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An Impact of Virtualization on NetworkPerformance with Resource Management forScientific Organization Data Center

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Abstract : Nowadays, virtualization becomes one of an important computing approaches such as operating system, server and data center by using the running of multiple operating system on single server due to: cost minimization of hardware and maintenance, maximize the hardware utilization with virtual hardware, idle resource are not wasted, andflexibility in working with operating system that work as application;moreover scalability, and security.

In this paper we present management of server and network resource and measurement with performance of using virtualization technique methods on the hardware resources in term of:network virtualization,processing, memory and disk storage.

Finally, compared obtained results with some other traditional solution.

Keywords: *Virtual Machine (VM), performance, VMware, Internet Small Computer System Interface (ISCSI), storage area network (SAN), network attached storage (NAS).*

I. INTRODUCTION

Virtualization is a technique of working with multiple virtual computers simultaneously**;**it allows the sharing of one physical resource in a controlled manner and customizes the resource environment to meet workload requirements as well as to control the virtual resource execution.Data Center Network Virtualization consists of: 1) Link Virtualization "which will discuss later" 2) Virtual Network Appliances such as: device

Aggregation & emulation and 3) overlaying by Modifying a Layer,while Virtual resources consists of Virtual machine, Virtual switches, and Virtual links.

The sharing to multiple virtual systemsfor more than one user with various purposeslikes games, kids, internet, and so on….

For example, non-virtualized data centers needs too many servers with huge costs and infrastructure needs: maintenance, networking, floor space, cooling, Power, andrecoveryfor too little work so that virtualization technique gives the range from 60% to 70% from market sharing today.

VMware	Microsoft	Citrix	Open Source
ESX (Data Center)	Ms Virtual Server	Citrix Desktop server	Xen[1] (workstation)
Server	Ms Virtual PC	Ardence	Virtuaozzo open Vz (Desktop)
Workstation	Kidaro		Qumranet (Workspace server)

Table (1) Major types of product form for Desktop and application Virtualization with different process automation tools

There are also Player, VDI /Propero, and ACE in VMware productwithtable 1 and the proprietary are just exists in Microsoft and VMware, although high cost and special need of hardware, VMware has been considered as best chose among all others[2].Virtual machine created on physical machineby utilizing the hardware resources(Processor,Ram, HDD, Network,….etc.), System management needs to be managed in order to use all of these resources efficiently.

II. RELATED WORK

In [3],[4],[5],[6] the adaptive services and resource improvement had been done using both distributed communication measurements based technique and centralized decision making.
In [7] Opportunistic resource sharing is taken into consideration at the entire network level for the first time and we develop an online approximation algorithm, FFA, for solving the corresponding time slot assignment problem and devise a simple and practical method to estimate the residual resource of a substrate node/link.

Presenting a model of a full solution that compared to existing systems provides stricter isolation between different virtual networks while at the same time providing more flexibility [8].In [9] studied ICT subsystems power consuming within data center using the two methods: specifications of separated components and active configuration.

Paweł G. & Vijay K. [10] had been implemented the Harmony grid environment consisting of heterogeneous resources and heterogeneous workload. Experimental results indicate that approach is efficient and effective, And using a two-phase heuristic that allows the decision making component to scale up to handle large scale grid systems. To overcome the problem of number of requests generated by users more than real needs for application, the solution of [11] [12] has been generated by overbooking the resource in cloud computing by optimizing the resource in data center for data center servers and reduce the cost of service.

The [13] discuss the effect of virtualization in servers with various jobs also enhance the power consumption from one side and the problems caused by using virtualization technique.Adaptation of changes occurs in measurement result of data [14][15], enhance resource management in [15] [17] to increase network performance with high cost resource to expand the bandwidth. In [14][15][16] direct measurement to reduce Vm migration in distributed environments.

III. NETWORK AND RESOURCESMANAGEMENT

Any data center should follow network policies, which control the traffic, middlebox had been proposed utilization and characteristics, also minimize the number of working middlebox in case of active environment in vyas et al. [18]. In [19] develop of new framework called PACE “Policy Aware Application Cloud Embedding”, it support application bandwidth and reliability.

Recently, most researches in this field try to overcome the problem of making movement of Vms in risks in policy and performance; One of network policy research is software defined networking[20] by both deploy more flexible middlebox and traffic of subsets migrates to desired set of middlebox.Kazem et al.[21] proposed a Netplumber which defined as real time policy for checking tools with small run time per modified rule. Both [22][23] using Software Defined Network “SDN” with dynamic traffic policy and update network status after particular Vm move one step.

The implementation in daynam VMs moves environment to show the impact of optimal policy when end user try to damage the network’s policies [24][25].Link network virtualization involves: resource reservation, packet scheduling, traffic profiling, admission control and, load balancing.Resources

such as (CPU,Network,Memory,I/O) are allocated to VM to handleworkload and operate at certain performance level each VM sees workload variation with time changes in order to monitor resourcerequirement changes the equations below shows that reactive load balancing from overload having minimum VSR.

$$VSR = \frac{\frac{1}{1-CPU} * \frac{1}{1-net.} * \frac{1}{1-mem.}}{Vm\ memory\ size}$$

VSR : Virtualized Server Recovery

1- Resource Engineering Management Aspects

A- Latency & Policy Aware Traffic

Latency can be represent with "HULL" [26] High bandwidth Ultra low latency with phatom queue, adaptive response to ECN using DTCP and packet level of arriving pacing; while in policy SDN can manage improve network policies.

B- Utilization and Power aware Traffic

Extreme explosion of network bandwidth presented a TE by M. Al-Fares [27], while in power represented as path diversity to conserve the energy by routing support in [28] without considering network performance. IT center equipment consumes 59% for sharing, 33% for cooling, 8% for energy distribution loss [29].

C- Data center Traffic criteria

In [30] present Tor traffic matrices with low level of exchanging data among each other data tors; the aim is to minimize each throughput of I/O server to others [31] during congestion that it isn't occur in various level of infrastructure.

There are a10 concurrent flows of data with specific server and unit of time [31].

D- Data center Traffic

Network resource can be used by reconstruct of network traffic: Deployment, evaluation, and computation of optimal scheduling and routing to: 1) minimize latency power consumed by network elements,and 2) improve the link of network utilization.

Manage of the system resource is needing to share in our working are mentioned with describing the waste and needing of resource as in table below.

System resources	Waste (by default)	Needing of resource
HDD ,Network	No	No
CPU, Memory	Yes	yes

Table 2: Resource Wasting and Needing

2- Storage Concept in EXS Server:

ESX server storage [32] concept contain three types of storage basics as shown below in figures: first is direct attached storage (DAS) in figure 1 below and it is not sharable storage for example HDD in personal computer, second network attached storage (NAS) as in figure 2 below that is file level shared storage and it is shared folders in storage server and it is working as CIFS, NFS protocols, third is storage area network (SAN) as in figure 3is shared storage, block level shared storage.

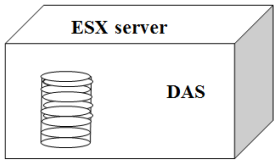

Figure 1: DAS

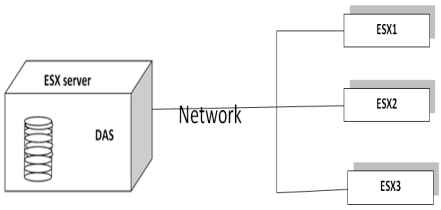

Figure 2: NAS

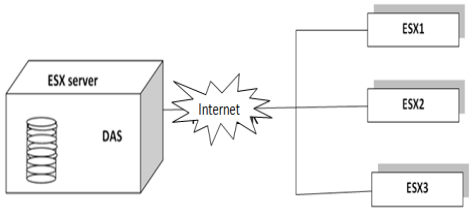

Figure 3: ISCSI SAN

These about storage basics that represent the sharing of storage, further we can change in figure 4 instead of Internet the Intranet in case of using the sharing resources between the researchers in organization or company, share storage devices as apart from one VM to another that can have desired storage spaces in another VM.
Network connection Bridged, VM in this case showing in figure 5 below that use like VM connect to physical network.

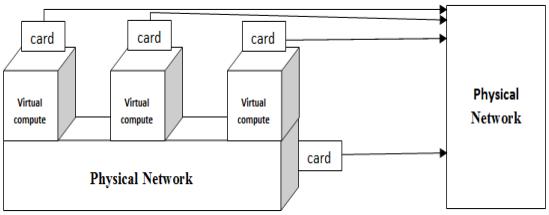

Figure 4: VM with physical network

NAT represents in the figure 6shows VMWARE in this way IPs Nat with IP of physical machine.

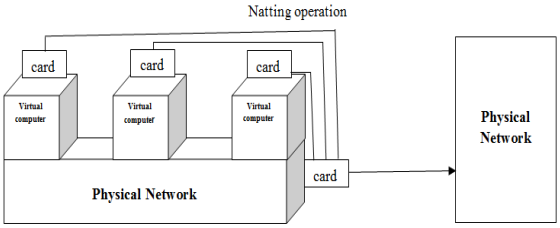

Figure 5: VM with IPs Nat with IP of physical

Private network works as host only as follows:

1- HOST: the IPs of VMWARE in this way there is no communication with physical network; here it is work as host only.

2- It like private network as figure 6below:

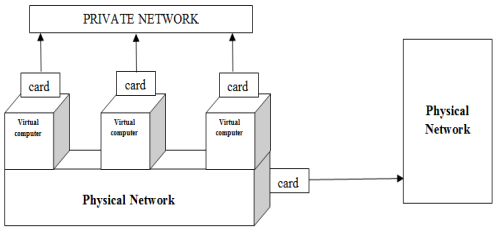

Figure 6: Private Network (Host only)

3-Processor concept:
Physical processor unit have processor socket and it is called core.
Figure 7 present an example of sharing processor.

2 core processor (dual core) CORE 1 CORE 2 1 physical processor with 2 core	Core 2 Duo CORE ½ 1 physical processor with 2 core (works as 2)
4 core Dual processor (dual core) CORE 1 CORE 1 CORE 2 CORE 2 CORE 3 CORE 3 CORE 4 CORE 4 2 physical processors with 8 cores	8 core processor CORE 1 CORE 2 CORE 3 CORE 4 CORE 5 CORE 6 CORE 7 CORE 8 One physical processor with 8 cores

Figure 7: processor architecture 2 physical processors with 8 cores

4- Hard Disk Drive(HDD) concept:
There are two types of hard disk first is: Thin HDD which is thin provisioning, dynamic allocation and space on disk takes as required; While second type is Thick HDD: thick provisioning, Static/ Pre allocation space on disk takes in real time scenarios.

A- Sharing resource withinSmall organization:
Figure 8 demonstrate the connection of switches to the server via cards from one side, and switch with particular VM from other side. The Connection between particular VMs with other VMsshow in figure 8.

Each three VM represent group of working in the same system**,** in this small network we can share resources between the partners as in above figure that explain sharing in small organization VM2 within group2 in switch 1 with VM3 in group1 in switch n.

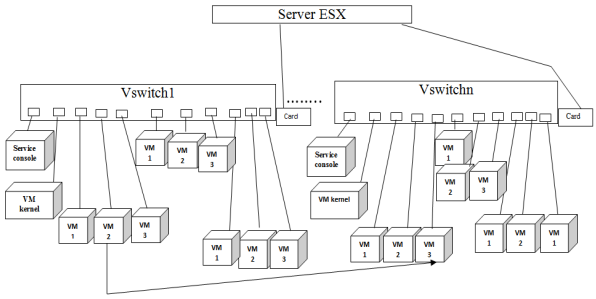

Figure 8: Sharing resource within Small organization

B- Sharing resource Middle size or large organization:

In this way we can use the sharing in medium area by using the Intranet in figure 9:

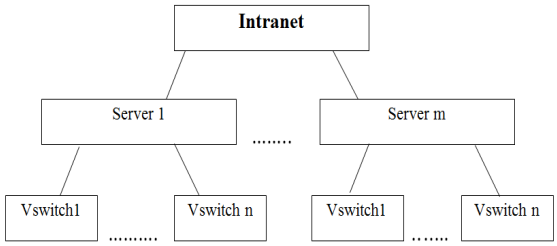

Figure 9:Sharing resource Middle size or large organization

This architecture is expanding for previous architecture, also the structure of vswitch is same but here we use block of switch only, here we can use this network within area lager than previous one.

C- Sharing Resources within Large Area:

Using Internet, can develop the previous proceduresby making the access and sharing between with large area connection this idea is quite similar to cloud computing technique but it is used amongpartners without using web site of companies.

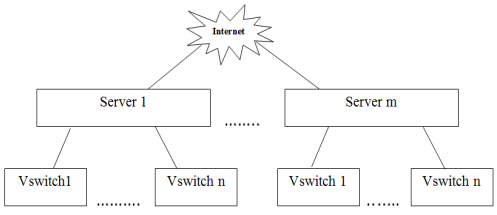

Figure 10:Sharing resource within large area

This architecture is expanding for previous one and we can share any VM in one switch belong to one server with other VM belong to same server or switch also to another VM in different server belong to any switch in that server as in figure 10.

5- ShortestRoute byDynamic programming function to choose best stage is:

To get best policy decision starting in state S with stage C to find minimum cost.

$$fb(s) = \min Dn \{C(d)Dn + fn + 1(xn)\}$$

Where:
S: number of stage
C: current stage number.
Dn: decision label for current stage.
b: best stage decision from all stages
C(d): decision cost

Whenever, current state for stage decreased by one, the new best stage function is derived by decreasing number of stage and current stage by one during preceding iteration, after that repeat previous procedure.The shortest path can be calculated by:

$$D_{ij}(k) = \min \{D_{ij}(k-1), D_{ik}(k-1) + D_{kj}(k-1)$$

K: internal or intermediate node
$D_{ij}(k)$: shortest path between vertices I and j.

6- Construction and configuration:
The following steps are configured:

- Summary page displays ESX Hardware resources information, network information, maintenance mode, reboot, shutdown commands etc...
- Resource allocation page displays CPU, Memory utilization, shares, etc...
- Virtual Machine Page displays existing VMs and their state, status, utilization information etc…
- Performance page displays hardware resources utilization as graphs chart options display the custom graphs based on time slot.
- Configuration page displays processors, memory, storage, networking, storage adapters, and network adapter's information. The entire configuration can be done from third page.
- Users & groups' page display the current users and group information.
- Events Page display the event logs information.
- Permission page display the Roles assigned to the users.
- ESX configuration page Health status information, page Processor Configuration.
- Configuration service console memory 256MB less than service console memory less than 800MB.
- From add Storage to add new storage like SAN volumes (LUN) can be added after those new storage devices like SAN (LUN) can be added. Moreover, New Virtual switches can be created. VM port groups, VM Kernel ports, service console port can be added whenever there are needed to create new one.
- Configure time and DNS and routing gateway options.
- Setting security profile, firewall properties and services.
- Configure system resource allocation and advanced setting.
- Vm port group created then add network adapter in to vm port group.
- Vm windows 2003 server (or any windows server version) is added to vm port group (or any other.
- Specify name and vlan id, vmotion, fault tolerance options.
- Creating vm kernel port and new service console port on vswitch 0.
- Display virtual and Physical network adapter information, Number of port in switch can be modified.

- NIC failover and load balancing can be changed and manage path in data store (selecting multi-path method).
- Browse and upload file into data store.
- Firewall properties configuration.
- Edit system resource allocation.
- ESX 4.0 server that is working as standalone OS and it has two kernels first Linux kernel 2.6 that is represent console OS and it is used for OS features and security, second type is that VM kernel that is used for VMWARE features.

IV. IMPLEMENTATION& EXPERIMENTAL RESULTS

Figure 11 show that spatialexperimental implemented with five small instance pairs and three mediuminstance, while in temporal experimental implemented with 400 pairs of small instance and75 mediums instances.

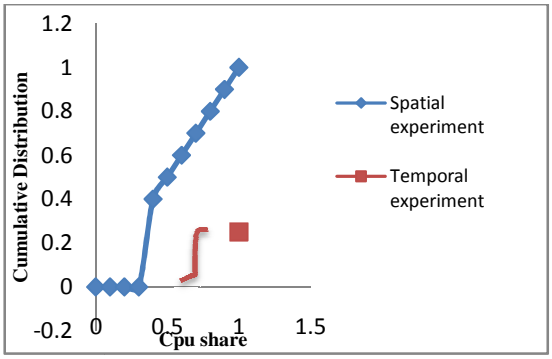

Figure 11: Spatial and Temporal Experiment

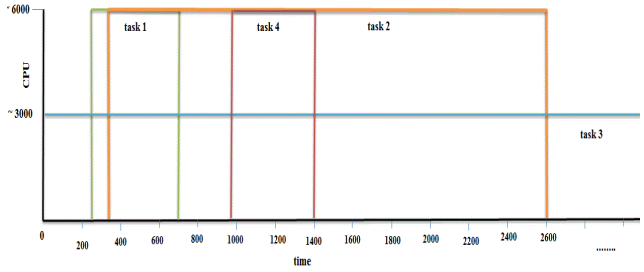

Figure 12: Tasks implementation for individual amount of works without depend of (class of those tasks)

Figure 12 shows that all tasks execute with the performance of double CPU except task3.ESX configuring containsprocessor, memory, and storage configuration.

In storage configuration,new storage device like SAN volume can be addedand networking, new virtual switches can be created.

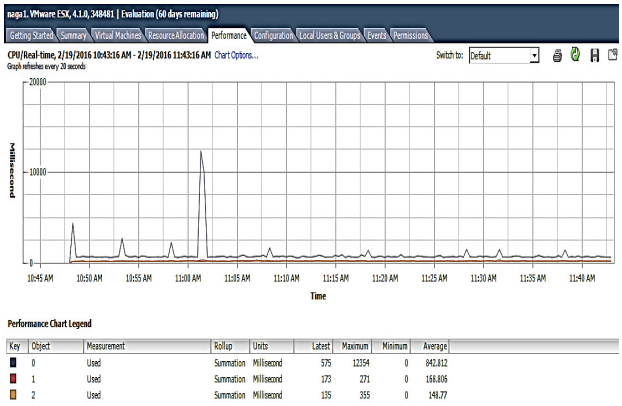

Figure 13:Performance page displays hardware resources utilization as graphs chart options display the custom graphs based on time slot

Figure 12 & 13 shows the differences in term of time of execution specific job with difference of using Virtualization technique.

V. CONCLUSION AND FUTURE SYSTEM

In this paper, a new method has presented a new resource management system for data centers by applying methods and setting appropriate value on a virtualized data center by a provider;Due to save cost, resource, high performance ,also gives more confidential and privacy and ability to work with VM that have desired application or required performance.Experimental results show that, by directly measuring traffic demand between VMs, S-CORE can achieve significant (up to 87%) communication cost minimization.

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