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Self Sustainable Data Centre Virtualization

Jeeshma v k
Computer Science and Engineering Dept
KMCT College of Engineering
Calicut, Kerala, India
jeeshmavk@gmail.com

Anu K S
Computer Science and Engineering Dept
KMCT College of Engineering
Calicut, Kerala, India
anuksoman@gmail.com

***Abstract*— Virtualization technology has revolutionized the data centre network concept. It has reduced the space, cost and energy requirements for a data centre. It has also helped in improving security and reliability of data centers. However, IT Infrastructure management of data centre network remains a challenge during disaster recovery. Manual recovery can increase the down time, require larger number of man power and cause unpredictable loss of business. It is possible to automate the redeployment of data centers by scripting the kickstart module of Linux kernel for automatically install and configure the client network.**

Keywords—Data Centre,virtualization,kickstart

I. INTRODUCTION

Data centers are specially designed facilities that provides reliable IT infrastructure for uninterrupted large scale computing applications like scientific computation, financial analysis, data analysis and warehousing, large scale networking services, maintaining failure free websites for large organization with multiple applications like web servers and mail servers, etc. It houses computers, storage arrays, telecommunication networks and other Information and Communication technology devices which are used to set up and maintain the servers, application software and data back up and retrieval facilities.

Two very important demands on a data centre design are failure free operation and quick recovery from failures or down period. The reliability has been improved over time by improving the hypervisor module. The greater challenge is the disaster tolerance, redundancy and disaster recovery. Manual recovery of data centers can be time consuming as well as costly,. This paper aims to develop a self-sustainable data centre that would automatically reinstall and reconfigure the entire connected devices in LAN/WAN and set it in action in no time on the event of an unexpected down time, provided the physical network is still intact and powered on.

1.2. OBJECTIVE

To set up a secure, reliable and automatic disaster recovering scaled-down model of a state of the art data centre to serve the requirements of academic institutions of the capacity of a deemed university. The model may be coined the name self-sustainable data centre.

2. VIRTUALIZATION AND DATA CENTRE

Data-centre virtualization typically focuses on server virtualization to achieve functionalities like Software as a Service, Platform as a Service, or Infrastructure as Service solutions. Server virtualization can be achieved using Virtual machine monitor (VMM), commonly referred to as virtualization hypervisor software. VMware, Xen, and KVM, etc are common hypervisor software. Virtual Machines (VMs) created by hypervisors share the same physical environment with each other. With the improvements in Linux kernels and the rise of Red hat Enterprise for Linux and Redhat Enterprise for Virtualization (RHEI and RHEV), security and reliability of Linux based data centers have undergone a revolutionary change.[1]

The hypervisor software Xen implements its own CPU scheduling and memory management whereas KVM coexists with the host OS and provides a set of system calls (ioctl-s) for creating and managing virtual machines from user space. Well-known Xen extension for fault tolerance, with Romulus, an ad-hoc user space implementation on top of KVM, it is understood that KVM bring significant advantages in terms of code reuse [4].

3. DATA CENTRE SCALED DOWN MODEL

The scaled down model consist of a data centre administrator machine and a few virtualization enabled desktop computers that can be configured to operate as main server, web server, mail server, ftp server and other client servers for individual colleges under an education group. If the main server or any of the client systems of a data centre goes down, the server administrator at the control room must be able to redeploy the entire network by automatically installing and configuring the server machines through the physical network link (LAN or WAN) with out any delay, provided the network link is intact

and the devices are turned on. The main server is placed in the Engineering College. Other colleges may be configured with similar LAN server to serve local requirements and to support the main server. A data centre network for an education group can cater to the following requirements.

1. Mail server for central management, institute management, staff, faculties, contract staff, students, parents and alumni to cater to numerous communications, announcements and other data distribution.

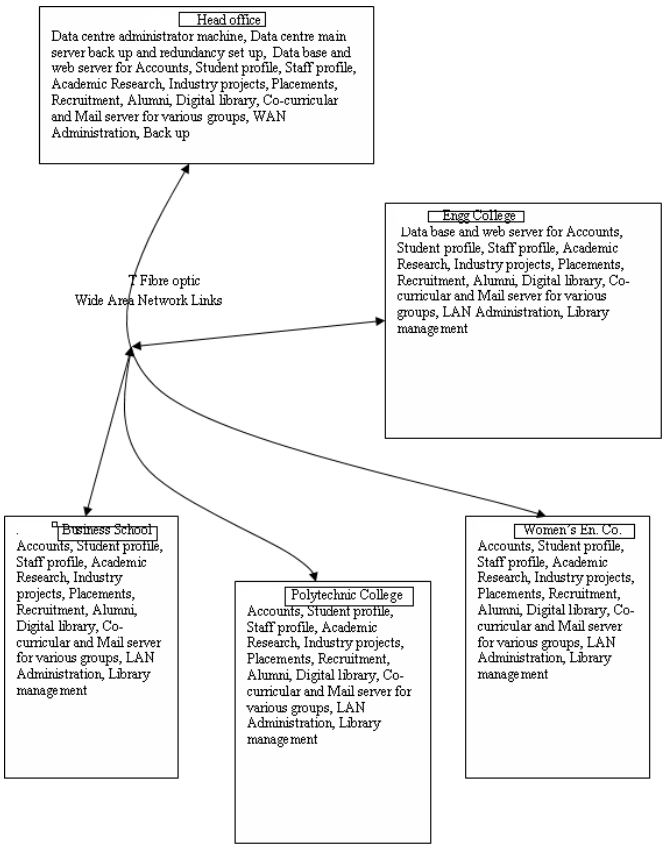
2. Student Profile data back up and access can be done with a web server and a back mechanism.
3. Alumni data base

4. Web server hosting study material, multimedia based video lectures, various essential tutorials and free course ware from MIT and IITs.

5. Library management and accounts data base through a web server

6. Even management and conferences at the institutions and start up support infrastructure.

The functional block diagram for the data centre to list its applications is shown below.



The data centre and WAN-LAN network for the education group consists of a centralized data centre administrator computer and a redundant server and back up unit at Head office, a WAN set up with fiber optic links connecting the individual institutions to the head office and to each other and the internal LAN for each institute. The scaled down model for the institute IT Infrastructure Network consist of a Central unit which is a control console with a high capacity server and individual PCs operating as server machines of each college. The Engineering College is set up with the Main Server unit for the data centre network. A redundant server unit with back up facility is provided at head office as replica of the main server. The main server at one of the institute may house a web server for web site hosting, a mail server for internal communications across management, staff and students, license server and ftp server. The ftp server houses the shared installation files for applications and their licenses, video files for multimedia based learning and other shared material for academic and research purposes.

The data centre administrator computer is installed and configured with redhat operating system. It is provided with a bash script to install and configure the main server unit in Engineering College. The same configuration shall also be deployed in the redundancy server in the Head office. In the event of a failure of the main server in the Engineering College, the redundant server in the head office is swung in to action as the main server to cater to requirements during the down period.

4. SERVER INSTALLATION AND VIRTUALIZATION FOR INSTITUTE DATA CENTRE MODEL

The following section describes the types of servers for the above mentioned requirements.

1. Yum Server:-

Instead of patching the individual servers using a CD or a network drive, it is easy to have a centralized server which downloads the recent patches and it holds the patches and packages from which the patches can be installed. This can be accessed by any server that is configured as yum client.

2. Web Server:-

This server is responsible for accepting HTTP requests from clients, which are known as Web browsers, and serving them HTTP responses along with optional data contents, which usually are Web pages such as HTML documents and linked objects, images, etc.

3. Ftp Server:-

For transferring files between server and clients the File Transfer Protocol is used. Since Most Web-based download sites use the built-in FTP capabilities of Web browsers, most

server oriented operating systems usually include an FTP server application as part of the software suite.

4. NFS Server:-

A Network File System (NFS) allows remote hosts to mount file systems over a network and interact with those file systems as though they are mounted locally.

5. AUTOMATED SERVER DEPLOYMENTS

In the beginning, servers were configured completely by individually setting up the machines using installation CDs.Server deployment systems, such as Kickstart, allow administrators to configure most anything to be set after a server is loaded. With an automated install administrators could create a configuration file with the installation option they selected augment it to the installer when to ruin with the boot. During booting the server goes through the complete automated installation and configuration.

5.1. THE KICKSTART CONFIGURATION FILE

Kickstart file can be created either manually or by using system-config-kickstart, an x based window tool. The kickstart consists of four sections-The Command Section, %packages section (specifies what packages to install), %post (Specifies script to be run after the installation) and %pre (Specifies script to be run before the installation).After creating the Kickstart file, configure nfs server, web server, dhcp server. The ks kernel argument specifies an automated install and the location of the configuration file. After this reboot the machine and create a new virtual machine and change its settings

6. SELF SUSTAINABLE DATA CENTRE

This paper focuses on developing a redundant data centre model that would recover automatically in case of a disaster at one location. Sustainability in this context is not only energy efficient operation but automated cost efficient operation with minimal human involvement for configuration, maintenance and repair. Self-sustaining data centre envisioned in this paper is a data centre model that would have a central control console from which all the other local units can be installed from scratch without requiring a service person to individually install and configure the network at each location.

7. SELF SUSTAINABLE CONFIGURATION

After configuring the required servers such as web server, ftp server, yum server, dhcp server and nfs server set up the system to be recovered to be suitable for network based kickstart automated installation The PXE Boot first requests an IP address from the DHCP server and obtains pxe boot file and load this boot file and also obtains a configuration file for the Anaconda installer. Anaconda locates the kickstart configuration file from the HTTP server and reads it. The kickstart configuration file has a default name of ks.cfg, but can be named anything. Download the required RPM files from the http server. The kickstart configuration file can also contain bash script commands that can be run both before and after the rest of the installation.

8. RESULTS

Successful installation and configuration of scaled data centre model.
Successful demonstration of auto-redeployment of a connected PC as client machine.
Main server and redundancy server combination successfully implemented.

9. CONCLUSION AND FUTURE SCOPE

Auto-redeployment of data centre network has been successfully tested. Two server machines were selected. One machine, chosen as the data centre administrator machine was manually installed with the data centre central server configuration in redhat platform. The installation program was augmented with necessary bash script to auto deploy a connected machine through network link (LAN or connected computer network) using Preboot Execution Environment.

The data centre administrator machine was then connected to a virtualization technology enabled PC machine that represents the main server. This additional PC was successfully auto-deployed with the main server and two virtual server machines. In addition, the same was repeated for another PC to act as the redundancy server unit.. If the main server fails, the redundancy server-machine will swing to action as main server within no time. Future work includes improving the system to redeploy the entire data centre network, to auto deploy various configured mail server, web server, ftp server and client server machines in the connected LAN. The work also can be improved by configuring the firewall setting to ensure security and limited access features that restrict the access of the academic network to only academic and research purposes. Another improvement that can be considered as an area of research is Over the Air redeployment over a satellite Based internet connectivity, provided it is provided the connected network meets all protocol requirements for auto-deployment.

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