NOAA

Earth System Research Laboratory (ESRL)
Global Systems Division (GSD)
Putting tools in the hands of users
Server Virtualization Program

General Virtualization

Taking multiple "logical" servers and consolidating them into one "physical" server

EARTH SYSTEM
RESEARCH LABORATORY

GLOBAL SYSTEMS DIVISION

ESRL
GLOBAL SYSTEMS DIVISION

VIRTUALIZATION MANUAL

Policy and Procedures
For the GSD Virtual Machine Environment

Background

The Earth System Research Laboratory/Global Systems Division (GSD) has a robust Server Virtualization program which began in 2011. This was prompted by various budget challenges which focused Information Technology on cost savings. GSD established a restrictive policy on acquiring physical servers, thus driving projects and programs to use a "virtual" environment for computing resources. At the same time, GSD invested in the required architecture to support a virtual machine environment for the extended future.

What is Virtualization?

Virtualization in this context is the ability to host many "logical" servers on one "physical" server. This technology allows numerous different operating systems to run on a single server, thus allowing multiple projects or tasks to run on the same server.

Why Virtualize?

On a traditional server, rarely is a Central Processing Unit (CPU) or Random Access Memory (RAM) utilized at 100%. This leaves other periods of time when the CPU and RAM can be used by other "virtual" machines on the same host. By consolidating through virtualization, CPU and memory resources can be shared between the tasks on the virtual machines.

Server virtualization presents a solution to numerous challenges: When you can run many logical servers on one physical server, you get more processing power out of your hardware, you reduce the number of, and space required for, physical servers, and you reduce your energy and cooling requirements.

There are other indirect advantages related to savings, from eliminating procurement time, to addressing scaling to meet new application demands on the fly. Some figures from GSD's virtual server program:
- Number of Virtual Machine Servers – 110 (as of September 2014)
- Total Estimated Annual Electrical Cost Savings – $36,960.00
- Total Carbon Footprint Reduction – 273.9 Metric Tons

Process and Procedure

All related procedures are published in the GSD VM Manual which outlines the virtual environment and provides guidance on obtaining resources. Users in GSD who wish to procure a server for a specific project simply submit an online "Server Request" with the required information related to their needs. A six member board of IT Networking; Security; Operations, and Management personnel evaluates and approves or denies the request. A technical lead weighs in with resource availability. When approved, the user receives an email identifying the appropriate coordinator who can provide access to their new virtual server. A denial only means that the specific requested resources are not available, or are not appropriate for virtualization.

Virtual Waivers

Occasionally a project requires server resources which cannot be provided within the GSD virtual environment. This can occur if security expectations require a physical server, or if the server must mirror a field application, requiring a physical server. This can also occur if a documented performance level cannot be achieved virtually, or if the GSD virtual environment simply cannot support the needed requirements.

If a physical server is absolutely required, a waiver is drafted explaining the justification, and the GSD Director must authorize the physical server purchase. This data is also recorded for future reference to steer the future enhancement of the virtual environment toward a Division-wide solution for all use cases.

Enhanced Resources

One unique benefit of hosting servers within a virtual environment is performing resource enhancements in real time. If a particular project using a virtual server requires more compute power, an additional CPU (Central Processing Unit) can be easily allocated. If more RAM (Random-Access Memory) is required, it can be quickly assigned with a few key strokes. Similarly, if increased storage is needed, additional hard-drive space can be quickly allocated. All of these enhancements would require downtime and expense on a physical server outside of the virtual environment.

Use Case

GSD performs research in a very broad range of weather related disciplines. As weather patterns tend to be seasonal, a project may require intense research over a specific geographical location between the months of April and September, as an example.

A virtual server can accommodate the computational needs of the project in a simple and efficient manner. The server resources are allocated from a virtual pool in April, utilized for all computational aspects of the particular project till September, and then turned off. Those resources can then be made available to another project, while results of the initial project are analyzed and published.

For Further Information on the Server Virtualization Program at GSD, Contact:

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