliance, or even an internal network of the client, and the external interface should be connected to the VPN that leads to the Amazon Cloud in the other endpoint. [12]

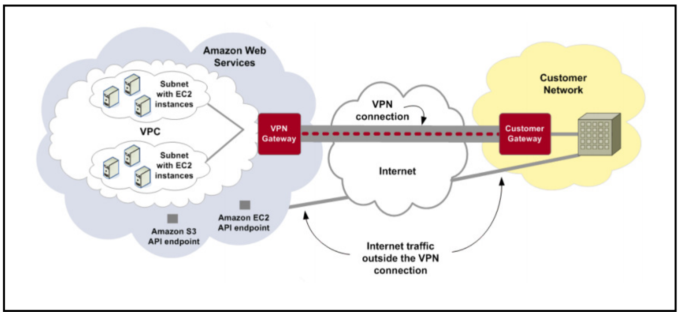

Figure 5. VPC connection with Amazon E2C

At the endpoint in the side of AWS exists an element called "VPN attachment". That is the connection between the VPN gateway and the VPC.

Configure and work Inside the AWS cloud. [12]

Inside the AWS Cloud is possible to work with subnets, for example, if you want to work with separated resources or different instances of the same resource.
This becomes very useful to the Ontology Database, because allows us to create several instances of the same object, allowing also is use by several users at the same time. That is a component of a building in virtual closet of a V-Lab. Each one of this elements became completely isolated (instance of the object) from the others.
Each of this subnets those really are segments of our VPC´S IP´S addressing space, are connected with the other subnets in a virtual manner that simulates a router in a star topology each of the subnets/instances creates an Amazon E2C instance, respecting all the security and operational requirements.
Once you have a VPN connection established you can launch Amazon E2C instances, since you have been building your own API, tools and utilities.

Routing Security Issues: [12]

A VPN works like a tunnel over the internet, between the VPC define in the AWS Cloud and the office or house network of the client. It`s necessary to configure the gateway in our network (customer network) in order to route the traffic which is intended to virtual machines in VPC to the customer gateway, to go through the VPN, to the VPC gateway, that is directly connected with your pre-defined VPC in the AWS Amazon side.
Traffic originated at the AWS Amazon VPC side is routed through the VPN directly to the customer gateway and there, all traffic passes through the firewall and other security systems existing at the entrance of the customer internal network at the customer gateway. So the level of security of the VPN is defined by the customer, respecting all is security policies.

Conclusions concerning interaction between AWS and Euronet Lab:

Attempting to the reasons exposed above in this paper we think that our proposed Euronet Lab System is very suitable to work with a Cloud Computing configuration, because in this particular case the Euronet Lab is possible to take real advantage of the following points:

- Software as a service
- Network Service
- Platform as a Service
- Integration of Internet Services
- Infrastructure as a service

Considering all the characteristics and demands, we think that the Euronet Lab system will be better developed in the philosophy of:

- IaaS- Infrastructure as a service: The users can use all the infrastructure as cloud accessing to all the services and remote and virtual labs.
- PaaS- Platform as a service: in this case the platform, that can be connect with several e-learning platforms, so abstracts the infrastructure and supports a set of application program interface to all the cloud applications. In this case are the several labs and experiences that are available at the system. [5]
- SaaS- Software as a service: in our case the software that is running in the computers of the Cloud ,virtualises all the labs and experiences replacing completely the installation of specific software installed in users PC´s. Probably to the user only will asked in some cases for the installation of plug-ins to the browsers they use. [5]

So instead of buying the software to access the several labs at a very high price, the user can follow the "pay-per-use" pattern (and only in the cases were the labs are not completely free) which will reduce considerably to total cost of the operations.
This concept (SaaS) is very attractive those days because the large band access of Internet is very spread out in the Universities and in the enterprise world.
Of course this the kind of solution, is completely supported by the Internet connections, a large delay of communications in the network will be very distressing to the system.
So attempting to all this issues and reasons above we think that the Cloud Computing environment and is philosophy of work will be very suitable as a solution for the Euronet Lab environment.

One of the main characteristics is the very large scalability level that Cloud Computing allows to this environment. Here people can contribute with new experiences and new pedagogical supports every day.

V. FUTURE DEVELOPMENTS

The future developments to follow

1. Create a VPC from Amazon E2C and try to locate the Ontology users and virtual closed Data in this Cloud from Amazon
2. Build a Ontology with some starting components and produce a database and allocate them in the VPC from Amazon Web Services
3. Try to put a prototype lab running in a experience mode using all the resources from the Euronet Lab Network connect to the VPC environment from Amazon Web Services

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