Enhancing Productivity of Costs and Energy through VNC and SAN

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Abstract
SAN, which stands for Storage Area Network, is a data sharing architecture widely used for its great security and access as well as its compatibility with a variety of operating systems. In view of the importance of networks optimization, this system has recently shifted from a sole data sharing to resource sharing. As the reduction of energy consumption has become a vitally important issue worldwide, Iran has also taken appropriate actions in this regard which subsequently embraced by different organizations. A great deal of energy consumption reduction and costs cutbacks could be achieved through utilizing Virtual Network Computing in the system. The present article presents procedures for reducing energy consumption.
Key words: Virtual Network Computing, Resource sharing, SAN architecture, optimization, energy consumption reduction

Introduction
In the past, it was believed that every user would need separate and allocated resources; nowadays, however, we need to make offices smaller and reduce expenses as much as possible due to economic reasons, such as the rent of a place, cost of electricity, and air-conditioning. On the other hand, technical issues may also arise that necessitate the centralization and making offices smaller of which maintenance, imposing restrictions, having access to hardware, updating essential software programs on a server, to name but a few. In recent years, great innovations and technological advancement have emerged in this area that could generally be considered as solutions one of which is resource sharing services. As the article continues, concepts of resource sharing, its subcategories, and implementation will be introduced, then a study of energy consumption and the conclusion will follow.

Resource sharing
Resource sharing familiarizes us with the concept that multiple users could utilize a piece of hardware simultaneously. For instance, a single processor may process multiple systems or a Grid Computing central system, which is a special type of resource sharing, may distribute input processing to other systems having lower amount of load. These actions enjoy multiple advantages: firstly, the speed of processors will be boosted. Secondly, systems with higher load could be assisted by idle systems. Lastly, maximum productivity will be achieved by means of keeping time and hardware to a minimum. The upcoming sections will explain more area of resource sharing.

Virtual Network Computing (VNC)
Virtual Network Computing could be considered as a subcategory of resource sharing. This technology is currently very sophisticated and important as a representation of which could be found in every large computer network and server room. In virtualization as well as centralizing processing in one place, it is also possible to meet the demands of a particular server as nothing more than a display, keyboard and mouse would be needed and an interface or thin client can link them to the server. By help of this technology, the need for multiple computers in a workstation is eliminated and the heat produced will be reduced compared to before. The consumption of energy is reduced and there is no need for physical activity to upgrade systems. A practical example of this type of network will follow.

Virtual Machine (VM)
After understanding how hardware is used, it is time to learn about network software, that is, the operating system. Virtual operating systems or virtual machine make it possible for mother or principal systems to be
implemented on a server and clients to use their own separate operating system. In this case, installing multiple operating systems on a virtual machine, we enable users to use their OS to meet their needs without any change in clients. An advantage of these systems is that the need to install and run clients and OSs that serve all clients will be removed once they have been installed for the first time. Memory space will be optimized due to centralizing and eliminating the needs for multiple OS and software installation.

**SAN architecture**
SAN is a data sharing architecture that enables saving of all system data through substrate network. Enjoying high determination coefficient, data sustainability and security, SAN is employed by a large number of network users. One of its foremost characteristics, namely being centralized, it could be protected in the event of fire and earthquake and could be the best place for backup servers. SAN is best coordinated with and consolidated into modern virtual technologies to produce the best efficiency and productivity for users. SAN, per se, could also be used for regular systems and under different models with a capacity of 200 terabytes.

**Employing SAN and VNC together**
By combining the above-mentioned technology and architecture, SAN is employed to meet the requirements of storing and maintaining data. On the other hand, VNC is employed for centralized system processing and as a substrate operating system in a way that clients are connected to main VNC server through the Ethernet or optical fiber and SAN is usually linke to VNC through optical fiber. Considering the implementation of the network above, we expect to meet the following objectives:

- Centralizing of the core of all systems in a unitary space
- Removing computer case from users surroundings
- Increasing data coefficient of determination
  - All data are kept on a server in a separate room so it is much easier to protect one room against natural disasters and human infiltration than is the case with several hard disks of a large number of systems.
- Reducing maintenance costs
  - Whenever there are a small number of physical parts, damages will be significantly decreased because all critical hardware is centralized in a VNC server.
  - It is easier to effect change and repair software when there are VM and a central operating system.
- Reducing computer accessories procurement costs
  - Due to not having to buy systems of different usability and capacity, it will be possible to purchase all needed parts uniformly and in bulk i.e. monitors and mouse. As a result, the power of these systems could be defined means of VNC according to users’ needs.
- Reducing ambient temperature
  - Through removing computer cases from workstations and replacing 10 computers with one server, the ambient temperature will be reduced and so will the air-conditioning costs.
  - Increasing productivity through decreasing costs
  - Reducing labor force in hardware department
  - Upgrading systems through improving access
  - The ability to use multiple OS on a server simultaneously
  - Energy consumption optimization
    - Every system, whether working or standby, consumes energy. When it becomes virtual the energy consumption will be decreased by more than 1/5.
  - Imposing restriction and monitoring fairly easily

**Presenting a proposal for Masjed Soleiman Petroleum and Gas headquarter**
The hardware and software requirements of headquarter having been examined and estimated, the following system was proposed which is currently being assessed. The capabilities of the proposed server to serve 30 clients are listed as shown in the table below:
Main server 7G 380 HP DL

<table>
<thead>
<tr>
<th>Product description</th>
<th>DL 380G6 &amp; X5670 12MB (2P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor family</td>
<td>Intel® Xeon® 5600 series</td>
</tr>
<tr>
<td>Processor Core available</td>
<td>6 or 4 or 2</td>
</tr>
<tr>
<td>Number of Processors</td>
<td>3</td>
</tr>
<tr>
<td>Maximum memory</td>
<td>384 GB</td>
</tr>
<tr>
<td>Memory type</td>
<td>PC3-10600R R-DIMMs DDR3</td>
</tr>
<tr>
<td>Memory slots</td>
<td>18 DIMM slots</td>
</tr>
<tr>
<td>Storage controller</td>
<td>(1) Smart Array P411/1GB</td>
</tr>
<tr>
<td>Power supply</td>
<td>(2) 750 Watt hot plug CS HE</td>
</tr>
</tbody>
</table>

The parts that should be installed corresponding to the requirements of the headquarter are listed in the following table:

<table>
<thead>
<tr>
<th>description</th>
<th>Qty</th>
<th>Model</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>3</td>
<td>X5670 (6 core, 2.93 GHz, 12MB L3, 95W)</td>
<td>18 core 52.74 GHz</td>
</tr>
<tr>
<td>Memory</td>
<td>18</td>
<td>HP-16 GB, DIMM 240-pin, DDR3</td>
<td>288 GB</td>
</tr>
</tbody>
</table>

P2000 G3 FC Controllers

<table>
<thead>
<tr>
<th>Capacity</th>
<th>SFF: 21.6 TB SAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller Cache</td>
<td>2 GB per controller</td>
</tr>
<tr>
<td>Protocol (host connect)</td>
<td>8 Gb Fibre Channel</td>
</tr>
<tr>
<td>Sequential Reads MB/s</td>
<td>1,572</td>
</tr>
<tr>
<td>Sequential Writes MB/s</td>
<td>790</td>
</tr>
<tr>
<td>OS Support Fibre Channel ports</td>
<td>• Microsoft Windows Server 2008 IA32, x64, IA64 (Standard, Enterprise, Datacenter)</td>
</tr>
<tr>
<td></td>
<td>• Microsoft Windows 2003 SP1, SP2, and R2 and 2003 R2 IA32, x64</td>
</tr>
<tr>
<td></td>
<td>• Red Hat Linux (32/64) SuSE SLES (32/64)</td>
</tr>
<tr>
<td></td>
<td>• Hyper-V VMware OpenVMS</td>
</tr>
<tr>
<td></td>
<td>• Apple Mac OS</td>
</tr>
<tr>
<td></td>
<td>• Solaris 10 (x86)</td>
</tr>
<tr>
<td>SAS &amp; SATA Drives (SFF 2.5-inch)</td>
<td>HP 900GB 6G SAS 10K rpm SFF (2.5-inch) Enterprise 3yr Warranty Hard Drive</td>
</tr>
<tr>
<td>Input Power Requirements</td>
<td>110VAC 3.32A, 344-390 W; 220VAC 1.61A, 374-432W</td>
</tr>
</tbody>
</table>

We need three servers like the one described above to meet our needs accordingly while having better efficiency. Consequently, in case of any problem for one of the servers, the other two servers will compensate.

The space needed for storage on SAN whose server enjoys these specifications:

We need two of these servers each of which having a volume of 16 TB. The above-mentioned server is linked to the main server, to which clients connect, through optical fiber. At the site of headquarter a built-in wiring is used for making a network so RG45 cables are needed. The other equipment needed for running a centralized system including monitor, keyboard, mouse, and Thin Client- HP 2020.

To manage operating systems, VM Ware Base software is installed on the server and all clients will have access to Windows 7, Ultimate installed on VM.

**Energy consumption**

In a discussion of energy consumption, a comparison will be made between the consumption in traditional networks and the networks with new approaches such as the model of National Petroleum Company:

1. **Consumption in traditional network serving 30 clients with one server:** The consumption for each system is as the following:

   A. Monitor 120W
   B. Case power 400 W
   Sum= 520W

   The amount of consumption for one server
   Server 1000W= (30*520) +1000=16600W
2. Consumption in networks like National Petroleum Company:
   A. consumption per client
      Monitor 150W+ Thin Client= 4500=
      30*150= Sum
   B. consumption per VNC server
      W285W= 95*3 CPU= W1500= 2*750
      Server= 5355W= (3*1785) Sum=
   C. consumption per SAN server
      864W= 2W*432 Sum=
      Total consumption:
      10719= 864+5355+4500 Sum=

As a result, it would be apparent that the new system, in addition to all abovementioned advantages, consumes about 600 W less which consequently saves up more money.

Conclusion
It could be possible to save up more energy by means of resource sharing in SAN and virtualization. Moreover, instead of using several computers, one server could be used to serve all computers, which may otherwise work without any load or may be on standby and consume energy, so that much less energy is used by far. Using software, virtualization makes managing resource possible and consolidates purchasing hardware that in turn results in cutbacks. Additionally, due to being more centralized, a significant reduction in security and maintenance costs are expected.

References: