A Survey on Implementation and Design of Cloud based NMS

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***Abstract*-Network Management Systems are often challenged by the need to manage networks comprised of a very large number of elements. With the rapid growing of the network scale and its capacity, the traditional peer-to-peer (P2P) network management model is not suitable. Self-management and self-healing capabilities are the keys to Wireless Mesh Networks (WMNs).**

This paper presents a method which leverages commercial cloud computing services for conducting large scale management and testing of various type of networks. Here we concentrate on four scenarios.They are testing large scale network management, cloud based NMS for peer to peer networks, cloud based NMS for dynamically self-optimizing wireless network and cloud based management of dynamic airborne network.

***Keywords* —Network Management System, Cloud Computing.**

I. INTRODUCTION

Over the past few decades, computer network underwent tremendous developments; architecture of networks is becoming more and more complex. As a result, methods of network managements changed, which have evolved from a centralized model to a distributed model. To effectively manage a large scale network consisting of thousands or tens of thousands of managed elements, a Network Management System (NMS) must be designed toaccommodate the scale, distribution and complexity of the managed elements.

Cloud Computing is a technology that uses the internet and central remote servers to maintain data and applications. Cloud computing allows consumers and businesses to use applications without installation and access their personal files at any computer with internet access. This technology allows for much more efficient computing by centralizing data storage, processing and bandwidth.

In particular cloud computing services can be utilized to create a computing or networking platform of considerable scale and power, in a way that is cost-effective to applications with varying scalability requirements. In some cases, cloud computing is used to provide software services

(“Software as a Service” or SaaS model). In other cases, development platforms are offered (“Platform as a Service” or PaaS). In yet another type of service, resources such as storage and CPU are provided tothe service’s users as infrastructure for their own applications (“Infrastructure as a Service” or IaaS which is also known as “Utility Computing”). These types of services can be combined. For example, IaaS can be used to provide SaaS. One of the advantages of this approach is that undifferentiated tasks (for example, hardware costs, maintenance and utilization) no longer take the majority of time, energy and money. Exact definitions of the different types of cloud computing services are still being debated.

In this paper, we will use the term cloud computing to refer to the latter type, namely “Infrastructure as a Service”.

II. CLOUD TO CLOUD MODEL FOR NETWORK MANAGEMENT

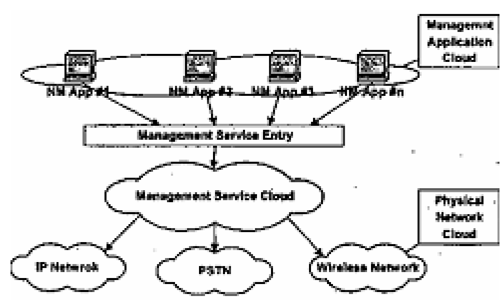

Fig I. C2C (Cloud to Cloud) Model

Management applications can access the services provided by the management service cloud through the service entry. Management service cloud looks like a middle layer, which make the complexity of underlying heterogeneous networks transparent to ' the up-level applications. The management applications invoke these services to accomplish management tasks, without interaction with agents directly (Fig 2).

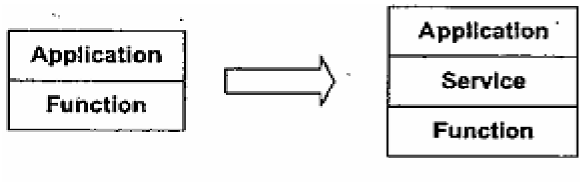

Fig 2. Migration of the management invocation style

Furthermore, we can also abstract C2C model into four layers: computing layer, management component layer, management service logic layer and management service entry, as shown in Fig 3:

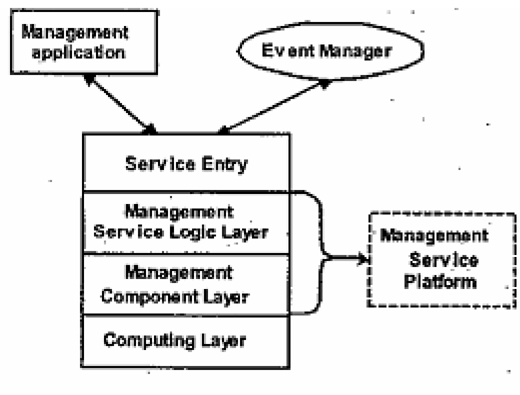

Fig 3. Abstract model of C2C

Among them, the computing layer is the foundation of all above layers, which provides distributed computing capacity for the up levels. The management component layer and management service logic layer together form the management service platform, which is a cloud that hosts a number of management services. The management service platform spans across the whole network and is the fundamental part of the whole system.

Above it is the management service entry. Both the operators and applications can invoke certain management service through this entry. Such entry is not only a simple directory, and it also hosts several specific services of its own, such as relationship service, authentication service, naming service and etc. Meanwhile, the service entry provides an open interface for the event manager, which can collect events from the network and trigger NMS to do some adjustment.

The whole model is loosely coupled and scalable. Within such framework, management applications will be mucheasy to develop.

III. CLOUD BASED NMS FOR AIRBORNE NETWORK

Airborne Network (AN) is set up by the United States Air Force, in order to expand the Global Information Grid (GIG), an all-encompassing communications project of the United States Department of Defense, which is defined as a "globally interconnected, end-to-end set of information capabilities for collecting, processing, storing, disseminating, and managing information on demand to warfighters, policy makers, and support personnel". Airborne Network connects the three major domains of warfare: Air, Space and Terrestrial. The Transformational Satellite Communications System (TSAT) network currently works for all communication through space assets. The Combat Information Transport System and Theater Deployable Communications connect terrestrial facilities for theatre based operations. The airborne network is designed to utilize all airborne assets to connect with space and terrestrial networks building a seamless communications platform.

The architecture is divided into three layers, which are infrastructure layer, systemic function layer and systemic integration layer. Following is the description of each layer.

• Infrastructure layer: all the hardware resources of space-air-ground are included in this layer, such as cameras on satellites, sensors on aircraft, processing units on ground mobile nodes, storage units on ground fixed nodes, etc. This layer provides IaaS, just like the typical cloud computing’s infrastructure layer. Since the airborne network’s hardware seems as a whole by means of virtualizations, users do not have to care about the locations of currently used resources. For example, the passengers of one aircraft are watching movies from the ground movies storage center; or the pilot of fighter A try to aim at the enemy fighter with the help of the radar of fighter B, but neither of them knows where the resources come from. This layer provides infrastructure services to the systemic function layer.

• Systemic function layer: it is between the systemic integration layer and infrastructure layer, and composed of a large number of service elements, which are the smallest units to provide different kinds of services. Systemic function layer responds to the logic function requirements from the systemic integration layer, and organizes suitable service elements to implement the required function. At the same time, every service element has the ability to schedule resources in the infrastructure layer. This layer changes the typical relation of logic functions and hardware resources in airborne network. Since service elements could utilize all the resources in the network, the breakdown of hardware in one node may not cause performance degradation. Instead service elements could schedule the available resources to fit the requirements. On the other hand, some characteristicsof airborne network, such as reliability and real-time should be guaranteed by some specific algorithms.

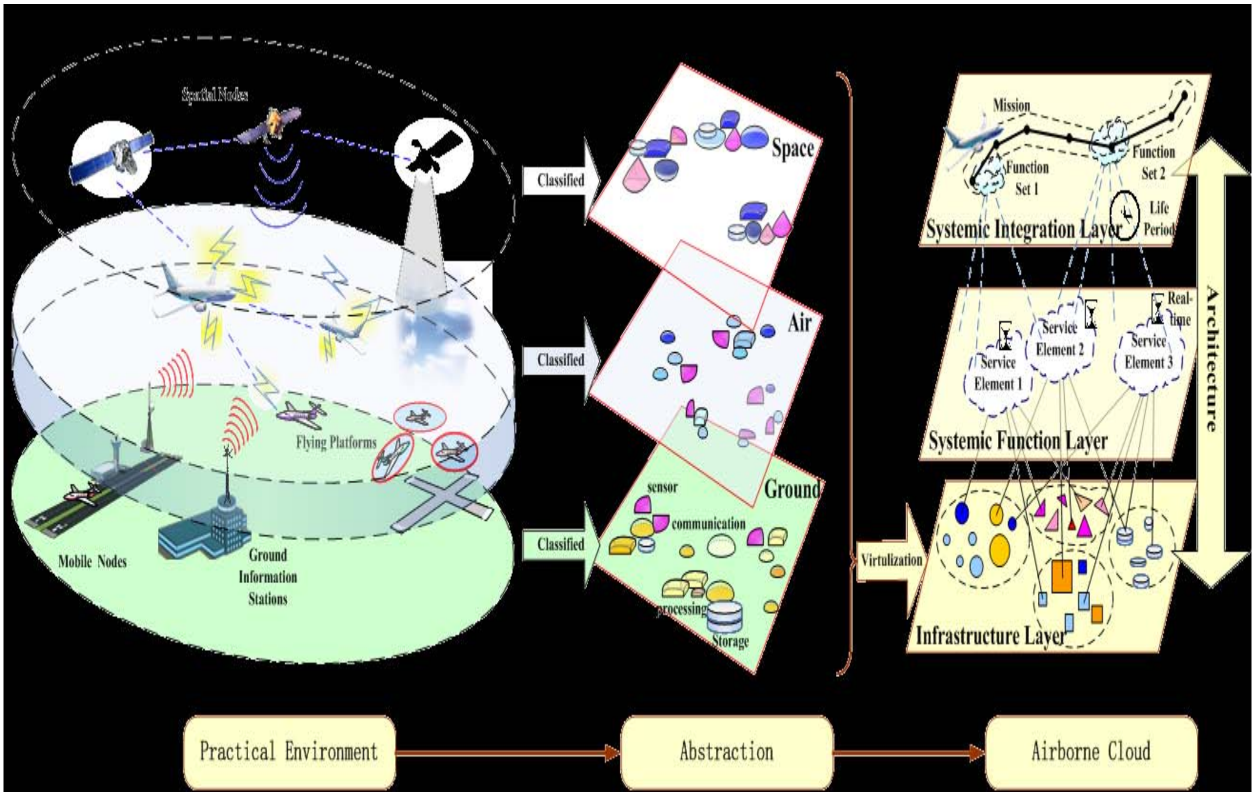

Figure 4. Concept of Airborne Cloud

• Systemic integration layer: it is like the application layer in the cloud computing architecture. It contains cross-platform applications or even system of system. This layer responds the users' commands, analyses that and turns it into standard missions, which could be processed by machines. In general, mission is a very complex task, and it is difficult for computers to resolve it directly. It's the systemic integration layer's work to divide the mission into several function sets, which could be achieved by the combination of service elements in the systemic function layer. In addition, the performance requirements of every function set should also be calculated to guarantee the mission being completed, and those requirements will be sent to the systemic function layer together with the function sets.

IV. CLOUD BASED NMS FOR WIRELESS MESH NETWORKS

Self-management and self-healing capabilities are the keys to Wireless Mesh Networks (WMNs).In order to manage network intelligently, this paper introduces the concept of cloud computinginto management of WMNs, and names it CCMS, which is based on cloud platform, the overall architecture of the system is shown in Figure 4. The proposed system was designed with the principles of cloud computing in mind, and scalability as a number one priority.

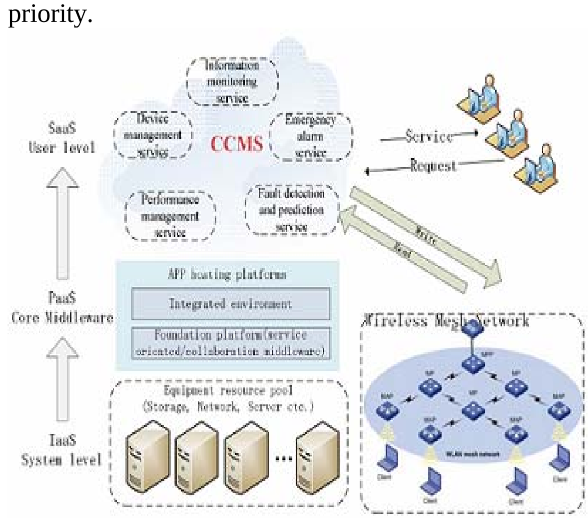

Figure 5. The architecture of cloud computing network management(CCMS)

IaaS provides CCMS infrastructures with virtualization technology. By virtualizing all resources, there are many advantages as follows.

1) Apparent advantages is the decrease equipment cost with effective development and easy realization of the information sharing.

2) Virtualization technologies used to hide the physical characteristics of resources from users to ensure the safety of data and equipment.

3) Unified access interface available for lower SaaS applications. This will reduce the needs for multiple instances of the same service.

4) At the same time, the elastic expansion capabilities of cloud computing can play a role of load balancing.

5) CCMS breaks down the barriers between the physical structures, which ensures that it is very easy to do system expansion though the network load is constantly increasing.

PaaS services reduce the complexity of the applications.

SaaS use large-scale platform to make information resource integration easier and resources more abundant.

It is a scalable, service oriented and distributed processing architecture which aims to increase reliability and decrease costs of processing large amounts of data.

V. CONCLUSIONS

This paper mainly concentrate on network management systems that uses cloud computing technology. This paper discuss architectures of various examples of cloud based network management systems.

The appeal of the suggested method may increase as the number of providers offering cloud computing services increases.

The application of a cloud methodology promises a scalable and robust management platform. Use of virtualization reduces network load and provides a simple and transparent management scheme.

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